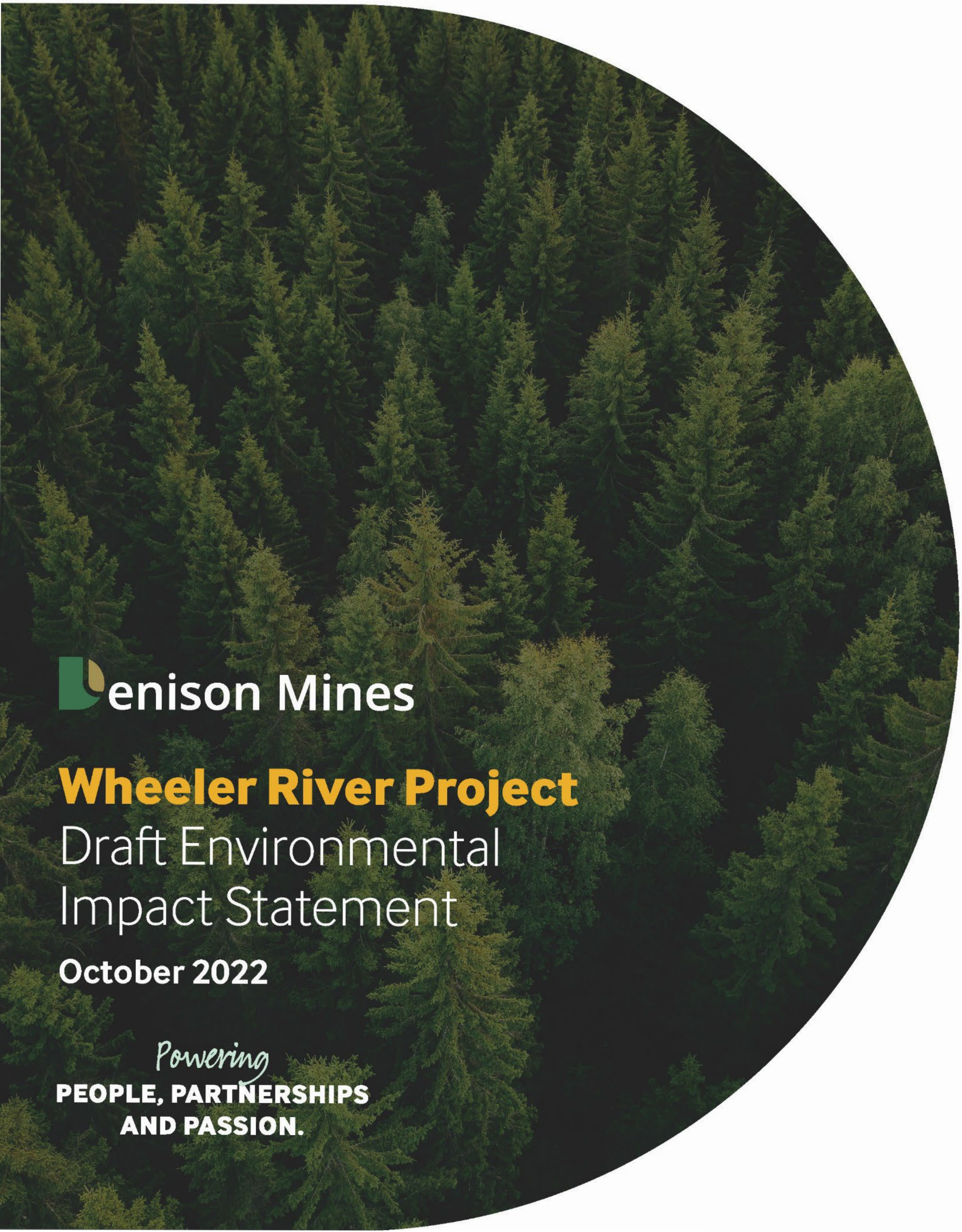

Denison Mines

Wheeler River Project

Draft Environmental Impact Statement

October 2022

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Wheeler River Project

Draft Environmental Impact Statement

Alternative Means Assessment - Appendix 2-C

October 2022

Denison Mines

Denison Mines Corp.

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Denison Mines Corp. (Denison) first evaluated production potential from the Wheeler River Project (the Project) in 2010. Since that time, the Project has undergone significant design and review stages and has naturally evolved into the Project described and assessed in this Environmental Impact Statement (EIS). The purpose of this appendix is to describe the alternative means assessment framework employed and the results of the alternatives assessment for key Project components and activities. The selected alternative(s) were carried forward into the environmental assessment (EA) process.

1 Alternative Means Assessment Framework

Alternative means are the various ways Denison considered to implement Project components and activities. During the planning process, it is common to consider various means by which to fulfill a specific aspect of the Project.

A systematic assessment of these alternatives was used to select preferred alternatives that are carried forward as Project design elements. These preferred alternatives ultimately become the basis upon which potential Project-related effects are evaluated in the EIS. The preferred alternatives have been presented in the Project Description in Section 2 of the EIS.

The documentation of this systematic alternative assessment provides transparency and traceability with respect to decision making on Project design and also documents how input received by Indigenous groups and other Interested Parties has been considered in the design/planning process.

In the following subsections the alternative means assessment is presented. The alternative means assessment has been carried out in a stepwise fashion as follows:

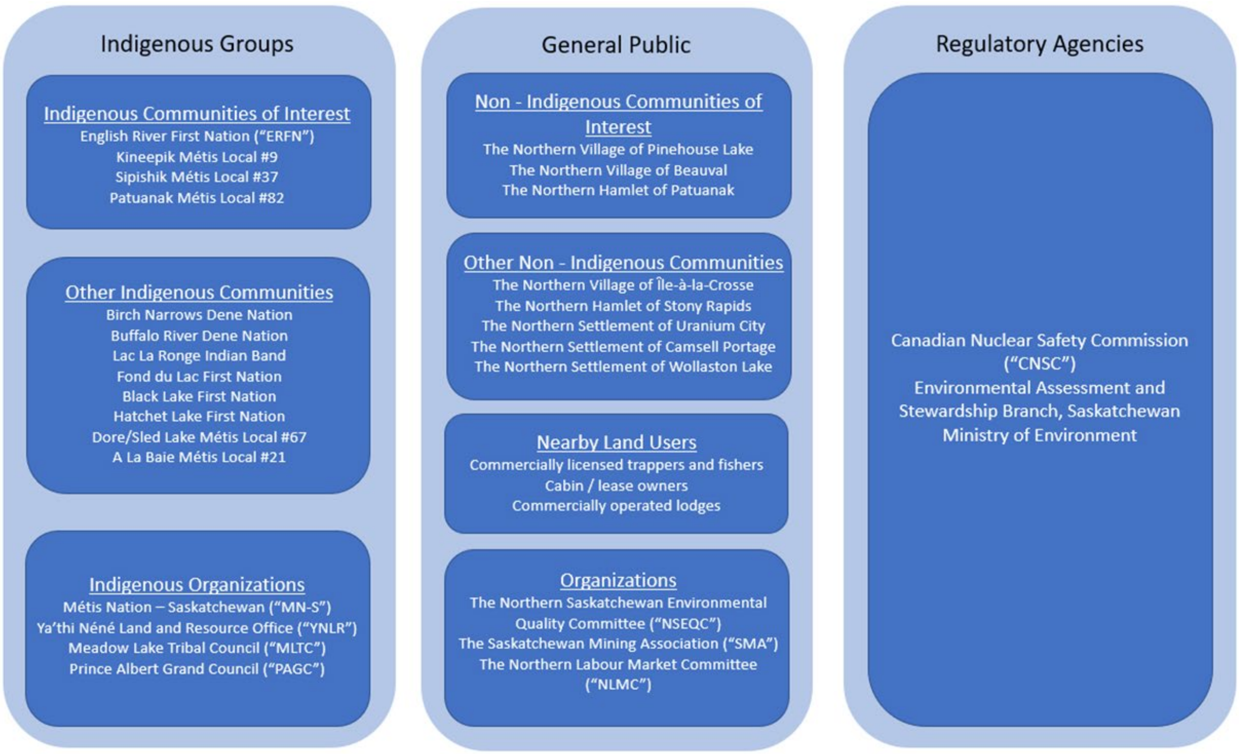
1. Identification of Alternative Means: Project components for which alternate means were considered are identified;
2. Consideration of Technical Feasibility, Economic Feasibility, and Land Use Factors: the technical and economic feasibility of these alternate means is considered along with a specific screening for land use intensity and importance. Only alternate means that are deemed technically feasible, economically feasible, and passed the land use screening are carried forward in the evaluation.
3. Potential Residual Effects Associated the Alternative Means: the potential residual effects of each alternative, in consideration of mitigation, are described; and,
4. Evaluation of Alternative Means: a comparative evaluation of alternative means that considers the potential residual effects for each alternative relative to various assessment criteria and indicators.

Based on the above, a preferred alternative means for each respective Project component or activity evaluated was selected (Figure 2). Rationale for the selection based on the comparative evaluation of alternatives is provided and input received by Interested Parties is presented.

Since 2016, Denison has been engaging with local and Indigenous communities, residents, businesses, organizations, land users and the various regulatory authorities, which are collectively referred to herein as Interested Parties. Interested Parties include the following:

- Indigenous Groups
    - Indigenous Communities of Interest (COI)
    - Other Indigenous Communities
    - Indigenous Organizations
- General Public
    - Non-Indigenous COI
    - Other Non-Indigenous Communities
    - Nearby Land Users
    - Organizations
- Regulatory Agencies

A list of the Interested Parties for the Project can be found in Figure 1.



Note:

- The MN-S holds the delegated Duty to Consult for Dore/Sled Lake Métis Local #67 and A La Baie Métis Local # 21, SML, and PML.
- Engagement activities with the Athabasca Basin First Nations and Communities (Fond du Lac, Black Lake, Hatchet Lake, Stony Rapids, Camsell Portage, Uranium City and Wollaston Lake) occur through YNLR.

Figure 1: Interested Parties for the Project

Refer to EIS Section 4 Engagement for more information. Denison’s engagement with Interested Parties helped to develop meaningful relationships and facilitate a collaborative approach to engagement and the advancement of the Project. Engagement with Interested Parties naturally included alternatives means and the engagement input was included in the evaluation of alternative means. Refer to the references list below and *Appendix 2-A Engagement Database Summary – Project Description* for details of engagement information referenced in this alternative means assessment.

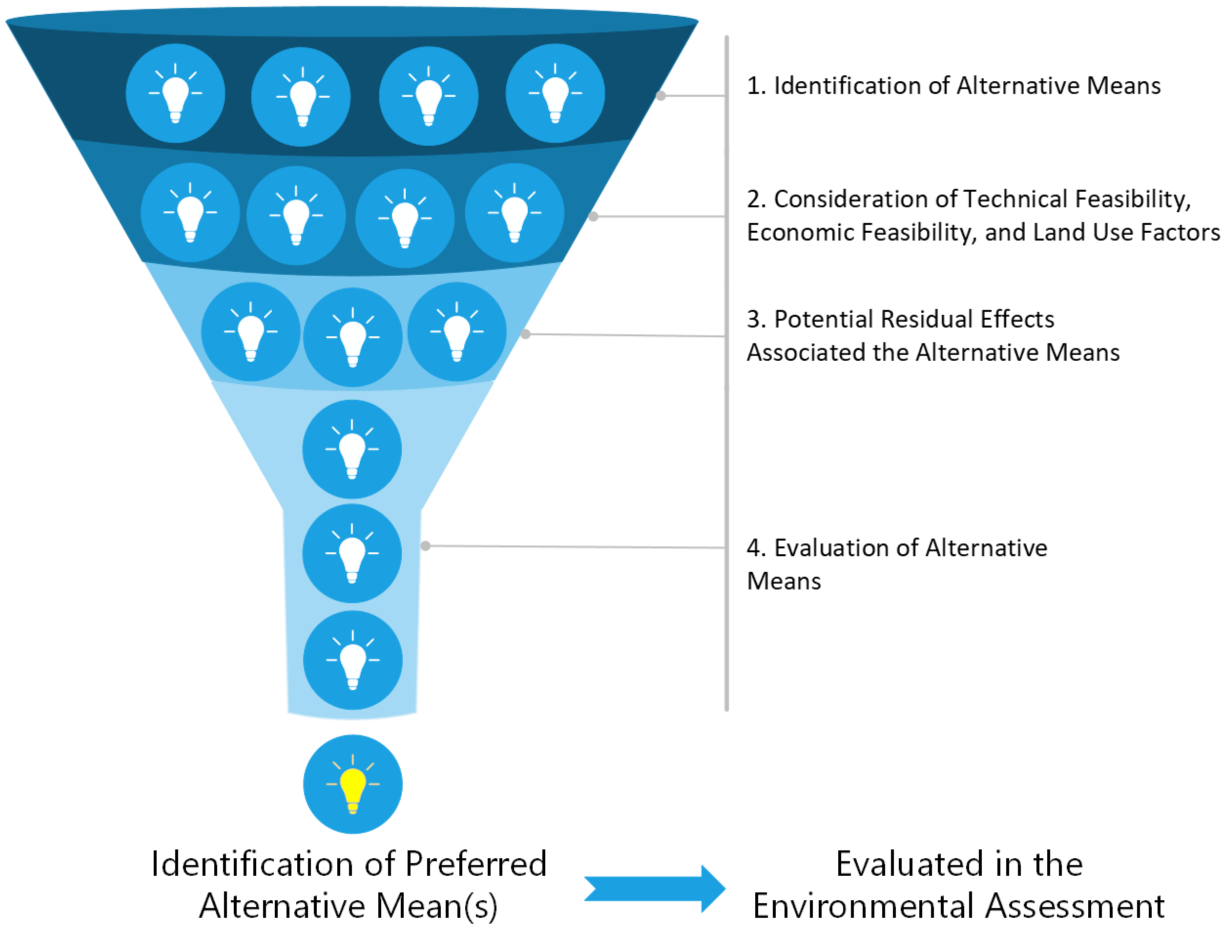


Figure 2: Alternative Means Assessment Framework for the Project

For reference, the alternative means assessment is conducted at a screening level, appropriate for the stage of the Project when the alternatives were considered. The assessment considered both quantitative (where possible) and qualitative information as available. The comparative evaluation identified more preferred versus less preferred alternatives. As indicated above, the preferred alternative(s) was selected and evaluated in much greater detail in the EA.

1.1 Identification of Alternative Means

Project components for which alternate means were considered are described below and summarized in Table 1. For ease of consideration, alternatives have been grouped according to the following main subject categories: mining; processing; water management; waste management; access and transportation; and support facilities (Table 1).

1.1.1 Mining

1.1.1.1 Method

1. Open pit

Open pit mining has been used to develop some of the shallower deposits in the region. Open pit mining involves blasting and bringing volumes of waste rock to surface until the ore is accessible at the bottom of the pit. The Phoenix uranium deposit is an unconformity style deposit and to Denison's knowledge, only two mining methods have been used to extract uranium in these style of deposits in Saskatchewan, one of which is open pit mining.

2. Jet Boring

Jet boring is a vertical stopping with mechanical cutting underground mining method. The jet boring system drills a pilot hole through the orebody. Then the jet boring nozzle is inserted in the pilot hole and the system begins boring through the rock using a high-pressure jet of water. Loose ore is flushed down the pilot hole. After a series of processes, ore is pumped to the surface in a slurry form. This would be an entry type of mining, meaning workers go underground into select areas of the mine workings.

As indicated above, the Phoenix uranium deposit is an unconformity style deposit and to Denison's knowledge, only two mining methods have been used to extract uranium in these style of deposits in Saskatchewan, one of which is jet boring used at Cameco Corporation's (Cameco's) renowned Cigar Lake deposit.

3. Surface Boring

The surface borehole mining method involves the application of petroleum style drilling and state of the art directional drilling technologies to selectively mine the deposit. The boreholes would be drilled from surface, collared vertically, steered through waste rock to a horizontal approach in proximity to the deposit, and continued horizontally through the ore. By strategically placing the collar and curved portion of the boreholes (referred to as the parent borehole) and backfilling completed horizontal portions of the borehole (referred to as the lateral borehole), additional directional drilling at depth would permit multiple lateral boreholes from a single parent borehole. Acceptable recovery rates can be achieved by drilling an array of closely spaced boreholes. As an non-entry mining method, surface boring would be highly mechanized and used remote equipment from the surface. Consideration was given to a slurry system on surface to produce a transportable slurry and use of a surface dry drill handling option across most factors to allow for transportation of dry drill cuttings to an existing mill for processing.

4. Micro Tunnel Boring

Microtunnel boring method would be an underground mining method which uses high-tech mining equipment to bore horizontal cavities. The horizonal cavities are created using automated to semi-automated tunnel boring machines. The tunnels would be 2 to 3 m in diameter. Ore would come to surface as hoisted cuttings or as a slurry. This would be an entry type of mining, meaning workers go underground into select areas of the mine workings.

The techniques and equipment are commonly used in the civil engineering industry. For example, microtunnel boring machines are used to construct utility tunnels.

5. In Situ Recovery

In situ recovery (ISR) mining is also known as solution mining or in situ leaching. It is a surface extraction method using mining fluids to dissolve uranium from the host rock without physically removing the host rock. The ore is dissolved ‘in situ’ by mining solution and pumped to surface. No underground or open pit workings are required in an ISR operation; no heavy equipment is needed, and people do not work underground (non-entry mining method). The process uses a series of injection wells to inject mining solution into the uranium deposit and another series of wells (recovery wells) to return the uranium rich solution back to surface for processing. There is minimal surface disturbance and minimal waste rock generated. The ISR technology is in widespread use in international uranium operations (USA, Kazakhstan), although it has not been used for uranium mining in Canada. The ISR mining method is amenable to uranium deposits in certain sedimentary formations and is well known in the industry for having comparatively minimal surface disturbance, high production flexibility, and low operating and capital costs relative to open pit or conventional underground mining methods. Continuous development and improvement of ISR mining techniques has occurred in recent years, particularly in the two decades since the International Atomic Energy Agency published the Manual of Acid In-Situ Leach Uranium Mining Technology (IAEA 2001).

1.1.1.2 Freeze design for tertiary containment of mining solution

1. Freeze dome

With a freeze dome design option, tertiary containment of mining solution would be done by creating a freeze wall above and on all sides of the uranium deposit – encapsulating the uranium deposit.

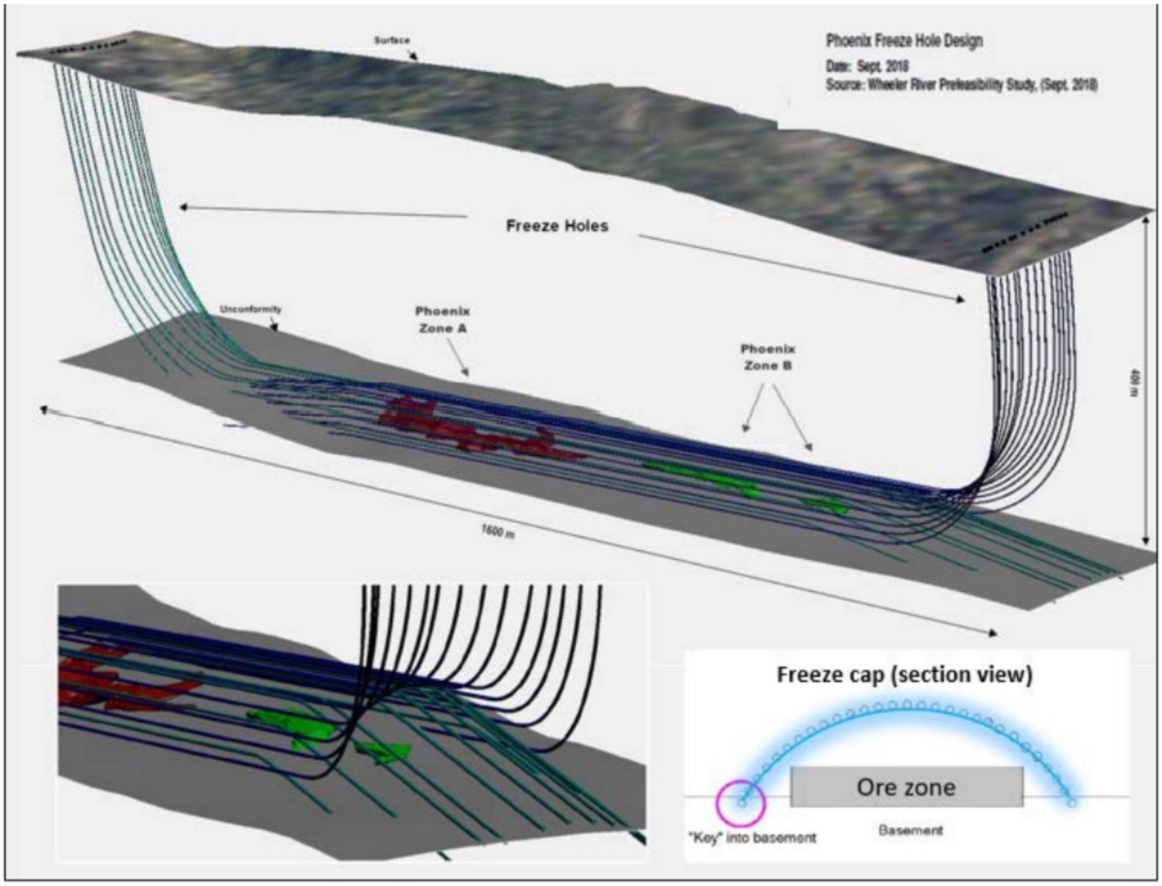


Figure 3: Freeze Dome Option for Tertiary Containment of Mining Solution

The freeze dome would be established by drilling parallel cased holes from surface, starting at both ends of the deposit and travelling horizontally along the long axis of the uranium deposit, anchoring into the impermeable basement rock on the opposite end of the deposit. This process is illustrated above and is expected to be achievable using existing directional drilling techniques.

Once the drill holes have been installed, a low temperature brine solution is circulated through the cased holes to remove heat from the ground, ultimately freezing the natural groundwater and establishing an impermeable, frozen dome to encapsulate the uranium deposit. While a freeze dome would be several metres thick, it would be developed around the uranium deposit, to make sure the uranium deposit itself does not freeze.

Ground freezing technology is well established throughout the world. Its use in a mining environment was pioneered in Saskatchewan’s potash mining industry and later adapted for use in Saskatchewan’s uranium industry. Ground freezing to control and eliminate groundwater from entering the mining areas is a fundamental component of two existing Athabasca Basin underground uranium mines.

2. Freeze wall

The freeze wall would be established by drilling parallel cased holes from surface, anchoring into the impermeable basement rock. The freeze wall would be constructed to surround the entire mining area. This process is illustrated in Figure 4 and is expected to be achievable using existing commonly used drilling techniques, likely diamond drilling. Once the drill holes have been installed, a low temperature brine solution would be circulated through the cased holes to remove heat from the ground, ultimately freezing the natural groundwater and establishing an impermeable, frozen wall to encompass the uranium deposit. While the freeze wall would be expected to be several metres thick, it would be developed around the uranium deposit, to make sure the uranium deposit itself does not freeze. The ground freezing technology would be the same as that outlined for the freeze dome.

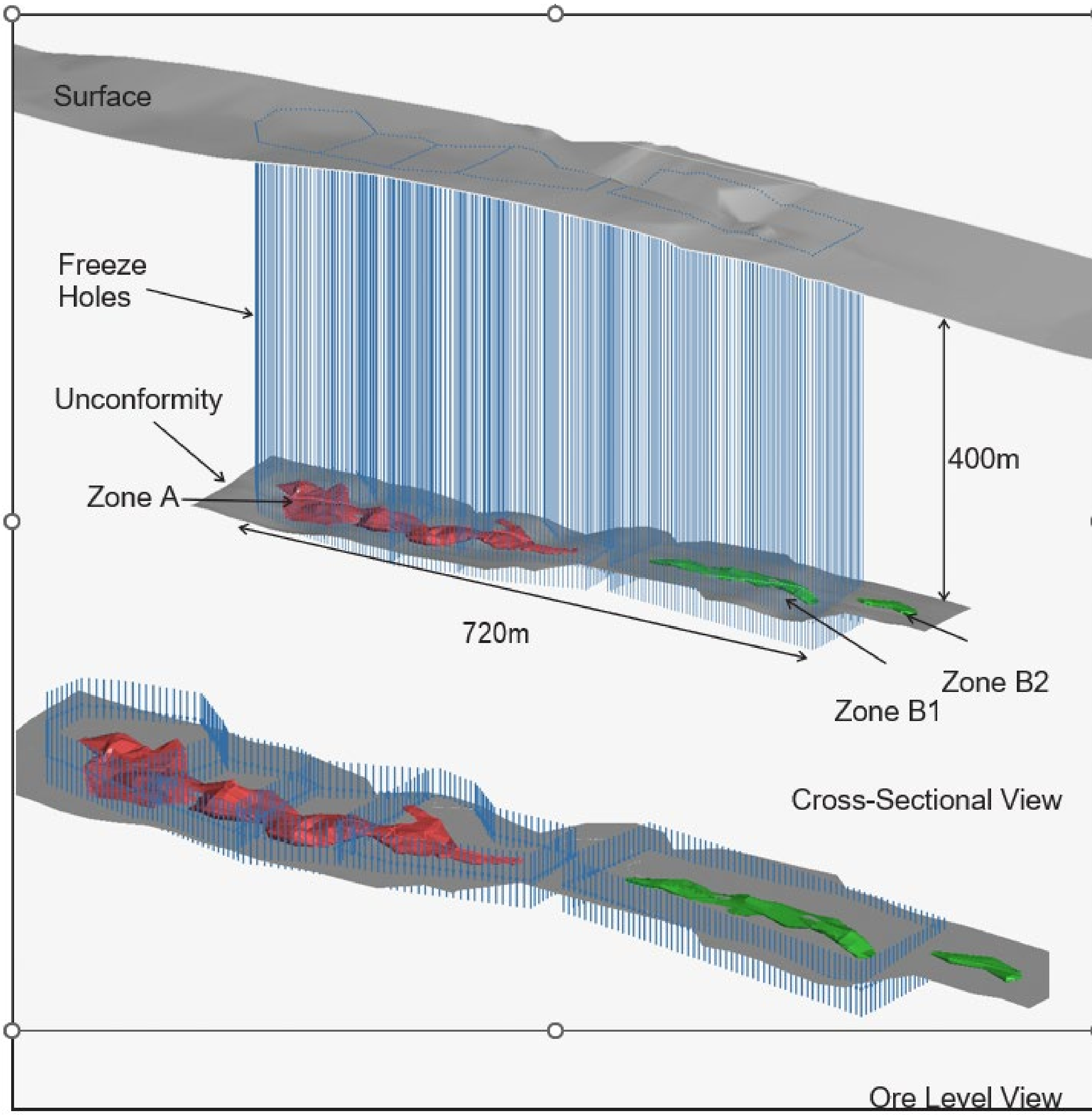


Figure 4: Freeze Wall Option for Tertiary Containment of Mining Solution

1.1.1.3 Permeability enhancement

In situ recovery relies on fluid movement within the mining area. Within the context of the Project, permeability is a measure of the ease of passage of liquids through rock in the mining area. Several permeability enhancement techniques have been considered for the Project to create sufficient permeability for uranium extraction and injection and recovery of solutions.

As Denison advanced the Project as an ISR operation, it was common to receive questions about how the method compared to fracking. For instance, when mining options were presented at workshops in 2018, some members of local communities had reservations because ISR reminded them of fracking, which carried a negative connotation (18-EN-VB-4.54). As context for the evaluation of alternatives means for permeability enhancement, information on conventional fracking is provided here.

Conventional fracking pressures used in the oil and gas industry can vary; however, common pressures to induce fracturing can be on the order of 15,000 psi and require injection of fracking fluids of up to 16,000 liter per minute over periods of three to four days. Fracking fluids are comprised of a slurry of water, proppant (generally silica sand), and chemical additives to support and maintain the open fracture system after fracking is conducted. Conversely, ISR mining is planned at nominal pressures of 100 psi, intermittent pressures of up 250 psi, and average flow rates of 30 liters per minute within a given well.

1. Hydraulic

Hydraulic permeability enhancement is a technique involving the flushing of bedrock formations by a pressurized liquid. The process involves pressure injection of water into a wellbore to create access to existing fractures in the defined formations that may not have been previously connected to the main fracture network due to clays, sands, or other materials being present in the fractures themselves. After hydraulic permeability enhancement, mining solutions may flow more freely. Hydraulic enhancement is used as a means of flushing or cleaning the well and formation in preparation for mining. Hydraulic permeability enhancement pressures can reach up to 250 psi with a consistent duration of 24 to 48 hrs.

2. Propellant

Propellant permeability enhancement methods involve wireline-conveyed tools designed to perforate and stimulate well production using a controlled propellant, e.g., progressively burning solid propellants or gas injection. The wireline tools effectively clean out restricted pathways within the well screen, well bore, and the geological formation and provide increased flow rates in the wells by intersecting and connecting to the naturally occurring fractures within the mining area.

Propellants used are typically classified as a low hazard explosive (S.1 special-purpose explosives, low hazard explosives, per *Explosive Regulations*, Section 36). Propellants technically do not explode (like classic mine explosives which detonate) but rather burn through a process called deflagration. Deflagration means the material burns slower than the speed of sound, thus no shock waves are generated. Propellant permeability enhancement methods reach injection pressures of up to 8,000 psi and are near instantaneous, lasting only over periods of milli seconds.

3. Mechanical

Mechanical permeability enhancement uses a downhole tool that produces clean flow paths radially from an existing borehole into the ore zone. The tool uses mechanical pressure excavation methods to drill penetration tunnels out from the borehole. The resulting tunnels can be up to 1.8 m in length and 1.8 cm in diameter.

1.1.1.4 Mining solution

Factors determining the choice between acid or alkaline ISR technology are: composition of the host rock and ores, reagent cost and consumption, the degree of uranium recovery, and the intensity of the process (IAEA 2001). The leach intensity is determined as the sum of the leach duration, solution ratio (liquid/solid), and average uranium concentration in the recovery solution.

1. Alkaline solution

Alkaline or high-pH mining solutions are used at a number of uranium ISR operations. The mining solution is typically made with carbonate or bicarbonate. The single most important factor in the process is the rock composition within the productive aquifer, and in particular, the concentration of calcium carbonate. Ores with a higher carbonate content normally require alkaline (bicarbonate) leaching.

2. Acidic solution

Acidic or low-pH mining solutions are used at a number of uranium ISR operations. The acidic mining solution is typically made with dilute sulfuric acid. The single most important factor in the process is the rock composition within the productive aquifer, and in particular, the concentration of calcium carbonate. For economic sulphuric acid leaching, the carbonate content should not exceed 2% CO_2.

1.1.2 Processing

1.1.2.1 Location of processing

1. Off-site processing at an existing mill

Off-site processing at an existing mill would require temporary on-site handling of ore, ore slurry, or uranium bearing solution (depending on the associated mining method) produced at the Project site. This would require construction, operation, and decommissioning of surface facilities for safe storage and load-out of the uranium-containing material into approved containers for transport. This could include ponds, pads, buildings, and associated water management facilities. The ore, ore slurry, or uranium bearing solution would be sold, loaded onto appropriate transport containers, and transported along existing public provincial highways to an existing uranium mill. At the off-site mill, the ore, ore slurry, or uranium bearing solution would be processed through the mill for production of yellowcake and disposal of any resulting wastes under the licence and permits associated with the off-site facility. This option was considered in conjunction with a number of mining methods evaluated for the Project.

Evaluation of this option within the alternatives means assessment framework is focused on the activities and components that would be under Denison's operational control. Once the material is sold and leaves the Project site, the transport and transfer to an existing, licensed facility, the assessment of processing is under the regulatory responsibility of the buyer/existing mill's operator, and as such, those of-sire activities fall outside the bounds of the Project-specific evaluation of alternative means.

2. On-site processing in purpose-built processing plant

The construction, operation, and decommissioning of a purpose-built, on-site processing plant would allow for processing of uranium bearing solution to yellowcake. On-site processing in a purpose-built processing plant was primarily considered for uranium bearing solution produced via ISR mining. This option would create wastes (process precipitates) that would require temporary handling on site before transported off site for reprocessing and final disposal.

1.1.2.2 On-site processing method

1. Ion exchange

Ion exchange is one of the most prevalent process technologies that is used in association with ISR mining. The process considers pumping uranium bearing solution from the recovery wells to the processing facilities. The initial step is to pump the uranium bearing solution into ion exchange columns where the uranium is filtered through the resin columns and loads up on the resin beads within. The resin columns are then stripped, and the resulting solution is sent to precipitation, dewatered and dried, and yellowcake is produced.

Due to the expected high dissolved uranium content in the uranium bearing solution and considering the limited capacity of the commercially available resin to load uranium operating in an acidic environment, the ion exchange columns considered for this Project would necessarily be of unique design.

Because the flow rate is so low and the grade so high, the columns would require a larger number of smaller columns than normal and would require a very complex piping system to constantly fill, strip, and refill the columns.

2. Solvent extraction

The option to add a solvent extraction circuit ahead of precipitation was also included as an alternative. The equipment required for solvent extraction is similar to ion exchange, with the addition of the mixer settler units.

3. Direct precipitation

Due to the high-grade nature of the uranium bearing solution returning from the wellfield the Project Wheeler, direct precipitation was considered as an alternative means. The direct precipitation process would operate exactly as the back end of the ion exchange and solvent extraction options, but without the concentrating and clarification step up front.

Uranium liberated from underground is routed to an iron-radium 226 removal circuit, where the pH of the solution is adjusted to allow the precipitation of iron hydroxide and other metals (process precipitates). Once the iron hydroxide has precipitated and fallen out of the solution, the uranium bearing solution would be routed to the uranium precipitation circuit. Yellowcake would be produced from the uranium bearing solution following iron removal. The uranium bearing solution would be pH-adjusted to optimal levels for uranium precipitation with sodium hydroxide, then yellowcake product would be precipitated with hydrogen peroxide using sodium hydroxide to maintain optimal pH. Following uranium precipitation, the barren lixiviant or mining solution would be reconstituted to the proper acidity level prior to being pumped back to the wellfield for reinjection.

The precipitated yellowcake slurry would be transferred to a filter press, where excess liquid is removed. Following a freshwater wash step to further clean the yellowcake product, the resulting yellowcake would be transferred to the yellowcake dryer or calciner, which further reduces the moisture content, yielding the final dried, free-flowing product. Refined yellowcake is packaged in 55-gallon steel drums.

1.1.3 Water Management

1.1.3.1 Freshwater supply

Freshwater supply is needed for drilling, processing, the potable water plant, fire water system, and wash bay. The approximate freshwater needs during Operation have been estimated to be 40.5 m^3/hr or 0.01125 m^3/second.

1. Groundwater

A shallow groundwater well with a pipeline back to the main Project Area was considered as an alternative means for freshwater supply. The groundwater supply in the Athabasca Basin is abundant and requires less treatment than surface water to meet potable water requirements. The exploration camp for the Project has historically used groundwater as its potable water source. Groundwater withdrawal for the Project would occur at a shallow depth outside of the freeze wall to avoid any potential interaction with mining solution.

2. Surface water

Sourcing freshwater from a surface waterbody was included as an alternative means. This option would include an intake pipe and pump, with a surface pipeline back to the main Project Area. Information on nearby lake and stream hydrology was available from baseline programs to support evaluation of this option. Refer to details in the treated effluent discharge location assessment.

1.1.3.2 Drinking water

1. Truck drinking water to site

The option to bring treated drinking water to site was considered. This option would allow for less water treatment on site, with a simplified plant (likely a chlorination step) to generate water of a sufficient quality to meet other on-site water needs, such as hygiene water for showers and sinks.

The other freshwater needs for the Project (e.g., water needed in the process plant, drilling) would be obtained from a local freshwater supply. Evaluation of this option within the alternatives means assessment framework included the transport component within the bounds of the Project-specific evaluation of alternative means.

2. Generate drinking water on site with a potable water treatment plant

The option to generate drinking water on site would require construction, operation, and decommissioning of a potable water treatment plant. The water treatment details would be defined later but would likely include ultrafiltration or reverse osmosis with ultraviolet filtration.

The other freshwater needs for the Project (process water, drilling) would be obtained from a local freshwater supply.

1.1.3.3 Treated effluent discharge location

The approximate treated effluent release rate anticipated during Operation and Decommissioning of the Project is 36.5 m^3/hr.

1. To groundwater

In this option, following treatment through the industrial wastewater treatment plant (IWWTP), treated effluent could be released to groundwater. Treated water would be of adequate quality for release and meet any applicable regulatory requirements or performance objectives that would be defined. A pipeline or series of pipelines would be constructed from the IWWTP to one or more purpose-built treated effluent discharge wells. The wells would be located in areas where the aquifer can accept the volume of treated effluent expected. The effluent discharge line on surface would be double walled with heat tracing to prevent operational issues with cold weather temperatures.

2. To surface water

Following treatment through the industrial wastewater treatment plant (IWWTP), treated effluent could be released to a nearby surface waterbody. Treated water would be of adequate quality for release and meet any applicable regulatory requirements or performance objectives that would be defined. A pipeline would be constructed from the IWWTP to a nearby lake, enter the lake, run along the bottom of the waterbody, and release treated effluent into the lake through a multi-port diffuser. The effluent discharge line on surface would be double walled with heat tracing to prevent operational issues with cold weather temperatures.

1.1.3.4 Treated effluent discharge location to surface water

Treated effluent discharge to surface water involved evaluation of a number of options (lakes) for discharge location. The approximate treated effluent release rate anticipated during Operation and Decommissioning of the Project is 36.5 m^3/hr.

See Figure 5 for a map of the lakes in the area, including lakes considered for treated effluent discharge location. See Figure 6 for the local drainage basin flows in the Icelander River drainage and Williams Lake drainage.

The Project site lies within the Wheeler River watershed, which is part of the Churchill River Basin. The Water Survey of Canada operates a hydrometric station on the Wheeler River downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 km^2. The hydrometric station has been in operation from 1973 to the present and discharge at Wheeler River downstream of Russell Lake ranges from approximately 10 to 27 m^3/second, with average flows around 18 m^3/second.

Surface water from the Project area is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage (Figure 6). Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River drainage and the Williams Lake drainage are 371 km^2 and 78 km^2, respectively. Downstream of Russell Lake, the Wheeler River flows into the Geikie River, which subsequently discharges to Wollaston Lake.

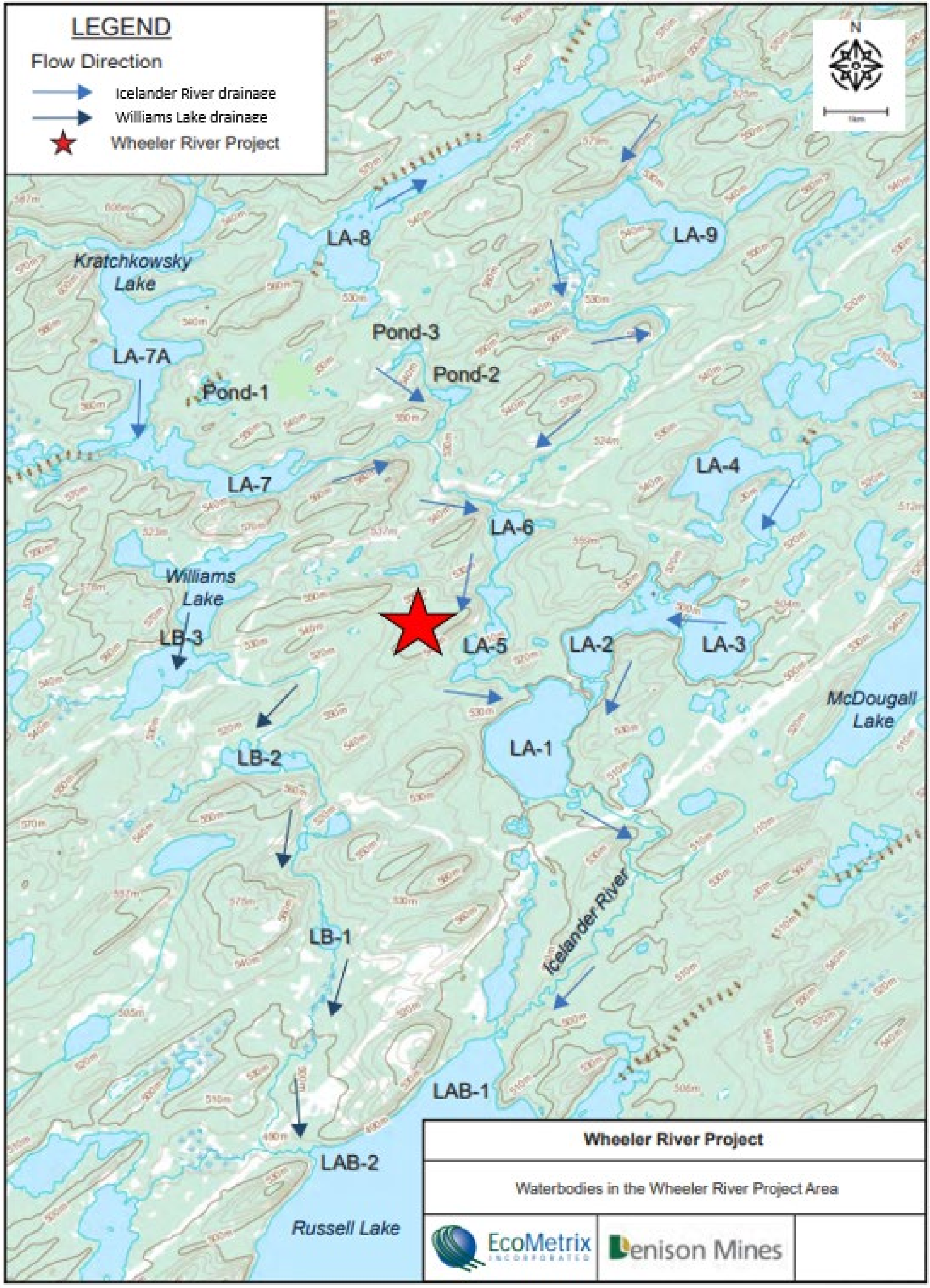


Figure 5: Waterbodies in the Project Area

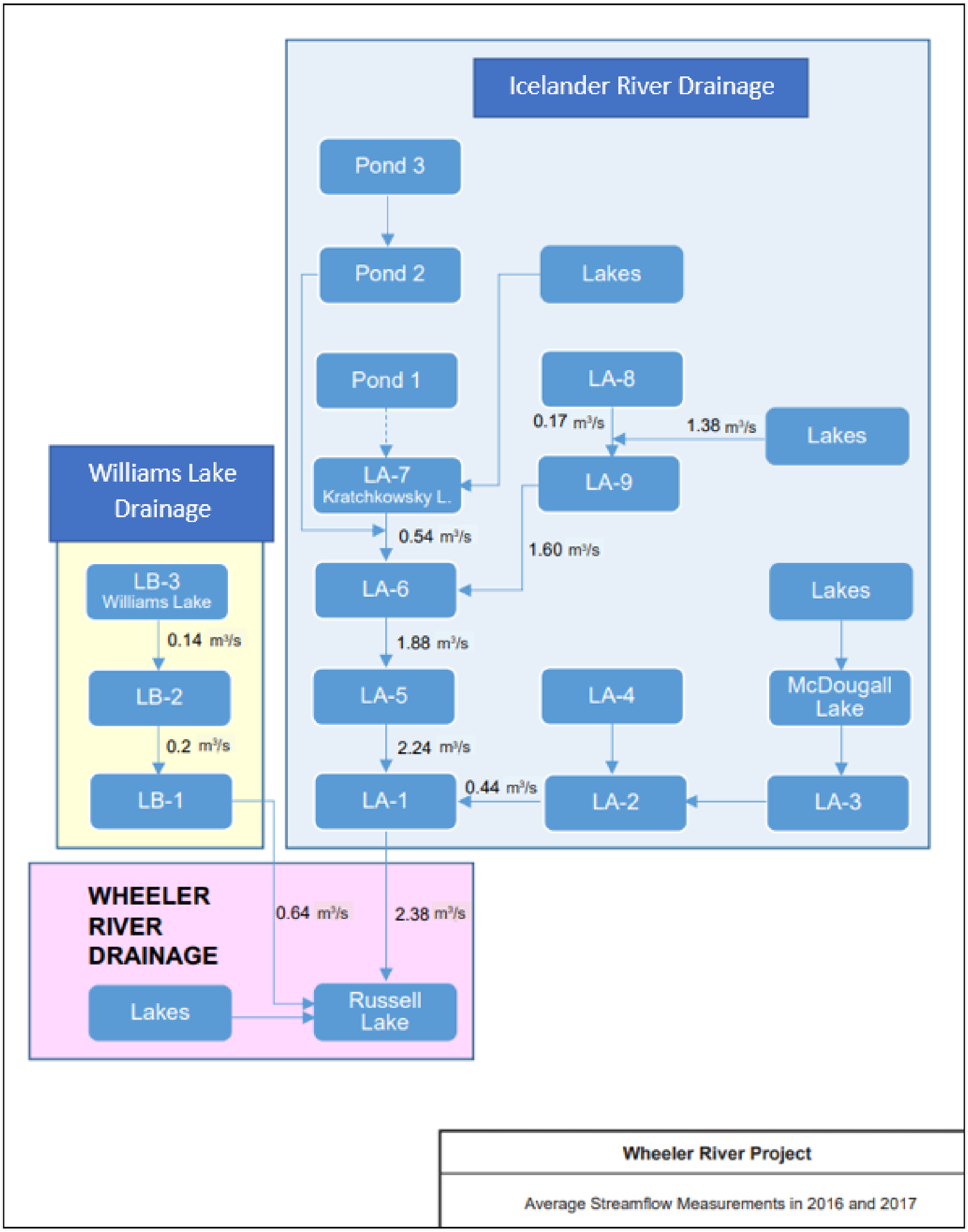


Figure 6: Average Streamflow Measurements in 2016 and 2017

As part of baseline studies, aquatic environment characterization efforts have included surveys and sampling for hydrology, water quality, limnology, sediment quality, aquatic habitat, bathymetry, plankton community, benthic invertebrate community, benthic invertebrate tissue chemistry, fish community, fish spawning habitat, and fish tissue chemistry. The more relevant aquatic environment details for the assessment of alternative means are provided in each option below, with additional information in the aquatic baseline report for the EIS.

Water quality samples of the lakes considered for treated effluent discharge location were collected and analyzed as part of baseline environmental studies. Water quality in the lakes was generally characterized by neutral or slightly acidic pH values, low concentrations of nutrients and ions, as well as metal and radionuclide concentrations that were near or below analytical detection limits. Average streamflow measurements from 2016 and 2017 are shown below.

For the alternatives means screening, it was assumed that with any of the options, suitable specific locations for discharge can be determined without affecting fish habitat or spawning grounds and that a suitable land corridor for a discharge pipeline, and adjacent trail for monitoring purposes, can be determined.

1. Kratchkowsky Lake (LA-7; identified on Figure 5 and Figure 6)

   Kratchkowsky Lake is situated within the Icelander River drainage area, upstream of lake LA-6. Compared to Lakes 1, 5, and 6, Kratchkowsky Lake is a large waterbody. This lake has relatively low flow entering and discharging from the lake.

   Similar to Russell Lake, as part of baseline studies, a small portion of the lake was surveyed: the south-east bay of the lake. These surveys and summaries provided here are not representative of the entire lake, but provide information on the specific areas surveyed. Habitat assessments found the shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. Within the area surveyed, the maximum depth was 6.78 m and the mean depth was 2.90 m. Using a straight line, Kratchkowsky Lake (LA-7) is approximately 3 km from the Project.

   A local resource user has commercially pulse fished on Kratchkowsky Lake in previous years (19-LK-ERFNTrap-134.68). Pulse fishing is fishing for one year at a lake and then not fishing at it for the following two years. The resource user fished using nets and would target Walleye, as well as Northern Pike, Whitefish, and Trout. No commercial fish harvests were reported from lakes local to the Project for the past five years (Government of Saskatchewan 2021).

2. Whitefish Lake north (LA-6; identified on Figure 5 and Figure 6)

   Whitefish Lake north is a relatively small lake. The lake has a surface area of 262,740 m^2, maximum depth of 2.71 m, mean depth of 1.57 m, and volume of 413,505 m^3. The substrate is sand and organic material. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes with presence of active erosional areas. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. This lake receives flows from two separate streams, Kratchkowsky Creek (from LA-7; Figure 7) and Hart Creek (from LA-9; Figure 8). Considering the small size of the lake in combination with the flows in and out, water in Whitefish Lake north (LA-6) has a relatively short retention time or flushing time. Using a straight line, Whitefish Lake north (LA-6) is approximately 900 m from the Project.

Figure 7: Kratchkowsky Creek flowing toward Whitefish Lake north (LA-6) from Kratchkowsky Lake (LA-7)

Figure 8: Hart Creek flowing toward Whitefish Lake north (LA-6) from LA-9

3. Whitefish Lake (south LA-5; identified on Figure 5 and Figure 6)

   Whitefish Lake south (LA-5) is a relatively small lake. The lake has a surface area of 324,049 m^2, maximum depth of 4.07 m, mean depth of 1.08 m, and volume of 332,503 m^3. The substrate is sand and organic material. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. This lake receives flow from Whitefish Lake north (LA-6). Considering the small size of the lake in combination with the flows in and out, water in Whitefish Lake south (LA-5) has a relatively short retention time or flushing time. Using a straight line, Whitefish Lake south (LA-5) is approximately 500 m from the Project.

   A photo from September 2016 (Figure 9) shows the connecting channel between Whitefish Lake north (LA-6) and Whitefish Lake south (LA-5).

Figure 9: Connecting channel between Whitefish Lake north (LA-6) and Whitefish Lake south (LA-5)

4. McGowan Lake (LA-1; identified on Figure 5 and Figure 6)

   McGowan Lake (LA-1) is located upstream of Russell Lake along the Icelander River drainage. The lake has a surface area of 1,485,480 m^2, maximum depth of 9.67 m, mean depth of 5.51 m, and volume of 8,189,320 m^3. The substrate is sand and boulders. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes with presence of old and active erosional areas. Cover observed included emergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation. McGowan Lake (LA-1) is downstream of LA-5, and LA-6 and, therefore, has slightly higher inflows and outflows than those lakes. Figure 10 shows the stream between Whitefish Lake south (LA-5) and McGowan Lake (LA-1) in September 2016. Using a straight line, McGowan Lake (LA-1) is approximately 2 km from the Project. A recreational lease (cabin) is located on the southwest portion of LA-1 and an industrial property (Rio Tinto) is south of LA-1.

Figure 10: Stream between Whitefish Lake south (LA-5) and McGowan Lake (LA-1)

5. Russell Lake (identified on Figure 5 and Figure 6)

   Russell Lake is the largest lake evaluated and is located the furthest from the proposed Project Area. Russell Lake is located on the opposite side of Highway 914 from the Project. Wheeler River flows through the lake from the southwest and out towards the northeast. Russell Lake receives drainage basin on the southwest end of the lake where Cameco's Key Lake Operation releases treated effluent approximately 20 km upstream. The lake also receives drainage from two drainage basins near the proposed Project: the Icelander Lake drainage and the Williams Lake drainage.

   As part of baseline studies, the portion of Russel Lake at the mouth of the Icelander River was surveyed. These surveys and summaries provided here are not representative of the entire lake but provide information on the specific areas surveyed. Habitat assessments found the shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes with presence of old and active erosional areas. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation. In the area surveyed, the maximum depth was 18.78 m and the mean depth was 3.04 m.

A local land user (ERFN Trapper) has commercially pulse fished on Russell Lake in previous years (19-LK-ERFNTrap-134.68). The resource user fished using nets, targeting target Walleye, as well as Northern Pike, Whitefish, and Trout. No commercial fish harvests were reported from the lakes local to the Project for the past five years (Government of Saskatchewan 2021).

Russell Lake is used for recreational fishing. A number of recreational leases and one traditional land use lease can be found along the lake shore, many of which have cabins that are used primarily for a few weeks in the summer months. Additionally, outfitters operate on Russell Lake and are mainly fly-in fishing camps. Information available from ERFN showed a historical winter route crossing a large portion of Russell Lake. Two industrial use properties (SaskPower) occur on the southwest portion of Russell Lake. Using a straight line, Russell Lake is over 8 km from the Project site.

6. Mardoc Lake (LA-4; identified on Figure 5 and Figure 6)

   Mardoc Lake is situated within the eastern sub-basin of the Icelander River drainage area, upstream of LA-2 and McGowan Lake (LA-1). It is a headwater lake with a maximum depth of 13 m. Flows out from the lake (via LA-2) are relatively low at approximately 0.44 m^3/second.

7. Williams Lake (LB-3; identified on Figure 5 and Figure 6)

   Williams Lake is a headwater lake located in the Williams Lake drainage and upstream of LB-2. The lake is close to Denison's exploration camp. A local land user (ERFN trapper) had an identified winter route crossing through Williams Lake (LB-3).

   The lake has a maximum length of 3.5 km, surface area of 1,522,984 m^2, maximum depth of 17.82 m, mean depth of 4.55 m, volume of 6,933,788 m^3. The substrate is boulders and sand. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.

1.1.4 Waste Management

1.1.4.1 Organic waste disposal

Organic waste generated on site is expected to be mainly food waste, but can also include cardboard, paper, wood chips, brown paper lunch bags, and other compostable materials.

Following stringent waste characterization and segregation, organic waste generated in the camp and other facilities would be organic material without hazardous material or radionuclide contamination. Assuming 150 individuals on site generating a food waste volume of 250 g per meal/person, the Project could produce approximately 788 kg of food waste per week. Adding other organic wastes (cardboard, paper, wood chips, brown paper lunch bags, and other compostable materials) would increase the total volume of organic waste requiring disposal.

At a later stage, Denison may consider adding biosolids (e.g., solids from the domestic wastewater plant) to the organic waste stream as the Project engineering advances and during Operation. For the purposes of this alternative means evaluation, the following three options were considered for the disposal of organic wastes generated as part of Project activities.

1. On-site disposal using an incinerator

   With this option, organic waste would be separated from other waste streams. Organic waste would be collected on a regular collection schedule for incineration. An on-site incinerator would be required; the design, construction, operation, and decommissioning of the incinerator would be the responsibility of Denison and its contractors. Testing and monitoring for the incinerator's performance criteria and emissions would be done to meet requirements in approvals.

2. On-site disposal in domestic landfill

   With this option, organic waste would be combined with domestic waste and disposed of in an on-site domestic landfill. It is assumed the contribution of organic wastes would slightly increase the total volume of domestic waste expected over the life of the mine and selecting this option would result in the need for a bigger domestic landfill footprint. The domestic waste landfill would be designed, constructed, operated, and decommissioned on site by Denison staff and contractors. It would be designed according to best practices and meet guidelines.

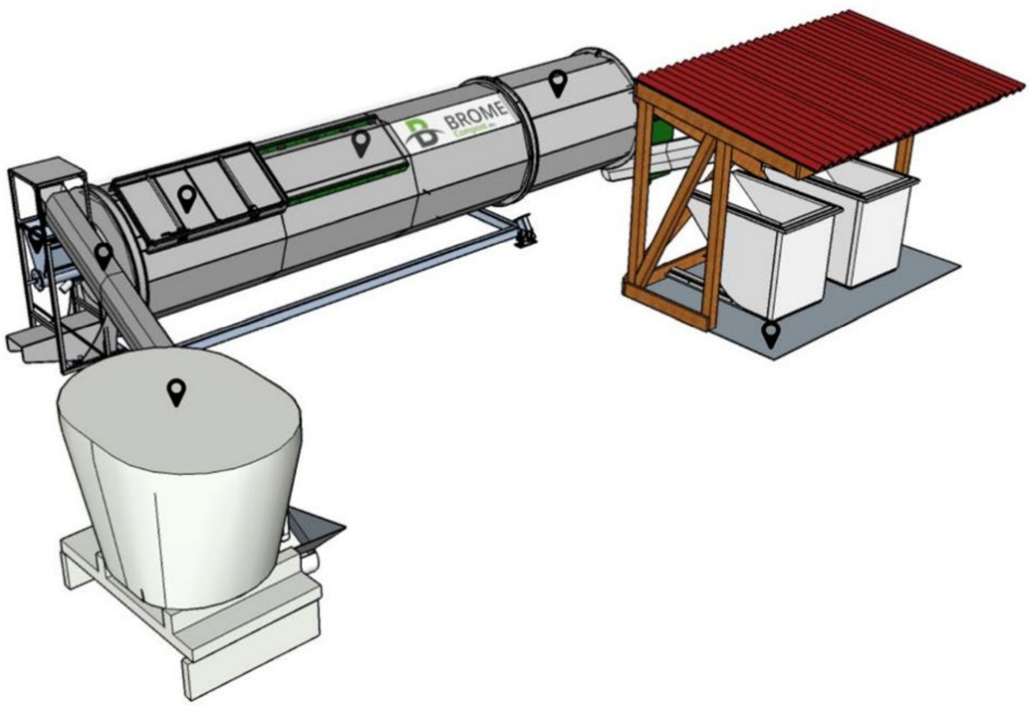
3. On-site composting

   A contained and partially automated composter, such as the Brome composting system, is an example of what could be used for on-site composting. The composting system would likely be contained within a seacan near the proposed domestic waste landfill, although the exact location would be determined as engineering advances.

   Organic waste would be separated from other waste streams. Organic waste would be collected in clear, compostable bags on a regular collection schedule. A sorting step may be required for greater control of waste streams entering the composter and to provide optimal quality of the final compost product. After sorting, the waste will be added into the composter where it has a residence time of 9 to 20 days. The compost would be automatically rotated at regular intervals to help maintain the required anaerobic environment and the temperature inside the composter would be kept above 55°C. Gases produced during the composting process are to be vented to the outside through a vent hood at the output of the composting unit. Compost would be discharged with each rotation and collected in bins where it would be screened and large material removed and returned to the composter for additional decomposition.

After composting is complete, an outdoor curing phase will be required during summer months. Based on experience with the Brome composting system at other mine sites, the finished compost is not expected to be a wildlife attractant. Prior to any compost being used on site for remediation purposes, the compost will be tested to determine its suitability for unrestricted or restricted use, based on the Canadian Council of Ministers of the Environment guidelines for compost quality (Canadian Council of Ministers of the Environment 2005).

Figure 11 shows a typical Brome composter set up. The mixer with a conveyor and feeder moves organic material into the composting vessel. At the discharge point, two bins collect mature compost that is ready for curing.



Source: www.bromecompost.com

Figure 11: Typical Brome Composter

1.1.4.2 Process precipitate management

Process precipitates will be generated in the processing plant prior to the uranium extraction circuit and in the first water treatment stage of the industrial wastewater treatment plant (IWWTP). These precipitates will contain non-radionuclides (e.g., sulphur, iron, copper) and radionuclides (e.g., uranium, radium-226, thorium-230) extracted from the ISR mine and brought to surface in the uranium bearing solution. Two options were evaluated as alternative means for disposal. The process precipitates are expected to contain economical concentrations of uranium in the range of 2%. The volume of process precipitates generated during the life of mine is expected to be around 50,000 m^3; however, it should be noted that this volume is very conservative as it incorporates a 15-year Operation phase and this production assumption exceeds the known reserves at the Phoenix deposit.

1. On-site permanent disposal

   Under this option, Denison would design, construct, operate, and decommission an on-site permanent disposal area for the process precipitates. This area would need to be designed to meet the CNSC's requirements for safety and control areas for protection of workers and the environment.

2. Off-site reprocessing and final disposal

   With this option, the process precipitates would be temporarily stored on site on an appropriately designed area for worker and environmental protection, e.g., an area double lined with leak detection capabilities. Contact water would be captured and treated on site before release to the environment.

   As part of Decommissioning, the process precipitates would be removed off site for reprocessing and eventual disposal at an appropriately licensed, third-party facility.

1.1.4.3 Domestic waste disposal

Following stringent waste characterization and segregation, the domestic waste generated as part of Project activities would comprise non-recyclable, non-hazardous material without radionuclide contamination and would, therefore, be suitable for disposal in a domestic waste landfill. The expected volume of domestic waste generated over the life of mine is 34,400 m^3. Examples of waste destined for disposal in a domestic landfill are non-recyclable plastics, broken furniture, textiles, and wood. Domestic waste is not expected to contain organic waste.

1. Collection and disposal off site by a third-party contractor

This option assumes a regional off-site landfill would have capacity to accept the domestic wastes generated at the site over the life of mine. Domestic waste would be collected by Denison and temporarily stored and managed on site in appropriate containers. Transport of domestic waste from the Project to the approved landfill facility would be done by a third-party contractor.

2. Collection and disposal in an on-site domestic landfill

This option assumes a dedicated domestic waste landfill is designed, constructed, operated, and decommissioned on site by Denison staff and contractors. Conceptually, the domestic landfill would have a composite liner system with leachate collection. The design consists of a high-density polyethylene (HDPE) liner directly over a geosynthetic clay liner (GCL), with leachate collection system above the composite liner. The leachate collection pond associated with the domestic landfill would have a double composite liner system with leak detection. The leachate would be collected by vacuum truck and treated in the industrial wastewater treatment plant. The landfill would be fenced and the surface contoured to direct non-contact runoff away from the facility. The domestic landfill would require regular covering with clean soil to prevent wind borne litter leaving the landfill and to avoid attracting wildlife and birds. Performance of the domestic landfill and leachate containment system would be monitored through a network of groundwater monitoring wells, including at a minimum one upgradient and two downgradient wells.

1.1.5 Access and Transportation

1.1.5.1 Access road alignment

1. Option 1 – Direct route

The first option considered for accessing the Project site was a direct route that intersected a drumlin and followed the height of land to the location of the proposed site facilities. The alignment has a total length of 5.31 km and would result in a total cut of 904,400 m^3 and 36,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This route is at least 200 m away from an open water body and is more than 500 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12, Figure 13.

2. Option 2 – Direct route to reduce cut volumes

The second option considered for accessing the Project site attempted to reduce the cut volume generated in Option 1, which directly intersected a drumlin. To do so, Option 2 skirted the perimeter of the drumlin and then followed the height of land to the location of the proposed site facilities. The alignment has a total length of 5.77 km and would result in a total cut of 85,200 m^3 and 71,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This option is within 200 m (approximately 140 m) of an open waterbody and is located approximately 240 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12 and Figure 14.

3. Option 3 – Following part of the existing exploration access road

The third option considered for accessing the Project site considered following near the current exploration access road, following the height of land to the location of the proposed site facilities. The alignment has a total length of 6.47 km and would result in a total cut of 57,300 m^3 and 37,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This option is at least 200 m away from an open water body and is more than 1,000 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12 and Figure 15.

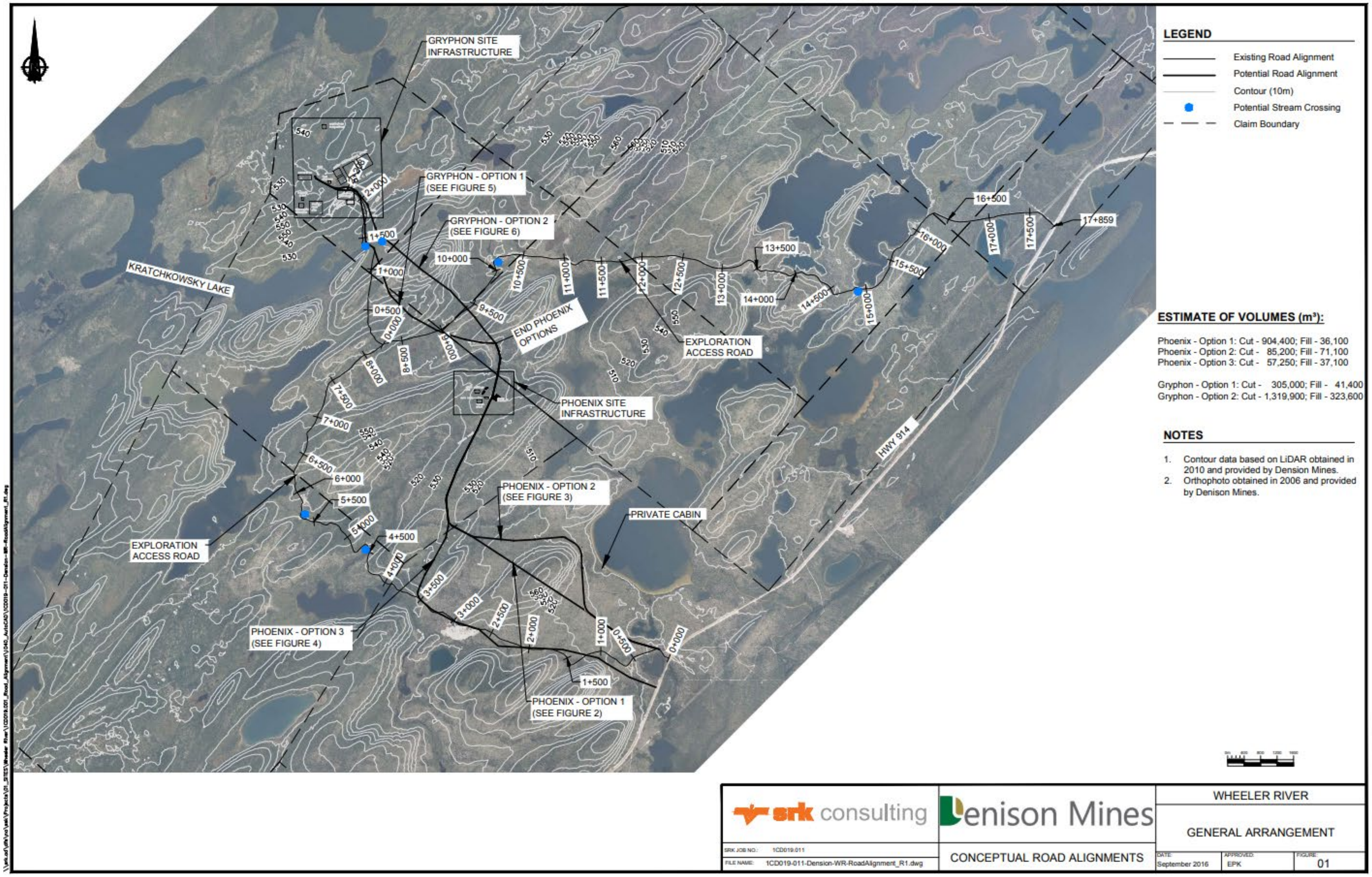


Figure 12: Overview of Three Access Road Alignment Options

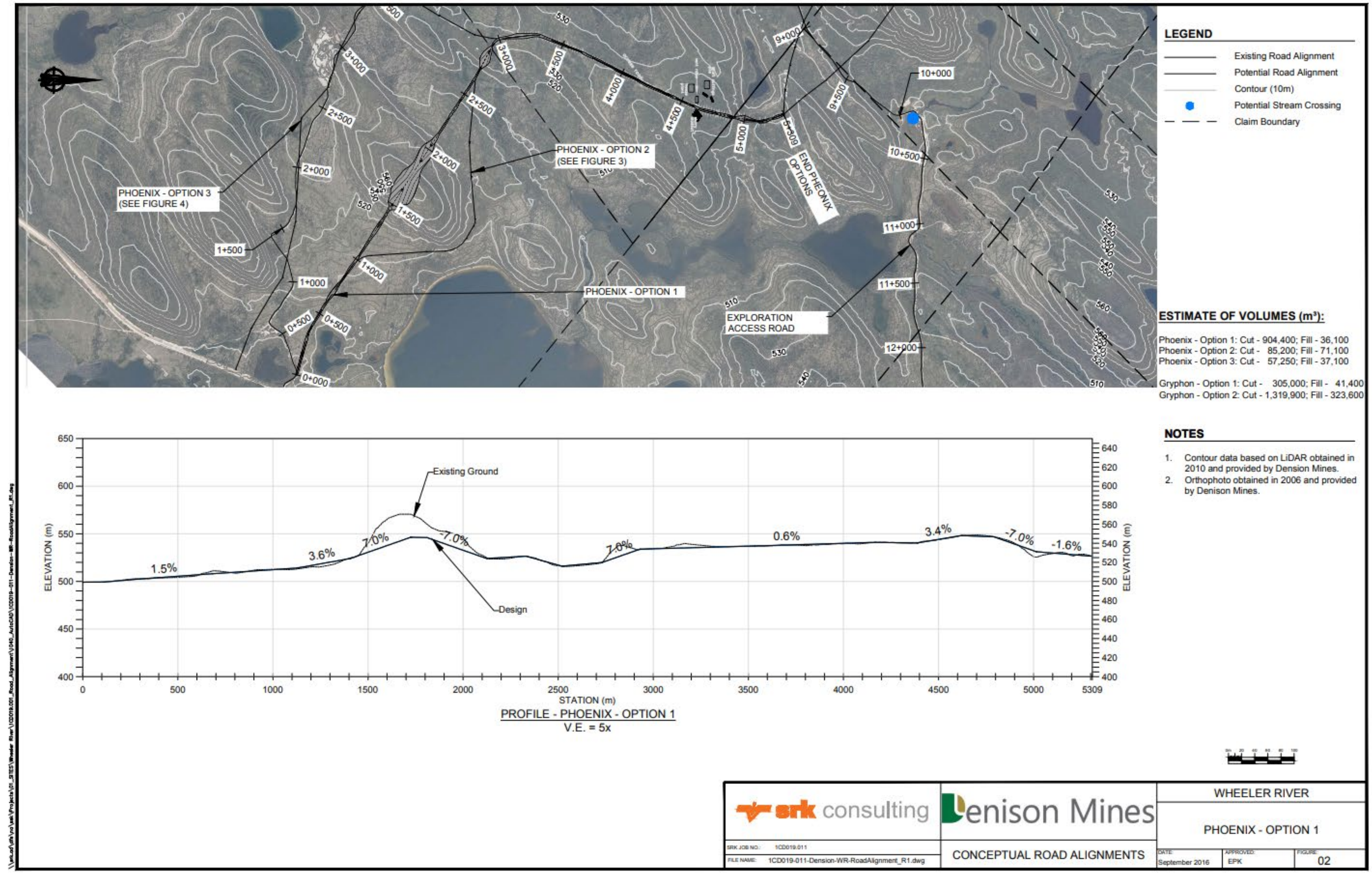


Figure 13: Access Road Option 1

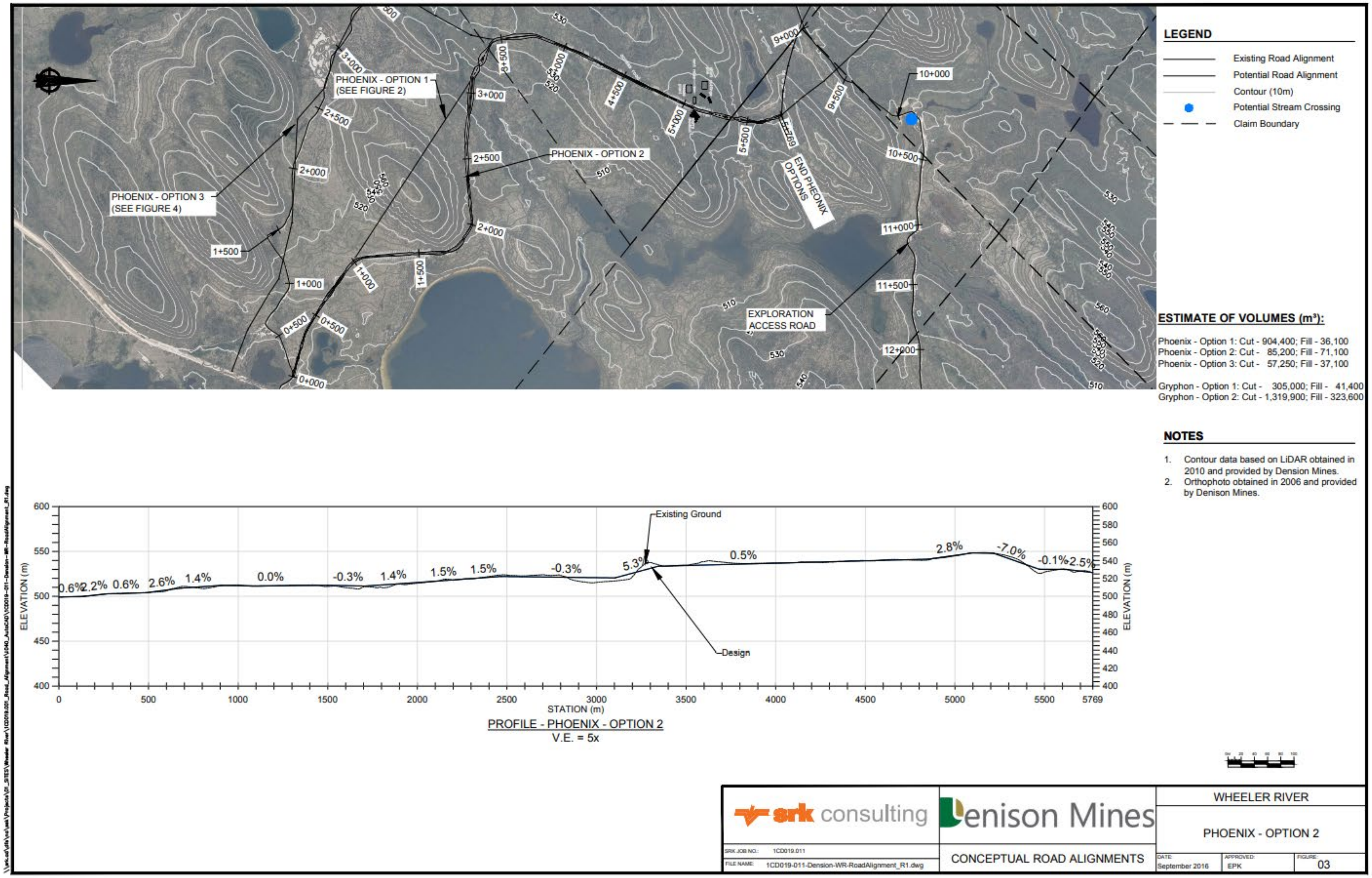


Figure 14: Access Road Option 2

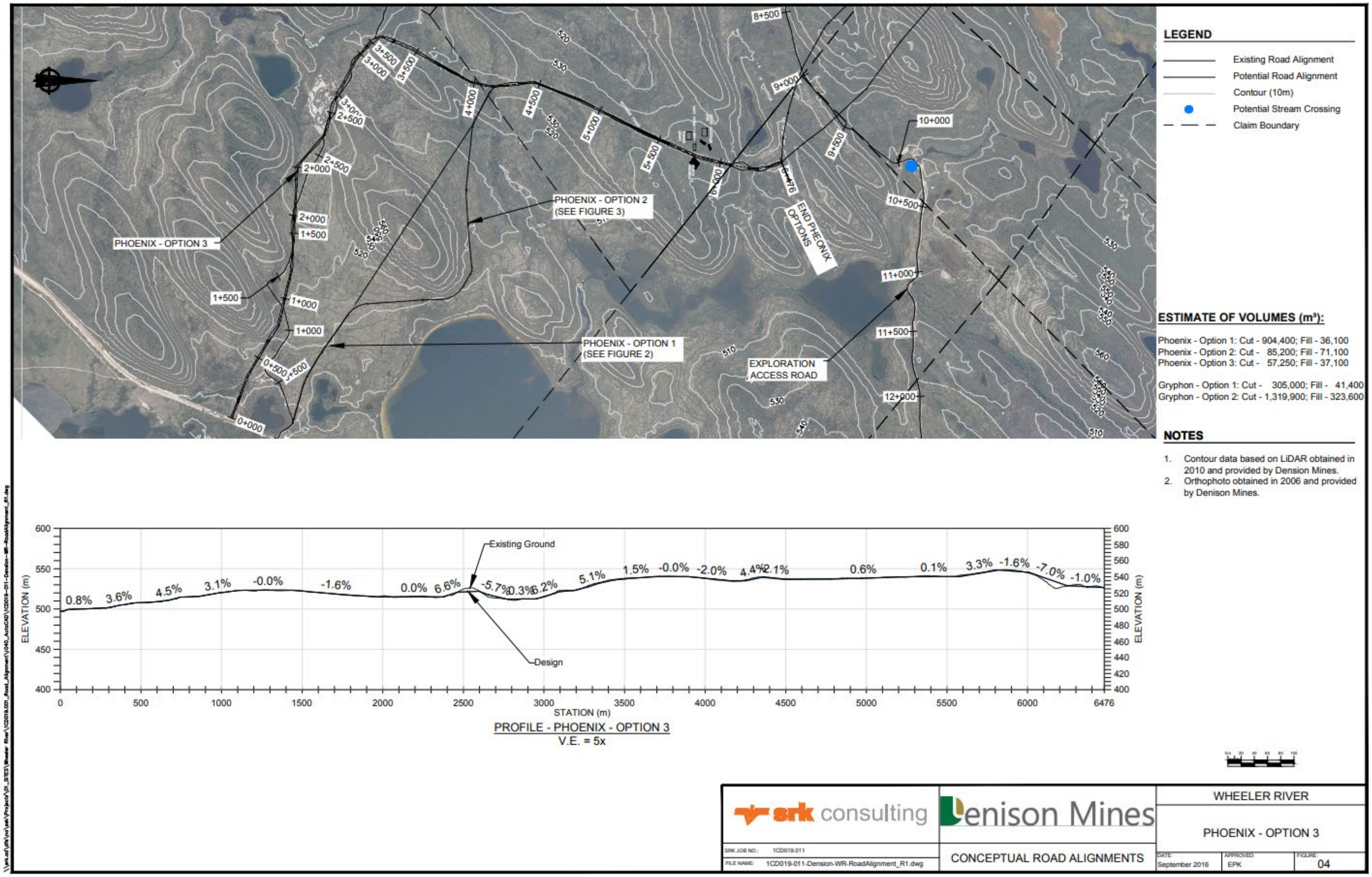


Figure 15: Access Road Option 3

1.1.5.2 Stream crossing structures

The proposed road from the Project Area to the proposed on-site airstrip would cross two streams. Both stream crossings are upstream of Whitefish Lake north (LA-6). Kratchkowsky Creek is downstream of Kratchkowsky Lake (LA-7) and Hart Creek is downstream of LA-9. Refer to Figure 5, Figure 6, Figure 7, Figure 8, and Figure 16.

The two stream crossings would be installed at locations where crossings previously existed, but were decommissioned by Cameco in 2015. The previous stream crossings at these locations were clear span bridges. The crossing at Kratchkowsky Creek was a 15 m single span steel girder bridge. The crossing at Hart Creek was a 30 m double span steel girder bridge with a mid-channel steel culvert for support. Two options were considered for these two crossings associated with the Project: culverts and clear span bridges.

1. Culverts

   Depending on the width of the stream, one or a series of large-diameter round culverts were considered as an option for stream crossing structures. Culverts would be designed following best practice for design, construction, and maintenance as indicated by standards and codes of practice for fish passage and to withstand a flood event.

   Vegetation removal, fill, and grading would be required only to the extent necessary to prepare the area for culvert installation. Laydown areas would be kept adjacent to the roadway and above the flood-prone area. Culverts would be pre-assembled in the laydown area and lifted into place in the stream bed.

   Culverts placement in the streams would result in unavoidable harmful alteration, disruption, or destruction (HADD) of fish habitat under subsections 34(1) and 35(2) of the *Fisheries Act* (Government of Canada 2019).

   Culverts would be inspected periodically to remove accumulated material and debris that may prevent efficient passage of water and fish through the structures.

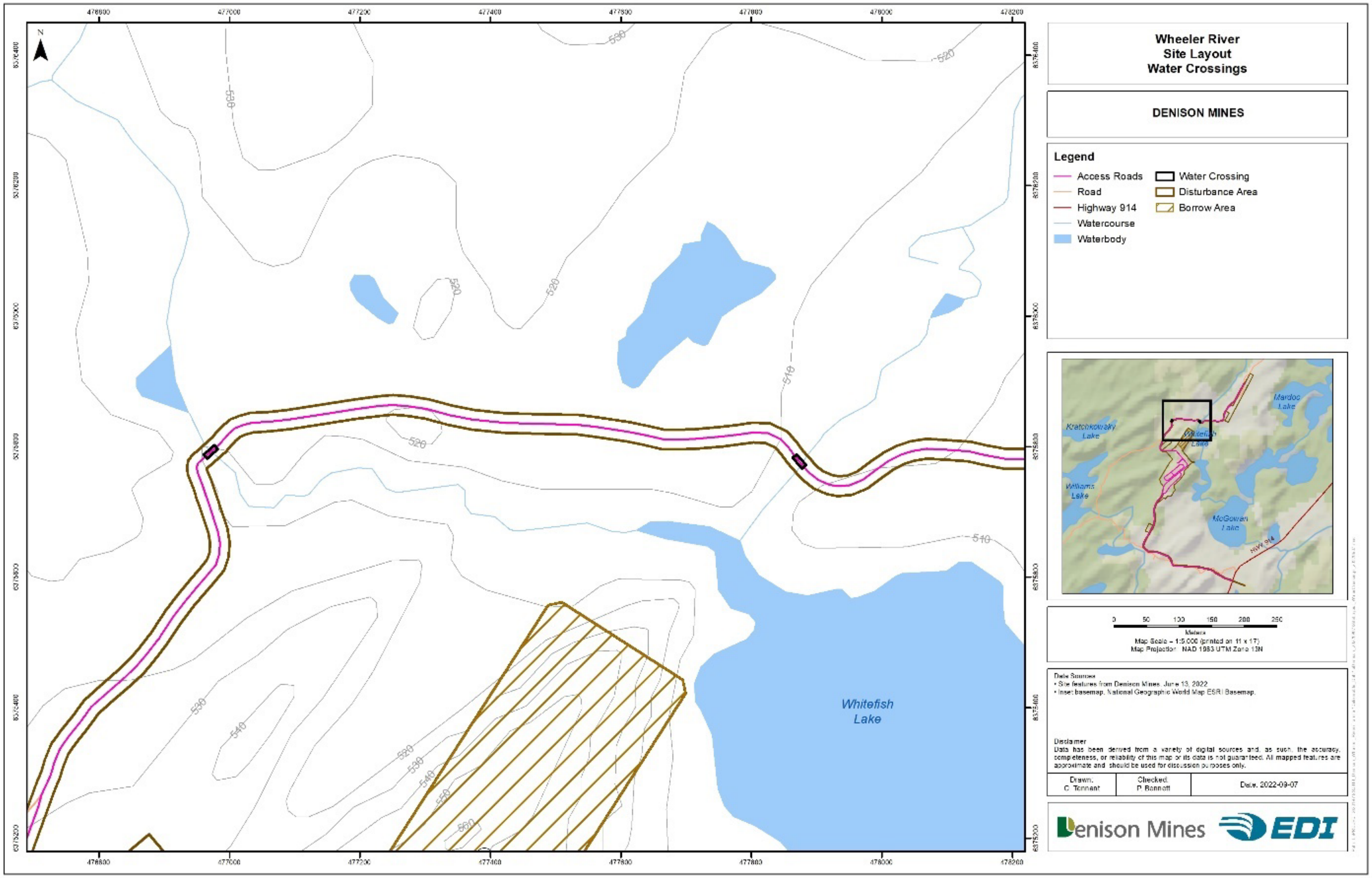


Figure 16: Proposed Stream Crossing Locations

2. Clear span bridges

   The option for clear span bridges allows for road crossing without in-water works, supports or buttresses. This option would also be similar to what was previously in place at these locations.

   Vegetation removal, fill, and grading would be required only to the extent necessary to prepare footings for the bridge, which would remain above the high-water mark. Heavy construction equipment would be needed to prepare footing areas for concrete. Laydown areas would be kept adjacent to the roadway and above the flood-prone area. Crossings would be pre-assembled in the laydown area and lifted into place.

   It is expected that the works associated with construction of clear span bridges could be either conducted to avoid fish habitat or conducted over a short duration, at a small spatial scale, and during appropriate timing windows. As such, the use of clear span bridges for the stream crossing structures would not be expected to constitute a HADD of fish habitat under subsections 34(1) and 35(2) of the *Fisheries Act* (Government of Canada 2019).

   Clear span bridges would be inspected periodically to remove accumulated material and debris upstream and downstream, although accumulated debris volumes are expected to be minimal because the bridge will span the full width of each stream.

1.1.5.3 Worker transportation

For all worker transportation options, pick-up points would be available at key communities based on an analysis of transportation efficiency. All of the worker transportation alternative means assume a worker rotation system would be in place for staff and contractors.

1. Ground transport

   Ground transportation involves using buses, vans, and trucks to transport Denison staff and contractors between pick-up points and the camp at the Project. Ground transport is the current, main mode for mobilizing Denison's exploration staff to and from the site.

   Approximate distances and travel times to the Project Area are provided for context:
   - 740 km or 10 hours from Saskatoon;
   - 470 km or 7.5 hours from La Ronge;
   - 450 km or 7 hours from Patuanak; and
   - 355 km or 5 hours from Pinehouse.

   Evaluation of this option within the alternatives means assessment framework assumes the ground transport is Denison's responsibility, and as such, the transport was considered within the bounds of the Project-specific evaluation of alternative means.

2. Air transport to existing airstrip at nearby Cameco operations

   Cameco operates two existing airstrips, one at each of the Key Lake and McArthur River operations. For this option, an agreement would need to be developed between Denison and Cameco. For the purposes of this alternative means screening assessment, it is the assumed that an agreement is attainable.

   Air transport would be chartered through a third-party carrier. Approximate flight time from Saskatoon to the Key Lake or McArthur River operations airstrip, with a pick-up stop in La Ronge, would be 2 hours.

   On shift change days, Denison staff and contractors would travel by van or bus between the airstrip and the camp. The distance between the Project and the McArthur River Operation airstrip is about 40 km and the drive would take approximately 30 minutes. The distance between the Project and the Key Lake Operation airstrip is about 30 km and the drive would take approximately 25 minutes.

   Evaluation of this option within the alternatives means assessment framework assumes the ground transport component of the routing is Denison's responsibility, and as such, the ground transport was considered within the bounds of the Project-specific evaluation of alternative means.

3. Air transport to new airstrip constructed and operated by Denison

   For this option, Denison would design, construct, operate, and decommission an airstrip as part of the Project to meet the need for staff and contractor transportation to and from site. This option also requires the construction of a 5 km long road from the main area of Project infrastructure to the proposed airstrip, which would require two stream crossings (Figure 17). An airstrip terminal building would be required near the airstrip, which would have electricity, heat, and washroom facilities. Two double-walled Jet A fuel tanks would be needed to provide site service to aircrafts as required.

   A 1,600 m long airstrip would be positioned in a natural and relatively flat area, and an area to the northeast of the main Project infrastructure was selected based on topography and proximity to the main Project components (Figure 17). The magnetic headings are 03/21, which is similar to both the Collins Bay airport and Key Lake Operation airstrip. The runway would be designed to accommodate the aircraft presently used by existing mining operations in northern Saskatchewan to transport workers into and out of site. The approach line to the airstrip from the southwest would clear the surface facilities by 500 m.

   Air transport would be chartered through a third-party carrier. Approximate flight time from Saskatoon to the airstrip, with a pick-up stop in La Ronge, would be 2 hours. On shift change days, Denison staff and contractors would travel by van or bus between the airstrip and the camp. The distance between the camp and the airstrip is about 5 km and the drive would take approximately 5 minutes.

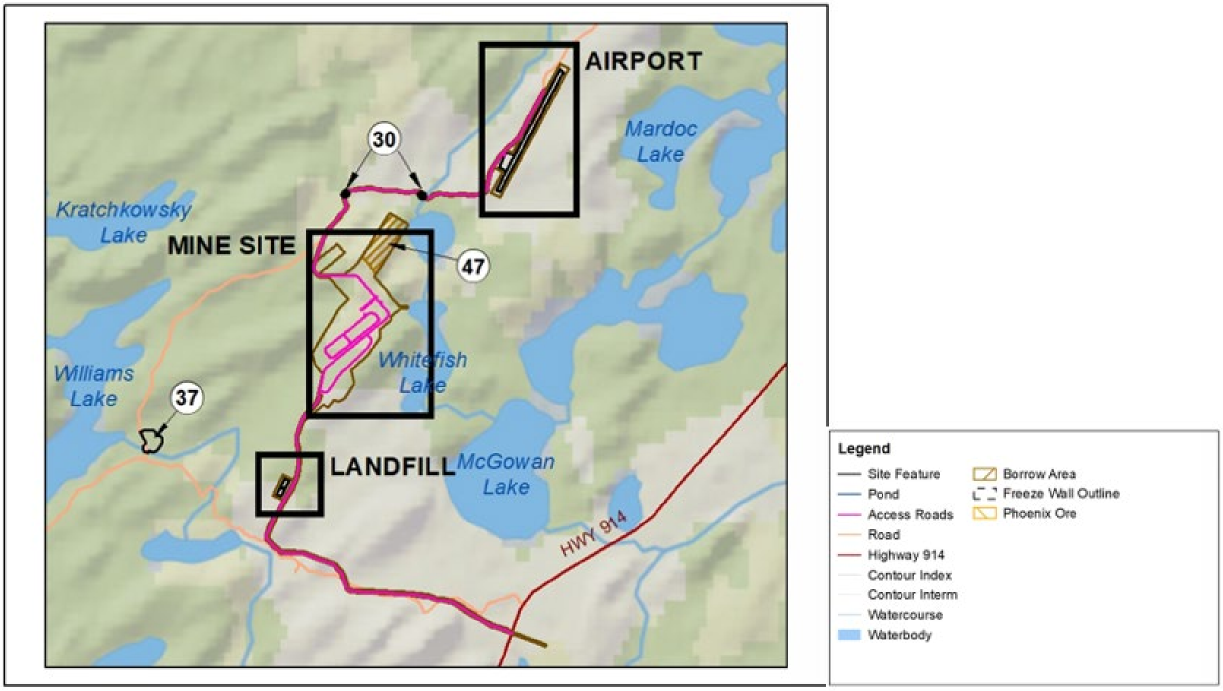


Figure 17: Potential Site Layout for On Site Airstrip Option

1.1.6 Power

1.1.6.1 Primary power supply

The estimated peak power demand for the Project is 7.6 MW. A variety of options have been considered for the primary power supply.

1. Liquefied natural gas (LNG) power plant

   Powering the Project with LNG would require appropriately designed tanks to store approximately 250,000 L. Liquefied natural gas would be transported to the Project on a regular basis by third-party suppliers; however, there are currently no existing or proposed LNG facilities in Saskatchewan. As a partial estimate of operating costs, the purchase of liquefied natural gas to meet the Project's power demand could be in the range of $8M per year. This does not include other costs for transportation of LNG, power plant equipment purchase or rental, construction and monitoring of tanks and containment systems. In addition to the above, the evaluation of this option within the alternatives means assessment framework also included the transport component (need to transport LNG to site) within the bounds of the Project-specific evaluation of alternative means.

2. Solar photovoltaic power plant

   Photovoltaic panels are used to convert thermal energy into electricity. As a very rough approximation, a 1 MW solar photovoltaic power plant requires approximately 4 ha of land area to house the photovoltaic panels. With a peak power demand of the Project being 7.6 MW, it is reasonable to assume that an area of approximately 30 ha would be needed for panels. This estimate does not consider the Project's latitude, power losses, plant output, an inverter, and batteries for storage needs to consistently meet power demands. As a comparison, a 10 MW solar project proposed in southern Saskatchewan consisted of 37,000 photovoltaic panels and all solar project components combined to cover an area of 35.8 ha (Saskatchewan Environmental Assessment Branch 2020). The cost of a 10 MW solar photovoltaic power plant is estimated at >$15M.

3. Diesel generators

Powering the Project with diesel would require appropriately designed tanks on site to store approximately 500,000 L. Diesel would be transported to the Project on a regular basis by third-party suppliers. As a partial estimate of operating costs, the cost of diesel to meet the Project's power demand is approximately $12M per year. This does not include other costs for transportation of fuel, generator purchase or rental, construction and monitoring of tanks and containment systems. In addition to the above, the evaluation of this option within the alternatives means assessment framework also included the transport component (need to transport diesel to site) within the bounds of the Project-specific evaluation of alternative means.

4. Provincial power grid

SaskPower is the electricity transmission and distribution provider for the province of Saskatchewan. This option involves tying into one of SaskPower's existing distribution lines: the 138 kV overhead transmission line that runs along Highway 914. The installation costs of the power line extension from the existing line into the Project site are approximately $6M. Most power feeding the line is generated at the Island Fall hydroelectric station. Annual electrical costs are estimated at $4M per year. An electrical substation would be needed on site to step down and distribute the power from the transmission line to the site.

With this option, SaskPower will be responsible for conducting activities such as line routing, environmental studies, permitting, public consultation, and engineering design work as applicable to the load interconnection. Although it would be largely ancillary to the Project, some of this information was considered in the evaluation of alternative means.

1.1.7 Support facilities

Efforts have been made to reduce the overall footprint of the Project as the design process has progressed; however, the overall process has been one of incremental optimization as opposed to considering alternative locations that would fundamentally change the Project assessment basis or unnecessarily expand the site footprint/Project Area. Denison has also made efforts to minimize new clearing of vegetation by optimizing the site layout within previously disturbed areas. As with many natural resource projects, the location of the resource dictates the mining location and, therefore, the location of supporting infrastructure.

As an example of incremental optimization, the evolution in the proposed camp location is presented in the alternative means assessment.

1.1.7.1 Camp location optimization

All alternative camp locations were positioned close to the site road. The camp locations were also located southwest of all the main sources of air emissions (processing plant, special waste rock pad, precipitate storage areas) based on prevailing wind information.

1. First location – Prefeasibility

   At the prefeasibility stage, a camp location was selected to provide views over the nearby lake. On further review this location required a large fill volume to develop.

2. Second location - Reduce fill volumes

   At the next design stage, the location of the camp was moved south and west along the access road. It was still very close to the other Project components, but reduced the fill volumes relative to the first location.

3. Third location – Southwest from second location

   As the technical assessments for the environmental assessment were underway, the air dispersion modelling results flagged potential minor air quality concerns at the camp location (i.e., the “second location”). Although the predictions were based on conservative assumptions, Denison made the decision to evaluated a camp location further south and west along the access road to potentially provide increased distance between the camp and other Project components.

Table 1: List of Project Component and Activity Alternative Means

Project Component		Alternative Means Considered						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	Open pit	Jet Boring	Surface Boring	Micro Tunnel Boring	ISR		
	Freeze design for tertiary containment of mining solution	Freeze dome	Freeze wall					
	Permeability enhancement	Hydraulics	Propellant	Mechanical				
	Mining solution	Alkaline solution	Acidic solution					
Processing	Location of processing	Off-site processing at an existing mill	On-site processing in purpose-built processing plant					
	On-site processing method	Ion exchange	Solvent extraction	Direct precipitation				
Water management	Freshwater supply	Groundwater	Surface water					
	Drinking water	Truck drinking water to site	Generate drinking water on site with a potable water treatment plant					
	Treated effluent discharge location	To groundwater	To surface water					
	Treated effluent discharge location to surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	Whitefish Lake (south LA-5)	McGowan Lake (LA-1)	Russell Lake	Mardoc Lake (LA-4)	Williams Lake LB-3
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	On-site composting				
	Process precipitate management	On-site permanent disposal	Off-site reprocessing and final disposal					

Project Component		Alternative Means Considered						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
	Domestic waste disposal	Collection and disposal off site by a third-party contractor	Collection and disposal in an on site domestic landfill					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	Follows part of the existing exploration access road				
	Stream crossing structures	Culverts	Clear span bridges					
	Worker transportation	Ground transport	Air transport to existing airstrip at nearby Cameco operations	Air transport to new airstrip constructed and operated by Denison				
Power	Primary power supply	Liquefied natural gas power plant	Solar photovoltaic power plant	Diesel generators	Provincial power grid			
Support facilities	Camp location	First location - Prefeasibility	Second location – Reduce fill volumes	Third location - Southwest from second location				

1.2 Consideration of Technical and Economic Feasibility along with Land Use Screening

Alternative means considered in an EIS must be technically and economically feasible (CEAA 2015). Technical feasibility pertains to the ability to safely and efficiently implement the Project in a manner that meets Denison's operating requirements and is in compliance with current applicable technical standards and codes. Economic feasibility pertains to the ability to implement the Project in a manner that allows Denison to meet the needs of its customers while remaining financially viable. Environmental or socio-economic factors can affect technical and/or economic feasibility, usually by requiring mitigation measures that are technically challenging or very costly. Accordingly, the need to implement such measures is considered in the identification of technically and economically feasible alternatives.

Denison integrated an additional category at this early stage in the alternative means assessment framework: land use screening. Although technical feasibility can include land use considerations, Denison opted to include land use separately to provide greater transparency on the approach taken and also in recognition of the importance of local land use that has been communicated by interested parties. In conjunction with screening for technical and economic feasibility, an initial evaluation was conducted to review Indigenous and other land use in the area to identify alternative means that may interact with areas of high land use intensity or areas of cultural importance (e.g., known gravesites). Consideration was given to information made available to Denison in the early stages of project planning. Mapped land use information provided by English River First Nation and Pinehouse Kineepik Métis included locations of trails, burial/sacred locations, plant harvesting, hunting, fishing, camping, and cabins. The land lease map identified traditional, recreational, and industrial land uses based on lease data provided by the Saskatchewan government (Figure 18). Subsequent, additional consideration of engagement information, including Indigenous and other land and resource use is completed at later stages in the alternatives means assessment framework. The purpose of considering land use information at this stage was to identify land use that could compromise the feasibility of the Project and screen an alternative means out from additional evaluation.

In consideration of the above, the technical feasibility criteria, economic feasibility criteria, and land use criteria considered by Denison in relation to the Project included the following:

- Technologically feasible: Alternative is based on technology that has not been determined to be adequately effective to the extent that technical uncertainty is such to deem an alternative as unsuitable for implementation. Consideration of technical feasibility includes a consideration of safety.

- Financial feasibility: Alternative results in capital (i.e., equipment purchase, installation, construction), operating (e.g., reagents, consumables, operating risks, labour requirements) and/or closure costs (i.e., decommissioning duration and scope) that threaten the economic feasibility of the Project.

- Land use: Alternative will interact with an area of high land use intensity or an area of high cultural importance based on information available to Denison during early Project planning that would compromise the feasibility of the Project.

For each Project component identified in Table 1, a consideration of the technical, economic, and land use characteristics of each alternative is provided in Table 2 to identify feasible alternatives for further assessment and to eliminate those alternative means that are not considered to be feasible from a technical, economic, or land use lens. Only those alternatives that are deemed technically and/or economically feasible and avoided interaction with areas of high intensity or high importance land use, are carried forward for further assessment. The initial screening of alternatives is summarized in Table 3.

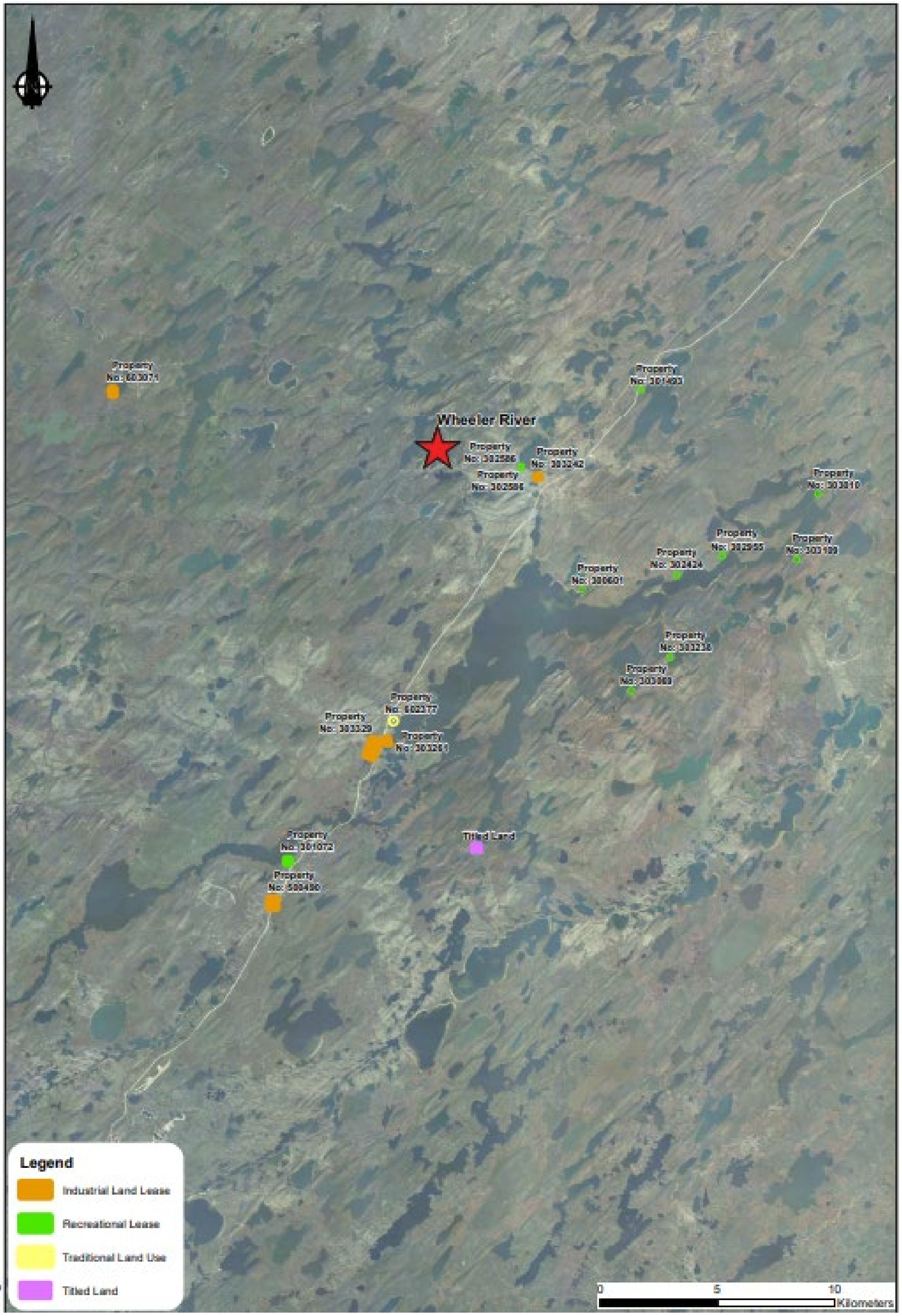


Figure 18: Provincial Land Leases for Traditional, Recreational, and Industrial Land Uses

Table 2: Screening of Alternative Means for Technical and Economic Feasibility with Consideration of Land Use Factors

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
Mining	Method	Option 1 Open pit Option 2 Jet Boring Option 3 Surface Boring Option 4 Micro Tunnel Boring Option 5 ISR	The financial cost associated with Option 1 deems this option as uneconomic. Options 2, 3, 4, and 5 would be technically and economically feasible.	Options 1 through 55 would result in similar footprint locations (to match the uranium deposit location), although the size of the footprint would vary. Overall, the options would have a similar interaction with known land use and proximity to the closest recreational land lease. Based on available land use information, Options 1 through 5 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 was screened out from additional evaluation for economic factors. Options 2, 3, 4, and 5 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Freeze design for tertiary containment of mining solution	Option 1 Freeze dome Option 2 Freeze wall	Option 1 is technically and economically feasible using directional drilling techniques; the costs and risks are higher than Option 2. Option 2 is technically and economically feasible using diamond drilling techniques. The ground freezing technology is the same for both options.	Options 1 and 2 would result in similar footprint locations (because the freeze wall is close to the uranium deposit) and similar interaction with known land use and proximity to the closest recreational land lease. Based on available land use information, Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Permeability enhancement	Option 1 Hydraulics Option 2 Propellant Option 3 Mechanical	All options are technically and economically feasible in terms of operability within the context of increasing connectivity within the mining area.	Because permeability enhancement options are an underground activity, they would be conducted within the footprint for the ISR mining method (considered separately). The permeability enhancement options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Mining solution	Option 1 Alkaline solution Option 2 Acidic solution	Option 1 is not technically feasible based on the uranium deposit geochemistry. Option 2 is technically and economically feasible based on the uranium deposit geochemistry and ability to dissolve uranium.	The mining solution options do not interact with an area of high land use intensity or an area of high cultural importance.	Option 1 was not technically feasibility and not carried forward as an alternative. The EIS evaluated use of an acidic mining solution.
Processing	Location of processing	Option 1 Off-site processing at an existing mill	Options 1 and 2 are technically and economically feasible. Option 1 would be contingent on the sale (or pre-sale) of ore, ore slurry, or uranium bearing solution	Assuming the location selected for the surface handling and loadout facility (Option 1) or on-site processing plant (Option 2) are	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
		Option 2 On-site processing in purpose-built processing plant	at the time the material is loaded onto appropriate containers and leaves the Project site.	close (e.g., within 1 km) to the mining area and within what is generally expected to be the development footprint of the Project, this option would not interact with an area of high land use intensity or an area of high cultural importance.	
	On-site processing method	Option 1 Ion exchange Option 2 Solvent extraction Option 3 Direct precipitation	The processing plant methods evaluated were for an on-site processing plant for processing of uranium bearing solution generated via the ISR mining method. Each option would require different processing plant design (e.g., tanks, piping, reagents, control systems) but at the initial screening level, all three options were individually considered to be technically and economically feasible.	Assuming the location selected for an on-site processing plant is close (e.g., within 1 km) to the mining area and within what is generally expected to be the development footprint of the Project, the three options for on-site processing methods do not interact with an area of high land use intensity or an area of high cultural importance	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Water management	Freshwater supply	Option 1 Groundwater Option 2 Surface water	Options 1 and 2 are technically and economically feasible based on the estimated freshwater needs of the Project in the context of environmental baseline data collected for the local groundwater environment and surface water quantity (hydrology) and quality.	Freshwater supply associated with Options 1 and 2 could interact with surface water flows. However, based on the low volume of withdrawal relative to the baseline flows and no discernable changes in local lake hydrology (flows, water levels) would be experienced by land users at nearby lakes.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Drinking water	Option 1 Truck drinking water to site Option 2 Generate drinking water on site with a potable water treatment plant	Options 1 and 2 are technically and economically feasible.	Based on available land use information, Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Treated effluent discharge location	Option 1 To groundwater Option 2 To surface water	Options 1 and 2 are technically and economically feasible with consideration of expected volumes and quality.	Based on land use information available Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Treated effluent discharge location to surface water	Option 1 Kratchkowsky Lake (LA-7)	Option 6 (Mardoc Lake, LA-4) and Option 7 (Williams Lake, LB-3) were removed from further consideration due to technical feasibility. Options 6 and 7 are both	Option 7 (Williams Lake, LB-3) overprints with a winter trail route for a local land user (ERFN trapper) and does not pass the land	Option 6 was removed at this stage for technical reasons. Option 7 was removed at this stage based on the land use screening in conjunction with technical considerations.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
		Option 2 Whitefish Lake north (LA-6) Option 3 Whitefish Lake (south LA-5) Option 4 McGowan Lake (LA-1) Option 5 Russell Lake Option 6 Mardoc Lake (LA-4) Option 7 Williams Lake LB-3	headwater lakes of small relative size with low flows and little assimilative capacity based on the preliminary screening. Options 1, 2, 3, 4, and 5 are technically and economically feasible.	use criterion, though it had been also screened out for technical reasons. The remaining options were carried forward based on land use screening as they did not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 through 5 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Waste management	Organic waste disposal	Option 1 On-site disposal using an incinerator Option 2 On-site disposal in domestic landfill Option 3 On-site composting	Options 1, 2, and 3 are technically and economically feasible.	The three organic waste disposal options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Process precipitate management	Option 1 On-site permanent disposal Option 2 Off-site reprocessing and final disposal	Both options for process precipitate management are technically and economically feasible.	Assuming the location selected for an on-site disposal permanent (Option 1) or a temporary process precipitates handling area (Option 2) is close (e.g., within 1 km) to the mining area, within what is generally expected to be the development footprint of the Project, and would meet all requirements for radioactive waste management and disposal for protection of the environment and human health, there would be no limiting land use factors associated with this option. For the purposes of this screening, Option 2 assumes existing public transport routes would be used and reprocessing, and disposal would be covered	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
				at an existing facility under that site's licensing and permitting framework.	
	Domestic waste disposal	Option 1 Collection and disposal off site by a third-party contractor Option 2 Collection and disposal in an on site domestic landfill	Both options for disposal of domestic wastes (clean, non-recyclable material such as plastics, wood) are technically and economically feasible.	Assuming the area for Option 2 is close to the main project area and within what is generally expected to be the development footprint of the Project, both options for domestic waste disposal do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Access and transportation	Access road alignment	Option 1 Direct route Option 2 Direct route to reduce cut volumes Option 3 Follows part of the existing exploration access road	All three options are technically and economically feasible. Each alternative route could be safely and economically constructed and operated.	The three access road alignment options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Stream crossing structures	Option 1 Culverts Option 2 Clear span bridges	Large diameter culverts (Option 1) or clear span bridges (Option 2) are both technically and economically feasible ways to cross streams at the two locations on the access road from the site to the airstrip.	The stream crossing structure options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Worker transportation	Option 1 Ground transport Option 2 Air transport to existing airstrip at nearby Cameco operations Option 3 Air transport to new airstrip constructed and operated by Denison	Options 1, 2, and 3 are technically and economically feasible. Note that Option 2 would be contingent on an agreement with Cameco; however, the approach taken at this step in the screening was that this option would remain technically feasible and carried forward for additional assessment.	The three worker transportation options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
Power	Primary power supply	Option 1 Liquefied natural gas power plant Option 2 Solar photovoltaic power plant Option 3 Diesel generators Option 4 Provincial power grid	Although Option 2 (solar) would be beneficial for the Project's scope 1 emissions, the area of panels required to meet the peak load demand of 7.6 MW in northern Saskatchewan and the battery requirements for storage needs resulted in this option being screened out for technical and economic factors. Options 1, 3, and 4 were technically and economically feasible.	The primary power supply options do not interact with an area of high land use intensity or an area of high cultural importance.	Option 2 was screened out for technical and economic reasons. Options 1, 3, and 4 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Support facilities	Camp location optimization	Option 1 First location - Prefeasibility Option 2 Second location - Reduce fill volumes Option 3 Third location - Southwest from second location	Options 1, 2, and 3 are technically and economically feasible.	Assuming the camp location options are close (e.g., within 1 km) to the main project area, they do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means, as an examples of site layout incremental optimization.

Table 3: Summary of Alternative Means Carried Forward and those Screened Out from Additional Assessment Due to Technical, Economic, or Land Use Factors

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	~~Open pit~~	Jet Boring	Surface Boring	Micro Tunnel Boring	ISR		
	Freeze design for tertiary containment of mining solution	Freeze dome	Freeze wall					
	Permeability enhancement	Hydraulics	Propellant	Mechanical				
	Mining solution	~~Basic solution~~	Acidic solution					
Processing	Location of processing	Off-site processing at an existing mill	On-site processing in purpose-built processing plant					
	On-site processing method	Ion exchange	Solvent extraction	Direct precipitation				
Water management	Freshwater supply	Groundwater	Surface water					
	Drinking water	Truck drinking water to site	Generate drinking water on site with a potable water treatment plant					
	Treated effluent discharge location	To groundwater	To surface water					
	Treated effluent discharge locations for surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	Whitefish Lake south (LA-5)	McGowan Lake (LA-1)	Russell Lake	~~Mardoc Lake (LA-4)~~	~~Williams Lake LB-3~~
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	On-site composting				
	Process precipitate management	On-site permanent disposal	Off-site reprocessing and final disposal					
	Domestic waste disposal	Collection and disposal off site by a third-party contractor	Collection and disposal in an on-site domestic landfill					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	Follows part of the existing exploration access road				

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
	Stream crossing structures	Culverts	Clear span bridges					
	Worker transportation	Ground transport	Air transport to existing airstrip at nearby Cameco operations	Air transport to new airstrip constructed and operated by Denison				
Power	Primary power supply	Liquefied natural gas power plant	~~Solar photovoltaic power plant~~	Diesel generators	Provincial power grid			
Support facilities	Camp location optimization	First location - Prefeasibility	Second location – Reduce fill volumes	Third location - Southwest from second location				

Option was removed from further assessment due to technical, economic, or land use factors

1.3 Potential Residual Effects Associated the Alternative Means

Based on the determination in Section 1.1.2 of technically and economically feasible alternatives with consideration of land use factors, Table 4 provides a summary of the expected residual effects following application of mitigation measures assumed to be in place for each of the alternatives. The identification of the potential residual effects of each alternative, in consideration of mitigation, provides the means to compare the alternatives based on the specific assessment criteria and indicators as described below.

Table 4: Mitigation Measures and Residual Effects for Remaining Alternative Means

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
Mining	Method	Option 2: Jet Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	6
		Option 3: Surface Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	
		Option 4: Micro Tunnel Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water-related receptors whereby mine water is released to local surface water features	
		Option 5: ISR	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria	• Effects to local geology by development of ISR mining area	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support ISR mining • Effects on groundwater quantity and flow paths based on development of ISR wellfield (injection and recovery well systems) • Effects on groundwater quality by introduction of ISR mining solutions to the mining area • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	
	Freeze design for tertiary containment of mining solution	Option 1: Freeze dome	• Minimize development footprint on surface to support freeze dome operations • Employ erosion and sediment control measures during construction activities • Provide appropriate buffer zones around sensitive areas/receptors as needed/appropriate	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to freezing process • Effects on groundwater flows paths by constraining flow within the vicinity of the freeze dome	7
		Option 2: Freeze wall	• Minimize development footprint on surface to support freeze wall operations • Employ erosion and sediment control measures during construction activities • Provide appropriate buffer zones around sensitive areas/receptors as needed/appropriate	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to freezing process • Effects on groundwater flows paths by constraining flow within the vicinity of the freeze wall	
	Permeability enhancement	Option 1: Hydraulics	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	8
		Option 2: Propellant	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	
		Option 3: Mechanical	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	
Processing	Location of processing	Option 1: Off-site processing at an existing mill	• Retain appropriately licensed or trained operators to transport ore, ore slurry, or uranium bearing solution off site.	• Direct effect on traffic associated with the transport of ore, ore slurry, or uranium bearing solution off site • Temporary loss of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct the storage area/facility and associated infrastructure	9

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
				• Effects to air quality and those receptors associated with the air emissions pathway from fugitive releases from storge area/facility	
		Option 2: On-site processing in purpose-built processing plant	• Related to construction, operation, and decommissioning of a purpose built processing plant site clearing and other works that involve disturbance of vegetation and/or soil will follow best practices such as: work will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable; cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation; and construction activities restricted to the approved Construction footprint. • During Decommissioning, the plant components and building will be decontaminated, where possible, assets will be removed, and the remaining items will be demolished and disposed of in the industrial landfill. The processing plant footprint will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • The processing plant will be designed using engineering best practices, taking into account potential environmental and health and safety effects and mitigating interactions to the extent possible. For example, the floor will be graded as required and sumps will be installed to collect spills, dust control in place, ventilation consistent with the As Low As Reasonably Achievable (ALARA) principle to provide sufficient worker protection, appropriate containment for chemicals.	• Direct effect on traffic associated with the transport of processing chemicals and other supplies to site and yellowcake off site. • Temporary loss of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct the processing plant and associated infrastructure (ponds, pads). • Changes in air quality from stack emissions. • Changes in noise levels. • Release of treated effluent to local groundwater or surface water, and resulting direct effects on aquatic environment	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
	On-site processing method	Option 1: Ion exchange	• The general mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	10
		Option 2: Solvent extraction	• The mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options. • Solvent extraction carries a risk of fire associated with the use of low flash point hydrocarbons. Should this be considered in the future a separate building for the solvent extraction circuit with a robust fire suppression system would be required to mitigate fire risk and risks to worker safety.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	
		Option 3: Direct precipitation	• The mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	
Water management	Freshwater supply	Option 1: Groundwater	• Install and decommission supply well(s) according to applicable codes/standards and best practices • Limit water taking to that volume that is necessary to support intended supply need • Locate well(s) in that will provide supply need with minimal effect on local water table, surface waters and other users	• Effects (alteration) of local groundwater flow paths and discharge to local receiving waterbodies • Effects to terrestrial vegetation / wetland vegetation by reduction in local water groundwater elevations • Effect to fish and fish habitat through reduction of groundwater discharge to local receiving waterbodies	11
		Option 2: Surface water	• Install supply infrastructure according to applicable codes/standards and best practices, including for example avoiding key aquatic habitat, respecting in- and near-water construction limitation windows, implementing erosion and sediment control during construction, sizing infrastructure appropriately to avoid entrainment, screening intakes appropriately to avoid entrainment.	• Effects to local hydrology • Effects to fish and fish habitat due to reduced flows and through the development of the footprint related to surface water taking infrastructure near- and in-water	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Limit water taking to that volume that is necessary to support intended supply need		
	Drinking water	Option 1: Truck drinking water to site	• Retain appropriately licensed or trained operators to deliver potable water to site. • Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading	• Effects on air quality and traffic associated with delivery of water, including traffic in proximity to local communities and areas of intertest to local Indigenous communities	12
		Option 2: Generate drinking water on site with a potable water treatment plant	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified areas of cultural importance • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required water treatment plant infrastructure	
	Treated effluent discharge location	Option 1: To groundwater	• Development of appropriate performance criteria for discharge groundwater quality so as not to limit beneficial use of the groundwater receiving environment • Injection well design to mitigate potential unplanned releases (e.g., double walled wells, real time monitoring) • Injection of treated effluent to subsurface strata that are not used as potable water or for other uses, or to groundwater environments whose ambient quality precludes beneficial uses • Implementation of effluent and groundwater monitoring programs with contingency plans based on an adaptive management framework	• Direct effect to groundwater quantity and quality in local / regional groundwater environment • Indirect effects to receptors associated with the groundwater exposure pathway • Indirect effect of potential loss of use of groundwater as a resource to traditional land and resources and recreation and resources users	13
		Option 2: To surface water	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework	• Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
	Treated effluent discharge locations for surface water	Option 1: Russell Lake	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	14
		Option 2: McGowan Lake (LA-1)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.		
		Option 3: Whitefish Lake north (LA-6)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
		Option 4: Whitefish Lake south (LA-5)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.		
		Option 5: Kratchkowsky Lake (LA-7)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework • .	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
Waste management	Organic waste disposal	Option 1: On-site disposal using an incinerator	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Use designated wildlife-proof organic waste containers prior to incineration. • Collect organic waste on a regular schedule. • Incinerate in small batches. • Dispose of incinerator ash. • Regularly maintain incinerator.	• Effects on air quality, associated with emissions for the incineration process (including GHGs, and potential hazardous chemicals) • Effects on receptor exposure pathways associated with air emissions / deposition of air emission constituents	15
		Option 2: On-site disposal in domestic landfill, within the domestic non-hazardous waste landfill	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Regularly cover material in the landfill with clean fill and soil to bury organic wastes.	• No incremental effects specifically identified with this option since disposal would occur in the on-site domestic non-hazardous waste landfill	
		Option 3: On-site composting	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Use designated wildlife-proof organic waste containers prior to composting.	• Minor potential effect to soil, terrain and terrestrial habitat VCs to develop compost facility footprint • Effect animal behaviour as odors may act as an attractant	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Collect organic waste on a regular schedule. • Regularly maintain composting system.		
	Process precipitate management	Option 1: On-site permanent	Related to construction, operation, and decommissioning of a process precipitate management cell: • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SKMOESK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the process precipitates disposal cell will be dewatered to the extent practical, and covered with an engineering covered designed to minimize water infiltration. The process precipitate disposal cell will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.	• Effect on air quality and receptors associated with the air emissions pathway • Effect on local groundwater flow patterns • Effect of groundwater quality and associated receptors on the groundwater exposure pathway if loss of control of seepage was to occur • Effect on surface water quality and associated receptors on the surface water exposure pathway was to occur • Effect on of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct facility • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land, as well as on the suitability of the area developed for future uses even in consideration of reclamation activities	16
		Option 2: Off-site reprocessing and final disposal	Related to construction, operation, and decommissioning of an on-site temporary storage area (process precipitate pond): • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable.	• Temporary or time limited effects on: – air quality and receptors associated with the air emissions pathway for transport and storage – local groundwater flow patterns – groundwater quality and associated receptors on the groundwater exposure pathway if loss of control of seepage was to occur	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SKMOESK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the now empty process precipitate pond liner would be cleaned and disposed of in the industrial waste landfill. The pond area will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.	– surface water quality and associated receptors on the surface water exposure pathway was to occur – vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct facility – Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	
	Domestic waste disposal	Option 1: Collection and disposal off site by a third-party contractor	• Waste management including waste characterization and separation to make sure only non-recyclable, inert materials are included in the domestic waste stream. • Educate employees and contractors on the importance of separating recyclable and hazardous items (and organic waste if applicable based on organic waste disposal analysis) from personal waste. • Use clear garbage bags to facilitate monitoring of waste sorting habitats. • Periodically assess domestic waste to make sure that waste streams are being separated correctly. • Retain appropriately licensed or trained operators to collect domestic waste and transport it off site • Deposition of domestic waste into a licensed waste management facility.	• Direct effect on traffic associated with the transport of material off site • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from material transport operations • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles during material transport • Effects to noise levels through the operation of vehicles during material transport • Direct effect to local economy and infrastructure and services through use of regional facilities	17

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
		Option 2: Collection and disposal in an on-site domestic landfill	• Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the domestic landfill will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • Waste management including waste characterization and separation to make sure only non-recyclable, inert materials are included in the domestic waste stream • Educate employees and contractors on the importance of separating recyclable and hazardous items (and organic waste if applicable based on organic waste disposal analysis) from personal waste. • Use clear garbage bags to facilitate monitoring of waste sorting habitats. • Periodically assess domestic waste to make sure that waste streams are being separated correctly. • On site domestic landfill would be constructed with a composite liner system with leachate collection.	• Loss (temporary) of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct a domestic waste landfill for the Project • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• On site domestic landfill would be operated with standard environmental protection measures. • Footprint disturbance related to an on site facility would be reduced to the extent possible. • Segregation of organic waste from the domestic waste (and composting of organic wastes) will minimize birds and wildlife being attracted to the landfill. • Domestic landfill will be fenced to minimize interactions with wildlife.		
Access and transportation	Access road alignment	Option 1: Direct route	• For the suitability of road construction and safety during operation and maintenance, the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%. • Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area. • Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species.	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	18

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape, and, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing.		
		Option 2: Direct route to reduce cut volumes	• For the suitability of road construction and safety during operation and maintenance the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area. • Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species. • Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape And, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Pre-clearing wildlife, avian, and listed plant species surveys will be conducted.	• Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing. • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • Maintain access roads by periodically regrading and ditching to improve water flow, reduce erosion, and manage vegetation growth. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.		
		Option 3: follows part of the existing exploration access road	• For the suitability of road construction and safety during operation and maintenance the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%%. • Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area.	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species. • Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape And, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Pre-clearing wildlife, avian, and listed plant species surveys will be conducted. • A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing. • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • Maintain access roads by periodically regrading and ditching to improve water flow, reduce erosion, and manage vegetation growth. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours		

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			(slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • Much of this proposed route option would be developed within previously disturbed areas, thereby minimizing additional soil, vegetation, wildlife and avian habitat disturbance.		
	Stream crossing structures	Option 1: Culverts	• Implementation of erosion and sediment controls during construction • Timing windows for vegetation clearing and in-water work to protect fish and wildlife • Stream crossings would be constructed in accordance with applicable regulatory requirements to protect fish habitat • Maintenance program to ensure ongoing proper functioning of crossings	• Disruption to watercourses containing fish habitat resulting from watercourse crossing during construction • Temporary disruption/loss of riparian habitat during construction • Effects on fish movement, habitat connectivity – long span culverts may act as barriers to fish movement/migration • Loss of navigability of water course (direct effect) and associated loss (indirect effect) of use	19
		Option 2: Clear span bridges	• Implementation of erosion and sediment controls during construction. • Timing windows for vegetation clearing to protect fish and wildlife. • Stream crossings would be constructed in accordance with applicable regulatory requirements to protect fish habitat • Maintenance program to ensure ongoing proper functioning of crossing.	• Disruption to watercourses containing fish habitat resulting from watercourse crossing during construction • Temporary disruption/loss of riparian habitat during construction • Effects on fish movement, habitat connectivity – long span culverts may act as barriers to fish movement/migration • Loss of navigability of water course (direct effect) and associated loss (indirect effect) of use	
	Worker transportation	Option 1: Ground transport	• Retain appropriately licensed or trained drivers to transport staff and contractors between various pre-defined pick-up points and the Project. • Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading vehicles for worker safety.	• Increased vehicle traffic on provincial road network including through communities of interest and worker/staff pick-up locations resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with worker transport • Effects of noise levels through operation of vehicles associated with worker transport • Change in traffic volume (increase) on public roads from Saskatoon through to various pick-up points to the Project Area.	20

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
				• Possible business opportunity for ground transportation creates positive effect on income of local workers	
		Option 2: Air transport to existing airstrip at nearby Cameco operations	• Retain appropriately licensed or trained drivers to transport staff and contractors between Cameco-owned airstrip and the Project. Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading	• Increased vehicle traffic, localized to the section of Highway 914 between Key Lake and McArthur River operations resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with worker transport • Effects of noise levels through operation of vehicles associated with worker transport	
		Option 3: Air transport to new airstrip constructed and operated by Denison	• Retain appropriately likened air carrier to transport staff and contractors from pick-up points to Denison's airstrip. • Retain appropriately licensed or trained drivers to transport staff and contractors between the airstrip and the main Project building. Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading • Road and airstrip construction, use and maintenance conducted in a manner which protects worker health and safety, wildlife, and minimizes dust and noise. Examples include: enforcing speed limits, appropriate water diversion and drainage, maintaining vegetation adjacent to road and airstrip, employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order.	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required infrastructure (e.g., airstrip, road) • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near road/airstrip operations due to dust, noise, smells • Increased likelihood of wildlife interactions (e.g, mortality from collisions) from road/airstrip operations • Effects on air quality, including dust dispersion and emissions from vehicles along road and planes at the airstrip. • Effects on noise levels with aircraft arrival and departure.	
Power	Primary power supply	Option 1: Liquefied natural gas	• Retain appropriately licensed or trained operators to deliver LNG to site. • Fuels will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards.	• Loss of vegetation and potential wildlife habitat to construct LNG related infrastructure • Increased vehicle traffic on provincial road network including through communities of interest associated with LNG delivery resulting in potential for greater human- and wildlife-vehicle interactions	21

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Leave vegetated buffer zones around watercourses and other sensitive features when developing/operating supporting infrastructure • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure	• Effects on Change in traffic volume (increase) on public roads to and from the Project Area. • Change in air quality due to vehicle emissions (combustion products) and dust generated as a result of vehicle operations associated with LNG delivery. • Effects on air quality (combustion products) due to operation of LNG power generation • Effects of noise levels through operation of vehicles associated with LNG delivery Change in sound levels.	
		Option 3: Diesel generators	• Retain appropriately licensed or trained operators to deliver diesel to site • Fuels will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards. Leave vegetated buffer zones around watercourses and other sensitive features when developing/operating supporting infrastructure • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure	• Loss of vegetation and potential wildlife habitat to construct LNG related infrastructure • Increased vehicle traffic on provincial road network including through communities of interest associated with diesel delivery resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with diesel delivery • Effects on air quality (combustion products, including GHGs) due to operation of diesel power generation system • Effects of noise levels through operation of vehicles associated with LNG delivery • Change in traffic volume (increase) on public roads to and from the Project Area. • Change in air quality from combustion of diesel. • Change in sound levels.	
		Option 4: Provincial power grid	• Optimize transmission right of way route to minimize interactions with key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited grading or stripping within transmission right of way.	• Potential for temporary effects on watercourses containing fish habitat as a result of watercourse crossings/ riparian vegetation removal • Loss of vegetation and potential wildlife habitat as a result of right of way construction	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
Support facilities	Camp location optimization	First location - Prefeasibility	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	22
		Second location – Reduce fill volumes	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	
		Third location - Southwest from second location	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	

1.4 Evaluation of Alternative Means

1.4.1 Assessment Criteria and Indicators

Alternatives that were deemed to be technically and economically feasible with consideration of land use factors were assessed by comparing selected evaluation criteria representing biophysical environment factors, socio-economic factors, considerations associated with Indigenous groups and land and resource uses, technical factors, and cost factors. Table 5 describes the evaluation criteria and indicators, including relevant metrics, used to assess Project-related alternatives.

Table 5: Detailed Alternatives Means Assessment Evaluation Criteria and Metrics

Criteria	Section	Valued Component	Indicator	Metric
Biophysical Environment	Atmospheric and Acoustic Environment	Air quality	Changes in air quality, including concentrations of dust, combustion products, uranium, metals and/or radionuclides	Alternatives that minimize changes in air quality and effects on ecological and human receptors are preferred.
		Noise	Changes in sound levels	Alternatives that minimize the increase in sound levels, and subsequent effects on wildlife and human receptors, are preferred.
	Geology and Groundwater	Geology	Changes in geology	Alternatives that avoid or minimize effects on geology are preferred
		Groundwater quantity	Changes in groundwater levels, groundwater flow patterns, and discharge rates to local surface water bodies	Alternatives that minimize interaction with groundwater quantity are preferred.
		Groundwater quality	Changes in concentrations of physical and chemical parameters in groundwater with consideration of discharge to local surface water bodies	Alternatives that minimize changes in groundwater quality, in the context of groundwater discharge to surface water bodies, are preferred.
	Aquatic Environment	Surface Water Quantity	Changes in surface water quantity through water taking, surface water discharge, and project overprinting of drainage areas (footprints)	Alternatives that minimize Project footprint, as well as surface water intake and release to surface water bodies, are preferred.
		Surface Water Quality	Changes in physical and chemical parameters of surface water quality can result from discharge of treated effluent to surface water bodies and land disturbance and clearing can mobilize solids into the aquatic environment	Alternatives that minimize Project footprint and changes in surface water quality and effects on fish, and other ecological receptors, are preferred.
		Fish and Fish Habitat	Changes in fish and fish habitat may develop from Project overprinting of fish habitat (habitat alteration or loss), changes in surface water quantity, surface water quality (physical and chemical parameters), sediment quality, or benthic invertebrates	Alternatives that minimize interaction with fish and fish habitat are preferred.
		Sediment Quality	Changes in sediment quality mainly from discharge of treated effluent to surface water bodies	Alternatives that minimize effects on sediment quality are preferred.
		Benthic Invertebrates	Changes in benthic invertebrate communities and quality from uptake of chemical parameters	Alternatives that minimize effects on benthic invertebrates are preferred.
		Fish Health	Changes in fish health mainly from discharge of treated effluent to surface water bodies	Alternatives that minimize effects on fish health are preferred.

Criteria	Section	Valued Component	Indicator	Metric
	Terrestrial Environment	Terrain	Changes to terrain	Alternatives that minimize interaction with terrain are preferred.
		Soil	Changes in soil quantity or quality	Alternatives that minimize loss or alteration of soil quantity, and minimize changes in soil quality, are preferred.
		Organic matter/peat	Loss of organic matter/peat	Alternatives that minimize loss or alteration of organic matter/peat are preferred.
		Vegetation and Ecosystems	Change in areal extent of vegetation habitat types and ecosystems	Alternatives that minimize loss vegetation and ecosystems are preferred.
		Listed Plant Species	Change in number of listed plant species	Alternatives that minimize direct and indirect effects on listed plant species are preferred.
		Wetlands	Change in areal extent of wetlands	Alternatives that minimize loss or alteration of wetlands are preferred.
		Ungulates	Changes in ungulate habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize ungulate habitat loss or alteration and minimize ungulate mortality are preferred.
		Furbearers	Changes in furbearer habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize furbearer habitat loss or alteration and minimize furbearer mortality are preferred.
		Woodland caribou	Changes in woodland caribou habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize woodland caribou habitat loss or alteration and minimize woodland caribou mortality are preferred.
		Raptors	Changes in raptor habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize raptor habitat loss or alteration and minimize raptor mortality are preferred.
		Migratory breeding birds	Changes in migratory breeding bird habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize migratory breeding bird habitat loss or alteration and minimize migratory breeding bird mortality are preferred.
		Bird species at risk	Changes in bird species at risk habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize bird species at risk habitat loss or alteration and minimize bird species at risk mortality are preferred.
Human Environment	Human Health	Human Health	Changes in human health from exposure to non-radiological and radiological constituents in air, water, and food	Alternatives that minimize negative changes in human health are preferred.
		Worker Health	Worker conventional health and safety and radiation exposure	Alternatives that reduce conventional health and safety risks and radiation exposure are preferred.

Criteria	Section	Valued Component	Indicator	Metric
	Land and Resource Use	Indigenous Land and Resource Use	Changes in the area of land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	Alternatives that minimize negative changes in Indigenous land and resource use are preferred.
		Other Land and Resource Use	Changes in the area of land available for non-Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	Alternatives that minimize negative changes in other land and resource use are preferred.
		Heritage Resources	Change in the number of known archaeological resources	Alternatives that minimize direct or indirect alteration or loss of archaeological resources are preferred
	Quality of Life	Cultural Expression	Changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	Alternatives that minimize direct or indirect adverse effects on cultural expression are preferred.
		Community Well-being	Change in income of local workers and community cohesion	Alternatives that minimize direct or indirect adverse effects on community well-being are preferred.
		Infrastructure and Services	Changes in traffic, community infrastructure and services	Alternatives that minimize direct or indirect adverse effects on infrastructure and services are preferred.
	Economics	Economy	Changes in participation in the traditional economy	Alternatives that minimize direct or indirect adverse effects on economy are preferred.
Other Evaluation Factors				
Criteria			**Metric**	
Technical Factors	Complexity of design, construction, operation, and decommissioning		Simple or straightforward designs, construction techniques, and operational procedures based on tested and proven technologies are preferred. Alternatives that are more amenable to decommissioning and/or reclamation are preferred.	
Cost Factors	Capital, operating, and decommissioning costs		Lower capital costs are preferred to reduce the pre-production costs and influence the project economic viability. Lower operational costs are preferred to maintain project economics. Lower decommissioning costs are preferred to reduce long term liabilities	

1.4.2 Comparative Evaluation of Alternative Means

The comparative evaluation of alternative means is presented in Table 6 to Table 22. The evaluation considers the relative residual effects of each of the technical and economically feasible alternatives for each of the evaluation criteria identified in Table 5, following the application of mitigation measures described in Table 4. In each case, the preferred alternative and rationale for its selection are identified. In addition, specific input received from Indigenous groups and other Interested Parties that contributed to the selection of the preferred option is highlighted, when applicable.

The alternative means assessment provided in the tables in this section was conducted at a screening level, appropriate for the stage of the Project when the alternatives were considered. The assessment considered both quantitative (where possible) and qualitative information as available. The comparative evaluation identified more preferred versus less preferred alternatives.

Table 6: Mining – Methods - Alternative Means Assessment

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
Biophysical	Atmospheric and Acoustic Environment	Air quality	Less preferred option. Air quality on surface would be influenced by slurry handling, radon gas, radioactive dust in vent exhaust, dust from surface stockpiles including clean waste rock. Air quality in the mine workings would be managed with ventilation.	More preferred option. Size of mine rock stockpiles and their influence on air quality would be similar to Option 5. Changes in concentrations of radon in air from well development would be similar to option 5.	Less preferred option. Air quality in the mine workings would be managed with ventilation. Air quality on surface would be influenced by hoisted cuttings or slurry, radon gas, radioactive dust in vent exhaust, dust from surface stockpiles including clean waste rock.	More preferred option. Size of mine rock stockpiles and their influence on air quality would be similar to Option 3. Changes in concentrations of radon in air from well development would be similar to option 3.
		Noise	No appreciable difference was identified among the alternatives for changes in noise. Continual noise from surface ventilation fans and noise from mobile equipment. Similar to Option 4.	No appreciable difference was identified among the alternatives for changes in noise. No fans, noise from production drilling from surface includes compressors and mobile equipment would be continual.	No appreciable difference was identified among the alternatives for changes in noise. Continual noise from surface ventilation fans and noise from mobile equipment. Similar to Option 2.	No appreciable difference was identified among the alternatives for changes in noise. No fans, noise from surface drilling equipment includes compressors and mobile equipment would be intermittent as drilling is done only as required.
	Geology and Groundwater	Geology	Less preferred option for changes to geology, compared to options 3 and 5.	More preferred option for geology compared to options 2 and 4 since this is a surface method requiring less excavation.	Less preferred option for changes to geology, compared to options 3 and 5.	More preferred option for geology compared to options 2 and 4 since this is a surface method requiring less excavation.
		Groundwater quantity	Less preferred compared to option 3. Volume of groundwater management during mining would be similar to Option 4.	Preferred option with smallest interaction on groundwater quantity compared to options 2, 4 and 5.	Less preferred compared to option 3. Volume of groundwater management during mining would be similar to Option 4.	Less preferred compared to option 3. Use of ground freezing temporarily interacts with groundwater flow during operations.
		Groundwater quality	No appreciable difference was identified among the alternatives for changes to groundwater quality. Groundwater quality would interact with mine workings in a limited way due to groundwater management during mining.	No appreciable difference was identified among the alternatives for changes to groundwater quality.	No appreciable difference was identified among the alternatives for changes to groundwater quality. Groundwater quality would interact with mine workings in a limited way due to groundwater management during mining.	No appreciable difference was identified among the alternatives for changes to groundwater quality. Mining area remediation during decommissioning would mitigate effects on groundwater quality.
	Aquatic Environment	Surface Water Quantity Surface Water Quality	Less preferred than options 3 and 5. The volume of water requiring	More preferred option compared to options 2 and 4. The volume of water	Less preferred than options 3 and 5. The volume of water requiring	More preferred option compared to options 2 and 4. The volume of

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
		Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	treatment and release would be high, because of the groundwater management required for mine development. This could result in a larger effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	needed treatment and release to a surface waterbody would be minimal, and as such, this option would have a smaller effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	treatment and release would be high, because of the groundwater management required for mine development. This could result in a larger effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	water needed treatment and release to a surface waterbody would be minimal, and as such, this option would have a smaller effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.
	Terrestrial Environment	Terrain Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands Ungulates Furbearers Woodland caribou Raptors Migratory breeding birds Bird species at risk	This option is less preferred as it may result in a greater potential effect (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species, wetlands and related loss and alteration of wildlife habitat. Largest amount of disturbance due to underground waste rock creating stockpiles of acid generating, contaminated and clean waste rock. Footprint estimated to be similar to Option 4 and double the total disturbance of Option 5.	Direct surface footprint/mining disturbance expected to be the second lowest of the four options. This option is more preferred than option 2 and 4, similar to option 5 with regard to potential effects on the terrestrial environment.	This option is less preferred as it may result in a greater potential effect (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species, wetlands and related loss and alteration of wildlife habitat. Largest amount of disturbance due to underground waste rock creating stockpiles of acid generating, contaminated and clean waste rock. Footprint estimated to be similar to Option 2 and double the total disturbance of Option 5.	Direct surface footprint/mining disturbance expected to be the lowest of the four options. This option is more preferred than option 2 and 4, similar to option 3 with regard to potential effects on the terrestrial environment.
Human Environment	Human Health	Human Health	Less preferred. Potential exposure to non-radiological and radiological constituents in air, water, and food may be higher with this option compared to options 3 and 5 due to 1. changes in air quality from mine rock, slurry handling, and mine ventilation and 2. larger volume of treated effluent release to the aquatic environment.	More preferred compared to option 2 and 4 due to smaller changes in air quality and smaller volume of treated effluent release	Less preferred. Potential exposure to non-radiological and radiological constituents in air, water, and food may be higher with this option compared to options 3 and 5 due to 1. changes in air quality from mine rock, slurry handling, and mine ventilation and 2. larger volume of treated effluent release to the aquatic environment.	More preferred compared to option 2 and 4 due to smaller changes in air quality and smaller volume of treated effluent release

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
		Worker Health	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Within this context, underground work is higher risk than surface due to confined working area with heavy equipment underground and higher contaminates in underground atmosphere compared to open air conditions on surface.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Surface operation with specialized surface equipment to drill horizontal cavities at ore depth. Physical ore cuttings will need to be rehandled on surface to either slurry for wet transport or dewater for dry transport increasing dose relative to Option 5 (which has a fraction of the drill cuttings to handle). Good conventional H&S as there is minimal mobile surface equipment.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Within this context, this option has potentially the highest dose as workers will have greater potential exposure to radiation while servicing equipment that is working within the ore zone. Underground work is higher risk than surface due to confined working area with heavy equipment underground and higher contaminates in underground atmosphere compared to open air conditions on surface.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Lowest dose of the four mining options evaluated in terms of dose associated with drill cuttings. The main contributor to worker dose would be radon associated with drilling the ISR wells. Surface piping of UBS, pumphouses, and well maintenance will also be a source of dose during pipeline repairs and inspection of equipment.
	Land and Resource Use	Indigenous Land and Resource Use	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (and changes to terrestrial environment) and 2. lower volume of treated effluent (and changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (changes to terrestrial environment) and 2. lower volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.
		Other Land and Resource Use	Less preferred compared to options 3 and 5 because of larger potential	More preferred compared to options 2 and 4 because of smaller potential	Less preferred compared to options 3 and 5 because of larger potential	More preferred compared to options 2 and 4 because of smaller

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
			changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	changes in resource availability linked to: 1. smaller footprint (and changes to terrestrial environment) and 2. lower volume of treated effluent (and changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	potential changes in resource availability linked to: 1. smaller footprint (changes to terrestrial environment) and 2. lower volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.
		Heritage Resources	Less preferred compared to options 3 and 5. Larger area of surface disturbance increases potential interaction with archaeological resources.	More preferred compared to options 2 and 4. Smaller area of surface disturbance reduces potential interaction with archaeological resources.	Less preferred compared to options 3 and 5. Larger area of surface disturbance increases potential interaction with archaeological resources.	More preferred compared to options 2 and 4. Smaller area of surface disturbance reduces potential interaction with archaeological resources.
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.			
		Community Well-being	No appreciable difference was identified between alternatives for change in income of local workers and community cohesion.			
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.			
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.			

Other Evaluation Factors					
Criteria		**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Potential advantages: technology currently in use in Canadian uranium industry; mine layouts do not require development at or above the	Potential advantages: technology in widespread use in oil and gas industry; reduced safety and environmental risks with elimination of underground excavations; completely remote system – safe for	Potential advantages: technology in widespread use in civil / municipal applications; remote system – safe for radiological risks under normal operating conditions; self-supported tunnels, thus risk of ground failure or	Potential advantages: technology in widespread use in international uranium operations (USA, Kazakhstan, Australia); reduced safety and environmental risks with elimination of underground

Other Evaluation Factors					
Criteria		**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
		unconformity; remote system – safe for radiological risks. Potential technical weaknesses: Long duration development timeline; low production rate with limited ability to increase; currently used at only one mine with limited experience outside of that operation; may require extensive research and development; high technical risk including underground operating risks, inflow risk, design and operating risk; may require bulk freezing approach versus perimeter freeze design as assumed in the PEA. This would increase freeze cost and time significantly.	radiological risks; reduced number of employees on site; short timeframe to production (weeks); good production rate with scalability; similar technique under evaluation in Canadian uranium industry (Orano's SABRE mining method). Potential technical weaknesses: Drilling accuracy is paramount and needs additional testing; not currently in use in Canadian uranium industry.	inflow in tunnels reduced; simple concept and operation, variety of knowledgeable contractors/personnel; moderate production rate (approximately 4M lbs/yr per machine); ability to apply multiple units (scalability). Potential technical weaknesses: Recovery of ore may be limited to 90% at best due to configuration of the tunnels; congested working space in the launch stations; not currently in use in Canadian uranium industry.	excavations; completely remote system – safe for radiological risks; reduced number of employees on site; short timeframe to production (months); reduced technical risk with majority of remaining risks tested during feasibility stage; toll milling not required. Potential technical weaknesses: Not currently in use in Canadian uranium industry; mining solution permeability requires additional testing to increase confidence; low production rate – based on production rate at US operations (future testing may allow for higher production rates).
Cost Factors	Capital, operating, and decommissioning costs	Option 2 has high operating cost relative to the grade of the ore body, high capital costs and long duration development timeline, although the technology is in use at an existing uranium operation in Canada.	Option 3 has low capital and operating costs compared to jet boring.	Option 4 has the lowest ore recovery and high capital costs and long duration development timeline. Technology is commonly used in civil engineering.	Option 5 has low capital and operating costs. The technology is in widespread use at international uranium operations. ISR mining operations often have comparatively low capital and operating costs, as well as shorter timelines to first production and greater flexibility to allow production to be scaled to meet market demands.

Input received from Interested Parties:

Denison discussed potential mining methods early in the engagement process. As part of the engagement program for the Project, Denison organized a series of in-person workshops with Indigenous and non-Indigenous communities of interest (COI) and other Interested Parties in 2018. The workshops gathered community and student input in relation to potential mining methods for the Phoenix deposit. Given the history of uranium mining in the Athabasca Basin, there is a wealth of knowledge on various mining methods, and Denison sought input for which method would be best suited to efficiently and safety mining the Phoenix deposit.

Other Evaluation Factors				
Criteria	**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
The following mining methods were evaluated for effectiveness in mining the Phoenix deposit at the Project: Jet Boring, Surface Boring, Micro Tunnel Boring and In Situ Recovery. There was no specific engagement data collected related to surface boring or micro tunnel boring. Workshop participants noted that while jet boring was a relatively well-known method of mining, the high economic costs may make it undesirable for the Phoenix deposit (18-EN-VPL-2.38) (18-EN-ERFN-5.44). ISR mining is new to northern Saskatchewan and Canada. Some workshop participants were unsure how to evaluate the potential benefits and/or drawbacks of this mining method (18-EN-VILX-3.69), however other participants were confident in the method, saying they know it works in other locations, there are minimal waste streams, and method is more economically feasible than other methods (18-EN-VILX-3.68). A participant in the Village of Beauval workshop preferred the small footprint and lesser environmental impacts of ISR and viewed this method as a new opportunity for northern Saskatchewan (18-EN-VB-4.51). New opportunities are welcomed in the area, as they can support local businesses, provide training and learning opportunities, and keep money within the local economy (16-EN-MLA-109.26).				
Selected alternative for mining method = Option 5: ISR **Rationale:** Mining methods were evaluated through an increasingly rigorous process and considered factors such as: safety, environment, production rates, capital costs, operating costs, schedule, operational flexibility, and risk. The top four mining methods considered for the Phoenix deposit were: jet boring, surface boring, micro tunnel boring, and ISR. Independent preliminary economic assessment or class 5 level assessments were completed on each of these four options in 2017. The parameters evaluated included safety, environmental impacts, radiological safety, capital cost, operating cost, development timeframe, production rate, economic results (net present value, internal rate of return), regulatory risk, technology risk, equipment and contractor availability, and operating flexibility; this information has been summarized above in the alternatives means assessment cells. In addition, workshops were held in local Indigenous and non-Indigenous communities to capture community input into the selection of a preferred mining method once the options were narrowed down. Ultimately, based on the alternatives evaluated and feedback from Communities of Interest, Denison included the ISR method in the prefeasibility study (PFS; Denison 2018) and this mining method was selected as the basis for the EA.				

Less Preferred	Neutral	More preferred

Table 7: Mining - Freeze Design for Tertiary Containment of Mining Solution – Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Freeze dome	Option 2: Freeze Wall
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the freeze design for tertiary containment of mining solution alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the freeze design for tertiary containment of mining solution alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the freeze containment alternatives.	
		Groundwater quantity	No appreciable difference was identified between alternatives. During operations, groundwater above the freeze dome would continue to move freely. During operation, groundwater within the vertical extent of the freeze walls will be contained. Based on understanding of the groundwater flow in the Project Area, the options would have similar, negligible effects on the at the regional groundwater regime, including shallow groundwater flow to surface waterbodies.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the freeze containment alternatives. Both options would provide protection of groundwater from mining solution in combination with the primary and secondary protection.	
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on the aquatic environment would be expected for the freeze design for tertiary containment of mining solution alternatives.	
		Surface Water Quality		
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on the terrestrial environment would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints for Option 2 would be slightly smaller than Option 1 due to the location and reduction from two freeze plant locations at either end of the wellfield (Option 1) to one freeze plant located adjacent to the wellfield (Option 2), but the relative footprint size differences are not material within the context of the Project footprint.	
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates		
		Furbearers		

Criteria	Section	Valued Component	Option 1: Freeze dome	Option 2: Freeze Wall
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between alternatives for changes in worker health from conventional health and safety and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified between the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints and activities would be similar for Options 1 and 2.	
		Other Land and Resource Use	No appreciable difference was identified between the alternatives. No difference in potential effects on other land and resource use would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints and activities would be similar for Options 1 and 2.	
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Freeze dome**	**Option 2: Freeze Wall**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The freeze dome with directional drilling is a more complex option. Weaving the injection and recovery wells between the horizontal freeze holes poses a technical challenge for design, construction, and operation. The design also increases the risk of breaching tertiary containment due to the drilling complexity with the freeze holes perpendicular to the	The freeze wall design is less complex than Option 1 in terms of design, construction, and operation. The reliability of the freeze wall is expected to be higher than Option 1 because the design has the freeze holes adjacent to the injection and recovery wells. Decommissioning would be similar to Option 1.

Other Evaluation Factors			
Criteria		**Option 1: Freeze dome**	**Option 2: Freeze Wall**
		injection and recovery wells. Decommissioning would be similar to Option 2.	
Cost Factors	Capital, operating, and decommissioning costs	The capital costs are higher because the freeze holes would be created with the directional drilling technique. Operating and decommissioning costs would be similar to Option 2.	The capital costs are lower because the freeze holes can be created with the diamond drilling technique. Operating and decommissioning costs would be similar to Option 1.
Input received from Interested Parties: Substantial efforts were made to ensure Interested Parties were given adequate information on Denison's plan to construct a freeze containment around the Phoenix deposit (19-EN-YNLR-83.3) (21-EN-SUR-446.10) (22-EN-VPL/ML9-620.15). ISR is new to Canadian mining and although ground freezing technology is associated with mining at Cigar Lake and McArthur River operations (e.g., there is knowledge and familiarity on this technique), the combination of ISR and ground freezing technology is unique and Denison dedicated substantial engagement efforts to share information on this topic. Denison had initially proposed a freeze dome to surround the deposit but changed the design plan to a freeze wall after determining that approach would be more appropriate for the Project (21-EN-ERFN-458.1). The freeze wall will be constructed to provide complete containment of the mining solution and support environmental commitments (22-EN-VPL/ML9-620.19), including protection of groundwater sources. Denison understands the ongoing protection of groundwater is a top priority for COI's and other Interested Parties (21-EN-VILX-443.19). During the extensive engagement process Denison used workshops and meetings as opportunities to answer questions about the freeze wall timeline, the freeze solution, the reliability of the freezing technology, and how the freeze wall may interact with groundwater (19-EN-CNSC-1.23) (21-EN-SUR-446.10) (19-EN-CNSC-1.26) (22-EN-EQC-648.1).			
Selected alternative for freeze design for tertiary containment of mining solution = Option 2: Freeze wall **Rationale:** There were essentially no appreciable differences for biophysical and human environment criteria for the two options evaluated. The freeze dome was the more complex and higher cost option, with higher risk. As such, the freeze wall option was selected as the preferred alternative and evaluated in the EA.			

Less Preferred	Neutral	More preferred

Table 8: Mining – Permeability Enhancement - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Hydraulics	Option 2: Propellant	Option 3: Mechanical
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential effects on air quality would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology and groundwater would be expected for the permeability enhancement alternatives because these activities would be conducted within the established mining area.		
		Groundwater quantity			
		Groundwater quality			
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on aquatic environment Valued Components (VCs) would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives. No difference in potential effects on terrestrial environment VCs would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			

Criteria	Section	Valued Component	Option 1: Hydraulics	Option 2: Propellant	Option 3: Mechanical
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.		
		Worker Health	No appreciable difference was identified among alternatives for changes in worker health from conventional health and safety and radiation exposure.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the permeability enhancement alternatives. The surface footprints would be within the ISR wellfield footprint, which is not available for land and resource use activities during operations for safety reasons.		
		Other Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on other land and resource use would be expected for the permeability enhancement alternatives. The surface footprints would be within the ISR wellfield footprint, which is not available for land and resource use activities during operations for safety reasons.		
		Heritage Resources	No appreciable difference was identified among alternatives. No additional clearing for the permeability enhancement alternatives is needed. The clearing would have been done for the development for the ISR wellfield (which underwent heritage resource impact assessment surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch).		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Hydraulics**	**Option 2: Propellant**	**Option 3: Mechanical**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The technical factors for these options are similar in terms of providing the required permeability enhancement. Site-specific testing would be done and the options may be used at different locations in the deposit or at different times in the ISR process.		
Cost Factors	Capital, operating, and decommissioning costs	Cost factors for these factors are similar for capital, operation, and decommissioning.		
Input received from Interested Parties: During engagement activities it was critical for Denison to clearly explain the difference between permeability enhancement and fracking (21-EN-LLRIB-392.4) and communicate that the Wheeler River Project is not using any fracking methods. Part of the 2019 field work involved testing permeability enhancement techniques. Through meetings and workshops Denison kept COIs informed of field work, field tests and other activities happening at the Project site (21-EN-LLRIB-392.4) (21-EN-LLRIB-392.3). When mining options were presented at workshops in 2018, some members of the communities had reservations regarding the fact that ISR reminded them of fracking since fracking carried a negative connotation (18-EN-VB-4.54).				

Other Evaluation Factors			
Criteria	**Option 1: Hydraulics**	**Option 2: Propellant**	**Option 3: Mechanical**
Selected alternative for Permeability Enhancement = Option 1: Hydraulics, Option 2: Propellant, and Option 3: Mechanical			
Rationale: All three options were carried forward for evaluation in the EA. The evaluation of the performance of permeability enhancement options will be ongoing as the Project advances through the engineering process and into operation.			

Less Preferred	Neutral	More preferred

Table 9: Processing – Location of Processing - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Off-site processing at an existing mill	Option 2: On-site processing in purpose built processing plant
Biophysical	Atmospheric and Acoustic Environment	Air quality	Potential air quality changes would be lower than that expected for Option 2, since processing would occur off site and within the constraints of the licensing constraints of an existing third-party. Air quality changes associated with this option would be from wind dispersion of metals, radionuclides, particulate matter on stockpiles or from Uranium Bearing Solution (UBS) storage areas prior to transport off site.	The processing plant circuits in general, and drying/calcining in particular, increase concentrations of radionuclides, radon, metals in air, despite mitigation with scrubbers, and best management practises (BMPs). greenhouse gas (GHG) emissions associated with this option would be higher than Option 1, as the processing is fairly energy and heat intensive.
		Noise	Potential changes in sound levels would be lower than that expected for option 2.	Anticipate larger changes in sound level for this option compared to option 1.
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the processing location alternatives.	
		Groundwater quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quantity would be expected for the processing location alternatives.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the processing location alternatives.	
	Aquatic Environment	Surface Water Quantity Surface Water Quality Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	In consideration of treated effluent discharge that would be associated with processing plant operations, the water management and treatment volumes would be expected to be lower for Option 1 compared to Option 2, making this option more preferred from that perspective.	In consideration of treated effluent discharge that would be associated with processing plant operations, the water management and treatment volumes would be expected to be higher for Option 2 compared to Option 1, making this option less preferred from that perspective.
	Terrestrial Environment	Terrain Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands	There would be no construction-related effects (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands for this option. Operation of the surface handling and load out facilities would have a relatively small footprint and would generate emissions to air that may have indirect effects on terrestrial VCs.	Construction of a processing plant would result potentially result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands. Operation of the plant will generate emissions to air that may have indirect effects on terrestrial VCs.

Criteria	Section	Valued Component	Option 1: Off-site processing at an existing mill	Option 2: On-site processing in purpose built processing plant
		Ungulates Furbearers Woodland caribou Raptors Migratory breeding birds Bird species at risk	Habitat loss (direct loss of habitat) associated with clearing for an area/building for ore, ore slurry, or UBS storage and a container loading facility, and also indirect effect on habitat use from noises, lights, or odors from processing plant activities. Increased direct effects on mortality from increased road traffic.	Habitat loss (direct loss of habitat) associated with clearing for construction of processing plant, and associated project components (e.g., radon purge tanks, UBS holding area), and also indirect effect on habitat use from noises, lights, or odors from processing plant activities.
Human Environment	Human Health	Human Health	Changes in local air quality from surface handling and load out facility and lower volume of treated effluent discharge would make this option more preferred for exposure to non-radiological and radiological constituents in air, water, and food.	Changes in local air quality from processing plant emissions and higher volume of treated effluent discharge would make this option less preferred by increased exposure to non-radiological and radiological constituents in air, water, and food.
		Worker Health	No appreciable difference was identified between alternatives for worker health. These options would have similar conventional health and safety risks and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	The surface handling and load out facilities would be adjacent to (within 1 km) the mine, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.	The processing plant location would be adjacent to (within 1 km) the ISR wellfield, which is not available for Indigenous land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.
		Other Land and Resource Use	The surface handling and load out facilities would be adjacent to (within 1 km) the mine, which would not be available for other land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.	The processing plant location would be adjacent to (within 1 km) the ISR wellfield, which is not available for other land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 are assumed to be in the areas that underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	
		Community Well-being	No appreciable difference was identified between alternatives for changes to income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in infrastructure and services	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Off-site processing at an existing mill**	**Option 2: On-site processing in purpose built processing plant**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The main technical challenge with this option was the need for a toll-milling agreement with an existing mill. If this was not possible, the Project would be at risk. This technical risk was greater than the technical challenges associated with construction, operating, and decommissioning an on-site processing plant, associated with ISR mining.	Technical factors associated with building and operating an on-site processing plant are comparatively more complex than what would be needed for the surface handling and load out facilities. However, such technical factors are, but not complex enough to create feasibility concerns – similar processing operations are conducted in the region in an effective and safe manner. This option reduces the risks to the Project by not requiring a toll-milling arrangement with a third-party.
Cost Factors	Capital, operating, and decommissioning costs	The cost factors of focus here include the toll-milling fees that effectively lower profit for Denison, compared to Option 2. Option 1 would have a lower net present value as the ore, ore slurry, or UBS would be sold as it leaves site.	The direct capital, operating, and decommissioning costs to Denison would be higher than Option 1 for construction, operation, and decommissioning of an on-site processing plant, but the potential profit would be greater.
Input received from Interested Parties: ISR doesn't require materials to go through a crushing phase. The uranium bearing solution will be processed on site – not trucked to a mill at another facility (21-EN-YOUTH-445.2) (21-EN-ERFN-447.28). Having a processing facility located on site will help to reduce transportation costs, emissions from transportation vehicles, and road degradation (21-EN-SUR-446.75) (21-EN-SUR-446.74). A reduction in road traffic, thereby minimizing noise and dust pollution, would be appreciated by cabin and lodge lease holders that may also use highways and roads in the general area (20-LK-LEASESUR-267.99 to 20-LK-LEASESUR-267.108).			
Selected alternative for location of processing = Option 2: On-site processing in purpose-built processing plant **Rationale:** Processing location options were closely associated with assessment of alternative means for mining methods. With the decision to advance the Project as an ISR mine, the option for on-site processing (Option 2) is preferred to off-site processing (Option 1) as it conveys several advantages to the Project as a whole.			

Less Preferred	Neutral	More preferred

Table 10: Processing – On-site Processing Methods - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Ion Exchange	Option 2: Solvent Extraction	Option 3: Direct Precipitation
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers), the residual effects are expected to be similar for these options.		
		Noise	No appreciable difference was identified among alternatives. With application of mitigation measures, the residual effects are expected to be similar for these options.		
	Geology and Groundwater	Geology	No appreciable difference was identified among alternatives for geology, groundwater quantity and groundwater quality.		
		Groundwater quantity			
		Groundwater quality			
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among alternatives. With application of mitigation measures, the residual effects are expected to be similar for these options. Although solvent extraction increases the use of ammonia in the process, the water treatment methods are assumed to be sufficient to generate effluent of comparable quality, regardless of the processing method.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives for changes to terrestrial VCs. For the alternative means assessment for on-site processing method, it was assumed that the footprints of the plant would be similar among the methods evaluated. As indicated above, processing plant emissions would be similar for each option and therefore potential residual effects to terrestrial receptors through the air exposure pathway would be similar.		
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			

Criteria	Section	Valued Component	Option 1: Ion Exchange	Option 2: Solvent Extraction	Option 3: Direct Precipitation
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers, water treatment), the residual effects on worker health are expected to be similar for these options.		
		Worker Health	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers), the residual effects on worker health are expected to be similar for these options.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the processing method. The surface footprint for the processing plant was assumed to be similar for all three options and would be beside the wellfield footprint, which is not available for land and resource use activities during Operation for safety reasons.		
		Other Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the processing method. The surface footprint for the processing plant was assumed to be similar for all three options and would be beside the wellfield footprint, which is not available for land and resource use activities during Operation for safety reasons.		
		Heritage Resources	No appreciable difference was identified among alternatives on a change in known archaeological resources. For the alternative means assessment for on-site processing method, it was assumed that the footprints of the plant would be similar between the methods evaluated. This assessment is at the process level, with no consideration of the physical footprint.		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes to income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Ion Exchange**	**Option 2: Solvent Extraction**	**Option 3: Direct Precipitation**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Potential concerns associated with this option are linked to the elevated uranium concentrations in the UBS. Typical ion exchange application handles high volumes of low uranium concentration levels whereas for this Project, it is expected production from the wellfield will be the opposite: low	Solvent extraction is proven technology in similar applications, so no potential material concerns are raised here. Ammonium sulphate is commonly used for stripping the uranium and waste water requires additional equipment to prior to release in the environment. It has been assumed that sodium chloride	The main technical risk in direct precipitation is the concentration of contaminants in the product, especially with recirculation. The addition of a process precipitate circuit before the uranium extraction circuit could address this technical risk. Little to no industrial history exists for ISR

Other Evaluation Factors				
Criteria		**Option 1: Ion Exchange**	**Option 2: Solvent Extraction**	**Option 3: Direct Precipitation**
		flow with high uranium concentration. This creates the need for very small ion exchange vessels and a multitude number of ion exchange trains, which would require additional testing and a very complicated process control system with attendant piping and instrumentation to manage the frequent loading, unloading and stripping of solutions.	will be used for commonality with the ion exchange circuit. Solvent extraction carries a risk of fire associated with the use of low flash point hydrocarbons. Should this be considered a separate building for the solvent extraction circuit with a robust fire suppression system would be required in the design.	operations using direct precipitation. One of the benefits of this option is that this is a very simple plant with fewer processes and failure points, simplified piping systems, fewer reagents, reduced staffing, and low pressure process compared to Options 1 and 2. Based on the above, this option is more preferred from a technical factor perspective.
Cost Factors	Capital, operating, and decommissioning costs	A capital cost estimate was done at a scoping study level, or class 5 at best for the plant, and is estimated at $36 MM USD, which includes a 30% contingency. For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 2 and 3.	The capital estimate was $43.5 MM USD for the complete plant, which includes a 30% contingency. The mechanical equipment cost of the solvent extraction portion was estimated at $3.6 MM USD, (excluding clarifying circuit and fire protection system). For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 1 and 3.	The capital estimate for the plant was $30.5MM USD, this includes a 30% contingency. For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 1 and 2.

Input received from Interested Parties:

While there is considerable experience and expertise when it comes to mining in northern Saskatchewan, there was no engagement specific data collected relating to on site processing methods. Processing materials on site will require a resourceful workforce, a workforce that Denison is looking to source locally (16-EN-VB-107.17). Meaningful employment is highly value amongst COI's and is a frequent topic of discussion. Processing materials on site will help employees develop their skills and bring dollars to local economies (21-EN-SUR-446.21) (19-EN-PBN-135.5).

Selected Alternative for on-site processing method = Option 3: direct precipitation

Rationale: Direct precipitation was selected as the on-site processing method for the Project and carried through the EA. This selection was primarily based on the technical factors from the screening level alternative means assessment. The on-site processing method selected to support the EIS will be reviewed and adapted as needed through the completion of additional metallurgical test work and as the Project proceeds through licensing and permitting.

Less Preferred	Neutral	More preferred

Table 11: Water Management – Freshwater Supply - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Groundwater	Option 2: Surface water
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the freshwater supply alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the freshwater supply alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the freshwater supply alternatives.	
		Groundwater quantity	Less preferred. Withdrawing groundwater could have a very localized influence on groundwater quantity.	More preferred. Option 2 would not interact with groundwater quantity.
		Groundwater quality	No appreciable difference was identified between the alternatives. Withdrawal of water under Option 1 or 2 is not expected to change the quality of groundwater.	
	Aquatic Environment	Surface Water Quantity	Although groundwater recharge to surface waterbodies does account for some flow contribution, the change in surface waterbody flows or levels would be more influenced by direct withdrawal, making this option more preferred on the surface water quantity VC.	Less preferred option. The use of a waterbody as a freshwater intake source could lead to drawdown.
		Surface Water Quality	No appreciable difference was identified between the alternatives. Withdrawal of water under Option 1 or 2 is not expected to change the quality of surface water.	
		Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	Although groundwater recharge to surface waterbodies does account for some flow contribution, the change in surface waterbody flows or levels would be more influenced by direct, surface water withdrawal, making this option more preferred for these aquatic environment VCs.	Installation of a water intake in a nearby lake, depending on the design, may overprint a small spatial area of the lake bottom, thereby interacting with sediment, benthic invertebrates and fish and fish habitat. Fisheries and Oceans Canada (2013) identifies that cumulative flow alterations (e.g., water withdrawal) of less than 10% of the magnitude of the actual (instantaneous) flow in a river relative to a natural flow regime would result in a low probability of detectable impacts to ecosystems that support commercial, recreational, or Indigenous fisheries. Assuming the water withdrawal location meets these requirements (i.e., withdrawal volumes are <10% of instantaneous flow), would expect no detectable effects to aquatic environment components such as fish and fish habitat, sediment quality, benthic invertebrates, and fish health as it relates to flow/water level alteration.
	Terrestrial Environment	Terrain Soil	No appreciable difference was identified between the alternatives. Changes in terrain, soil, and organic matter/peat would not be anticipated in a discernable way for either option	

Criteria	Section	Valued Component	Option 1: Groundwater	Option 2: Surface water
		Organic matter/peat		
		Vegetation and Ecosystems	Less preferred. Shallow-groundwater withdrawal would have a greater potential to influence on terrestrial moisture regimes, and areal extent of vegetation and ecosystems, listed plant species, and wetlands	More preferred. Surface water withdrawal would have a lower potential to influence on areal extent of vegetation and ecosystems, listed plant species, and wetlands
		Listed Plant Species		
		Wetlands		
		Ungulates	No appreciable difference was identified between the alternatives. Habitat changes associated with Option 1 changing terrestrial moisture regimes and Option 2 changing surface water flows or water levels, would be similar and more importantly, both would be very unlikely to interact with the vertebrate terrestrial VCs. The presence of a small diameter pipeline from the well (Option 1) or the surface waterbody (Option 2) to the main Project Area would be similar in length and designed to facilitate wildlife crossing.	
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. Neither option would change non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between the alternatives. Any drinking water at site, regardless of the source, will need to meet potable water requirements. There are no conventional health and safety risks, or radiation exposure differences associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable differences were identified for changes in the area of land available for Indigenous and non-Indigenous or other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	
		Other Land and Resource Use		
		Heritage Resources	No appreciable difference was identified between these options for heritage resources. The main project area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed both options (well and pipeline for Option 1, pipeline for Option 2) are located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during construction	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.	
		Community Well-being	No appreciable difference was identified between alternatives for changes to income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Groundwater**	**Option 2: Surface water**
Technical Factors	Complexity of design, construction, operation, and decommissioning	A shallow groundwater well would be straightforward in terms of design, construction, operation, and decommissioning. Denison uses a shallow groundwater well at its existing exploration camp and drilling equipment is readily available on site for a proposed ISR operation.	A surface water withdrawal would be slightly more complex compared to Option 1. Installing and maintaining a surface water intake in a nearby lake would require more careful planning for in-water works, interaction with fish and fish habitat, and seasonal issues with ice influencing the intake pipe and pump.
Cost Factors	Capital, operating, and decommissioning costs	Costs would be similar for withdrawal components. The water treatment design on the potable side may be lower cost for this option, but that was considered outside of this assessment of alternative means.	The capital, operating, and decommissioning costs of a surface water intake would be similar between Options 1 and 2.

Input received from Interested Parties:

Hydrology information from baseline programs were used together with engagement information gathered from workshops and meetings to evaluate surface water locations (22-EN-VPL/ML9-620.8). Freshwater supply was an important aspect for Denison to consider when designing the Project as it supports components of both the mining method and camp operations. While the area surrounding the Project hosts a multitude of freshwater supply sources (e.g., lakes, rivers, ponds, streams), it was important for Denison to listen to the perspectives of Indigenous groups regarding which freshwater sources they believed would best align with the plans and requirements for the Project. This included conversations about which surface water bodies could effectively provide the amount of water needed, without affecting the surrounding aquatic and terrestrial ecosystems (18-EN-VPL-2.11).

Selected alternative for freshwater supply = Option 1: Groundwater and Option 2: Surface water

Rationale: The two options evaluated were determined to be viable options based on the screening. Both groundwater and surface water withdrawals were carried forward as freshwater supply alternative means and evaluated in the EA. Additionally, the freshwater needs have been scoped in the EA to allow for one source to be used exclusively. This will allow for a combination of the two water sources to be used, if needed. Assessing both options in the EIS provides operational flexibility for Denison and meets the aim of having a conservative assessment basis.

Less Preferred	Neutral	More preferred

Table 12: Water Management – Drinking Water - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on -site with a potable water treatment plant
Biophysical	Atmospheric and Acoustic Environment	Air quality	Transport would generate dust along roads.	No appreciable changes in air quality is anticipated for operation of a potable water treatment plant.
		Noise	No appreciable difference was identified between the alternatives. Option 1 would generate vehicular noise along roads; Option 2 would generate very low, localized levels of noise within the plant.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the drinking water alternatives.	
		Groundwater quantity	No appreciable difference was identified between the alternatives. Groundwater source of freshwater for Option 2 was evaluated separately.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the drinking water alternatives.	
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. Surface water source of freshwater for Option 2 was evaluated separately.	
		Surface Water Quality	No appreciable difference was identified between the aquatic environment VCs for these alternatives.	
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on terrain would be expected for the drinking water alternatives.	
		Soil	Transport would generate dust along roads, which could lead to indirect effects on soil and vegetation.	No appreciable changes in these terrestrial VCs would be anticipated for construction, operation, and decommissioning of a potable water treatment plant.
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on -site with a potable water treatment plant
		Furbearers	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	
		Woodland caribou	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	
		Raptors	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
		Migratory breeding birds	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
		Bird species at risk	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. Neither option would change non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between the alternatives. Any drinking water at site, regardless of the source, will need to meet potable water requirements. There are no differences in conventional health and safety risks or radiation exposure associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable differences were identified for changes in the area of land available for Indigenous and non-Indigenous or other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	
		Other Land and Resource Use		
		Heritage Resources	For this option, existing facilities (roads) would be used and, therefore, it is presumed no archaeological and cultural heritage features would be affected.	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the potable plant is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.
	Quality of Life	Cultural Expression	Less preferred option for cultural expressions due to increased traffic close to culture camp locations.	This option is not expected to effect a change in cultural expression.
		Community Well-being	Business opportunities for supplying bottled water and transporting to site may provide a potential positive effect on the income of local workers.	Having an on-site potable water treatment plant would increase the responsibility of Denison staff and contractors (for construction,

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on -site with a potable water treatment plant
				collection, disposal, maintenance, decommissioning), which may generate a positive effect on income of local workers.
		Infrastructure and Services	Less preferred option due to increase in traffic on local roads.	This option is not expected to effect a change to infrastructure and services.
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors		
Criteria		**Metric**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Complexity of design, construction, operation, and decommissioning were assumed to be similarly low for both options.
Cost Factors	Capital, operating, and decommissioning costs	Capital, operating, and decommissioning costs were assumed to be similarly low for both options.
Input received from Interested Parties: Water has been the topic of many conversations during the past seven years of engagement activities for the Project. The COIs and other Interested Parties are curious how drinking water will be provided for the Project (22-EN-VPL/ML9-620.8). Two options were considered for providing potable water to the Project. Potable water could be sourced off site and then truck into the Project, or potable water could be generated on site through nearby groundwater wells and associated potable water treatment plant infrastructure. The transport of additional materials by truck would increase traffic, which may have a potential effect on traditional land use, infrastructure and services, and wildlife. There were concerns that an increase in noise and vibrations because of truck traffic could potentially disrupt wildlife (19-LKERFNTrap-134.173) and increase greenhouse gas emissions.		
Selected alternative for drinking water = Option 2: Generate drinking water on site with a potable water treatment plant **Rationale:** The ability to generate drinking water on site was more preferred compared to trucking drinking water to site. Assessing this option allows Denison to have operational flexibility and the ability to provide for workers, with less logistical coordination and traffic associated with transport of potable water to site.		

Less Preferred	Neutral	More preferred

Table 13: Water Management – Treated Effluent Discharge Location - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: To groundwater	Option 2: To surface water
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the treated effluent discharge location alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the treated effluent discharge location alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the treated effluent discharge location alternatives.	
		Groundwater quantity	Less preferred. Local groundwater quantity could be changed; effects would be determined at a receptor location	More preferred. This option would not interact with groundwater quantity.
		Groundwater quality	Less preferred. Local groundwater quality would be changed; effects would be determined at a receptor location	More preferred. This option would not interact with groundwater quality.
	Aquatic Environment	Surface Water Quantity Surface Water Quality Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	More preferred. Release to groundwater would contribute to smaller change in these aquatic VCs, via groundwater contribution to surface water	Less preferred. Releasing treated effluent will have more direct effects on these aquatic VCs, through changes in water flow and water quality.
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on terrain would be expected for the treated effluent discharge location alternatives	
		Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands	Less preferred. Groundwater discharge would have a greater potential to influence terrestrial moisture regimes, and areal extent of vegetation and ecosystems, listed plant species, and wetlands.	More preferred. Surface water discharge would have a lower potential to influence areal extent of vegetation and ecosystems, listed plant species, and wetlands.
		Ungulates Furbearers Woodland caribou	More preferred. Release to groundwater will contribute smaller change in surface water quality (via groundwater contribution to surface water) and eventual uptake by wildlife VCs.	Less preferred. These wildlife VCs could experience an increased exposure to non-radiological and radiological constituents through intake of surface water that has received treated effluent.

Criteria	Section	Valued Component	Option 1: To groundwater	Option 2: To surface water
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	More preferred. Groundwater is not typically used as a drinking water source in the area by recreational and traditional users.	Less preferred. Surface water is more typically used as a drinking water source by recreational and traditional users.
		Worker Health	No appreciable difference was identified between the alternatives. No difference was found in conventional health and safety risks, or radiation exposure associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	More preferred. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 2.	Less preferred. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 1.
		Other Land and Resource Use		
		Heritage Resources	No appreciable difference was identified between these options for heritage resources.	
	Quality of Life	Cultural Expression	More preferred. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 2.	Less preferred. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 1.
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: To groundwater**	**Option 2: To surface water**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The regulatory framework and permitting/approval process for releasing treated effluent to groundwater is less clear than the release to surface water. With the selection of ISR, the option to release treated effluent to groundwater became less preferred as it could complicate interactions of the Project with groundwater. Because a portion of the treated effluent released to groundwater would report to lakes, the prediction and monitoring of the movement of effluent in groundwater was a technical/regulatory risk.	Release of treated effluent to surface water is standard approach for other uranium operations in Saskatchewan. Although it will trigger the Metal and Diamond Mine Effluent Regulations (MDMER), and there are associated costs and responsibilities (monitoring, reporting), this is a more preferred option from a technical standpoint.

Other Evaluation Factors			
Criteria		**Option 1: To groundwater**	**Option 2: To surface water**
Cost Factors	Capital, operating, and decommissioning costs	No appreciable difference was identified between the alternatives. For the screening, the costs were assumed to be comparable for option 1 and 2.	

Input received from Interested Parties:

As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshops gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. Potential locations for treated effluent discharge locations were discussed with COIs and other Interested Parties on multiple occasions. During a meeting with the Village of Beauval, participants voiced their confidence that all waterbodies in proximity to the Project had sufficient capacity to accept treated effluent from the Project. There was a general preference to discharge the treated effluent into a water system that was flowing, allowing for a more effective dilution of the treated effluent (18-EN-VB-4.34) (18-EN-VB-4.35). No specific engagement data were available relevant to discharging the treated effluent into a groundwater source, although there was sufficient material to determine that COIs preferred the option to discharge to a surface water source that experiences flow or movement.

Selected alternative for treated effluent discharge location = Option 2: to surface water

Rationale: The option to release treated effluent to surface water was selected and evaluated in the EA. Releasing treated effluent to surface water may be less preferred in terms of changes to surface water quality and the aquatic, terrestrial, and human VCs that may drink water or otherwise use aquatic resources (e.g., eat fish). However, the option to release treated effluent to surface water is industry-standard and the regulatory process is clearer. The option to discharge treated effluent to groundwater would complicate the Project's monitoring and permitting process.

Less Preferred	Neutral	More preferred

Table 14: Water Management – Treated effluent discharge locations for surface water - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential changes in air quality would be expected for the treated effluent discharge location to surface water alternatives.				
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for the treated effluent discharge location to surface water alternatives.				
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives.				
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives				
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives				
	Aquatic Environment	Surface Water Quantity Surface Water Quality	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, Kratchkowsky Lake (LA-7) was identified as less preferred.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-6 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-5 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-1 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, Russell Lake was identified as one of the preferred discharge locations.
		Fish and Fish Habitat	In Step 2 of the preliminary evaluation of discharge location, consideration was given to fish and fish habitat. All options could be suitable if the discharge location is sited away from spawning areas. Because spawning habitat is present at all locations, but could be avoided, all locations were given a neutral rating. No waterbodies were eliminated from further consideration as potential intake and discharge locations based on the review of fish and fish habitat in this stage.				
		Sediment Quality Benthic Invertebrates	In Step 3 of the preliminary evaluation of discharge location, the potential effects on surface water, sediment, and other aquatic VCs associated with the discharge of treated mine water were evaluated using the environmental pathways model IMPACT. The IMPACT model has supported a number of				

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
		Fish Health	successful environmental assessments in the region and continues to be a key tool for demonstrating the high level of environmental performance of these operations. The IMPACT model was set up for the Icelander River drainage using site-specific baseline and hydrologic information. The IMPACT model includes flow and mass balance in lakes and streams. The constituents of potential concern (COPCs) enter the aquatic environment at the discharge location and travel downstream through a series of waterbodies. As the COPCs travel downstream, concentrations in water can decrease as a result of mixing with natural inflows from the surrounding watershed and interactions with lake sediment. The exchange of constituents is estimated using chemical-specific partitioning coefficients. The model was populated with sensitive aquatic (northern pike, lake whitefish, white sucker, spottail shiner, aquatic invertebrates, zooplankton, aquatic plants, phytoplankton) and terrestrial (loon, scaup, mink) biota to assess potential ecological effects of the discharge of COPCs in treated mine water during the life of the mine. Potential effects on the receiving environment were evaluated by comparing predicted water and sediment quality to water and sediment quality guidelines, and predicted the exposure of sensitive valued ecosystem components to toxicological and radiological benchmarks. Results flagged that molybdenum in sediment in LA-7 was anticipated to exceed a guideline (Kratchkowsky Lake = less preferred). No other guidelines for water/sediment or toxicity reference values for aquatic and terrestrial biota were predicted to be exceeded.				
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives. No difference in potential changes in terrain would be expected for the treated effluent discharge location to surface water alternatives.				
		Soil	Interaction of options with these terrestrial VCs would be through surface clearing for installation of a pipeline and adjacent trail or road for maintenance. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake.				
		Organic matter/peat					
		Vegetation and Ecosystems					
		Listed Plant Species					
		Wetlands					
		Ungulates	Interaction of options with these terrestrial VCs would be through surface clearing for installation of a pipeline and adjacent trail or road for maintenance. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. In Step 3 of the preliminary evaluation of discharge location, the potential effects on surface water, sediment and valued ecosystem components from the discharge of treated mine water were evaluated using the environmental pathways model IMPACT. The IMPACT model has supported a number of successful environmental assessments in the region and continues to be a key tool for demonstrating the high level of environmental performance of these operations. The IMPACT model was set up for the Icelander River drainage using site-specific baseline and hydrologic information. The IMPACT model includes flow and mass balance in lakes and streams. The COPCs enter the aquatic environment at the discharge location and travel downstream through a series of waterbodies. As the COPCs travel downstream, concentrations in water can decrease as a result of mixing with natural inflows from the surrounding watershed and interactions with lake sediment. The exchange of constituents is estimated using chemical-specific partitioning coefficients. The model was populated with sensitive aquatic (northern pike, lake whitefish, white sucker, spottail shiner, aquatic invertebrates, zooplankton, aquatic plants, phytoplankton) and terrestrial (loon, scaup, mink) biota to assess potential ecological effects of the discharge of COPCs in treated mine water during the life of the mine. Potential effects on the receiving environment were evaluated by comparing predicted water and sediment quality to water and sediment quality guidelines, and predicted the exposure of sensitive valued ecosystem components to toxicological and radiological benchmarks. Results flagged that				
		Furbearers					
		Woodland caribou					
		Raptors					
		Migratory breeding birds					
		Bird species at risk					

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
			molybdenum in sediment in LA-7 was anticipated to exceed a guideline. No other guidelines for water/sediment or TRVs for aquatic and terrestrial biota were predicted to be exceeded.				
Human Environment	Human Health	Human Health	Neutral as this would be less preferred than Options 2 and 3, but more preferred than Options 4 and 5, considering historical commercial fishing at this lake, but no current leases (receptors).	More preferred as there are no leases/cabins or known land use at this lake.	More preferred as there are no leases/cabins or known land use at this lake.	Less preferred because of the land use at this lake (receptor location). Release of effluent here could increase non-radiological and radiological constituents in water and fish. Perceived changes are also considered here.	Less preferred because of the land use at this lake (receptor location). Release of effluent here could increase non-radiological and radiological constituents in water and fish. Perceived changes are also considered here.
		Worker Health	No appreciable difference was identified among the alternatives. No difference was identified in conventional health and safety risks, or radiation exposure associated with these options.				
	Land and Resource Use	Indigenous Land and Resource Use	More preferred as these lakes would have a smaller influence in the change in area of land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use, based on Indigenous land use information available.				Less preferred. One traditional land use lease on Russell Lake. Fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.
		Other Land and Resource Use	Less preferred as this lake has, in previous years, been fished commercially.	More preferred as there are no recreational leases, and no known land use.	More preferred as there are no recreational leases, and no known land use.	A recreational lease (cabin) occurs on McGowan Lake. Water taking and fishing on McGowan Lake could be affected by a change in the perceived suitability of the lake for safe use.	Less preferred. Several recreational leases and outfitters are found on Russell Lake. This lake has, in previous years, been fished commercially. Recreational and commercial fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
		Heritage Resources	No appreciable differences were identified among these options. If not within the bounds of a previous heritage resources impact assessment, the land corridor for the effluent pipeline will be examined. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.				
	Quality of Life	Cultural Expression	Less preferred. As this is a larger lake, and has previously been commercially fished, there may be potential for a larger perceived change in the suitability and safety of resources that support a traditional diet with effluent release at this location.	More preferred as, based on land use information, there may be potential for a smaller perceived change in the suitability and safety of resources that support a traditional diet with effluent release at these locations.			Less preferred. As this is a larger lake, and has previously been commercially fished, there may be potential for a larger perceived change in the suitability and safety of resources that support a traditional diet with effluent release at this location.
		Community Well-being	No appreciable differences was identified among these options. No difference in potential changes in income of local workers and community cohesion would be expected for the treated effluent discharge locations for surface water.				
		Infrastructure and Services	No appreciable differences was identified among these options. No difference in potential changes to traffic, or community infrastructure and services would be expected for the treated effluent discharge locations for surface water.				
	Economics	Economy	Less preferred. Commercial fishing on Kratchkowsky Lake could be affected by a change in the perceived suitability of the lake for safe use.	More preferred with smaller potential change in participation in traditional economy.			Less preferred. Commercial fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.

Other Evaluation Factors						
Criteria		Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
Technical Factors	Complexity of design, construction, operation, and decommissioning	The general design of the treated effluent pipeline and diffuser would be the same for all options. The parameter that would vary is the length of the pipeline. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. A line to Russell Lake would also have to cross Highway 914.				
Cost Factors	Capital, operating, and decommissioning costs	The main driver of cost would be related to the length of the pipeline. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. A line to Russell Lake would also have to cross Highway 914.				

Other Evaluation Factors					
Criteria	**Option 1: Kratchkowsky Lake (LA-7)**	**Option 2: Whitefish Lake north (LA-6)**	**Option 3: Whitefish Lake south (LA-5)**	**Option 4: McGowan Lake (LA-1)**	**Option 5: Russell Lake**
Input received from Interested Parties: As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshop gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. Treated effluent discharge locations for surface water received substantial feedback during engagement workshops with COIs. Surface waterbodies considered for receiving treated effluent discharge included Russell Lake, McGowan Lake, Kratchkowsky Lake, and Whitefish Lake. Denison looked to local land users for guidance on how to select an appropriate location for the discharge of any treated effluent. It was important to avoid areas within the identified surface waterbodies that may be spawning habitat or popular locations for fishing and other recreational activities (18-EN-VPL-2.13) (18-EN-VB-4.23). Common reasons provided for why a waterbody was unsuitable to receive treated effluent was the location of the waterbody was too far from the Project site, meaning additional infrastructure would have to be constructed to get the treated effluent to the discharge point. Secondly, the presence of recreational cabins and popular fishing locations (referring to Russell Lake) where present on or around the lake in question. Finally, the presence of potentially sensitive habitat and aquatic species (18-EN-VILX-3.43), which should be avoided to prevent any potential disruption. A consensus was given that any lake, other than Russell Lake, was acceptable to receive the treated effluent discharge, as Russell Lake is frequently used for fishing (18-EN-VPL-2.15).					
Selected alternative for treated effluent discharge locations for surface water = Option 3: Whitefish Lake south (LA-5) **Rationale:** Whitefish Lake south (LA-5) was selected as the treated effluent discharge location and was advanced to the EA for more detailed assessment. Based on the alternative means assessment screening, Whitefish Lake south has the required characteristics (e.g., depth, flow) and assimilative capacity to receive effluent without inducing effects on aquatic and terrestrial biota, as evaluated with the IMPACT model. This location is the closest lake to the Project Area, resulting in the shortest discharge line and associated trail out of the options evaluated, thereby reducing interaction with various terrestrial VCs and optimizing technical factors associated with construction, operation, and decommissioning. No known land use occurs on the lake and although all the lakes evaluated are in the same drainage, the largest changes in surface water quality and sediment quality would be expected in the receiving lake, with decreases moving downstream, reflecting increasing natural flows with increasing catchment areas and distance from the Project.					

Less Preferred	Neutral	More preferred

Table 15: Waste Management – Organic Waste Disposal - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
Biophysical	Atmospheric and Acoustic Environment	Air quality	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	Odor from organic waste in the domestic landfill could serve as an attractant to wildlife.	More preferred. The finished product from the composting system is not expected to have odor.
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for organic waste disposal alternatives.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No effects on geology associated with this option.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. The option more likely to interact with groundwater quantity is Option 2; however, with implementation of mitigation measures, no discernable changes in groundwater quantity are expected with these options.		
		Groundwater quality	No appreciable difference was identified among the alternatives. The option more likely int interact with groundwater quality is Option 2; however, with implementation of mitigation measures, no discernable changes in groundwater quality are expected with these options.		
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in these aquatic environment VCs would be expected for the organic waste disposal options.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No anticipated effects on terrain associated with this option.	The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in terrain.	No anticipated effects on terrain associated with this option.
		Soil	Air dispersion from the incinerator to nearby soil could influence soil quality.	The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in soil.	More preferred. Potential positive effect on soils if compost can be used in reclamation activities.
		Organic matter/peat	Less preferred. Air emissions from the incinerator to nearby areas could influence organic matter/peat quality.	Less preferred. The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in the extent of organic matter/peat.	More preferred. Potential positive effect on organic matter/peat if compost can be used in reclamation activities.
		Vegetation and Ecosystems			

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
		Listed Plant Species	Less preferred. Air emissions from the incinerator to nearby areas could influence quality of vegetation and ecosystems, listed plant species, and wetlands.	Less preferred due to direct loss of terrestrial ecosystems from landfill footprint.	More preferred. Potential positive effect on these terrestrial VCs if compost can be used in reclamation activities.
		Wetlands			
		Ungulates	Less preferred. Air emissions could alter how wildlife use habitat near the incinerator.	Less preferred. Landfill footprint results in direct loss of habitat and odor from organic waste in the domestic landfill could serve as an attractant to wildlife.	More preferred. Fewer potential interactions with these terrestrial VCs compared to Options 1 and 2.
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	More preferred than Option 1 for effects on human health.	
		Worker Health	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	More preferred than Option 1 for effects on worker health.	
	Land and Resource Use	Indigenous Land and Resource Use	The incinerator would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to emissions associated with this option.	The domestic landfill would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to odors associated with this option.	The composting system would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. No appreciable indirect effects of this option expected on Indigenous land and resource use.
		Other Land and Resource Use	The incinerator would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to emissions associated with this option.	The domestic landfill would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to odors associated with this option.	The composting system would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. No appreciable indirect effects of this option on other land and resource use.
		Heritage Resources	No appreciable difference was identified among alternatives. The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the area required for all three options is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.		

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes in knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: On-site disposal using an incinerator**	**Option 2: On-site disposal in domestic landfill**	**Option 3: On-site composting**
Technical Factors	Complexity of design, construction, operation, and decommissioning	For the alternative means assessment, technical factors for each of these options were assumed to be similar. Design, construction, and decommissioning would be similar for all three options. Operation of Option 2 would be the simplest; operation of the incinerator (Option 1) and composter (Option 3) would be relatively more active/complex, but not unduly complicated.		
Cost Factors	Capital, operating, and decommissioning costs	For the alternative means assessment, total Project costs for each of these options was assumed to be similar.		

Input received from Interested Parties:

As part of the federal EA process, there was a public review period of Denison's Project Description and Technical Proposal (Denison 2019). In the 2019 Project Description and Technical Proposal (Denison 2019), Denison proposed incineration for disposal of food and other organic wastes. Comments received from the Ya'thi Néné Land and Resource Office on the Project Description and Technical Proposal (Canadian Nuclear Safety Commission 2019) recommended Denison consider composting food scraps and other organic material instead of the proposed incineration option. This comment has greatly influenced Denison's evaluation of alternatives and the selection of the on-site composting option for the EA.

Organic waste generated in the camp and other facilities would be managed on site. The options considered for managing organic waste include composting, placing organic material in the domestic landfill, or separating the organic material from other waste streams and using an incinerator. No specific information related to organic waste disposal was collected during engagement activities; however, Denison understands the importance of minimizing all potential waste and keeping the Project site clean (22-EN-SUR-652.21) (22-EN-SUR-652.23).

Organic materials have the possibility of attracting wildlife. Proactive management of organic waste materials will reduce the possibility of wildlife interactions at site and minimize any form of disturbance to wildlife (21-EN-ERFN-473.1).

Selected alternative for organic waste disposal = Option 3: on-site composting

Rationale: Based on current understanding of the composting systems available, Denison selected the use of on-site composting for organic waste disposal for additional evaluation in the EA. This option provided many environmental benefits and also met a specific recommendation received from the Ya'thi Néné Land and Resource Office in 2019 on the Project Description and Technical Proposal (Canadian Nuclear Safety Commission 2019).

Less Preferred	Neutral	More preferred

Table 16: Waste Management – Process Precipitate Management - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. With both options, potential exists for changes in air quality from wind dispersion of metals, radionuclides, and particulate matter from process precipitates. These changes are expected to be similar for the two options.	No appreciable difference was identified between the alternatives. With both options, potential exists for changes in air quality from wind dispersion of metals, radionuclides, and particulate matter from process precipitates. These changes are expected to be similar for the two options. This option requires transportation and increased traffic along public roads increases road dust and combustion emissions from mobile equipment.
		Noise	More preferred as this option avoids transportation and associated change in sound levels.	Less preferred because the transportation activity would increase changes in sound levels.
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the process precipitate management alternatives.	
		Groundwater quantity	Less preferred. Decommissioning of the process precipitates on site is effectively adding 50,000 m^3 of material which could slightly alter groundwater flow or levels.	More preferred. Decommissioning an empty temporary storage area would reverse any changes to groundwater flow or levels.
		Groundwater quality	Less preferred. Even with implementation of design mitigations such as cover design to limit water infiltration into and liner design to limit release out of the disposal area, a slow release of material is anticipated over the long-term into the local groundwater environment. Evaluation of the appropriateness of designs will focus on long-term contaminant release from the precipitates and eventual discharge of groundwater to local surface water bodies and reducing effects at these receptor locations.	More preferred. This alternative would have less potential interaction with groundwater quality, because the precipitate storage would be temporary in nature and have less of an effect on changes to groundwater quality in the post-decommissioning period
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on surface water quantity would be expected for the process precipitate management alternatives.	
		Surface Water Quality Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	Less preferred. Even with implementation of design mitigations such as cover design to limit water infiltration into and liner design to limit release out of the disposal area, a slow release of material is anticipated over the long-term into the local groundwater environment. Evaluation of the appropriateness of designs will focus on discharge of groundwater to local surface water bodies and reducing effects at these aquatic environment receptor locations. Collection, treatment, and release of process precipitate contact water during operation would be similar for both options.	More preferred. This alternative would have less potential interaction with changes to surface water quality via groundwater discharge to local lakes, because the precipitate storage would be temporary in nature (e.g., no source term remaining on site). Collection, treatment, and release of process precipitate contact water during operation would be similar for both options.

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
	Terrestrial Environment	Terrain	Less preferred. Decommissioning of the process precipitates on site is effectively adding 50,000 m^3 of material, which could slightly change local terrain.	More preferred. Decommissioning an empty temporary storage area would reverse any changes to minor operational changes to terrain.
		Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands Ungulates Furbearers Woodland caribou Raptors Migratory breeding birds Bird species at risk	More preferred. Both options would have similar footprints, and as such, similar changes in areal extent of ecosystems and loss and/or alteration of wildlife habitat.	Less preferred. Increased likelihood of interaction with the terrestrial environment associated with transport of material off site (e.g., wildlife collisions, alteration or loss of vegetation, soil, and potential wildlife habitat from dust, noise, smells associated with traffic). Both options would have similar footprints, and as such, similar changes in areal extent of ecosystems and loss and/or alteration of wildlife habitat.
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives. Options would have similar contribution to changes in non-radiological and radiological constituents in air, water, and food. The Post-Decommissioning exposure for Option 1 is assumed to pose no additional risk to human health in consideration of the disposal area designs and slow transport out of the facility.	
		Worker Health	No appreciable difference was identified between alternatives for worker health. These options would have similar conventional health and safety risks and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified between alternatives. A change in the perceived suitability of Indigenous land and resources for safe use may be bigger for this option, compared to Option 2 (e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for Indigenous land and resource use activities during operations for safety reasons.	No appreciable difference was identified between alternatives. A change in the perceived suitability of Indigenous land and resources for safe use may be smaller for this option, compared to Option 1 (e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for Indigenous land and resource use activities during operations for safety reasons. Changes in resource availability may be associated with traffic needed to transport the material off site.
		Other Land and Resource Use	No appreciable difference was identified between alternatives. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 2	No appreciable difference was identified between alternatives. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 1 (e.g., temporary storage preferred to

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
			(e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for other land and resource use activities during operations for safety reasons.	permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for other land and resource use activities during operations for safety reasons. Changes in resource availability may be associated with traffic needed to transport the material off site.
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 are assumed to be in the areas that underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives. There is potential for a larger perceived change in the suitability and safety of resources that support a traditional diet, with on-site permanent disposal generally being less preferred to temporary storage.	No appreciable difference was identified between alternatives. With perceived change in the suitability and safety of resources that support a traditional diet, temporary storage would be preferred to permanent storage. However, the potential changes in cultural expression related to traffic would be less preferred compared to option 1.
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: On-site permanent**	**Option 2: Off-site reprocessing and permanent disposal**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Less preferred. Design, construction, and decommissioning would be more complex in terms of planning for long-term environmental protection with precipitates permanently on site. Operation would be similar for both options.	More preferred. Design, construction, and decommissioning would be more straightforward compared to option 1. Operation would be similar for both options.
Cost factors	Capital, operating, and decommissioning costs	Less preferred. This would be a higher cost option.	More preferred. This option has an overall lower cost. Denison would benefit from the sale/processing of the precipitates and not incur decommissioning costs for permanent disposal.

Input received from Interested Parties:

The small footprint of the Project helps to reduce any potential effects to the surrounding environment (21-EN-VILX-443.35) but limits the amount of space available for storage of materials and waste. This means operating efficiently within the footprint and removing materials off site for proper disposal, when available. During engagement activities, some members shared their experience at other mining and milling operations where materials are buried on site, and their general disapproval of this practice (22-EN-ERFN-618.26). No engagement material was available for the option of on-site precipitate disposal; however, the proactive removal of waste material from site and minimizing potential disturbances to the land, aligns with feedback collected during other Project engagement sessions (22-EN-SUR-652.87).

Selected alternative for process precipitate management = Option 2: Off-site reprocessing and permanent disposal:
Rationale: From a biophysical environment, human environment, technical and cost perspective, off-site reprocessing and permanent disposal was preferred to on-site permanent disposal. The off-site reprocessing and permanent disposal alternative was advanced through the EA for additional evaluation.

Less Preferred	Neutral	More preferred

Table 17: Waste Management – Domestic Waste Disposal - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Collection and disposal off-site by a third-party contractor	Option 2: Collection and disposal in an on-site domestic landfill
Biophysical	Atmospheric and Acoustic Environment	Air quality	Dust generation along on and off-site gravel roads from transportation. Scope 3 GHG emissions from off-site transportation.	Changes in air quality at the landfill are assumed to be mitigated by best practice for landfill management.
		Noise	No appreciable difference was identified between the alternatives. Trucks used for transportation under Option 1 and machinery used in landfill construction and management under Option 2 would likely both change sound levels.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the domestic waste disposal alternatives.	
		Groundwater quantity Groundwater quality	No appreciable difference was identified between the alternatives. No effects on groundwater quantity and quality would be expected for either of the domestic waste disposal alternatives. It is assumed that both on-site and approved off-site alternatives would have similar / equivalent environmental protection measures.	
	Aquatic Environment	Surface Water Quantity Surface Water Quality	No appreciable difference was identified between the alternatives. No difference in potential effects on surface water quality and quantity would be expected for either of the domestic waste disposal alternatives. Drainage from an on-site domestic waste landfill would be diverted around the landfill as much as possible. Leachate collected from the landfill would be treated. An approved off-site facility would have similar effects on local surface water quantity and quality; and water management controls would be in place.	
		Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	No appreciable difference was identified between the alternatives. No difference in potential effects on these aquatic VCs would be expected for the domestic waste disposal alternatives.	
	Terrestrial Environment	Terrain Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands	Road dust from transportation would have indirect effects on these terrestrial VCs. Option 1 uses existing, off-site facilities – no new land clearing is required.	Construction of a domestic landfill may result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands.
		Ungulates Furbearers Woodland caribou Raptors	Potential increased direct effects on mortality from increased road traffic.	Expected habitat loss associated with clearing for landfill construction and operation (direct loss of habitat), and also indirect effect on habitat use from noises or odors at the landfill.

Criteria	Section	Valued Component	Option 1: Collection and disposal off-site by a third-party contractor	Option 2: Collection and disposal in an on-site domestic landfill
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between alternatives for changes in worker conventional health and safety and radiation exposure	
	Land and Resource Use	Indigenous Land and Resource Use	This option is not expected to interact with Indigenous land and resources use in the Project local study area.	This option is less preferred in terms of requiring construction of an on-site landfill, resulting in anticipated direct effects on vegetation and soil and indirect effect on wildlife (i.e., resource availability).
		Other Land and Resource Use	This option is not expected to interact with other land and resources use in the Project local study area.	This option is less preferred in terms of requiring construction of an on-site landfill, resulting in anticipated direct effects on vegetation and soil and indirect effect on wildlife (i.e., resource availability).
		Heritage Resources	No appreciable difference was identified between alternatives. A new on-site landfill footprint underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction. For options 1, an existing facility would be used and therefore it is presumed no archaeological and cultural heritage features would be affected.	
	Quality of Life	Cultural Expression	Change in traffic volume (increase) on public roads for regular transport of domestic waste off site. Less preferred option for cultural expressions due to likely increased traffic in proximity to a culture camp.	No appreciable effects of this option on cultural expression were identified.
		Community Well-being	The transportation component could generate an economic or business opportunity for a local operator, thereby generating a positive effect on income of local workers.	Having an on-site domestic waste landfill would increase the responsibility of Denison staff and contractors (for construction, collection, disposal, maintenance, decommissioning), which may generate a positive effect on income of local workers.
		Infrastructure and Services	Less preferred option with increased traffic. Also, waste disposal capacity that would otherwise be dedicated to serve local or regional communities would be consumed by Project-related waste, which may not be viewed favorably.	No appreciable effects of this option on infrastructure and services.
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Collection and disposal off-site by a third-party contractor**	**Option 2: Collection and disposal in an on-site domestic landfill**
Technical Factors	Complexity of design, construction, operation, and decommissioning	This is simple option in terms of design, construction, operation, and decommissioning – the main on-site components would be temporary storage containers for domestic waste. The off-site landfill design, construction, operation and decommissioning are considered separately from the Project. This option would result in increases to Denison's scope 3 GHG emissions associated with transportation.	While design, construction, operation, and decommissioning of an on-site domestic waste landfill is more complex than the transport of domestic waste off sites, the domestic waste landfill is not complex compared to other Project components.
Cost Factors	Capital, operating, and decommissioning costs	Capital costs and decommissioning costs would be minimal – mainly for on-site temporary storage containers for domestic waste. The operational costs would be higher than Option 2 with transport and disposal of material off site.	Capital costs and decommissioning costs would be higher compared to Option 1; operating costs would be lower compared to Option 1. For context, the incremental capital and decommissioning costs associated with this alternative are small in comparison to the Project as a whole, and not material in comparison.

Input received from Interested Parties:

During seven years of engagement activities for the Project, Denison has understood the importance of designing a project that minimizes interactions with the biophysical environment and the importance of continued land use by Indigenous groups. Looking at domestic waste disposal options, the option to transport domestic waste off site to a nearby licensed facility may generate a local economic opportunity (16-EN-DesNd-101.1, 19-EN-VB-132.5, 21-EN-SUR-446.48). However, the transport of material off site would increase traffic, which may have a negative effect on traditional land use, infrastructure and services, and wildlife (16-EN-ERFN-100.15) (21-EN-SUR-446.68). Increased traffic would also increase greenhouse gas emissions. Concerns related to climate change were raised during engagement and consultation activities completed by Denison (e.g., 22-EN-ERFN-621.15, 22-EN-SUR-652.57). It should be noted that these concerns pertain to climate change rather than GHG emissions specifically. The concerns included observations of climate-related changes that have been noticed by the English River First Nation (e.g., depth of permafrost; 16-EN-ERFN-100.17) and observations by the English River First Nation Trapper who provided local knowledge in support of the EIS (19-LK-ERFNTrap-134.232). While no specific feedback was received on the domestic waste disposal options, the above provides context on how Denison's fulsome engagement activities have influenced the selection of a preferred alternative for domestic waste disposal.

Preferred alternative for domestic waste disposal: Option 2: Collection and disposal in an on-site domestic landfill

Rationale: The on-site domestic landfill option was selected for the EA as it provides operational flexibility for Denison to construct, operate, and decommission the landfill to manage non-recyclable, non-hazardous material without radionuclide contamination. Collection and disposal off site by a third-party contractor emerged as a less preferred option due to the associated increased traffic and scope 3 GHG emissions. Also this option can become a burden to local communities if regional landfill availability is limited and placing Project's waste in a regional landfill would lessen the landfill's life.

Less Preferred	Neutral	More preferred

Table 18: Access and Transportation – Access Road Alignment - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential effects on air quality would be expected for the access road alignment alternatives. All options would have equivalent environmental protection measures to minimize changes in air quality.		
		Noise	Distance to the closest recreational lease (cabin) is >500 m.	Distance to the closest recreational lease (cabin) is 240 m.	Distance to the closest recreational lease (cabin) is >1,000 m.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the access road alignment alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the access road alignment alternatives		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the access road alignment alternatives		
	Aquatic Environment	Surface Water Quantity Surface Water Quality Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	No stream crossings are associated with this option and this route was not within 200 m of a waterbody. No interaction with aquatic environment is expected.	No stream crossings are associated with this option. This route was the closest (140 m) to a waterbody (McGowan Lake, LA-1)	No stream crossings are associated with this option and this route was not within 200 m of a waterbody. No interaction with aquatic environment is expected.
	Terrestrial Environment	Terrain	This option has the potentially greatest effect on terrain, as a result of the large cut volumes.	No appreciable difference was identified between these alternatives. Effects on terrain would be similar for these two access road alignment alternatives based on cut and fill estimates.	
		Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands	Option-specific clearing of undisturbed vegetation estimated at 6 ha (3 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.	Option-specific clearing of undisturbed vegetation estimated at 7 ha (3.5 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.	Option-specific clearing of undisturbed vegetation estimated at 2 ha (1 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.
		Ungulates			

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
		Furbearers Woodland caribou Raptors Migratory breeding birds Bird species at risk	Option-specific clearing of undisturbed vegetation estimated at 6 ha (3 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options. Cut and fill volumes are highest for this option. Theoretically, because this is the shortest road (5.31 km), there may be less potential for direct wildlife mortality from collisions.	Option-specific clearing of undisturbed vegetation estimated at 7 ha (3.5 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options Cut and fill volumes are between those for Options 1 and 3. Slightly longer road (5.77 km) compared to Option 1.	Option-specific clearing of undisturbed vegetation estimated at 2 ha (1 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options. For construction costs, this options has the lowest cut and fill volumes. Theoretically, because this is the longest road (6.77 km), there may be higher potential for direct wildlife mortality from collisions, but this would not be quantifiable.
Human Environment	Human Health	Human Health	No appreciable difference was identified among the alternatives. No difference in potential effects on human health would be expected for the access road alignment alternatives.		
		Worker Health	No appreciable difference was identified among the alternatives. No difference in potential effects on worker health would be expected for the access road alignment alternatives. All options would have equivalent safety measures to minimize risk to workers.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the access road alignment alternatives.		
		Other Land and Resource Use	Distance to the closest recreational lease (cabin) is >500 m.	Distance to the closest recreational lease (cabin) is 240 m.	Distance to the closest recreational lease (cabin) is >1,000 m.
		Heritage Resources	This option had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 1. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.	This option had a heritage resource impact assessment completed in 2017. The assessment resulted in the identification of HiNi-6, an artifact find of an unknown precontact cultural affiliation that was identified on the western terrace of McGowan Lake, adjacent to access road Option 2. The site has limited interpretive potential and no additional concerns were attached to the site in the context of the study. The assessment received approval from the Heritage Conservation Branch. The	This option had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 3. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
				implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified among the alternatives. No difference in potential effects on cultural expression would be expected for the access road alignment alternatives.		
		Community Well-being	No appreciable difference was identified among the alternatives. No difference in potential effects on community well-being would be expected for the access road alignment alternatives.		
		Infrastructure and Services	No appreciable difference was identified among the alternatives. No difference in potential effects on infrastructure and services would be expected for the access road alignment alternatives.		
	Economics	Economy	No appreciable difference was identified among the alternatives. No difference in potential effects on economy would be expected for the access road alignment alternatives.		

Other Evaluation Factors				
Criteria		Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
Technical Factors	Complexity of design, construction, operation, and decommissioning	Cut and fill volumes are highest, making the construction more complex. Shortest road (5.31 km).	Cut and fill volumes are between those for options 1 and 3. Slightly longer road (5.77 km) compared to option 1.	For construction costs, this option has the lowest cut and fill volumes. Longest road (6.47 km).
Cost Factors	Capital, operating, and decommissioning costs	Cut and fill volumes are highest, feeding into higher capital costs on this metric. However, a shorter road brings down the capital, operating and decommissioning cost based on total road length.	For cut-fill volumes and total length, this option was intermediate to options 1 and 3.	Cut and fill volumes are lowest, feeding into lower capital costs on this metric. However, this is the longest road which increases the capital, operating, and decommissioning cost based on total road length.

Other Evaluation Factors			
Criteria	**Option 1: Direct route**	**Option 2: Direct route to reduce cut volumes**	**Option 3: Follows part of the existing exploration access road**
Input received from Indigenous groups **and Interested Parties** As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshop gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. While the most direct access route is generally optimal (18-EN-VPL-2.1), where possible, Denison will consider using existing routes that may have been previously used for exploration and other activities. A focus on minimizing terrestrial disturbance and keeping access roads a respectable distance away from the identified cabin in the area, to reduce noise, dust, and deter the general public from accessing private cabins, was important to COIs and Interested Parties (18-EN-VPL-2.2) (18-EN-VPL-2.3, 18-EN-VPL-2.9, 18-EN-VPL-2.10) (18-EN-VB-4.6). The Denison engagement team also received comments that local land users did not want access roads constructed near waterbodies, again as it may potentially increase disturbance (18-EN-VPL-2.6) (18-EN-VB-4.7). It is important for rights holders to have confidence that they can still access their traditional areas and activities like hunting and berry picking (16-EN-ERFN-100.15, 21-EN-ERFN-473.6). Restrictions on access to the site area would be controlled through two security gates. Security gates are in place to provide for safety in and around the active site. Through engagement efforts Denison has learn that maintaining restricted access to the north (through Cameco's Key Lake gate) is a high priority for local Indigenous groups, to preserve and protect the area. Access road designs that have security gates are preferred and will make sure the Project site is safe and secure (19-LK-ERFNTrap-134.224, 19-LK-ERFNTrap-134.226). Denison has worked hard to make sure plans for access roads have been shared with COIs and feedback collected (18-EN-VPL-2.1) (18-EN-VILX-3.1) (18-EN-VB-4.4).			
Selected alternative for access road alignment = Option 3: Follows part of the existing exploration road **Rationale:** Although this is the longest route, which increases facets of cost considerations, the rationale for selecting this alternative was driven by Denison's commitment to minimize new disturbances to the terrestrial environment. This was achieved by selecting the routing that followed part of the existing exploration access road. This option was supported by Interested Parties, as evidenced by the feedback received from the 2018 workshops.			

Less Preferred	Neutral	More preferred

Table 19: Access and Transportation – Stream Crossing Structures - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between these options. These options are not expected to interact with or change air quality.	
		Noise	No appreciable difference was identified between these options. These options are not expected to change noise levels.	
	Geology and Groundwater	Geology	No appreciable difference was identified between these options. These options are not expected to interact with or change geology.	
		Groundwater quantity	No appreciable difference was identified between these options. These options are not expected to interact with or change groundwater quantity.	
		Groundwater quality	No appreciable difference was identified between these options. These options are not expected to interact with or change groundwater quality.	
	Aquatic Environment	Surface Water Quantity	Crossing would be installed to withstand a flood event. Culverts may concentrate flows and increase water velocities and potential sediment scour at high flows.	Crossing would be installed to withstand a flood event. Clear span bridges should not limit stream hydraulic capacity.
		Surface Water Quality	Culverts may concentrate flows and increase water velocities and potential scour at high flows.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Fish and Fish Habitat	Installation of culverts would likely destroy a small area of fish habitat (substrate beneath culvert) and loss of habitat from infilling around the culvert. Culverts can concentrate flows and increase water velocities. Fish passage would be part of culvert design criteria, although culverts are more likely to interfere with fish passage, compared to clear span structures.	Clear span bridges can be constructed without in-water works and avoid harmful alteration, disruption, or destruction of fish habitat. Can retain existing bottom substrate, bank structure, riparian vegetation, and natural fish passage stream qualities.
		Sediment Quality	Culverts may concentrate flows and increase water velocities and potential sediment scour at high flows.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Benthic Invertebrates	Destroy a small area of fish habitat (substrate beneath culvert) and loss of habitat from infilling around the culvert. Culverts can concentrate flows and increase water velocities.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Fish Health	Culverts can concentrate flows and velocities. Fish passage would be part of culvert design criteria, although culverts are more likely to interfere with fish passage, compared to clear span structures.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives for terrestrial environment valued components.	
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates		

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. No difference in potential effects on human health would be expected for the stream crossing alternatives.	
		Worker Health	Implementing mitigation measures on culverts (inspected periodically to remove accumulated material and debris that may prevent efficient passage of water and fish through the structures) may pose a relatively higher risk to work health and safety for the culvert option. Would expect to clear more debris more frequently from culverts, requiring more near and in water work for Denison staff and contractors.	Reduced potential effect on worker health and safety for this option compared to culverts.
	Land and Resource Use	Indigenous Land and Resource Use	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing has not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Sourcing culverts of a sufficient diameter to maintain navigability is uncertain. With regard to navigability this option would be less preferred. Looking at local travel by truck or ATV, there would be no appreciable difference in the options: both stream crossings may provide increased ease of access across these steams at these locations.	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing has not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Clear span bridges at both locations could be designed to maintain navigability. With regard to navigability this option would be preferred. Looking at local travel by truck or ATV, there would be no appreciable difference in the options: both stream crossings may provide increased ease of access across these steams at these locations.
		Other Land and Resource Use	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing had not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Sourcing culverts of a sufficient diameter to maintain navigability is uncertain. With regard to navigability, this option would be less preferred. Looking at local travel by truck or ATV, there would be no appreciable difference for the two options: both stream crossings may provide increased ease of access across these steams at these locations.	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing had not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Clear span bridges at both locations could be designed to maintain navigability. With regard to navigability, this option would be more preferred. Looking at local travel by truck or ATV, there would be no appreciable difference for the two options: both stream crossings may provide increased ease of access across these steams at these locations.
		Heritage Resources	No appreciable difference was identified between alternatives. The land adjacent to the crossing structures is part of the decommissioned Fox Lake trail, and, therefore, it is presumed no archaeological and cultural heritage features would be affected, because this area was previously disturbed.	

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
	Quality of Life	Cultural Expression	No appreciable difference was identified between the alternatives. No difference in potential effects on cultural expression would be expected for the stream crossing alternatives.	
		Community Well-being	No appreciable difference was identified between the alternatives. No difference in potential effects on community well-being would be expected for the stream crossing alternatives.	
		Infrastructure and Services	No appreciable difference was identified between the alternatives. No difference in potential effects on infrastructure and services would be expected for the stream crossing alternatives. Both stream crossings may provide increased ease of access across these streams at these locations.	
	Economics	Economy	No appreciable difference was identified between the alternatives. No difference in potential effects on economy would be expected for the stream crossing alternatives.	

Other Evaluation Factors			
Criteria		**Option 1: Culverts**	**Option 2: Clear span bridges**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The design of culverts is fairly simple. However, it would be challenging to find culverts to provide navigability at Hart Creek. The construction and decommissioning would require in-water works and would be technically challenging. The operation phase would require more attention for clearing of debris.	The option of a clear span bridge over the 30 m section of Hart Creek may be a more complex design compared to culverts. But, but the construction, operation and ease of decommissioning would be preferred for this option.
Cost Factors	Capital, operating, and decommissioning costs	Culverts would be a lower cost option for capital considerations. Operational and decommissioning costs are expected to be higher than clear span bridge options.	Capital costs for clear span bridges would be higher than culverts but require less operational costs and be easier to decommission.

Input received from Interested Parties:

Denison is intending to use a small portion of road to access the proposed airstrip to the north of the Project site. Stream crossing structures will need to be constructed as the previous crossings were deconstructed by Cameco in 2015. While engagement efforts did not produce any specific information on the preferred stream crossing structure (culverts or clear span bridges), Denison is aware that there is a strong interest from local rights holders to preserve and protect the area and keep the Project site secure. This includes restricting access (using security gates) so the general public cannot use the proposed stream crossing structures or roads as an entry point into English River First Nation (ERFN) territory (19-LK-ERFNTrap-134.224, 19-LK-ERFNTrap-134.226).

Selected alternative for stream crossing structures = Option 2: Clear span bridge

Rationale: The clear span bridge option is likely more expensive for Denison to construct, but it is anticipated to provide fewer effects on the aquatic environment and avoid harmful alteration, disruption, and destruction of fish habitat. The option for clear span bridges allows for road crossing without in-water supports or buttresses. This option is also similar to what was previously in place at these locations.

Less Preferred	Neutral	More preferred

Table 20: Access and Transportation – Worker Transportation - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
Biophysical	Atmospheric and Acoustic Environment	Air quality	Includes dust generation along gravel roads and scope 3 GHG emissions from vans and buses. Avoids. This option avoids dust dispersion at an airstrip, but generates scope	Dust dispersion at the airstrip would be similar to Option 3. Dust dispersion along roads during transport to and from the Project Area and Cameco's airstrip would be less preferred compared to Option 3 (longer distance). Aircraft scope 3 GHG emissions would be similar to Option 3.	Dust dispersion at the airstrip would be similar to Option 2. Dust dispersion along roads during transport to and from the Project Area and new airstrip would be more preferred compared to Option 3 (shorter distance). Aircraft scope 3 GHG emissions would be similar to Option 2.
		Noise	Comparatively less noise generation.	Increased sound levels at the airstrip and surrounding area.	Increased sound levels at the airstrip and surrounding area.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the worker transportation alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the worker transportation alternatives.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the worker transportation alternatives.		
	Aquatic Environment	Surface Water Quantity Surface Water Quality Fish and Fish Habitat Sediment Quality Benthic Invertebrates Fish Health	No new interaction with aquatic environment as the infrastructure needed for options are existing facilities.	No new interaction with aquatic environment as the infrastructure needed for options are existing facilities.	This option requires two stream crossings along the road to the new airstrip. Depending on the crossing structure selected, there is potential for in -water works, loss of fish habitat, changes to riparian vegetation, concentrated flows and increased velocities, and issues with fish passage.
	Terrestrial Environment	Terrain Soil Organic matter/peat Vegetation and Ecosystems Listed Plant Species Wetlands	No appreciable difference was identified among alternatives for these terrestrial VCs. The infrastructure needed for options are existing facilities – no new land clearing is required.	No appreciable difference was identified among alternatives for these terrestrial VCs. The infrastructure needed for options are existing facilities – no new land clearing is required.	This option is less preferred as it requires construction of a road and airstrip, resulting in greater potential direct effects (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species and wetlands.

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
		Ungulates Furbearers Woodland caribou Raptors Migratory breeding birds Bird species at risk	Potential increased effects on mortality from increased road traffic.	Similar to Option 3 for potential indirect effects on wildlife (altered habitat use) and direct effects on birds from airstrikes.	Similar to Option 2 for potential indirect effects on wildlife (altered habitat use) and direct effects on birds from airstrikes.
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.		
		Worker Health	Less preferred option for worker health and safety. Ground transport higher risk for accidents and collisions, icy conditions during winter months, and staff sitting in vehicles for up to 10 hours each way, per shift (potentially negative for physical and mental health).	These two options would be similar in terms of worker health.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference between these two alternatives regarding land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The infrastructure needed for these options are existing facilities. No changes to access.		This option is less preferred in terms of requiring construction of a road and airstrip, resulting in potential direct effects on vegetation and soil and indirect effect on wildlife. The installation of stream crossings along the road may locally increase ease of access for ATVs or trucks in the immediate vicinity—this is not clearly preferred or less preferred and depends on the perspective as it relates to land and resource use.
		Other Land and Resource Use	No appreciable difference between these two alternatives regarding land available for other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The infrastructure needed for these options are existing facilities. No changes to access.		This option is less preferred in terms of requiring construction of a road and airstrip, resulting in potential direct effects on vegetation and soil and indirect effect on wildlife. The installation of stream crossings along the road may locally increase ease of access for ATVs or trucks in the immediate vicinity—this is not clearly preferred or less preferred and depends on the perspective as it relates to land and resource use.

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
		Heritage Resources	No appreciable difference was identified among alternatives. The new on-site airstrip footprint underwent a heritage resource survey in 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction. For Options 1 and 2, existing facilities (e.g., roads, Cameco's airstrips) would be used and, therefore, it is presumed no archaeological and cultural heritage features would be affected.		
	Quality of Life	Cultural Expression	Less preferred option for cultural expressions due to increased traffic close to a culture camp location.	These two options would be similar in terms of cultural expression.	
		Community Well-being	No appreciable difference was identified among alternatives for changes to income of local workers and community cohesion.		
		Infrastructure and Services	Less preferred option for cultural expressions due to increased traffic.	These two options would be similar in terms of infrastructure and services.	
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Ground Transport**	**Option 2: Air transport to existing airstrip at nearby Cameco operations**	**Option 3: Air transport to new airstrip constructed and operated by Denison**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Technical issues would be operation of this option (e.g., time driving, logistics for shift changes, weather delays).	The complexity and largest possible constraint for this option is that it relies on an agreement for Denison to use an airstrip owned and operated by a competing company. Otherwise, this option is simple with regard to technical factors.	Road and airstrip are not unduly complex in terms of design, construction, operation, and decommissioning, but more complex than using existing facilities (roads for Option 1, Cameco's airstrips for Option 2).
Cost Factors	Capital, operating, and decommissioning costs	Relatively low capital, operating, and decommissioning costs. Operating costs would be from paying workers during travel time to and from site.	Lowest capital and decommissioning costs. Operating costs would be similar to Option 3.	Highest capital and decommissioning costs. Operating costs would be similar to Option 2.

Input received from Interested Parties:

While including an airstrip in the overall Project design will add to the total footprint, having the ability to transport the site workforce by air will greatly reduce the amount of traffic on both highways and Project access roads (21-EN-VILX-443.2). Assessable and convenient worker pick-up points were highlighted in survey responses (21-EN-SUR-446.61). The airstrip may also reduce potential vehicle and wildlife interactions and reduce the frequency of noise and dust disturbances along the roads (18-EN-VB-4.6). Responses on an engagement survey indicated that increases in traffic volumes were a consistent concern (20-LK-LEASESUR-267.99 to 20-LK-LEASESUR-267.108).

Other Evaluation Factors			
Criteria	**Option 1: Ground Transport**	**Option 2: Air transport to existing airstrip at nearby Cameco operations**	**Option 3: Air transport to new airstrip constructed and operated by Denison**
Selected alternative for worker transportation = Option 3: Air transport to new airstrip constructed and operated by Denison			
Rationale: Based on this assessment, the more preferred option is air transport to an existing airstrip at a nearby Cameco operation (Option 2). It reduces the Project's direct loss of vegetation and soil and reduced indirect effects on wildlife associated with construction, operation, and decommissioning a new airstrip. This option also avoids construction, operation, and decommissioning of a road from the site out to a new airstrip, which includes two stream crossings. This option is also the preferred option in terms of cost. However, there is a risk for Denison to advance the EA without having its own airstrip option assessed. As such, Denison will advance Option 3 through the EA to fully assess the effects associated with constructing, operating, and decommissioning a new, on-site airstrip and associated supporting facilities (e.g., road, stream crossings, airstrip terminal). If Option 2 is secured in the intervening years prior to Denison's construction decision, the EA will have been overly-conservative on many assessments (e.g., air quality, noise, all terrestrial VC assessments). This would be an example of continuous improvement as the Project advances through design stages towards development.			

Less Preferred	Neutral	More preferred

Table 21: Power – Primary Power Supply - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
Biophysical	Atmospheric and Acoustic Environment	Air quality	More preferred than Option 2, but less preferred than Option 3 with regard to GHG emissions. Transport would generate dust along roads (similar to Option 2).	Less preferred option with regard to GHG emissions. Transport would generate dust along roads (similar to Option 1).	More preferred option. Electricity would yield scope 2 emissions for the Project but would avoid large scope 1 emissions from fuel combustion. No ground transport component.
		Noise	Less preferred option due to increases in sounds levels.	Less preferred option due to increases in sounds levels.	This option would have the lowest associated increase in sound levels.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the primary power supply alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the primary power supply alternatives.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the primary power supply alternatives.		
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on aquatic environment VCs would be expected for the primary power supply alternatives.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	Emissions may alter quality of soil and vegetation; potential effects on terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands from clearing associated with construction. Transport would generate dust along roads.	Emissions may alter quality of soil and vegetation; potential effects on terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands from clearing associated with construction. Transport would generate dust along roads.	Construction of the power line into site may result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands over a small area.
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates	Noise and emissions/smells may alter ungulate habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter ungulate habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line.

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
		Furbearers	Noise and emissions/smells may alter furbearer habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter furbearer habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line.
		Woodland caribou	Noise and emissions/smells may alter woodland caribou habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter woodland caribou habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line. Clearing may create a linear feature for the line into site. Denison will endeavor to have SaskPower align the power line with the access road.
		Raptors	Noise and emissions/smells may alter raptor habitat use.	Noise and emissions/smells may alter raptor habitat use.	Raptors may collide with the power line. Certain species may nest on the power poles. Habitat loss from clearing for overhead power line.
		Migratory breeding birds	Noise and emissions/smells may alter migratory breeding bird habitat use.	Noise and emissions/smells may alter migratory breeding bird habitat use.	Habitat loss associated with clearing for the overhead power line.
		Bird species at risk	Noise and emissions/smells may alter bird species at risk habitat use.	Noise and emissions/smells may alter bird species at risk habitat use.	Habitat loss associated with clearing for the overhead power line.
Human Environment	Human Health	Human Health	Potentially poorer air quality compared to Option 3	Potentially poorer air quality compared to Option 3	No appreciable effects of this option expected on human health.
		Worker Health	Potentially poorer air quality for workers compared to Option 3.	Potentially poorer air quality for workers compared to Option 3.	No appreciable effects of this option on worker health.
	Land and Resource Use	Indigenous Land and Resource Use	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	No appreciable effects of this option on Indigenous land and resource use.
		Other Land and Resource Use	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	No appreciable effects of this option on other land and resource use.
		Heritage Resources	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the LNG plant is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the diesel generators is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding	This preferred road alignment option (assuming the overhead power line will be within the assessed road + buffer area) had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 3. The assessment received approval from the Heritage Conservation Branch. The

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
			to any chance encounters of artifacts during clearing and construction.	to any chance encounters of artifacts during clearing and construction.	implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during line clearing and construction.
	Quality of Life	Cultural Expression	Change in traffic volume (increase) on public roads for regular transport of LNG to site. Less preferred option for cultural expressions due to increased traffic in proximity to a culture camp.	Change in traffic volume (increase) on public roads for regular transport of diesel to site. Less preferred option for cultural expressions due to increased traffic in proximity to a culture camp.	No appreciable effects of this option on cultural expression.
		Community Well-being	Business opportunities for supplying LNG and transporting to site may provide potential positive effect on income of local workers.	Business opportunities for supplying diesel and transporting to site may provide potential positive effect on income of local workers.	Line clearing and construction opportunities through SaskPower may provide potential positive effect on income of local workers.
		Infrastructure and Services	Change in traffic volume (increase) on public roads for regular transport of LNG to site.	Change in traffic volume (increase) on public roads for regular transport of diesel to site.	No appreciable effects of this option on infrastructure and services
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Liquefied natural gas power plant**	**Option 2: Diesel generators**	**Option 3: Provincial power grid**
Technical Factors	Complexity of design, construction, operation, and decommissioning	More complex option compared to Option 3 as tanks and containment systems are required for fuel storage. Operationally would need more day to day oversight than Option 3. Increases Project's scope 1 GHG emissions compared to Option 3.	More complex option compared to Option 3 as tanks and containment systems are required for fuel storage. Operationally would need more day-to-day oversight than Option 3. Increases Project's scope 1 GHG emissions compared to Option 3.	Not a technically complex option. SaskPower will be responsible for bringing the line into site. Denison will construct a substation. Lowers the Project's scope 1 GHG emissions. Reliability is high.
Cost Factors	Capital, operating, and decommissioning costs	Capital costs similar for all options. Operating costs between options 2 and 3. Decommissioning costs similar for all options.	Capital costs similar for all options. Highest operating costs – purchase of fuel and transport of fuel. Decommissioning costs similar for all options.	Capital costs similar for all options. Lowest operating costs. Decommissioning costs similar for all options.
Input received from Interested Parties: Multiple methods for powering the Project were discussed during engagement activities. There was interest from workshop participants regarding solar power and wind turbines as a means to power the Project using renewables (18-EN-ERFN-5.48). Ideas for environmentally responsible methods for powering the Project were shared with Denison during a workshop with ERFN members, with preference being given to options that reduced emissions and minimized potential impacts (18-EN-ERFN-5.48). It was suggested that the most cost effective and least environmentally disruptive method for powering the Project would be to connect to the existing provincial grid and run the powerline in a straight line from the connection point to the Project. In a local land user's opinion, the powerline does not necessarily need to follow the proposed access road (19-LK-ERFNTrap-134.248), but would provide a consistent and reliable source of power.				

Other Evaluation Factors			
Criteria	**Option 1: Liquefied natural gas power plant**	**Option 2: Diesel generators**	**Option 3: Provincial power grid**
Selected alternative for primary power supply = Option 3: Provincial power grid			
Rationale: Tapping into the provincial power grid is the more preferred option for primary power supply for a number of reasons. Denison is committed to minimizing GHG emissions and this option is preferable to Options 1 and 2 in terms of air emissions in general and scope 1 GHG emissions in particular. The option will result in incrementally more loss of habitat compared to Options 1 and 2, but this will be minimized to the extent practical by aligning the overhead line with the access road. The other two options would require regular transport of fuel to site, which has other potential interactions with the terrestrial environment (e.g., increased frequency of collisions). The increased traffic associated with Options 1 and 2 makes these options less preferred for cultural expression and infrastructure and services VCs.			

Less Preferred	Neutral	More preferred

Table 22: Support Facilities – Camp Location Optimization - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: First location - Prefeasibility	Option 2: Second location – Reduce fill volumes	Option 3: Third location - Southwest from second location
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable effects of this option on air quality were identified.	This location may experience changes in air quality parameters due to proximity to the wellfield and processing plant areas.	No appreciable effects of this option on air quality were identified.
		Noise	No appreciable difference was identified among the alternatives. No difference in potential changes in sound levels would be expected for the camp location options.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the camp location options.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in groundwater quantity would be expected for the camp location options.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential changes in groundwater quality would be expected for the camp location options.		
	Aquatic Environment	Surface Water Quantity	Less preferred option due to the amount of cut and fill required and the influence on hydrology.	No appreciable difference was identified between these two alternatives. No difference in potential effects on surface water quantity would be expected for these two camp location options.	
		Surface Water Quality	No appreciable difference was identified among the alternatives. No difference in potential changes in these aquatic environment VCs would be expected for the camp location options.		
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	Less preferred option due to the amount of cut and fill required.	No appreciable difference was identified between these alternatives. No difference in potential effects on terrain would be expected for these two camp location options	
		Soil	Less preferred option due to the amount of cut and fill required.	No appreciable difference was identified between these alternatives. No difference in potential effects on soil would be expected for these two camp location options	
		Organic matter/peat	No appreciable difference was identified among alternatives for these various terrestrial VCs. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint.		
		Vegetation and Ecosystems			
		Listed Plant Species			

Criteria	Section	Valued Component	Option 1: First location - Prefeasibility	Option 2: Second location – Reduce fill volumes	Option 3: Third location - Southwest from second location
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	More preferred option for human health considerations.	Changes in air quality from other mining activities in proximity to camp may have negative effects on human health, making this option less preferred.	More preferred option for human health considerations.
		Worker Health	More preferred option for worker health considerations.	Changes in air quality may have negative effects on worker health, making this option less preferred.	More preferred option for worker health considerations.
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among alternatives for land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint. There are no changes to access associated with the camp location options.		
		Other Land and Resource Use	No appreciable difference was identified among alternatives for land available for other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint. There are no changes to access associated with the camp location options.		
		Heritage Resources	No appreciable difference was identified among these options for heritage resources. The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and all three options are located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during line clearing and construction.		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes in knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: First location - Prefeasibility**	**Option 2: Second location – Reduce fill volumes**	**Option 3: Third location - Southwest from second location**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Design and construction would be less preferred due to higher cut and fill volumes. Operation and decommissioning would be similar to Options 2 and 3.	No appreciable difference in complexity of design, construction, operation, and decommissioning for this option and Option 3.	No appreciable difference in complexity of design, construction, operation, and decommissioning for this option and Option 2.
Cost Factors	Capital, operating, and decommissioning costs	High capital costs for cut and fill volumes. Otherwise, operating and decommissioning costs would be similar to Options 2 and 3.	No appreciable difference in capital, operating, and decommissioning costs for this option and Option 3.	No appreciable difference in capital, operating, and decommissioning costs for this option and Option 2.

Input received from Interested Parties:

Denison understands the importance of optimizing the location of the Project camp and associated facilities within the footprint of the Project site. The Project will have a small footprint when compared to other, more traditional, mining operations throughout northern Saskatchewan; as such, the Project does not require as much infrastructure and buildings on site. This allows for efficient placement of the critical buildings required for the operation – including the camp facilities. While some specific engagement material was collected on optimizing the location of the camp within the site design, Denison is aware that a footprint, regardless of size, can still have potential effects (21-EN-ERFN-447.38). Therefore, the number of buildings will be as minimal as possible, and as mobile or modular as possible. This will allow for easier installation and removal (21-EN-ERFN-447.29).

Preferred alternative for camp location optimization = Option 3: Third location – southwest from second location

Rationale: The camp location selected remains close the other Project components for the purpose of minimizing Project footprints. It is located in a relatively flat area, which avoids unnecessary costs, construction complexity, and effects on terrain, soil, and surface water quantity associated with moving large volumes of material for cut and fill. The camp location is sufficiently far from emissions based on results from earlier iterations of the air dispersion model. As described earlier, this alternative means assessment was provided as an example of incremental optimization.

Less Preferred	Neutral	More preferred

2 Summary of Selected Alternative(s)

Table 23 provides a summary of the preferred alternative means that were selected for the Project and carried forward to the EA process.

The alternatives means assessment framework incorporated technical, economic, land use, biophysical and human environment considerations, in the context of mitigation measures and residual effects. The evaluation of the Project's performance will be ongoing through the process of continual improvement and adaptive management. The alternatives selected will continue to be reviewed and adapted as needed through the completion of the EA process and as the Project proceeds through licensing and permitting.

Table 23: Summary of Alternative Means Carried Forward into the Environmental Assessment

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	~~Open pit~~	Jet Boring	Surface Boring	Micro Tunnel Boring	**ISR**		
	Freeze design for tertiary containment of mining solution	Freeze dome	**Freeze wall**					
	Permeability enhancement	**Hydraulics**	**Propellant**	**Mechanical**				
	Mining solution	~~Basic solution~~	**Acidic solution**					
Processing	Location of processing	Off-site processing at an existing mill	**On-site processing in purpose built processing plant**					
	On-site processing method	Ion exchange	Solvent extraction	**Direct precipitation**				
Water management	Freshwater supply	**Groundwater**	**Surface water**					
	Drinking water	Truck drinking water to site	**Generate drinking water on site with a potable water treatment plant**					
	Treated effluent discharge location	To groundwater	**To surface water**					
	Treated effluent discharge locations for surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	**Whitefish Lake south (LA-5)**	McGowan Lake (LA-1)	Russell Lake	~~Mardoc Lake (LA-4)~~	~~Williams Lake LB-3~~
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	**On-site composting**				
	Process precipitate management	On-site permanent disposal	**Off-site reprocessing and final disposal**					
	Domestic waste disposal	Collection and disposal off site by a third-	**Collection and disposal in an on-**					

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
		party contractor	**site domestic landfill**					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	**Follows part of the existing exploration access road**				
	Stream crossing structures	Culverts	**Clear span bridges**					
	Worker transportation	Ground transport	**Air transport to existing airstrip at nearby Cameco operations**	**Air transport to new airstrip constructed and operated by Denison**				
Power	Primary power supply	Liquefied natural gas power plant	~~Solar photovoltaic power plant~~	Diesel generators	**Provincial power grid**			
Support facilities	Camp location optimization	First location - Prefeasibility	Second location – Reduce fill volumes	**Third location - Southwest from second location**				

Selected alternative

~~Strikethrough~~ option was eliminated at an earlier step due to technical, economic, or land use factors (see Table 3)

3 References

Note: Refer to EIS Appendix 2-A for a summary of the following engagement database references:

16-EN-DesNd-101.1, Meeting, 2016-09-26, Available From: Engagement Database.

16-EN-ERFN-100.15, Community Meeting, 2016-07-27, Available From: Engagement Database.

16-EN-ERFN-100.17, Community Meeting, 2016-07-27, Available From: Engagement.

16-EN-MLA-109.26, Community Meeting, 2016-12-07, Available From: Engagement Database.

16-EN-VB-107.17, Community Event, 2016-12-06, Available From: Engagement Database.

18-EN-ERFN-5.44, Workshop, 2018-05-03, Available From: Engagement Database.

18-EN-ERFN-5.48, Workshop, 2018-05-03, Available From: Engagement Database.

18-EN-VB-4.23, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.34, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.35, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.4, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.51, Workshop, 2018-01-18, Available From: Engagement Database

18-EN-VB-4.54, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.6, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VB-4.7, Workshop, 2018-01-18, Available From: Engagement Database.

18-EN-VILX-3.1, Workshop, 2018-07-17, Available From: Engagement Database.

18-EN-VILX-3.43 Workshop, 2018-07-17, Available From: Engagement Database.

18-EN-VILX-3.68, Workshop, 2018-01-17, Available From: Engagement Database.

18-EN-VILX-3.69, Workshop, 2018-01-17, Available From: Engagement Database.

18-EN-VPL-2.1, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.10, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.11, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.15, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.2, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.3, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.38, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.6, Workshop, 2018-01-16, Available From: Engagement Database.

18-EN-VPL-2.9, Workshop, 2018-01-16, Available From: Engagement Database.

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