NexGen Energy Ltd.

Rook I Project

Environmental Impact Statement

TSD VII: Mine Waste Alternatives Assessment Report

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MINE WASTE ALTERNATIVES ASSESSMENT REPORT
TECHNCIAL SUPPORT DOCUMENT
FOR THE ROOK I PROJECT

Prepared for:

NexGen Energy Ltd.

Prepared by:

Golder Associates Ltd.

April 2022

Executive Summary

NexGen Energy Ltd. (NexGen) is proposing to develop a new uranium mining and milling operation in northwestern Saskatchewan, called the Rook I Project (Project). The Project would be located approximately 40 km east of the Saskatchewan-Alberta border, 130 km north of the town of La Loche, and 640 km northwest of the city of Saskatoon. The Project would reside within Treaty 8 territory and the Métis Homeland. At a regional scale, the Project would be situated within the southern Athabasca Basin adjacent to Patterson Lake, along the upper Clearwater River system. Patterson Lake is at the interface of the Boreal Shield and Boreal Plain ecozones. Access to the Project would be from an existing road off Highway 955, with on-site worker accommodation serviced by fly-in/fly-out access.

This report presents a mine waste alternatives assessment prepared for NexGen by Golder Associates Ltd. The assessment was completed for tailings, gypsum, and waste rock that would be generated by the Project. Alternatives were identified and evaluated using a systematic process to inform the selection of the preferred alternative for each waste type.

Waste types were evaluated separately and in combination to determine the preferred location and technology by completing the following assessments:

- pre-screening for general location;
- screening for specific locations and technologies; and
- multiple accounts analysis (MAA) on alternatives, each including a location and technology.

For the MAAs, alternatives were described during the Construction, Operations, and Closure phases of the Project lifespan and evaluated using measurable indicators in environmental, technical, economic, and social accounts. These accounts were weighted to reflect perceived importance to Indigenous communities, the local public, and other stakeholders through engagement activities undertaken by NexGen. Each MAA included a sensitivity analysis considering the effect of different weighting schemes on ranking of alternatives. The study follows guidance from Environment and Climate Change Canada (ECCC) and the Canadian Nuclear Safety Commission (CNSC) for mine waste alternatives assessments.

Tailings Alternatives Assessment

A total of 17.7 million tonnes (Mt) of tailings would be generated during the Project, of which 11 Mt would be placed underground to backfill mine workings. The remaining 6.7 Mt must be stored in a tailings management facility (TMF).

Five general locations for tailings storage were pre-screened. General locations that passed pre-screening were located within the conceptual (hereafter referred to as “proposed”) Project surface lease boundary and included underground, in-pit, and surface locations. General locations that did not pass pre-screening included storage of tailings off-site, which would increase the area of disturbance beyond the proposed Project surface lease boundary; and storage of tailings in Patterson Lake, which did not meet NexGen’s criterion that no waste be placed in lakes. NexGen has indicated that feedback from local public and Indigenous engagement supported not placing waste in lakes.

Ten specific locations were screened for storage of tailings at the three general locations that passed pre-screening and included four underground, three in-pit, and three surface locations. Locations were described and screened for relative advantages and disadvantages based on environmental, technical, economic, and social indicators. Four specific locations (one underground, two surface, and one in-pit location) passed screening due to relative advantages compared to the six specific locations that were eliminated.

Four tailings technologies were screened at the four specific locations that passed screening (totalling 16 combinations). Technologies that were screened included co-disposal with waste rock, dewatering by filtering, dewatering by thickening to paste consistency, and deposition as slurry. Technologies were described and screened for relative advantages and disadvantages at the four specific locations that passed screening based on environmental, technical, economic, and social indicators. Four alternatives, each including a location and a technology, passed screening due to relative advantages compared to the 12 eliminated alternatives.

The four alternatives were then developed to a conceptual level, described for Construction, Operations, and Closure phases defined for the assessment, and then evaluated by MAA using quantitative scoring and weighting. Alternatives included storage of cemented paste tailings (CPT) in a purpose-built underground tailings management facility (UGTMF), storage of paste tailings at two surface TMF locations, and subaqueous deposition of slurry tailings in a purpose-built pit. Storage of CPT in a purpose-built UGTMF scored the highest, exceeding scores for in-pit storage, which was the perceived “best practice” in Saskatchewan for storage of uranium tailings at the time of this study. The UGTMF meets a recommendation by the CNSC (2018) to maximize underground storage of tailings and a requirement of the Global Industry Standard on Tailings Management (GTR 2020) to reduce the quantity of tailings and water stored on surface.

A sensitivity analysis was completed to evaluate the effect of bias introduced by account weighting. Results of the sensitivity analysis indicated that the rank of the alternatives and study outcome did not change with account weighting (introduction of bias).

Gypsum Alternatives Assessment

A total of 1.5 Mt gypsum would be generated by the Project, which must be permanently stored.

Five general locations for gypsum storage were pre-screened using the same method as the tailings assessment. General locations that passed pre-screening were located within the proposed Project surface lease boundary and included underground and surface locations. General locations that did not pass pre-screening included storage of gypsum off site, which would increase the area of disturbance; storage of gypsum in Patterson Lake, which did not meet NexGen’s criterion that no waste be placed in lakes; and storage of gypsum in-pit, which would increase surface disturbance and the quantity of overburden and waste rock that would need to be stored on the surface through excavation of a pit.

Four specific locations for storage of gypsum were screened at the two general locations that passed pre-screening. Specific locations that were screened included storage of gypsum with tailings in the UGTMF, in a purpose-built underground facility, with waste rock in a surface waste rock storage area (WRSA), and in a purpose-built surface storage facility. Locations were described and screened for relative advantages and disadvantages based on environmental, technical, economic, and social indicators. Two specific locations, storage of gypsum with tailings in the UGTMF and storage of gypsum with waste rock in a WRSA, passed screening due to relative advantages compared to the two specific locations that were eliminated. Storage of gypsum in separate, purpose-built facilities (gypsum only) did not pass screening due to a greater potential for environmental effects, greater surface disturbance, increased complexity to design and operate additional facilities, and increased cost relative to storage of gypsum in combination with tailings or waste rock.

The two alternatives for storage of gypsum that passed screening were developed to a conceptual level and described for Construction, Operations, and Closure phases defined for the assessment, and then evaluated by MAA using quantitative scoring and weighting. The placement of gypsum with tailings in the UGTMF scored the highest, with advantages of lower operational complexity and the potential for gypsum to reduce the binder requirement in the CPT. Storage of gypsum with waste rock in the WRSA would require separation and cleaning of the gypsum, and also engineered placement in the WRSA to avoid potential instability related to dissolution of gypsum. Storage of gypsum with the tailings stream was the standard practice for uranium mines in Saskatchewan at the time of this study.

A sensitivity analysis was completed to evaluate the effect of bias introduced by account weighting. Results of the sensitivity analysis indicated that ranking was sensitive to the account weighting scheme. The first-place rank of placement of gypsum with tailings in the UGTMF was consistent for three out of four account weighting scenarios. When using the NexGen account weighting scenario, where a higher weighting is placed on the economic and social accounts, placement of gypsum with waste rock in the WRSA was the preferred alternative.

Waste Rock Alternatives Assessment

A total of 25.4 Mt waste rock would be generated during the Project, of which 10.7 Mt would be potentially acid generating (PAG) waste rock and the remainder would be non-potentially acid generating (NPAG). In addition to mine development, the quantities of waste rock to be managed at the site are tied to the selection of options for tailings and gypsum storage. Storing tailings and gypsum underground requires excavation of underground chambers. Waste rock from excavation of the chambers must be stored. The tailings and gypsum assessments indicated storage of tailings and gypsum underground scored higher than storage on surface. The total waste rock quantity used for the waste rock alternatives assessment therefore included waste rock from the UGTMF (considering tailings and gypsum stored underground), and the mine.

Five general locations for waste rock storage were pre-screened using the same method as the tailings and gypsum assessments. One general location passed pre-screening: storage on surface within the proposed Project surface lease boundary. General locations that did not pass pre-screening included storage of waste rock off site, which would increase the Project footprint and area of disturbance beyond the proposed Project surface lease boundary; storage of waste rock in Patterson Lake, which did not meet NexGen's criterion that no waste be placed in lakes; and storage of waste rock in a pit, which is fatally flawed due to volume incompatibility (i.e., excavating a pit to store waste rock would generate more waste rock than can be backfilled into the pit due to bulking, and does not allow storage of additional waste from the UGTMF or mine). Similar to tailings, NexGen has indicated that feedback from local public and Indigenous engagement supported not placing waste in lakes.

Five specific locations were screened for storage of waste rock at the single general location that passed pre-screening. Waste rock stockpiles at the specific locations were described by three-dimensional models and compared for relative advantages and disadvantages based on environmental, technical, economic, and social indicators. One specific location near the proposed mine terrace passed screening due to relative advantages compared to the four specific locations that were eliminated. The location that passed screening had a shorter haul distance, which reduced the potential for dust generation from haulage, lowered potential operational maintenance requirements and costs for transport, and used the least amount of water for dust suppression compared to the other locations. The proposed mine terrace location was also consistent with NexGen's overall objective of limiting the spatial extent of the Project by reducing and consolidating the footprint associated with Project infrastructure. NexGen has indicated that feedback from local public and Indigenous engagement supported the idea of minimizing surface footprint.

Six conceptual alternatives for waste rock storage technology at the specific location that passed screening were described for Construction, Operations, and Closure phases defined for the assessment, and then evaluated by MAA using quantitative scoring and weighting. Alternatives were evaluated based on water balances informed by one-dimensional infiltration models, and by quantitative predictions of chemistry of contact water reporting to Patterson Lake based on geochemical source terms and a simplified groundwater mixing model.

The highest scoring alternative included storage of NPAG waste rock in an unlined facility and PAG waste rock in a lined facility with lower-permeability layers within the waste rock (engineered source control). The highest scoring alternative was predicted to have a reduced potential to affect Patterson Lake water quality during Operations and Closure, complied with Saskatchewan Environment and Resource Management (SERM 2000) draft guidelines to use a HDPE (high-density polyethylene) liner for PAG stockpiles, had lower costs for lining compared to fully lined alternatives, had the potential to be progressively closed during operation, and had reduced potential for long-term water treatment. Alternatives without a liner for PAG waste rock did not meet SERM (2000) draft guidelines. Alternatives without engineered source control layers had greater potential to produce water quality that could affect Patterson Lake during Closure and had greater potential to require water treatment post-closure. Alternatives that did not store PAG and NPAG in separate facilities had proportionally more expensive engineering controls than alternatives that segregated waste rock types to focus controls on the PAG waste rock.

The highest scoring alternative (NPAG waste rock in an unlined facility and PAG waste rock in a lined facility with low permeability layers) scored higher than the perceived best practice in Saskatchewan for storage of uranium waste rock at the time of this study, where NPAG waste rock is stored in an unlined facility and PAG waste rock is stored in a lined facility without low permeability layers. A sensitivity analysis was completed to evaluate the effect of bias introduced by account weighting. Results of the sensitivity analysis indicated that ranking is sensitive to the account weighting scheme. The first-place rank was consistent for all weighting scenarios except when the economic account was removed from consideration. When economics were removed from consideration, the highest scoring alternative was a single lined facility (PAG with NPAG) with low permeability layers.

This study is to be read with the Study Limitations subsection, which succeeds the text of the report and forms an integral part of this document.

Abbreviations and Units of Measure

Abbreviation	Definition
1D	one-dimensional
2D	two-dimensional
3D	three-dimensional
CCME	Canadian Council of Ministers of the Environment
CNSC	Canadian Nuclear Safety Commission
CPT	cemented paste tailings
ECCC	Environment and Climate Change Canada
Golder	Golder Associates Ltd.
GTR	Global Tailings Review
LiDAR	light detection and ranging
MAA	multiple accounts analysis
NAD	North American Datum
NexGen	NexGen Energy Ltd.
NLR	neutralized leach residue
NPAG	non-potentially acid generating
PAG	potentially acid generating
Project	Rook I Project
SERM	Saskatchewan Environment and Resource Management
TMF	tailings management facility
UGTMF	underground tailings management facility
UTM	Universal Transverse Mercator
WRSA	waste rock storage area

Unit	Definition
%	percent
°	degree
°C	degree Celsius
µg/L	microgram per litre
<	less than
>	more than
g	gravity
H:V	horizontal to vertical
ha	hectare
km	kilometre
lb	pound
m	metre
masl	metres above sea level
mbgs	metre below ground surface
Mm^3	million cubic metres
mm/yr	millimetres per year
t	tonne
Mt	million tonnes

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1 INTRODUCTION

This report presents a mine waste alternatives assessment for tailings, gypsum, and waste rock at the Rook I Project (Project), a proposed uranium mine and milling operation in northern Saskatchewan, Canada. The study was completed for NexGen Energy Ltd. (NexGen) by Golder Associates Ltd. (Golder).

1.1 Project Description

The Rook I Project is a proposed new uranium mining and milling operation that is 100% owned by NexGen. The Project would be located in northwestern Saskatchewan, approximately 40 km east of the Saskatchewan-Alberta border, 130 km north of the town of La Loche, and 640 km northwest of the city of Saskatoon (Figure 1). The Project would reside within Treaty 8 territory and the Métis Homeland. At a regional scale, the Project would be situated within the southern Athabasca Basin adjacent to Patterson Lake, along the upper Clearwater River system (Figure 2). Access to the Project would be from an existing road off Highway 955, with on-site worker accommodation serviced by fly-in/fly-out access.

The Project would include underground and surface facilities to support the extraction and processing of uranium ore from the Arrow deposit, a land-based, basement-hosted, high-grade uranium deposit. The proposed mine life (Operations Phase) considered for this study was 24 years, with ore milled at an average rate of 1,400 t per day (Golder 2019). The Project would use two underground mining methods to extract the uranium ore: transverse longhole stoping with backfill and longitudinal longhole retreat with backfill (Golder 2019). Waste produced during mining and milling would include tailings, gypsum, and waste rock. More than 50% of the overall tailings produced would be used as backfill for mined-out stopes.

Project lifespan phases and corresponding stages considered in the mine waste alternatives assessment are presented in Table 1.

Table 1: Project and Mine Waste Alternatives Assessment Project Lifespan Phase

<table>
<tr><th>Project
Phase</th><th>Mine Waste Alternatives Assessment
Lifespan Phase</th></tr>
<tr><td>Construction</td><td>Construction</td></tr>
<tr><td>Operations</td><td>Operations</td></tr>
<tr><td>Decommissioning and Reclamation (i.e., Closure)</td><td rowspan="3">Closure</td></tr>
<tr><td>Active Closure Stage</td></tr>
<tr><td>Transitional Monitoring Stage</td></tr>
</table>

1.2 Purpose of Assessment

The purpose of the mine waste alternatives assessment was to evaluate available alternatives for the storage of tailings, gypsum, and waste rock based on environmental, technical, economic, and social indicators for Construction, Operations, and Closure. Results of the assessment are intended to inform and rationalize NexGen's selection of preferred alternatives. This report presents the methods and results of the assessment.

1.3 Local Public and Indigenous Engagement

Golder understands NexGen is committed to conducting meaningful engagement with Indigenous communities and the local public that would potentially be affected by, or who have expressed interested in, the Project.

Records of local public and Indigenous engagement activities are maintained, including feedback received (NexGen 2019). Feedback received prior to issue of this report indicated general agreement that underground storage of tailings is the preferred approach for the Project, that maximizing the return of waste rock underground should also be a priority, and that surface footprint should be minimized.

2 BASIS OF ASSESSMENT

The basis of the mine waste alternatives assessment includes regulations, guidelines, standards, the Project mine waste production schedule, and site characteristics. The basis of assessment is presented in this section.

2.1 Regulations, Guidelines, and Standards

Applicable guidelines and standards considered for the mine waste alternatives assessment included:

- Canadian Nuclear Safety Commission's (CNSC) regulatory document REGDOC-2.11.1, *Waste Management, Volume II: Management of Uranium Mine Waste Rock and Mill Tailings* (CNSC 2018).
  - The CNSC (2018) document states the assessment should include a "…list of all possible candidate mine waste disposal options…" to be screened to "…reduce the number and provide assurance that any of the remaining options could prove to be the preferred option...." The regulation requires scoring and weighting of environmental, technical, economic, and socio-economic characteristics for each alternative.
  - Tailings should be stored underground where possible.
- Environment and Climate Change Canada's (ECCC) *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (ECCC 2016).
  - The ECCC (2016) guidelines state "…alternatives assessment should objectively and rigorously consider all available options for mine waste disposal…" from "construction through operation, closure, and ultimately long-term monitoring and maintenance" and that the "…assessment will consider the predicted quality and quantity of effluent that would be discharged from each alternative assessed..."
  - Like the CNSC regulation, the ECCC guidelines require consideration and documentation of environmental, technical, and socio-economic elements that would be affected by a new mine waste facility.
- Saskatchewan Environment and Resource Management's (SERM) *Draft Construction Guidelines for Pollution Control Facilities at Uranium Mining and Milling Operations* (SERM 2000).
  - Potentially acid generating (PAG) waste rock piles should be lined with high-density polyethylene (HDPE).
- Global Tailings Review (GTR) *Global Industry Standard on Tailings Management* (GTR 2020).
  - Principle 3: "Use all elements of the knowledge base - social, environmental, local economic and technical - to inform decisions throughout the tailings facility lifecycle, including closure."

- Requirement 3.2 "For new tailings facilities, the Operator shall use the knowledge base and undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for tailings management. The goal of this analysis shall be to: (i) select an alternative that minimizes risks to people and the environment throughout the tailings facility lifecycle; and (ii) minimize the volume of tailings and water placed in external tailings facilities..."

2.2 Project Mine Waste Production Schedule

The mine process plant would be capable of producing up to 31 million lbs of triuranium octoxide (U_3O_8) per year over a mine life of 24 years (Golder 2019). Life of mine quantities for tailings, gypsum, and waste rock production used in the mine waste alternatives assessment are summarized in Table 2. For the tailings alternatives assessment, tailings were considered as a combination of neutralized leach residue, effluent treatment plant precipitates, and gypsum. For the gypsum alternatives assessment, quantities used for facility sizing were based on the amount of gypsum generated by the Project. For the waste rock alternatives assessment, waste rock quantities used for facility sizing are based on excavation of both the mine and the underground tailings management facility (UGTMF) chambers and access, assuming gypsum and tailings are placed in the UGTMF.

Table 2: Waste Material Quantities Used for the Mine Waste Alternatives Assessment

Waste Material	Mass (Mt)	Volume (Mm^3)	Dry Density (t/m^3)
Tailings			
Total (including gypsum)	17.7 (calculated)	13.7 (NexGen 2020a)	1.29 (calculated)
Stored in mine stopes	11.0 (calculated)	6.9 (NexGen 2020a)	1.58 (NexGen 2020a)
Stored in underground tailings management facility (UGTMF)	6.7 (calculated)	6.7 (NexGen 2020a)	1.00 (NexGen 2020a)
Gypsum			
Total	1.5 (NexGen 2020a)	1.7 (calculated)	0.87 underground (NexGen 2020b)
Waste Rock			
Total (Mine + UGTMF including gypsum in tailings)	25.4 (NexGen 2020b)	13.8 (calculated)	1.83 (NexGen 2020b)
Potentially acid generating	10.7 (NexGen 2020b)	5.8 (calculated)	
Non-potentially acid generating	14.6 (NexGen 2020b)	8.0 (calculated)	

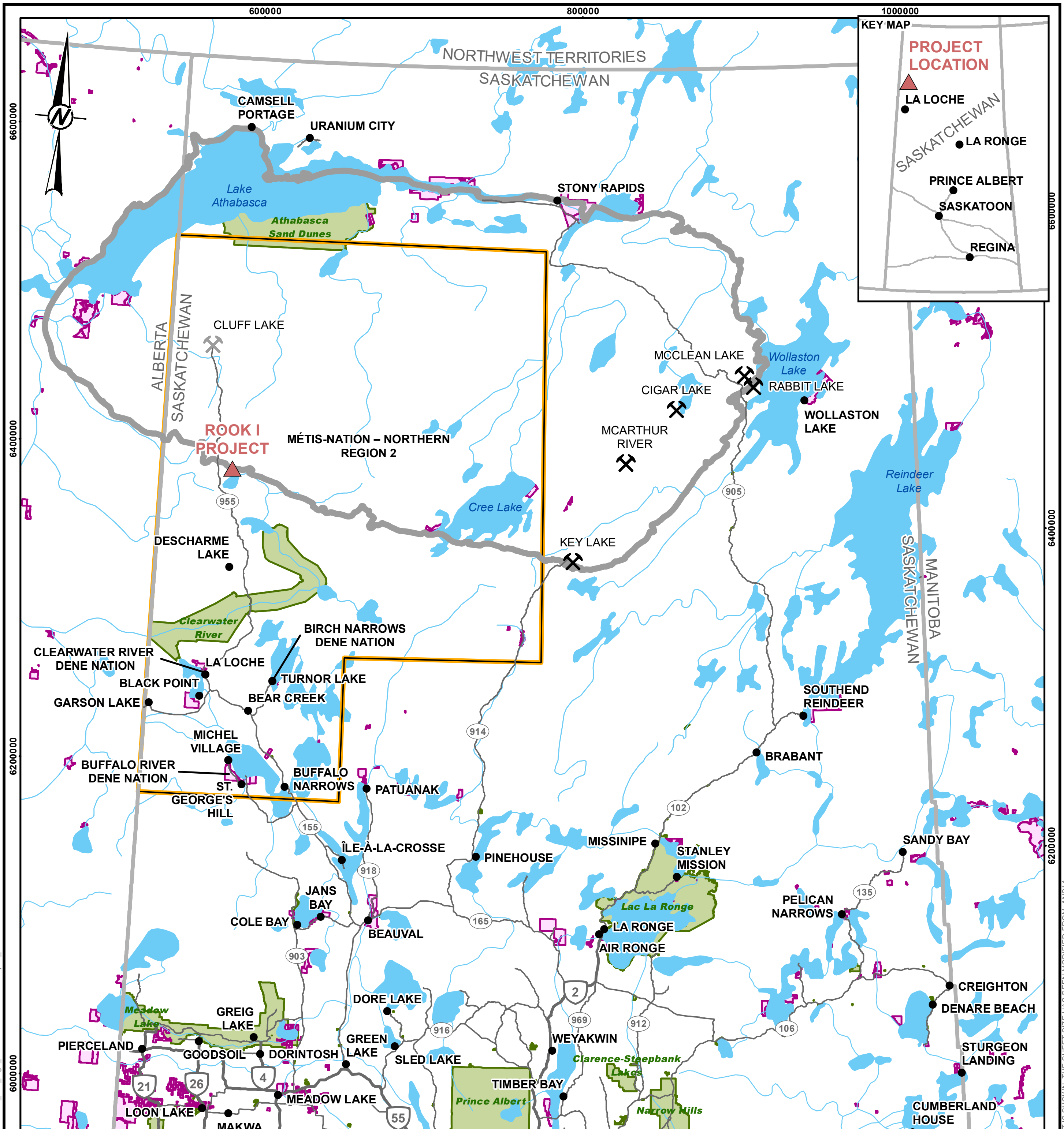
Note: Values may not sum due to rounding.
Mt = million tonnes; Mm^3 = million cubic metres.

2.3 Site Characteristics

Project site characteristics described in this subsection include location and topography, current land and resource use, planned infrastructure and battery limits, ecology, climate and hydrology, geology and geotechnical conditions, hydrogeology, and seismicity.

2.3.1 Location and Topography

The Project site is located in northern Saskatchewan, approximately 130 km north of the town of La Loche and 640 km northwest of Saskatoon (Figure 1). A conceptual Project surface lease boundary (hereafter referred to as “the proposed surface lease boundary”) on a peninsula within Patterson Lake and near Forrest Lake was assumed for the mine waste alternatives assessment. The site is accessible from an existing road off Highway 955 (Figure 2). Project site topography is dominated by eskers and drumlins with a maximum elevation of 583 metres above sea level (masl) and minimum elevation of 499 masl at Patterson Lake (Golder 2019). The site has been characterized by orthophotography and multispectral light detection and ranging (LiDAR) survey (Axiom 2019). The Project datum is UTM Zone 12N NAD83.



LEGEND

- POPULATED PLACE
- URANIUM MINING FACILITY (ACTIVE)
- URANIUM MINING FACILITY (DECOMMISSIONED)
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- ATHABASCA BASIN BOUNDARY
- INDIAN RESERVE
- PROVINCIAL PARKS
- WATERBODY
- PROJECT LOCATION
- MÉTIS NATION-SASKATCHEWAN NORTHERN REGION 2

0 100 200
1:3,500,000 KILOMETRES

REFERENCE(S)
1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. PARKS OBTAINED FROM IHS MARKIT CANADA ULC.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

PROJECT

NexGen Energy Ltd.

ROOK I PROJECT

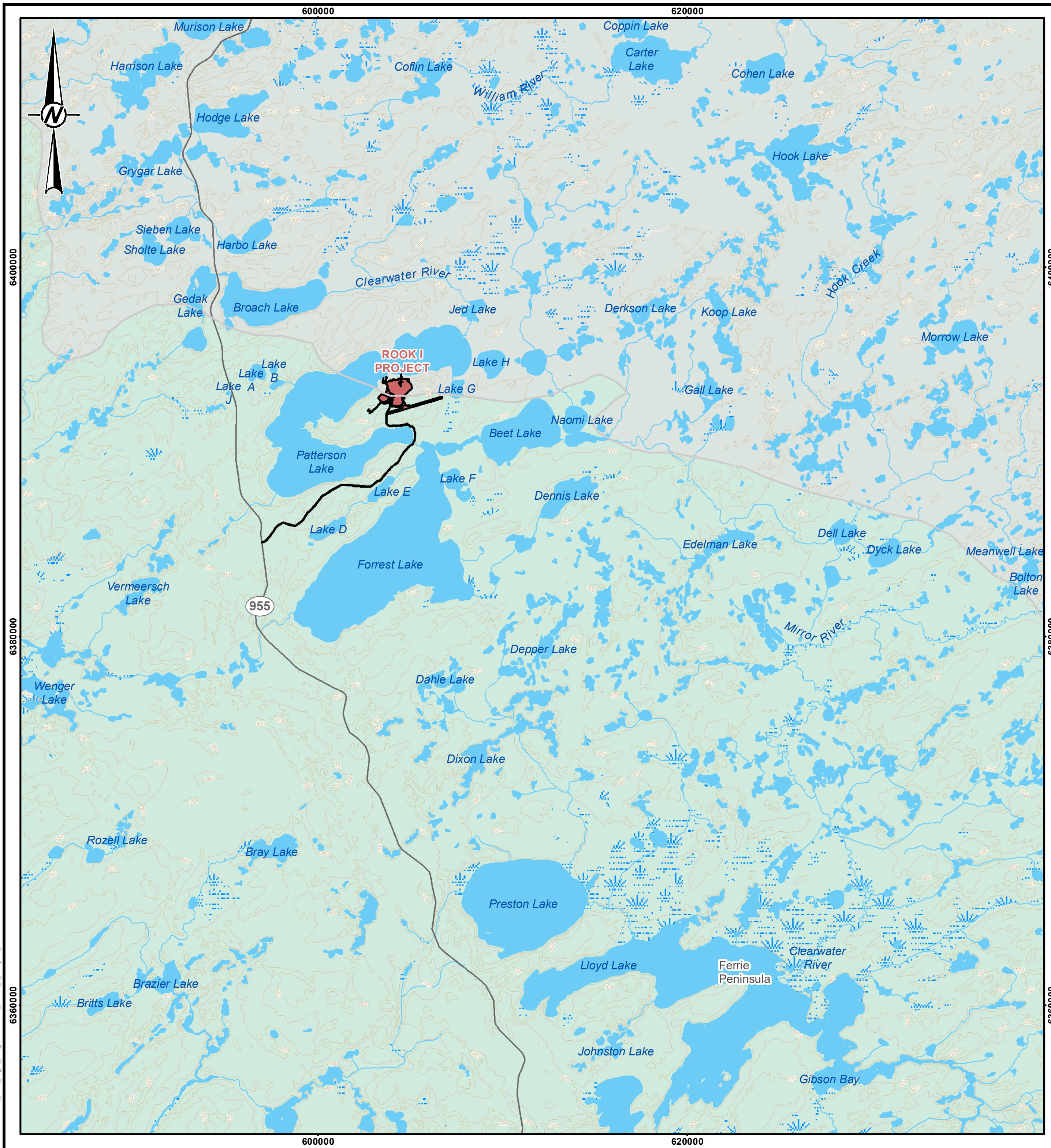
TITLE

LOCATION OF THE ROOK I PROJECT

CONSULTANT

GOLDER MEMBER OF WSP

PROJECT		20144150	PHASE	3314 - 6
DESIGN	JMC	2022-02-28	SCALE AS SHOWN	REV. 0
GIS	NO	2022-02-28	FIGURE 1	
CHECK	JMC	2022-02-28		
REVIEW	MM	2022-02-28		



LEGEND

- ELEVATION CONTOUR (20 m INTERVAL)
- SECONDARY HIGHWAY
- WATERCOURSE
- ATHABASCA BASIN
- WATERBODY
- WETLAND
- WOODED AREA
- PROPOSED PROJECT FOOTPRINT

0 5 10
1:300,000 KILOMETRES

REFERENCE(S)
1. PROJECT FEATURES OBTAINED FROM NEXGEN, APRIL 6, 2021.
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 12 DATUM: NAD 83

PROJECT

NexGen Energy Ltd.

ROOK I PROJECT

TITLE

REGIONAL AREA OF THE ROOK I PROJECT

CONSULTANT

GOLDER MEMBER OF WSP

PROJECT		20144150	PHASE 3314 - 6
DESIGN	JMC	2022-02-28	SCALE AS SHOWN REV. 0
GIS	NO	2022-02-28	
CHECK	JMC	2022-02-28	**FIGURE 2**
REVIEW	MM	2022-02-28	

2.3.2 Current Land and Resource Use

The Project would be located within Treaty 8 territory and may overlap with current land and resource use activities by Indigenous Peoples (Golder 2019), specifically:

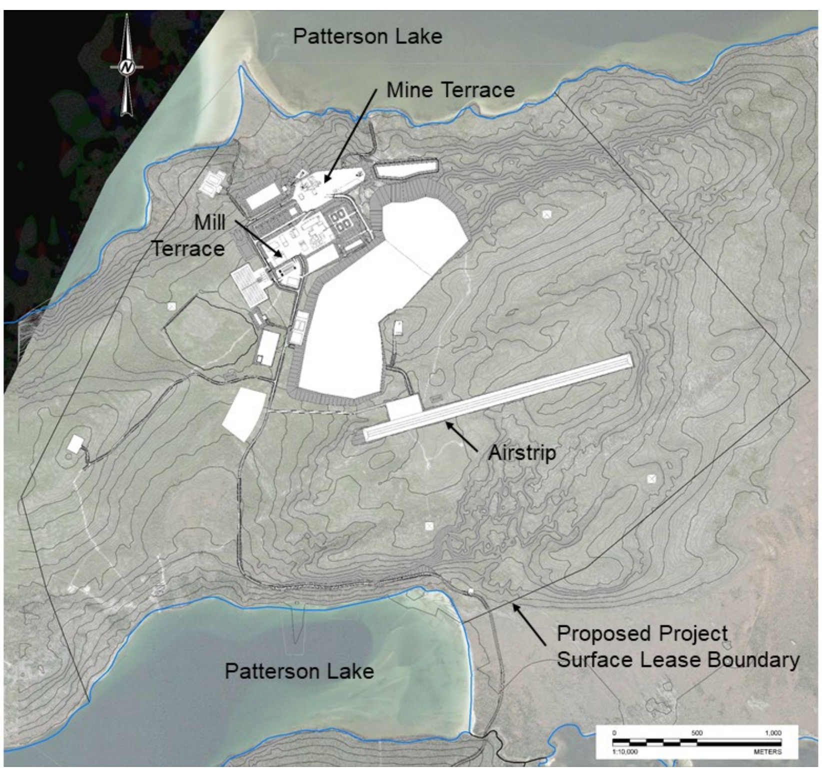
- Clearwater River Dene Nation – Signatory to Treaty 8;
- Métis Nation – Saskatchewan;
- Birch Narrows Dene Nation – Signatory to Treaty 10; and
- Buffalo River Dene Nation – Signatory to Treaty 10.

Hunting, fishing, trapping, and gathering activities may occur in the vicinity the Project. No known cultural heritage sites are located within the proposed Project surface lease boundary (CanNorth 2018). There are no known archaeological sites located in conflict with the Project (HCB 2021).

2.3.3 Planned Infrastructure and Battery Limits

The mine waste alternatives assessment considered an assumed layout for planned infrastructure shown in Figure 3 from NexGen (2020c). The proposed Project surface lease boundary, airstrip, ore deposit, mill terrace, mine terrace locations, and surrounding lakes were considered fixed for the assessment. Other infrastructure such as the mine camp, access and haul roads, and water management facilities were considered movable for the siting of mine waste alternatives.

Figure 3: Site Infrastructure Constraints and Proposed Project Surface Lease Boundary Used for Mine Waste Alternatives Assessment



2.3.4 Ecology

Wildlife species including moose, deer, black bear, wolf, and woodland caribou are known to be present in the area of the Project (Golder 2019). Some species of conservation concern were identified beyond the proposed Project surface lease boundary and are listed in the *Draft Terrestrial Environment Wildlife Baseline Inventory Report* (Omnia 2020).

2.3.5 Climate and Hydrology

The regional climate is sub-Arctic, typical of mid-latitude continental areas (Golder 2019), and is characterized by the following elements:

- Annual precipitation is approximately 0.45 m, where approximately 70% occurs as rain during summer and the remainder occurs as snow during winter.
- Temperatures range from over 30°C in the summer to colder than -40°C in winter. Winter mean temperatures are below 0°C.
- Lake freeze-up typically starts in October and break-up occurs in May.

The hydrologic setting includes the following key components:

- The Project is located within the Patterson Lake watershed, which is part of the larger Clearwater River watershed.
- The Clearwater River flows south and is part of the Mackenzie River watershed, designated as a Canadian Heritage River.

2.3.6 Geology

Geology in the area of the Project is described in Golder (2019) and summarized here.

- Arrow Deposit
  - Basement-hosted, vein-type uranium deposit.
  - Mineralization is defined by an area comprising several steeply dipping shears.
- Regional
  - The Project is located in southwestern Athabasca Basin, a Paleoproterozoic aged, intracontinental, redbed sedimentary basin covering a large area of northwestern Saskatchewan and a smaller area of northern Alberta.
  - The Athabasca Basin is oval shaped with approximate dimensions of 450 km by 200 km and reaches a maximum thickness of approximately 1,500 m near the centre. The dominant lithology of the basin is sandstone with local conglomeratic beds.
- The southwest portion of the Athabasca Basin is overlain by flat lying Phanerozoic stratigraphy of the Western Canada Sedimentary Basin, including carbonate-rich rocks of the Lower to Middle Devonian Elk Point Group, Lower Cretaceous Manville Group sandstones and mudstones, moderately lithified diamictites, and Quaternary unconsolidated sediments.

  - The Paleoproterozoic basement rocks of the Taltson Domain unconformably underly the Athabasca Basin and the Phanerozoic stratigraphy. The crystalline basement rocks comprise a spectrum of variably altered mafic to ultramafic, intermediate, and local alkaline rock types.
  - The Athabasca Basin and underlying rocks are host to the highest-grade uranium deposits in the world.
- Local
  - Surficial deposits are dominated by Quaternary glacial till of sand with gravels, cobbles, and boulders that ranges from 30 m to 100 m thick over Cretaceous mudstone.
  - The Arrow deposit is overlain by glacial overburden that is approximately 60 m thick as well as the Lower Cretaceous Manville Group and Lower to Middle Devonian Elk Point Group units (Regional Geology).
  - Cretaceous rocks are generally weak and most often geotechnically considered as soil.

2.3.7 Geotechnical Conditions

Geotechnical conditions in bedrock at depth are presented in NRMS (2021) and summarized here.

- Since 2016, four rock mass classification parameters have been collected at site: intact rock strength, rock quality designation, joint spacing, and joint condition data. These parameters are logged for every drill hole, in addition to specifically targeted bedrock geotechnical drill holes.
- Several interpreted basement shears and faults are concordant and acute to mineralization. Shear zones are closely related to controls on rock mass quality. There are eight primary shear zones between the hanging wall and footwall intrusives that are approximately concordant with mineralization. There are five interpreted tertiary shear zones that are approximately 45° to the primary shears.

Geotechnical conditions near surface are presented in BGC (2019) and summarized here.

- **Basal Till (Till 3):** fine sand to sandy till, some interbedded clay, dense to very dense. Deposited over Ablation Till and present only in the northeast corner of the mine development area.
- **Ablation Till:** poorly graded sand, compact to dense, with widespread distribution of cobbles and boulders. Over-thickening and coarse texture are the result of repeated pushing/reworking by glacial thrusting and meltwater. Unit thickness varies from <5 m to 25 m.
- **Basal Till (Till 2):** fine sand to sandy till, some interbedded clay, dense to very dense. Deposited during initial glacial thrusting advances. Covered by Ablation Till. Unit thickness varies from 5 m to 30 m.
- **Basal Till (Till 1):** sand and silt, dense to very dense. Covered by Ablation Till in uplands located south of the mine development area. Unit thickness varies from <5 m to 75 m.
- **Glaciolacustrine Sediments:** interbedding of sands, silts, and clays deposited by proglacial lakes. Buried by Till 2 in some areas of the Project and completely removed by glacial thrusting in some areas, such as the east side of the mine development area. Unit thickness varies from 2 m to 15 m.
- **Devonian La Loche Formation:** marine quartzose mudstone and weakly cemented silty and clayey sandstone. Unit thickness has not been confirmed.
- **Athabasca Group:** weakly cemented, poorly graded, fine to medium quartz rich sandstone and conglomerate with lesser dolomite and shale. Not present on the south-southeast side of the Arrow deposit but increases in thickness to the north-northwest.

2.3.8 Hydrogeology

Hydrogeology in the area of the Project is characterized in Golder (2019) by the following elements:

- Groundwater is controlled by low regional topography; regional flow gradients and direction in low-lying areas generally mimic lake elevations for gradient and flow direction, where flow is from higher elevation lakes to lower elevation lakes.
- Shallow groundwater flow is from the topographic high located south of the proposed mine terrace to the north towards Patterson Lake.
- Shallow groundwater flow occurs mainly in unconsolidated glacial tills.

Hydrogeology near surface is also presented in BGC (2019) and summarized here.

- Permeable nature of overburden material results in high infiltration and little surface flow.
- No stream courses are observed in the upper elevations of the terrain.
- Seeps and springs are observed in the lower portions of the slopes.
- Depth to groundwater varies across the Project site from 10 metres below ground surface (mbgs) to 25 mbgs in the mine terrace and 3 mbgs to 42 mbgs in the proposed stockpiles area.

2.3.9 Seismicity

The seismic site class and ground motions are characterized by the following elements (from BGC 2019):

- Site classification for seismic response per the National Building Code of Canada is Site Class D, representative of stiff soil.
- Peak ground acceleration = 0.041 g for a 2,475-year return period earthquake.
- The seismic hazard is low.

3 ASSESSMENT METHODOLOGY

Three alternatives assessments were completed by waste type in the order of priority for location: tailings storage location was determined first, then gypsum, and then waste rock. The assessment methodology is summarized in this section.

3.1 Method Summary

A common assessment methodology was followed for each mine waste type based on the CNSC (2018) regulation, ECCC (2016) guidelines, and GTR (2020) standard. The methodology is intended to provide a rational basis for assessment of alternatives for tailings, gypsum, and waste rock storage during Construction, Operations, and Closure. The assessment methodology generally included the following stages:

- pre-screening for general location;
- screening for specific locations and technologies; and
- multiple accounts analysis (MAA) on alternatives remaining after screening, where each alternative includes a location and technology.

The level of detail for each stage of the study is summarized in Table 3.

The MAA method included development of conceptual descriptions of each alternative followed by comparison of alternatives using a performance-based scoring system that included indicators in four primary accounts:

- Environmental;
- Technical;
- Economic; and
- Social.

Accounts were divided into sub-accounts that were further categorized by indicators. The indicators were quantitatively (preferred) or qualitatively scored. Indicators were selected that differentiated the alternatives and what were perceived to be important to Indigenous communities, the local public, and other stakeholders. The indicators were selected to be quantifiable, or measurable, where possible. Weighting was applied at the account, sub-account, and indicator levels to purposefully introduce bias reflecting perceived relative importance. Sensitivity analyses were completed by changing account level weightings to eliminate or change bias.

Table 3: Methodology Summary for the Mine Waste Alternatives Assessment

Assessment Stage	Level of Detail by Mine Waste Type		
	Tailings	Gypsum	Waste Rock
Pre-screening for General Location	▪ Descriptive comparison ▪ Relative evaluation for advantages/disadvantages		
Screening for Specific Location	▪ Descriptive comparison ▪ Relative evaluation for advantages/disadvantages		▪ Scoring and weighting by MAA method
Screening for Technology	▪ Descriptive comparison ▪ Relative evaluation for advantages/disadvantages	▪ Not applicable	
Multiple Accounts Analysis	▪ Scoring and weighting by MAA method		
Sensitivity Analysis	▪ Varying account weighting		

MAA = multiple accounts analysis.

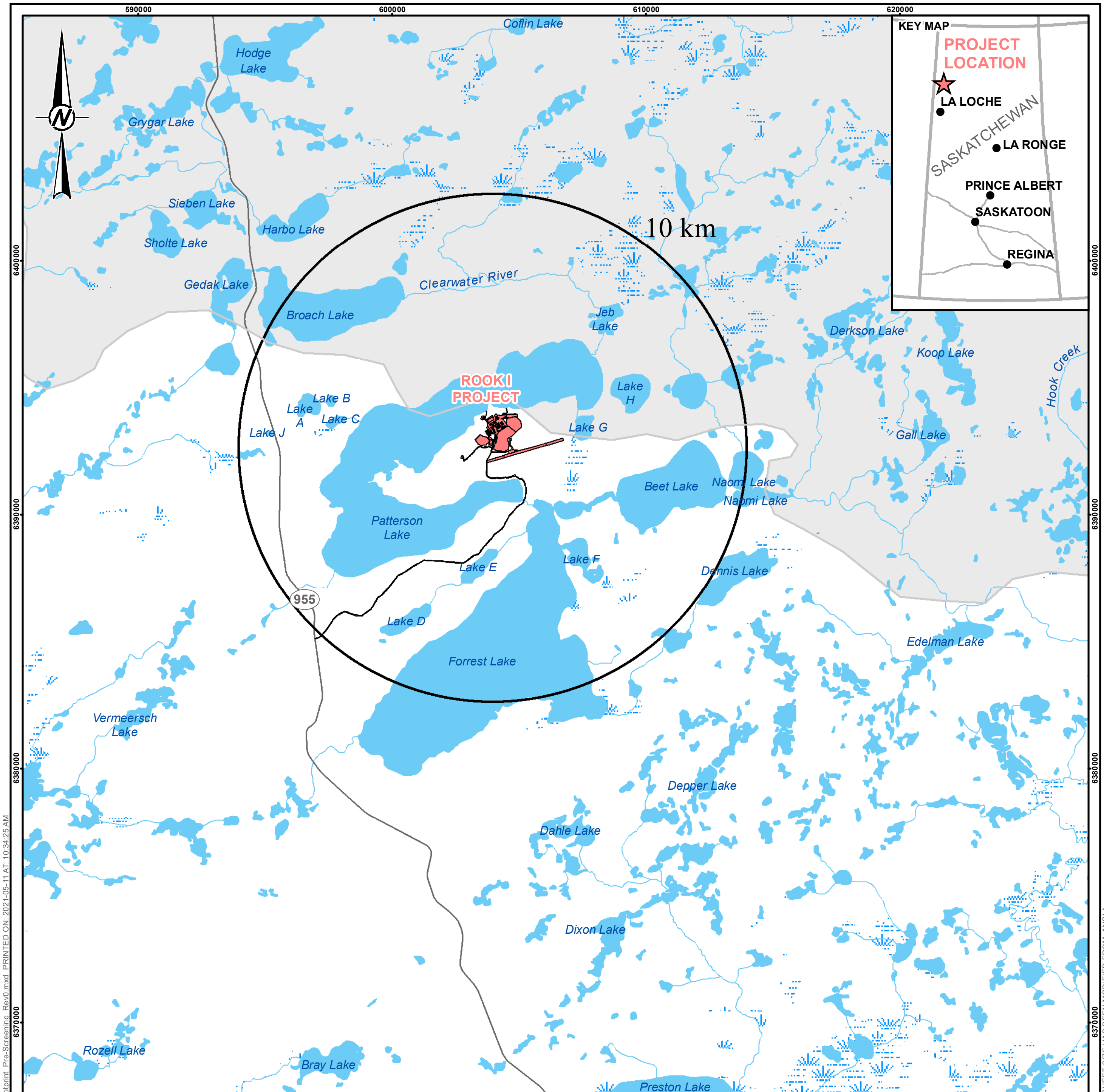
3.2 Pre-screening for General Location

Five general locations were pre-screened for tailings, gypsum, and waste rock storage: underground, in pit, surface, off site, and in lake. For the purpose of pre-screening, the closed Cluff Lake Mine site and sites within a 10 km radius from the Project were considered for off-site mine waste storage locations (Figure 4). Cluff Lake is a closed mine located approximately 80 km north of the Project (Golder 2019).

Relative advantages and disadvantages for each general location were evaluated by pre-screening against the following criteria:

- **Has required storage capacity:** A location was required to have capacity to store the quantity of mine waste to pass pre-screening.
- **No waste in lake (NexGen):** NexGen's criterion that no waste should be placed in lakes was adopted. This was supported by feedback received by NexGen during local public and Indigenous and community engagement.
- **Area of impact:** A location with the least area of impact was preferred.
- **Quantity of waste rock generated:** A location with the least quantity of waste rock generated was preferred.

General locations with relative advantages passed pre-screening, while locations with relative disadvantages or fatal flaws did not pass pre-screening.



LEGEND

- SECONDARY HIGHWAY
- WATERCOURSE
- WATERBODY
- WETLAND
- ATHABASCA BASIN
- PROPOSED PROJECT FOOTPRINT

0 5,000 10,000

1:225,000 METRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 12 DATUM: NAD 83

CLIENT

NexGen Energy Ltd.

PROJECT

ROOK I PROJECT

TITLE

PRE-SCREENING FOR GENERAL LOCATION MAP

CONSULTANT

GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-05-07
DESIGNED	HL
PREPARED	NO
REVIEWED	HL
APPROVED	BW

PROJECT NO.	PHASE	REV.	FIGURE
20144150		0	4

25mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PATH: I:\CLIENTS\NexGen\20144150\Mapping\Products\Geotechnical\20144150_Fig4_RookI-Proposed-Project-Footprint_Pre-Screening_Rev0.mxd PRINTED ON: 2021-05-11 AT: 10:34:25 AM

3.3 Screening for Specific Location

Specific locations for tailings and gypsum storage were described for the Construction, Operations, and Closure phases and screened by evaluation of relative advantages and disadvantages for indicators within four accounts: environmental, technical, economic, and social. Indicators were selected that were perceived to be important and that differentiated specific locations. Indicators are presented with the results of each assessment.

Specific locations for waste rock storage were modelled, described for Construction, Operations, and Closure phases, and then screened by MAA methods described in Section 3.5.

3.4 Screening for Technology

Technologies for tailings storage were described for the Construction, Operations, and Closure phases and then screened by evaluation of relative advantages and disadvantages for indicators within four accounts: environmental, technical, economic, and social. Indicators were selected that were perceived to be important and that differentiated the technologies. Indicators are presented with the results of the assessment.

Gypsum was not screened for technology and was considered as a solid form for storage on surface, and as part of the cemented paste tailings (CPT) for storage underground.

Waste rock was not screened for technology. Waste rock technologies were evaluated by MAA.

3.5 Multiple Accounts Analysis

Alternatives were assessed using an MAA approach following ECCC (2016) guidelines. A general methodology is described in this subsection and includes description of alternatives, sub-account and indicator selection, scoring and weighting, evaluation and ranking, and sensitivity analysis. Any modifications to the methodology are described with the results of each study.

- Description of Alternatives
  - Alternatives were described for Construction, Operations, and Closure phases.
  - Descriptions were developed to a conceptual level to allow identification and selection of sub-accounts and indicators.
- Sub-account and Indicator Selection
  - Four accounts (environmental, technical, economic, and social) were divided into sub-accounts that were generally common across assessments. A list of accounts, sub-accounts, and indicators used for the assessments is included as Appendix A, Accounts Ledger, Table A-1.
  - Indicators were selected for each sub-account that:
    - Differentiated alternatives.
    - Were perceived to be important to the Indigenous communities, local public, and other stakeholders.
    - Were quantifiable, or measurable, where possible.
- Scoring and Weighting
  - Scoring scales were developed for each indicator with values ranging from 1 to 6 following ECCC (2016) guidelines. When scoring alternatives, a value of 1 was always assigned to indicate the least favourable

alternative while a value of 6 was always assigned to indicate the most favourable alternative. The approach has an intended effect of magnifying the differences between alternatives.

- Indicators were scored based on quantitative assessment where possible (preferred method) or by qualitative assessment. Quantitative, measurable indicators were then normalized on a scale of 1 to 6, such that the best alternative scored 6, the lowest scored 1, and the remaining alternatives scores were calculated in proportion to the measured indicator value. Qualitative indicators were also scored on a scale of 1 to 6, such that the best alternative scored 6, the lowest scored 1, and the remaining normalized scores were assigned using scales defined for the specific indicator. Scoring scales and normalized indicator values for each indicator are provided with the results.
- For some quantitative indicators, a higher score indicates a preferred alternative, and for others a lower score indicates a preferred indicator. Normalized scores (of 1 to 6) were scaled such that the preferred option received a higher score.
- Economic indicators were scored based on quantitative indicators, such as volume of material excavated, rather than dollar values. Cost estimates were not developed for the mine waste alternatives assessment.
- Weighting was applied to purposefully introduce bias to each indicator, sub-account, and account to reflect perceived importance to Indigenous communities, local public, and other stakeholders.
- Indicators were weighted based on perceived importance relative to other indicators within a sub-account; similarly, sub-accounts were weighted based on perceived importance relative to other sub-accounts within an account. Base case account weighting followed ECCC (2016) guidance.
- Steps used in scoring are described at the end of this section.

- Evaluation and Ranking
  - Alternatives were evaluated by scoring and weighting of indicators and sub-accounts within the four accounts: environmental, technical, economic, and social.
  - Alternatives were then ranked, with the highest overall weighted score ranked 1, the next highest score ranked 2, and so on.
- Sensitivity Analysis
  - Sensitivity analyses were completed by varying account weighting to evaluate the effect of bias introduced by weighting. Account weighting schemes used in the sensitivity analyses are summarized in Table 4.

Table 4: Account Weighting Schemes Used in Sensitivity Analyses

Account	Account Weighting Scheme							
	ECCC (2016) Base Case		NexGen		Equal		ECCC (2016) Economic = 0	
	Value	Percent	Value	Percent	Value	Percent	Value	Percent
Environmental	6	44.4%	4.1	30%	3.4	25%	6	50%
Technical	3	22.2%	2.0	15%	3.4	25%	3	25%
Economic	1.5	11.1%	3.4	25%	3.4	25%	0	0%
Social	3	22.2%	4.1	30%	3.4	25%	3	25%
Total	**13.5**	**100%**	**13.5**	**100%**	**13.5**	**100%**	**12**	**100%**

Note: Values may not sum due to rounding.

Steps used to calculate the overall weighted score for each alternative follow ECCC (2016) and included:

1) Normalized indicator scores were multiplied by indicator weightings to calculate the indicator merit scores.
2) Indicator merit scores were summed for each sub-account to calculate total indicator merit score.
3) Total indicator merit scores were divided by the sum of indicator weightings to calculate sub-account merit ratings.
4) Sub-account merit ratings were multiplied by sub-account weightings to calculate sub-account merit scores.
5) Sub-account merit scores were summed to calculate total sub-account merit scores.
6) Total sub-account merit scores were divided by the sum of sub-account weightings to calculate account merit ratings.
7) Account merit ratings were multiplied by account weightings to calculate account merit scores.
8) Account merit scores were summed to calculate total account merit scores.
9) Total account merit scores were divided by the sum of account weightings to calculate alternative merit ratings.

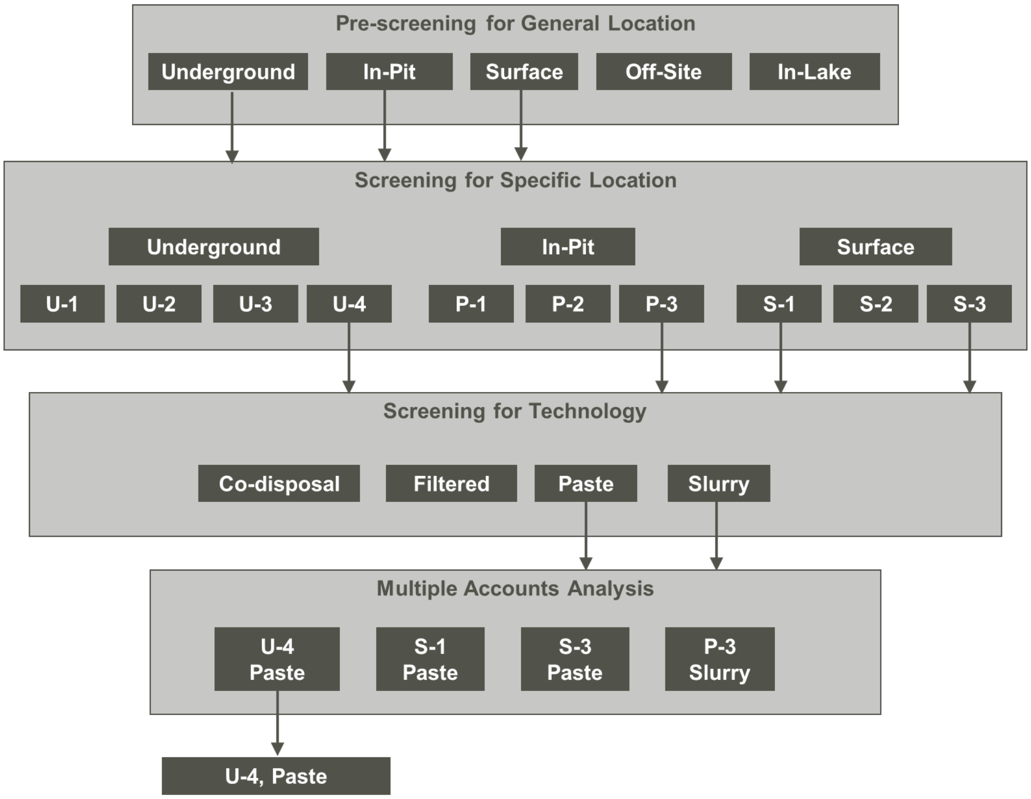
For the waste rock screening for specific location, alternative merit ratings were used to rank locations, where the highest alternative merit rating indicated the best available location and passed screening (i.e., the highest scoring location ranked first and indicated the best location for the storage of waste rock).

For the tailings, gypsum, and waste rock MAA, alternative merit ratings were used to rank alternatives, where the highest alternative merit rating indicated the best available alternatives (i.e., highest score ranked first and indicated best location and technology for the storage of tailings, gypsum, or waste rock).

4 TAILINGS ALTERNATIVES ASSESSMENT

An alternatives assessment was completed to identify the best location and technology for storage of tailings. Methods and outcomes for the tailings alternatives assessment are summarized in Figure 5 and described in this section.

Figure 5: Tailings Alternatives Assessment Methods and Outcomes



4.1 Pre-screening for General Location for Tailings Storage

Pre-screening for the general location for tailings storage was completed using the method described in Section 3.2. Five general locations were pre-screened and are described for Construction, Operations, and Closure phases in Table 5.

Table 5: General Locations for Tailings Considered for Pre-screening

Assessment Lifespan Phase	General Location				
	Underground	In-Pit	Surface	Off-Site	In-Lake
Construction	▪ Excavation of underground chambers (drill, blast, load) ▪ Haulage of excavated rock for placement in WRSA ▪ Construction of tailings distribution and water management systems	▪ Excavation of large pit (drill, blast, load) ▪ Haulage of overburden and rock for placement in WRSA ▪ Construction of tailings distribution and water management systems	▪ Construction of containment structure ▪ Placement of liner ▪ Construction of tailings distribution and water management systems	▪ Construction of transport and haulage infrastructure ▪ Potential construction of containment structure or increase capacity of existing structure ▪ Construction of tailings distribution and water management systems	▪ Construction of tailings distribution system to lake, construct access

Table 5: General Locations for Tailings Considered for Pre-screening

Assessment Lifespan Phase	General Location				
	Underground	In-Pit	Surface	Off-Site	In-Lake
Operations	▪ Tailings deposition in underground chambers ▪ Excavation of underground chambers (drill, blast, load) ▪ Haulage of excavated rock for placement in WRSA ▪ Water management	▪ Tailings deposition in pit ▪ Water management	▪ Tailings deposition in containment structure ▪ Raising of containment structure ▪ Water management	▪ Transport tailings to off-site location ▪ Tailings deposition in off-site containment structure ▪ Water management	▪ Tailings deposition in lake
Closure	▪ Progressive decommissioning of filled underground chambers can occur in Operations	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Draining of pond ▪ Placement of closure cover system	▪ Decommissioning facility and infrastructure (utilities, access) ▪ Draining of pond ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (transport, haulage, utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (utilities, access)

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area

The results from pre-screening for general tailings storage location are presented in Appendix B Tailings Alternative Assessment, Table B-1 and summarized in this subsection.

Two general locations did not pass pre-screening:

- **Off-site:** eliminated due to increase in overall surface disturbance area outside of the proposed Project surface lease boundary. There are no nearby facilities that could be used for tailings storage other than Cluff Lake, a closed mine with a decommissioned tailings management facility (TMF) that has no capacity for additional tailings. Transport to and placement of tailings at the closed Cluff Lake facility off site would increase the potential for environmental contamination and liability associated with a closed site that is not owned by NexGen.
- **In-lake:** eliminated based on NexGen's criterion to not place waste in lakes.

Three general locations passed pre-screening and are described in the next section:

- Underground;
- In-pit; and
- Surface.

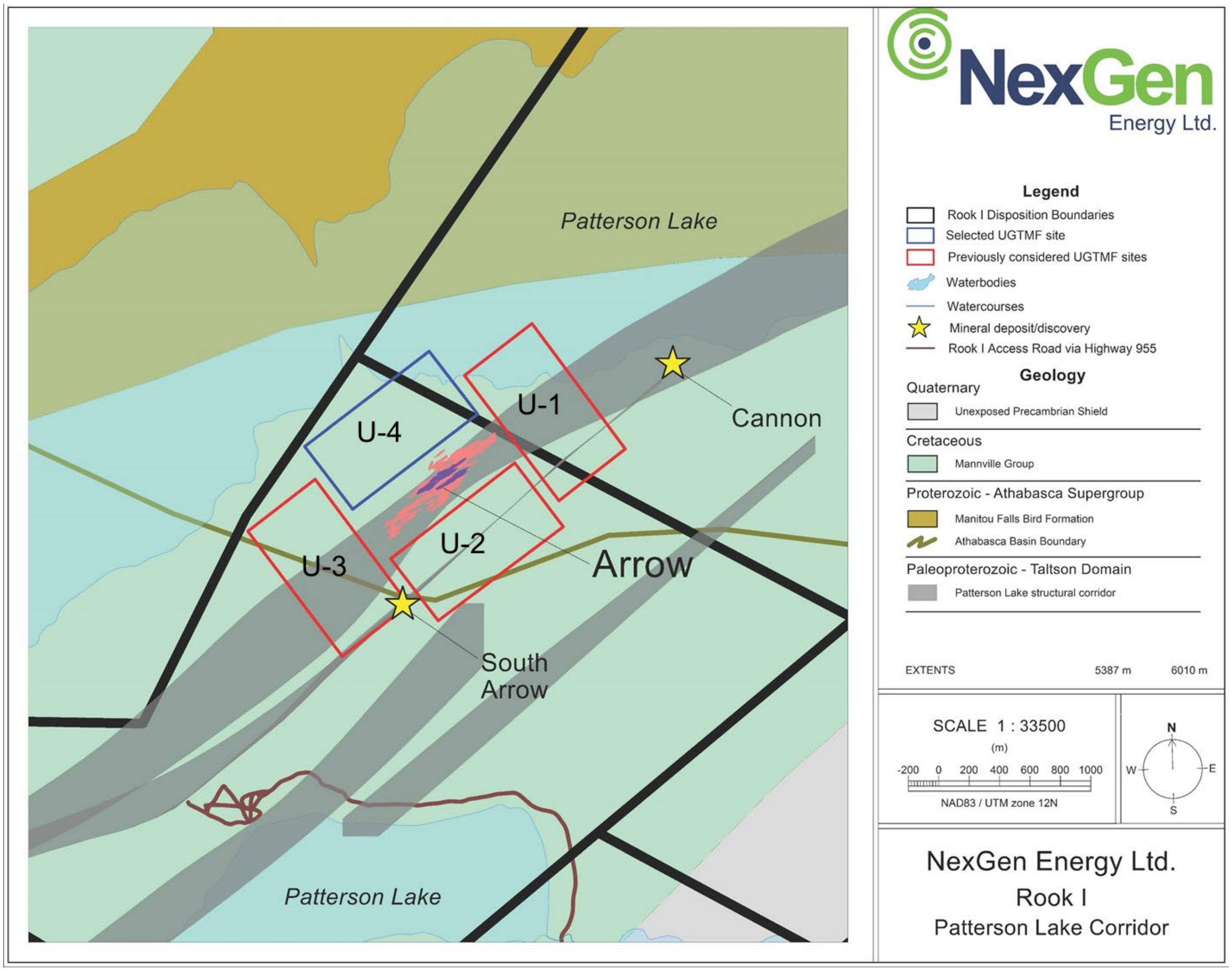
4.2 Surface Screening for Specific Location for Tailings Storage

Screening for a specific location for tailings storage was completed using the method described in Section 3.3. Ten specific locations were screened: four underground, three in pit, and three on surface. Underground locations were provided by NexGen (2020d). In-pit locations and surface locations for tailings were selected considering fixed infrastructure defined in Section 2.3.3.

4.2.1 Underground

The four specific underground locations (U-1, U-2, U-2, and U-4) considered for screening are illustrated in Figure 6 (NexGen 2020d) and described for Construction, Operations, and Closure phases in Table 6.

Figure 6: Specific Underground Locations for Tailings Storage Considered for Screening



Source: NexGen 2020d.

Table 6: Specific Locations for Underground Storage of Tailings Considered for Screening

<table>
<tr><th rowspan="2">Assessment Lifespan Phase</th><th colspan="4">Underground Location</th></tr>
<tr><th>U-1</th><th>U-2</th><th>U-3</th><th>U-4</th></tr>
<tr><td rowspan="2">Construction</td><td colspan="4">▪ Incremental excavation of underground chambers (drill, blast)
▪ Incremental removal of excavated rock and haulage to surface, placement at surface</td></tr>
<tr><td>▪ Northeast of mine development
▪ Within Patterson Lake structural corridor and adjacent to Cannon mineralization</td><td>▪ Southeast of mine development
▪ Adjacent to South Arrow mineralization</td><td>▪ Southwest of mine development
▪ Within Patterson Lake structural corridor and adjacent to South Arrow mineralization</td><td>▪ Northwest of mine development</td></tr>
<tr><td>Operations</td><td colspan="4">▪ Tailings deposition in underground chambers
▪ Incremental excavation of underground chambers (drill, blast)
▪ Incremental removal of excavated rock and haulage to surface, placement at surface
▪ Water management</td></tr>
<tr><td>Closure</td><td colspan="4">▪ Progressive decommissioning of filled underground chambers
▪ Final facility and infrastructure decommissioning (utilities, access)</td></tr>
</table>

Note: Monitoring is assumed to be common and is not listed.

The results from screening for specific location for underground tailings storage are presented in Appendix B, Table B-2 and summarized in this subsection.

Three specific underground locations did not pass screening based on relative disadvantages for indicators within the technical account:

- **U-1:** located adjacent to the Cannon mineral discovery, within the Patterson Lake structural corridor characterized by fault and shear zones and along the Athabasca Basin Boundary (NexGen 2020a) with potential for uranium mineralization.
- **U-2:** located adjacent to the South Arrow mineral discovery (NexGen 2020a) and along the Athabasca Basin Boundary with potential for uranium mineralization.
- **U-3:** located adjacent to the South Arrow mineral discovery and within the Patterson Lake structural corridor characterized by fault and shear zones (NexGen 2020d) with potential for uranium mineralization.

One specific underground location passed screening based on a relative advantage for indicators within the technical account:

- **U-4:** located outside known major geologic structures and potential areas of mineralization.

4.2.2 In-Pit

Three specific locations (P-1, P-2, and P-3) for in-pit storage of tailings were considered for screening and are illustrated in Figure 7 and described in Table 7.

Figure 7: Specific Locations for In-Pit Storage of Tailings Considered for Screening

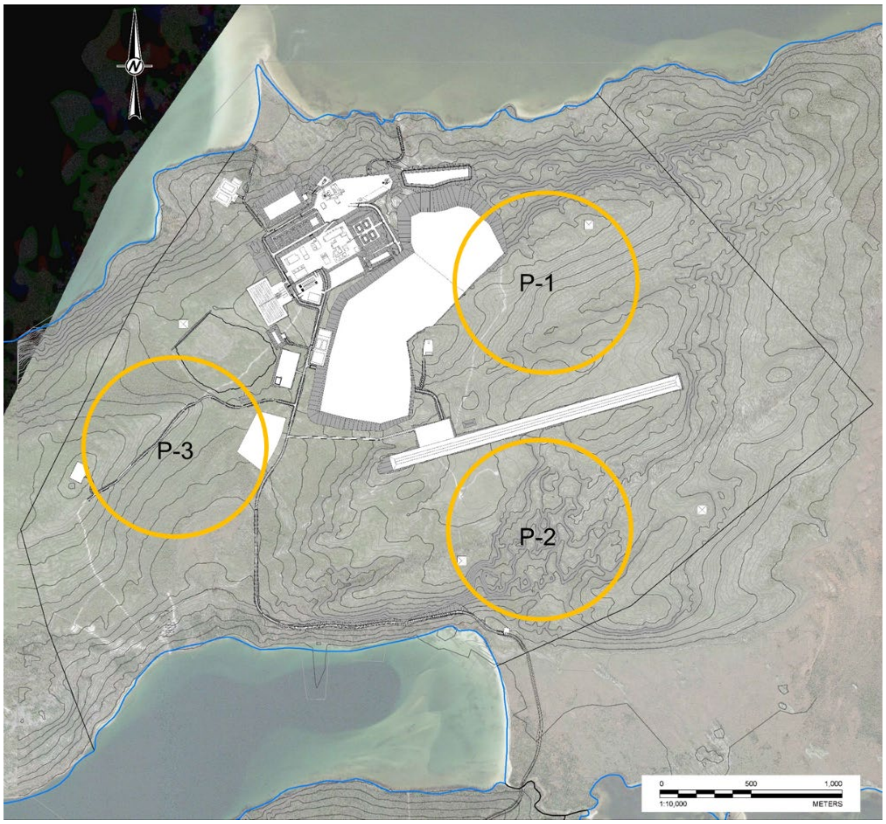


Table 7: Specific Locations for In-Pit Tailings Storage Considered for Screening

<table>
<tr><th rowspan="2">Assessment Lifespan Phase</th><th colspan="3">In-Pit Locations</th></tr>
<tr><th>P-1</th><th>P-2</th><th>P-3</th></tr>
<tr><td rowspan="2">Construction</td><td colspan="3">▪ Excavation of pit (drill, blast)
▪ Removal of excavated overburden and rock, haulage, and placement at surface</td></tr>
<tr><td>▪ East of mine development</td><td>▪ South of airstrip
▪ Within Patterson Lake structural corridor</td><td>▪ Southwest of mine development
▪ Within Patterson Lake structural corridor</td></tr>
<tr><td>Operations</td><td colspan="3">▪ Tailings deposition in pit
▪ Water management</td></tr>
<tr><td>Closure</td><td colspan="3">▪ Decommissioning of facility and infrastructure (utilities, access)
▪ Placement of closure cover system</td></tr>
</table>

Note: Monitoring is assumed to be common and is not listed.

The results from screening for specific location for in-pit tailings storage are presented in Appendix B, Table B-2 and summarized in this subsection.

Two specific locations for in-pit storage did not pass screening based on relative disadvantages for indicators within the environmental, technical, economic, and social accounts:

- **P-1:** located within a valley where surface water controls would be required to manage runoff from the surrounding area and where additional excavation into the surrounding area would be required for expansion (higher excavation quantity relative to other locations).
- **P-2:** located within the Patterson Lake structural corridor, nearest to Patterson Lake, and the most visible location due to a natural topographic plateau. This location had the greatest area of impact and cost, and highest risk to worker safety and human health due to longest haul and tailings transport distance from the mine terrace.

One specific location for in-pit storage passed screening based on indicator descriptions and relative evaluation:

- **P-3:** located within a relatively flat topographic area that does not restrict storage capacity or facility expansion. This location has a median haul and transport distance from the mine terrace.

4.2.3 Surface

Three specific locations (S-1, S-2, and S-3) for surface storage of tailings were considered for screening and are illustrated in Figure 8 and described for Construction, Operations, and Closure phases in Table 8.

Figure 8: Specific Locations for Surface Storage of Tailings Considered for Screening

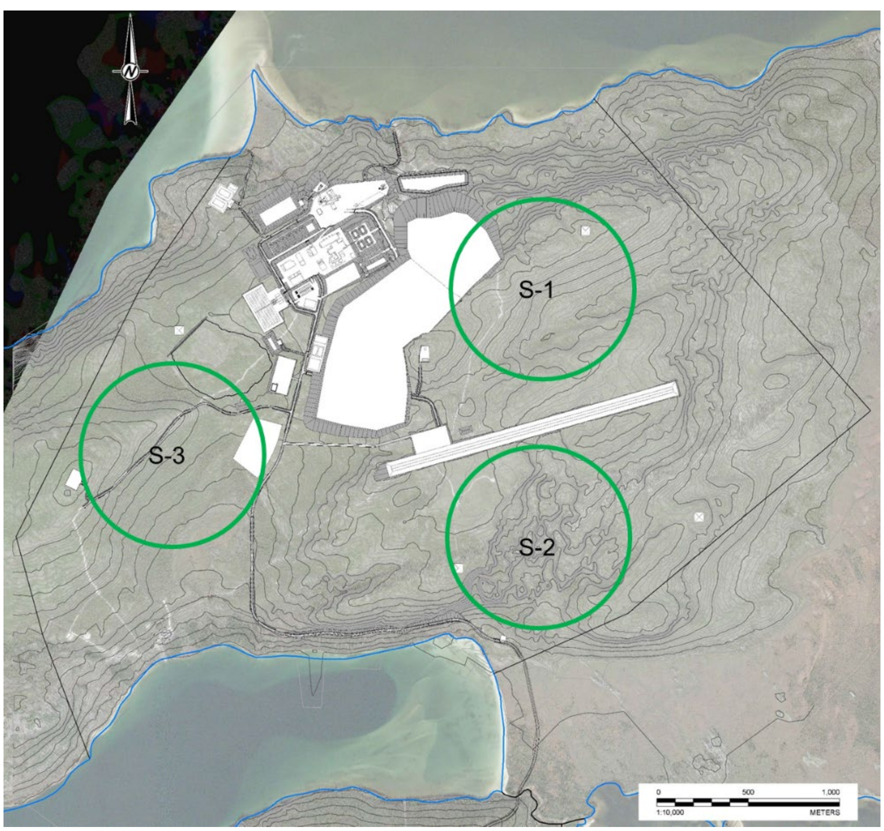


Table 8: Specific Locations for Surface Storage of Tailings Considered for Screening

Assessment Lifespan Phase	Surface Location		
	S-1	S-2	S-3
Construction	▪ Containment structure and water management works ▪ Placement of liner		
Operations	▪ Tailings deposition in containment structure ▪ Water management		
Closure	▪ Decommissioning of facility and infrastructure decommission (utilities, access) ▪ Placement of closure cover system ▪ Water management		

Note: Monitoring is assumed to be common and is not listed.

The results from screening for specific location for surface storage of tailings are presented in Appendix B, Table B-2 and summarized in this subsection.

One specific surface location did not pass screening based on indicator descriptions and relative evaluation within the environmental, technical, economic, and social accounts:

- **S-2:** located within the Patterson Lake structural corridor characterized by fault and shear zones that may host uranium (NexGen 2020d), nearest to Patterson Lake, with most visible location and least natural containment due to topographic plateau. Greatest area and cost, and highest risk due to longest haul and tailings transport distance from the mine terrace.

Two specific surface locations passed screening based on indicator descriptions:

- **S-1:** located within a topographic valley with the greatest potential for natural containment. Least area, with concentration of facilities near the mine terrace. Potential cost and operating efficiency due to use of planned access infrastructure with shortest haul and transport from mine terrace.
- **S-3:** located within a relatively flat topographic area that does not restrict storage capacity. Some increase in area, with concentration of facilities near the mill terrace. Some cost and operating efficiency due to use of planned infrastructure, though farther from the mill terrace than S-1.

4.3 Screening for Tailings Technology

Screening for technology was completed using the method described in Section 3.4. Four technologies were screened: co-disposal with waste rock (co-disposal), dewatering by filtering (filtered), dewatering in a thickener to paste consistency (paste), and deposition as slurry (slurry). Each technology was considered at each of four locations that passed screening: underground location U-4, in-pit location P-3, and surface locations S-1 and S-3.

4.3.1 Underground

Four technologies were screened at underground location U-4 and are described during the Construction, Operations, and Closure phases in Table 9.

Table 9: Tailings Technologies Considered for Screening at Underground Location U-4

<table>
<tr><th rowspan="2">Assessment Lifespan Phase</th><th colspan="4">Technology</th></tr>
<tr><th>Co-disposal</th><th>Filtered</th><th>Paste</th><th>Slurry</th></tr>
<tr><td rowspan="2">Construction</td><td colspan="4">▪ Incremental excavation of underground chambers (drill, blast)
▪ Incremental hauling and storing of excavated rock on surface</td></tr>
<tr><td>▪ Paste plant
▪ Mixing plant</td><td>▪ Thickener + filter plant</td><td>▪ Paste plant</td><td>▪ Additional tailings/water management system</td></tr>
<tr><td rowspan="2">Operations</td><td colspan="4">▪ Incremental excavation of underground chambers (drill, blast, load, haul)</td></tr>
<tr><td>▪ Tailings thickened to 50%–70% solids
▪ Tailings and waste rock are mixed and placed underground</td><td>▪ Tailings thickened and filtered to >70% solids and placed underground
▪ Excavated waste rock hauled to surface for placement in WRSA</td><td>▪ Tailings thickened to 50%–70% solids (flowable), binder added and placed underground
▪ Excavated waste rock hauled to surface for placement in WRSA</td><td>▪ Tailings dewatered to 30%–50% solids (flowable) and placed underground
▪ Decant of transport water
▪ Excavated waste rock hauled to surface for placement in WRSA</td></tr>
<tr><td>Closure</td><td colspan="4">▪ Progressive decommissioning of filled underground chambers
▪ Final facility and infrastructure decommissioning</td></tr>
</table>

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area.

The results from screening for tailings storage underground technology are presented in Appendix B, Table B-3 and summarized in this subsection.

Three tailings technologies did not pass screening:

- **Co-disposal:** fatally flawed due to volume incompatibility. The excavation of underground chambers to store tailings and waste rock would generate more excavated rock than can be stored underground.
- **Filtered:** fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport, placement, and compaction. Unconsolidated filtered tailings have a higher hydraulic conductivity and can swell once saturated, potentially affecting geochemical stability.
- **Slurry:** there is limited precedent application of placement of slurry tailings underground. Tailings consolidation and consistency are uncontrolled and would require construction of a cap or plug to keep tailings in place after facility decommissioning. There is a higher potential for ecological effect due to the permeability of the tailings and open voids that may form during consolidation.

One tailings technology passed screening based on indicator descriptions and relative evaluation:

Paste: there is a proven precedent for application of paste technology in underground tailings deposition. Cementing the tailings in chambers reduces the potential for effect on the environment.

4.3.2 In-Pit

The four technologies were screened at in-pit location P-3 and are described for Construction, Operations, and Closure phases in Table 10.

Table 10: Tailings Technologies Considered for Screening at In-Pit Location P-3

Assessment Lifespan Phase	Technology			
	Co-disposal	Filtered	Paste	Slurry
Construction	▪ Excavation of pit on surface (drill, blast) ▪ Removal of excavated overburden and rock			
	▪ Paste plant ▪ Mixing plant	▪ Thickener + filter plant	▪ Paste plant	▪ Additional tailings/water management system
Operations	▪ Tailings thickened to 50%–70% solids (flowable) ▪ Tailings, waste rock, and overburden mixed and placed in pit	▪ Tailings thickened and filtered to >70% solids, placed in pit and compacted ▪ Removal of excavated overburden and rock and haulage for placement at surface	▪ Tailings thickened to 50%–70% solids (flowable) and placed in pit ▪ Removal of excavated overburden and rock and haulage for placement at surface	▪ Tailings dewatered to 30%–50% solids (flowable); subaqueous tailings deposition in pit ▪ Removal of excavated overburden and rock and haulage for placement at surface
Closure	▪ Decommissioning of facility and infrastructure (utilities, access)			

Note: Filters and monitoring are assumed to be common and are not listed.

The results from screening for tailings storage in-pit technology are presented in Appendix B, Table B-4 and summarized in this subsection.

Three technologies were eliminated based on indicator descriptions and relative evaluation:

- **Co-disposal:** fatally flawed due to volume incompatibility. Excavation of a pit to store tailings and waste rock generates more excavated overburden and rock than can be stored in the pit.
- **Filtered:** fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport, placement, and compaction.
- **Paste:** higher potential for fugitive dust emission and worker exposure to gamma radiation through contact with the tailings and absence of a supernatant pond. Highest cost for construction, operation, and decommissioning of paste plant. Facility closure may be complicated by the presence of ice lenses that may form during tailings deposition.

One technology passed screening based on indicator descriptions and relative evaluation:

Slurry: there is a proven precedent for application of tailings as slurry for storage in pit at other uranium mines. The presence of a supernatant pond reduces the potential for fugitive dust emission and worker exposure to gamma radiation and mitigates the formation of ice lenses within the tailings.

4.3.3 Surface

The four technologies were screened for surface locations S-1 and S-3 and are described for Construction, Operations, and Closure phases in Table 11.

Table 11: Tailings Technologies Considered for Screening at Surface Locations S-1 and S-3

Assessment Lifespan Phase	Technology			
	Co-disposal	Filtered	Paste	Slurry
Construction	▪ Foundation preparation and placement of liner			
	▪ Paste plant ▪ Mixing plant	▪ Filter plant	▪ Paste plant ▪ Containment structure with progressive raises	▪ Containment structure with progressive raises ▪ Additional tailings/water management system
Operations	▪ Tailings thickened to 50%–70% solids ▪ Tailings and waste rock mixed and placed on surface	▪ Tailings thickened and filtered to >70% solids and placed on surface in stacked facility and compacted	▪ Tailings thickened to 50%–70% solids (flowable) and placed in containment structure ▪ Water management	▪ Tailings dewatered to 30%–50% solids (flowable); subaqueous tailings deposition in containment structure ▪ Tailings transport water management
Closure	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system			

Note: Monitoring is assumed to be common and is not listed.

The results from screening for tailings storage surface technology are presented in Appendix B, Table B-5 and summarized in this subsection.

Three technologies did not pass screening based on indicator descriptions and relative evaluation:

- **Co-disposal:** fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.
- **Filtered:** fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport, placement, and compaction.
- **Slurry:** greatest water content and potential for seepage, highest cost for water management. Has a supernatant pond and does not meet GTR (2020) requirement 3.2.(ii) “minimize the volume of tailings and water placed in external tailings facilities.”

One technology passed screening based on indicator descriptions and relative evaluation:

Paste: lower potential for seepage and cost for water management. Complies with GTR (2020) by reducing the volume of water placed in a surface TMF.

4.4 Multiple Accounts Analysis

An MAA for tailings storage alternatives was completed using the method described in Section 3.5. A description of alternatives, the results of the MAA, and the sensitivity analysis are summarized in this subsection.

4.4.1 Description of Alternatives

Conceptual models were developed for the four TMF alternatives that passed screening to obtain measurable indicators for scoring. The four alternatives are described for Construction, Operations, and Closure phases in Table 12, with key quantities and measurements.

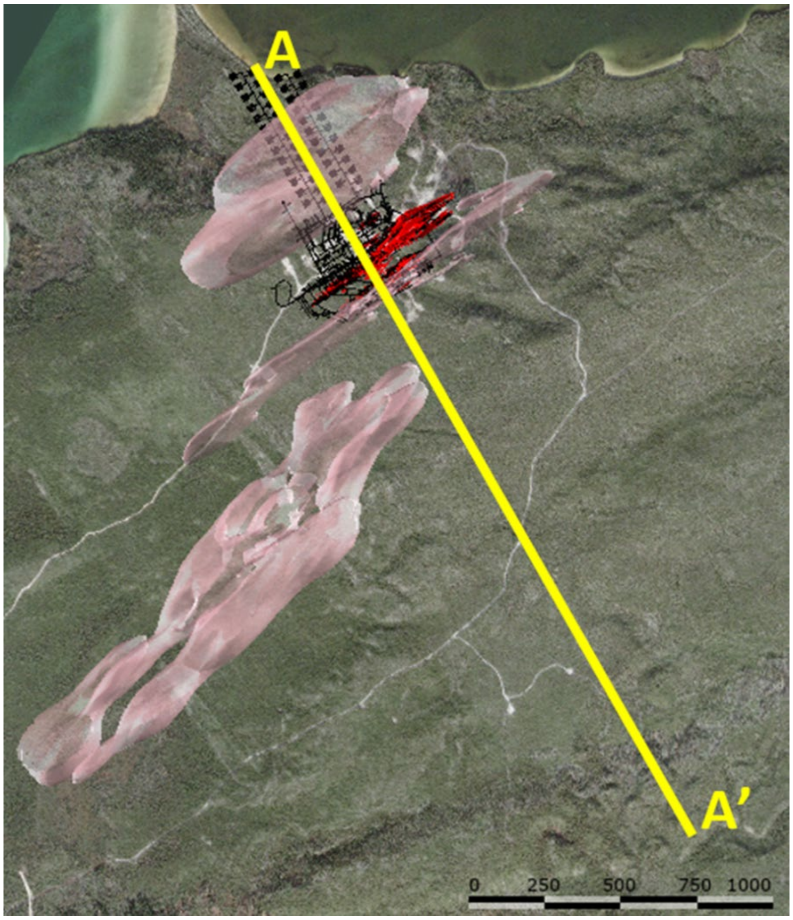
Table 12: Tailings Alternatives Evaluated by Multiple Accounts Analysis

Item	Tailings Alternative			
	Underground Location U-4 Paste Technology	**Surface Location S-1 Paste Technology**	**Surface Location S-3 Paste Technology**	**In-Pit Location P-3 Slurry Technology**
Distance to Patterson Lake (km)	0.2	1.0	0.9	0.9
Distance to mine shaft (km)	0.8	1.5	1.8	1.9
Area of tailings placed on surface (ha)	0.0	92	58	34
Volume earthworks (Mm^3)	11.3	3.2	3.5	12.8
Construction	▪ Excavation of underground chambers (drill, blast) ▪ Haulage of excavated rock for placement at surface	▪ Earthworks for cellular containment structures with progressive raises during Operations, no topographic containment	▪ Single containment structure with progressive raises during Operations, some natural topographic containment	▪ Excavation of pit (drill, blast) ▪ Haulage of excavated overburden and rock and placement at surface
	▪ Paste plant ▪ Tailings transport system	▪ Paste plant ▪ Tailings transport system		▪ Tailings / surface water management systems
Operations	▪ Tailings thickened to 50%–70% solids (flowable), add cement and place in underground chambers ▪ Incremental excavation of underground chambers (drill, blast) ▪ Removal of excavated rock and haulage for placement at surface	▪ Tailings thickened to 50%–70% solids (flowable) and place in surface containment structure		▪ Tailings dewatered to 30%–50% solids (flowable); subaqueous tailings deposition in pit ▪ Operation of tailings/water management systems
Closure	▪ Progressive decommissioning of filled underground chambers during Operations ▪ Decommissioning of final facility and infrastructure (utilities, access)	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover complicated by thaw of ice lenses in tailings		▪ Draining of water pond ▪ Placement of cover, considering consolidation ▪ Decommissioning of facility and infrastructure (utilities, access)

Note: Monitoring is assumed to be common and is not listed.
Mm^3 = million cubic metres

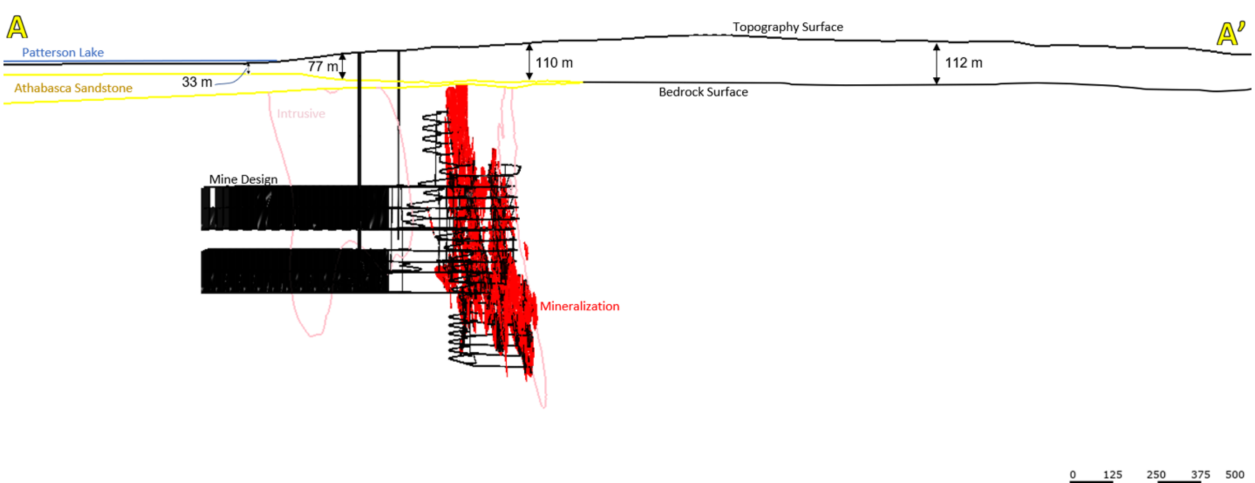
Plan and section illustrations from the conceptual model for the underground alternative are presented in Figure 9 and Figure 10 (NexGen 2020e).

Figure 9: Conceptual Plan Illustration of the Underground (U-4) Paste Technology Alternative



Source: NexGen 2021.

Figure 10: Conceptual Section Illustration of Underground (U-4) Paste Technology Alternative



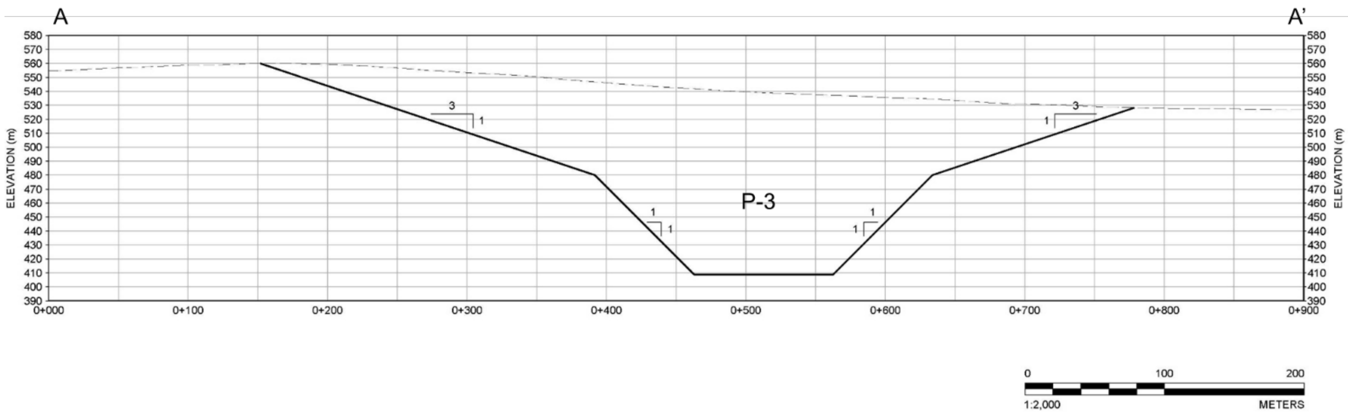
Source: NexGen 2021.

A conceptual model was developed for the in-pit tailings storage alternative using AutoCAD Civil 3D (Autodesk 2019) to obtain measurements and quantities used to score indicators. Plan and section illustrations from the conceptual model for the in-pit alternative are presented in Figure 11 and Figure 12. Assumptions used to develop the conceptual model include:

- maximum excavation slope of 3 horizontal to 1 vertical (3H:1V) in overburden and 1H:1V in bedrock; and
- glacial overburden is approximately 60 m thick (Golder 2019).

Figure 11: Conceptual Plan Illustration of the In-Pit (P-3) Slurry Technology Alternative

Figure 12: Conceptual Section Illustration of the In-Pit (P-3) Slurry Technology Alternative



Conceptual models were developed for the surface tailings storage alternatives using AutoCAD Civil 3D (Autodesk 2019) to obtain measurements and quantities used to score indicators. Plan illustrations from the conceptual model for surface alternatives at locations S-1 and S-3 are presented in Figure 13. Assumptions used to develop the conceptual models include:

- maximum exterior embankment slope of 3H:1V and interior embankment slope of 2H:1V.

Figure 13: Conceptual Plan Illustration of the Surface Paste Technology Alternatives at Locations S-1 and S-3

4.4.2 Results

A list of indicators, sub-accounts, and weighting is included in Appendix B, Table B-6.

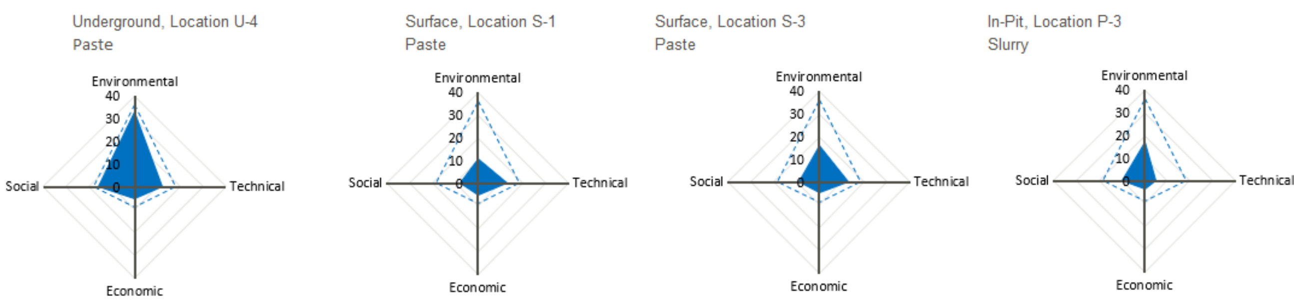
The MAA is presented in Appendix B, Table B-7 and summarized in this subsection. Alternatives were ranked based on the highest assessment score using ECCC (2016) account weighting:

1) **Underground location U-4 with paste technology** – highest scores in the environmental, economic, and social accounts.
   - **Environmental Account:** highest score due to lowest surface area, least potential for effect on the environment, least potential to require surface and contact water management and least potential for effect on groundwater. Placement underground would result in additional waste rock excavation during construction of the UGTMF and would generate more dust than some other alternatives due to haulage and placement of excavated waste rock on surface.
   - **Technical Account:** high score due to intermediate complexity to design, due to quantity of earthworks, with higher indicator scores for greatest operational flexibility with least risk – modular format is designed for expansion, reduced requirements for surface water management, simplest to close (allows progressive closure during Operations phase) with greatest resistance to post-closure extreme events such as flood or earthquake.
   - **Economic Account:** highest score. The evaluation uses total estimated volume of earthworks as a measurable indicator for capital cost, which results in a lower score for the UGTMF in the economic account. The approach does not differentiate types of earthworks and associated unit rates (underground mining excavation versus dam fill placement versus excavation from an open pit) and does not differentiate capital cost versus sustaining capital costs over the life of mine. The UGTMF would be constructed in stages, including an initial starter facility as part of capital expenditure, and then expanded as required over the life of mine. Surface alternatives would be similarly staged. The in-pit alternative would be constructed during the construction phase.
   - **Social Account:** highest score due to least potential for visual impact and least health risk to people downstream.
2) **Surface location S-3 with paste technology** – highest score in the technical account.
   - **Environmental Account:** low score due to greater surface disturbance area and potential to affect groundwater and surface water.
   - **Technical Account:** highest score due to less complex to design and construct with no additional rock excavated and hauled to surface.
   - **Economic Account:** low score due high costs for water treatment, closure, and decommissioning.
   - **Social Account:** scored low due to the visual disturbance associated with a surface facility.
3) **Surface location S-1 with paste technology** – lowest score in the environmental and social accounts.
   - **Environmental Account:** lowest score due to greatest surface area, and potential to affect surface water, groundwater, plants, fish, and other wildlife.
   - **Technical Account:** low score due to requiring an embankment raise should the facility be expanded.
   - **Economic Account:** low score due to costs for water treatment, closure, and decommissioning.
   - **Social Account:** low score due to visual disturbance and potential health risk to people downstream.

4) **In-Pit location P-3 with slurry technology** – lowest score in the technical and economic accounts.
   - **Environmental Account:** low score due to greater surface disturbance area and potential for dust emissions.
   - **Technical Account:** lowest score due to complexity to design, construct, and operate, limited potential to expand capacity beyond pit limit, limited potential for progressive closure, and effort required for expansion and design changes.
   - **Economic Account:** lowest score due to high capital cost to drill, blast, load, and haul excavated overburden and rock, operational costs for transport of tailings, and water treatment
   - **Social Account:** low score due to the greater potential for long-**term** change in land use and the quantity of rock excavated to construct the pit.

Radar charts for the tailings MAA are included as Figure 14 considering ECCC base case weighting to illustrate the distribution of scoring within the environmental, technical, economic, and social accounts for each alternative. The maximum score an alternative can achieve in each account is represented by the dashed line. Placement of tailings underground at location U-4 with paste technology is the preferred alternative based on results of the MAA.

Figure 14: Radar Charts for the Tailings Multiple Accounts Analysis Results



4.4.3 Sensitivity Analysis

A sensitivity analysis was completed using the method described in Section 3.5 to evaluate the effect of bias introduced by weighting, with results presented in Appendix B, Table B-8 and summarized in Table 13. The ranking of alternatives did not change the rank of tailings placed as CPT underground in a UGTMF at location U-4, indicating that weighting of accounts (introduction of bias) does not change the study outcome. The rank of the third and fourth placed alternatives switches with weighting if the economics account is discounted.

Table 13: Ranking of Tailings Alternatives by Different Account Weighting Schemes

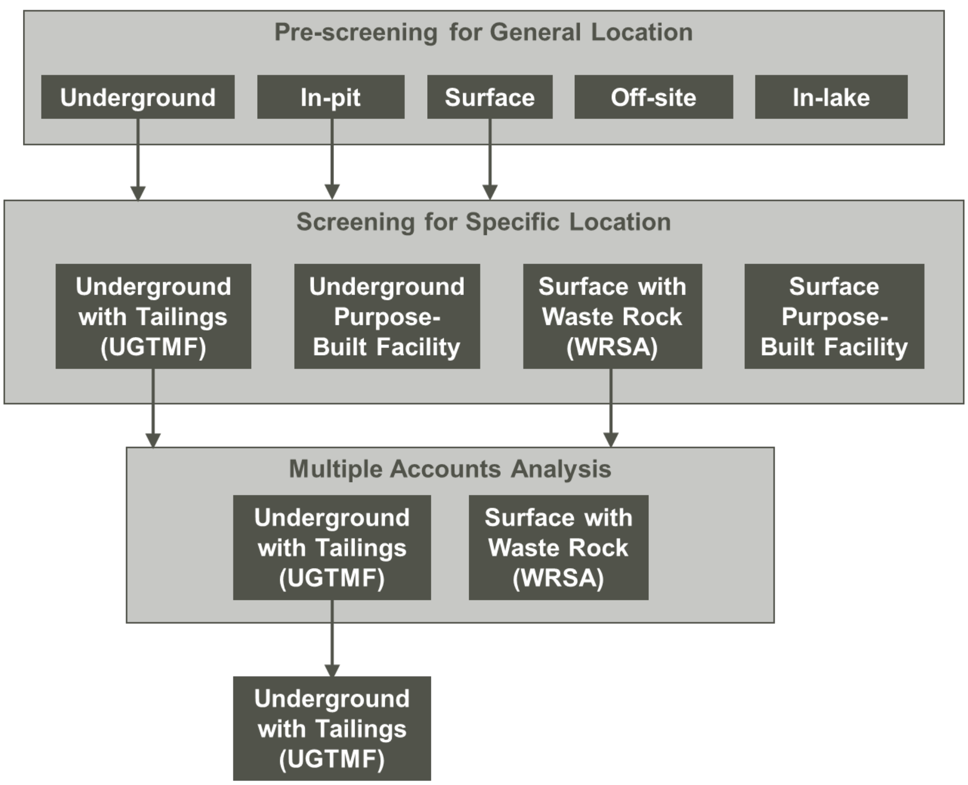
Account Weighting Scheme	Tailings Alternative Rank			
	Underground Location U-4 Paste Technology	Surface Location S-1 Paste Technology	Surface Location S-3 Paste Technology	In-Pit Location P-3 Slurry Technology
ECCC (2016) (Base Case)	1	3	2	4
NexGen	1	3	2	4
Equal	1	3	2	4
ECCC (2016), Economic = 0	1	4	2	3

5 GYPSUM ALTERNATIVES ASSESSMENT

An alternatives assessment was completed to identify the best available location and technology for the storage of gypsum. Gypsum is typically disposed as part of the tailings stream at uranium mines in Saskatchewan; however, an assessment was completed to determine if there was a more appropriate alternative for the Rook I Project.

Methods and outcomes for the gypsum alternatives assessment are summarized in Figure 15 and described in this section.

Figure 15: Gypsum Alternatives Assessment Methods and Outcomes



UGTMF = underground tailings management facility; WRSA = waste rock storage area.

5.1 Pre-screening for General Location for Gypsum Storage

Pre-screening for the general location for gypsum storage was completed using the method described in Section 3.2. The five general locations considered during pre-screening are described for Construction, Operations, and Closure phases in Table 14.

The results from pre-screening for general location for gypsum storage are presented in Appendix C, Gypsum Alternatives Assessment, Table C-1 and summarized in this subsection.

Three general locations did not pass pre-screening:

- **Off-site:** eliminated due to increase in overall surface disturbance area outside of the proposed Project surface lease boundary. There are no nearby facilities that could be used for gypsum storage other than Cluff Lake, a closed mine with a decommissioned TMF that has no capacity for additional gypsum. Transport to, and placement of gypsum at, the closed Cluff Lake facility off site would increase the potential for environmental contamination and liability associated with a closed site that is not owned or managed by NexGen.
- **In-pit:** eliminated as excavating a pit would generate more overburden and rock excavation than the volume of gypsum to be stored. Would result in additional surface disturbance due to the pit and for storage of excavated overburden and rock.
- **In-lake:** eliminated based on NexGen's criterion to not place waste in lakes.

Two general locations passed pre-screening:

- Underground; and
- Surface.

Table 14: General Locations for Gypsum Considered for Pre-screening

Assessment Lifespan Phase	General Location				
	Underground	In-Pit	Surface	Off-Site	In-Lake
Construction	▪ Excavation of underground chambers (drill, blast, load) ▪ Haulage of excavated rock for placement in WRSA	▪ Excavation of large pit (drill, blast, load) ▪ Haulage of overburden and rock for placement in WRSA	▪ Construction of containment structure	▪ Construction of transport and haulage infrastructure ▪ Potential construction of containment structure or increase capacity of existing structure	▪ Construction of transport and haulage infrastructure
Operations	▪ Gypsum placement in underground chambers ▪ Excavation of underground chambers (drill, blast, load) ▪ Haulage of excavated rock for placement in WRSA	▪ Gypsum cleaning (if required) ▪ Placement in pit	▪ Gypsum cleaning ▪ Placement in containment structure	▪ Gypsum cleaning ▪ Haulage to off-site location ▪ Placement in off-site containment structure	▪ Gypsum cleaning ▪ Placement in lake

Table 14: General Locations for Gypsum Considered for Pre-screening

Assessment Lifespan Phase	General Location				
	Underground	In-Pit	Surface	Off-Site	In-Lake
Closure	▪ Progressive decommissioning of filled underground chambers can occur in Operations ▪ Decommissioning of final facility and infrastructure (utilities, access)	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (transport, haulage, utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (utilities, access)

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area.

5.2 Screening for Specific Location for Gypsum Storage

Screening of specific locations for gypsum storage was completed using the method described in Section 3.3. Four specific locations were screened: two underground and two on surface. Underground locations for gypsum storage included placement with the tailings in a UGTMF and placement in a purpose-built underground facility. Surface locations for gypsum storage included placement with the waste rock in a waste rock storage area (WRSA) and placement in a purpose-built facility.

5.2.1 Underground

The two specific underground locations (UGTMF and purpose-built facility) were screened and are described for Construction, Operations, and Closure phases in Table 15.

Table 15: Specific Locations for Underground Storage of Gypsum Considered for Screening

Assessment Lifespan Phase	Underground Location	
	UGTMF	Purpose-Built Facility
Construction	▪ Use of planned facility for tailings storage ▪ Incremental excavation of underground chambers (drill, blast) ▪ Incremental removal of excavated rock and haulage to surface, placement at surface	▪ Excavation of purpose-built facility (drill, blast) ▪ Removal of excavated rock and haulage to surface, placement at surface ▪ Separate gypsum delivery system
Operations	▪ Gypsum in tailings stream placed in underground chambers ▪ Incremental excavation of underground chambers (drill, blast) ▪ Incremental removal of excavated rock and haulage to surface, placement at surface ▪ Potential advantage: gypsum may reduce cement binder requirement for CPT	▪ Gypsum placed in purpose-built facility ▪ Incremental removal of excavated rock and haulage to surface, placement at surface ▪ Maintenance and operation of separate gypsum delivery system
Closure	▪ Progressive decommissioning of filled underground chambers during Operations ▪ Decommissioning of final facility and infrastructure (utilities, access)	▪ Progressive decommissioning of filled underground chambers during Operations ▪ Decommissioning of final facility and infrastructure (utilities, access) of separate facility

Note: Monitoring is assumed to be common and is not listed.
UGTMF = underground tailings management facility; CPT = cemented paste tailings.

The results from screening for specific location for underground gypsum storage location are presented in Appendix C, Table C-2 and summarized in this subsection.

One specific location for underground storage of gypsum did not pass screening based on relative disadvantages on comparison of indicators:

Purpose-built: a separate, purpose-built underground facility would result in the greatest increase in quantity of rock excavated and surface disturbance from haulage and placement of excavated rock, with higher design effort, operational complexity, and Project lifespan costs for an additional facility and gypsum delivery system. No potential reduction in cement binder requirement for CPT mine backfill.

One specific underground location passed screening based on relative advantages for indicators:

- **UGTMF:** use of a planned facility and delivery system reduces complexity of operation and cost compared to construction of an additional purpose-built facility, and provides a potential advantage for reducing cement binder requirement for CPT.

5.2.2 Surface

Two specific locations (WRSA, purpose-built facility) for surface storage of gypsum were considered for screening and are described for Construction, Operations, and Closure phases in Table 16.

Table 16: Specific Locations for Surface Storage of Gypsum Considered for Screening

Assessment Lifespan Phase	Surface Location	
	WRSA	Purpose-Built Facility
Construction	▪ Use of planned facility to store gypsum with waste rock ▪ Incremental placement of excavated rock at WRSA	▪ Purpose-built containment structure ▪ Separate gypsum delivery system
Operations	▪ Gypsum cleaning ▪ Transport to WRSA ▪ Engineered placement with waste rock in WRSA ▪ Incremental placement of excavated rock at WRSA ▪ Potential disadvantage: could result in instability if placed incorrectly	▪ Gypsum cleaning ▪ Transport to and deposition in purpose-built facility ▪ Maintenance and operation of separate gypsum transport and placement system ▪ Requires extra equipment and work front
Closure	▪ Decommissioning of final facility and infrastructure (utilities, access) for WRSA only (incremental increase on closure)	▪ Decommissioning of final facility and infrastructure (utilities, access) for separate facility in addition to WRSA.

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area.

The results from screening of specific locations for surface storage of gypsum are presented in Appendix C, Table C-2 and summarized in this subsection.

One specific surface location did not pass screening based on indicator descriptions and relative evaluation:

- **Purpose-built:** a separate surface facility would increase surface disturbance with greater potential to affect surface and ground water, greater potential for dust, higher complexity, and higher cost, and would create an additional facility requiring closure.

One specific surface location passed screening based on indicator descriptions and relative evaluation:

- **WRSA:** storage of gypsum in a planned facility and delivery system reduces construction cost and effort, reduces operational complexity, and does not require an additional work front. Placement of gypsum with waste rock may require engineering controls to reduce potential for instability related to dissolution of gypsum.

5.3 Multiple Accounts Analysis

A MAA was completed for gypsum alternatives using the method described in Section 3.5. A description of alternatives, the results of the MAA, and the sensitivity analysis are summarized in this subsection.

5.3.1 Description of Alternatives

Two alternatives for gypsum, each including a location and technology, were evaluated and are described by Construction, Operations, and Closure phases in Table 17.

Table 17: Gypsum Alternatives Evaluated by Multiple Accounts Analysis

<table>
<tr><th rowspan="2">Assessment Lifespan Phase</th><th colspan="2">Gypsum Alternative</th></tr>
<tr><th>UGTMF</th><th>WRSA</th></tr>
<tr><td rowspan="2">Construction</td><td>▪ Incremental excavation of underground chambers (drill, blast, load) for placement of gypsum
▪ Incremental removal of excavated rock and haulage to surface for placement at WRSA</td><td>▪ Incremental increase in size of WRSA due to placement of gypsum</td></tr>
<tr><td colspan="2">▪ Construction of planned facility, access, and associated water management systems</td></tr>
<tr><td>Operations</td><td>▪ Gypsum is included in the tailings stream
▪ Tailings are placed in underground chambers
▪ Incremental excavation of underground chambers (drill, blast, load)
▪ Incremental removal of excavated rock and haulage to surface for placement at WRSA
▪ Potential advantage: gypsum may reduce cement binder requirement for CPT</td><td>▪ Gypsum cleaning
▪ Haulage to WRSA
▪ Engineered placement in WRSA
▪ Incremental increase in size of WRSA due to placement of gypsum</td></tr>
<tr><td>Closure</td><td>▪ Progressive decommissioning of filled underground chambers during Operations
▪ Decommissioning of final facility and infrastructure (utilities, access)</td><td>▪ Decommissioning of final facility and infrastructure decommission (utilities, access)</td></tr>
</table>

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area; CPT = cemented paste tailings.

Quantity assumptions used for the gypsum MAA include:

- For simplification, the waste rock quantity is included in the capital cost for construction, rather than operational cost.

5.3.2 Results

A list of indicators, sub-accounts, and weighting is included as Appendix C, Table C-3.

The MAA is presented in Appendix C, Table C-4 and summarized in this subsection. Alternatives were ranked based on the score using ECCC (2016) account weighting:

1) **Placement of gypsum with tailings in the UGTMF** – highest score in the environmental and technical accounts, lowest in the economic and social accounts.

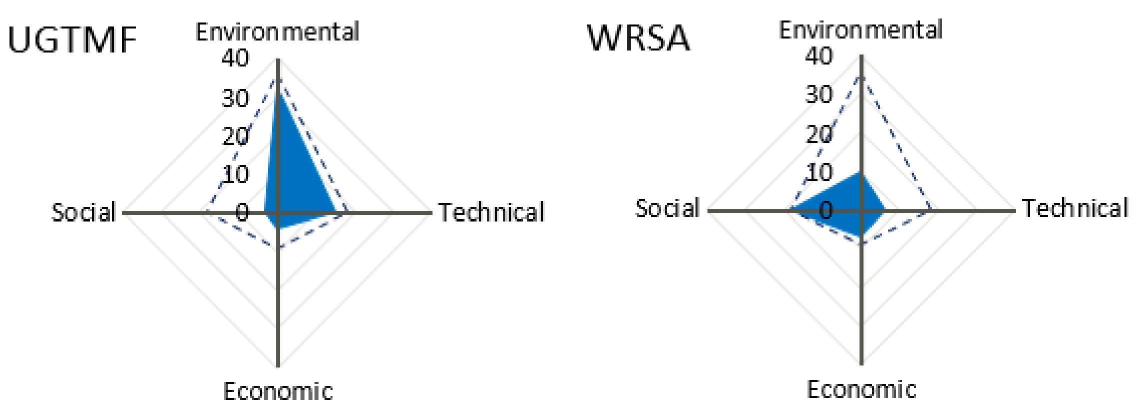
   - **Environmental Account:** highest score due to lowest potential for effects on Patterson Lake and lowest potential for surface contact water management. Storage of gypsum with tailings increases the quantity of waste rock to be excavated in the UGTMF and stored on surface, which has the potential to increase dust emissions from hauling of waste rock relative to storage of gypsum in the WRSA, which could also create dust.

- **Technical Account:** highest score due to least design effort, proven technology, lower effort required to clean and handle gypsum, with less design effort, and lowest geotechnical risk.
- **Economic Account:** lowest score due to higher capital cost for facility construction resulting from the increased quantity of waste rock generated from excavation of the UGTMF chambers, otherwise has a lower operating cost for pipeline transport of gypsum with tailings to the UGTMF. Placing gypsum underground has the potential to offset the cost of cement binder added to CPT.
- **Social Account:** lowest score due to higher quantity of excavation and haulage of rock to surface for UGTMF chamber construction, which would increase potential risks to workers due to additional mining activities.

2) **Placement of gypsum with waste rock in the WRSA** – highest scores in the economic and social accounts, lowest scores in the environmental and technical accounts.
   - **Environmental Account:** lowest score because gypsum on surface would increase the potential requirement for management of surface contact water.
   - **Technical Account:** lowest score due to requirement for control of placement of gypsum in the WRSA to avoid introducing potential for instability due to dissolution of gypsum, otherwise has higher flexibility during operation for design changes. Requires separation and cleaning of gypsum to be placed on surface.
   - **Economic Account:** highest score due to lower capital cost for construction, otherwise has a higher operating cost for haulage and placement of gypsum at the WRSA.
   - **Social Account:** highest score due to lower quantity of rock excavation for facility construction.

Radar charts for the gypsum MAA are presented in Figure 16 to illustrate the distribution of scoring within the environmental, technical, economic, and social accounts for each alternative. The maximum score an alternative can achieve in each account is represented by the dashed line. Placement of gypsum underground with CPT in the UGTMF is the preferred alternative based on results of the MAA.

Figure 16: Radar Charts for the Gypsum Multiple Accounts Analysis Results



UGTMF = underground tailiings management facility; WRSA = waste rock storage area.

5.3.3 Sensitivity Analysis

A sensitivity analysis was completed using the method described in Section 3.5 to evaluate the effect of bias introduced by weighting, with results presented in Appendix C, Table C-5 and summarized in Table 18. The first-place ranking changes from UGTMF to WRSA when considering the NexGen weighting scheme, where the economic and social accounts have a higher weighting, indicating that account weighting (introduction of bias) does change the study outcome. The change in rank is due, in part, to the limited number of indicators in the social account such that the use of 1 and 6 for indicator scoring changes the overall score.

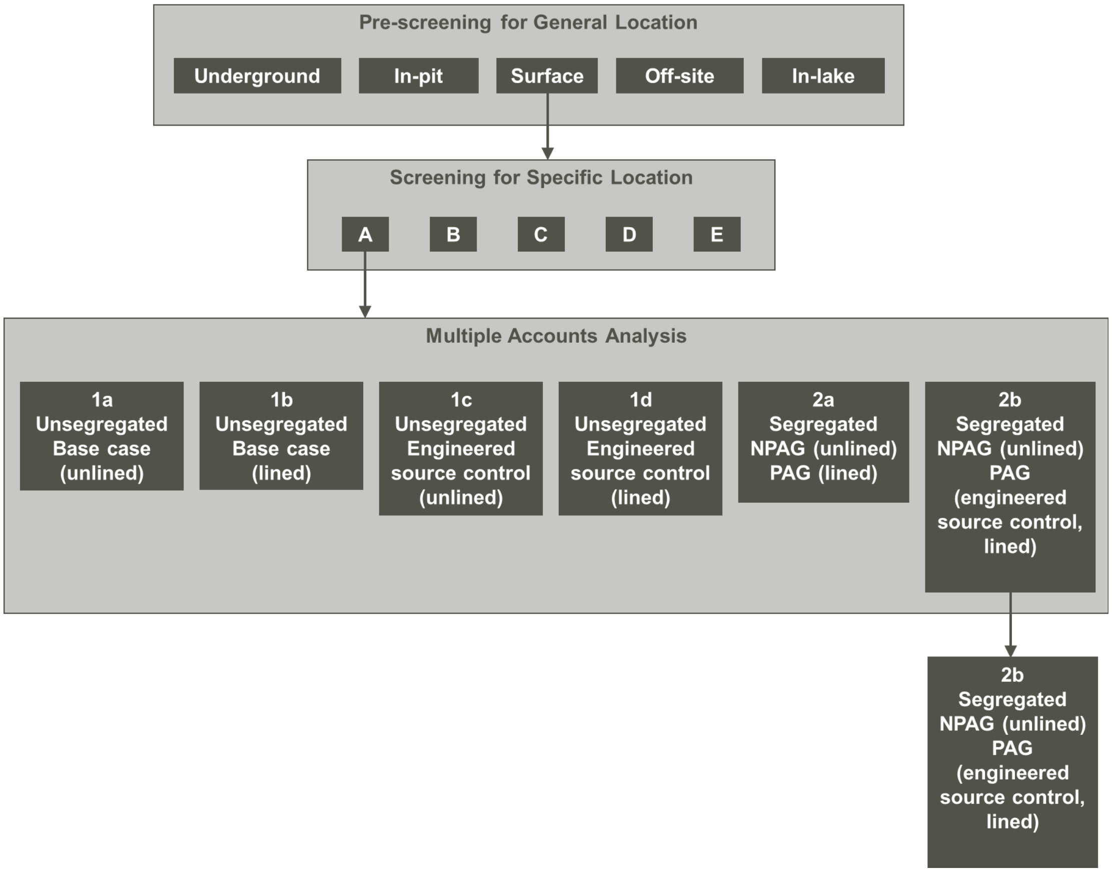
Table 18: Ranking of Gypsum Alternatives by Different Weighting Schemes

Account Weighting Scheme	Gypsum Alternative Rank	
	Underground Tailings Management Facility	Waste Rock Storage Area
ECCC (2016) (Base Case)	1	2
NexGen	2	1
Equal	1	2
ECCC (2016), Economic = 0	1	2

6 WASTE ROCK ALTERNATIVES ASSESSMENT

An alternatives assessment was completed to identify the best available location and technology for the storage of waste rock. Methods and outcomes for the waste rock alternatives assessment are summarized in Figure 17 and described in this section.

Figure 17: Waste Rock Alternatives Assessment Methods and Outcomes



NPAG = non-potentially acid generating; PAG = potentially acid generating.

6.1 Pre-screening for General Location for Waste Rock Storage

Pre-screening for the general location for waste rock storage was completed using the method described in Section 3.2. The five general locations were pre-screened and are described for Construction, Operations, and Closure phases in Table 19.

Table 19: General Locations for Waste Rock Considered for Pre-screening

Assessment Lifespan Phase	General Location				
	Underground	In-Pit	Surface	Off-Site	In-Lake
Construction	▪ Excavation of underground chambers (drill, blast, load) ▪ Incremental removal of excavated rock and placement in chambers	▪ Excavation of large pit (drill, blast, load) ▪ Haulage of overburden and rock for placement in pit	▪ Construction of WRSA ▪ Placement of liner (assumed)	▪ Construction of transport and haulage infrastructure ▪ Potential construction of WRSA, including placement of liner, or increase capacity of existing structure	▪ Construction of waste rock haulage system to lake, construct access
Operations	▪ Waste rock deposited in chambers ▪ Incremental excavation of underground chambers (drill, blast) ▪ Incremental removal of excavated rock and placement in chambers	▪ Waste rock placement in pit	▪ Waste rock placement in WRSA	▪ Haulage of waste rock to off-site location ▪ Waste rock placement in off-site WRSA	▪ Waste rock placement in lake
Closure	▪ Progressive decommissioning of filled underground chambers ▪ Decommissioning of final facility and infrastructure (utilities, access)	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and infrastructure (transport, haulage, utilities, access) ▪ Placement of closure cover system	▪ Decommissioning of facility and access infrastructure (utilities, access)

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area.

The results from pre-screening for general waste rock storage location are presented in Appendix D Waste Rock Alternatives Assessment, Table D-1 and summarized in this subsection.

Four general locations were eliminated by pre-screening:

- **Underground:** eliminated due to fatal flaw of volume incompatibility. Excavation of underground chambers would generate more waste rock than can be stored in the same underground chambers; waste rock cannot be stored underground.
- **In-pit:** eliminated due to fatal flaw of volume incompatibility. Excavation of a pit required to store waste rock would generate more excavated overburden and rock than can be stored in the same pit; waste rock from underground mining cannot be stored in a pit without a larger additional waste rock storage facility.
- **Off-site:** eliminated due to increase in overall surface disturbance area outside of the proposed Project surface lease boundary. There are no nearby facilities that could be used for waste rock storage other than Cluff Lake, a closed mine. Transport to, and placement of waste rock at, the closed Cluff Lake facility off site would increase the potential for environmental contamination and liability associated with a closed site that is not owned or managed by NexGen.
- **In-lake:** eliminated based on NexGen’s criterion to not place waste in lakes.

One general location for storage of waste rock passed pre-screening:

- **Surface**.

6.2 Screening for Specific Locations for Waste Rock Storage

Screening for a specific location for waste rock storage was completed using the methods described in Sections 3.3 and 3.5. Five specific locations, all on surface, were considered for the storage of waste rock. Surface locations were selected considering fixed infrastructure defined in Section 2.3.3 and modelled to obtain measurements and quantities used to score indicators for location screening.

6.2.1 Description of Alternatives

Conceptual models were developed for the five specific WRSA surface locations to obtain measurements and quantities used to score indicators. The five specific surface locations are described in Table 20 for Construction, Operations, and Closure phases, with key quantities and measurements.

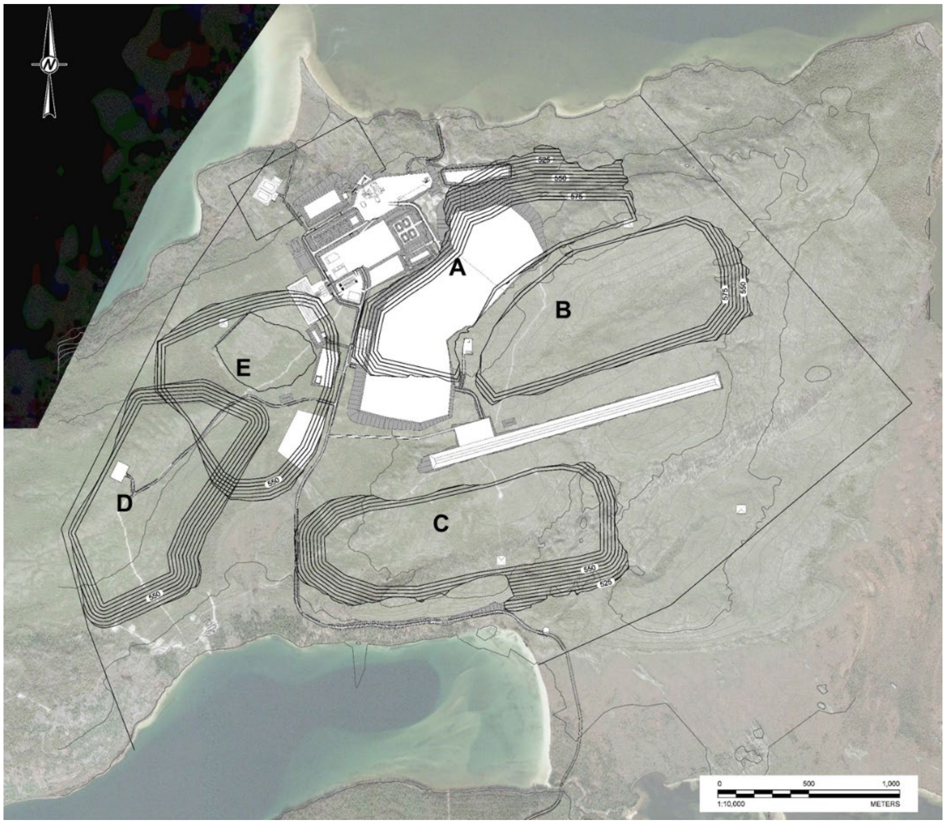
Conceptual models were developed for the surface waste rock storage alternatives using AutoCAD Civil 3D (Autodesk 2019) to obtain measurements and quantities used to score indicators. Conceptual models for the waste rock alternatives are presented in Figure 18. The concept models were modelled with outer slopes of 4H:1V.

Table 20: Specific Locations for Surface Storage of Waste Rock Evaluated by Multiple Accounts Analysis

Item	Waste Rock Location				
	A	B	C	D	E
Elevation change – measured from mine shaft collar to WRSA crest (m)	49	48	38	37	26
Distance – measured from WRSA toe to Patterson Lake (km)	0.5	0.9	0.5	0.6	0.6
Distance – measured from WRSA centroid to Patterson Lake (km)	1.0	1.2	0.7	1.0	1.0
Distance – measured from WRSA centroid to mine shaft collar (km)	0.9	1.6	2.0	2.2	1.4
Area – measured as 2D footprint area of the WRSA (ha)	87	91	104	91	86
Area – measured as 3D surface area of the WRSA (ha)	88	92	105	92	86
Construction	▪ Foundation preparation for surface WRSA ▪ Placement of liner				
	▪ Southeast and adjacent to the mine and mill terrace	▪ Southeast of the mine and mill terrace, north and adjacent to the airstrip	▪ South of the airstrip	▪ Southwest of the mine and mill terrace	▪ Southwest and adjacent to the mine and mill terrace
Operations	▪ Haulage of waste rock from mine terrace to WRSA				
Closure	▪ Decommissioning of facility and infrastructure (utilities, access) ▪ Placement of closure cover system				

Note: Monitoring is assumed to be common and is not listed.
WRSA = waste rock storage area

Figure 18: Conceptual Plan of the Specific Locations for Surface Storage of Waste Rock Considered for Screening



6.2.2 Results

A list of indicators, sub-accounts, and weightings used to screen specific waste rock locations is presented in Appendix D, Table D-2.

The results of screening for specific location for waste rock storage by MAA method are presented in Appendix D, Tables D-3 and D-4 and are summarized in this subsection. Specific locations were ranked based on the highest assessment score using ECCC (2016) account weighting:

1) **Surface location A** – highest scores in the environmental and social accounts

- **Environmental Account:** highest score due to greater potential for surface and groundwater contact water management. Also had the shortest distance from the mine terrace with the least potential for dust emissions from construction, access, and waste rock haulage.
- **Technical Account:** high score, with highest score for reduced operational risk and complexity due to shorter haul associated with least potential for operational maintenance, though had a shorter distance from Patterson Lake; longer distance is preferred to allow for water management.
- **Economic Account:** high score due to shorter haul and less water use for dust suppression.
- **Social Account:** highest score due to the shortest distance from mine terrace to WRSA (i.e., least worker exposure due to shortest haulage distance and haul duration).

2) **Surface location B** –highest score in the technical account

- **Environmental Account:** high score due to greatest distance from Patterson Lake, though is close to the proposed Project surface lease boundary, resulting in less area available for contact water management.
- **Technical Account:** highest score due to greatest distance from Patterson Lake, which allows greater area for management of contact water.
- **Economic Account:** intermediate score due to intermediate haul distance and associated cost for transport and operational maintenance, second highest elevation gain from shaft, which increases energy cost, and intermediate surface area with intermediate closure cost score resulting from quantity of cover material required at closure.
- **Social Account:** intermediate score due to intermediate haul distance, greater risk to worker safety and human health resulting from longer transport distance from the shaft to the WRSA.

3) **Surface location E** –highest score in the economic account

- **Environmental Account:** intermediate score due to shortest setback distance from proposed Project surface lease boundary, infrastructure, wetland, and Patterson Lake, resulting in less available area for contact water management. Also had lowest surface area.
- **Technical Account:** intermediate score due to potential for operation and maintenance resulting from intermediate transport distance from the shaft to WRSA, and intermediate setback distance from Patterson Lake, which is required for management of contact water.
- **Economic Account:** highest score due to least vertical elevation change from shaft to WRSA crest (i.e., least energy use during transport, equipment maintenance) though had an intermediate cost score due to haul distance.
- **Social Account:** intermediate score due to risk to worker safety and human health associated with intermediate transport distance from the shaft to the WRSA.

4) **Surface location D** – lowest score in the social account

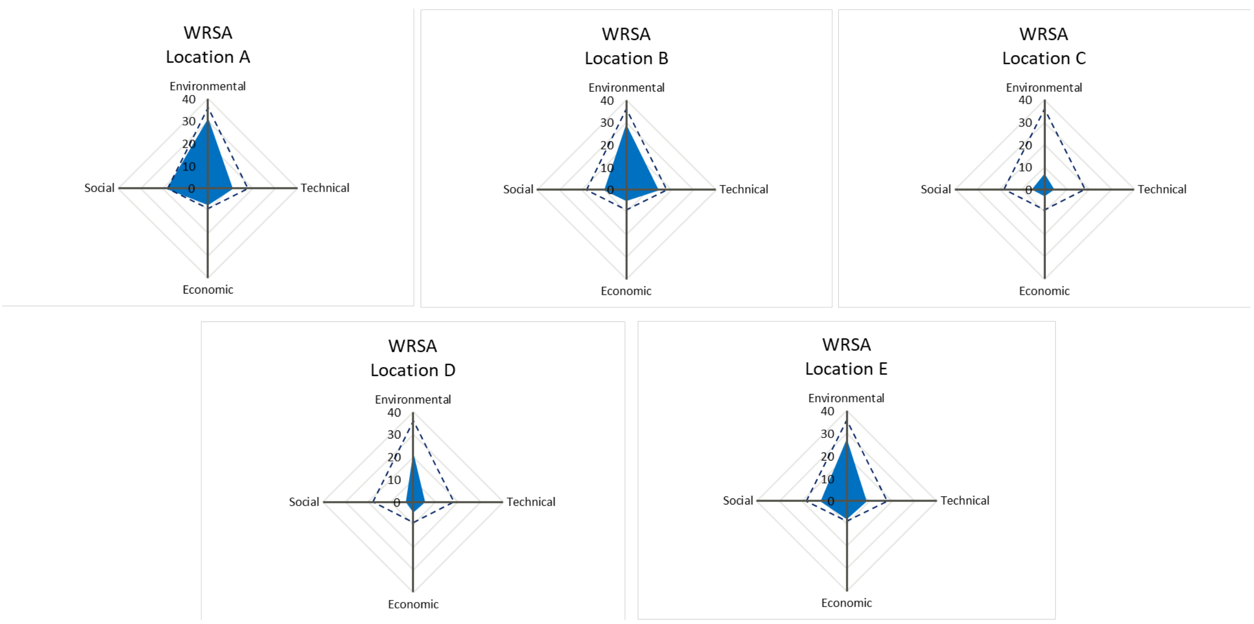
- **Environmental Account:** low score due to intermediate surface area, longest haul and associated highest potential for excessive emissions of fugitive dust and other non-greenhouse gas emissions, and least setback available for surface and groundwater contact water management.
- **Technical Account:** low score due to longest haul distance and associated potential for operational maintenance, and intermediate distance to Patterson Lake for water management.
- **Economic Account:** low score due to higher operating cost resulting from longer transport distance between the shaft and WRSA, and higher closure cost resulting from greater quantity of cover material required at closure.
- **Social Account:** lowest score due to greatest distance from mine shaft to WRSA (i.e., longest haul distance results in greatest potential for worker exposure).

5) **Surface location C** –lowest score in the environmental, technical, and economic accounts

- **Environmental Account:** lowest score due to proximity to Patterson Lake and the airstrip, a steep gradient toward the lake that would limit ability to manage water, and greatest surface area.
- **Technical Account:** lowest score due to short distance and steep gradient to Patterson Lake that would limit ability to effectively manage water.
- **Economic Account:** lowest score due to long haul, greatest WRSA area for closure cover placement. Longer haul results in higher cost for dust suppression water use, and waste rock transport and placement.
- **Social Account:** low score due to long haul and associated risk to worker safety and human health.

Radar charts for the waste rock storage location screening by MAA method are presented in Figure 19 to illustrate the distribution of scoring within the environmental, technical, economic, and social accounts. The maximum score an alternative can achieve in each account is represented by the dashed line. Location A passed screening for specific location and was carried forward to the MAA.

Figure 19: Radar Charts for the Waste Rock Storage Location Screening Results



WRSA = waste rock storage area.

6.3 Multiple Accounts Analysis

An MAA for waste rock storage alternatives was completed using the method described in Section 3.5. A description of alternatives, the results of the MAA, and the sensitivity analysis are summarized in this subsection.

6.3.1 Description of Alternatives

Six alternatives, each including the selected screening location and a technology, were evaluated for Construction, Operations, and Closure phases. These alternatives, along with key quantities and measurements used in the analysis, are summarized in Table 21.

Simplified water balances were developed to estimate the rate of infiltration, and one-dimensional infiltration model scenarios were developed to predict inflows and outflows on an annual basis (Okane 2020; BGC 2020). Geochemical source terms were developed by SRK Consulting (Canada) Inc. for each waste rock alternative as a mass flux. A simplified groundwater mixing model was then used to predict average and peak concentrations of constituents in seepage reaching Patterson Lake for operational and closure periods. Alternatives were evaluated for the Operations and Closure phases based on potential seepage water quality predictions. Indicators included predicted concentrations of the constituents that exceeded Canadian Council of Ministers of the Environment (CCME) guidelines as shown in Table 21.

Table 21: Waste Rock Alternatives Evaluated by Multiple Accounts Analysis

Item	Waste Rock Alternative					
	1a Unsegregated Base Case Unlined	**1b Unsegregated Base Case Lined**	**1c Unsegregated Engineered Source Control Unlined**	**1d Unsegregated Engineered Source Control Lined**	**2a Segregated NPAG (Unlined) PAG (Lined)**	**2b Segregated NPAG (Unlined) PAG (Engineered Source Control, Lined)**
Liner area – measured as 2D area of the WRSA to be lined, ha	0	87	0	87	37	37
Mass – borrow for engineered layers, t	0.0	0.0	2.5	2.5	0	1.1
Concentration – copper allowable (Operations), µg/L	2.0					
Concentration – copper exceedance (Operations), µg/L	4.0	0.0	4.0	0.0	0.0	0.0
Concentration – cobalt allowable (Closure), µg/L	1.0					
Concentration – cobalt exceedance (Closure), µg/L	3.8	3.8	0.0	0.0	3.8	0.0
Construction	▪ Surface WRSA with water control measures, access and haul roads					
	▪ One facility	▪ One facility ▪ Placement of liner for whole facility	▪ One facility	▪ One facility ▪ Placement of liner for whole facility	▪ Two facilities ▪ Placement of liner for one facility	▪ Two facilities ▪ Placement of liner for one facility
Operations	▪ Haulage of waste rock from mine shaft to WRSA					
	▪ End-dumping waste rock	▪ End-dumping waste rock	▪ Placement of waste rock in layers ▪ Excavation and placement of engineered source control in layers	▪ Placement of waste rock in layers ▪ Excavation and placement of engineered source control in layers	▪ End-dumping waste rock	▪ End-dumping NPAG waste rock ▪ Placement of PAG waste rock in layers ▪ Excavation and placement of engineered source control in layers
Closure	▪ Decommissioning of facility and infrastructure (utilities, access)					
	▪ Placement of cover system	▪ Placement of cover system	▪ Placement of cover system ▪ Closure of borrow source	▪ Placement of cover system ▪ Closure of borrow source	▪ Placement of cover system	▪ Placement of cover system ▪ Closure of borrow source

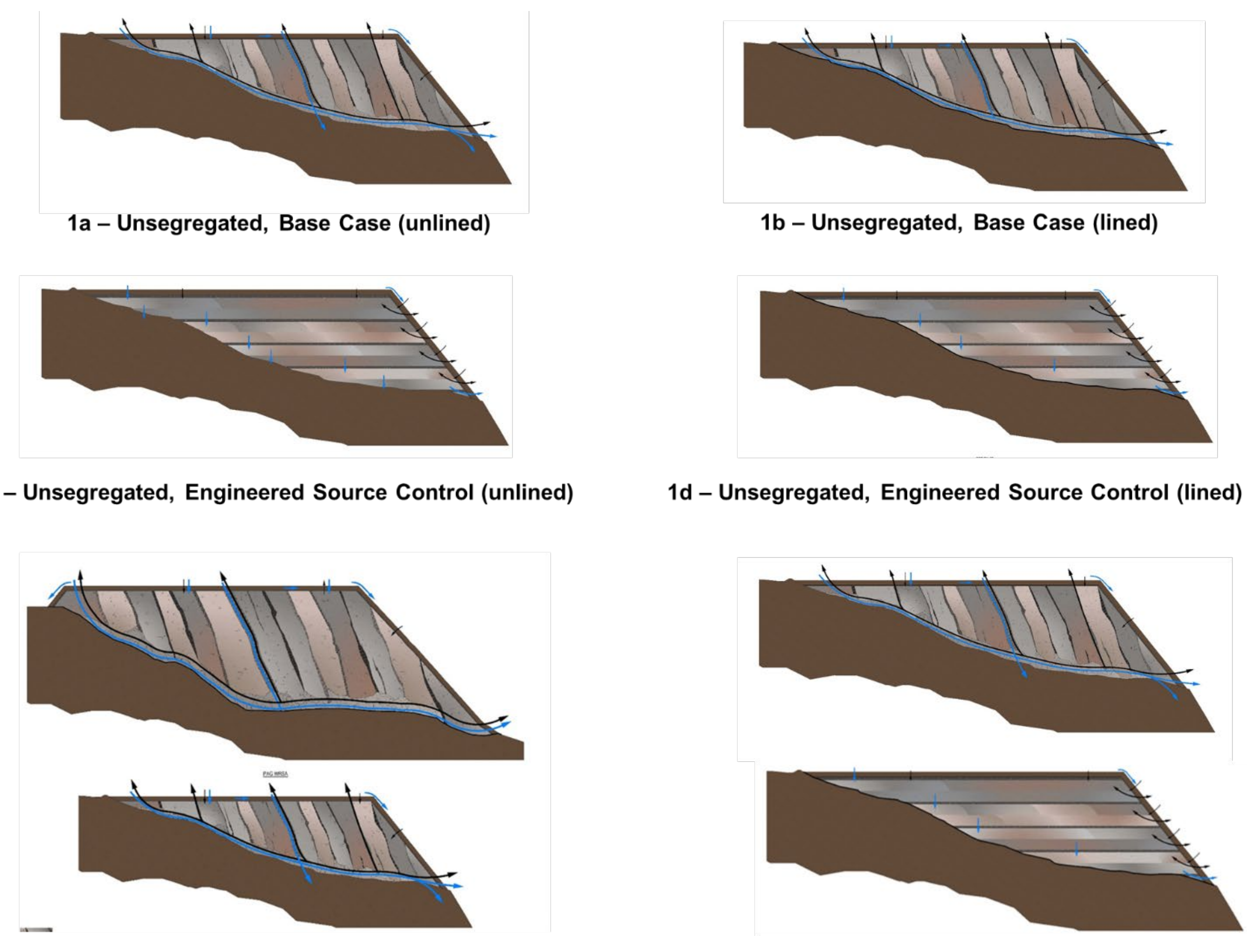
Note: Monitoring is assumed to be common and is not listed.
PAG = potentially acid generating; NPAG = non-potentially acid generating; WRSA = waste rock storage area.

Additional assumptions used to develop the conceptual models were:

- In unsegregated facilities, NPAG and PAG waste rock are not separated and are placed together in a single facility.
- In segregated facilities, NPAG and PAG waste rock are separated and placed in two separate facilities.
- The concept of engineered source control is where a 0.5 m lift of fine-grained material is placed between 5 m lifts of waste rock (Okane 2020). In concept, the fine-grained layer acts to control flow of water and oxygen, which provides a control on chemistry.

Section illustrations from the conceptual model for WRSA alternatives were provided by NexGen (2020e) and are presented in Figure 20.

Figure 20: Conceptual Plan Illustrations of the Waste Rock Technologies



1a – Unsegregated, Base Case (unlined)

1b – Unsegregated, Base Case (lined)

1c – Unsegregated, Engineered Source Control (unlined)

1d – Unsegregated, Engineered Source Control (lined)

2a – Segregated, NPAG (unlined), PAG (lined)

2b – Segregated, NPAG (unlined), PAG (Engineered Source Control, lined)

Source: NexGen 2020e.

6.3.2 Results

A list of indicators, sub-accounts, and weights for the waste rock alternatives assessment MAA is included in Appendix D, Table D-5.

The MAA is presented in Appendix D, Table D-6 and summarized in this subsection. Results of ranking by assessment score using ECCC (2016) account weighting are:

1) **Alternative 2b:** Segregated, NPAG (unlined) and PAG (engineered source control, lined) – highest score in the environmental account (tied with Alternative 1d), lowest score in the technical account.
   - **Environmental Account:** highest score, tied with Alternative 1d, due to no predicted exceedance of CCME constituent concentrations in seepage during Operations or Closure. For the PAG pile, placement of materials in layers reduces dust generation relative to end-dump waste rock placement.
   - **Technical Account**: lowest score due to the complexity and design effort, number of water management systems required, higher operational complexity due to number of activities, effort required for expansion, optimization or design changes, and number of facilities to close. Would require more maintenance and water management controls for separate facilities. Complies with SERM (2000) draft guideline to place PAG waste on a liner.
   - **Economic Account:** intermediate score, with intermediate capital, operating, and closure cost scores due to requirement of intermediate amounts of liner, engineered layers, and treatment of water captured on liner from PAG facility.
   - **Social Account:** intermediate score due to potential intermediate increase in employment opportunities with two facilities to construct, operate, and close. Intermediate score based on quantity of local materials used. Intermediate score for health risk to people downstream due to intermediate level of engineering controls for water management. Intermediate score for risk to workers due to intermediate levels of noise, dust, and equipment exposure.
2) **Alternative 1d:** Unsegregated, Engineered Source Control (lined) – highest scores in the environmental (tied with Alternative 2b) and social accounts, lowest score in the economic account
   - **Environmental Account:** highest score, tied with Alternative 2b, due to no predicted exceedance of CCME constituent concentrations in seepage during Operations or Closure. Construction of the entire pile in layers would reduce dust generation relative to end-dumped waste rock placement.
   - **Technical Account:** intermediate score due to additional mass required for engineered layers, highest lined area, and effort required to expand a lined facility. Complies with SERM (2000) draft guideline to place PAG waste on a liner.
   - **Economic Account:** lowest score due liner and finer layers, as well as requirement to treat water captured on the liner during Operations.

Social Account: highest score due to least noise, dust and equipment exposure, and largest change in local employment opportunities resulting from specialized labour requirements for liner installation and placement of finer layers.

1) **Alternative 1c:** Unsegregated, Engineered Source Control (unlined) – intermediate scores in all accounts

   - **Environmental Account:** intermediate score with predicted copper concentration exceedance from CCME guidelines during Operations (no liner) and greater surface area of impact resulting from the quantity of borrow material required for engineered source control layers.
   - **Technical Account:** intermediate score. Does not comply with SERM (2000) draft guideline to place PAG waste on a liner.
   - **Economic Account:** intermediate score as no liner is required, only one facility to close, and lower cost score for water treatment post-closure due to use of engineered source control.
   - **Social Account:** intermediate score due to potential health risk to people downstream (no liner) and high local resource consumption for fine-grained layers.

2) **Alternative 1b:** Unsegregated, Base Case (lined) – scored highest in the technical account

   - **Environmental Account:** low score due to predicted exceedance of CCME limits for cobalt concentration during Closure.
   - **Technical Account:** highest score due to ease of design and construction of single (unsegregated) lined facility. Complies with SERM (2000) draft guidelines for liner below PAG waste rock.
   - **Economic Account:** low score due to requirement for liner and for treatment of water captured on liner during Operations and Closure – no engineered layers.
   - **Social Account:** intermediate score due to lack of use of local resources for engineered layers (none), and due to worker safety due to potential exposure to noise, dust, and equipment.

3) **Alternative 2a:** Segregated, NPAG (unlined), PAG (lined) – intermediate scores in all accounts

   - **Environmental Account:** intermediate score with predicted exceedance of CCME limits for cobalt concentration during Closure – no engineered layers.
   - **Technical Account:** intermediate score due to the complexity and design effort, number of water management systems required, higher operational complexity due to number of activities, effort required for expansion, optimization or design changes, and number of facilities to close. Requires more maintenance and water management controls for separate facilities. Complies with SERM (2000) draft guideline to place PAG waste on a liner.
   - **Economic Account:** intermediate score due to lined area for PAG facility and requirement to close two separate facilities.
   - **Social Account:** intermediate score due to greater risk to worker safety and human health by exposure to noise, dust, and equipment with the construction of two separate facilities.

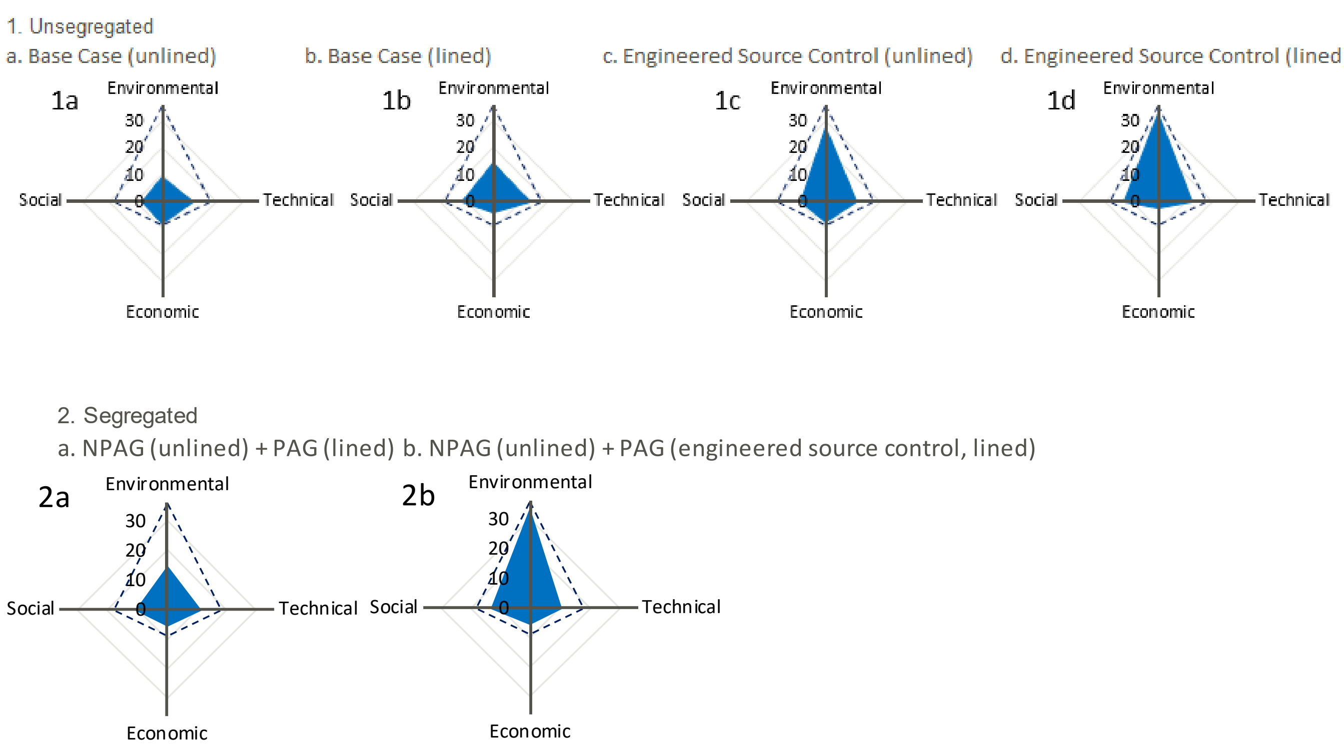
4) **Alternative 1a:** Unsegregated, Base Case (unlined) – highest score in the economic account, lowest score in the environmental and social accounts

   - **Environmental Account:** lowest score due to predicted exceedance of CCME limits for copper concentration during Operations and cobalt during Closure – no liner and no engineered layers.

- **Technical Account:** intermediate score, though does not comply with SERM (2000) draft guideline to place PAG waste rock on a liner.
- **Economic Account:** highest score, with the simplest design and least construction effort – no liner, no engineered layers.
- **Social Account:** lowest score due to least change in employment opportunities resulting from least specialized labour requirement for liner and engineered layer placement, greater risk to worker safety and human health by exposure to noise, dust, and equipment, highest health risk to people downstream due to lack of engineering controls for water management.

Radar charts for the waste rock MAA are included as Figure 21 to illustrate the distribution of scoring within the environmental, technical, economic, and social accounts for each alternative. The maximum score an alternative can achieve in each account is represented by the dashed line. Placement of waste rock on the surface at location A in segregated NPAG (unlined) and PAG (engineered source control, lined) WRSA facilities scored highest based on results of the MAA.

Figure 21: Radar Charts for the Waste Rock Multiple Accounts Analysis Results



NPAG = non-potentially acid generating; PAG = potentially acid generating.

6.3.3 Sensitivity Analysis

A sensitivity analysis was completed using the method described in Section 3.5 to evaluate the effect of bias introduced by weighting, with results presented in Appendix D, Table D-7 and summarized in Table 22. The results of sensitivity analysis indicate that account weighting (introduction of bias) does change the study outcome.

Table 22: Ranking of Waste Rock Alternatives by Different Weighting Schemes

Account Weighting Scheme	Waste Rock Alternative Rank					
	1a	1b	1c	1d	2a	2b
ECCC (2016) (Base Case)	6	4	3	2	5	1
NexGen	6	4	2	3	5	1
Equal	5	4	2	3	6	1
ECCC (2016), Economic = 0	6	4	3	1	5	2

The first ranked alternative was Alternative 2b (segregated, NPAG [unlined] and PAG [lined with engineered source control]) considering account weighting from ECCC (2016), NexGen, and equal weighting. Under ECCC weighting with the economic account weight set to zero, the highest ranked alternative was Alternative 1d (unsegregated, engineered source control, and lined).

The second ranked alternative was Alternative 1d under ECCC weighting, Alternative 1c under NexGen and equal weighting, and Alternative 2b under ECCC weighting with economic weight set to zero.

The third ranked alternative was Alternative 1c under ECCC weighting and ECCC weighting with economic weight set to zero, and Alternative 1d under NexGen and equal weighting.

The fourth ranked alternative was Alternative 1b under all weighting schemes.

The fifth ranked alternative was Alternative 2a under ECCC weighting, NexGen weighting, and ECCC weighting with economic weight set to zero, and Alternative 1a for equal weighting.

The sixth ranked alternative was Alternative 1a under ECCC weighting, NexGen weighting, and ECCC weighting with economic weight set to zero, and Alternative 2a for equal weighting.

7 SUMMARY AND DISCUSSION

This section presents a summary of the mine waste alternatives assessment outcomes, followed by discussion of the influence of study approach, weighting, scoring, and indicator selection, and comparison of study outcomes to practice for mine waste management for uranium mines in Saskatchewan at the time of this study.

Tailings

The tailings alternatives assessment included pre-screening for five general locations followed by screening for ten specific locations, screening for four technologies at four locations (sixteen combinations), and an evaluation of four alternatives (location and technology) by multiple accounts analysis (MAA).

The placement of tailings as cemented paste backfill (CPT) in an underground tailings management facility (UGTMF) was the highest scoring alternative for tailings management. The underground location is outside of known geologic structures and mineralized deposits. The technology has precedent for the controlled deposition of CPT, and placement of the tailings underground complies with the Canadian Nuclear Safety Commission (CNSC 2018) and Global Tailings Review (GTR 2020).

Gypsum

The gypsum alternatives assessment included pre-screening for five general locations, followed by screening for four specific locations, and an evaluation of two alternatives (location and technology) by MAA.

The placement of gypsum with tailings in an UGTMF was the highest scoring alternative. There is a potential for gypsum to reduce requirement for cement in the CPT.

Waste Rock

The waste rock alternatives assessment included pre-screening for five general locations followed by screening for five specific locations by MAA, and an evaluation of six alternatives (location and technology) by MAA.

The highest scoring alternative was the segregation of non-potentially acid generating (NPAG) and potentially acid generating (PAG) waste rock into two facilities, with NPAG waste rock stored in an unlined facility and PAG waste rock stored in a lined facility with additional engineered source control, where waste rock is alternated with low-permeability, fine-grained layers to control water quality.

The location of the waste rock storage area (WRSA) near the mine shaft reduces haul distance and associated dust, cost, and risk to workers. Segregating the NPAG and PAG rock types allows reduction of the liner area and complies with the Saskatchewan Environment and Resource Management (SERM 2000) draft guideline to use an HDPE (high-density polyethylene) liner for PAG stockpiles.

The method used in the waste rock alternatives assessment included description of alternatives by preliminary prediction of water balance and chemistry of seepage that may report to Patterson Lake to allow quantitative evaluation of differences. Prediction of water balance and chemistry is not typically completed for mine waste alternatives assessments; most alternatives assessments describe options at a conceptual level only.

Influence of Study Approach

The study is intended to be comprehensive, to demonstrate that all practical mine waste storage alternatives have been considered and evaluated. Locations were evaluated first because the masses of tailings, gypsum, and waste rock that would be generated by the Rook I Project (Project) must be stored somewhere. The study pre-screened general locations first, then screened by specific locations and technologies, and finally evaluated the resulting alternatives by MAA.

Generally, the results of location pre-screening indicated that storing mine waste within the proposed Project surface lease boundary would limit the area of Project impact. Storing wastes off site would increase the area of Project impact. In-lake storage is fatally flawed due to NexGen’s criterion that no waste should be placed in lakes, which was supported by feedback received during engagement with Indigenous communities, local public, and other stakeholders.

The evaluation of location first, then technology, is a choice and could be approached differently; however, re-ordering the study such that technologies are considered first or in parallel to location is not expected to change the outcome.

Three alternatives assessments were completed in the order of priority, where tailings location was selected first, followed by gypsum, and lastly by waste rock. Alternatives that represent a combination of the three types of mine waste at multiple locations, such as co-disposal of waste rock and tailings and storage of gypsum with waste rock or tailings, were also considered. Re-ordering of the study, such that waste rock or gypsum are considered first or in parallel to tailings, is not expected to change the outcome.

Influence of Weighting, Scoring, and Indicator Selection

The MAA methodology included weighting to purposefully introduce bias based on perceived importance to Indigenous communities, local public, and other stakeholders. Indicator-level weighting changes the influence of indicators relative to other indicators in the same sub-account but does not change the influence of the account or sub-account on the overall score. Similarly, sub-account weighting changes the influence of sub-accounts relative to the other sub-accounts in the same account but does not change the influence of the account on the overall score. The account weights have the largest effect on the study outcome and were varied in sensitivity analyses to evaluate the effect of weighting induced bias. The study has used a consistent approach to weighting (bias) for each mine waste assessment, with similar influence of indicators, sub-accounts, and accounts.

Indicators were selected that were perceived to be both important to Indigenous communities, local public, and other stakeholders, and that differentiate the alternatives. Where possible, indicators were selected that were quantifiable, or measurable, rather than qualitative, requiring interpretation. Where indicators are qualitative, the scoring scale is provided. For both quantitative and qualitative indicators, the alternatives were scored on a scale of 1 to 6, with the end values of 1 and 6 always assigned. The effect of always assigning the end values of 1 and 6 is to increase or magnify the differentiation between alternatives. In some cases (e.g., social account for gypsum alternatives assessment), the relative difference between alternatives is not high, and the scoring scheme increases the apparent difference. The effect was recognized, and was mitigated by indicator, sub-account, and account weighting.

Comparison of Study Outcomes to Current Practices

The industry standard practices for management of uranium mine waste in Saskatchewan at the time of this study are compared to the study outcomes in this subsection.

Uranium tailings management practices in Saskatchewan have changed with time, evolving from surface storage to subaqueous storage in pits, with corresponding reduction in geotechnical and geochemical risk. The highest scoring alternative in the study was storage of tailings in a purpose-built underground facility, with reduced potential to impact the environment and people compared to the recent industry practice of subaqueous storage in pits.

The standard practice for management of gypsum at uranium mines in Saskatchewan was to store the gypsum with the tailings stream. Gypsum alternatives were not typically evaluated separately from tailings. This study evaluated alternatives for storage of gypsum for the Rook I Project including with the tailings, with waste rock, and in purpose-built surface and underground facilities. The highest scoring alternative for storage of gypsum was with the tailings, which was consistent with industry standard or practice. However, the highest alternative also considered storing gypsum underground, which was not typical.

The standard practice for management of waste rock at uranium mines in Saskatchewan was to store PAG and NPAG types separately, with PAG waste on a liner. The highest scoring alternative follows the same method, and also introduces layers of fine-grained material as an additional control on seepage water quality. The alternative with additional controls scored higher than a facility constructed following industry standard practice.

CLOSING

Golder is pleased to submit this report to NexGen in support of the environmental assessment for the Rook I Project. For details on the limitations and use of information presented in this report, please refer to the Study Limitations section following this page. If you have any questions or require additional details related to this study, please contact the undersigned.

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APPENDIX A

Account Ledger

Table A-1: Composite Account Ledger for the Mine Waste Alternatives Assessment

Account	Sub-account	Sub-account Weighting			Indicator	Indicators						
		Tailings	Gypsum	Waste Rock		Tailings			Gypsum		Waste Rock	
		Multiple Accounts Analysis	Multiple Accounts Analysis	Multiple Accounts Analysis		Screening for Specific Location	Screening for Technology	Multiple Accounts Analysis	Screening for Specific Location	Multiple Accounts Analysis	Screening for Specific Location	Multiple Accounts Analysis
Environmental	Ecological Integrity	6	6	6	Surface area of impact.	x	x	x	x		x	
					Surface area of impact, borrow for engineered layers.							x
					Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	x	x	x			x	
					Potential for impact to Patterson Lake during operation.					x		x
					Potential for impact to Patterson Lake during closure.							x
	Hydrologic Regime	1	1	1	Surface water - potential for contact water management.	x	x	x		x	x	
					Surface water - potential for non-contact water management.			x				
					Surface water - potential for impact.				x			
					Groundwater - potential for contact water management.		x				x	
					Groundwater - potential for impact.			x	x			
	Air Quality	1	1	1	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	x	x	x	x	x	x	x
Technical	Design and Reliability	6	3	6	Facility design effort.		x	x	x	x		x
					Proven precedent for technology and configuration.		x		x	x		x
					Compliance with SERM (2000) draft guidelines.							x
					Difference in mass (engineered layers)							x
					Available storage capacity.	x						
	Construction Risk and Complexity	2	1	2	Liner area.							x
					Water management infrastructure (number of systems to be constructed).							x
					Geotechnical stability considering major geologic structures.	x						
					Geotechnical stability considering foundation conditions and waste placement			x	x	x		
	Operational Risk and Complexity	3		3	Operation and maintenance for transport and disposal system.	x	x	x	x		x	x
					Water balance and management during seasonal changes.	x	x	x			x	x
					Potential for progressive facility closure during operation.		x	x	x			x
					Potential for radon mitigation.			x				
					GTR (2020) 3.2 ii requirement of new TSFs to minimise the volume of tailings and water placed in external tailings facilities.		x	x				
	Closure Risk and Complexity	1		1	Ease of decommissioning. Number of facilities.							x
					Ease of decommissioning.		x	x	x			
					Resistance to extreme events (flood and earthquake) and climate change.			x				
	Flexibility	2	1	2	Effort required for expansion, optimization, and design changes.	x		x		x		x
Economic	Capital Cost	4	2	4	Liner procurement and installation.							x
					Facility construction and centralization.	x	x	x	x	x		
					Water treatment plant for surface runoff.			x				
					Paste plant.		x	x				
	Operating Cost	2	1	2	Transport and placement.						x	
					Energy use for transport – diesel (haul).						x	
					Transport and placement of gypsum, including energy, diesel, labor.				x	x		
					Transport and placement of tailings, including energy, diesel, labor.	x	x	x				
					Water use.						x	
					Water treatment.			x				
					Water treatment (capture by lined alternatives).							x
					Engineered layers.							x
					Requirement for tailings binder, flocculant, or other additives.		x	x	x	x		
					Paste plant.		x					
					Excavating and hauling additional waste rock.		x		x			
	Closure Cost	1		1	Facility closure.	x		x	x		x	x
					Water treatment.		x	x				x
Social	Community Impact	1		1	Change in local employment opportunities.		x	x				x
					Visual disturbance for an observer.	x		x	x			
	Change in Land Use	1		1	Local resource consumption as borrow source(s) for construction.	x			x			x
					Potential for loss of access and current land use.			x				
	Population at Risk	1	1	1	Worker safety and human health during construction, operation, and closure.	x	x	x	x	x	x	x
					Health risk to people downstream.							x
					Physical risk to people downstream		x	x				

APPENDIX B

Tailings Alternatives Assessment

Table B-1: Tailings Alternatives Assessment, Pre-screening for General Location

Pre-screening Criteria	**General Locations**				
	Underground	**In-Pit**	**Surface**	**Off-Site**	**In-Lake**
Has required storage capacity	Yes	Yes	Yes	Yes	Yes
No waste in lake (NexGen)	Aligned	Aligned	Aligned	Aligned	Fatally flawed
Area of impact.	Minimal surface disturbance area	Additional surface disturbance area	Additional surface disturbance area	Increase overall surface disturbance area outside proposed Project surface lease boundary	Minimal surface disturbance area
Quantity of waste rock generated	Increase in rock quantity from tailings chambers + access	Greatest increase in rock + overburden quantities	No change	No change	No change
Result	**Pass**	**Pass**	**Pass**	**Eliminated**	**Eliminated**

Note: red text indicates a relative disadvantage

Table B-2: Tailings Alternatives Assessment, Screening for Specific Location

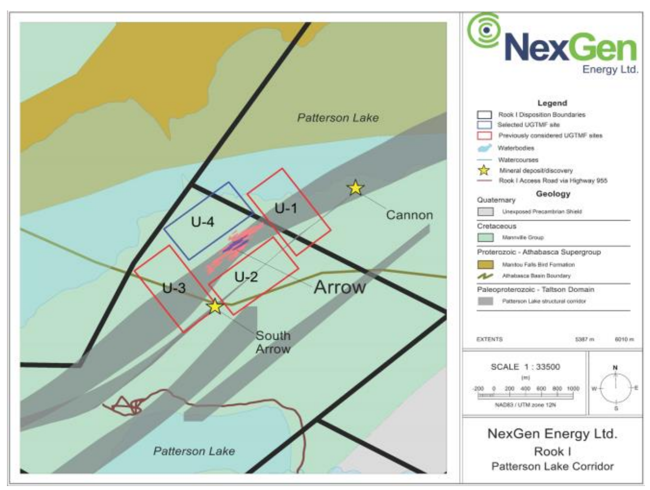
Account	Sub-account	Indicator	Underground Location U-1 vs. U-2 vs. U-3 vs. U-4				In Pit Location P-1 vs. P-2 vs. P-3			Surface Location S-1 vs. S-2 vs. S-3		
			U-1	U-2	U-3	U-4	P-1	P-2	P-3	S-1	S-2	S-3
Environmental	Ecological Integrity	Surface area of impact.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Least area of impact for haulage and infrastructure, shortest transport.	Greatest area of impact for haulage and infrastructure, longest transport.	Some area of impact for haulage and infrastructure, moderate transport.	Least area of impact for haulage and infrastructure, shortest transport.	Greatest area of impact for haulage and infrastructure, longest transport.	Some area of impact for haulage and infrastructure, moderate transport.
		Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Some potential due to distance from Patterson Lake.	Greatest potential due to proximity to Patterson Lake.	Some potential due to distance from Patterson Lake.	Low potential due to distance from Patterson Lake.	Greater potential due to distance to Patterson Lake.	Low potential due to distance from Patterson Lake.
	Hydrologic Regime	Surface water - potential for contact water management.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Some potential due to distance to proposed Project surface lease boundary and infrastructure constraint for runoff management.	Greatest potential due to proximity to Patterson Lake and steep topography.	Some potential due to distance to proposed Project surface lease boundary and infrastructure constraint for runoff management.	Some potential due to distance to proposed Project surface lease boundary and infrastructure constraint for runoff management.	Greatest potential due to proximity to Patterson Lake and steep topography.	Some potential due to distance to proposed Project surface lease boundary and infrastructure constraint for runoff management.
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Least potential to impact air quality due to shortest transport distance.	Greatest potential to impact air quality due to longest transport distance.	Some potential to impact air quality due to transport distance.	Least potential to impact air quality due to shortest transport distance.	Greatest potential to impact air quality due to longest transport distance.	Some potential to impact air quality due to transport distance.

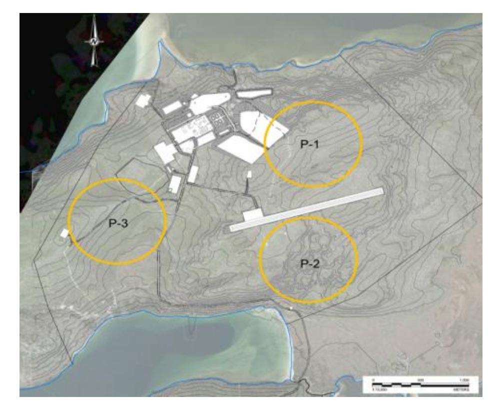
Account	Sub-account	Indicator	Underground U-1 vs. U-2				In Pit P-1 vs. P-2 vs. P-3			Surface S-1 vs. S-2 vs. S-3		
			U-1	U-2	U-3	U-4	P-1	P-2	P-3	S-1	S-2	S-3
Technical	Design and Reliability	Available storage capacity.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Topographic valley restricts storage capacity expansion.	Topographic plateau with small drainages may restrict storage capacity expansion.	Topographic flat area does not restrict storage capacity expansion.	Topographic valley area offers greatest storage capacity advantage.	Topographic plateau with small drainages reduces storage capacity.	Topographic low and flat area with some advantage to storage capacity.
	Construction Risk and Complexity	Geotechnical stability considering major geologic structures.	Located within Patterson Lake structural corridor and along the Athabasca Basin Boundary.	Located along the Athabasca Basin Boundary.	Located within Patterson Lake structural corridor.	No known major geologic structures.	No known major geologic structures.	Located within Patterson Lake structural corridor.	Located within Patterson Lake structural corridor and along the Athabasca Basin Boundary.	No known major geologic structures.	Located within Patterson Lake structural corridor.	Located within Patterson Lake structural corridor and along the Athabasca Basin Boundary.
	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Shortest transport distance to operate and maintain.	Longest transport distance to operate and maintain.	Medium transport distance to operate and maintain.	Shortest transport distance to operate and maintain.	Longest transport distance to operate and maintain.	Medium transport distance to operate and maintain.
		Water balance and management during seasonal changes.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Requires management of runoff from surrounding area.	No additional facility runoff management required.	Requires management of runoff from surrounding area.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.
	Flexibility	Effort required for expansion, optimization, and design changes.	Located between Arrow and Cannon deposit/discovery, potential impact to future expansion.	Located adjacent to South Arrow deposit/discovery, potential impact to future expansion.	Located adjacent to South Arrow deposit/discovery, potential impact to future expansion.	No impact to future expansion.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Greatest effort due to constraints of proposed Project surface lease boundary (east), airstrip (south), mine (west).	Some effort due to constraints of airstrip (north), Lake Patterson (south), proposed Project surface lease boundary (east).	Some effort due to constraints of mine (north) and access (east).

Account	Sub-account	Indicator	Underground U-1 vs. U-2				In Pit P-1 vs. P-2 vs. P-3			Surface S-1 vs. S-2 vs. S-3		
			U-1	U-2	U-3	U-4	P-1	P-2	P-3	S-1	S-2	S-3
Economic	Capital Cost	Facility construction and centralization.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Lowest cost due to centralized infrastructure (e.g., haulage, access, utility corridor).	Highest cost due to least centralized infrastructure (e.g., haulage, access, utility corridor).	Intermediate cost due to some centralized infrastructure (e.g., haulage, access, utility corridor).	Lowest cost due to centralized infrastructure (e.g., haulage, access, utility corridor).	Highest cost due to least centralized infrastructure (e.g., haulage, access, utility corridor).	Intermediate cost due to some centralized infrastructure (e.g., haulage, access, utility corridor).
	Operating Cost	Transport and placement of tailings, including energy, diesel, labor.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Lowest cost due to shortest transport distance with increase in elevation.	Highest cost due to longest transport distance.	Intermediate cost due to transport distance with limited elevation change.	Lowest cost due to shortest transport distance with increase in elevation.	Highest cost due to longest transport distance.	Intermediate cost due to transport distance with limited elevation change.
	Closure Cost	Facility closure.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Lowest cost due to most compact footprint area (e.g., haulage, access, utility corridor).	Highest cost due to least compact footprint area for infrastructure (e.g., haulage, access, utility corridor).	Intermediate cost due to footprint area (e.g., haulage, access, utility corridor).	Lowest cost due to most compact footprint area (e.g., haulage, access, utility corridor).	Highest cost due to least compact footprint area for infrastructure (e.g., haulage, access, utility corridor).	Intermediate cost due to footprint area (e.g., haulage, access, utility corridor).

Account	Sub-account	Indicator	Underground U-1 vs. U-2				In Pit P-1 vs. P-2 vs. P-3			Surface S-1 vs. S-2 vs. S-3		
			U-1	U-2	U-3	U-4	P-1	P-2	P-3	S-1	S-2	S-3
Social	Community Impact	Visual disturbance for an observer.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Least disturbance due to topographic low area with greatest natural containment.	Greatest visibility due to topographic plateau.	Some disturbance due to relatively flat area with some natural containment.	Least disturbance due to topographic low area with greatest natural containment.	Greatest visibility due to topographic plateau.	Some disturbance due to relatively flat area with some natural containment.
	Change in Land Use	Local resource consumption as borrow source(s) for construction.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Least consumption due to greatest natural topographic containment.	Greatest consumption due to topographic plateau, lack of natural containment.	Some consumption due to natural topographic containment.
	Population at Risk	Worker safety and human health during construction, operation, and closure.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Indicator not differentiating.	Lowest risk due to shortest transport and haul distance.	Highest risk due to longest transport and haul distance.	Intermediate.	Lowest risk due to shortest transport and haul distance.	Highest risk due to longest transport and haul distance.	Intermediate.
		Result	**Eliminated**	**Eliminated**	**Eliminated**	**Pass**	**Eliminated**	**Eliminated**	**Pass**	**Pass**	**Eliminated**	**Pass**

Note: red text indicates a relative disadvantage.





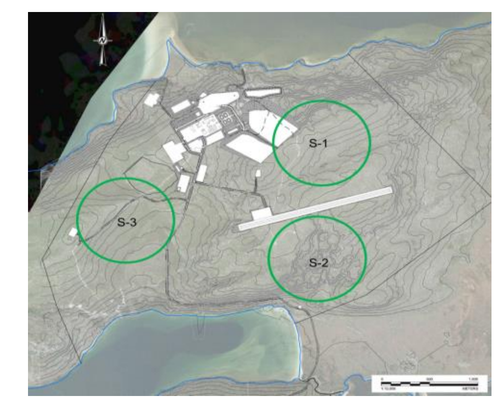


Table B-3: Tailings Alternatives Assessment, Screening for Technology at Underground Location U-4

Account	Sub-account	Indicator	Underground Location U-4			
			Co-disposal	Filtered	Paste	Slurry
Environmental	Ecological Integrity	Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	Fatally flawed due to volume incompatibility; excavation of underground chambers required to store tailings and waste rock generates more excavated rock to store underground.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement; unconsolidated filtered tailings may have a higher hydraulic conductivity and can swell on saturation, potentially impacting the geochemical stability of the TMF.	Least potential due to controlled deposition.	Greatest potential due to water management requirements, hydraulic conductivity of tailings and potential for opening of voids due to consolidation.

Account	Sub-account	Indicator	Underground Location U-4			
			Co-disposal	Filtered	Paste	Slurry
Technical	Design and Reliability	Proven precedent for technology and configuration.	Fatally flawed due to volume incompatibility; excavation of underground chambers required to store tailings and waste rock generates more excavated rock to store underground.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.	Proven precedent.	Limited application. Tailings consolidation and consistency are uncontrolled. Requires cemented cap or plug to keep tailings in place after decommissioning.

Account	Sub-account	Indicator	Underground Location U-4			
			Co-disposal	Filtered	Paste	Slurry
Economic	Capital Cost	Facility construction and centralization.	Fatally flawed due to volume incompatibility; excavation of underground chambers required to store tailings and waste rock generates more excavated rock to store underground.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.	Lower cost, excavation for tailings + binder.	Higher cost, excavation for tailings + water and water management.
		Paste plant.			Highest cost.	Not required.
	Operating Cost	Transport and placement of tailings, including energy, diesel, labor.			Cost of pump transport.	Cost of water return system.
		Requirement for tailings binder, flocculant, or other additives.			Highest cost.	Not required.
		Excavating and hauling additional waste rock.			Cost to haul waste rock to surface, excavation for tailings + binder.	Cost to haul waste rock to surface, excavation for tailings + water.

Account	Sub-account	Indicator	Underground Location U-4			
			Co-disposal	Filtered	Paste	Slurry
Social	Population at Risk	Worker safety and human health during construction, operation, and closure.	Fatally flawed due to volume incompatibility; excavation of underground chambers required to store tailings and waste rock generates more excavated rock to store underground.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.	Lower risk for paste plant operation, requiring less excavation and water management.	Higher risk due to requirements for water management system construction and operation, and greater quantity of waste rock to transport.
		Result	**Eliminated**	**Eliminated**	**Pass**	**Eliminated**

Note: red text indicates a relative disadvantage.

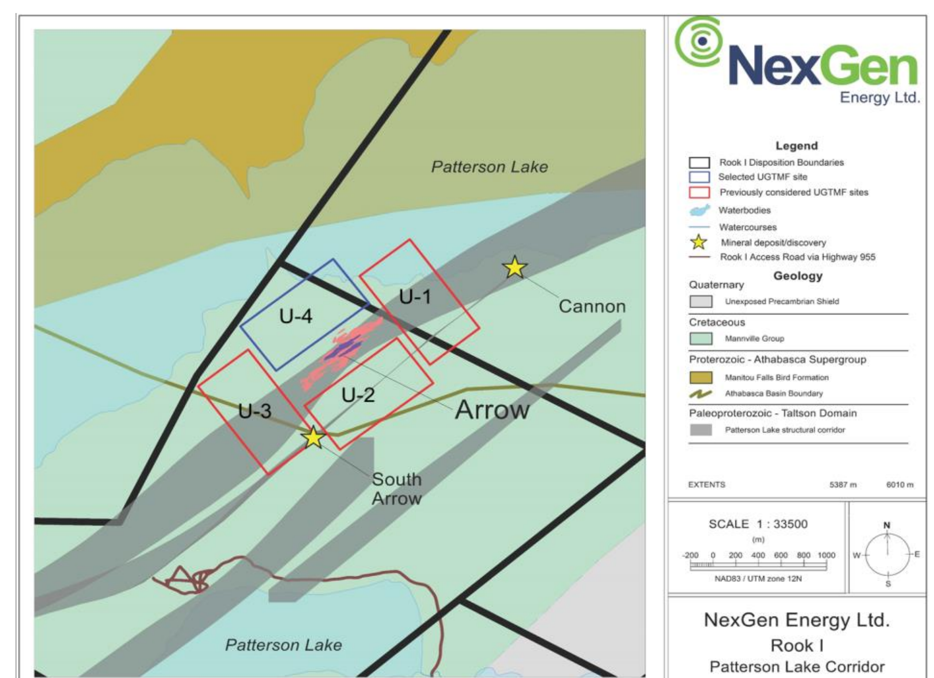


Table B-4: Tailings Alternatives Assessment, Screening for Technology at In Pit Location P-3

Account	Sub-account	Indicator	In Pit Location P-3			
			Co-disposal	Filtered	Paste	Slurry
Environmental	Ecological Integrity	Surface area of impact.	Fatally flawed due to volume incompatibility - excavation of a pit generates more excavated overburden and rock to store in-pit.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement; unconsolidated filtered tailings have a higher hydraulic conductivity and can swell once saturated, potentially impacting the geochemical stability of the TMF.	Least area of impact.	Greatest area of impact due to increased overburden and waste rock excavation.
	Hydrologic Regime	Surface water – potential for contact water management.			Least potential due to less quantity of excavation.	Greatest potential due to increased overburden and waste rock excavation to store lower tailings density and pond.
		Groundwater – potential for contact water management.			Least potential due to lack of pond.	Greater potential due to pond.
	Air Quality	Potential for excessive emissions of fugitive dust (e.g., particulates, heavy metals) and other non-GHG emissions during construction and operation.			Greater potential due to quantity of overburden and waste rock excavation (tailings + binder) and absence of supernatant pond.	Some potential due to quantity of overburden and waste rock excavation (tailings + water).

Account	Sub-account	Indicator	In Pit Location P-3			
			Co-disposal	Filtered	Paste	Slurry
Technical	Design and Reliability	Facility design effort.	Fatally flawed due to volume incompatibility - excavation of a pit generates more excavated overburden and rock to store in-pit.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement; unconsolidated filtered tailings have a higher hydraulic conductivity and can swell once saturated, potentially impacting the geochemical stability of the TMF.	Some effort (pit + tailings dewatering and transport + delivery).	Some effort (pit + tailings transport + greater capacity water reclaim system).
		Proven precedent for technology and configuration.			No.	Yes; technology applied at other uranium mines.
	Operation Risk and Complexity	Operation and maintenance for transport and disposal system.			Less maintenance (paste plant, pump + pipe, access road, least overburden and waste rock quantity).	More maintenance (pump + pipe, access road, water reclaim, greatest overburden and waste rock quantity).
		Water balance and management during seasonal changes.			Lower management effort	Greater management effort for subaqueous disposal pond management.
	Closure Risk and Complexity	Ease of decommissioning.			Complicated by ice lenses.	Complicated due to time required for consolidation.

Account	Sub-account	Indicator	In Pit Location P-3			
			Co-disposal	Filtered	Paste	Slurry
Economic	Capital Cost	Facility construction.	Fatally flawed due to volume incompatibility - excavation of a pit generates more excavated overburden and rock to store in-pit.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement; unconsolidated filtered tailings have a higher hydraulic conductivity and can swell once saturated, potentially impacting the geochemical stability of the TMF.	Lowest cost due to smaller excavation.	Highest cost due to larger excavation, water reclaim system.
		Paste plant.			Highest cost.	Not required.
	Operating Cost	Transport and placement of tailings, waste rock, including energy, diesel, labor.			Costs for pump + pipe, access road systems.	Cost for pump + pipe, access road, water reclaim systems.
		Paste plant.			Highest cost.	Not required.

Account	Sub-account	Indicator	In Pit Location P-3			
			Co-disposal	Filtered	Paste	Slurry
Social	Community Impact	Change in local employment opportunities.	Fatally flawed due to volume incompatibility - excavation of a pit generates more excavated overburden and rock to store in-pit.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement; unconsolidated filtered tailings have a higher hydraulic conductivity and can swell once saturated, potentially impacting the geochemical stability of the TMF.	Some jobs for pipeline transport, paste plant (specialized).	Least jobs for pipeline transport, water reclaim system.
	Population at Risk	Worker safety and human health during construction, operation, and closure.			Higher risk because of lack of gamma shielding by supernatant pond (no pond), dust exposure.	Lower risk because subaqueous deposition provides shielding from gamma radiation, dust exposure.
		Result	**Eliminated**	**Eliminated**	**Eliminated**	**Pass**

Note: red text indicates a relative disadvantage.

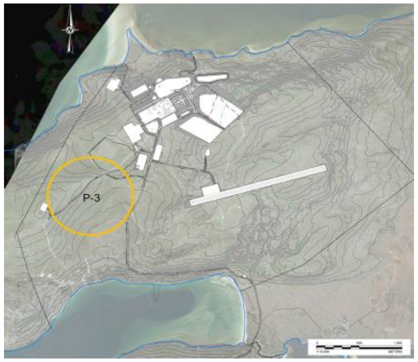


Table B-5: Tailings Alternatives Assessment, Screening for Technology at Surface Location S-1 or S-3

Account	Sub-account	Indicator	Surface Location S-1 or S-3			
			Co-disposal	Filtered	Paste	Slurry
Environmental	Hydrologic Regime	Surface water – potential for contact water management.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.		Some potential.	Greatest potential due to pond on surface.
		Groundwater – potential for contact water management.			Some potential.	Greatest potential for seepage.

Account	Sub-account	Indicator	Surface Location S-1 or S-3			
			Co-disposal	Filtered	Paste	Slurry
Technical	Design and Reliability	Facility design effort.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.		Some effort (embankment(s) + tailings + paste plant + delivery).	Some effort (embankment(s) + tailings + dewatering + greater water reclaim + delivery.
	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.			Least maintenance (pump + pipe, access road).	Greatest maintenance (pump + pipe, access road, greater water reclaim).
		Water balance and management during seasonal changes.			Some water management due to high water content with potential formation of ice lenses; freeze/thaw.	Greatest requirement for water management (pond); freeze/thaw.
		Potential for progressive facility closure during operation.			Low potential for progressive facility closure.	Least potential for progressive facility closure.
		GTR (2020) 3.2 ii requirement of new TSFs to minimize the volume of tailings and water placed in external tailings facilities.			Some reduction in water stored on surface, operated with no large pond.	Greatest volume of water on surface (pond); geohazard.
	Closure Risk and Complexity	Ease of decommissioning.			Complicated by ice lenses.	Complicated due to draindown and consolidation.

Account	Sub-account	Indicator	Surface Location S-1 or S-3			
			Co-disposal	Filtered	Paste	Slurry
Economic	Capital Cost	Facility construction and centralization.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.		Lowest cost.	Highest cost due to increase in excavation size, water management.
		Paste plant.			Highest cost.	Not required.
	Operating Cost	Transport and placement of tailings, including energy, diesel, labor.			Cost of pump transport.	Cost of water return system.
		Paste plant.			Highest cost.	Not required.
	Closure Cost	Water treatment.			Lowest cost.	Highest cost due to water management, time for drainage and consolidation of tailings.

Account	Sub-account	Indicator	Surface Location S-1 or S-3			
			Co-disposal	Filtered	Paste	Slurry
Social	Community Impact	Change in local employment opportunities.	Fatally flawed due to potential worker exposure to gamma radiation through contact with the tailings and dust ingestion during transport and placement.		Some jobs for embankment construction, pipeline transport, paste plant (specialized).	Least jobs for embankment construction, pipeline transport, water reclaim system.
	Population at Risk	Physical risk to people downstream.			Lowest risk due to lack of water retained on tailings surface.	Highest risk due to water maintained on tailings surface (pond); geohazard.
		Worker safety and human health during construction, operation, and closure.			Higher risk because of lack of gamma shielding by supernatant pond (no pond), dust exposure.	Lower risk because subaqueous deposition provides shielding from gamma radiation, dust exposure.
		Result	**Eliminated**	**Eliminated**	**Pass**	**Eliminated**

Note: red text indicates a relative disadvantage.

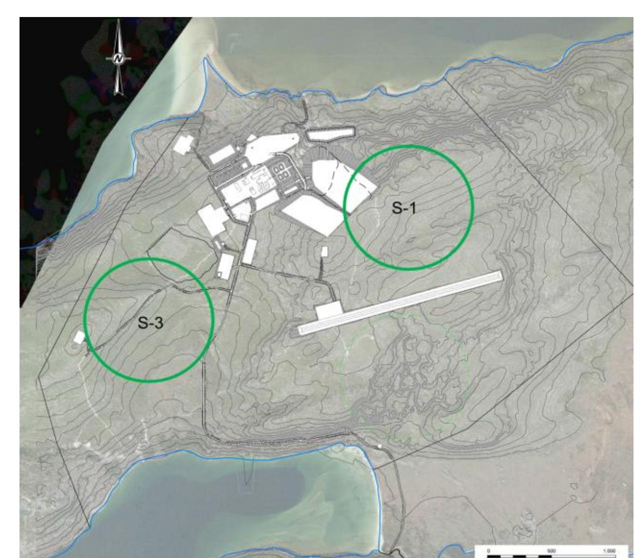


Table B-6: Tailings Alternatives Assessment, Multiple Accounts Analysis Sub-account and Indicator Weighting Summary

Account	Sub-account	Sub-account Weight (Ws)	Indicator	Indicator Weight (Wi)
Environmental	Ecological Integrity	6	Surface area of impact.	1
			Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	1
	Hydrologic Regime	1	Surface water - potential for contact water management.	3
			Surface water - potential for non-contact water management.	1
			Groundwater - potential for impact.	1
	Air Quality	1	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	1
Technical	Design and Reliability	6	Facility design effort.	1
	Construction Risk and Complexity	2	Geotechnical stability considering foundation conditions and waste placement.	1
	Operational Risk and Complexity	3	Operation and maintenance for transport and disposal system.	3
			Water balance and management during seasonal changes.	1
			Potential for progressive facility closure during operation.	1
			Potential for radon mitigation.	1
			GTR (2020) 3.2 ii requirement of new tailings facilities to minimise the volume of tailings and water placed in external tailings facilities.	6
	Closure Risk and Complexity	1	Ease of decommissioning.	1
			Resistance to extreme natural events (flood, earthquake) and climate change.	1
	Flexibility	2	Effort required for expansion, optimization, and design changes.	1
Economic	Capital Cost	4	Facility construction and centralization.	1
			Water treatment plant for surface runoff.	1
			Paste plant.	1
	Operating Cost	2	Transport and placement of tailings, including energy, diesel, labor.	1
			Requirement for tailings binder, flocculant, or other additives.	1
			Water treatment.	1
	Closure Cost	1	Facility closure.	1
			Water treatment.	3
Social	Community Impact	1	Visual disturbance for an observer.	1
			Change in local employment opportunities.	1
	Change in Land Use	1	Potential for loss of access and current land use.	1
	Population at Risk	1	Physical risk to people downstream.	1
			Worker safety and human health during construction, operation, and closure.	1

Table B-7: Tailings Alternatives Assessment, Multiple Accounts Analysis

Account	Sub-account	Indicator	Description	Indicator Measurement	Unit	Indicator Quantity				Indicator Value (S)				Indicator Weight (Wi)	Indicator Merit Score (S*Wi)				Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)				
						Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	
Environmental	Ecological Integrity	Surface area of impact.	Measured as the 2D surface area of the tailings facility (not including waste rock or stripping), with the lowest surface area preferred for lowest potential impact.	Area	ha	0.0	92.2	58.2	33.7	6.0	1.0	2.8	4.2	1	6.0	1.0	2.8	4.2	6	36.0	6.0	14.1	17.2	
		Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	Measured as distance from tailings facility centroid to Patterson Lake, with the longest distance preferred for lowest potential impact.	Distance	km	0.2	1.0	0.9	0.9	6.0	1.0	1.9	1.6	1	6.0	1.0	1.9	1.6						
														Total indicator merit score (Σ{S × Wi})	12.0	2.0	4.7	5.7						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0	2.4	2.9						
	Hydrologic Regime	Surface water - potential for contact water management.	*see below	Value	#	-	-	-	-	6.0	3.0	1.0	5.0	3	18.0	9.0	3.0	15.0	1	6.0	2.2	1.4	4.6	
		Surface water - potential for non-contact water management.	Measured as the 2D surface area of the TMF, with the lowest surface area preferred for diverting non-contact water.	Area	ha	0.0	92.2	58.2	33.7	6.0	1.0	2.8	4.2	1	6.0	1.0	2.8	4.2						
		Groundwater - potential for impact.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	4.0	1	6.0	1.0	1.0	4.0						
														Total indicator merit score (Σ{S × Wi})	30.0	11.0	6.8	23.2						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	2.2	1.4	4.6						
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	Measured as the highest amount of material hauled to surface.	Volume	M m^3	11.3	3.2	3.5	12.8	1.8	6.0	5.8	1.0	1	1.8	6.0	5.8	1.0	1	1.8	6.0	5.8	1.0	
														Total indicator merit score (Σ{S × Wi})	1.8	6.0	5.8	1.0		**43.8**	**14.2**	**21.3**	**22.9**	**Total sub-account merit score (Σ{Rs × Ws})**
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.8	6.0	5.8	1.0		**5.5**	**1.8**	**2.7**	**2.9**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Surface water - potential for contact water management.	6 (Best)	Underground - no potential surface contact water management for tailings; excavated waste rock to be placed in WRSA and use existing controls
	5	In Pit - limited potential due to greatest toe setback from proposed Project surface lease boundary, infrastructure, wetland, and Patterson Lake, and shallow gradient beyond toe.
	4	
	3	Surface, S-1 is farther from Patterson Lake, allows more area for water management than S-3
	2	
	1 (Worst)	Tailings on surface, greatest potential due to proximity to proposed Project surface lease boundary, infrastructure, wetland and Patterson Lake, and steep gradient beyond toe.
Groundwater - potential for impact.	6 (Best)	Underground - least potential for seepage to impact groundwater (cemented).
	5	
	4	
	3	
	2	
	1 (Worst)	Surface - greatest potential for seepage to impact groundwater.

Account	Sub-account	Indicator	Description	Indicator Measurement	Unit	Indicator Quantity				Indicator Value (S)				Indicator Weight (Wi)	Indicator Merit Score (S*Wi)				Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)				
						Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	
Technical	Design and Reliability	Facility design effort.	*see below	Value	#	-	-	-	-	3.0	6.0	6.0	1.0	1	3.0	6.0	6.0	1.0	6	18.0	36.0	36.0	6.0	
														Total indicator merit score (Σ{S × Wi})	3.0	6.0	6.0	1.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	3.0	6.0	6.0	1.0						
	Construction Risk and Complexity	Geotechnical stability considering foundation conditions and waste placement.	Measured as the quantity of earthworks, with the lowest quantity preferred.	Volume	M m^3	11.3	3.2	3.5	12.8	1.8	6.0	5.8	1.0	1	1.8	6.0	5.8	1.0	2	3.6	12.0	11.6	2.0	
														Total indicator merit score (Σ{S × Wi})	1.8	6.0	5.8	1.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.8	6.0	5.8	1.0						
	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.	Measured as distance from shaft to tailings facility centroid, with the shortest distance preferred.	Distance	km	0.8	1.5	1.8	1.9	6.0	2.9	1.2	1.0	3	18.0	8.8	3.7	3.0	3	17.5	5.2	4.4	11.0	
		Water balance and management during seasonal changes.	Measured as the area of the tailings facility on surface, with the lowest surface area preferred (generates less tailings contact water from precipitation).	Area	ha	0	92.2	58.2	33.7	6.0	1.0	2.8	4.2	1	6.0	1.0	2.8	4.2						
		Potential for progressive facility closure during operation.	*see below	Value	#	-	-	-	-	6.0	4.0	4.0	1.0	1	6.0	4.0	4.0	1.0						
		Potential for radon mitigation.	*see below	Value	#	-	-	-	-	4.0	1.0	1.0	6.0	1	4.0	1.0	1.0	6.0						
		GTR (2020) 3.2 ii requirement of new tailings facilities to minimise the volume of tailings and water placed in external tailings facilities.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	5.0	6	36.0	6.0	6.0	30.0						
														Total indicator merit score (Σ{S × Wi})	70.0	20.8	17.6	44.2						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	5.8	1.7	1.5	3.7						
	Closure Risk and Complexity	Ease of decommissioning.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	3.0	1	6.0	1.0	1.0	3.0	1	6	1	1	3	
		Resistance to extreme natural events (flood, earthquake) and climate change.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	3.0	1	6.0	1.0	1.0	3.0						
														Total indicator merit score (Σ{S × Wi})	6.0	1.0	1.0	3.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0	1.0	3.0						
	Flexibility	Effort required for expansion, optimization, and design changes.	*see below	Value	#	-	-	-		6.0	3.0	4.0	1.0	1	6.0	3.0	4.0	1.0	2	12	6	8	2	
														Total indicator merit score (Σ{S × Wi})	6.0	3.0	4.0	1.0		**57.1**	**60.2**	**61.0**	**24.0**	**Total sub-account merit score (Σ{Rs × Ws})**
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.0	4.0	1.0		**4.1**	**4.3**	**4.4**	**1.7**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Facility design effort.	6 (Best)	Surface - least design effort; dam design, paste plant, tailings transport, water management
	5	
	4	
	3	Underground - blasting and waste rock excavation + haul, paste plant, water return
	2	
	1 (Worst)	In Pit - greatest effort; blasting, pit wall stability, filters, tailings transport, water management
Potential for progressive facility closure during operation.	6 (Best)	Underground - greatest potential for progressive closure
	5	
	4	Surface - some potential for progressive closure
	3	
	2	
	1 (Worst)	In Pit - least potential for progressive closure
Potential for radon mitigation.	6 (Best)	In Pit - least potential due to water cover over tailings
	5	
	4	Underground - high potential to mitigation using mine ventilation system
	3	
	2	
	1 (Worst)	Surface - highest potential with no pond on surface paste alternative
GTR (2020) 3.2 ii requirement of new tailings facilities to minimise the volume of tailings and water placed in external tailings facilities.	6 (Best)	Underground - no tailings or water stored on surface
	5	In Pit - low potential for tailings or pond release
	4	
	3	
	2	
	1 (Worst)	Surface - tailings stored on surface
Ease of decommissioning.	6 (Best)	Underground - simplest to decommission
	5	
	4	
	3	In Pit - must consider dewatering pond, tailings consolidation, cover placement
	2	
	1 (Worst)	Surface - decommissioning complicated by ice lenses, tailings consolidation, cover placement
Resistance to extreme natural events (flood, earthquake) and climate change.	6 (Best)	Underground - resistant to extreme events and climate change
	5	
	4	
	3	In Pit - some resistance to extreme events and climate change
	2	
	1 (Worst)	Surface - least resistant to extreme events and climate change
Effort required for expansion, optimization, and design changes.	6 (Best)	Underground - least effort due modular design expanded by additional chamber excavation
	5	
	4	Surface, S-3 - requires only additional cell or raise
	3	Surface, S-1 - additional raise
	2	
	1 (Worst)	In Pit - most effort to expand, excavation required

Account	Sub-account	Indicator	Description	Indicator Measurement	Unit	Indicator Quantity				Indicator Value (S)				Indicator Weight (Wi)	Indicator Merit Score (S*Wi)				Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)				
						Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	
Economic	Capital Cost	Facility construction and centralization.	Earthworks (not considering staging).	Volume	M m^3	11.3	3.2	3.5	12.8	1.8	6.0	5.8	1.0	4	7.3	24.0	23.3	4.0	4	9.5	17.3	16.9	7.3	
		Water treatment plant for surface runoff.	Water treatment plant required for surface tailings contact water.	Count	No.	0.0	1.0	1.0	1.0	6.0	1.0	1.0	1.0	1	6.0	1.0	1.0	1.0						
		Paste plant.	Paste plant required.	Count	No.	1.0	1.0	1.0	0.0	1.0	1.0	1.0	6.0	1	1.0	1.0	1.0	6.0						
														Total indicator merit score (Σ{S × Wi})	14.3	26.0	25.3	11.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	2.4	4.3	4.2	1.8						
	Operating Cost	Transport and placement of tailings, including energy, diesel, labor.	Measured as distance from shaft to TMF centroid, with the shortest distance preferred for lowest cost.	Distance	km	0.8	1.5	1.8	1.9	6.0	2.9	1.2	1.0	1	6.0	2.9	1.2	1.0	2	8.7	5.3	4.2	5.3	
		Requirement for tailings binder, flocculant, or other additives.	*see below	Value	#					1.0	4.0	4.0	6.0	1	1.0	4.0	4.0	6.0						
		Water treatment.	Water treatment plant required for surface tailings contact water.	Count	No.	0.0	1.0	1.0	1.0	6.0	1.0	1.0	1.0	1	6.0	1.0	1.0	1.0						
														Total indicator merit score (Σ{S × Wi})	13.0	7.9	6.2	8.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	4.3	2.6	2.1	2.7						
	Closure Cost	Facility closure.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	4.0	1	6.0	1.0	1.0	4.0	1	6.0	1.0	1.0	4.0	
		Water treatment.	*see below	Value	#	-	-	-	-	6.0	1.0	1.0	4.0	3	18.0	3.0	3.0	12.0						
														Total indicator merit score (Σ{S × Wi})	24.0	4.0	4.0	16.0		**24.2**	**23.6**	**22.0**	**16.7**	**Total sub-account merit score (Σ{Rs × Ws})**
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0	1.0	4.0		**3.5**	**3.4**	**3.1**	**2.4**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Requirement for tailings binder, flocculant, or other additives.	6 (Best)	In Pit - no cement or flocculant required
	5	
	4	Surface - flocculant required for paste
	3	
	2	
	1 (Worst)	Underground - cement and flocculant required
Facility closure.	6 (Best)	Underground - lowest cost to decommission
	5	
	4	In Pit - must consider dewatering pond, tailings consolidation, cover placement
	3	
	2	
	1 (Worst)	Surface - highest cost due to consideration of thaw of ice lenses, tailings consolidation, cover placement
Water treatment.	6 (Best)	Underground - lowest cost because tailings contact water limited to groundwater flow through cemented mass
	5	
	4	In Pit - some water treatment required
	3	
	2	
	1 (Worst)	Surface - highest cost due to water treatment

Account	Sub-account	Indicator	Description	Indicator Measurement	Unit	Indicator Quantity				Indicator Value (S)				Indicator Weight (Wi)	Indicator Merit Score (S*Wi)				Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)				
						Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	
Social	Community Impact	Visual disturbance for an observer.	Measured as the 2D surface area of the TMF, with the lowest surface area preferred for lowest visual impact.	Area	ha	0.0	92.2	58.2	33.7	6.0	1.0	2.8	4.2	1	6.0	1.0	2.8	4.2	1	5.0	1.0	1.9	5.1	
		Change in local employment opportunities.	*see below	Value	#	-	-	-	-	4.0	1.0	1.0	6.0	1	4.0	1.0	1.0	6.0						
														Total indicator merit score (Σ{S × Wi})	10.0	2.0	3.8	10.2						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	5.0	1.0	1.9	5.1						
	Change in Land Use	Potential for loss of access and current land use.	*see below	Value	#	-	-	-	-	6.0	3.0	3.0	1.0	1	6.0	3.0	3.0	1.0	1	6.0	3.0	3.0	1.0	
														Total indicator merit score (Σ{S × Wi})	6.0	3.0	3.0	1.0						
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.0	3.0	1.0						
	Population at Risk	Physical risk to people downstream.	*see below	Value	#	-	-	-	-	6.0	1.0	2.0	6.0	1	6.0	1.0	2.0	6.0	1	4.6	3.5	3.9	3.5	
		Worker safety and human health during construction, operation, and closure.	Measured as the quantity of earthworks, with the lowest quantity preferred.	Volume	M m3	8.4	3.2	3.5	12.8	3.3	6.0	5.8	1.0	1	3.3	6.0	5.8	1.0						
														Total indicator merit score (Σ{S × Wi})	9.3	7.0	7.8	7.0		**15.6**	**7.5**	**8.8**	**9.6**	**Total sub-account merit score (Σ{Rs × Ws})**
														Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	4.6	3.5	3.9	3.5		**5.2**	**2.5**	**2.9**	**3.2**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Change in local employment opportunities.	6 (Best)	In Pit - greatest increase in employment opportunities due to pit excavation during construction period, water management
	5	
	4	Underground - chamber excavation during mine life, paste plant operation
	3	
	2	
	1 (Worst)	Surface paste - least change in employment opportunities - required for dam construction (may be staged) and paste plant operation
Potential for loss of access and current land use.	6 (Best)	Underground - least potential for surface disruption
	5	
	4	
	3	Surface - moderate potential for long-term disruption of current land use
	2	
	1 (Worst)	In-Pit - greatest potential for long-term disruption of current land use
Physical risk to people downstream.	6 (Best)	Lowest risk for underground and in-pit
	5	
	4	
	3	
	2	Some risk for Surface, S-3 due to potential consequence of failure and runout
	1 (Worst)	Highest risk for Surface, S-1 due to potential consequence of failure and runout

ECCC Weighting

Account	Account Weight (W_a)	Account Merit Rating (R_a)				Account Merit Score (R_s*W_1)				
		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	
Environmental	6	5.5	1.8	2.7	2.9	32.9	10.7	16.0	17.1	
Technical	3	4.1	4.3	4.4	1.7	12.2	12.9	13.1	5.2	
Economic	1.5	3.5	3.4	3.1	2.4	5.2	5.1	4.7	3.6	
Social	3	5.2	2.5	2.9	3.2	15.6	7.5	8.8	9.6	
	13.5					**65.9**	**36.1**	**42.6**	**35.5**	**Total account merit score (Σ{Ra × Wa})**
						4.9	**2.7**	**3.2**	**2.6**	**Alternative merit rating (A = Σ{Ra×Wa}/ ΣWa)**
						1	**3**	**2**	**4**	**Rank**

Table B-8: Tailings Alternatives Assessment, Multiple Accounts Analysis Sensitivity

ECCC Weighting

Account	Weight	Account Merit Weighting				Account Merit Score			
		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry
Environmental	6	5.5	1.8	2.7	2.9	32.9	10.7	16.0	17.1
Technical	3	4.1	4.3	4.4	1.7	12.2	12.9	13.1	5.2
Economic	1.5	3.5	3.4	3.1	2.4	5.2	5.1	4.7	3.6
Social	3	5.2	2.5	2.9	3.2	15.6	7.5	8.8	9.6
	13.5				Total Account Merit Score	65.9	36.1	42.6	35.5
					Account Merit Rating	4.9	2.7	3.2	2.6
					Rank	**1**	**3**	**2**	**4**

NexGen Weighting

Account	Weight	Account Merit Rating				Account Merit Score			
		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry
Environmental	4.1	5.5	1.8	2.7	2.9	22.2	7.2	10.8	11.6
Technical	2.0	4.1	4.3	4.4	1.7	8.3	8.7	8.8	3.5
Economic	3.4	3.5	3.4	3.1	2.4	11.7	11.4	10.6	8.0
Social	4.1	5.2	2.5	2.9	3.2	21.1	10.1	11.9	12.9
	13.5				Total Account Merit Score	63.2	37.4	42.2	36.0
					Account Merit Rating	4.7	2.8	3.1	2.7
					Rank	**1**	**3**	**2**	**4**

Equal Weighting

Account	Weight	Account Merit Rating				Account Merit Score			
		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry
Environmental	3.4	5.5	1.8	2.7	2.9	18.5	6.0	9.0	9.6
Technical	3.4	4.1	4.3	4.4	1.7	13.8	14.5	14.7	5.8
Economic	3.4	3.5	3.4	3.1	2.4	11.7	11.4	10.6	8.0
Social	3.4	5.2	2.5	2.9	3.2	17.6	8.4	9.9	10.8
	13.5				Total Account Merit Score	61.5	40.3	44.3	34.3
					Account Merit Rating	4.6	3.0	3.3	2.5
					Rank	**1**	**3**	**2**	**4**

ECCC Weighting with Economic = 0

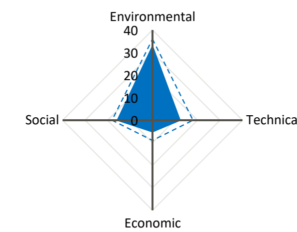
Account	Weight	Account Merit Rating				Account Merit Score			
		Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry	Underground Location U-4 Paste	Surface Location S-1 Paste	Surface Location S-3 Paste	In Pit Location P-3 Slurry
Environmental	6	5.5	1.8	2.7	2.9	32.9	10.7	16.0	17.1
Technical	3	4.1	4.3	4.4	1.7	12.2	12.9	13.1	5.2
Economic	0	3.5	3.4	3.1	2.4	0.0	0.0	0.0	0.0
Social	3	5.2	2.5	2.9	3.2	15.6	7.5	8.8	9.6
	12				Total Account Merit Score	60.7	31.1	37.9	31.9
					Account Merit Rating	5.1	2.6	3.2	2.7
					Rank	**1**	**4**	**2**	**3**

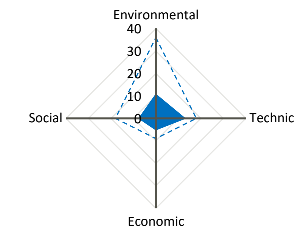
Underground, Location U-4 Paste

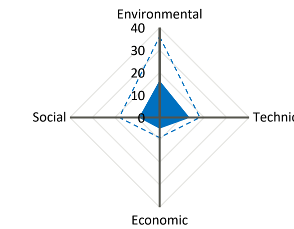
Surface, Location S-1 Paste

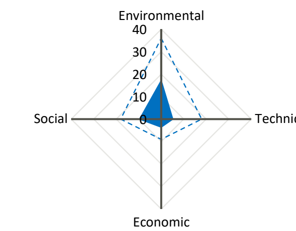
Surface, Location S-3 Paste

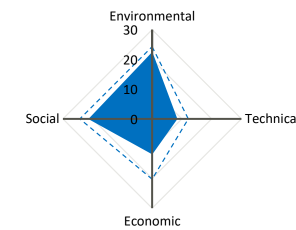
In-Pit, Location P-3 Slurry

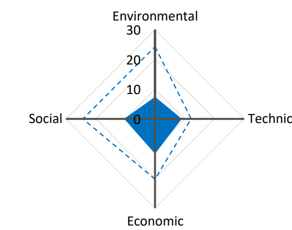


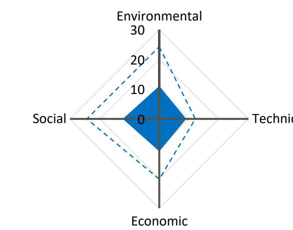


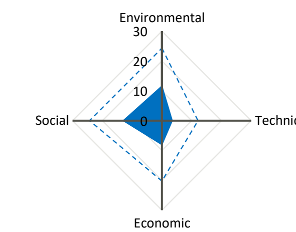


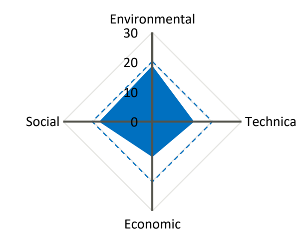


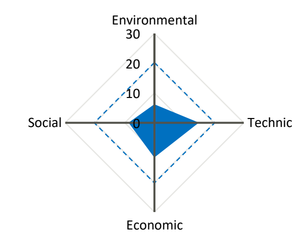


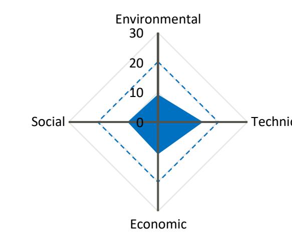


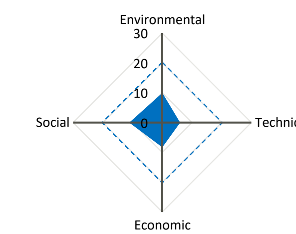


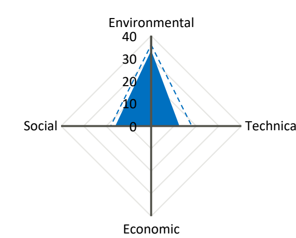


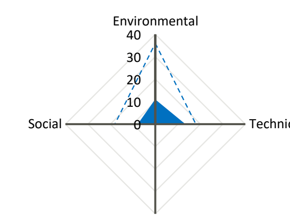


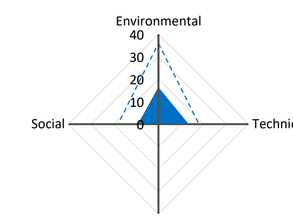


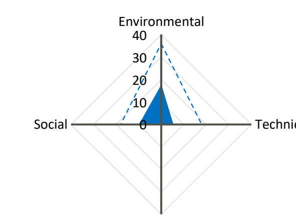












APPENDIX C

Gypsum Alternatives Assessment

Table C-1: Gypsum Alternatives Assessment, Pre-screening for General Location

Pre-screening Criteria	**General Locations**				
	Underground	**In-Pit**	**Surface**	**Off-site**	**In-Lake**
Has required storage capacity	Yes	Yes	Yes	Yes	Yes
No waste in lake (NexGen).	Aligned	Aligned	Aligned	Aligned	Fatally flawed
Area of impact.	None	Additional surface disturbance area within proposed Project surface lease boundary	Additional surface disturbance area within proposed Project surface lease boundary	Increase in overall surface disturbance area outside proposed Project surface lease boundary	Disturbance of lake outside proposed Project surface lease boundary
Quantity of waste rock generated.	Volume of gypsum stored + volume for underground access	Overburden + waste rock from pit development greater than volume of gypsum stored	No change	No change	No change
Result	**Pass**	**Eliminated**	**Pass**	**Eliminated**	**Eliminated**

Note: red text indicate a relative disadvantage.

Table C-2: Gypsum Alternatives Assessment, Screening for Specific Location

Account	Sub-account	Indicator	**Underground** UGTMF vs. Purpose Built		**Surface** WRSA vs. Purpose Built	
			UGTMF (underground, gypsum with tailings)	**Purpose Built** (underground, gypsum only)	**WRSA** (surface, gypsum with waste rock)	**Purpose Built** (surface, gypsum only)
Environmental	Ecological Integrity	Surface area of impact.	Least increase in surface disturbance due to size of the UGTMF and quantity of excavated material stored on surface.	Greatest increase in surface disturbance due to additional volume of underground excavation .	Least area of impact due to size of WRSA.	Greatest area of disturbance for additional facility, access roads, and water management infrastructure.
	Hydrologic Regime	Surface water - potential for impact.	Least potential for impact due to increase in additional excavated material stored on surface.	Greatest potential for impact due to increase in additional excavated material stored on surface.	Least potential - mitigated by planned controls for WRSA.	Greatest potential - requires additional controls to mitigate impact.
		Groundwater - potential for impact.	Least potential change in seepage quality and quantity, mitigated by planned controls for the UGTMF.	Greatest potential for impact due to larger volume containing waste underground, additional controls may be required.	Least potential - mitigated by planned controls for WRSA.	Greatest potential due to additional surface facility area, requires additional controls and instrumentation for water management and monitoring.
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	Incremental increase/non differentiating.	Incremental increase/non differentiating.	Least potential - mitigated by planned controls for WRSA.	Greatest potential due to additional surface facility area.

Account	Sub-account	Indicator	**Underground** UGTMF vs. Purpose Built		**Surface** WRSA vs. Purpose Built	
			UGTMF (underground, gypsum with tailings)	**Purpose Built** (underground, gypsum only)	**WRSA** (surface, gypsum with waste rock)	**Purpose Built** (surface, gypsum only)
Technical	Design and Reliability	Facility design effort.	Least effort due to single facility to design.	Greatest due to additional facility to design.	Least effort due to single facility to design.	Greatest due to additional facility to design.
		Proven precedent for technology and configuration.	Proven, potential advantage to use gypsum as binder for tailings.	Proven.	Less precedent - some geotechnical uncertainty in placement of large or concentrated volumes of gypsum in waste rock that can be mitigated by placement methods.	Proven.
	Construction Risk and Complexity	Geotechnical stability considering foundation conditions and waste placement.	Indicator not applicable.	Indicator not applicable.	Relies on WRSA foundation - no additional facility.	Requires consideration of foundation conditions for additional facility.
	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.	Least complexity due to use of UGTMF systems.	Greatest complexity due to requirement for separate systems.	Potential use of planned WRSA fleet.	Requires more equipment to operate.
		Potential for progressive facility closure during operation.	Indicator not applicable.	Indicator not applicable.	Indicator not applicable.	Indicator not applicable.
	Closure Risk and Complexity	Ease of decommissioning.	Simplest - single facility to close.	Most complex due to additional facility to close.	Simplest - single facility to close.	More complex - additional surface facility to close.

Account	Sub-account	Indicator	**Underground** UGTMF vs. Purpose Built		**Surface** WRSA vs. Purpose Built	
			UGTMF (underground, gypsum with tailings)	**Purpose Built** (underground, gypsum only)	**WRSA** (surface, gypsum with waste rock)	**Purpose Built** (surface, gypsum only)
Economic	Capital Cost	Facility construction and centralization.	Lowest cost due to size of UGTMF (e.g., number of chambers).	Highest cost due to construction of separate facility and access to construct.	Lowest cost due to incremental increase in size of WRSA.	Highest cost due to increase in surface disturbance for additional facility, access, equipment, and infrastructure.
	Operating Cost	Transport and placement of gypsum, including energy, diesel, labor.	Lowest cost due to use of transport system for the UGTMF.	Highest cost due to operation of separate transport system.	Lowest cost due to use of WRSA fleet.	Highest cost due to additional equipment.
		Requirement for tailings binder, flocculant, or other additives.	Lowest cost due to potential for gypsum to decrease tailings binder requirement.	Highest cost for tailings binder (no potential advantage).	Indicator not differentiating.	Indicator not differentiating.
		Excavating and hauling additional waste rock.	Lowest cost - incremental increase in waste rock excavation.	Highest cost due to increase in waste rock excavation.	Indicator not differentiating.	Indicator not differentiating.
	Closure Cost	Facility closure.	Lowest cost due to single facility to close.	Highest cost due to additional facility to close.	Lowest cost due to single facility to close.	Highest cost due to additional facility to close.

Account	Sub-account	Indicator	**Underground** UGTMF vs. Purpose Built		**Surface** WRSA vs. Purpose Built	
			UGTMF (underground, gypsum with tailings)	**Purpose Built** (underground, gypsum only)	**WRSA** (surface, gypsum with waste rock)	**Purpose Built** (surface, gypsum only)
Social	Community Impact	Visual disturbance for an observer.	Indicator non-differentiating.	Indicator non-differentiating.	Least due to incremental increase in size of WRSA.	Greatest due to additional facility.
	Change in Land Use	Local resource consumption as borrow source(s) for construction.	Indicator non-differentiating.	Indicator non-differentiating.	Least due to incremental increase in size of WRSA.	Greatest due to additional facility.
	Population at Risk	Worker safety and human health during construction, operation, and closure.	Lowest risk - single facility to construct, operate, and close.	Highest risk due to additional facility to construct, operate, and close.	Lowest risk - single facility to construct, operate, and close.	Highest risk due to additional facility to construct, operate, and close.
		Result	**Pass**	**Eliminated**	**Pass**	**Eliminated**

Note: red text indicate a relative disadvantage.

Table C-3: Gypsum Alternatives Assessment Sub-account and Indicator Weighting Summary

Account	Sub-account	Sub-account Weight (Ws)	Indicator	Indicator Weight (Wi)
Environmental	Ecological Integrity	6	Potential for impact to Patterson Lake during operation.	1
	Hydrologic Regime	1	Surface water - potential for contact water management.	1
	Air Quality	1	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	1
Technical	Design and Reliability	3	Facility design effort.	1
			Proven precedent for technology and configuration.	6
	Construction Risk and Complexity.	1	Geotechnical stability considering foundation conditions and waste placement.	1
	Flexibility	1	Effort required for expansion, optimization, and design changes.	1
Economic	Capital Cost	2	Facility construction and centralization.	1
	Operating Cost	1	Transport and placement of gypsum, including energy, diesel, labor.	1
			Requirement for tailings binder, flocculant, or other additives.	1
Social	Population at Risk	1	Worker safety and human health during construction, operation, and closure.	1

Table C-4: Gypsum Alternatives Assessment, Multiple Accounts Analysis

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity		Indicator Value (S)		Indicator Weight (Wi)	Indicator Merit Score (S*Wi)		Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)		
						UGTMF	WRSA	UGTMF	WRSA		UGTMF	WRSA		UGTMF	WRSA	
Environmental	Ecological Integrity	Potential for impact to Patterson Lake during operation.	*see below	Value	#	-	-	6	1	1	6	1	6	36	6	
										Total indicator merit score (Σ{S × Wi})	6.0	1.0				
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0				
	Hydrologic Regime	Surface water - potential for contact water management.	*see below	Value	#	-	-	6	1	1	6	1	1	6	1	
										Total indicator merit score (Σ{S × Wi})	6.0	1.0				
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0				
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	Material to surface	Tonnage	Mt	4.4	0.0	1	6	1	1	6	1	1	6	
										Total indicator merit score (Σ{S × Wi})	1.0	6.0		**43.0**	**13.0**	**Total sub-account merit score (Σ{Rs × Ws})**
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	6.0		**5.4**	**1.6**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Potential for impact to Patterson Lake during operation.	6 (Best)	UGTMF - least potential for impact to Patterson Lake by gypsum
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - greatest potential for impact
Surface water - potential for contact water management.	6 (Best)	UGTMF - Least potential for contact water management, incremental increase in excavated material to surface
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - Greatest potential for contact water management

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity		Indicator Value (S)		Indicator Weight (Wi)	Indicator Merit Score (S*Ws)		Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)		
						UGTMF	WRSA	UGTMF	WRSA		UGTMF	WRSA		UGTMF	WRSA	
Technical	Design and Reliability	Facility design effort.	*see below	Value	#	-	-	6	1	1	6	1	3	18	3	
		Proven precedent for technology and configuration.	*see below	Value	#	-	-	6	1	6	36	6				
										Total indicator merit score (Σ{S × Wi})	42.0	7.0				
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0				
	Construction Risk and Complexity.	Geotechnical stability considering foundation conditions and waste placement.	*see below	Value	#	-	-	6	1	1	6	1	1	6	1	
										Total indicator merit score (Σ{S × Wi})	6.0	1.0				
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0				
	Flexibility	Effort required for expansion, optimization, and design changes.	*see below	Value	#	-	-	1	6	1	1	6	1	1	6	
										Total indicator merit score (Σ{S × Wi})	1.0	6.0		**25.0**	**10.0**	**Total sub-account merit score (Σ{Rs × Ws})**
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	6.0		**5.0**	**2.0**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Facility design effort.	6 (Best)	UGTMF - least design effort - incremental increase in chambers in UGTMF and use of UGTMF transport system
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - greatest design effort for gypsum removal from tailings stream, haul from plant to WRSA, manage placement to avoid segregation
Proven precedent for technology and configuration.	6 (Best)	UGTMF - proven precedent for placement of gypsum with tailings
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - not common, requires management of placement of gypsum with waste rock to avoid segregation
Geotechnical stability considering foundation conditions and waste placement.	6 (Best)	UGTMF - no change expected to stability of WRSA with additional waste rock
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - potential impact to stability related to dissolution of gypsum
Effort required for expansion, optimization, and design changes.	6 (Best)	WRSA - requires less effort to expand WRSA
	5	
	4	
	3	
	2	
	1 (Worst)	UGTMF - requires more effort to expand both UGTMF and WRSA

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity		Indicator Value (S)		Indicator Weight (Wi)	Indicator Merit Score (S*Wi)		Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)		
						UGTMF	WRSA	UGTMF	WRSA		UGTMF	WRSA		UGTMF	WRSA	
Economic	Capital Cost	Facility construction and centralization.	Waste rock to surface	Tonnage	Mt	4.4	0	1	6	1	1	6	2	2.0	12.0	
										Total indicator merit score (Σ{S × Wi})	1.0	6.0				
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	6.0				
	Operating Cost	Transport and placement of gypsum, including energy, diesel, labor.	*see below	Value	#	-	-	6	1	1	6	1	1	6.0	1.0	
		Requirement for tailings binder, flocculant, or other additives.	Gypsum available	Tonnage	Mt	1.5	0	6	1	1	6	1				
										Total indicator merit score (Σ{S × Wi})	12.0	2.0		**8.0**	**13.0**	**Total sub-account merit score (Σ{Rs × Ws})**
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0		**2.7**	**4.3**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Transport and placement of gypsum, including energy, diesel, labor.	6 (Best)	UGTMF - lower cost due to potential use of planned tailings transport system
	5	
	4	
	3	
	2	
	1 (Worst)	WRSA - higher cost due to requirement to separate gypsum from tailings, clean gypsum, load, haul, place

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity		Indicator Value (S)		Indicator Weight (Wi)	Indicator Merit Score (S*Wi)		Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)		
						UGTMF	WRSA	UGTMF	WRSA		UGTMF	WRSA		UGTMF	WRSA	
Social	Population at Risk	Worker safety and human health during construction, operation, and closure.	Material to surface	Tonnage	Mt	4.4	0.0	1.0	6.0	1	1	6	1	1.0	6.0	
										Total indicator merit score (Σ{S × Wi})	1.0	6.0		**1.0**	**6.0**	**Total sub-account merit score (Σ{Rs × Ws})**
										Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	6.0		**1.0**	**6.0**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

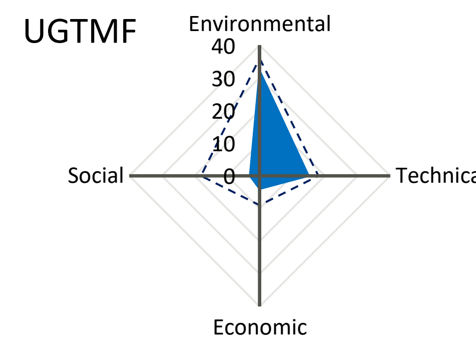
ECCC Weighting

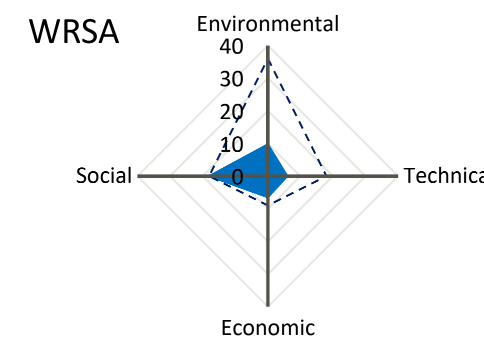
Account	Account Weight (W_a)	Account Merit Rating (R_a)		Account Merit Score (R_s*W_1)		
		UGTMF	WRSA	UGTMF	WRSA	
Environmental	6	5.4	1.6	32.3	9.8	
Technical	3	5.0	2.0	15.0	6.0	
Economic	1.5	2.7	4.3	4.0	6.5	
Social	3	1.0	6.0	3.0	18.0	
	13.5			**54.3**	**40.3**	**Total account merit score (Σ{Ra × Wa})**
				4.0	**3.0**	**Alternative merit rating (A = Σ{Ra×Wa}/ ΣWa)**
				1	**2**	**Rank**

Table C-5: Gypsum Alternatives Assessment, Multiple Accounts Analysis Sensitivity

ECCC Weighting

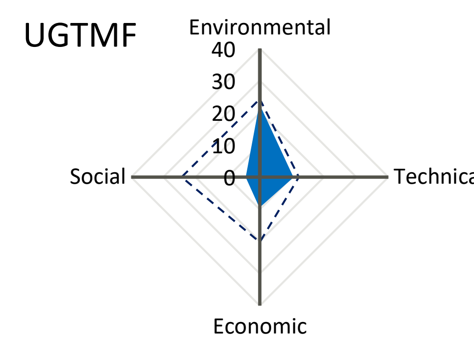
Account	Weight	Account Merit Weighting		Account Merit Score		
		UGTMF	WRSA	UGTMF	WRSA	
Environmental	6	5.4	1.6	32.3	9.8	
Technical	3	5.0	2.0	15.0	6.0	
Economic	1.5	2.7	4.3	4.0	6.5	
Social	3	1.0	6.0	3.0	18.0	
	13.5			54.3	40.3	Total Account Merit Score
				4.0	3.0	Account Merit Rating
				1	**2**	**Rank**

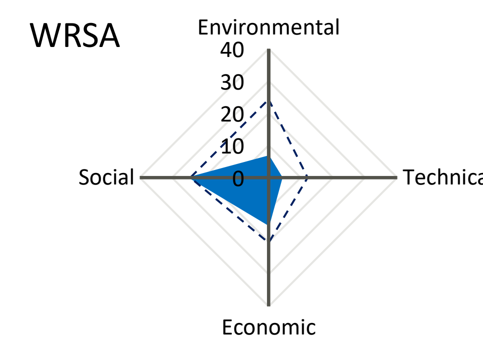




NexGen Weighting

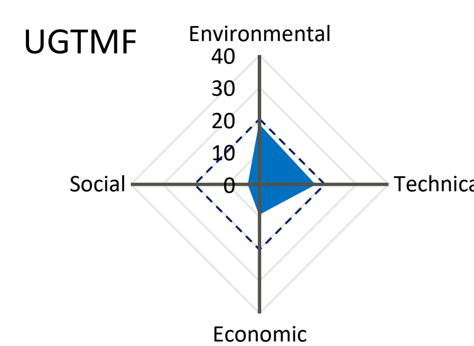
Account	Weight	Account Merit		Account Merit		
		UGTMF	WRSA	UGTMF	WRSA	
Environmental	4.1	5.4	1.6	21.8	6.6	
Technical	2.0	5.0	2.0	10.1	4.1	
Economic	3.4	2.7	4.3	9.0	14.6	
Social	4.1	1.0	6.0	4.1	24.3	
	13.5			44.9	49.6	Total Account Merit Score
				3.3	3.7	Account Merit Rating
				2	**1**	**Rank**

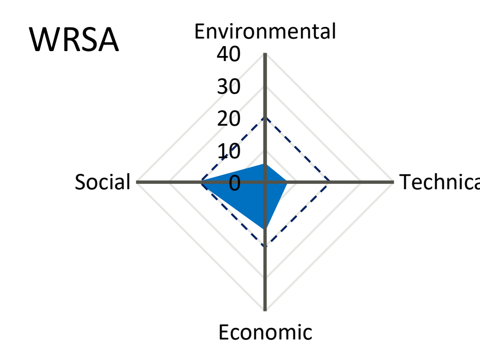




Equal Weighting

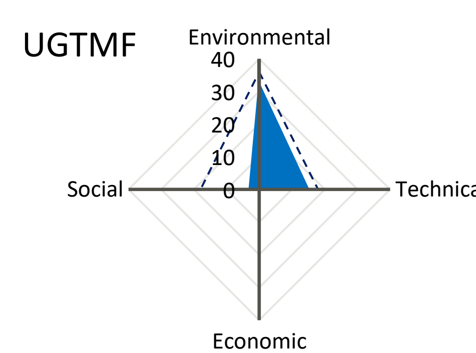
Account	Weight	Account Merit		Account Merit		
		UGTMF	WRSA	UGTMF	WRSA	
Environmental	3.4	5.4	1.6	18.1	5.5	
Technical	3.4	5.0	2.0	16.9	6.8	
Economic	3.4	2.7	4.3	9.0	14.6	
Social	3.4	1.0	6.0	3.4	20.3	
	13.5			47.4	47.1	Total Account Merit Score
				3.5	3.5	Account Merit Rating
				1	**2**	**Rank**

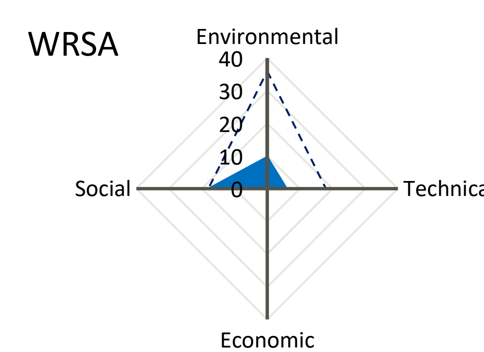




ECCC Weighting with Economic = 0

Account	Weight	Account Merit		Account Merit		
		UGTMF	WRSA	UGTMF	WRSA	
Environmental	6	5.4	1.6	32.3	9.8	
Technical	3	5.0	2.0	15.0	6.0	
Economic	0	2.7	4.3	0.0	0.0	
Social	3	1.0	6.0	3.0	18.0	
	12			50.3	33.8	Total Account Merit Score
				4.2	2.8	Account Merit Rating
				1	**2**	**Rank**





APPENDIX D

Waste Rock Alternatives Assessment

Table D-1: Waste Rock Alternatives Assessment, Pre-screening for General Location

Pre-screening Criteria	General Locations				
	Underground	**In-Pit**	**Surface**	**Off-site**	**In-Lake**
Has required storage capacity	Fatally flawed - volume incompatibility (i.e. excavation generates more waste rock than can be stored)	Fatally flawed - volume incompatibility (i.e. excavation generates more waste rock than can be stored)	Yes	Yes	Yes
No waste in lake (NexGen).	Aligned	Aligned	Aligned	Aligned	Fatally flawed
Area of impact.	None	Additional surface disturbance area	Additional surface disturbance area	Increase in overall surface disturbance area outside proposed Project surface lease boundary	Minimal surface disturbance area
Quantity of waste rock generated.	Not applicable	Not applicable	No change	No change	No change
Result	**Eliminated**	**Eliminated**	**Pass**	**Eliminated**	**Eliminated**

Note: red text indicates a relative disadvantage.

Table D-2: Waste Rock Alternatives Assessment, Sub-account and Indicator Weighting Summary for Specific Location Screening

Account	Sub-account	Sub-account Weight (Ws)	Indicator	Indicator Weight (Wi)
Environmental	Ecological Integrity	6	Surface area of impact.	1
			Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	1
	Hydrologic Regime	1	Surface water - potential for contact water management.	3
			Groundwater - potential for contact water management.	1
	Air Quality	1	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	1
Technical	Operational Risk and Complexity	1	Operation and maintenance for transport and disposal system.	1
			Water balance and management during seasonal changes.	1
Economic	Operating Cost	2	Transport and placement.	1
			Energy use for transport – diesel (haul).	1
			Water use.	1
	Closure Cost	1	Facility closure.	1
Social	Population at Risk	1	Worker safety and human health during construction, operation, and closure.	1

Table D-3: Waste Rock Alternatives Assessment, Screening for Specific Location

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity A	Indicator Quantity B	Indicator Quantity C	Indicator Quantity D	Indicator Quantity E	Indicator Value (S) A	Indicator Value (S) B	Indicator Value (S) C	Indicator Value (S) D	Indicator Value (S) E	Indicator Weight (Wi)	Indicator Merit Score (S*Wi) A	Indicator Merit Score (S*Wi) B	Indicator Merit Score (S*Wi) C	Indicator Merit Score (S*Wi) D	Indicator Merit Score (S*Wi) E	Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws) A	Sub-account Merit Score (Rs*Ws) B	Sub-account Merit Score (Rs*Ws) C	Sub-account Merit Score (Rs*Ws) D	Sub-account Merit Score (Rs*Ws) E	
Environmental	Ecological Integrity	Surface area of impact.	Measured as the 2D surface area of the WRSA, with the lowest surface area preferred for least potential impact.	Area	ha	87	91	104	91	86	5.7	4.5	1.0	4.5	6.0	1	5.7	4.5	1.0	4.5	6.0	6	28.8	31.6	6.0	25.4	30.7	
		Potential for impact to plant, fish, and other wildlife population and habitat during construction, operation, and closure.	Measured as distance from WRSA centroid to Patterson Lake, with the longest distance preferred for least potential impact.	Distance	km	1.0	1.2	0.7	1.0	1.0	3.9	6.0	1.0	3.9	4.2	1	3.9	6.0	1.0	3.9	4.2							
																Total indicator merit score (Σ{S × Wi})	9.6	10.5	2.0	8.5	10.2							
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	4.8	5.3	1.0	4.2	5.1							
	Hydrologic Regime	Surface water - potential for contact water management.	*see below	Value	#	-	-	-	-	-	6.0	3.0	1.0	1.0	1.0	3	18.0	9.0	3.0	3.0	3.0	1	6.0	3.0	1.0	1.0	1.0	
		Groundwater - potential for contact water management.	*see below	Value	#	-	-	-	-	-	6.0	3.0	1.0	1.0	1.0	1	6.0	3.0	1.0	1.0	1.0							
																Total indicator merit score (Σ{S × Wi})	24.0	12.0	4.0	4.0	4.0							
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.0	1.0	1.0	1.0							
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	Measured as distance from shaft to WRSA centroid, with the shortest distance preferred for least potential emissions.	Distance	km	0.9	1.6	2.0	2.2	1.4	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	
																Total indicator merit score (Σ{S × Wi})	6.0	3.2	1.7	1.0	3.8		40.8	37.9	8.7	27.4	35.5	Total sub-account merit score (Σ{Rs × Ws})
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.2	1.7	1.0	3.8		5.1	4.7	1.1	3.4	4.4	Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)

Indicator	Value	Descriptor
Surface water - potential for contact water management.	6 (Best)	Greatest setback from proposed Project surface lease boundary, infrastructure, wetland, and Patterson Lake, and shallow gradient beyond toe.
	5	
	4	
	3	
	2	
	1 (Worst)	Least setback from proposed Project surface lease boundary, infrastructure, wetland and Patterson Lake, and steep gradient beyond toe.
Groundwater - potential for contact water management.	6 (Best)	Greatest setback from proposed Project surface lease boundary, infrastructure, wetland, and Patterson Lake, and shallow gradient beyond toe.
	5	
	4	
	3	
	2	
	1 (Worst)	Least setback from proposed Project surface lease boundary, infrastructure, wetland and Patterson Lake, and steep gradient beyond toe.

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity A	Indicator Quantity B	Indicator Quantity C	Indicator Quantity D	Indicator Quantity E	Indicator Value (S) A	Indicator Value (S) B	Indicator Value (S) C	Indicator Value (S) D	Indicator Value (S) E	Indicator Weight (Wi)	Indicator Merit Score (S*Wi) A	Indicator Merit Score (S*Wi) B	Indicator Merit Score (S*Wi) C	Indicator Merit Score (S*Wi) D	Indicator Merit Score (S*Wi) E	Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws) A	Sub-account Merit Score (Rs*Ws) B	Sub-account Merit Score (Rs*Ws) C	Sub-account Merit Score (Rs*Ws) D	Sub-account Merit Score (Rs*Ws) E	
Technical	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.	Measured as distance from shaft to WRSA centroid, with the shortest distance preferred for least operation and maintenance potential.	Distance	km	0.9	1.6	2.0	2.2	1.4	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	1	3.6	4.6	1.4	1.7	2.9	
		Water balance and management during seasonal changes.	Measured as distance from WRSA toe to Patterson Lake, with the longest distance preferred for greater seasonal change management.	Distance	km	0.5	0.9	0.5	0.6	0.6	1.1	6.0	1.0	2.3	1.9	1	1.1	6.0	1.0	2.3	1.9							
																Total indicator merit score (Σ{S × Wi})	7.1	9.2	2.7	3.3	5.7		3.6	4.6	1.4	1.7	2.9	Total sub-account merit score (Σ{Rs × Ws})
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	3.6	4.6	1.4	1.7	2.9		3.6	4.6	1.4	1.7	2.9	Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity A	Indicator Quantity B	Indicator Quantity C	Indicator Quantity D	Indicator Quantity E	Indicator Value (S) A	Indicator Value (S) B	Indicator Value (S) C	Indicator Value (S) D	Indicator Value (S) E	Indicator Weight (Wi)	Indicator Merit Score (S*Wi) A	Indicator Merit Score (S*Wi) B	Indicator Merit Score (S*Wi) C	Indicator Merit Score (S*Wi) D	Indicator Merit Score (S*Wi) E	Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws) A	Sub-account Merit Score (Rs*Ws) B	Sub-account Merit Score (Rs*Ws) C	Sub-account Merit Score (Rs*Ws) D	Sub-account Merit Score (Rs*Ws) E	
Economic	Operating Cost	Transport and placement.	Measured as distance from shaft to WRSA centroid, with the shortest distance preferred for least transport and placement cost.	Distance	km	0.9	1.6	2.0	2.2	1.4	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	2	8.7	5.0	4.5	3.7	9.1	
		Energy use for transport – diesel (haul).	Measured as vertical elevation change from shaft to WRSA crest, with the least elevation change preferred for least energy use during transport and subsequent equipment maintenance.	Elevation Change	m	48.5	48	38	37	26	1.0	1.1	3.3	3.6	6.0	1	1.0	1.1	3.3	3.6	6.0							
		Water use.	Measured as distance from shaft to WRSA centroid, with the shortest distance preferred for less dust suppression water use required.	Distance	km	0.9	1.6	2.0	2.2	1.4	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8							
																Total indicator merit score (Σ{S × Wi})	13.0	7.6	6.8	5.6	13.6							
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	4.3	2.5	2.3	1.9	4.5							
	Closure Cost	Facility closure.	Measured as 3D cover placement area, with the lowest surface area preferred for less cover system placement.	Area	ha	88	92	105	92	86	5.6	4.6	1.0	4.5	6.0	1	5.6	4.6	1.0	4.5	6.0	1	5.6	4.6	1.0	4.5	6.0	
																Total indicator merit score (Σ{S × Wi})	5.6	4.6	1.0	4.5	6.0		14.2	9.6	5.5	8.2	15.1	Total sub-account merit score (Σ{Rs × Ws})
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	5.6	4.6	1.0	4.5	6.0		4.7	3.2	1.8	2.7	5.0	Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)

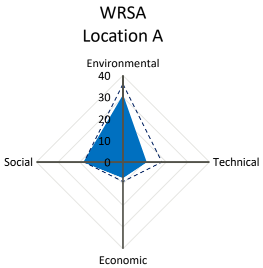
Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity A	Indicator Quantity B	Indicator Quantity C	Indicator Quantity D	Indicator Quantity E	Indicator Value (S) A	Indicator Value (S) B	Indicator Value (S) C	Indicator Value (S) D	Indicator Value (S) E	Indicator Weight (Wi)	Indicator Merit Score (S*Wi) A	Indicator Merit Score (S*Wi) B	Indicator Merit Score (S*Wi) C	Indicator Merit Score (S*Wi) D	Indicator Merit Score (S*Wi) E	Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws) A	Sub-account Merit Score (Rs*Ws) B	Sub-account Merit Score (Rs*Ws) C	Sub-account Merit Score (Rs*Ws) D	Sub-account Merit Score (Rs*Ws) E	
Social	Population at Risk	Worker safety and human health during construction, operation, and closure.	Measured as distance from shaft to WRSA centroid, with the least distance preferred to reduce number of workers exposed.	Distance	km	0.9	1.6	2.0	2.2	1.4	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	1	6.0	3.2	1.7	1.0	3.8	
																Total indicator merit score (Σ{S × Wi})	6.0	3.2	1.7	1.0	3.8		6.0	3.2	1.7	1.0	3.8	Total sub-account merit score (Σ{Rs × Ws})
																Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.2	1.7	1.0	3.8		6.0	3.2	1.7	1.0	3.8	Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)

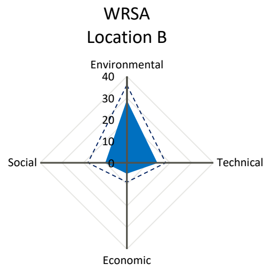
ECCC Weighting	Account	Account Weight (Wa)	Account Merit Rating (Ra) A	Account Merit Rating (Ra) B	Account Merit Rating (Ra) C	Account Merit Rating (Ra) D	Account Merit Rating (Ra) E	Account Merit Score (Rs*Wa) A	Account Merit Score (Rs*Wa) B	Account Merit Score (Rs*Wa) C	Account Merit Score (Rs*Wa) D	Account Merit Score (Rs*Wa) E	
44%	Environmental	6	5.1	4.7	1.1	3.4	4.4	30.6	28.4	6.5	20.6	26.6	
22%	Technical	3	3.6	4.6	1.4	1.7	2.9	10.7	13.8	4.1	5.0	8.6	
11%	Economic	1.5	4.7	3.2	1.8	2.7	5.0	7.1	4.8	2.8	4.1	7.5	
22%	Social	3	6.0	3.2	1.7	1.0	3.8	18.0	9.7	5.1	3.0	11.4	
100%	Total	13.5						66	57	18	33	54	Total account merit score (Σ{Ra × Wa})
								4.9	4.2	1.4	2.4	4.0	Alternative merit rating (A = Σ{Ra×Wa}/ ΣWa)
								1	2	5	4	3	Rank

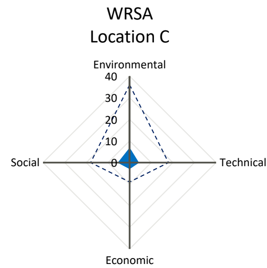
Table D-4: Waste Rock Alternatives Assessment, Specific Location Screening Result Summary

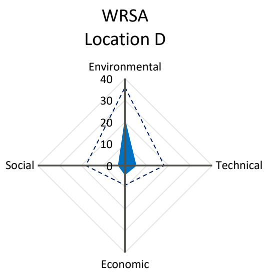
ECCC Weighting

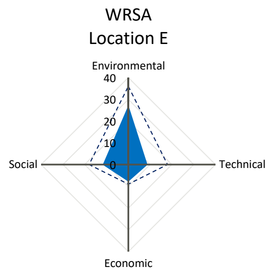
Account	Account Weight	Account Merit Weighting					Account Merit Score				
		A	B	C	D	E	A	B	C	D	E
Environmental	6	5.1	4.7	1.1	3.4	4.4	31	28	7	21	27
Technical	3	3.6	4.6	1.4	1.7	2.9	11	14	4	5	9
Economic	1.5	4.7	3.2	1.8	2.7	5.0	7	5	3	4	8
Social	3	6.0	3.2	1.7	1.0	3.8	18	10	5	3	11
						Total Account Merit Score	**66**	**57**	**18**	**33**	**54**
						Alternative Merit Rating	**4.9**	**4.2**	**1.4**	**2.4**	**4.0**
						Rank	**1**	**2**	**5**	**4**	**3**











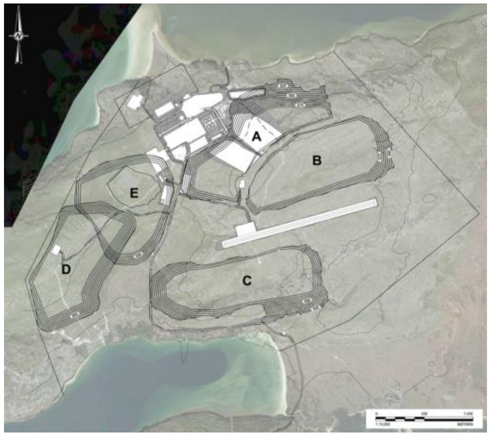


Table D-5: Waste Rock Alternatives Assessment, Sub-account and Indicator Weighting Summary for Multiple Accounts Analysis

Account	Sub-account	Sub-account Weight (Ws)	Indicator	Indicator Weight (Wi)
Environmental	Ecological Integrity	6	Surface area of impact, borrow for engineered layers.	1
			Potential for impact to Patterson Lake during operation.	2
			Potential for impact to Patterson Lake during closure.	6
	Air Quality	1	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	1
Technical	Design and Reliability	6	Facility design effort.	1
			Proven precedent for technology and configuration.	6
			Compliance with SERM (2000) draft guidelines.	4
			Difference in mass (engineered layers).	1
	Construction Risk and Complexity	2	Liner area.	1
			Water management infrastructure (number of systems to be constructed).	1
	Operational Risk and Complexity	3	Operation and maintenance for transport and disposal system.	1
			Water balance and management during seasonal changes.	1
			Potential for progressive facility closure during operation.	1
	Closure Risk and Complexity	1	Ease of decommissioning. Number of facilities.	1
	Flexibility	2	Effort required for expansion, optimization, and design changes.	1
Economic	Capital Cost	4	Liner procurement and installation.	1
	Operating Cost	2	Water treatment (capture by lined alternatives).	1
			Engineered layers.	2
	Closure Cost	1	Facility closure.	1
			Water treatment.	1
Social	Community Impact	1	Change in local employment opportunities.	1
	Change in Land Use	1	Local resource consumption as borrow source(s) for construction.	1
	Population at Risk	1	Health risk to people downstream.	1
			Worker safety and human health during construction, operation, and closure.	1

Table D-6: Waste Rock Alternatives Assessment, Multiple Accounts Analysis

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity						Indicator Value (S)						Indicator Weight (Wi)	Indicator Merit Score (S*Wi)						Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)						
						1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b	
Environmental	Ecological Integrity	Surface area of impact, borrow for engineered layers.	Borrow for engineered layers	Mass	Mt	0.0	0.0	2.5	2.5	0.0	1.1	6	6	1	1	6	4	1	6.0	6.0	1.0	1.0	6.0	3.9	6	9.3	16.0	26.0	32.7	16.0	34.6	
		Potential for impact to Patterson Lake during operation.	Peak concentration of copper during operation reporting to Patterson Lake.	Concentration Copper	ug/L	4.0	0.0	4.0	0.0	0.0	0.0	1	6	1	6	6	6	2	2.0	12.0	2.0	12.0	12.0	12.0								
		Potential for impact to Patterson Lake during closure.	Concentration of cobalt (highest exceedance of CCME concentration limits)	Concentration Cobalt	ug/L	3.8	3.8	0.0	0.0	3.8	0.0	1	1	6	6	1	6	6	6.0	6.0	36.0	36.0	6.0	36.0								
																		Total indicator merit score (Σ{S × Wi})	14.0	24.0	39.0	49.0	24.0	51.9								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.6	2.7	4.3	5.4	2.7	5.8								
	Air Quality	Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	*see below	Value	#	-	-	-	-	-	-	1	1	6	6	1	4	1	1.0	1.0	6.0	6.0	1.0	4.0	1	1.0	1.0	6.0	6.0	1.0	4.0	
																		Total indicator merit score (Σ{S × Wi})	1.0	1.0	6.0	6.0	1.0	4.0		**10.3**	**17.0**	**32.0**	**38.7**	**17.0**	**38.6**	**Total sub-account merit score (Σ{Rs × Ws})**
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	1.0	6.0	6.0	1.0	4.0		**1.5**	**2.4**	**4.6**	**5.5**	**2.4**	**5.5**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Potential for excessive emissions of fugitive dust (e.g. particulates, heavy metals) and other non-GHG emissions during construction and operation.	6 (Best)	Bottom-up construction method
	5	
	4	
	3	
	2	
	1 (Worst)	End dumped construction method

1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unlined)
   d. Engineered Source Control (lined)
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (engineered source control, lined)

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity						Indicator Value (S)						Indicator Weight (Wi)	Indicator Merit Score (S*Ws)						Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)						
						1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b	
Technical	Design and Reliability	Facility design effort.	*see below	Value	#	-	-	-	-	-	-	6	5	4	3	2	1	1	6.0	5.0	4.0	3.0	2.0	1.0	6	11.0	32.5	13.5	29.0	31.0	32.4	
		Proven precedent for technology and configuration.	*see below	Value	#	-	-	-	-	-	-	1	5	3	5	5	6	6	6.0	30.0	18.0	30.0	30.0	36.0								
		Compliance with SERM (2000) draft guidelines.	*see below	Value	#	-	-	-	-	-	-	1	6	1	6	6	6	4	4.0	24.0	4.0	24.0	24.0	24.0								
		Difference in mass (engineered layers).	Mass engineered layers	Tonnage	Mt	0.0	0.0	2.5	2.5	0.0	1.1	6	6	1	1	6	4	1	6.0	6.0	1.0	1.0	6.0	3.9								
																		Total indicator merit score (Σ{S × Wi})	22.0	65.0	27.0	58.0	62.0	64.9								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.8	5.4	2.3	4.8	5.2	5.4								
	Construction Risk and Complexity	Liner area.	Liner Area	Liner Area	ha	0	87	0	87	37	37	6	1	6	1	4	4	1	6.0	1.0	6.0	1.0	3.9	3.9	2	12.0	7.0	12.0	7.0	4.9	4.9	
		Water management infrastructure (number of systems to be constructed).	Number of Facilities	Number of Facilities	Count	1	1	1	1	2	2	6	6	6	6	1	1	1	6.0	6.0	6.0	6.0	1.0	1.0								
																		Total indicator merit score (Σ{S × Wi})	12.0	7.0	12.0	7.0	4.9	4.9								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.5	6.0	3.5	2.4	2.4								
	Operational Risk and Complexity	Operation and maintenance for transport and disposal system.	*see below	Value	#	-	-	-	-	-	-	6	5	4	3	2	1	1	6.0	5.0	4.0	3.0	2.0	1.0	3	13.0	12.0	14.0	12.0	8.0	8.0	
		Water management.	Number of Facilities	Number of Facilities	Count	1	1	1	1	2	2	6	6	6	6	1	1	1	6.0	6.0	6.0	6.0	1.0	1.0								
		Potential for progressive facility closure during operation.	*see below	Value	#	-	-	-	-	-	-	1	1	4	3	5	6	1	1.0	1.0	4.0	3.0	5.0	6.0								
																		Total indicator merit score (Σ{S × Wi})	13.0	12.0	14.0	12.0	8.0	8.0								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	4.3	4.0	4.7	4.0	2.7	2.7								
	Closure Risk and Complexity	Ease of decommissioning. Number of facilities.	*see below	Number of Facilities	Count	1	1	1	1	2	2	6	6	6	6	1	1	1	6.0	6.0	6.0	6.0	1.0	1.0	1	6.0	6.0	6.0	6.0	1.0	1.0	
																		Total indicator merit score (Σ{S × Wi})	6.0	6.0	6.0	6.0	1.0	1.0								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	6.0	6.0	6.0	1.0	1.0								
	Flexibility	Effort required for expansion, optimization, and design changes.	*see below	Value	#	-	-	-	-	-	-	6	3	4	2	3	1	1	6.0	3.0	4.0	2.0	3.0	1.0	2	12.0	6.0	8.0	4.0	6.0	2.0	
																		Total indicator merit score (Σ{S × Wi})	6.0	3.0	4.0	2.0	3.0	1.0		**54.0**	**63.5**	**53.5**	**58.0**	**50.9**	**48.3**	**Total sub-account merit score (Σ{Rs × Ws})**
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	3.0	4.0	2.0	3.0	1.0		**3.9**	**4.5**	**3.8**	**4.1**	**3.6**	**3.5**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Facility design effort.	6 (Best)	1a Least design effort, unsegregated + unlined
	5	1b unsegregated + lined
	4	1c unsegregated + engineered source control
	3	1d unsegregated + lined + engineered source control
	2	2a Segregated + lined
	1 (Worst)	2b Greatest design effort, segregated + lined + engineered source control
Proven precedent for technology and configuration.	6 (Best)	Proven precedent + potential unproven benefit
	5	Proven precedent
	4	
	3	Unproven but potential benefit
	2	
	1 (Worst)	Proven not to work
Compliance with SERM (2000) draft guidelines.	6 (Best)	Complies
	5	
	4	
	3	
	2	
	1 (Worst)	Does not comply
Operation and maintenance for transport and disposal system.	6 (Best)	1a load, haul, dump, push
	5	1b load, haul, dump, push over liner
	4	1c load, haul, dump, spread waste rock, plus load, haul, dump, spread engineered layers
	3	1d load, haul, dump, spread waste rock, plus load, haul, dump, spread engineered layers, place liner
	2	2a load, haul, dump, with 2 work fronts requiring spreading, over liner
	1 (Worst)	2b load, haul, dump, spread waste rock (PAG), push waste rock (NAG), plus load, haul, dump, spread engineered layers, over liner
Potential for progressive facility closure during operation.	6 (Best)	Greatest potential for progressive closure
	5	
	4	
	3	
	2	
	1 (Worst)	Least potential for progressive closure
Effort required for expansion, optimization, and design changes.	6 (Best)	Least effort to expand - no liner or engineered source control, one pile
	5	
	4	
	3	
	2	
	1 (Worst)	Greatest effort to expand - liner, 2 facility, engineered source control

Alternatives:
1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unlined)
   d. Engineered Source Control (lined)
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (engineered source control, lined)

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity						Indicator Value (S)						Indicator Weight (Wi)	Indicator Merit Score (S*Wi)						Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)						
						1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b	
Economic	Capital Cost	Liner procurement and installation.	Liner Area	Area	ha	0	87	0	87	37	37	6.0	1.0	6.0	1.0	3.9	3.9	1	6.0	1.0	6.0	1.0	3.9	3.9	4	24.0	4.0	24.0	4.0	15.5	15.5	
																		Total indicator merit score (Σ{S × Wi})	6.0	1.0	6.0	1.0	3.9	3.9								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	1.0	6.0	1.0	3.9	3.9								
	Operating Cost	Water treatment (capture by lined alternatives).	Volume	Treated per year	M m^3/year	0.0	0.1	0.0	0.9	0.6	0.4	6.0	5.1	6.0	1.0	2.3	3.9	1	6.0	5.1	6.0	1.0	2.3	3.9	2	12.0	11.4	5.3	2.0	9.6	7.8	
		Engineered layers.	Fine Material	Mass	Mt	0.0	0.0	2.5	2.5	0.0	1.1	6.0	6.0	1.0	1.0	6.0	3.9	2	12.0	12.0	2.0	2.0	12.0	7.8								
																		Total indicator merit score (Σ{S × Wi})	18.0	17.1	8.0	3.0	14.3	11.6								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	5.7	2.7	1.0	4.8	3.9								
	Closure Cost	Facility closure.	Number of Facilities	Number of Facilities	Count	1.0	1.0	1.0	1.0	2.0	2.0	6.0	6.0	6.0	6.0	1.0	1.0	1	6.0	6.0	6.0	6.0	1.0	1.0	1	3.5	3.5	6.0	6.0	1.0	3.5	
		Water treatment.	*see below	Value	#	-	-	-	-	-	-	1.0	1.0	6.0	6.0	1.0	6.0	1	1.0	1.0	6.0	6.0	1.0	6.0								
																		Total indicator merit score (Σ{S × Wi})	7.0	7.0	12.0	12.0	2.0	7.0		**39.5**	**18.9**	**35.3**	**12.0**	**26.1**	**26.8**	**Total sub-account merit score (Σ{Rs × Ws})**
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	3.5	3.5	6.0	6.0	1.0	3.5		**5.6**	**2.7**	**5.0**	**1.7**	**3.7**	**3.8**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Indicator	Value	Descriptor
Water treatment.	6 (Best)	Lowest cost for water treatment (engineered source control)
	5	
	4	
	3	
	2	
	1 (Worst)	Highest cost for water treatment (no engineered source control)

Alternatives:
1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unlined)
   d. Engineered Source Control (lined)
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (engineered source control, lined)

Account	Sub-account	Indicator	Description	Indicator Parameter	Unit	Indicator Quantity						Indicator Value (S)						Indicator Weight (Wi)	Indicator Merit Score (S*Wi)						Sub-account Weight (Ws)	Sub-account Merit Score (Rs*Ws)						
						1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b		1a	1b	1c	1d	2a	2b	
Social	Community Impact	Change in local employment opportunities.	*see below	Value	#	-	-	-	-	-	-	1.0	3.0	4.0	6.0	2.0	5.0	1	1.0	3.0	4.0	6.0	2.0	5.0	1	1.0	3.0	4.0	6.0	2.0	5.0	
																		Total indicator merit score (Σ{S × Wi})	1.0	3.0	4.0	6.0	2.0	5.0								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	3.0	4.0	6.0	2.0	5.0								
	Change in Land Use	Local resource consumption as borrow source(s) for construction.	Fine Material for Engineered Layers	Tonnage	Mt	0.0	0.0	2.5	2.5	0.0	1.1	6.0	6.0	1.0	1.0	6.0	3.9	1	6.0	6.0	1.0	1.0	6.0	3.9	1	6.0	6.0	1.0	1.0	6.0	3.9	
																		Total indicator merit score (Σ{S × Wi})	6.0	6.0	1.0	1.0	6.0	3.9								
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	6.0	6.0	1.0	1.0	6.0	3.9								
	Population at Risk	Health risk to people downstream.	*see below	Value	#	-	-	-	-	-	-	1.0	5.0	3.0	6.0	4.0	5.0	1	1.0	5.0	3.0	6.0	4.0	5.0	1	1.0	3.0	4.5	6.0	2.5	4.0	
		Worker safety and human health during construction, operation, and closure.	*see below	Value	#	-	-	-	-	-	-	1.0	1.0	6.0	6.0	1.0	3.0	1	1.0	1.0	6.0	6.0	1.0	3.0								
																		Total indicator merit score (Σ{S × Wi})	2.0	6.0	9.0	12.0	5.0	8.0		**8.0**	**12.0**	**9.5**	**13.0**	**10.5**	**12.9**	**Total sub-account merit score (Σ{Rs × Ws})**
																		Subaccount merit rating (Rs = Σ{S×Wi}/ ΣWi)	1.0	3.0	4.5	6.0	2.5	4.0		**2.7**	**4.0**	**3.2**	**4.3**	**3.5**	**4.3**	**Account merit rating (Ra = Σ{Rs×Ws}/ ΣWs)**

Alternatives:
1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unli
   d. Engineered Source Control (line
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (enginee

Indicator	Value	Descriptor
Change in local employment opportunities.	6 (Best)	Specialized labor for liner installation, + placement of engineered layers
	5	Some (partial) liner placement + some engineered layer placement
	4	Unlined + engineered layer placement
	3	Lined
	2	Some (partial) liner
	1 (Worst)	No liner or engineered layers
Health risk to people downstream.	6 (Best)	Least risk due to most engineering controls for water management
	5	Fully lined
	4	Partially Lined
	3	Engineered source control
	2	
	1 (Worst)	highest risk due to fewest engineering controls for water management
Worker safety and human health during construction, operation, and closure.	6 (Best)	Least noise, dust, and equipment exposure
	5	
	4	
	3	
	2	
	1 (Worst)	Greatest noise, dust and equipment exposure

Alternatives:
1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unlined)
   d. Engineered Source Control (lined)
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (engineered source control, lined)

ECCC Weighting

Account	Account Weight (W_a)	Account Merit Rating (R_a)						Account Merit Score (R_s*W_1)								
		1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b			
Environmental	6	1.5	2.4	4.6	5.5	2.4	5.5	8.9	14.6	27.4	33.1	14.6	33.1	33.1	8.9	
Technical	3	3.9	4.5	3.8	4.1	3.6	3.5	11.6	13.6	11.5	12.4	10.9	10.4	13.6	10.4	
Economic	1.5	5.6	2.7	5.0	1.7	3.7	3.8	8.5	4.1	7.6	2.6	5.6	5.7	8.5	2.6	
Social	3	2.7	4.0	3.2	4.3	3.5	4.3	8.0	12.0	9.5	13.0	10.5	12.9	13.0	8.0	
	13.5							**36.9**	**44.2**	**56.0**	**61.1**	**41.6**	**62.1**			**Total account merit score (Σ{Ra × Wa})**
								2.7	**3.3**	**4.1**	**4.5**	**3.1**	**4.6**			**Alternative merit rating (A = Σ{Ra×Wa}/ ΣWa)**
								6	**4**	**3**	**2**	**5**	**1**			**Rank**

Table D-7: Waste Rock Alternatives Assessment, Multiple Accounts Analysis, Sensitivity

ECCC Weighting

Account	Weight	Account Merit Weighting						Account Merit Score					
		1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b
Environmental	6	1.5	2.4	4.6	5.5	2.4	5.5	8.9	14.6	27.4	33.1	14.6	33.1
Technical	3	3.9	4.5	3.8	4.1	3.6	3.5	11.6	13.6	11.5	12.4	10.9	10.4
Economic	1.5	5.6	2.7	5.0	1.7	3.7	3.8	8.5	4.1	7.6	2.6	5.6	5.7
Social	3	2.7	4.0	3.2	4.3	3.5	4.3	8.0	12.0	9.5	13.0	10.5	12.9
	13.5						Total Account Merit Score	36.9	44.2	56.0	61.1	41.6	62.1
							Account Merit Rating	2.7	3.3	4.1	4.5	3.1	4.6
							Rank	**6**	**4**	**3**	**2**	**5**	**1**

1. Unsegregated
a. Base Case (unlined)

b. Base Case (lined)

c. Engineered Source Control (unlined)

d. Engineered Source Control (lined)

2. Segregated
a. NPAG (unlined) + PAG (lined)

b. NPAG (unlined) + PAG (engineered source control, lined)

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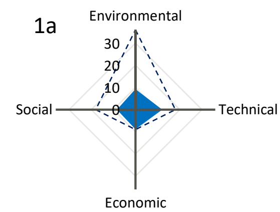

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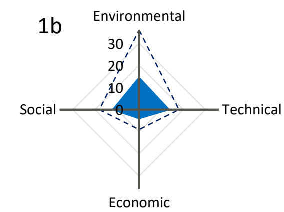

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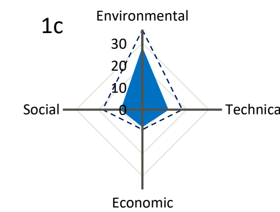

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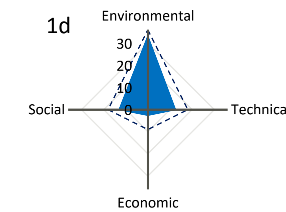

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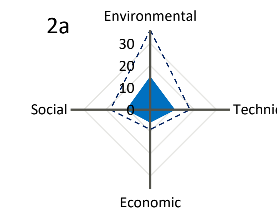

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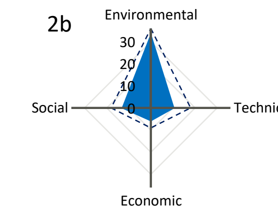

NexGen Weighting

Account	Weight	Account Merit Rating						Account Merit Score					
		1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b
Environmental	4.1	1.5	2.4	4.6	5.5	2.4	5.5	6.0	9.8	18.5	22.4	9.8	22.3
Technical	2.0	3.9	4.5	3.8	4.1	3.6	3.5	7.8	9.2	7.7	8.4	7.4	7.0
Economic	3.4	5.6	2.7	5.0	1.7	3.7	3.8	19.0	9.1	17.0	5.8	12.6	12.9
Social	4.1	2.7	4.0	3.2	4.3	3.5	4.3	10.8	16.2	12.8	17.6	14.2	17.4
	13.5						Total Account Merit Score	43.6	44.3	56.1	54.1	44.0	59.6
							Account Merit Rating	3.2	3.3	4.2	4.0	3.3	4.4
							Rank	**6**	**4**	**2**	**3**	**5**	**1**

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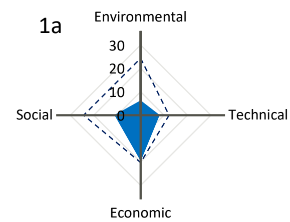

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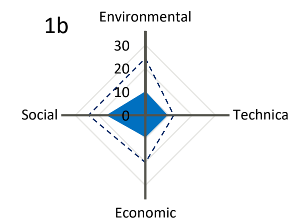

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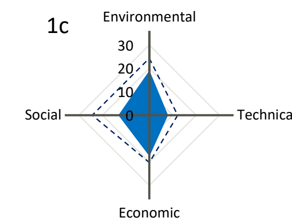

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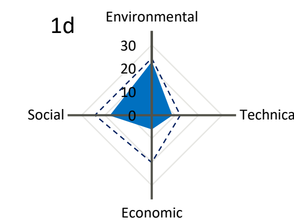

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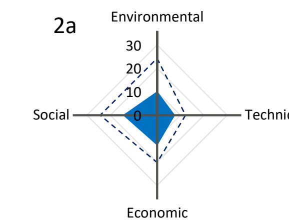

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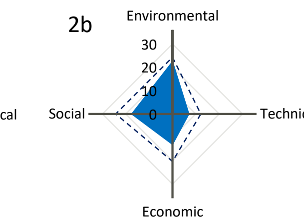

Equal Weighting

Account	Weight	Account Merit Rating						Account Merit Score					
		1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b
Environmental	3.4	1.5	2.4	4.6	5.5	2.4	5.5	5.0	8.2	15.4	18.6	8.2	18.6
Technical	3.4	3.9	4.5	3.8	4.1	3.6	3.5	13.0	15.3	12.9	14.0	12.3	11.7
Economic	3.4	5.6	2.7	5.0	1.7	3.7	3.8	19.0	9.1	17.0	5.8	12.6	12.9
Social	3.4	2.7	4.0	3.2	4.3	3.5	4.3	9.0	13.5	10.7	14.6	11.8	14.5
	13.5						Total Account Merit Score	46.0	46.1	56.0	53.0	44.9	57.7
	3.375						Account Merit Rating	3.4	3.4	4.2	3.9	3.3	4.3
							Rank	**5**	**4**	**2**	**3**	**6**	**1**

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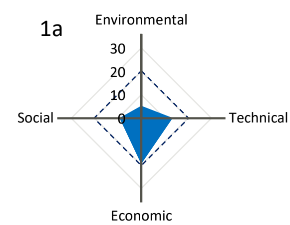

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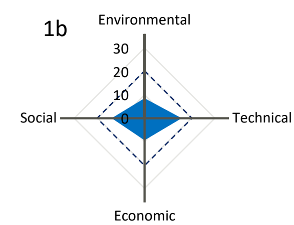

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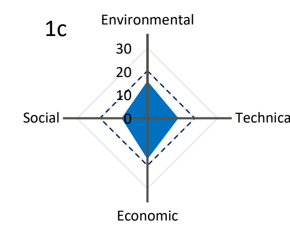

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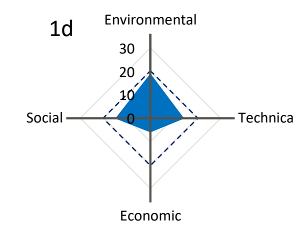

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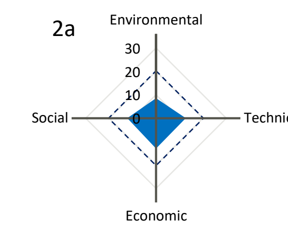

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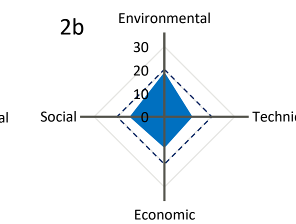
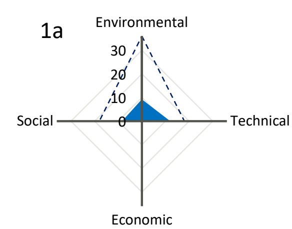


ECCC Weighting with Economic = 0

Account	Weight	Account Merit Rating						Account Merit Score					
		1a	1b	1c	1d	2a	2b	1a	1b	1c	1d	2a	2b
Environmental	6	1.5	2.4	4.6	5.5	2.4	5.5	8.9	14.6	27.4	33.1	14.6	33.1
Technical	3	3.9	4.5	3.8	4.1	3.6	3.5	11.6	13.6	11.5	12.4	10.9	10.4
Economic	0	5.6	2.7	5.0	1.7	3.7	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Social	3	2.7	4.0	3.2	4.3	3.5	4.3	8.0	12.0	9.5	13.0	10.5	12.9
	12						Total Account Merit Score	28.4	40.2	48.4	58.6	36.0	56.3
							Account Merit Rating	2.4	3.3	4.0	4.9	3.0	4.7
							Rank	**6**	**4**	**3**	**1**	**5**	**2**

1a


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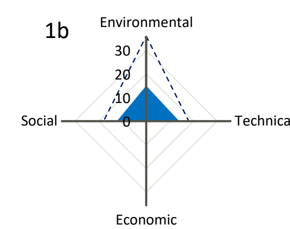

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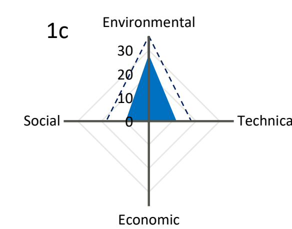

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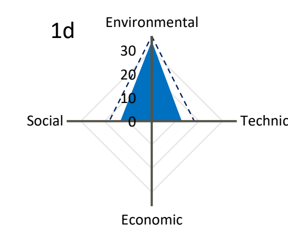

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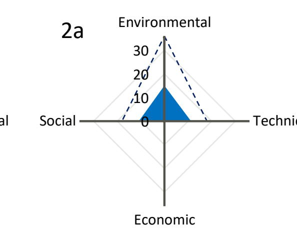

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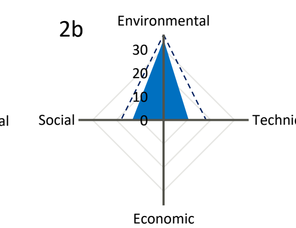

Alternatives:

1. Unsegregated
   a. Base Case (unlined)
   b. Base Case (lined)
   c. Engineered Source Control (unlined)
   d. Engineered Source Control (lined)
2. Segregated
   a. NPAG (unlined) + PAG (lined)
   b. NPAG (unlined) + PAG (engineered source control, lined)