# CMD 25-H3.REF - CNSC Staff Submission

## Reference Package for CMD 25-H3 Submission from CNSC Staff on Cameco Corporation Request to Revoke the Current Licence and Release the Beaverlodge Project to the Institutional Control Program

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| **Classification** | UNCLASSIFIED |
| **Type of CMD** | References |
| **CMD Number** | 25-H3.REF |
| **Original CMD** | 25-H3 |
| **Public hearing date** | 29-30 January 2025 |
| **PDF e-DOC #** | 7330036 |
| **Summary** | This supplemental CMD includes all publicly available documents referenced in CNSC staff CMD 25-H3. Confidential and classified documents referenced in CMD 25-H3 are not included. |
| **Actions required** | There are no actions requested of the Commission. This CMD is in support of the actions and recommendations set out in CNSC staff CMD 25-H3. |

# CMD 25-H3.REF – Soumission par le personnel de la CCSN

## Dossier de référence pour le CMD 25-H3 Mémoire du personnel de la CCSN concernant la demande de Cameco Corporation de révoquer le permis actuel et de soumettre le projet Beaverlodge au programme de contrôle institutionnel

| | |
|---|---|
| **Classification** | NON CLASSIFIÉ |
| **Type de CMD** | Références |
| **Numéro de CMD** | 25-H3.REF |
| **CMD Original** | 25-H3 |
| **Date de l'audience** | 29 et 30 janvier 2025 |
| **Numéro e-Doc du PDF** | 7330036 |
| **Résumé** | Ce CMD supplémentaire comprend tous les documents accessibles au public qui sont référencés dans le CMD 25-H3 du personnel de la CCSN. Les documents confidentiels et classifiés mentionnés dans le CMD 25-H3 ne sont pas inclus. |
| **Mesures requises** | Aucune mesure n'est requise de la Commission. Ce CMD soutient les actions et les recommandations énoncées dans le CMD 25-H3 du personnel de la CCSN. |

Canadian Nuclear Safety Commission Commission canadienne de sûreté nucléaire

Canada

# CMD 25-H3.REF

# Reference Package for CMD 25-H3 Submission from CNSC Staff on Cameco Corporation Request to Revoke the Current Licence and Release the Beaverlodge Project to the Institutional Control Program

## Signed by:

X

Sigouin, Luc
C=CA, O=GC, OU=CNSC-CCSN, CN="Sigouin, Luc"

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Luc Sigouin
Director General, Directorate of Nuclear Cycle and Facilities Regulation

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# 1 Final Closure Report Beaverlodge Properties

# Final Closure Report

# Beaverlodge Properties

**URA 7, URA 1, BOLGER 1,**

**Tailings Management Area Properties**

**Prepared for**

## Cameco Corporation

**2121 – 11th Street West**
**Saskatoon, Saskatchewan**
**S7M 1J3**

**Prepared by**

**Kingsmere Resource Services Inc.**
Box 1475
Prince Albert, SK
S6V 5T1

**NOVEMBER 2023**

This report is dedicated to the memory of Don Hovdebo who passed away unexpectedly before this report was finalized. Don was instrumental in the development of the Province of Saskatchewan's Institutional Control Program and played key role in supporting the management of the decommissioned Beaverlodge Site. His passion for northern Saskatchewan and its people was evident in everything he did. Don's in-depth experience and knowledge was invaluable and greatly contributed to the strength of this report. Don was a great mentor and will be dearly missed by all who knew him.

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# Glossary

Definitions of the terms used in this report are as follows:

| Term | Definition |
|---|---|
| **Adit (Decline, Portal)** | A horizontal or nearly horizontal entrance to an underground mine usually driven into the side of a hill or rock outcrop where local topography allows. |
| **Administrative Controls** | Administrative controls are a type of hazard control used to improve safety by putting in place policies, rules and/or restrictions decided to reduce the risk to the public via actions such limiting access and/or allowable activities. |
| **ARD (Acid Rock Drainage)** | Base metal, precious metal and uranium mines contain sulphide minerals, either in the ore or the surrounding waste rock. When these sulphide minerals, particularly pyrite and pyrrhotite, are exposed to oxygen and water, a process of conversion of sulphide to sulphate takes place. Water in contact with these oxidizing minerals is made acidic, and in the absence of calcareous materials, such as calcite, the acidic water carries with it toxic metals and elevated levels of dissolved salts. As the reactions proceed, temperature and acidity increase, resulting in an increased rate of reaction. Rainfall and snowmelt flush the toxic solutions from the waste sites into the downstream environment. If acidic drainage is left uncollected and untreated, the drainage can contaminate groundwater and local water courses, damaging the health of plants, wildlife, and fish (MEND, 1992). |
| **Catastrophic Failure** | A sudden failure without warning (E.g. crown pillar collapse, dam failure, large scale slope slip [slide], etc.), as opposed to a degradation failure |
| **Closed Site** | A site at which all decommissioning, remediation and reclamation measures and transition phase monitoring have been completed to the satisfaction of an institution willing to accept custodial responsibility. |
| **COPC** | Constituents of potential concern or contaminants of potential concern. |
| **Crown Pillar** | A rock mass of variable geometry that is situated above the uppermost underground workings of a mine and that serves to ensure permanently or temporarily the stability of surface elements and underground workings. |
| **Decommissioning** | The activity of disassembling, dismantling, disposal, removal or otherwise addressing all infrastructures associated with a project or site. |
| **Degradation Failure** | The failure of an aspect over time due to such things as the effects of time, metal fatigue, incremental erosion, etc. Degradation failures, if left unaddressed, can increase the potential of catastrophic failure. |
| **Disturbed Land** | Land that has been disturbed by human activities to the extent that there is a material difference in the physical, chemical or biological characteristics of the disturbed land. Disturbances can either improve or impair future land use options. Cleared land, re-graded land, waste rock piles, land affected by a surface or groundwater contaminant plume, etc. are examples of disturbed lands. |
| **Dorrclone** | Facility where the coarse material in mill tailings was separated by cyclones for underground backfill and the finer material pumped to the tailing's disposal area. In the actual operation, the tailings slurry from the mill was pumped to a bank of six hydrocyclone separators. The overflow fines flowed by gravity at approximately 10% solids to Fookes tailings area and the coarse bottom fraction was re-slurried and pumped to a second bank of six hydrocyclone separators. The underflow from the second bank of separators was stored in a backfill tank for later use in the mine. |
| **Engineered Structure** | A constructed facility or structure (i.e., building, dyke, overflow channel, shaft cap, etc.) or remnants of such. |

| Term | Definition |
|---|---|
| **Formerly Regulated Lands** | Areas of the Beaverlodge site which formerly hosted activities regulated by the *Atomic Energy Control Act* (and subsequently, *the Nuclear Safety and Control Act*) and therefore require inclusion in the Saskatchewan Institutional Control Registry. |
| **Flowing Artesian** | Refers to groundwater that is upwelling above the ground surface due to piezometric levels that exceed the surface elevation of the delta |
| **Guidelines** | Recommended, non-mandatory controls that serve as a reference when no applicable standards are in place. |
| **Hazard** | A source of potential harm, or a situation with a potential for causing harm, in terms of human injury, damage to health, property, the environment and other things of value; or some combination of these. (Source: Risk Management: Guideline for Decision Makers, CAN/CSA-Q850-97 (Reaffirmed 2009), Canadian Standards Association, 2009) |
| **Institutional Controls** | Actions, mechanisms and arrangements implemented to maintain control or knowledge of a closed site after custodial transfer. This control may be active (e.g. by means of monitoring, surveillance, remedial work, fences, etc.) or passive (e.g. land use restrictions, markers, records, etc.). Activities undertaken by the post-transfer custodian can range from the simple act of permanently recording the location of a remediated site; to conducting regular inspections that may or may not include active measurements and the collection of samples for analysis; all the way to maintenance of certain aspects of the property. |
| **Impacted Lands** | Areas of the Beaverlodge site identified by the Saskatchewan Ministry of Environment as "formerly impacted lands requiring administrative controls or scheduled inspection of specific aspects" and therefore require inclusion in the Saskatchewan Institutional Control Registry. |
| **Long-term** | 100 years or more. |
| **Mine Site** | A previously active mining area, including all land used in or resulting from the work of extracting minerals from their natural deposits or the secondary recovery of ore from refuse or other storage piles, wastes, or mill tailings by any means or method and all works engines, machinery, plant, buildings, residual material (i.e. mill tailings, spent heap leach material, etc.), waste rock and waste management facilities associated with that activity. |
| **Objectives** | Non-statutory limits used to guide decisions. (Example: Environment Canada – "Water quality objectives specify the concentrations of substances permissible for all intended water uses at a *specific location* on a lake, river, or estuary. The objectives are based on the water quality guidelines for the uses at that location, as well as on public input and socio-economic considerations.") |
| **Raise** | A vertical or inclined excavation in an underground mine that leads from one level, or drift, to another or from one drift or level to surface (i.e. vent raise). |
| **Reclamation** | Actions intended to return the land surface to an equivalent undisturbed condition. Reclaimed land has achieved the desired condition. |
| **Remediation** | Action taken to remove/reduce a hazard and improve safety or to remove, isolate or reduce pollution or contaminants from environmental media such as soil, groundwater, sediment, or surface water. |
| **Risk** | The chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment or other things of value. (Source: Risk Management: Guideline for Decision Makers, CAN/CSA-Q850-97 (Reaffirmed 2009), Canadian Standards Association, 2009) |
| **Shaft** | A vertical excavation adjacent to an ore body equipped with a hoist. A shaft is generally used when ground conditions, ground water, ventilation or other worker safety conditions warrant or when haulage to surface via truck is not economical. |

| Term | Definition |
|---|---|
| **Slumping** (Sloughing) | Slope (rock) movement that occurs when a coherent mass of loosely consolidated materials or rock layers moves a short distance down a slope typically as a mass and under the force of gravity. |
| **Stakeholder** | Any individual, community, group or organisation with an interest in the state of the site or outcome of a remediation programme, either as a result of being affected by it positively or negatively, or by being able to influence the activity in a positive or negative way. |
| **Tailings** | Uneconomical materials remaining after passing mined ore through a mill or processing facility for the purpose of extraction of the valuable fraction. |
| **Transition Phase Monitoring** | Monitoring conducted once all decommissioning, remediation and reclamation activities are completed to demonstrate that all areas are performing as predicted and to demonstrate that the site is physically and chemically stable. |

# 1 Introduction

## 1.1 Background

Following the implementation of the Province of Saskatchewan's Institutional Control Program (IC Program), the Beaverlodge Management Framework (the Framework) was developed to provide a clear scope for the management of the decommissioned Beaverlodge properties. The Framework outlines a systematic process for assessing site-specific risks to facilitate the transfer of Beaverlodge properties to the IC Program or, in the absence of historical mining/milling activities, for the properties to be free-released. The Framework was developed cooperatively in 2009 by Cameco Corporation (Cameco) and the Joint Regulatory Group (JRG) consisting of the Canadian Nuclear Safety Commission (CNSC), the Saskatchewan Ministry of Environment (SkMOE), Department of Fisheries and Oceans (DFO) and Environment and Climate Change Canada (ECCC). The Framework was presented to the CNSC Commission members during 2009 re-licensing activities, was accepted by the Commission and is referenced in the Licence Condition Handbook (LCH). In addition to collaboration with the JRG, the Framework has been reviewed with public stakeholders, including the Northern Saskatchewan Environmental Quality Committee, as well as residents and leaders of the Northern Settlement of Uranium City.

In following the Framework, Cameco developed the Beaverlodge Path Forward Report (Path Forward) to establish an agreed upon remediation plan paired with evaluation criteria and the expected timeline for transferring properties into the IC program. The Path Forward confirmed that natural recovery paired with additional site-specific remedial options was the best long-term management scenario for the properties. The remedial options that were selected were considered to be based on good engineering practices, contribute to long-term safety and security and expected to result in localized improvements in water quality. The Path Forward was presented to the CNSC Commission members during 2013 relicensing. The Path Forward was accepted by the Commission and Cameco was issued Cameco a 10-year licence to implement the remedial work and prepare the properties for transfer to the IC program.

The Path Forward included criteria to establish that potential risks have been managed and that the properties would be eligible for transfer to the IC Program. The criteria consisted of the overall performance objectives of "safe, secure and stable/ improving." The CNSC Staff presented further information on the performance objectives and associated performance indicators and regulatory acceptance criteria to the Commission in 2014. To facilitate the release from CNSC licensing and transfer to the IC program, Cameco proposed advancing properties in a staged approach.

In 2009, Cameco successfully transferred 5 properties to the provincial IC Program, following release from decommissioning and reclamation by SkMOE, release from CNSC licensing and acceptance by the Saskatchewan Ministry of Energy and Resources (SkMER). During 2016, discussions were held with the SkMOE and the Ministry of Economy (now SkMER) to establish the expected Beaverlodge IC boundaries. The boundaries developed during those discussions reflect the expected IC boundaries once all the properties are ready for transfer to IC and are based on areas of historic mining/milling activities requiring long term monitoring or administrative controls to ensure future land use restrictions are maintained, if required. Most recently, in 2019 and 2020, Cameco successfully transferred 19 properties to the provincial IC Program, following release from decommissioning and reclamation by SkMOE, release from CNSC licensing and acceptance by the SkMER. One property and portions of some properties were free-released due to the absence of historical mining/milling activities and lack of any safety or environmental risk and therefore have not required any long-term monitoring or ongoing administrative controls. In 2022, an additional 18 properties were released from CNSC licensing and in 2023 the properties were granted a release from decommissioning and reclamation requirements from SkMOE. It is anticipated that these 18 properties, or portions there of, will be transferred to the IC Program, in Q4 of 2023. This report follows a similar format to the report applications successfully submitted for the previous 43 Beaverlodge properties, which initiated the regulatory review process for Cameco to receive a release from decommissioning and reclamation by SkMOE, release from CNSC licensing and acceptance of the properties to the IC Program or free-release.

## 1.2 Purpose

In accordance with the Path Forward, following a similar process from previous, successful applications, Cameco is hereby submitting this application for the remaining 27 decommissioned Beaverlodge properties to initiate their transfer to the IC program or to have portions free-released where applicable. These properties include; URA 7, URA 1, BOLGER 1, the Fookes Reservoir Area (GC 3, EXC GC 3, GC 5, GC 1, GORE 1, NW 2, NW 1, LEE 4, GORE 2, LEE 3, EXC LEE 3, LEE 2), the Marie Reservoir Area (EXC ACE 18, EXC ACE 17, ACE 17, ACE 15, EXC ACE 14, GORE, EXC GC 2, GC 4, EXC GC 4) Minewater Reservoir Area (EXC URA 6, ACE 19, URA 6) (**Figure 1**). Cameco understands the CNSC, SkMOE and SkMER, must all agree that the Properties have met all the requirements to be considered for transfer.

Cameco requests that the SkMOE consider this submission as a formal request for "Release from Decommissioning and Reclamation" pursuant to Section 22 of *The Mineral Industry Environmental Protection Regulations (MIEPR), 1996*.

Cameco is also providing this report to SkMER for review, in support of an application for custodial transfer of the properties into the IC Program in accordance with *The Reclaimed Industrial Sites Act*. The report contains an assessment of the properties, which will help to inform a proposed schedule and cost estimate of IC inspections prior to the properties being transferred into the IC Program.

The process for entry to the IC Program that has been followed to date requires a Partial Surrender of Surface Lease (Beaverlodge Surface Lease Agreement, 2006) from the Ministry of Environment - Lands Branch, before SkMER will accept the Properties into the IC Program. The properties subject to this report are the last decommissioned Beaverlodge properties to be proposed for the IC Program. Therefore, once all of the decommissioned Beaverlodge properties are released from CNSC licensing, termination of the Surface Lease will be requested from the Ministry of Environment - Lands Branch.

If a specific property is licensed pursuant to the federal NSCA, the CNSC must agree, in writing, to grant an exemption or release from the obligation to hold a licence under the NSCA in order for an individual property to be accepted into the provincial IC Program. Activities on the Beaverlodge site are currently managed under a CNSC Waste Facility Operating License (WFOL-W5-2120.0/2025) issued pursuant to the NSCA which expires on May 31, 2025. By way of this submission, Cameco is providing the information required to support a decision by the CNSC to release the properties from CNSC licensing.

This report addresses the applicable aspects of CNSC REGDOC-2.11.2, *Decommissioning,* and provides a brief discussion of the historical use the properties, a discussion of past decommissioning and reclamation activities and a description of the current condition of the properties. The document also assesses the properties against the performance objectives and associated performance indicators, provides a summary of remaining (if any) hazards/liabilities associated with each and identifies the anticipated institutional control requirements. For ease of discussion, the Tailings Management Area (TMA) properties are discussed herein as three distinct areas rather than individual properties.

The report also provides a document log for each individual property or area.

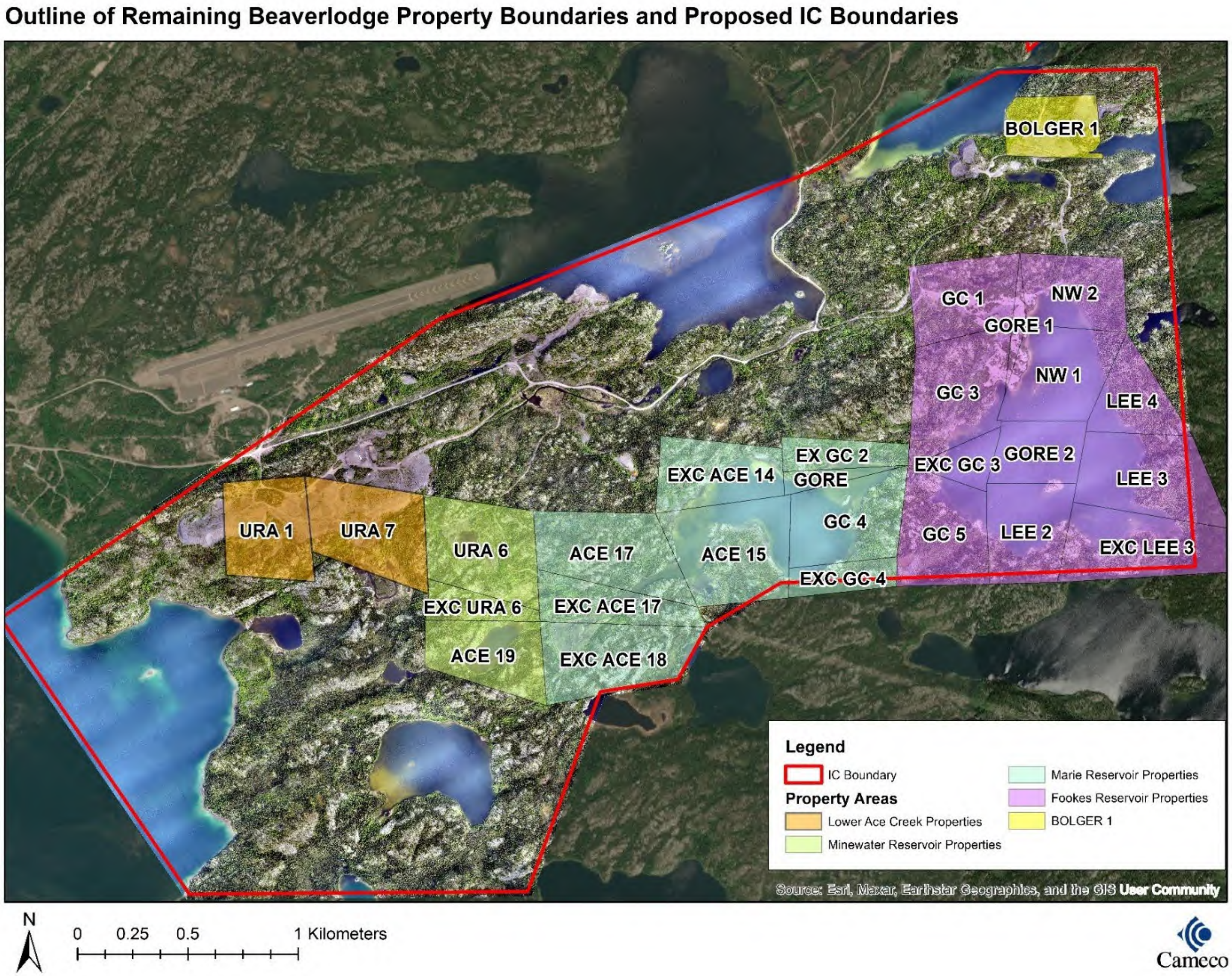



**Figure 1: Outline of Remaining Beaverlodge Property Boundaries and Proposed IC boundaries**

## 1.3 Schedule

All physical work to prepare the properties for transfer to the IC Program has been completed. The current WFOL-W5-2120.0/2025 is set to expire in May 2025 and the Beaverlodge Surface Lease Agreement expires in December 2026. The decommissioned Beaverlodge Properties have met the established criteria to facilitate a release from CNSC licensing; Release from Decommissioning and Reclamation from SkMOE; and transfer to the ICP, managed by SkMER. The plan is to complete all document preparation, public engagement, and regulatory processes to support the final release of the decommissioned Beaverlodge properties prior to May 2025,to facilitate transfer to the IC program.

# 2 Submitting Organization

This document is submitted by:

**CAMECO CORPORATION**
2121 - 11th Street West
Saskatoon, Saskatchewan
S7M 1J3

(306) 956-6200 (Phone)
(306) 956-6201 (FAX)

Officers of Cameco Corporation are as follows:

| | |
|---|---|
| President & Chief Executive Officer | - T. S. Gitzel |
| Senior Vice-President & Chief Financial Officer | - G. Isaac |
| Senior Vice-President & Chief Operating Officer | - B. Reilly |
| Senior Vice-President & Chief Corporate Officer | - A. Wong |
| Senior Vice-President, Chief Legal Officer & Corporate Secretary | - S. Quinn |

The Board of Directors of Cameco Corporation as of October 31, 2023 is as follows:

| | |
|---|---|
| C. Gignac | L. van Leeuwen-Atkins |
| D. Camus | D. Kayne |
| T. Gitzel | K. Jackson |
| J. Gowans | D. Minière |
| T. Cook-Searson | D. Deranger |

Management (monitoring and maintenance) of the decommissioned Beaverlodge properties is the responsibility of Cameco, while the Government of Canada, through Canada Eldor Inc. (CEI) retains responsibility for the financial liabilities associated with the properties. Including the provision of funds to finance the long-term monitoring program to be implemented under the IC Program.

# 3 Beaverlodge Site History

## 3.1 Eldorado Mining and Refining Limited

Uranium bearing mineralization was first discovered in the Beaverlodge area of northern Saskatchewan in 1934 (**Figure 2**). Since there was little demand for uranium at that time, further prospecting and development in the region was delayed for almost ten years until 1944 when Eldorado Mining and Refining Ltd. (Eldorado), a crown corporation owned by the Government of Canada, commenced detailed exploration in the area of Fishhook Bay on the north shore of Lake Athabasca. Between 1944 and 1948 Eldorado continued to explore the area around Beaverlodge Lake, discovering the Martin Lake and Ace Zones in 1946. In 1947, a prospecting incline shaft was developed to explore the Ace ore body and the Dubyna claims were staked.

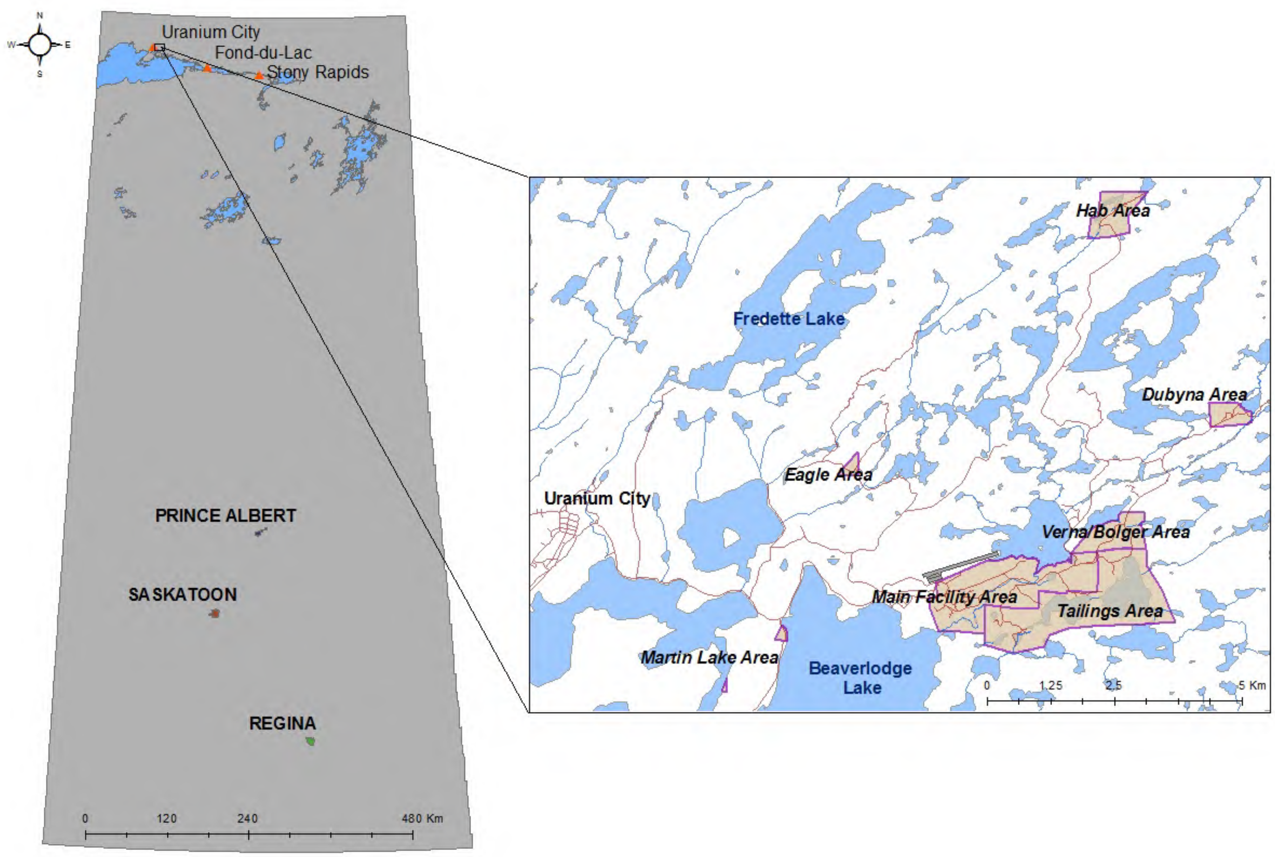



**Figure 2: Beaverlodge Site Area**

Exploration and initial development of a number of separate ore bodies continued until 1951 when Eldorado Mining and Refining Ltd. developed the Fay shaft and headframe, and the following year laid the foundations for a 450 tonnes/day (t/day) carbonate leach mill. Carbonate leach was selected over an acid leach process due to the high carbonate content of the ore. The mill started production in 1953 and expanded to 680 t/day in 1954, to 1800 t/day in 1956 and operated until 1982. Over its operating history, Eldorado Mining and Refining Limited was also known as Eldorado Nuclear Limited and Eldorado Resources Limited.

During the years of mining activity at the Beaverlodge site, the primary focus was on an area north and east of Beaverlodge Lake where the Ace, Fay and Verna shafts were sunk with production from these areas continuing until 1982. Over the entire 30-year production period (1952 – 1982) the majority of the ore used to feed the mill came from these areas, however a number of satellite mines, primarily in the Ace Creek watershed and the Melville Lake/Beaverlodge Lake watershed were also developed and operated for shorter periods of time. Placement of mill tailings during the mill operating period was underground (40%) and into small waterbodies (60%) within the Fulton Creek watershed.

Although the Atomic Energy Control Board (the predecessor to the current CNSC) licensed the Beaverlodge activities, environmental protection legislation and regulation did not exist either federally or provincially and therefore was not a consideration during the early operating period. It was not until the mid-1970's that effluent treatment processes were initiated at the Beaverlodge site in response to discussions with provincial and federal regulatory authorities.

At the request of the Atomic Energy Control Board (AECB) a conceptual decommissioning plan was submitted in June 1981. On December 3, 1981, Eldorado Nuclear Limited (formerly Eldorado Mining and Refining Ltd.) announced that its operation at Beaverlodge would be shutdown.

Mining operations at the Beaverlodge site ceased on June 25, 1982 and the mill discontinued processing ores in mid-August 1982. At that time, Eldorado initiated site decommissioning, following a formally approved plan. The decommissioning and reclamation work was completed in 1985 and transition phase monitoring was initiated at that time. The transition phase monitoring continues today.

The original decommissioning and reclamation documents were presented in six documents to the regulatory agencies (consisting of the AECB, Environment Canada, Labour Canada, Environment Saskatchewan and Labour Saskatchewan) between June 1982 and February 1987. These are:

1. *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site*, June 1982, Eldorado Nuclear Limited

2. *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2 Operating History and Environmental Conditions*, February 1983, Eldorado Resources Limited

3. *Beaverlodge Tailings and Sludges Close-Out Engineering Feasibility Studies*, February 1983, Eldorado Resources Limited

4. *Radiological and Environmental Assessment of Close-out Options*, April 1983, Eldorado Resources Limited

5. *Plan for Close-out of the Beaverlodge Site, Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site*, August 1983, Eldorado Nuclear Limited

6. *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site,* February 1987, Eldorado

The Beaverlodge operation was the first uranium mining and milling operation in Canada to be subject to a formal decommissioning and reclamation strategy. As such, each phase of the shutdown, decommissioning and reclamation was subject to detailed discussion between Eldorado and the regulatory agencies. At the time of decommissioning the regulatory agencies formed the Joint Review Committee (JRC) (consisting of the AECB, Environment Canada, Labour Canada, Environment Saskatchewan and Labour Saskatchewan) and throughout the decommissioning and reclamation project, regular progress meetings were held and chaired by the AECB as the lead agency (Eldorado 1987). The JRC established close-out criteria, were kept informed of all activities and conducted regular on-site inspection and monitoring to ensure that the decommissioning and reclamation activities were undertaken according to the plan and in a safe manner. Joint approvals were issued on behalf of the inter-agency committee with the primary documents being:

- *Eldorado Nuclear Ltd., Eldorado, Saskatchewan, Decommissioning and Close-Out Approval AECB-DCOA-130-0*.

- *AECB AECB-DA-142-0, Eldorado Resources Limited Decommissioning Approval*, Atomic Energy Control Board, November 1983

## 3.2 Cameco Corporation

On February 22, 1988, the Government of Canada and the Province of Saskatchewan publicly announced their intention to establish an integrated uranium company as the initial step in privatizing their respective uranium investments.

On October 5, 1988, Cameco Corporation - a Canadian Mining and Energy Corporation was created from the merger of the assets of the Saskatchewan Mining Development Corporation (a crown corporation owned by the Province of Saskatchewan) and Eldorado Resources Limited (the federal crown corporation). Following the merger, management (monitoring and maintenance) of the decommissioned Beaverlodge properties became the responsibility of Cameco Corporation - a Canadian Mining and Energy Corporation, while the Government of Canada, CEI retained responsibility for the financial liabilities associated with the properties. Cameco - a Canadian Mining and Energy Corporation was issued *AECB-MFDL-340-0 Cameco, Beaverlodge/Dubyna Saskatchewan Decommissioning License* by the Atomic Energy Control Board in October 1988.

In 1990, Cameco Corporation - a Canadian Mining and Energy Corporation's name was changed to simply Cameco Corporation (Cameco) and currently shares of Cameco are traded on both the Toronto and New York stock exchanges.

The management of the Beaverlodge monitoring program and any special projects associated with the properties is the responsibility of the Compliance & Licensing – Safety, Health, Environment and Quality (SHEQ ) Department, Cameco.

## 3.3 Local Environment

The Beaverlodge site is located within the Taiga Shield ecoregion which is the northernmost ecozone of the province. The area is underlain by the crystalline rocks of the Precambrian shield, with poor soil development, covered in areas by glacial drift. The poor drainage and rolling post-glacial topography result in numerous lakes. The area's cold winters and low precipitation limit the vegetation to lichen woodlands on higher elevations, and bogs in the lowlands which contribute to a low number of animal species—the lowest of any ecozone in the province (U of Regina 2015).

Chapter 2 of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2 Operating History and Environmental Conditions* (Eldorado 1983) provides a more detailed discussion of the local terrestrial and aquatic environments in the Beaverlodge area.

While Beaverlodge Lake is the receiving environment for water exiting the Beaverlodge decommissioned sites, it is also the receiving environment for discharges from the former Lorado Uranium Mining Ltd. mill site and tailings area, and nine other non-Eldorado abandoned uranium mine sites within the Beaverlodge Lake watershed.

# 4 Development of the Beaverlodge Performance Objectives

## 4.1 Beaverlodge Management Framework

In response to the implementation of the IC Program, the Beaverlodge Management Framework (Cameco 2009) was developed cooperatively between Cameco and the JRG. The Framework provides a clear scope for the management of the decommissioned Beaverlodge properties and a systematic process for assessing potential residual site-specific risks to allow decisions to be made regarding the transfer of Beaverlodge properties to the IC Program. The accepted Framework has been reviewed by public stakeholders, including the Northern Saskatchewan Environmental Quality Committee, as well as residents and leaders of the Uranium City community. Five general stages (**Figure 3**) are applied to each property using the Framework and include the following:

- Establish a comprehensive foundation of information upon which residual risks can be assessed.
- Assess the residual risk posed by the properties.
- If necessary, develop and assess reasonable remedial options that could mitigate residual risk on or immediately downstream the properties.
- Implement selected remedial option(s) and monitor results.
- If implemented options are successful in achieving the expected benefit or if it is determined that nothing more could reasonably be done to mitigate the residual risk(s) beyond natural recovery, then an application will be made to transfer the property to the IC Program for long-term monitoring.

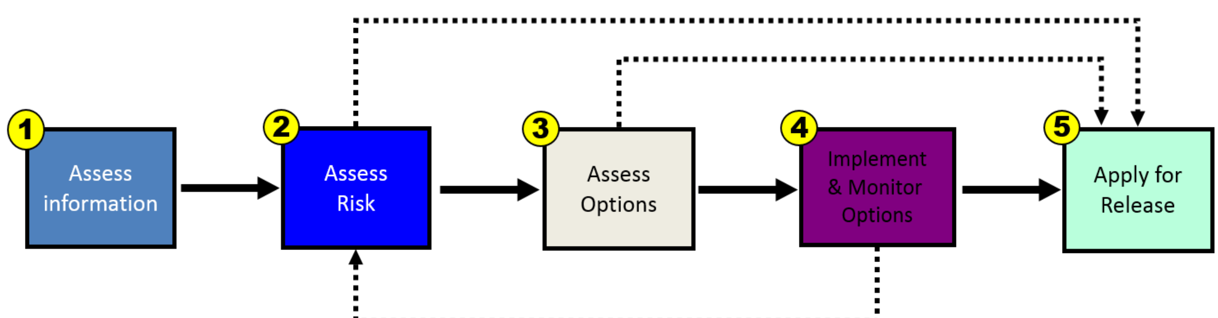



**Figure 3: Stages – Beaverlodge Management Framework**

In progressing through the Framework, Cameco has gathered extensive information regarding environmental conditions and human activities on the decommissioned properties through a combination of routine monitoring and special investigative studies. An example of a special investigative study conducted is the Country Food Study initiated in May 2010. This was a two-year study with a primary objective of determining whether there were any potential human health risks associated with the consumption of country foods gathered in the Uranium City area by local residents. The study involved interviewing community members as well as analyzing samples of wildlife and vegetation voluntarily provided by members of the community (CanNorth and SENES 2012). The study concluded that traditional harvesting of country foods does not present health risks to residents of Uranium City. Results from routine monitoring and special investigative studies like the Country Food Study, combined with historical information, was used to develop the Beaverlodge Quantitative Site Model (QSM; SENES 2012a; 2012b).

The QSM was a tool that allowed for assessment of ecological and human health risk from a baseline water and sediment quality perspective, which was established based on information gathered in the first phase of the Framework. In addition, the QSM was developed with a feature that allowed simulation of potential remedial activities and comparison of simulated results to the baseline option.

Once the QSM was developed, a Remedial Options Workshop was conducted in 2012, which included participants from Uranium City, including elders, youth and local leadership, as well as representatives of the Northern Saskatchewan Environmental Quality Committee (Athabasca Sub-committee) representing six Athabasca communities. Also, in attendance at this workshop were representatives from the JRG, Cameco, and a variety of third-party experts. This workshop presented various remedial options, their implementation costs, as well as their expected environmental benefits as evaluated in the QSM. Workshop results informed the assessment of potential remedial options and were instrumental in development of the Beaverlodge Path Forward Report (Cameco 2012).

## 4.2 Beaverlodge Path Forward Report

Following the development of the Framework and informed by the Beaverlodge remedial options workshop and the Path Forward Report was developed. The Path Forward Report provides a checklist and schedule of additional remedial activities to be implemented on the decommissioned Beaverlodge properties over the current 10-year licence period to address residual risk on the properties and prepare them for release from CNSC licensing and transfer to the IC program. In addition, the Path Forward Report also describes the performance objectives by which to assess the effectiveness of the implemented remedial activities. During the development of the Path Forward Report, all stakeholder feedback received during the remedial options workshop was considered.

Once the remedial activities have been implemented, and the properties are shown to meet the site performance objectives set out in the Path Forward Report, an application can then be made for a Release from Decommissioning and Reclamation from SkMOE, release from CNSC licensing and, where applicable, transfer to the Province of Saskatchewan's IC Program for long-term monitoring and stewardship.

The Framework and the Path Forward Report were presented to the CNSC during the Beaverlodge re-licensing hearing in 2013 and help form the licensing basis of the 10-year licence granted by the Commission.

### 4.2.1 Performance Objectives and Indicators

Criteria to determine the eligibility for release from decommissioning and reclamation, release from CNSC licensing and transfer to IC were presented to the CNSC Commission and SkMOE with the intent that each of the properties associated with the decommissioned Beaverlodge properties will be assessed through the Framework. The performance objectives for the decommissioned Beaverlodge site have been defined as “safe, secure, and stable/improving”.

> Safe – The site is safe for unrestricted public access. This objective is to ensure that the long-term safety is maintained.
>
> Secure – There must be confidence that long term risks to public health and safety have been assessed by qualified person and are acceptable.
>
> Stable/Improving – Environmental conditions (e.g. water quality) on and downstream of the decommissioned properties are stable and continue to naturally recover as predicted.

To determine if a property is meeting the performance objectives, site specific performance indicators were established (**Figure 4**). **Table 1** provides an overview of the performance indicators as presented to the Commission by CNSC Staff in 2014 meeting (CNSC 2014). The applicable indicators vary depending on the nature of the property, but generally include ensuring that: risks associated with residual gamma radiation and crown pillars are acceptable; mine openings to surface are closed and secure; boreholes (if present) are plugged; and, the site is free from historical mining debris. The stable/improving objective is also related to these performance indicators but is more relevant to monitoring water quality and comparing to predicted recovery. In order to verify that conditions on and downstream of the properties are stable/improving, Cameco has continued to monitor the progress of natural recovery and the expected localized improvements from the additional remedial measures implemented at the properties. Meeting the performance objectives will ensure that residual human health and ecological risks are managed to acceptable levels to allow for a release from licensing.

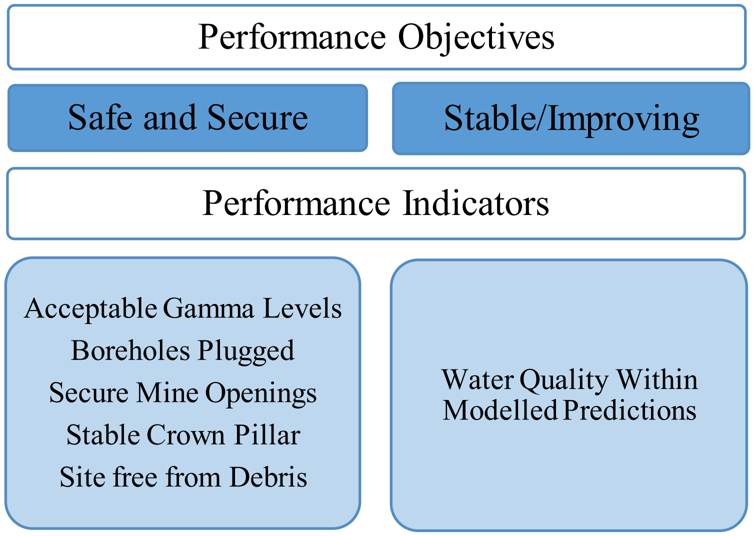



**Figure 4: Performance Objectives and Underlying Indicators**

**Table 1: Description and Acceptable Criteria - Beaverlodge Performance Indicators**

| Performance Indicators | Description | Acceptance Criteria |
|---|---|---|
| **Acceptable Gamma Levels** | Cameco will complete a site-wide gamma survey that will indicate where additional material may need to be applied to cover existing waste rock or tailings. Following the application of the cover material, a final survey will be completed of the remediated areas verifying that the cover was adequate. | Reasonable use scenario demonstrating gamma levels at the site are acceptable. |
| **Boreholes Plugged** | Cameco will plug all identified boreholes on the site to prevent groundwater outflow to the surface. | All boreholes have been sealed. |
| **Stable Mine Openings*** | The current concrete caps on the vertical mine openings will be replaced with new engineered caps with established designs to improve the long-term safety of the site, where applicable. | Mine openings have been secured and signed off by a qualified person, where applicable* |
| **Stable Crown Pillar** | Based on the surface subsidence in the Lower Ace Creek area, a crown pillar assessment will be completed for the four areas that have mine workings close to surface, specifically Hab, Dubyna, Bolger/Verna, and Lower Ace Creek. | Crown pillar assessed, remediated (if required), and signed off by a qualified person. |
| **Site Free From Debris** | Inspection and removal of any residual debris will be completed prior to exempting the properties from CNSC licensing and accepting them into the provincial IC Program. | Site free of former mining debris at the time of transfer to IC Program. |
| **Water Quality Within Modelled Predictions** | Trends established from past and future water monitoring will be compared to modelled predictions to verify:<br><br>1. That remedial options expected to result in localized improvements are having the desired effects; and<br><br>2. That natural recovery on and downstream of the decommissioned properties is continuing as predicted. | Water quality data is stable/improving. |

*Note: The performance indicator identified above as “Stable Mine Openings” was originally labelled as “Stable Caps on Vertical Mine Openings”. The scope and acceptable criteria for this performance indicator was expanded to include all mine openings.

# 5 Institutional Control

## 5.1 Saskatchewan Institutional Control Registry and Funds

A site cannot be accepted into the Saskatchewan IC Program until remediation activities have taken place and regulatory authorities have issued a release. In Saskatchewan, the responsible custodian under the IC Program is the ministry or ministries assigned responsibility for implementing and managing the program. The legislative authority to implement and enforce the IC Program is the *Reclaimed Industrial Sites Act* and the *Reclaimed Industrial Sites Regulations*. To date, SkMER is the provincial ministry that has been assigned the responsibility for managing the IC Program.

The program consists of two primary components, the Institutional Control Registry and the Institutional Control Funds. The registry maintains a formal list of the transferred properties and manages the funds provided for any required monitoring and maintenance work. The funds, which are provided at the time of transfer by the applicant pay for long term monitoring and maintenance of individual properties (if required) as well as any unforeseen events. Once accepted to the IC Program monitoring and maintenance will continue at an agreed upon frequency to ensure they continue to meet the performance objectives of safe, secure and stable/improving. Copies of the inspection reports will be available to interested members of the public.

The Saskatchewan IC Program addresses all aspects of conventional closed mines as well as the uranium-specific issues of radioactive waste management, including those defined in the articles of the International Atomic Energy Agency's (IAEA) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, all applicable provincial acts and regulations, and the NSCA. The program includes a formal, publicly accessible registry and document repository.

The Province of Saskatchewan's *The Reclaimed Industrial Sites Act* and its Regulations require provision of a fund sufficient to pay for the long-term monitoring and maintenance of the site. In addition, depending on whether any engineered structures or tailings remain on the site, an additional contribution of between 10 - 20% of the monitoring and maintenance amount is made to an Unforeseen Events Fund. The IC program also requires that a financial assurance in the amount of the maximum potential failure event be carried until such time as the Unforeseen Events Fund builds to a level that the Province of Saskatchewan is comfortable that there is sufficient money in the fund to cover any future unforeseen event.

As properties are transferred to the IC Program, Canada Eldor Inc. (CEI) provides the required funds to the Province of Saskatchewan to meet the Monitoring and Maintenance requirements as well as the Unforeseen Events Fund.

## 5.2 Maximum Potential Failure Event

The IC Program requires that a site holder post a financial assurance in the amount sufficient to cover the cost of the remediation of the maximum potential failure event. A financial assurance for the maximum potential failure event has not been required for Beaverlodge properties transferred to the IC Program as the financial liabilities associated with the management of the Beaverlodge properties are held by the Government of Canada. The financial liabilities are managed by Canada Eldor Inc. (CEI), a wholly owned subsidiary of the Canada Development Investment Corporation (CDEV) that reports to the federal Minister of Finance.

As such, the Ministry of Finance prepared the following statement, which states that no detailed maximum potential failure event calculations are required for the Beaverlodge properties,

> *"Canada Eldor Inc. is an agent of the Crown in right of Canada for all purposes. It follows that any undischarged obligations and liabilities of Canada Eldor Inc. are the obligations and liabilities of the Crown in right of Canada. That will include Canada Eldor Inc.'s obligations and liabilities to decommission the Beaverlodge Site and the expenses associated with possession, management and control of nuclear substances at that site.*
>
> *As the obligations and liabilities associated with this site have been accepted by the Crown, there is no need to maintain a financial assurance for the maximum potential failure event for these properties to cover any future unforeseen event"* (Cameco 2005).

## 5.3 Institutional Control Boundaries

During the operation of the former Eldorado Beaverlodge mines and milling facilities, the company retained formal tenure on 70 separate properties. To date, 43 of the properties have received a *Release from Decommissioning and Reclamation* from the SkMOE and been exempted/released from CNSC licensing. Of the 43 properties, 24 properties (or portions of them) have been transferred to the Saskatchewan IC Registry, while one property has been free-released in its entirety, while the other 18 properties are expected to be transferred in Q4 of 2023.

During 2016, discussions were held with the SkMOE and the Ministry of Economy (now SkMER) to establish the expected Beaverlodge Institutional Control boundaries. The boundaries developed during those discussions reflect the expected IC boundaries once all the properties are ready for transfer to IC and are based on areas of historic mining/milling activities requiring long term monitoring or administrative controls to ensure future land use restrictions are maintained. These areas have been outlined in red in Figure 1.

During active operations many of the Beaverlodge properties within these boundaries were retained to host the physical activities associated with mining, milling and waste management, many others were retained to secure access to individual sites, to host transmission and communications corridors, or to secure surface tenure over areas of underground mining. As a result, the post-closure condition of individual properties varies, as does the need for long term institutional controls.

The following provides a definition of the post-closure land status classifications for the former Eldorado Beaverlodge properties.

- *Disturbed Lands Within Current Surface Lease Boundary* - Areas which formerly hosted activities regulated by the Atomic Energy Control Act (and subsequently, the Nuclear Safety Control Act (NSCA) and located within the current surface lease boundaries, and therefore require inclusion in the Saskatchewan IC Registry. As these locations hosted licenced activities on or below surface, they have been determined to require either inspections or ongoing administrative controls to manage future development.

- *Disturbed Lands Outside of Surface Lease Boundary* - Areas identified by the SkMOE as off the current surface lease that will require administrative controls or scheduled inspection of specific aspects and therefore require inclusion in the Saskatchewan IC Registry. These areas include an approximately 50m buffer beyond the surface projected extent of the underground workings, as well as the area of Greer Lake downstream of the Tailings Management Area (TMA).

- *Free Release* - The Province of Saskatchewan identified some areas of the properties where management under the IC Program is unwarranted. These portions of Beaverlodge site are typically undisturbed land, or between mining areas, and did not host any licensed activities. As such there is no residual risk to be managed, nor any site features that will require long term monitoring, maintenance or ongoing administrative controls to manage future development. These areas are identified on Figure 1 as the areas that were within the original surface lease boundaries but lie outside the IC Boundary, outlined in red.

**Table 2** provides the coordinates of the proposed IC boundaries as applicable to the current request (also see **Figure 1**).

**Table 2: Coordinates of Institutional Control Boundaries**

| Area | UTM WGS84 Zone 12 | |
|---|---|---|
| | X Coordinate (East) | Y Coordinate (North) |
| **Main Site** | 646274 | 6606475 |
| | 646455 | 6604217 |
| | 644575 | 6604142 |
| | 644238 | 6603941 |
| | 644108 | 6603705 |
| | 643756 | 6603648 |
| | 643426 | 6602741 |
| | 641891 | 6602729 |
| | 641035 | 6603981 |
| | 643027 | 6605340 |
| | 644751 | 6606024 |
| | 645562 | 6606460 |

# 6 Site Wide Conditions

As discussed previously, Cameco, in cooperation with community members and the JRG, developed the Beaverlodge Management Framework to facilitate assessment of the Beaverlodge properties following a clear and transparent methodology to establish that the properties are safe, secure and stable/ improving.

## 6.1 Site Inspections

Several targeted and routine inspections have been completed on the decommissioned properties in preparation for their transfer to IC:

***Geotechnical Inspections:***

Regular geotechnical inspections are conducted at the Fookes Reservoir Delta; the two outlet spillways at Fookes and Marie Reservoirs; the Marie Reservoir Delta; Ace Creek Catchment Area III; the Ace Stope Area; the Hab crown pillar area; the Dubyna crown pillar area; and the Bolger Pit area, including the Bolger Flow Path from the Zora Creek Channel to the Verna Lake Inlet, in order to assess their condition and to confirm that each is performing as expected.

Third party inspections of the Fookes Reservoir Delta and the outlet spillways at the Fookes and Marie Reservoirs were undertaken by SRK Consulting (Canada) Inc. (SRK) in June 2004 (SRK 2005a), August 2007 (SRK 2008), May 2010 (SRK 2010a), June 2015 (SRK 2015a), and September 2020 (SRK 2021). SRK previously undertook an inspection of the Marie Reservoir Delta and the catchment areas around Ace Creek in 2004 (SRK 2005b), June 2015 (SRK 2015a) as well as September 2020 (SRK 2021). Third party inspections of the crown pillars also occurred in 2015 (SRK 2016) and September 2020 (SRK 2021) and the Bolger Pit area was inspected by SRK in each of the two years following construction of the Flow Path (SRK 2018, SRK 2019) as well as in September 2020 (SRK 2021). In the 2020 Geotechnical Report SRK concluded that these sites are stable and expected to remain so in the future, and conditions are appropriate for final closure and transfer to IC.

In addition to third party inspections, Cameco has conducted annual inspections of Fookes Reservoir Delta, the two outlet spillways at Fookes and Marie Reservoirs, the crown pillar areas, and the Bolger Pit area since 2016. These inspections have been guided by a Geotechnical Inspection Checklist developed by Cameco and SRK and are appended to annual reports. All geotechnical inspections conducted have been submitted and accepted by regulators.

***Exploration Borehole Surveys*:** From 2009 to 2011, several borehole investigations were conducted on the Beaverlodge properties. The intent of the investigations was to record the location and condition of boreholes on and near the Beaverlodge properties and identify all holes with the potential to exhibit artesian conditions in which groundwater associated with flooded underground workings is reporting to the surface.

As part of the investigations, a review of existing historical exploration drill records was performed followed by detailed ground surveys to locate and provide coordinates for all flowing and non-flowing drill holes and all surface seeps within the study area. Drill holes were characterized in terms of location, condition, and presence/absence of surface discharges.

Following the original search for boreholes, additional boreholes have been discovered during numerous ground inspections of the properties including a 2014 surficial gamma survey, a 2015 to 2017 debris clean-up campaign as well as multiple JRG inspections. All boreholes located have been sealed according to accepted methods (Cameco 2017), with the location and condition recorded in a borehole log appended to each Beaverlodge annual report.

***Surficial Gamma Survey*****:** In 2014, SENES Consultants and Cameco developed the Beaverlodge gamma radiation survey plan in consultation with the CNSC and SkMOE. The main purpose of the gamma radiation survey was to gather sufficient data to complete a risk assessment on properties that did not meet the criteria described in the Guidelines for Northern Mine Decommissioning and Reclamation The survey included accessible areas disturbed by mining and milling infrastructure, accessible areas of known tailings spills, access roads as well as appropriate background reference areas.

The study was conducted using both walking surveys and all-terrain vehicle surveys depending on terrain and vegetation cover. As part of the survey, photos of remnant debris were also taken whenever encountered. These photos were used to help inform the final site inspections and debris cleanup process. The surficial gamma survey was submitted and accepted by regulators.

Following the completion of the gamma survey in 2014, if an area was subsequently disturbed for any reason (additional cover material added, excavation related to exposure of mine openings, etc), the area was re-scanned to confirm the original readings and the new gamma data was incorporated into the final gamma assessment provided in this document.

***Site Visual Surveys*****:** From 2015 through 2017, Kingsmere Resources Services Inc. was retained to conduct visual inspections of each of the decommissioned Beaverlodge properties, including those which are the subject of this report. The inspections were conducted by walking transects over the entire property unless safety considerations, surface features, lack of previous land use or significant vegetation prohibited access to a specific area. All inspections were tracked using individual handheld Garmin Model GPSmap 62S or 64S.

During the inspections, debris was cached for later retrieval and transport off the property for disposal. If debris was too large or heavy to be safely removed by two people, it was "marked" (Waypoint) on the hand-held GPS and flagging tape secured in a visually prominent position to allow easy location of the material during the clean-up activities.

Members of the JRG have conducted follow-up inspections of each of the properties to confirm the property meets the relevant performance indicators. During these final inspections the location of any additional debris identified is recorded as a waypoint and collected for disposal.

***Regulatory Inspections*:** The performance of the remediated areas of the Beaverlodge site is assessed through routine inspections conducted by Cameco personnel, third party consultants and/or the JRG) The JRG is currently comprised of representatives from SkMOE and the CNSC.

The Saskatchewan Ministry of Labour Relations and Workplace Safety (LRWS) Mines Unit, Fisheries and Oceans Canada and Environment and Climate Change Canada each provide expert technical support to the JRG lead agencies as required. The JRG inspections are conducted to ensure that conditions on the properties do not impact the health and safety of people, the continued protection of the environment, and that the requirements of the license and Surface Lease Agreement continue to be met. The SkMOE also participates in regulatory inspections. As the agency responsible for management of the IC program, their participation is vital in ensuring the properties meet the requirements for acceptance to the IC program and there is an understanding of the existing condition of the properties and the future monitoring requirements.

The objective of the most recent inspections has been to conduct a general assessment of the Beaverlodge site, while focusing on the properties scheduled for transfer to the IC Program and identifying any remaining issues prior to transferring the selected properties. In addition, the inspection was completed to verify compliance with Cameco's approved licensing documentation, the NSCA and associated Regulations; while ensuring the properties remained safe, secure and stable/improving.

## 6.2 Assessments

In order to demonstrate that the decommissioned properties that are the subject of this request are eligible for a *Release from Decommissioning and Reclamation*, release from CNSC licensing and transfer to the IC Program, Cameco undertook several studies to assess the properties relative to the performance indicators. These assessments consist of:

***Waste Rock Stability Assessment*:** In 2010, SRK was retained by Cameco to conduct a third-party assessment of waste rock slope stability at the Beaverlodge properties. The assessment included the waste rock piles at the Hab, Verna and Lower Ace Creek areas and concluded that the slopes were stable with little risk of failure (SRK 2010b). This report has been submitted and accepted by regulators.

***Pit Wall Slope Stability Assessment:*** In 2010, SRK was retained by Cameco to conduct a third-party assessment of the pit wall stability at the Beaverlodge properties. The assessment included the pit wall slopes associated with the Hab, Dubyna and Bolger open pits. The main conclusions arising from this evaluation are that slope instability at the Hab, Dubyna and Bolger pits is not expected, and the risk of rockfall at each of these pits is limited (SRK 2010c). This report has been submitted and accepted by regulators.

***Utility Corridor Assessment:*** In 2015 during the visual site surveys, utility corridors that contained historic power line infrastructure were located on the ACE 5 property. Additional investigations revealed that historic infrastructure was located on and between several of the properties. In response, Cameco commissioned Kingsmere Resource Services Inc. to complete an assessment of the extent of the infrastructure remaining as well as to provide an assessment of potential remediation options. Subsequently, power poles were cut into smaller sections and laid on the ground to facilitate natural breakdown. All remaining electrical and communication infrastructure were removed and disposed of in the Lower Fay Pit as approved by SkMOE.

***Country Foods Assessment*:** The main objective of this study was to collect information regarding locally harvested foods typically consumed by Uranium City residents and assess the potential associated risk. Information from the lab analysis of the collected plant and animal specimens was used to conduct a human health risk evaluation for the Beaverlodge area. The final conclusion of the study was d that traditional harvesting and consumption of country foods does not present health risks to the residents of Uranium City, provided the posted healthy fish consumption advisories are followed where applicable (CanNorth and SENES 2012). This report has been submitted and accepted by regulators.

***Quantitative Site Model*:** The QSM was developed for Cameco by SENES Consultants as a tool to predict changes in water and sediment quality and assess the potential ecological and human health risks associated with the decommissioned Beaverlodge properties. An important feature of the QSM was the model's ability to simulate potential remedial options and predict the expected benefit of their implementation. In general, the QSM confirmed natural recovery, and provided model predictions for comparison to future monitoring results to verify that the associated lakes continue to have a stable/improving trend in the long term (SENES 2012a; 2012b). This report has been submitted and accepted by regulators.

***Land Use Assessment:*** In December 2014, a door-to-door survey was conducted in Uranium City to gather information from the residents of the community regarding their use of the areas around Uranium City in order to determine a reasonable approximation of the time each person spent on the former Beaverlodge properties. The focus of the interviews was on land use in the past 5 years and expected land use in the foreseeable future (SENES and Kingsmere 2015).

The survey included the interview of representatives from 21 of the 34 reportedly active Uranium City residences. The remaining 13 residences were not interviewed because the residents either declined to participate (4) or were out of town during the survey period and were unreachable (9).

As outlined in the report, the assessment was based on familiarity with the residents of Uranium City and interviews conducted covered the key people and groups who use the land in the region. This report has been submitted and accepted by regulators.

***Gamma Assessment*:** A risk assessment regarding residual gamma radiation was completed for all disturbed areas on the Beaverlodge properties that were above the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). The gamma risk assessment utilized the data collected in 2014 Site-Wide Gamma Survey and the findings from the Land-Use Assessment to estimate the potential risks from radiation exposure at the Beaverlodge properties based on spatial considerations, use of the properties and measured gamma radiation levels while also taking into consideration the consumption of country foods and exposure to other pathways. Overall, the evaluation found that from a risk perspective, the gamma radiation levels on the Beaverlodge properties are acceptable and as such, no further remedial actions were recommended at these sites to reduce gamma exposure levels (ARCADIS 2015). This report has been submitted and accepted by regulators.

***Site Wide Crown Pillar Assessment*:** To ensure properties remain safe, stable and secure, Cameco initiated a third-party investigation of crown pillars on all Beaverlodge properties in 2014. A report assessing the crown pillars and related risks on all properties was submitted in 2015 for regulatory review. The properties associated with this closure report did not have any areas that required remediation or detailed monitoring of Crown Pillars. Based on the assessment of the available mining data, it was determined that the Ace Stope Area required additional remediation to address potential risk, and visual monitoring was recommended for the Hab and Dubyna areas (SRK 2015b). Those areas have been previously released from CNSC licensing and are not the subject of this report. The report regarding the Crown Pillar Assessment has been submitted and accepted by regulators.

***2020 Beaverlodge ERA:*** In this update of the decommissioned Beaverlodge QSM, the water dispersion modelling was updated along with an examination of the potential risks to human and ecological receptors that use the area. The model assumptions were revisited based on the current understanding of the environmental conditions informed by almost 40 years of monitoring results. The environmental performance indicators related to water quality at various monitoring stations were also updated accordingly. CNSC Staff have concluded the updated performance indicators are appropriate. See **Figure 5 and 6** for the Beaverlodge Environmental Monitoring Program water quality monitoring stations.

The 2020 ERA complies with applicable components of the Canadian Standards Agency (CSA) N288.6-12 standard for Environmental Risk Assessments at Class I Nuclear Facilities

> and Uranium Mines and Mills. Consistent with previously accepted assessments, the 2020 ERA concluded that the immediate and downstream environments will continue to naturally recover over time. As shown previously, based on reported use of the land, there are not expected to be risks to humans residing near, or consuming food from areas surrounding the Decommissioned Beaverlodge Mine Site. Therefore, living a traditional lifestyle and consuming country foods from the area, while respecting the water and fish advisories, can continue to be done safely (CanNorth 2020a). A summary of the ERA is made publicly available on the Beaverlodge website.

The above noted studies have established that the decommissioned Beaverlodge properties meet the performance objectives set out in the Path Forward; and that human health remains protected and ecological risk has been sufficiently managed to allow the properties to be considered for transfer to the provincial IC Program for long term management. As such, the properties will support traditional activities, such as hunting/gathering of country foods and collection of firewood.

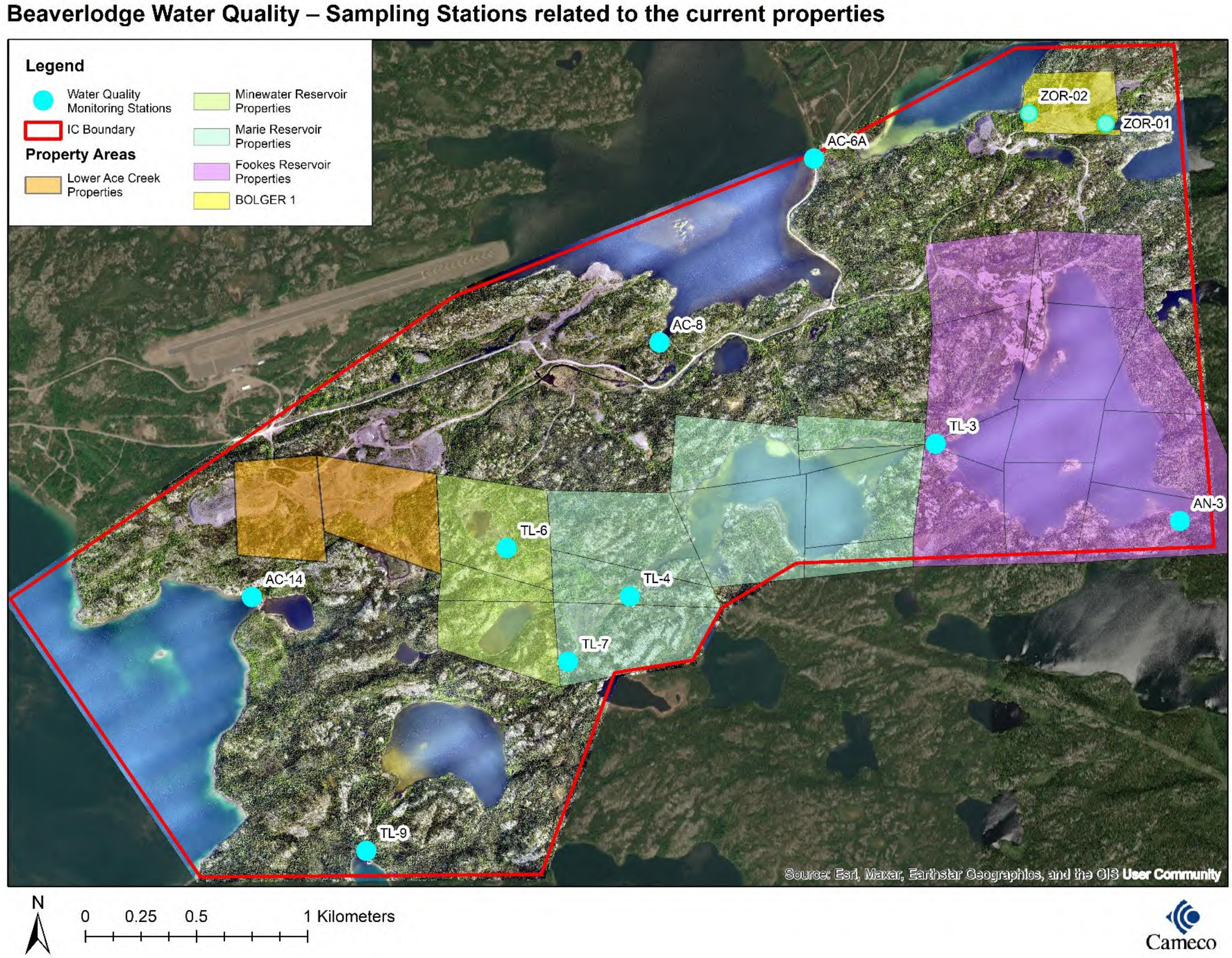



**Figure 5: Beaverlodge Water Quality – Sampling Stations related to the current properties.**

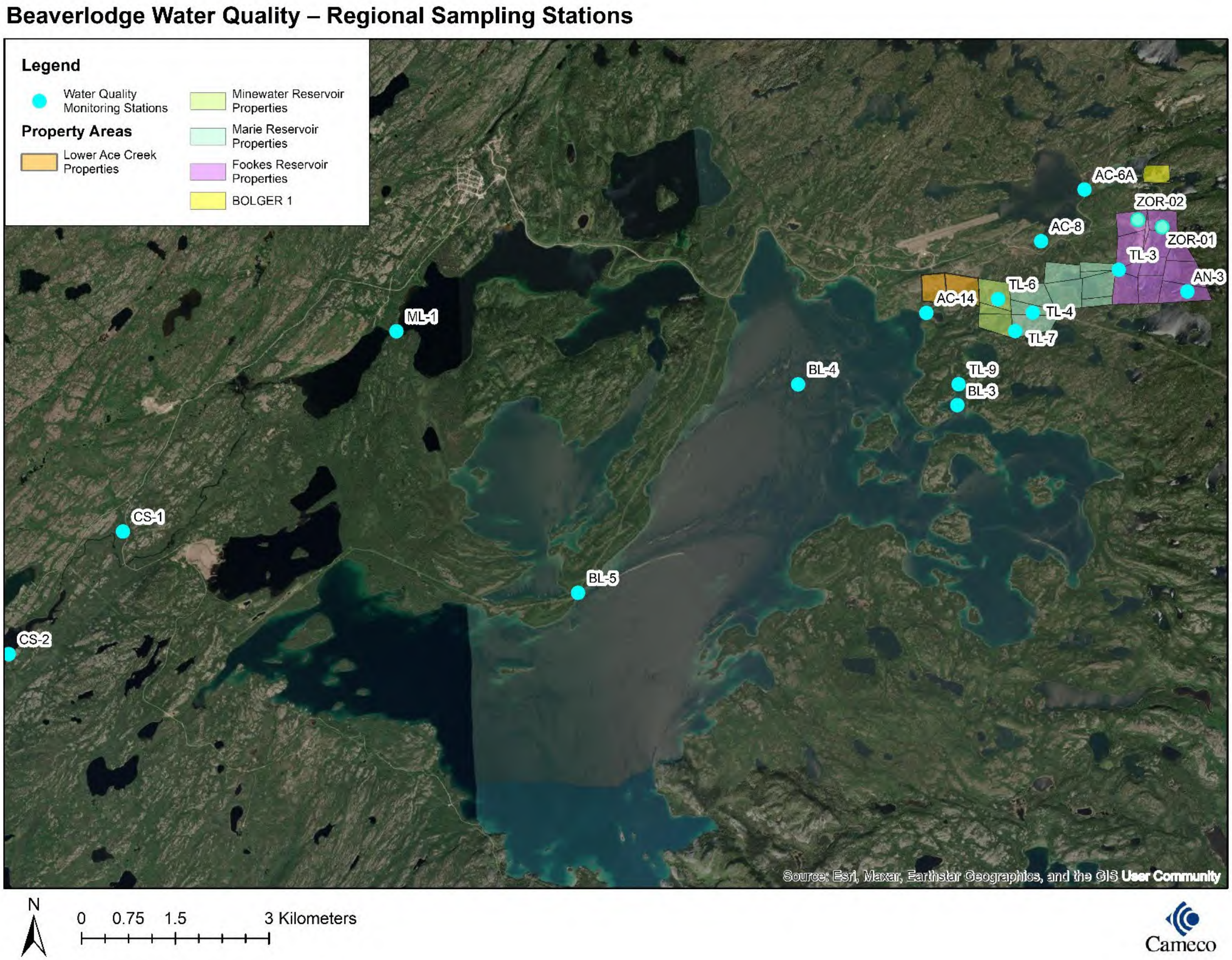



**Figure 6. Beaverlodge Water Quality - Regional Sampling Stations**

# 7 Assessing Remaining Site Aspects Requiring Future Monitoring or Maintenance

In order to assess any residual risks resulting from historical mineral exploration, mine/mill operations or decommissioning on each property, it is necessary to:

1. Identify the potential hazards/liabilities (if any) that exist on each property.
2. Assess the likelihood of the hazard being realized.
3. Assess the potential severity/consequence posed by the hazard/liability.
4. Evaluate the residual risk based on the potential severity/consequence of an event occurring and the likelihood of the event occurring.

This section of the document identifies the methodology employed to identify potential hazards/liabilities (aspects) requiring ongoing monitoring or maintenance once the property has been transferred to the IC Program. The risk rankings provided in this document are based on the methodology described in Beaverlodge Project Screening Level Risk Assessment (Cameco 2010) and are consistent with those applied to the 43 Beaverlodge properties previously released from CNSC licensing.

The aspects list of potential hazards and liabilities was developed by a committee of knowledgeable persons that included Cameco employees (past and present) and key third-party consultants.

The frequencies identified in **Table 3** below are used to define the "likelihood" of a potential hazard being realized:

**Table 3: Potential of a hazard being released**

| Likelihood | Frequency |
|---|---|
| **Very Likely** | The aspect will contribute to a negative change in current condition one or more times a year. |
| **Quite Likely** | The aspect will likely contribute to a negative change in current condition once in ten years. |
| **Somewhat Likely** | The aspect will likely contribute to a negative change in current condition once in 50 years. |
| **Unlikely** | It is not expected that the aspect will contribute to a negative change in current condition once in 100 years. |
| **Very Unlikely** | It is not expected that the aspect will contribute to a negative change in current condition once in 1000 years. |

"Consequence" is defined as the outcome of an event or change in circumstances affecting the achievement of Beaverlodge performance objectives. Following the Cameco Corporate Risk

Management Standard, a severity/consequence index was developed to rank the potential severity/consequence of potential hazards for related site aspects based on two different endpoints (Environment and Health & Safety). The severity/consequence terminology utilized in this assessment has been defined in **Table 4**.

**Table 4: Severity/consequence terminology**

| | Severity/Consequence | | | | |
|---|---|---|---|---|---|
| | **Insignificant** | **Minor** | **Moderate** | **Major** | **Catastrophic** |
| **Environment** | Localized condition/ event and no effects. | Short term condition/event or minor disturbance to existing conditions | Visible, measurable, or detectable plume or release with short term physical and/or chemical changes to the existing environment. Chronic occurrence of low or negligible incident | Localized upset to existing conditions, mortality within some species, reversible with effort | Regional/ Extensive damage to existing environment |
| **Public Health & Safety** | First aid injury. Negligible health impacts. | Medical aid injury. Radiation exceeds target levels | Injury requiring medi-vac to major centre. Radiation exposure exceeds regulatory dose limit for public | Related fatality or permanent disability stemming from an incident related to the current condition of the property. | Several related fatalities or permanent disability for several individuals stemming from incidents related to the current condition of the property |

Once the likelihood and consequence of a hazard being realized have been selected, they are assessed together using a consequence versus likelihood matrix method to evaluate the level of risk associated with the existing conditions of the Beaverlodge properties.

The risk matrix follows a 5 X 5 format that considers the consequence and likelihood of the effect occurring resulting in five possible risk ratings for a specific site element ranging from Low to High. Rankings of risk were assigned based on the consequence and likelihood that a risk would result in a negative change to the current condition of the endpoint being assessed, as opposed to the risk of impact to a greenfield site. The assessment of residual risk for this report is based on the Beaverlodge Risk Matrix (BRM) (Cameco 2010). The BRM consequence-likelihood matrix is used to establish rankings of risk. The categories developed for the risk ratings assigned for the Beaverlodge properties are shown in **Table 5**.

**Table 5: Beaverlodge Risk Matrix (BRM)**

| | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | **Insignificant** | **Minor** | **Moderate** | **Major** | **Catastrophic** |
| **Likelihood** | **Very Likely** | Medium - Low | Medium - Low | Medium-High | High | High |
| | **Quite Likely** | Medium - Low | Medium - Low | Medium | High | High |
| | **Somewhat Likely** | Low | Medium - Low | Medium - Low | Medium-High | High |
| | **Unlikely** | Low | Low | Medium - Low | Medium | Medium-High |
| | **Very Unlikely** | Low | Low | Low | Medium-Low | Medium-Low |

# 8 Property/Area Summaries

## 8.1 Tailings Management Area

### 8.1.1 Description

Table 3.4 of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions, MacLaren Plansearch* (Eldorado 1983) indicates that a total 10,109,605 tonnes of tailings were produced over the lifetime of the Beaverlodge mill (1953 until August 1982).

Of that total, 4,299,156 tonnes were deposited in the underground mine as backfill and the remainder was placed on surface within the Tailings Management Area (TMA). The TMA consists of a number of water bodies in the Fulton Creek Watershed, as is shown is Figure 5. The main water bodies are Fookes Reservoir, Marie Reservoir, Minewater Reservoir and Greer Lake. Fulton Lake is upstream of the TMA and has not been impacted by past mining activity. Fresh water flows into Fookes Reservoir from Fulton Lake while water exiting Fookes Reservoir flows into Marie Reservoir and then through a meadow (known as Meadow Fen) to Greer Lake. In addition, the small catchment which hosts Minewater Reservoir flows through the Meadow Fen into Greer Lake. Water exiting Greer Lake flows into Fulton Bay of Beaverlodge Lake. It should be noted that Greer Lake is not located within a licensed property and is approximately 0.22 km south of the ACE 19 property. Greer Lake and surrounding area will be included within the IC boundaries to ensure that future activities and naturally recovering environmental conditions are monitored in the future.

Residual tailings from spills that occurred during operations along the pipelines running from the mill and the Dorrclone separator to the tailings management area were assessed and remediated in accordance with the approved decommissioning plan (Eldorado 1987). Accessible tailings were either relocated to the underground mine workings or covered with 0.6 m of waste rock. Locations with residual tailings that were inaccessible, either due to topography or naturally established vegetative cover, were assessed on an individual basis, with the participation of regulatory personnel, to determine whether they should be left as is or remediated. If a decision was made to leave the residual tailings in situ, it was because the disturbance associated with removal or covering the of the tailings would have resulted in greater environmental damage.

The Beaverlodge TMA consists of:

- Fookes Reservoir (1957 – 1982) and Marie Reservoir (1954 – 1957), which received tailings via pipeline from the mill;
- An artificial pond was created with the installation of a dam at the outlet of the Meadow Fen in 1976 (creating the Meadow Settling Pond) and was used for the settlement of radium sludges following barium chloride addition at the Marie Reservoir treatment plant; and,
- Minewater Reservoir was used for tailings deposition during the initial milling period (1953 – 1954). Originally discharged was towards Ace Creek and but it was re-directed to flow into the Fulton watershed in 1971 when it was used as a settling pond for treated minewater from the Fay shaft.

At the start of milling operations in 1953, tailings were deposited in Minewater Reservoir. In 1954, the tailings line was moved to Marie Reservoir, likely to make use of its greater volume (Eldorado 1983). The settling of tailings solids in Marie Reservoir was poor, resulting in tailings migration downstream to Greer Lake. As a result, the tailings discharge point was moved to Fookes Reservoir in 1957. Subsequent to this, dams were constructed at the outlets of Fookes and Marie reservoirs in 1969 and 1971 respectively, to maintain water levels. In 1976 a water treatment plant was constructed at the outlet of Marie Reservoir, and the Meadow Settling Pond was created by the construction of the Meadow Basin dam (TL-7) in 1977 (Eldorado 1983). The decommissioning of the TMA was carried out between the winter of 1983 and the summer of 1985.

Water sampling stations were established at various locations within the TMA to monitor recovery of the various water bodies affected by past mill operation. Fulton Lake outlet (AN-3) is collected to measure background water quality for the watershed. Water quality samples are collected at the following locations within the TMA (shown in Figure 5): Fookes Reservoir outlet (TL-3), Marie Reservoir outlet (TL-4), Minewater Reservoir outlet (TL-6), Meadow Fen outlet (TL-7) and Greer Lake outflow (TL-9). Monitoring at these locations was initiated during operation of the mill and was monitored through decommissioning and continues today. As stated in the 2020 ERA the SEQGs do not account for the historic deposition of tailings during mine operation, water quality in waterbodies within the TMA are not expected to meet SEQGs in the near, or long-term, and comparison to SEQGs is therefore not relevant. As a result, long-term recovery of the TMA is compared to model predictions in the sections that follow.

The TMA properties are listed in Appendix A of the Eldorado Resources Limited Decommissioning Approval AECB-DA-142-0 (November 1983) as "N-294 Tailing's storage and treatment system". The properties are included on the *2006 Beaverlodge Surface Lease Agreement* map as N-294 and in the *Property Description Manual* referenced in the LCH, which is referenced in the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025.

For ease of discussion, the decommissioned TMA properties are discussed herein as three distinct areas as identified in Figure 7. These are, starting at the upstream end of the historic tailings storage and treatment system:

- *Fookes Reservoir* Area - which consists of 12 properties surrounding and under the former Fookes basin, the Fookes tailings delta, and the Fookes outlet. The properties discussed in association with Fookes Reservoir cover and area of approximately 180.4 hectares.

- *Marie Reservoir Area* - which consists of 9 properties surrounding and under the former Marie basin, the Marie tailings delta, the Marie outlet and the Meadow basin, and includes the decommissioned dam built at the outflow of the Meadow basin (TL-7). The properties discussed in association with Marie Reservoir cover an area of approximately 133.5 hectares.

- *Minewater Reservoir Area* - which consists of 3 properties surrounding and downstream of the former Minewater basin. The properties discussed in association with the Minewater Reservoir cover an area of approximately 42.5 hectares.

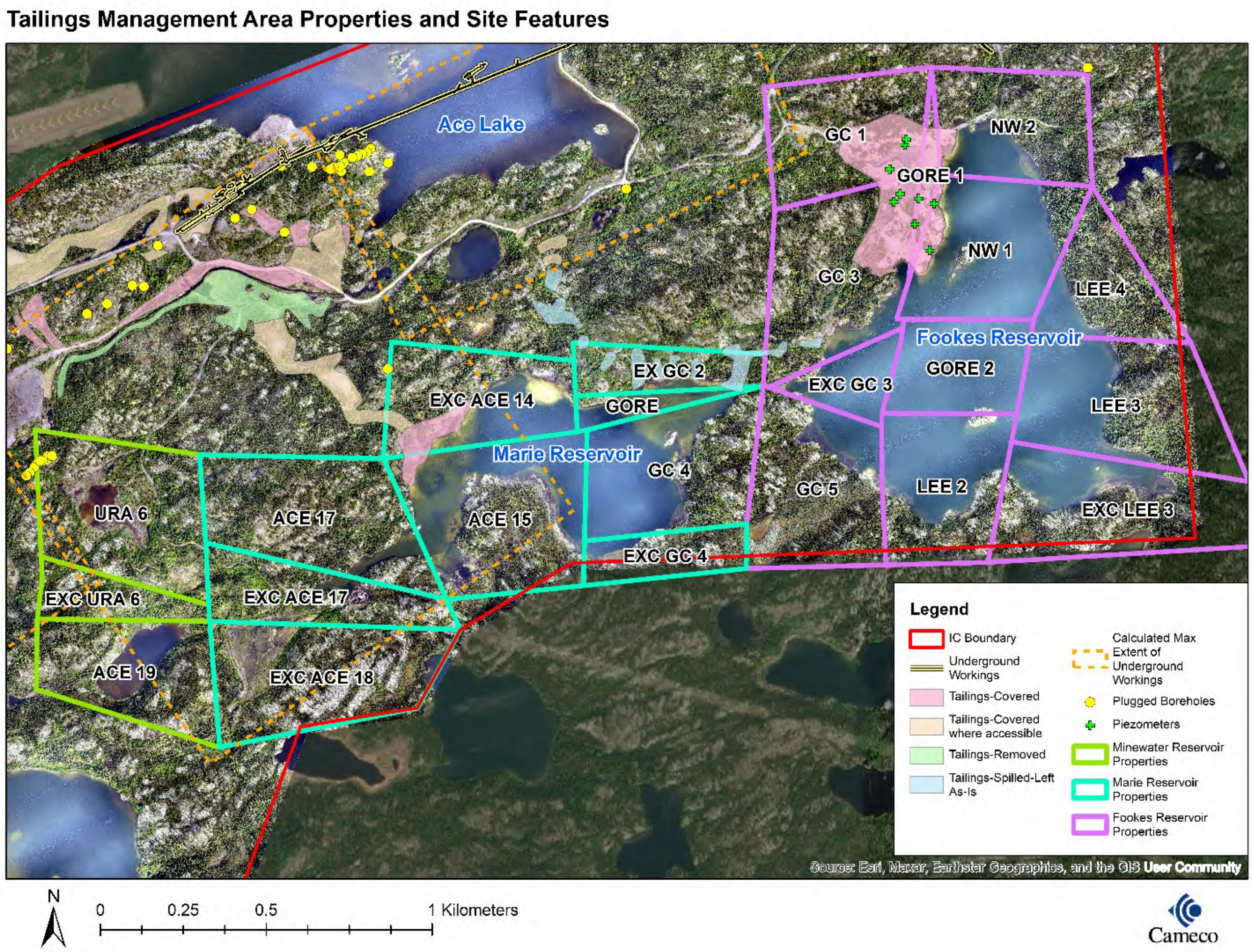



**Figure 7. Tailings Management Area Properties and Site Features**

## 8.2 Fookes Reservoir Area

Table 2.I of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 3, Beaverlodge Tailings and Sludges Close-out Engineering Feasibility Studies, Stefan Robertson & Kirsten* (Eldorado 1983b) indicates that more than 5 million tonnes of mill tailings were placed within the Fookes basin between 1957 and the cessation of milling in 1982. Tailings were originally discharged at the north-west corner of the reservoir and solids settled over the entire bottom of the reservoir. A tailings delta was formed in the northwest corner of the reservoir, which

covered approximately 7% of the original reservoir surface area at shutdown. The Fookes Reservoir Area consists of the following properties shown in **Table 6**.

**Table 6: Fookes Reservoir Area Properties**

| AECB License Number | Cameco Number | Area (hectares) | Coordinates (UTM WGS 84, 12N) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| N-294 | GC 3 | 21 | 644587 | 6604647 |
| | | | 645629 | 6605320 |
| | | | 645188 | 6605209 |
| | | | 645592 | 6604994 |
| | | | 645556 | 6604880 |
| | | | 645578 | 6604878 |
| | | | 645574 | 6604852 |
| | | | 645160 | 6604774 |
| | | | 645154 | 6604677 |
| | EXC GC 3 | 5.3 | 645511 | 6604554 |
| | | | 645574 | 6604852 |
| | | | 645169 | 6604674 |
| | | | 645511 | 6604595 |
| | GC 5 | 19.2 | 645102 | 6604126 |
| | | | 645154 | 6604677 |
| | | | 645169 | 6604674 |
| | | | 645511 | 6604554 |
| | | | 645511 | 6604388 |
| | | | 645104 | 6604260 |
| | | | 645524 | 6604137 |
| | GC 1 | 16.4 | 645188 | 6605209 |
| | | | 646131 | 6605618 |
| | | | 644653 | 6605545 |
| | | | 645629 | 6605320 |
| | GORE 1 | 2.1 | 644653 | 6605545 |
| | | | 645592 | 6604994 |
| | | | 645691 | 6605316 |
| | | | 646131 | 6605618 |
| | NW 2 | 15.3 | 646146 | 6605280 |
| | | | 645661 | 6605640 |
| | | | 646131 | 6605618 |
| | | | 645691 | 6605316 |
| | NW 1 | 18.5 | 645968 | 6604878 |
| | | | 645592 | 6604994 |
| | | | 645691 | 6605316 |
| | | | 646146 | 6605280 |
| | | | 645556 | 6604880 |
| | | | 645578 | 6604878 |
| | LEE 4 | 11.3 | 646443 | 6604809 |
| | | | 645691 | 6605316 |
| | | | 646146 | 6605280 |
| | | | 645968 | 6604878 |
| | | | 645961 | 6604831 |
| | GORE 2 | 11.3 | 645918 | 6604593 |

| | | | | |
|---|---|---|---|---|
| | | | 645578 | 6604878 |
| | | | 645968 | 6604878 |
| | | | 645574 | 6604852 |
| | | | 645961 | 6604831 |
| | | | 645511 | 6604595 |
| | LEE 3 | 21.8 | 646443 | 6604809 |
| | | | 646618 | 6604388 |
| | | | 645902 | 6604509 |
| | | | 645918 | 6604593 |
| | | | 645961 | 6604831 |
| | EXC LEE 3 | 21.9 | 645831 | 6604145 |
| | | | 642048 | 6604476 |
| | | | 646618 | 6604388 |
| | | | 646697 | 6604197 |
| | LEE 2 | 16.3 | 645524 | 6604137 |
| | | | 645511 | 6604595 |
| | | | 645918 | 6604593 |
| | | | 645511 | 6604554 |
| | | | 645902 | 6604509 |
| | | | 645511 | 6604388 |
| | | | 645511 | 6604145 |

## Initial Decommissioning Activities

*Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site*, MacLaren Plansearch, Eldorado Resources Limited (Eldorado 1987) states that dismantling of the tailings line was carried out at various times between April 1983 and May 1985. During that activity, the 250 mm diameter Sclairpipe tailings line was salvaged and sent to Rabbit Lake in 1983. The wood stave tailings pipelines were burned at various times during 1983, 1984 and 1985.

## Fookes Delta

The reclamation of the Fookes Reservoir Area involved removal of artificial structures to return the water level in the basin to within 1 m of its natural outlet level as well as covering of the exposed tailings delta to reduce gamma radiation and the potential for erosion and dispersion.

The initial lowering of Fookes Reservoir began in January 1983 and was complete by early April 1983. This was accomplished by incrementally removing stop-logs from the dam to maintain a treatable flow at the Meadow basin treatment plant. In November 1983, the logs were replaced in the dam to minimize the volume of water entering Marie Reservoir so that the reclamation of the Marie Reservoir Area could also proceed. During the spring and summer of 1984, the outflow from Fookes was still dammed off to maintain the lowest possible water level in Marie while reclamation work was underway in that area. The stop-logs were removed during November and early December 1984 to once again lower the Fookes Reservoir water level and was allowed to drain until flow ceased in early January 1985, at which point the cribwork at the dam was removed. The outflow channel was re-built at the end of May 1985, and the area landscaped to final contours.

The tailings delta (i.e., Fookes Delta) at the northwest corner of Fookes Reservoir had formed through the direct discharge of tailings and covered approximately 9.2 ha at shutdown. The Fookes Delta is located on properties; GC 1; GC 3; GORE 1; NW 1 and NW 2. Lowering of the reservoir level exposed an additional 1.3 ha of tailings. In total, 88,540 $m^3$ of waste rock were used to create a 600 mm cover on Fookes Delta in 1983 and 1984. The objectives of the cover were to control gamma radiation, to provide protection against direct contact with the tailings, and to reduce the potential for erosion and dispersion.

To ensure tailings on the Fookes Delta would remain covered, waste rock was placed on the ice, along the edge of the delta extending into Fookes Reservoir. When the ice melted the waste rock settled along the edge of the tailings delta. In addition, the Fookes outflow channel was reconstructed, raising the water level in Fookes Reservoir by 1m.

Following the initial completion of the waste rock cover, some of the tailings began working their way upward through the waste rock, forming small mounds, or "boils", of exposed tailings on the surface of the cover. This was attributable to seasonally high piezometric pressures within the tailings related to the geometry and stratigraphy of the delta (SRK, 1995), which resulted in localized flowing artesian conditions.

Nine pneumatic piezometers (P93-1 through P93-9) were installed in the tailings delta in 1993 to study the piezometric levels on the delta. These piezometers were monitored regularly (although P93-7 was abandoned in 2005 due to instrument malfunction) and provided an indication of piezometric levels at select locations over the delta for a period of approximately 10 years. Piezometric data indicated that, generally, no artesian levels were observed at any time in some locations, i.e. well back from the Fookes Reservoir shoreline. However, close to the Fookes Reservoir shoreline, artesian levels were observed either seasonally or, at some locations, most of the year.

As a result, remediation work was initiated in 1997, and consisted of covering the exposed tailings boils with two layers of sand: 0.3 m of fine-grained filter sand, overlain by 0.3 m of sand and gravel ("general fill"). Strict grain size distribution requirements were set for the lower filter sand layer to ensure that the sand was fine enough to prevent tailings particles from migrating upwards through the void spaces in the sand, while at the same time allowing groundwater to flow upwards through the filter sand without pore pressure build-up. The upper sand and gravel layer serve only to weigh down the filter sand layer (to reduce the potential for "blow-out" due to high upward seepage gradients) and to protect the filter sand layer from erosion. Stockpiles of additional filter sand and general fill were placed on the delta for future maintenance work. Other work completed in 1997 included the provision of a surface drainage channel at the northeast end of the delta, and placement of erosion protection on the roadway at the northwest end of the delta. A detailed description of the work completed in 1997 is provided in an SRK report entitled "Beaverlodge Decommissioning, Fookes Lake Tailings Delta Remediation, 1997 Construction" (October 1997).

In addition to piezometer monitoring, the surface of the delta was inspected by a geotechnical engineer every three years, starting in 1998. The expectation was that, when the inspections no longer detected any signs of renewed boil activity over a three-year period, it would be reasonable to assume that conditions on the delta are sufficiently stabilized for final site close out. At that point, subject to regulatory approval, the inspections would be discontinued.

In 2004, at the request of Cameco, SRK completed a six-year review of the cover at the Fookes Delta. As a result of that assessment, SRK recommended that incremental cover material be placed over the tailings delta in accordance with, or as a variant of, one of the following two options:

- Place a strategic cover that corresponds to areas of exposed tailings observed during the inspections of 2001 and/or 2004; or
- Place a full cover over those areas of the delta believed to be prone to forming tailings boils.

Following discussions between Cameco, SRK and others, Cameco decided to proceed with the both options, with installation proceeding in two-stages. During the first stage, the strategic cover would be placed using borrow materials which were stockpiled on the delta in 1997. Concurrent with the borrow placement, additional investigations would be undertaken to identify the design and limits of the full cover and to identify sufficient quantities of borrow materials to complete its installation the following year. During the second stage, the borrow areas developed during the first stage would be used to complete the installation of the full cover.

The strategic cover, consisting of 0.3m of filter sand and 0.3m of general fill, was placed on identified tailings boil areas, and supporting investigations were completed in 2005 for the optimized full cover planned for 2006. The installation of the optimized full cover in 2006 using material hauled from local borrow areas was postponed until 2007 for budgetary reasons. The optimized full cover consisted of 0.15m – 0.3m of filter sand covered with a 0.3m layer of general fill. As-built reports describing the placement of the strategic cover in 2005 and the full cover in 2007 were prepared by SRK in 2006 and 2008, respectively.

The 2007 geotechnical inspection of the cover occurred while the second stage of cover installation was under way. SRK geotechnical engineers completed a formal inspection of the cover in 2010 and 2015, and an informal inspection in 2014. Consistent with SRK's recommendations in 2010, Cameco undertook annual inspections of the cover in June of 2011, 2012 and 2013 and July of 2014, as well as in 2016, 2017, 2018 and 2019, The timing of the 2020 inspection was consistent with the schedule defined in 2015 (SRK, 2015).

Between 1997 and 2010, piezometers installed on the delta were monitored and levels were quite consistent in terms of annual and seasonal trends. In addition, no boils (new or old) were observed during the tailings surface inspection completed by SRK in 2010. SRK (2010a) concluded there was no technical reason for continuing the collection of piezometer data and, following regulatory approval, the collection of incremental piezometric data was discontinued. The eight operational piezometers and single non-operational piezometer were decommissioned in 2022 to prepare the associated Beaverlodge properties for the IC Program.

In 2020, Cameco commissioned SRK Consulting (Canada) Inc.to conduct a detailed geotechnical assessment of the decommissioned Beaverlodge Mine/Mill site which included the Fookes Delta.

This report concluded that no new boils or significant erosion features were observed during the 2020 inspection, which is consistent with the annual Cameco inspection reports completed between 2016 and 2019, inclusive and the conditions on the delta have stabilized sufficiently to support the transfer of properties associated with the Fookes Reservoir delta to the Institutional Control (IC) Program (SRK 2021).

### Fookes Outlet Structure

The Fookes Outlet structure is located at the intersection of 3 properties associated with the Fookes Reservoir area: GC 3; EXC GC 3; and GC 5. Stabilization measures at the outlet of the Fookes Reservoir were undertaken in 1985 in an effort to maintain minimum water levels at the outlet 1 m above the highest level of uncovered tailings.

During the 1986 spring-melt, flows through the Marie Reservoir outlet were higher than anticipated (due to glaciation effects in the spillway) and this resulted in substantial erosion of the spillway channel and a 0.15 m drop in the water level. As a consequence, the outlets from both Fookes and Marie reservoirs were upgraded to provide improved long-term stability.

The spillway invert controlling the reservoir level was set at an elevation of 2,824.0 m (based on local datum) at the outlet of Fookes Reservoir. The elevation is approximately 1 m above the elevation down to which the waste rock cover was placed on the tailings delta. This elevation represents an increase of about 2 m in the outlet level of Fookes Reservoir, compared to pre-mine development. The general design objective for the Fookes outlet structure was to:

- Enhance the erosion resistance of the spillway in the long term;
- Raise the embankment to reduce the potential for overtopping; and,
- Prevent erosion of the embankment in the event that glaciations of the spillway results in overtopping of the embankment.

The Fookes outlet structure was upgraded in 1987 in accordance with the objectives noted above.

The Fookes outlet structure consists of a rip-rap lined spillway (with trapezoidal cross section) discharging into a rip-rap lined stilling basin. The rip-rap lining in the spillway channel and the stilling basins was intruded with grout for added erosion protection; however, the rip-rap in the spillway was designed to be stable in the absence of grout intrusion. The Fookes spillway is capable of passing a 500-year flood event with a depth of 0.3 m (680 L/sec) at the entrance of the Fookes outlet structure. In the event of embankment overtopping, the coarse rip-rap will resist erosion of the upper surfaces and downslope embankments (SRK 1986).

Subsequent to the remediation of the Fookes Delta in 1997, inspections of the outlet spillways at the Fookes and Marie reservoirs were undertaken by SRK in September 1998 (SRK, 1998), September 2001 (SRK, 2001), June 2004 (SRK, 2005a), August 2007 (SRK, 2008), May 2010 (SRK, 2010b), June 2015 (SRK, 2015) and September 2020 (SRK 2021). Since 2010, a Cameco representative has also completed annual inspections of the outlet structures. In 2020, Cameco commissioned SRK Consulting (Canada) Inc. to conduct a detailed geotechnical assessment of the decommissioned Beaverlodge Mine/Mill site which included the Fookes outlet structures. That report concluded that, from a geotechnical perspective, the conditions at the outlet structures have stabilized sufficiently to support the transfer of associated properties to the IC Program (SRK 2021).

### 8.2.1 Recent Decommissioning Activities and Beaverlodge Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

During 2014, a detailed surficial gamma survey was conducted primarily focusing on the disturbed areas (i.e., Fay area, roads and the former tailings pipeline corridor) and included the Fookes Reservoir Area properties (ARCADIS SENES 2014). The properties were surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2” x 2” sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10).

The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008).

As shown in **Figure 8**, the surface gamma survey results ranged from <0.1 µSv/h to 1.0 µSv/h above background (ARCADIS SENES 2014), which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). Therefore, the Fookes Reservoir properties meet the Performance Indicator associated with acceptable gamma levels.

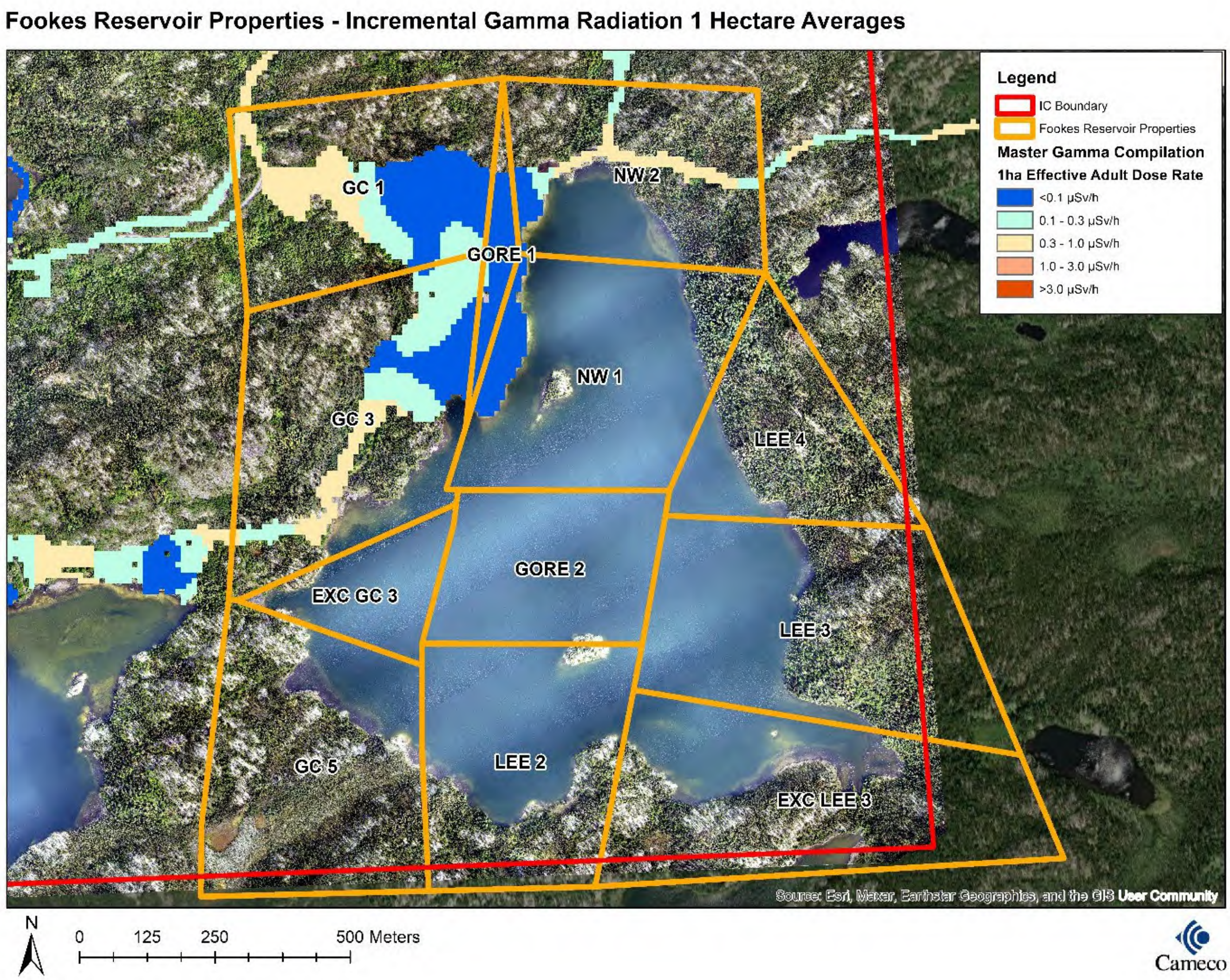



**Figure 8. Incremental Gamma Radiation 1 Hectare Averages: Fookes Reservoir Properties**

## Boreholes Plugged (Performance Indicator is not applicable)

Surface inspections in support of transferring the Fookes Reservoir properties to IC did not identify any exploration drill holes.

## Stable Mine Openings (Performance Indicator is not applicable)

The Fookes Reservoir properties do not host any mine openings to surface.

### Geotechnical Stability

#### *Crown Pillar (Performance Indicator has been met)*

The crown pillar performance indicator is not applicable to the Fookes Reservoir properties as presented to the Commission by CNSC Staff during the 2014 update meeting.

#### *Pit Walls*

There are no open pits associated with the Fookes Reservoir properties.

#### *Tailings*

No new boils or significant erosion features were observed during the 2021 inspection of the Fookes Delta. The conditions on the delta have stabilized sufficiently to support the transfer of properties associated with the Fookes Reservoir delta to the Institutional Control (IC) Program (SRK 2020)

As shown in **Figure 7**, there are tailings present on one Fookes Reservoir property (GC 3) that were left undisturbed (i.e., left as is). Monitoring has confirmed that surface runoff that comes in contact with tailings are not a significant source of the primary constituents of concern (SENES 2012a; 2012b). All gamma readings measured in the Fookes Reservoir Area meet the *Guidelines for Northern Mine Decommissioning and Reclamation* and no additional remedial actions are justified (ARCADIS 2015).

#### *Waste Rock*

Waste rock present on the Fookes Reservoir properties is limited to that used to cover the exposed tailings on the delta and to construct the roads transecting the properties Waste rock samples specific to the Fookes Reservoir area properties have not been collected; however, based on general waste rock samples collected on the Beaverlodge properties, uranium content is typically below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%). This is reflected in the gamma survey results provided above. Areas where waste rock is located are typically below 1 µSv/hr and below 0.3 µSv/hr on the areas where waste rock is exposed on the Fookes Delta. Further, waste rock sampling has also shown the waste rock is non-acid generating and visual observation for more than 60 years has not identified any impacts that could be attributed to the generation of acidic conditions.

### Water Quality within Modelled Predictions (Performance Indicator has been met)

To determine if natural recovery is occurring in the Fookes Reservoir Area as expected, water quality has been monitored at station TL-3 (located at the outflow of Fookes Reservoir) and concentrations have helped inform water quality model predictions. The modelled data helped establish WQ performance indicators, which CNSC Staff have deemed appropriate for evaluating the recovery of Fookes Reservoir. The relevant water quality constituents that are assessed as part of the performance indicator include: radium-226, uranium, and selenium. As shown in Figure 9, 10, and

11 and discussed in greater detail in the 2020 Beaverlodge ERA (CanNorth 2020a) the following observations can be made that demonstrate the Fookes Reservoir water quality data is meeting the water quality performance indicator as defined by regulatory accepted assessment methodologies:

- Radium-226 levels in Fookes Reservoir are within the predicted bounds identified as the performance indicator for this area.
- Uranium and selenium levels in Fookes Reservoir meet the performance indicator for this area and are expected to continually improve over the long-term.

Radium-226 levels are expected to increase slightly before they decline. The chemical processes causing this increase are known and well understood. As detailed in the 2020 ERA, increases are attributed to the release of historically precipitated radium from sediments. Radium-226 precipitates in the Fookes Reservoir are associated with naturally occurring calcium and barium, which may have been introduced in the milling process. After the peak is reached, levels are expected to gradually improve.

The Fookes Reservoir properties therefore meet the "water quality within modelled predictions" performance indicator as defined by the regulatory accepted assessment methodologies.

Figures 9 and 10 are provided to show the rapid decrease in uranium and selenium concentrations that occurred following decommissioning. Due to the rapid improvement of selenium and uranium concentrations following decommissioning, a second graph showing a more suitable scale of current concentrations is also provided.

The water quality of Fookes Reservoir will continue to be monitored as part of the Beaverlodge EMP, until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

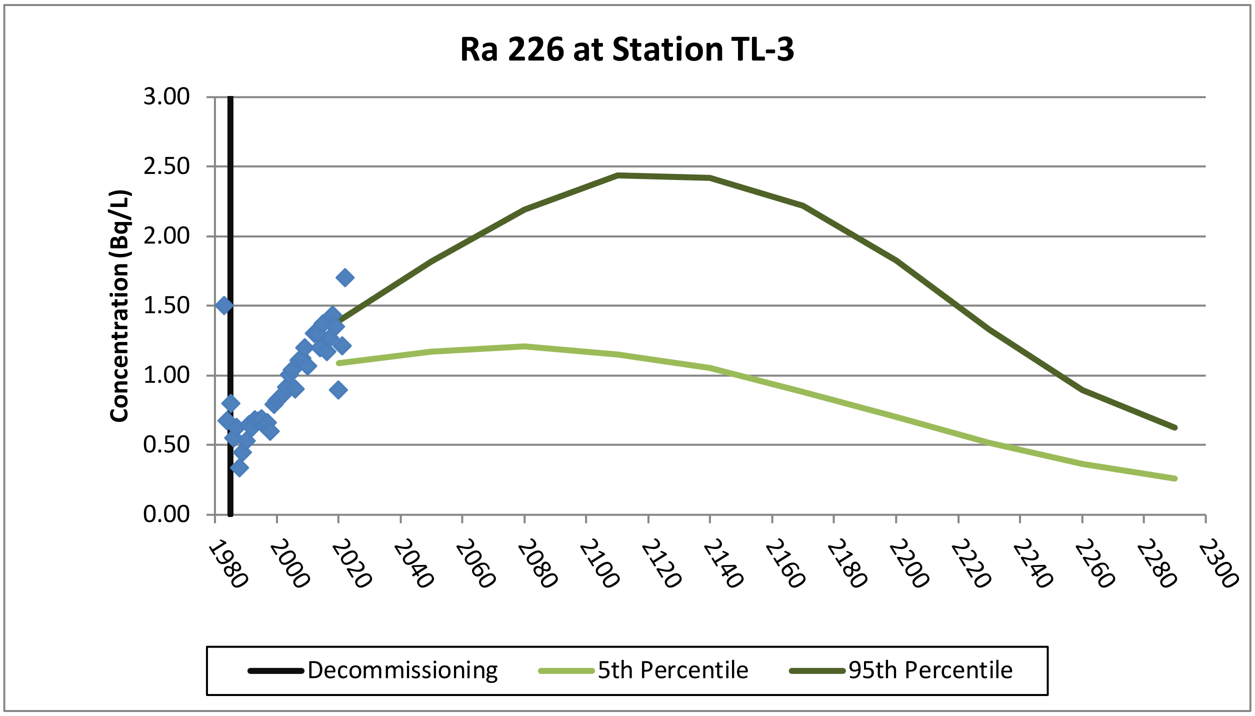
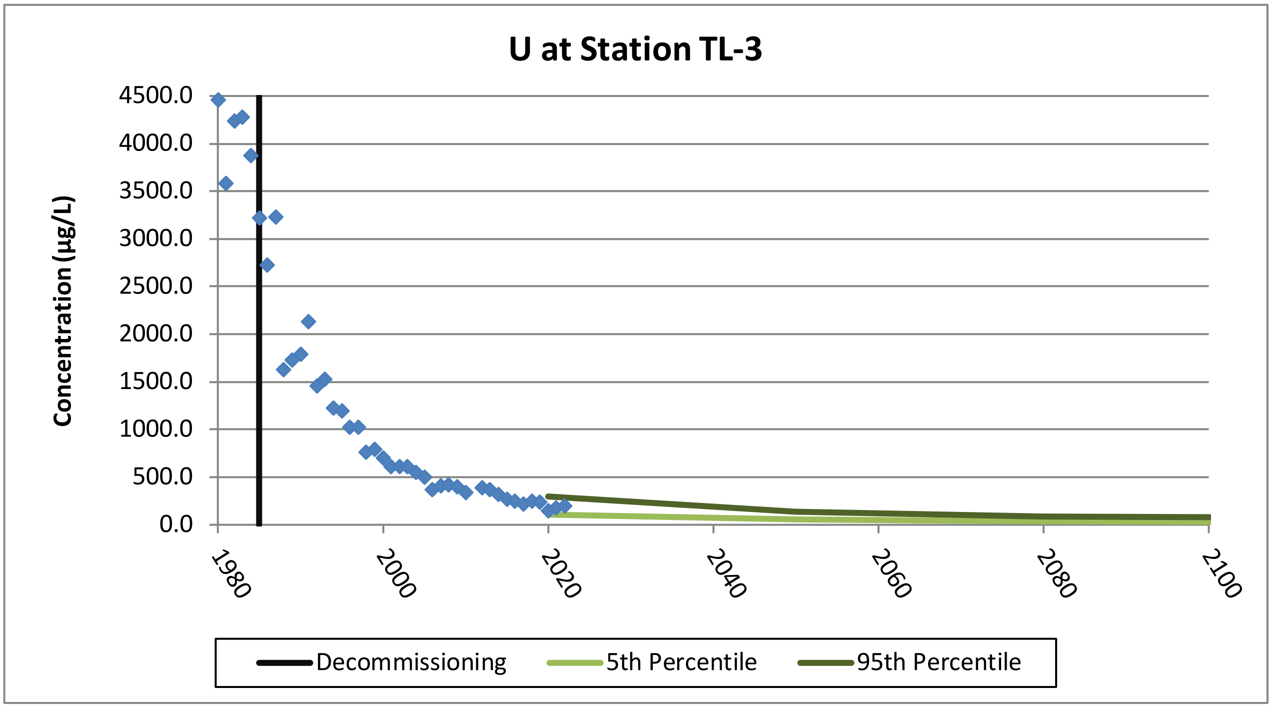



**Figure 9: Ra-226 Performance Indicator at TL-3**



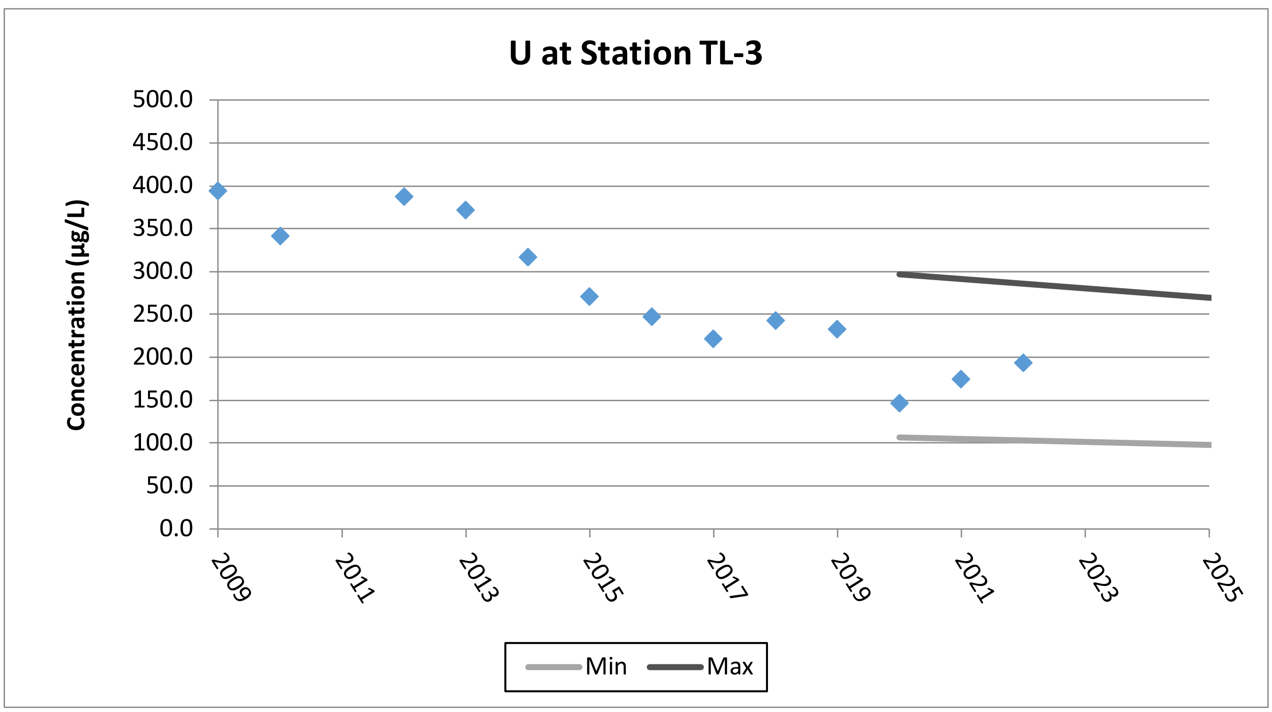
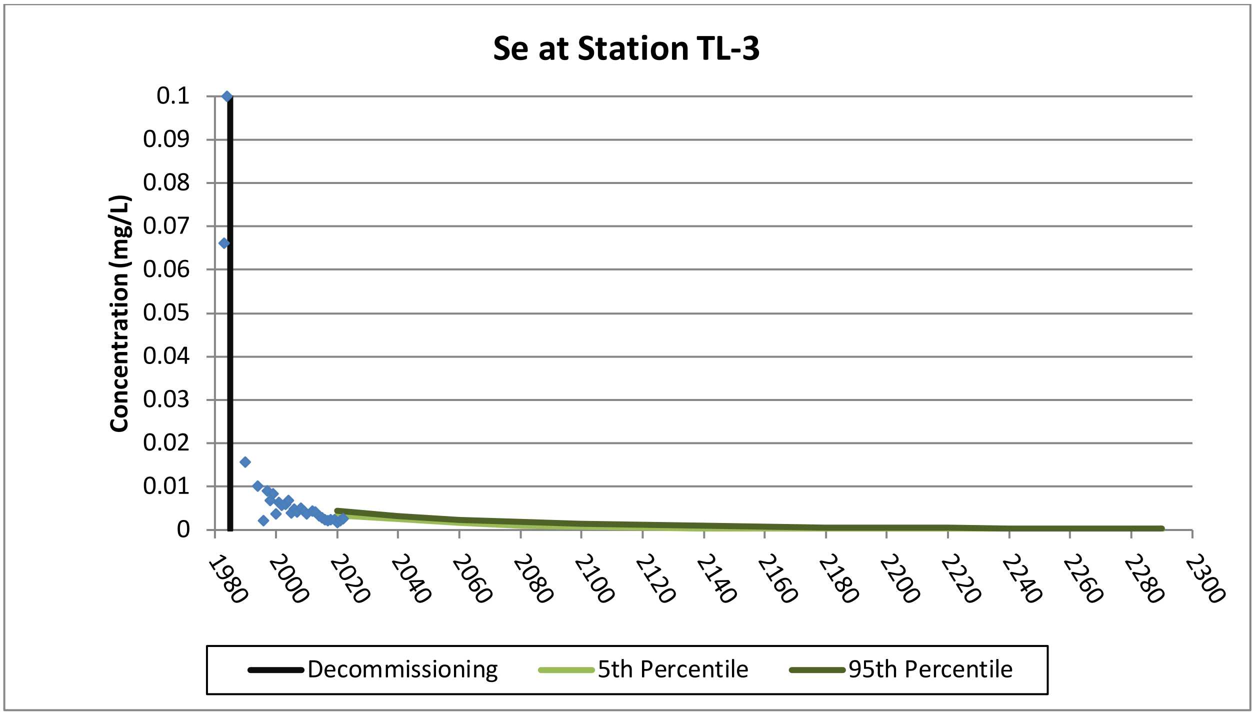




**Figure 10: U Performance Indicator at TL-3**



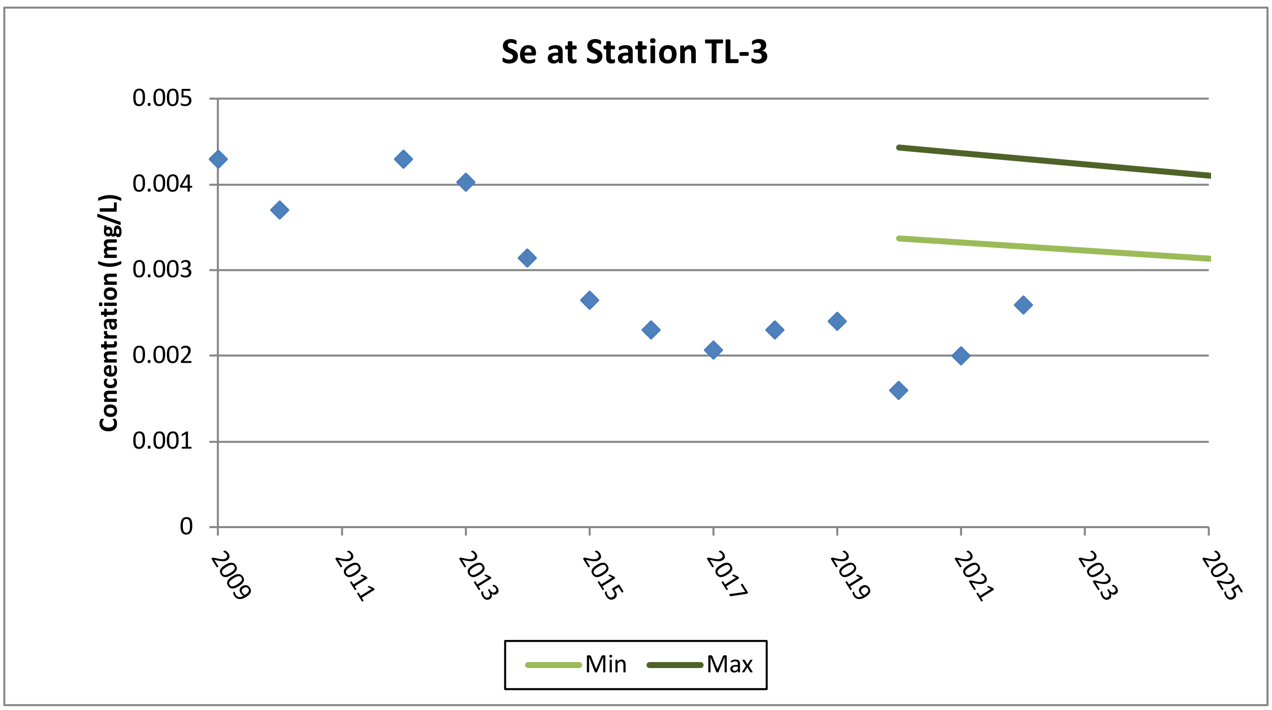




**Figure 11: Se Performance Indicator at TL-3**

## Site Free from Debris (Performance Indicator has been met)

All Beaverlodge related properties were inspected in an effort to locate historic debris not removed during initial decommissioning. During the main clean-up campaign in 2015 and 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the Fookes Reservoir properties, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 12**).

Following the above noted inspections, various debris found on the property, including the remaining electrical and power infrastructure (pole brackets) and concrete pilons and anchor bolts used to anchor the tailings line were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

As a result of this activity, the Fookes Reservoir properties meets the performance indicator of being free of debris.

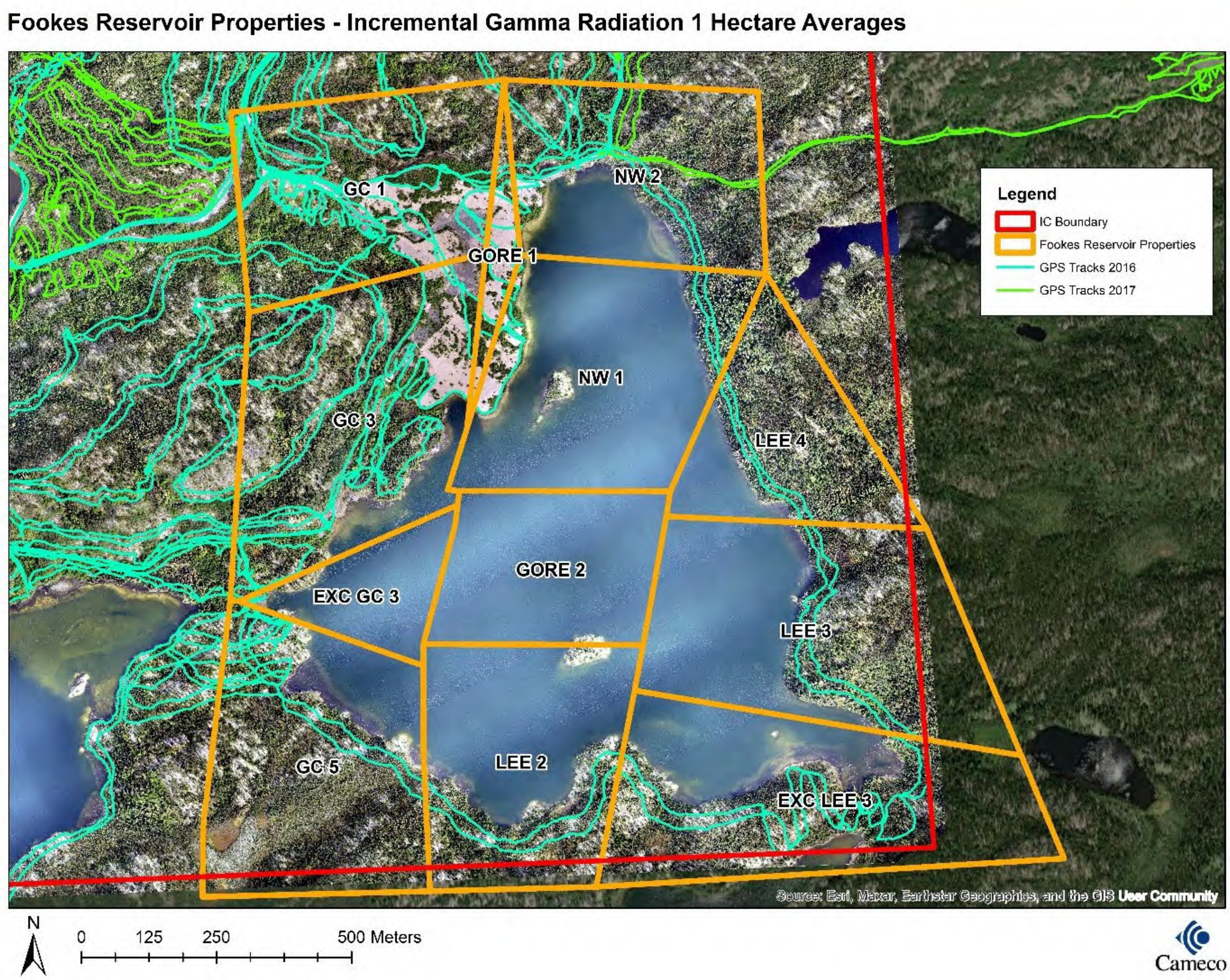



**Figure 12: Fookes Reservoir Properties – Inspection Track**

### 8.2.2 Decommissioning and Reclamation Documentation

**Table 7** provides a summary of general documents which include refence to the Fay site and by extension the Fookes Reservoir properties.

**Table 7: Documentation Log – Fookes Reservoir properties**

| **Document** | **Date** |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 3, Beaverlodge Tailings and Sludges Close-out Engineering Feasibility Studies, Stefan Robertson & Kirsten,* Eldorado Resources Limited | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 – Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Beaverlodge Decommissioning, 2005 Construction Activities at the Fookes Lake Delta,* SRK Consulting | February 2006 |
| *Surface Lease Renegotiation, Appendix D – Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
| *Beaverlodge Decomissioning 2007 Construction Activities at the Fookes Lake Delta,* SRK Consulting | February 2008 |
| *Waste Rock Stability Assessments – Former Beaverlodge Sites,* SRK Project No. 4CC008.027, SRK Consulting (Canada) Inc | December 2010 |
| *Surficial Gamma Radiation Survey of Disturbed Areas at the Former Beaverlodge Mine Site*, Final Rev. 1, ARCADIS SENES Canada Inc. | November 2014 |
| *2014 Uranium City Consultation on Land Use*, SENES Consultants & Kingsmere Resources Services | January 2015 |
| *Beaverlodge Site Gamma Radiation Risk Evaluation*, ARCADIS Canada Inc., | June 2015 |
| *Beaverlodge Property – Crown Pillar Assessment (2014-2015*), SRK Project No. 1CC007.048, SRK Consulting (Canada) Inc. | July 2015 |
| *Beaverlodge 2017: Borehole Decommissioning Report*, Cameco Corporation (Cameco). | July 2017 |
| *Remediation of Utility Corridors & Related Infrastructure, Beaverlodge Properties,* Kingsmere Resource Services Inc. | January 2018 |

| Document | Date |
|---|---|
| *Beaverlodge Property Inspection for Institutional Control Transfer Report,* Kingsmere Resource Services Inc. | January 2018 |
| *2020 Geotechnical Inspection Report Decommissioned Beaverlodge Mine/Mill Site*, SRK Consulting (Canada) Inc., 1CC007.067 | February 2021 |

### 8.2.3 Evaluation of Fookes Reservoir Properties

The properties meet the established performance objectives of safe, secure, stable/improving and have no remaining liabilities (see **Table 8**).

**Table 8: Evaluation of Fookes Reservoir Properties**

| Performance Indicators | Acceptance Criteria | Fookes Reservoir Area |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | NA |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | NA |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | NA |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the properties associated with Fookes Reservoir should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.0/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing Fookes Reservoir properties while under Institutional Control.

### 8.2.4 Institutional Control Considerations and Requirements

#### Engineered Structures

The Fookes Reservoir properties hosts the Fookes Delta Cover and Fookes Reservoir Outlet Structure. These structures have been designed as passive structures and Cameco does not anticipate any future maintenance to required. However, Cameco has identified potential sources of cover material near to Fookes Reservoir and provided funding in the monitoring and maintenance plan to perform minor remediation work if erosion were to occur on the site. The potential sources of cover material are located on the former ACE 3 property and the Highway's Pit, that was used to cover tailings boils as discussed earlier.

### Beaverlodge Post Closure Land Status

As previously shown, **Figure 1** outlines the proposed IC border, including the Fookes Reservoir Area. Small portions of the south and southwest properties are outside the IC boundary defined in collaboration with the SkMOE and the Ministry of Economy (now SkMER). These portions will be free-released as they have not been impacted by historical mining/milling activities and the boundaries are based on a simplified (geometrically) IC boundary.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance (2020)

To meet the requirements of section 22 of the MIEPR, **Table 9** provides a summary of aspects of the Fookes Reservoir properties in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 9: Remaining Site Aspects – Fookes Reservoir Properties**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Tailings Delta (erosion of cover) | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Fookes Outlet Structure (erosion of outlet) | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |

As noted earlier, the water quality of Fulton Creek watershed will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties located within the entire watershed are transferred to the provincial IC Registry. A long-term water monitoring program will be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

**Figure 7** outlines the site features associated with Fookes Reservoir properties. Based on the historical activities at the Fookes Reservoir properties, the delta and the outlet structure will require inspection under the Province of Saskatchewan's institutional control management framework. As noted by SRK (2021), involvement by a geotechnical engineer should not be required except in the unlikely event that significant geotechnical concerns arise. Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation,
- Fookes Delta (SRK 2021),
    - Evidence of new tailing boils or tailings exposure due to frost action;
    - Evidence of significant erosion of the cover material:
        - Trench along the northeast edge of the delta (sand flows, erosion of waste rock, slumping, etc.) – maintain photographic and GPS record (identify areas of concern on map).
        - Cover limit along its contact with Fookes Reservoir – maintain photographic and GPS record (identify areas of concern on map) where sand from the delta cover extends into the reservoir.
    - Evidence of erosional features;
    - Ensure erosion-protection devices are performing as expected on former north access road:
        - Waterbars (chevrons);
        - Diversion ditches; and
        - Erosion of cover adjacent to the former access road.
    - Ensure earthen berms are in place to limit access to the delta.
    - Condition of vegetation.
- Fookes Outlet Structure (SRK 2021);
    - Check the condition of the spillway channel, with a view to confirming the grout intruded rip-rap is still in place.
    - Check the condition of the rip-rap embankments on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event.
    - Document conditions with photographs.
- Water quality.

### Institutional Control Maintenance

Although no aspect of the Fookes Reservoir properties is expected to require maintenance under institutional control, funds have been provided to perform remediation on the Fookes Delta if erosional features that need to be addressed are identified.

## 8.3 Marie Reservoir Area

During operations, more than 170,000 tonnes of mill tailings were placed within the Marie Reservoir between 1954 and 1957. During deposition of tailings a small tailings delta was developed in the northwest end of Marie. The Marie delta is mostly contained to the EXC ACE 14 property; however, a small portion of the delta extends onto the ACE 15 property. This delta was partially submerged by the construction of the Marie Reservoir dam in 1971; and at shutdown, covered approximately 5 to 10% of the reservoir area.

As shown in Figure 7, spilled tailings was identified and left "as-is" along the pipeline right-of-way on properties EXC GC2 and GORE within the Marie Reservoir Area. Residual tailings from spills that occurred during operations along the pipelines running from the Dorrclone separator to the tailings management area were assessed and remediated in accordance with the approved decommissioning plan (Eldorado 1987). Accessible tailings were either relocated to the underground mine workings or covered with 0.6 m of waste rock. Locations with residual tailings that were inaccessible, either due to topography or naturally established vegetative cover, were assessed on an individual basis, with the participation of regulatory personnel, to determine whether they should be left as is or remediated. If a decision was made to leave the residual tailings in situ, it was because the disturbance associated with removal or covering the of the tailings would have resulted in greater environmental damage.

In 1976 a water treatment plant was constructed at the outlet of Marie Reservoir. As a result, the water from Marie was discharged at a controlled rate into the Meadow basin. Sample station TL-4 was established at the outflow of Marie Reservoir, where barium chloride solution and ferric sulphate solution were injected at rates proportional to the discharge flows and the precipitates deposited in the Meadow basin which was created by the construction of a concrete and stop log dam in 1977 (the Meadow dam at sample station TL-7) at the southern end of the Meadow basin on the ACE 19 property. An area approximately 100m to the north and west of the Marie Outlet also appears to have been built up with large angular rip-rap, likely during the construction of the water treatment plant, to prevent water from flowing through an alternate path.

The Meadow basin was used for the settling of barium-radium precipitate resulting from the treatment of water at the Marie dam treatment plant, and for the additional settling of precipitate overflowing from the Minewater basin (see Minewater Reservoir discussion). The Marie Reservoir Area consists of nine properties listed in **Table 10**.

**Table 10: Marie Reservoir Area Property Coordinates**

| AECB License Number | Cameco Number | Area (hectares) | Coordinates (UTM WGS 84, 12N) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| N-294 | EXC ACE 18 | 20.7 | 643514 | 6603586 |
| | | | 644110 | 6603704 |
| | | | 644240 | 6603942 |
| | | | 643483 | 6603967 |
| | EXC ACE 17 | 11.9 | 644240 | 6603942 |

| | | | | |
|---|---|---|---|---|
| | | | 643472 | 6604204 |
| | | | 644199 | 6604033 |
| | | | 643481 | 6604016 |
| | | | 643483 | 6603967 |
| | ACE 17 | 21.2 | 643472 | 6604204 |
| | | | 643543 | 6604470 |
| | | | 644007 | 6604458 |
| | ACE 15 | 23.6 | 643481 | 6604016 |
| | | | 644622 | 6604545 |
| | | | 644593 | 6604539 |
| | | | 644007 | 6604458 |
| | | | 644611 | 6604075 |
| | EXC ACE 14 | 16.1 | 643481 | 6604016 |
| | | | 644032 | 6604811 |
| | | | 644582 | 6604753 |
| | | | 644587 | 6604647 |
| | | | 644622 | 6604545 |
| | | | 644593 | 6604539 |
| | | | 644611 | 6604075 |
| | GORE | 7.1 | 644593 | 6604539 |
| | | | 645154 | 6604677 |
| | | | 644587 | 6604647 |
| | | | 644622 | 6604545 |
| | EXC GC 2 | 7.4 | 644587 | 6604647 |
| | | | 644580 | 6604808 |
| | | | 645160 | 6604774 |
| | | | 644582 | 6604753 |
| | | | 645154 | 6604677 |
| | GC 4 | 18.9 | 645104 | 6604260 |
| | | | 643946 | 6605142 |
| | | | 645154 | 6604677 |
| | | | 644622 | 6604545 |
| | EXC GC 4 | 6.6 | 644611 | 6604075 |
| | | | 645102 | 6604126 |
| | | | 645104 | 6604260 |
| | | | 644614 | 6604211 |

### 8.3.1 Initial Decommissioning Activities

#### Marie Reservoir Tailings Delta

During the life of mine, tailings were deposited in two general locations within the Marie Reservoir: one near the west end and a second at the east end. Tailings were delivered to the basin using wood stave pipelines that discharged tailings into channels cut into the natural slopes. Given the steepness of these gullies, the vast majority of the tailings flowed into the reservoir as planned, thereby forming each of the two deltas. These channels are heavily vegetated today and only very minor traces of the tailings are evident in the vicinity of these channels.

In 1983 and 1984, as part of the approved mine decommissioning plan, the following activities were undertaken:

- Tailings near the surface of Marie Reservoir were moved to a deeper part of the reservoir; and
- Tailings deltas in Marie Reservoir were covered with waste rock.

### Marie Outlet Structure

The Marie Reservoir Outlet structure is located on the EXC ACE 17 property. Close-out activities at the Marie Reservoir in 1985 included measures to remove water treatment infrastructure and to stabilize the outlet of the Marie Reservoir in an effort to maintain minimum water levels at the outlet 1 m above the highest level of uncovered tailings.

During the 1986 spring-melt, flows through the Marie Reservoir outlet were higher than anticipated (due to glaciation effects in the spillway) and this resulted in erosion of the spillway channel and a 0.15 m drop in the water level. As a consequence, the outlets from both Fookes and Marie reservoirs were upgraded to provide improved long-term stability.

The Marie Reservoir spillway was upgraded in 1987 in accordance with the objectives noted below. The spillway invert controlling reservoir level was set at an elevation of 2,815.2 m (based on local datum) at the outlet in Marie Reservoir. The elevation is approximately 1 m above the elevation down to which the waste rock cover was placed on the tailings deltas. This elevation represents an increase of about 1 m in the outlet level of Marie Reservoir, compared to pre-mine development. The general design objective for the outlet structure was to:

- Prevent piping into the coarse embankment fill by constructing an embankment with a low permeability upstream zone;
- Enhance the erosion resistance of the spillway in the long term;
- Raise the embankment to reduce the potential for overtopping; and,
- Prevent erosion of the embankment in the event that glaciations of the spillway results in overtopping of the embankment.

Similar to the Fookes outlet structure, the Marie outlet structure consists of a rip-rap lined open channel (with trapezoidal cross section) discharging into a rip-rap lined stilling basin. The rip-rap lining in the spillway channel and the stilling basins was intruded with grout for added erosion protection; however, the rip-rap in the spillway was designed to be stable in the absence of grout intrusion. The spillway is capable of passing a 500-year flood event with a depth of 0.3 m (680 L/sec) at the entrance of the Marie spillway. In the event of embankment overtopping, the coarse rip-rap will resist erosion of the upper surfaces and downslope embankments (SRK 1986).

Inspections of the outlet spillways at the Fookes and Marie reservoirs were undertaken by SRK in September 1998 (SRK, 1998), September 2001 (SRK, 2001), June 2004 (SRK, 2005a), August 2007 (SRK, 2008), May 2010 (SRK, 2010b), June 2015 (SRK, 2015) and September 2020 (SRK 2021). Since 2010, a Cameco representative has also completed annual inspections of the outlet structures.

In 2020, Cameco commissioned SRK Consulting (Canada) Inc. to conduct a detailed geotechnical assessment of the decommissioned Beaverlodge Mine/Mill site which include Marie outlet structure. That report concluded that, from a geotechnical perspective, the conditions at the outlet structures have stabilized sufficiently to support the transfer of associated properties to the IC Program (SRK 2021).

**Meadow Basin**

The majority of the Meadow Settling Basin and the outlet of the settling basin is located on the EXC ACE 18 property; however the NE portion, located immediately downstream of the Marie Outlet Structure, is located on EXC ACE 17 property.

After the Marie Reservoir water treatment plant was shutdown the remediation of the Meadow Basin area commenced. Remediation involved the removal of numerous stop-logs from the dam at the south-western outlet (on EXC ACE 18; at monitoring station TL-7) in July 1984, lowering the water level in the basin, exposing the settled precipitate from the Marie Reservoir water treatment plant. The settled precipitate was excavated and disposed of underground. At the time precipitate depths in the Meadow basin varied from 100 mm at the basin inlet to 10 mm at the stoplog dam (TL-7) basin outlet, with the average thickness being 20 mm. The inlet and outlet channels were cleared in September 1984, in preparation for Marie Reservoir overflow to commence in mid-October.

Precipitate was excavated and stockpiled at Meadow during the winter of 1985. Due to equipment limitations, it was necessary to remove a layer approximately 300 mm deep from the total basin floor area. This layer contained primarily muskeg, with a large proportion of ice and snow.

Consequently, the excavated material was stockpiled on the shores of Meadow basin to allow the ice and snow to melt prior to disposal down the Ace Vent Raise.

Precipitate haulage and stockpiling was carried out between January and April 1985 and a total of 6,470 $m^3$ of material (sludge and muskeg) was hauled and underground disposal was completed during in May and June 1985. Additional remediation of the stoplog dam at TL-7 occurred in 2021 and is discussed further in Section 8.3.2.

During August 2021, the concrete stop log flow control structure (at sample station TL-7) located at the outlet of the Meadow Basin, on property EXC ACE 18, was decommissioned by the removal of the wooden stop logs and steel frame followed by the partial removal of the concrete dam.

The Meadow basin also collects runoff from the Minewater Reservoir area. When runoff from Minewater Reservoir was redirected towards the Meadow basin, in 1971, a culvert was installed in the road along the north side of the Meadow basin to allow drainage into the basin. This culvert was removed in September 2023 and a level crossing was created to allow drainage to continue.

### 8.3.2 Recent Decommissioning Activities and Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

During 2014, a detailed surficial gamma survey was conducted primarily focusing on the disturbed areas (i.e., Fay area, roads and the former tailings pipeline corridor) and included previously disturbed areas of the Marie Reservoir properties (ARCADIS SENES 2014). The properties were surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2" x 2" sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10).

The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). As shown in **Figure 13**, the surface gamma survey results ranged from <0.1 µSv/h to 1.0 µSv/h above background (ARCADIS SENES 2014), which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). Therefore, the Marie Reservoir properties meet the performance indicator associated with acceptable gamma levels.

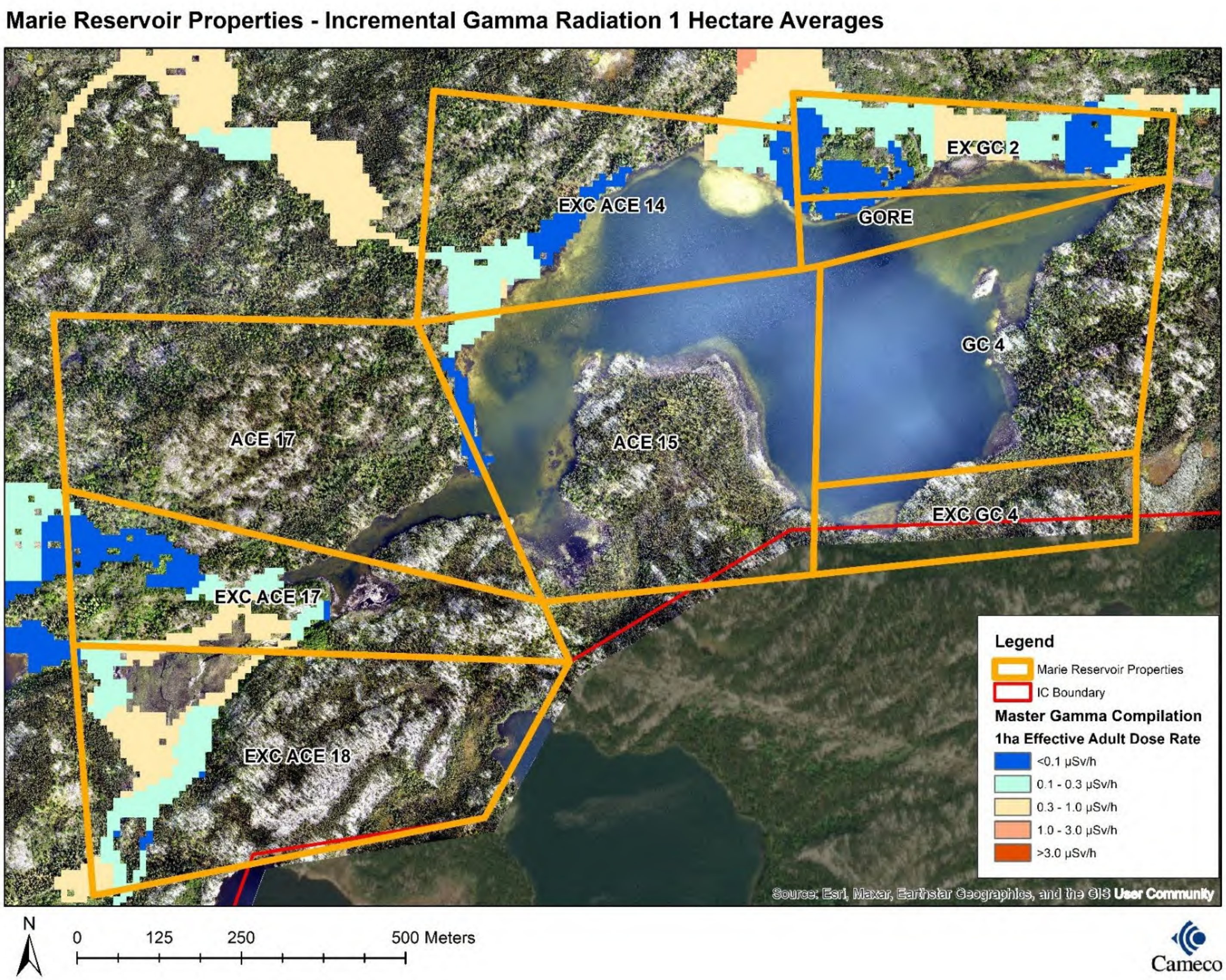



**Figure 13: Incremental Gamma Radiation 1 Hectare Averages: Marie Reservoir Properties**

### Boreholes Plugged (Performance Indicator is not applicable)

Surface inspections in support of transferring the property to IC did not identify any exploration drill holes on the Marie Reservoir properties.

### Stable Mine Openings (Performance Indicator is not applicable)

The Marie Reservoir properties do not host any mine openings to surface.

### Geotechnical Stability

#### *Crown Pillar (Performance Indicator has been met)*

The crown pillar performance indicator is not applicable to the Marie Reservoir properties as presented to the Commission by CNSC Staff during the 2014 update meeting.

#### *Pit Walls*

There are no open pits associated with the Marie Reservoir properties.

#### *Tailings*

In 2020, SRK (Canada) Consulting Ltd. Inspected the Marie Reservoir Delta Area and concluded that, consistent with previous assessments (SRK 2005b; 2015), the condition of the cover is generally good despite the observation that tailings have worked their way to surface through the waste rock cover. Visual inspection completed by geotechnical specialist between 2004 and 2020 indicate that no large-scale changes to the extent of exposed tailings have occurred and the exposed tailings have a brown, aged appearance that has remained unchanged since 2004. These observations suggest that the tailings at the Marie Reservoir Delta have been exposed for a long period of time, possibly as far back as 1984 when the rock fill cover was installed (SRK 2021b). From a geotechnical perspective, based on inspections completed over the past 16 years, the conditions on the delta have stabilized sufficiently to support the transfer of properties associated with the Marie delta to the IC Program (SRK 2021).

As shown in Figure 7, there are tailings present on Marie Reservoir properties (EXC GC 2 and GORE) that were left undisturbed (i.e., left as is). Monitoring has confirmed that surface runoff that comes in contact with tailings are not a significant source of the primary constituents of concern. (SENES 2012a; 2012b). Further, the results from the site wide gamma survey meet the *Guidelines for Northern Mine Decommissioning and Reclamation* and no additional remedial actions are justified (ARCADIS 2015).

#### *Waste Rock*

Waste rock present on the Marie Reservoir properties was used to cover the exposed tailings on the delta and to construct the roads transecting the properties. In addition, approximately 900m$^2$ of waste rock is located approximately 100m NW of the Marie Outlet to prevent water from flowing through an alternate pathway. This waste rock pile was placed during the operating period of the mine/mill and was upgraded in 1987 with additional material, when the upgrades to the Marie Outlet drainage channel were completed.

Waste rock samples specific to the Marie Reservoir area properties have not been collected; however, based on general waste rock samples collected on the Beaverlodge properties, uranium content is typically below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%). This is reflected in the gamma survey results provided above. Areas where waste rock is located are typically below 0.3 µSv/hr. Further, waste rock sampling has also shown the waste rock is non-acid generating and visual observation for more than 60 years has not identified any impacts that could be attributed to the generation of acidic conditions.

### Water Quality within Modelled Predictions (Performance Indicator has been met)

To determine if natural recovery is occurring in the Marie Reservoir Area as expected, water quality has been monitored at station TL-4 (located at the outflow of Marie Reservoir) and concentrations have helped inform modelled predictions. The modelled data helped establish WQ performance indicators, which CNSC Staff have deemed appropriate for evaluating the recovery of Marie Reservoir. The relevant water quality constituents that are assessed as part of the performance indicator include: radium-226, uranium, and selenium. As shown in **Figure 14, 15, and 16** and discussed in greater detail in the 2020 Beaverlodge ERA (CanNorth 2020a), the following observations can be made that demonstrate the Marie Reservoir water quality data is meeting the water quality performance indicator as defined by regulatory accepted assessment methodologies:

- Radium-226 levels in Marie Reservoir are within the predicted bounds identified as the performance indicator for this area.
- Uranium and selenium levels in Marie Reservoir meet the performance indicator for this area and are expected to continually improve over the long-term.

Radium-226 levels are expected to increase slightly before they decline. The chemical processes causing this increase are known and well understood. As detailed in the 2020 ERA, increases are attributed to the release of historically precipitated radium from sediments. Radium-226 precipitates in the Marie Reservoir are associated with naturally occurring calcium and barium, which may have been introduced in the milling process. After the peak is reached, levels are expected to gradually improve.

The Marie Reservoir properties therefore meet the “water quality within modelled predictions” performance indicator.

Figures 14 and 15 are provided to show the rapid decrease in uranium and selenium concentrations that occurred following decommissioning. Due to the rapid improvement of selenium and uranium concentrations following decommissioning a second graph showing a more suitable scale of current concentrations is also provided.

The water quality of Marie Reservoir will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

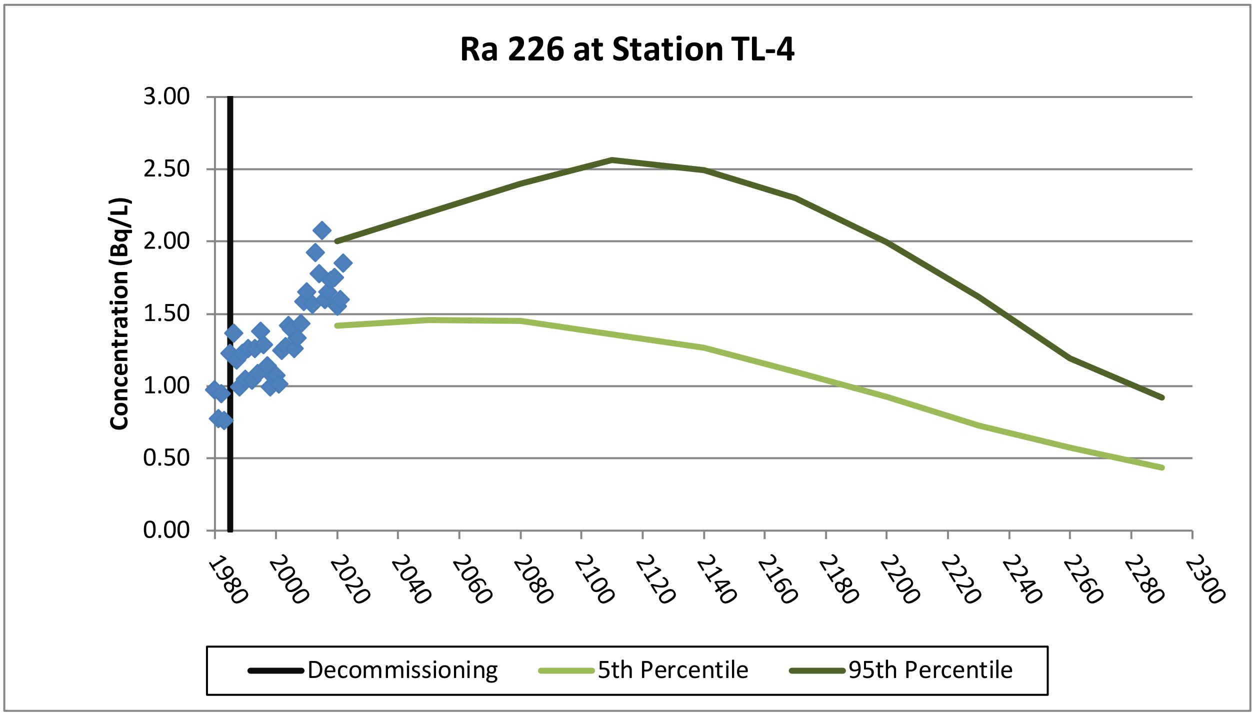
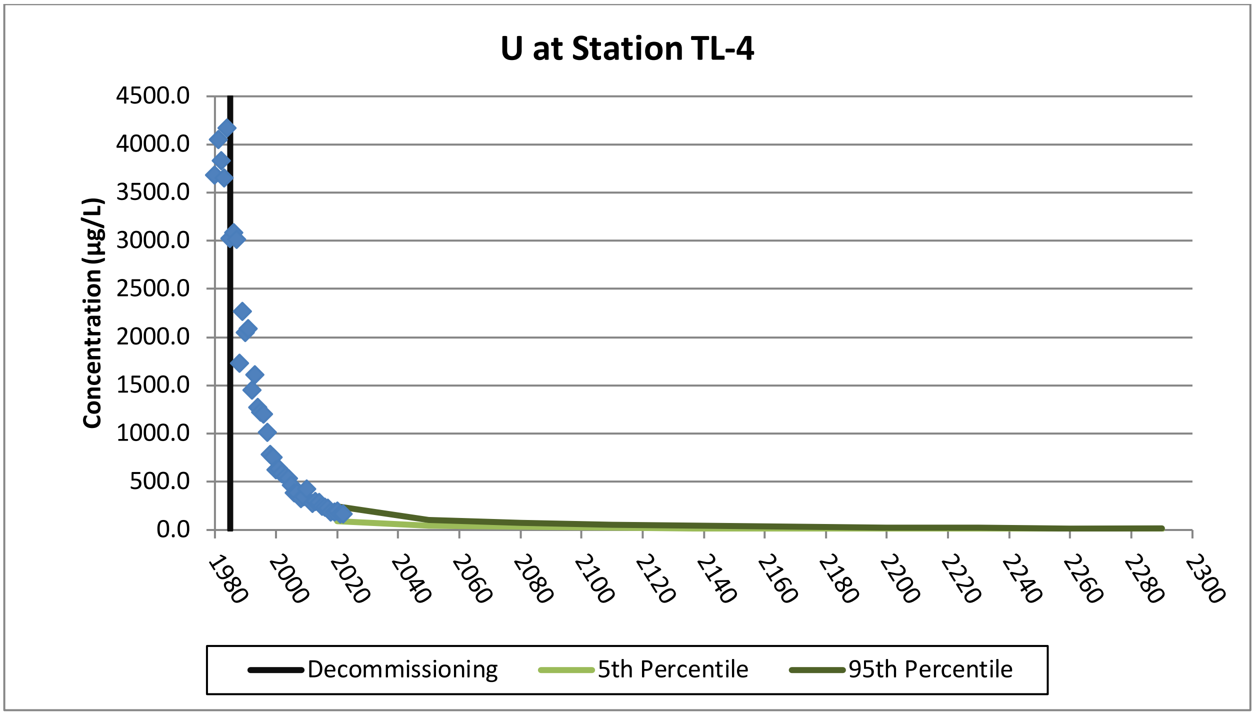



**Figure 14: Ra-226 Performance Indicator at TL-4**



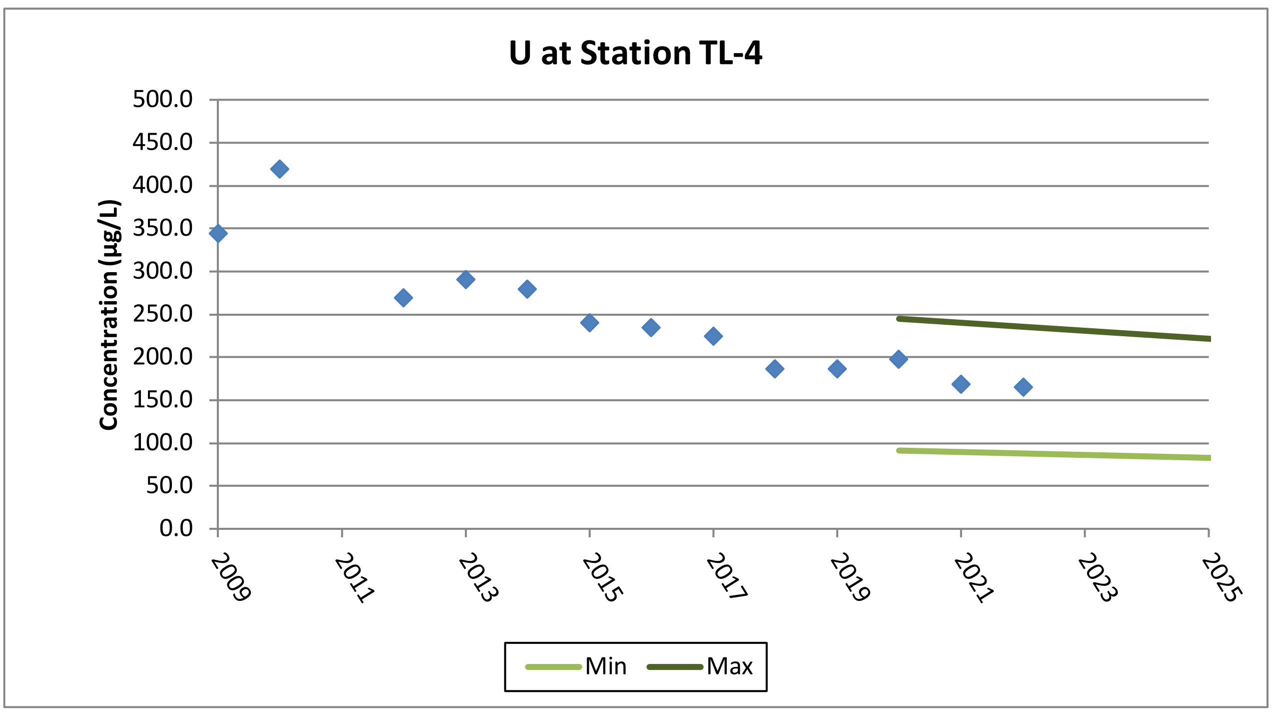
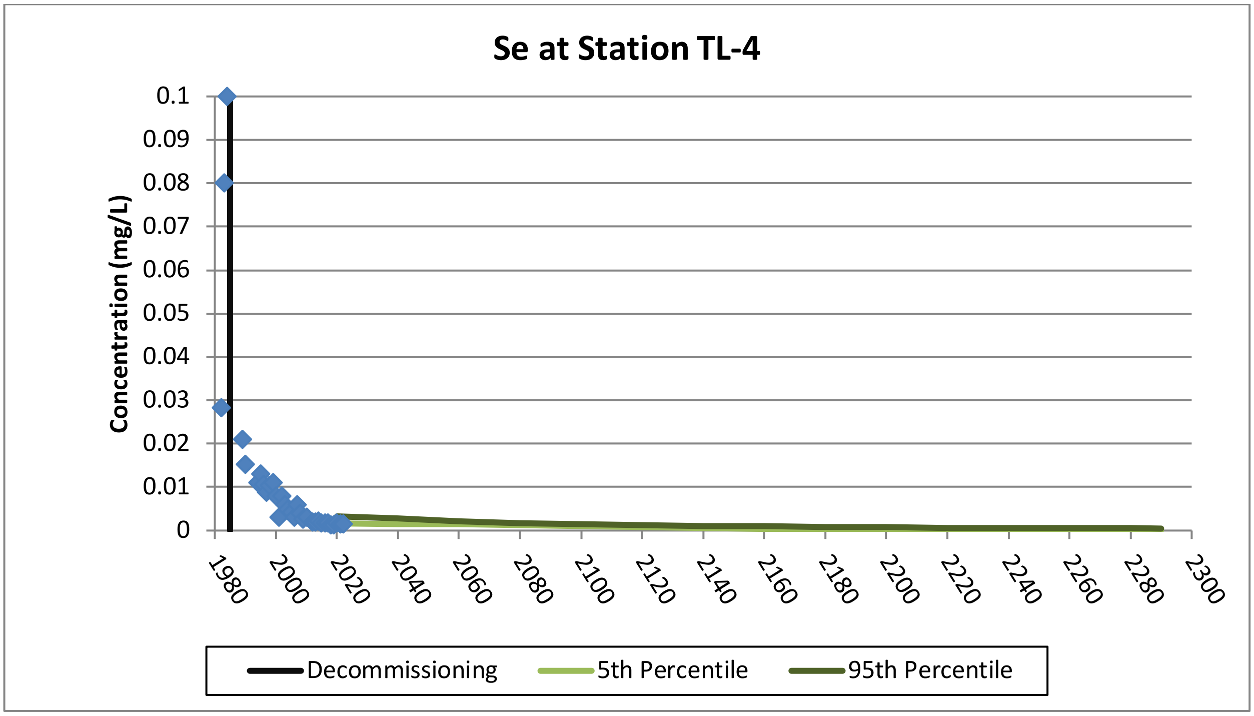




**Figure 15: U Performance Indicator at TL-4**



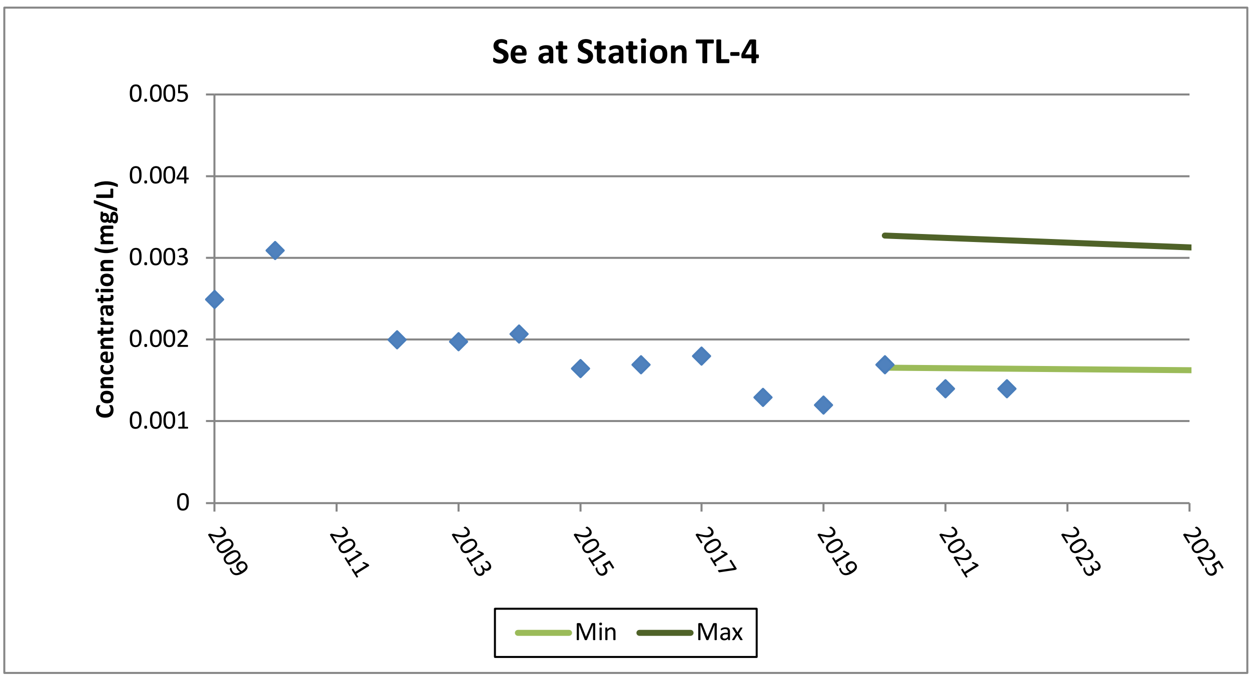




**Figure 16: Se Performance Indicator at TL-4**

## Site Free from Debris (Performance Indicator has been met)

All Beaverlodge related properties were inspected in an effort to locate historic debris not removed during initial decommissioning. During the main clean-up campaign in 2015 and 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the Marie Reservoir properties, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 17**).

Following the above noted inspections, various debris found on the property, including the remaining electrical and power infrastructure (pole brackets) and concrete pilons and anchor bolts used to anchor the tailings line were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

During August 2021, the concrete stop log flow control structure (at sample station TL-7) located on property EXC ACE 18, was decommissioned by the removal of the wooden stop logs and steel frame followed by the partial removal of the concrete dam. All materials removed (wood, steel and concrete was removed and disposed of in the Lower Fay Pit.

The culvert that was installed under the road along the north side of the Meadow basin to allow drainage from the Minewater Reservoir area was removed in September 2023 and a level crossing was created to allow drainage to continue. The culvert was disposed of in Lower Fay Pit.

As a result of this activity, the Marie Reservoir properties meets the performance indicator of being free of debris.

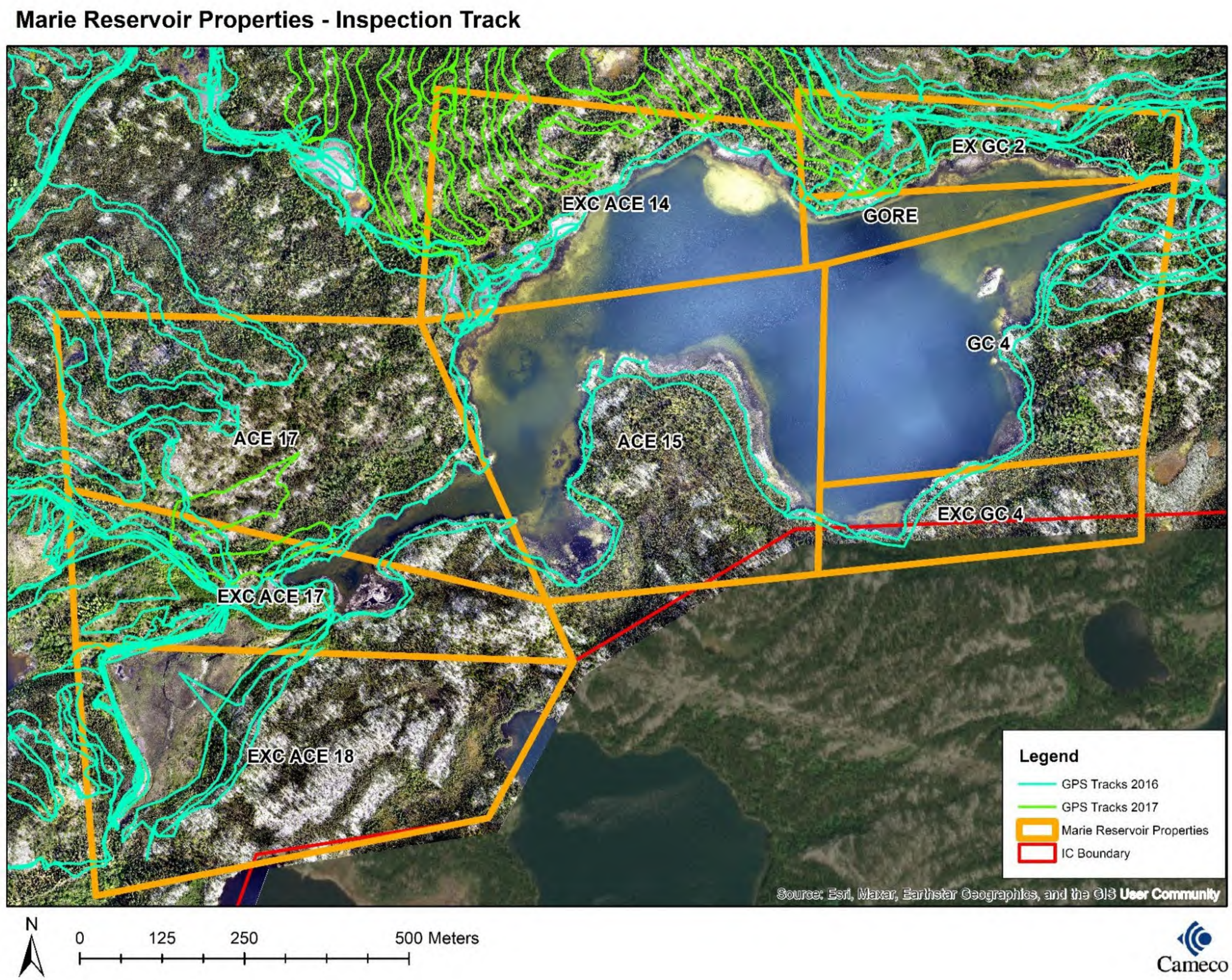



Figure 17: Marie Reservoir Properties – Inspection Track

### 8.3.3 Decommissioning and Reclamation Documentation

**Table 11** provides a summary of general documents which include reference to the Fay site and by extension the Marie Reservoir properties.

**Table 11: Documentation Log – Marie Reservoir properties**

| Document | Date |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited, | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 - Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Surface Lease Renegotiation, Appendix D - Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
| *Waste Rock Stability Assessments – Former Beaverlodge Sites,* SRK Project No. 4CC008.027, SRK Consulting (Canada) Inc | December 2010 |
| *Surficial Gamma Radiation Survey of Disturbed Areas at the Former Beaverlodge Mine Site*, Final Rev. 1, ARCADIS SENES Canada Inc. | November 2014 |
| *2014 Uranium City Consultation on Land Use*, SENES Consultants & Kingsmere Resources Services | January 2015 |
| *Beaverlodge Site Gamma Radiation Risk Evaluation*, ARCADIS Canada Inc., | June 2015 |
| *Beaverlodge Property – Crown Pillar Assessment (2014-2015*), SRK Project No. 1CC007.048, SRK Consulting (Canada) Inc. | July 2015 |
| *Beaverlodge 2017: Borehole Decommissioning Report*, Cameco Corporation (Cameco). | July 2017 |
| *Remediation of Utility Corridors & Related Infrastructure, Beaverlodge Properties,* Kingsmere Resource Services Inc. | January 2018 |
| *Beaverlodge Property Inspection for Institutional Control Transfer Report,* Kingsmere Resource Services Inc. | January 2018 |
| *2020 Geotechnical Inspection Report Decommissioned Beaverlodge Mine/Mill Site*, SRK Consulting (Canada) Inc., 1CC007.067 | February 2021 |
| *Beaverlodge Aquatic Support 2021 - Monitoring Summary / Cameco,* Outside Environmental Consulting Ltd. | September 2021 |

### 8.3.4 Evaluation of Marie Reservoir Properties

The properties meet the established performance objectives of safe, secure, stable/improving and have no remaining liabilities (see Table 12).

**Table 12: Evaluation of Marie Reservoir Properties**

| Performance Indicators | Acceptance Criteria | Marie Reservoir |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | NA |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | NA |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | NA |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the properties associated with Marie Reservoir should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.0/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing Marie Reservoir properties while under Institutional Control.

### 8.3.5 Institutional Control Considerations and Requirements

#### Engineered Structures

The Marie Reservoir properties host the Marie Reservoir Outlet Structure; and the remnants of the concrete foundation of the decommissioned control structure at the outlet of Meadow Basin. Neither of these aspects are expected to require maintenance.

#### Beaverlodge Post Closure Land Status

As previously shown, **Figure 1** outlines the proposed IC border for the Marie Reservoir Area. Small portions of the southern properties are outside the IC boundary defined in collaboration with the SkMOE and the Ministry of Economy (now SkMER). Those portions that will be free-released have not been impacted by historical mining/milling activities and the boundaries are based on a simplified (geometrically) IC boundary.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance (2020)

To meet the requirements of section 22 of the MIEPR, **Table 13** provides a summary of aspects of the Marie Reservoir properties in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 13: Remaining Site Aspects – Marie Reservoir Properties**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Tailings Delta (erosion of cover) | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Marie Outlet Structure (erosion of outlet) | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |

As noted earlier, the water quality of Fulton Creek watershed will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties located within the entire Ace Lake watershed are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

As previously shown, **Figure 7** outlines the site features associated with Marie Reservoir properties. Based on the historical activities at the Marie Reservoir properties, the tailings delta and the outlet structure will require inspection under the Province of Saskatchewan's institutional control management framework. As noted by SRK (2021), involvement by a geotechnical engineer should not be required except in the unlikely event that significant geotechnical concerns arise. Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation,
- Condition of vegetation,
- Marie Tailings Delta (SRK 2021),
    - Evidence of tailing boils or tailings exposure due to frost action
    - Evidence of significant erosion of the cover material
    - Evidence of erosional features
- Marie Reservoir Outlet (SRK 2021), and
    - Check the condition of the spillway channel, with a view to confirming the grout intruded rip-rap is still in place.
    - Check the condition of the rip-rap embankment on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event.

  - Check for disturbance along the SaskPower power line right-of-way, with attention to the areas of the Marie spillway channel and the area that was built up with angular rip-rap approximately 100m NW of the Marie spillway.
  - Document conditions with photographs.
- Water quality.

### Institutional Control Maintenance

Although no aspect of the Marie Reservoir properties is expected to require maintenance under institutional control, funds have been provided to perform remediation on the Marie Delta if erosional features that need to be addressed are identified.

## 8.4 Minewater Reservoir Area

During operations, approximately 101,000 tonnes of mill tailings were placed within the Minewater Reservoir between 1953 and 1954. After 1954 and until 1971, the Minewater Reservoir, (sometimes referred to as URA Pond) received mine slimes and sanitary wastes from underground. Between 1971 and 1982, the area was used for settling barium radium precipitate from treated mine water, while continuing to receive sewage, from the Fay underground mine.

The natural drainage direction of the Minewater Reservoir was originally to Ace Creek. A dam was constructed on the west side of Minewater basin in 1971 (saddle dam), to direct drainage from the Minewater Reservoir towards the tailings management area (Meadow Basin). The Minewater dam was constructed to a height of approximately 3 m in 1971 using mine waste rock to prevent the discharge of water from Minewater Reservoir to Ace Creek.

A geotechnical investigation of the saddle dam area was performed in 1981. That investigation indicated that the dam was constructed without a proper (low permeability) core using mine waste rock, which generally consists of sand and gravel sizes and is relatively permeable. No foundation preparations appear to have been made and the saddle dam is underlain by peat and glacial till, over bedrock. Following completion of the above noted investigation (in 1981) a 2 to 5 m blanket of clay/silt till was placed on the upstream face, by end dumping and without compaction.

At decommissioning it was concluded the saddle dam would not be maintained as a permanent structure. Instead, tailings and sludges were removed from Minewater Reservoir, the saddle dam wall was recontoured and a new spillway outlet was blasted into the bedrock on the south part of the reservoir, to permanently alter the drainage of Minewater towards Lost Duck Lake, and then to the Meadow Basin area within the TMA. The crest of the new channel is more than 1 metre below the base of the former saddle dam. Monitoring has confirmed that flows from spring runoff flow freely from the area through the blasted spillway. As a result, the recontoured former saddle dam remains in place, but serves no purpose and does not require future inspection.

Described in DRAWING 53601/15 and Appendix E of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 3 – Beaverlodge Tailings and Sludges Close-out Engineering Feasibility Studies,* Steffen Robertson & Kirsten for Eldorado Resources Limited (Eldorado 1983b).

The Minewater Reservoir is located on property URA 6. Flow is from URA 6 through Lost Duck Lake (located on ACE 19) and then into the Meadow Basin on property EXC ACE 18 (located within the Marie Reservoir Area). The Minewater Reservoir Area consist of the following properties shown in **Table 14**.

**Table 14: Minewater Reservoir Property Coordinates**

| AECB License Number | Cameco Number | Area (hectares) | Coordinates (UTM WGS 84, 12N) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| N-294 | URA 6 | 20.7 | 645524 | 6604137 |
| | | | 643453 | 6604470 |
| | | | 643472 | 6604204 |
| | | | 642975 | 6604162 |
| | EXC URA 6 | 6 | 643483 | 6603967 |
| | | | 642975 | 6604162 |
| | | | 642979 | 6604091 |
| | | | 643481 | 6604016 |
| | | | 642963 | 6603974 |
| | ACE 19 | 15.8 | 643514 | 6603586 |
| | | | 642963 | 6603974 |
| | | | 643483 | 6603967 |
| | | | 643514 | 6603586 |

### 8.4.1 Initial Decommissioning Activities

### Minewater Reservoir

The decommissioning of the Minewater Reservoir on the URA 6 property consisted of the removal of deposited tailings and mine slimes, to the maximum extent possible, with the disposal of the material underground through the Ace vent raise.

The Minewater Reservoir was drained in 1982. Drainage ditches were excavated in the reservoir-bottom muskeg in an attempt to drain the basin in the direction of Meadow; however, the ditch sides continuously slumped and the method of drainage was finally abandoned. A sump was excavated in the tailings by backhoe, and continuous pumping was required during excavation.

During the winter of 1982, test work was conducted on the Minewater materials as part of a preliminary winter program to assess the feasibility of using underground load, haul and dump (LHD) equipment. The results were satisfactory and LHD equipment was used throughout the decommissioning period.

The balance of the tailings and other settled waste were removed from the Minewater basin during 1983 and 1984 and dumped underground through the Ace vent raise. The perimeter of the basin was cleared using a tracked dozer, while the main area of the basin was excavated.

In all, approximately 112,000 $m^3$ of material was removed and final contouring of the Minewater Reservoir was carried out during a three-week period at the end of August 1984.

### 8.4.2 Recent Decommissioning Activities and Beaverlodge Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

During 2014, a detailed surficial gamma survey was conducted primarily focusing on the previously disturbed areas (i.e., Fay area, roads and the former tailings pipeline corridor s) and included previously disturbed areas of the Minewater Reservoir properties (ARCADIS SENES 2014). The properties were surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2" x 2" sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10).

The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008).

As shown in **Figure 18**, the surface gamma survey results for the areas downstream of Minewater Reservoir area typically ranged from <0.1 µSv/h to 1.0 µSv/h above background (ARCADIS SENES 2014), which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). The area surrounding the Minewater Reservoir itself typically measured between 1.0 and 3.0 µSv/h, with a small area on the east flank of Minewater Reservoir measuring >3.0 µSv/h above background. The area is difficult to access, and the area of the highest measured gamma levels is heavily vegetated. A risk-based approach was applied to evaluate potential radiation exposure risk at the property and concluded incremental dose from the properties based on the measured gamma results and the reported land use are well below the public dose criterion of 1 mSv/yr (ARCADIS 2015) and meet the Performance Indicator associated with acceptable gamma levels.

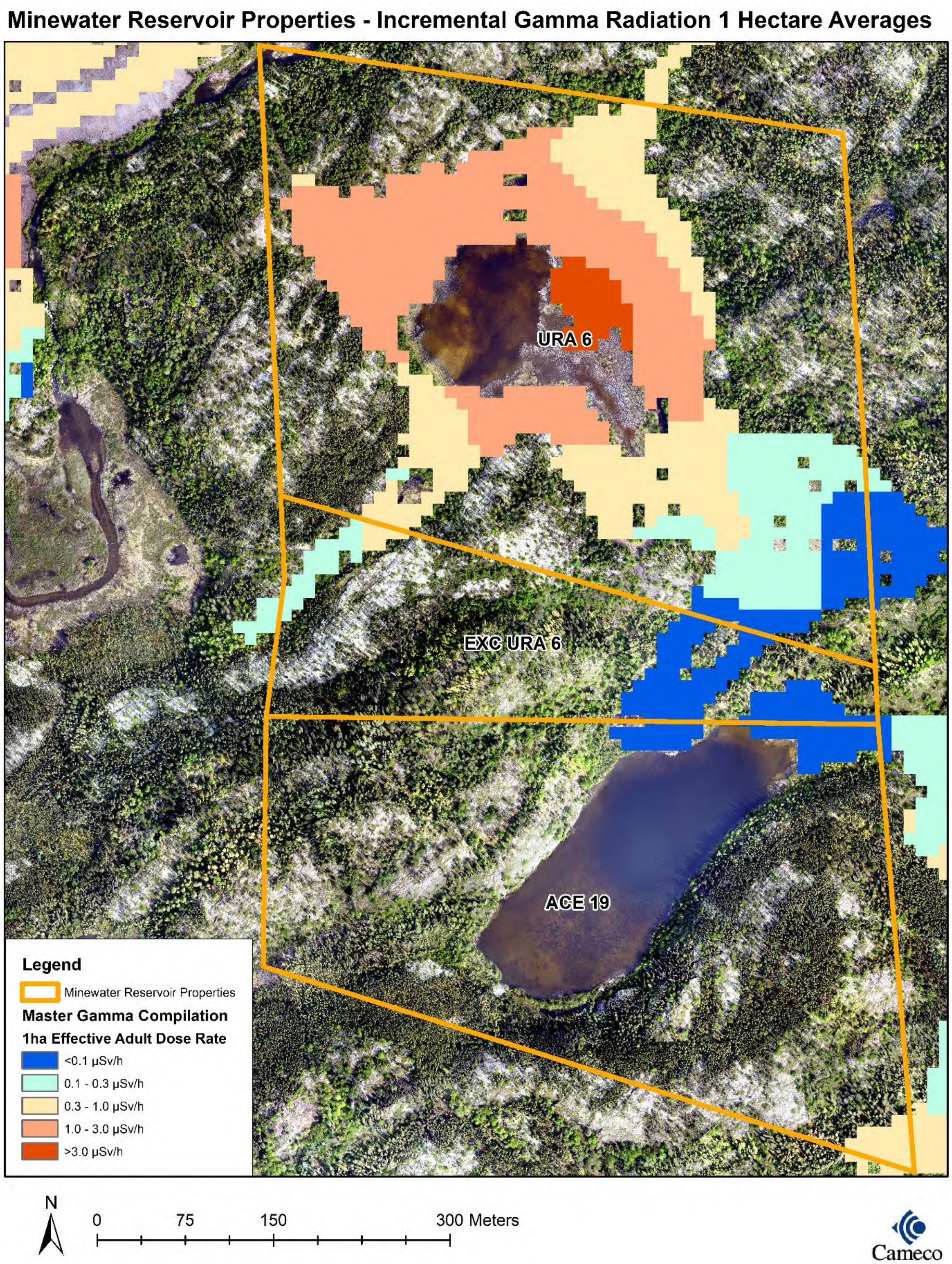



**Figure 18: Incremental Gamma Radiation 1 Hectare Averages: Minewater Reservoir Properties**

## Boreholes Plugged (Performance Indicator has been met)

Activities completed since 1985 have included sealing exploration boreholes according to accepted methods (Cameco 2017). Surface inspections in support of transferring the properties to IC identified eight exploration drill holes on the URA 6 property which forms part of the Minewater Reservoir properties. The following provides the designation and location of each hole:

**Table 15: Minewater Reservoir Property Boreholes**

| Designation | Coordinate System: WGS 84 UTM Zone 12 | | Year Remediated |
|---|---|---|---|
| | Easting | Northing | |
| BH-16 | 643009.193 | 6604465.019 | 2017 |
| BH-17 | 642993.852 | 6604455.146 | 2017 |
| BH-18 | 642995.637 | 6604466.051 | 2017 |
| BH-19 | 642978.88 | 6604452.098 | 2017 |
| BH-20 | 643007.541 | 6604467.124 | 2017 |
| BH-26 | 642972.143 | 6604451.532 | 2017 |
| BH-21 | 642966.862 | 6604445.757 | 2017 |

Each of the holes were found dry with no evidence of past liquid discharge. A review of the locations indicates that there is no potential for a hydraulic head to facilitate a surface discharge from the drill hole in the future. Despite showing no evidence or potential of flow, the drill holes were plugged with a concrete grout to a depth of 30 m or refusal in accordance with regulatory accepted methods.

As a result of the activities conducted since 1985, the Minewater Reservoir properties meet the boreholes plugged performance indicator.

## Stable Mine Openings (Performance Indicator is not applicable)

The Minewater Reservoir properties do not host any mine openings to surface.

## Geotechnical Stability

### *Crown Pillar (Performance Indicator has been met)*

The crown pillar performance indicator is not applicable to the Minewater Reservoir properties as presented to the Commission by CNSC Staff during the 2014 update meeting.

### *Pit Walls*

There are no open pits associated with the Minewater Reservoir properties.

***Waste Rock***

Waste rock present on the Minewater Reservoir properties is limited to that used to construct the roads transecting the properties. Waste rock samples specific to the Minewater Reservoir area properties have not been collected; however, based on general waste rock samples collected on the Beaverlodge properties, uranium content is typically below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%). This is reflected in the gamma survey results provided above showing the roads associated with this area are below 1µSv/hr. Further, waste rock sampling has also shown the waste rock is non-acid generating and visual observation for more than 60 years has not identified any impacts that could be attributed to the generation of acidic conditions.

***Tailings***

Since initial decommissioning, no additional remedial work related to tailings was required on the Minewater Reservoir properties.

### Water Quality within Modelled Predictions (Performance Indicator has been met)

Sample Station TL-6 is located at the discharge of Minewater Reservoir which was used temporarily for tailings deposition in 1953, then as a settling pond for treated mine water during the last 10 years of Beaverlodge operations. The analysis performed as part of the original QSM showed that the contributions of loads from the Minewater Reservoir influencing the downstream Meadow Fen area are quite small, estimated at no more than 10%. As such, 2020 ERA model predictions were not generated for TL-6 (CanNorth 2020a).

To determine if recovery is occurring in the Minewater Reservoir Area as expected, water quality has been monitored at station TL-7 (located at the discharge of Meadow Fen upstream of Greer Lake) and concentrations have helped inform modelled predictions. The modelled data helped establish WQ performance indicators, which CNSC Staff have deemed appropriate for evaluating the recovery of Minewater Reservoir. The relevant water quality constituents that are assessed as part of the performance indicator include: radium-226, uranium, and selenium. As shown in **Figure 19, 20, and 21** and discussed in greater detail in the 2020 Beaverlodge ERA (CanNorth 2020a), the following observations can be made that demonstrate the water quality concentrations measured at TL-7 are within modelled predictions and meeting the water quality performance indicator as defined by regulatory accepted assessment methodologies:

- Radium-226 levels downstream of the Minewater Reservoir area are within the predicted bounds identified as the performance indicator for this area.
- Uranium and selenium levels downstream of the Minewater Reservoir meet the performance indicator for this area and are expected to continually improve over the long-term.

Radium-226 levels are expected to increase slightly before they decline. The chemical processes causing this increase are known and well understood. As detailed in the 2020 ERA, increases are attributed to the release of historically precipitated radium from sediments. Radium-226 precipitates in the Fookes Reservoir are associated with naturally occurring calcium and barium, which may have been introduced in the milling process. After the peak is reached, levels are expected to gradually improve.

The Minewater Reservoir and downstream area meet the “water quality within modelled predictions” performance indicator.

Figures 19 and 20 are provided to show the rapid decrease in uranium and selenium concentrations that occurred following decommissioning. Due to the rapid improvement of selenium and uranium concentrations following decommissioning a second graph showing a more suitable scale of current concentrations is also provided.

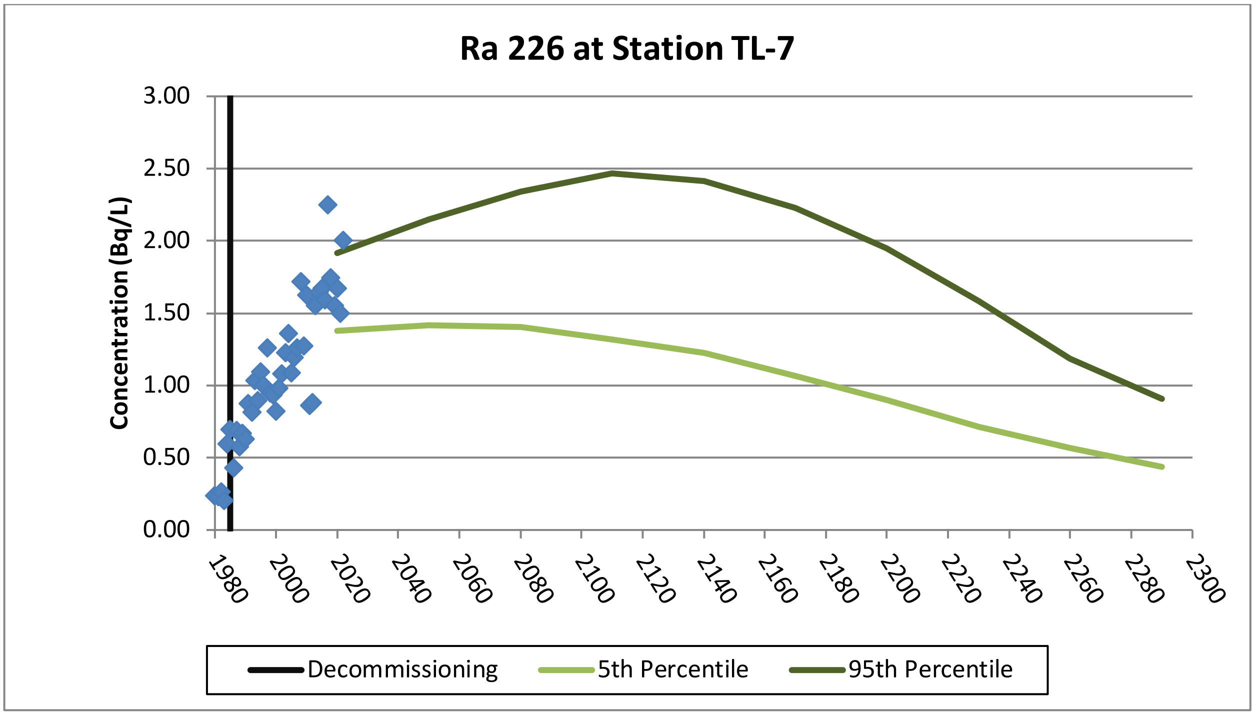
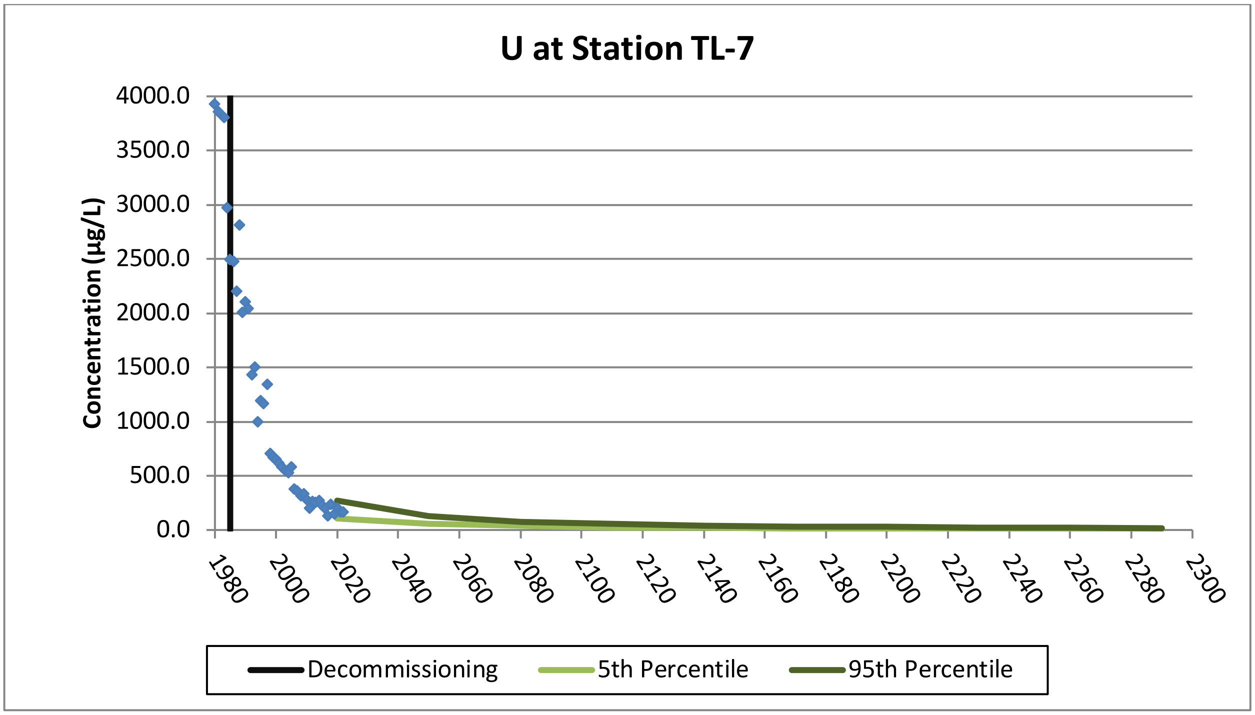



**Figure 19: Ra-226 Performance Indicator at TL-7**



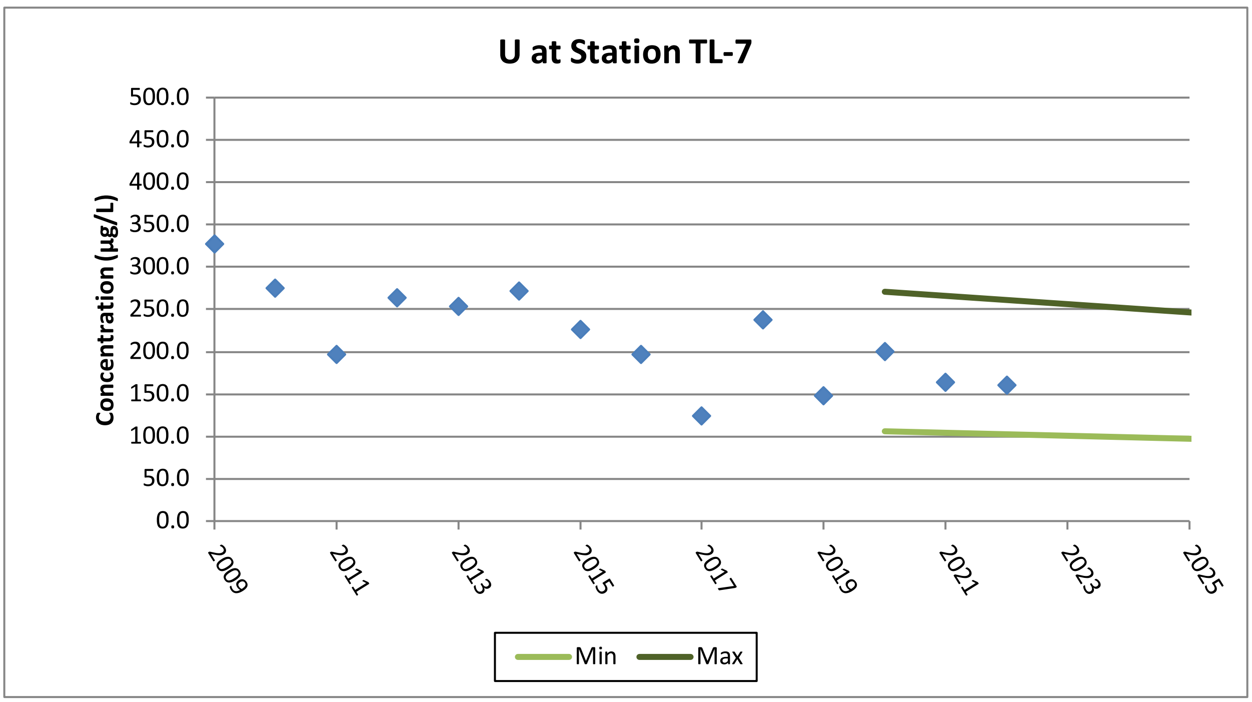
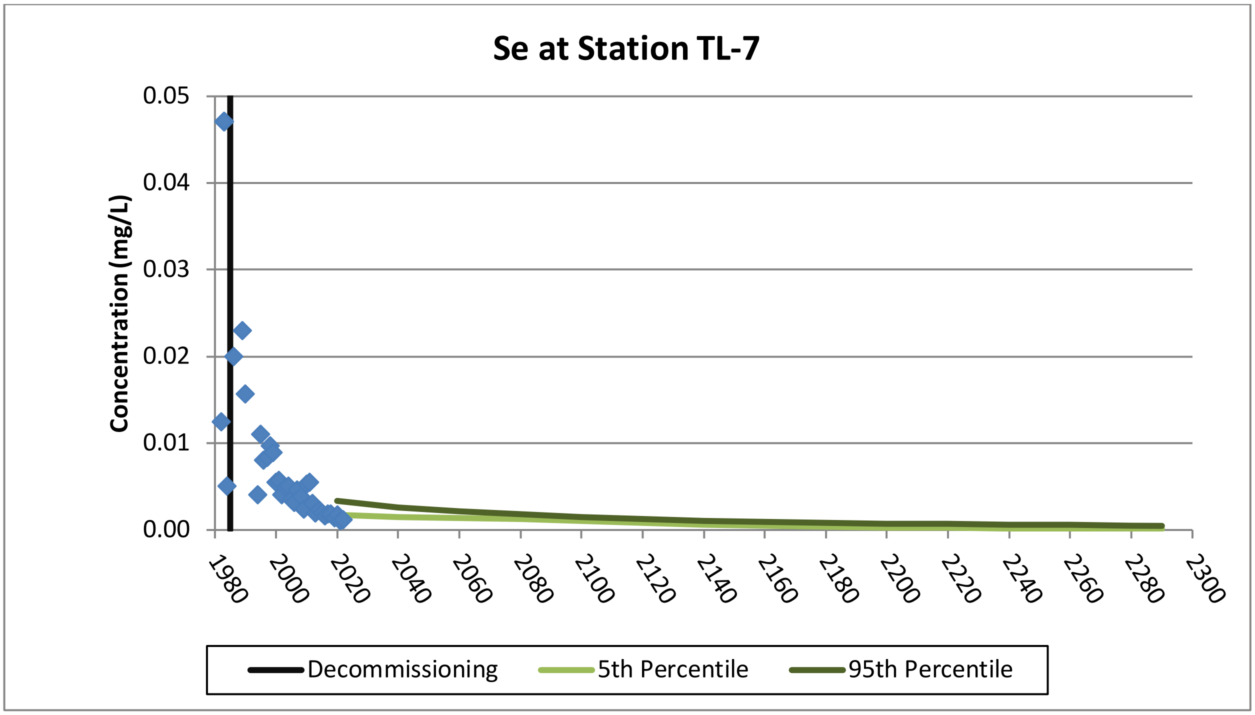




**Figure 20: U Performance Indicator at TL-7**



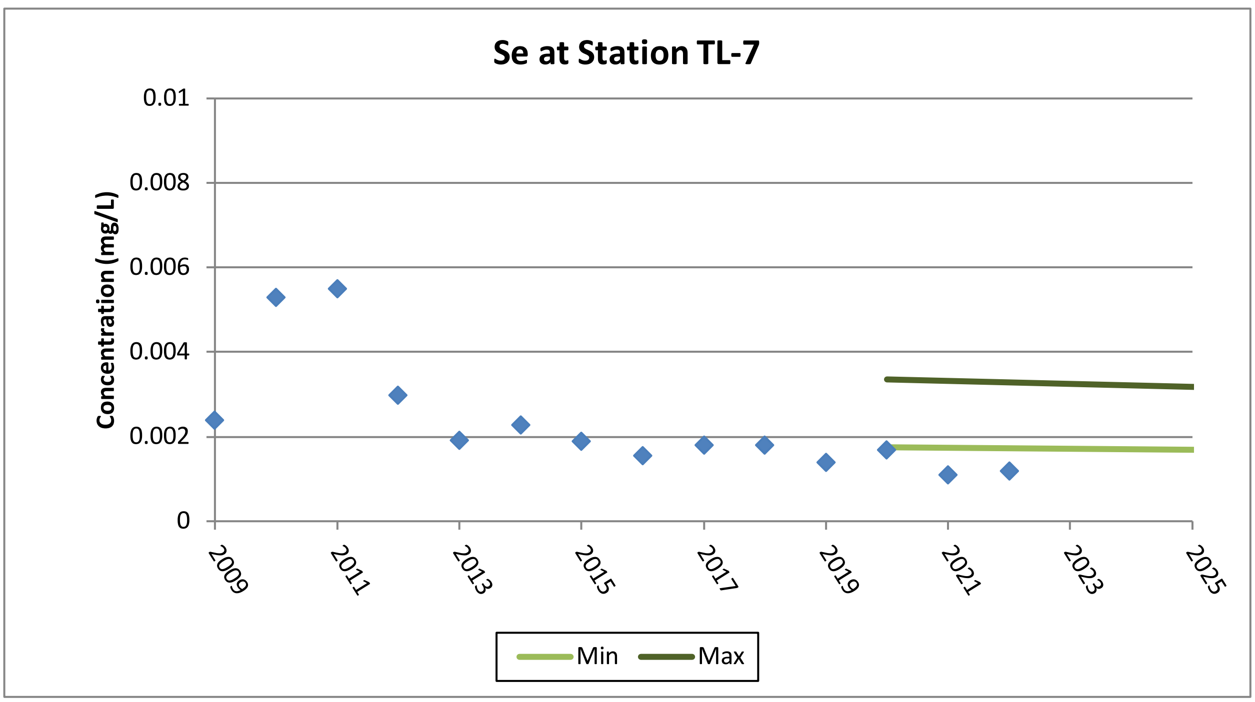




**Figure 21: Se Performance Indicator at TL-7**

The water quality of Minewater Reservoir Area will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).The Minewater Reservoir properties therefore meet the water quality within modelled predictions performance.

### Site Free from Debris (Performance Indicator has been met)

All Beaverlodge related properties were inspected to locate historic debris not removed during initial decommissioning. During the main clean-up campaign in 2015 and 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the Minewater Reservoir properties, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 22**).

Following the above noted inspections, various debris found on the property, including the remaining electrical and power infrastructure (pole brackets) anchor bolts used to anchor the tailings line and the "V" Notch weir installed in the outlet channel from Minewater Reservoir were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

As a result of this activity, the Minewater Reservoir properties meets the performance indicator of being free of debris.

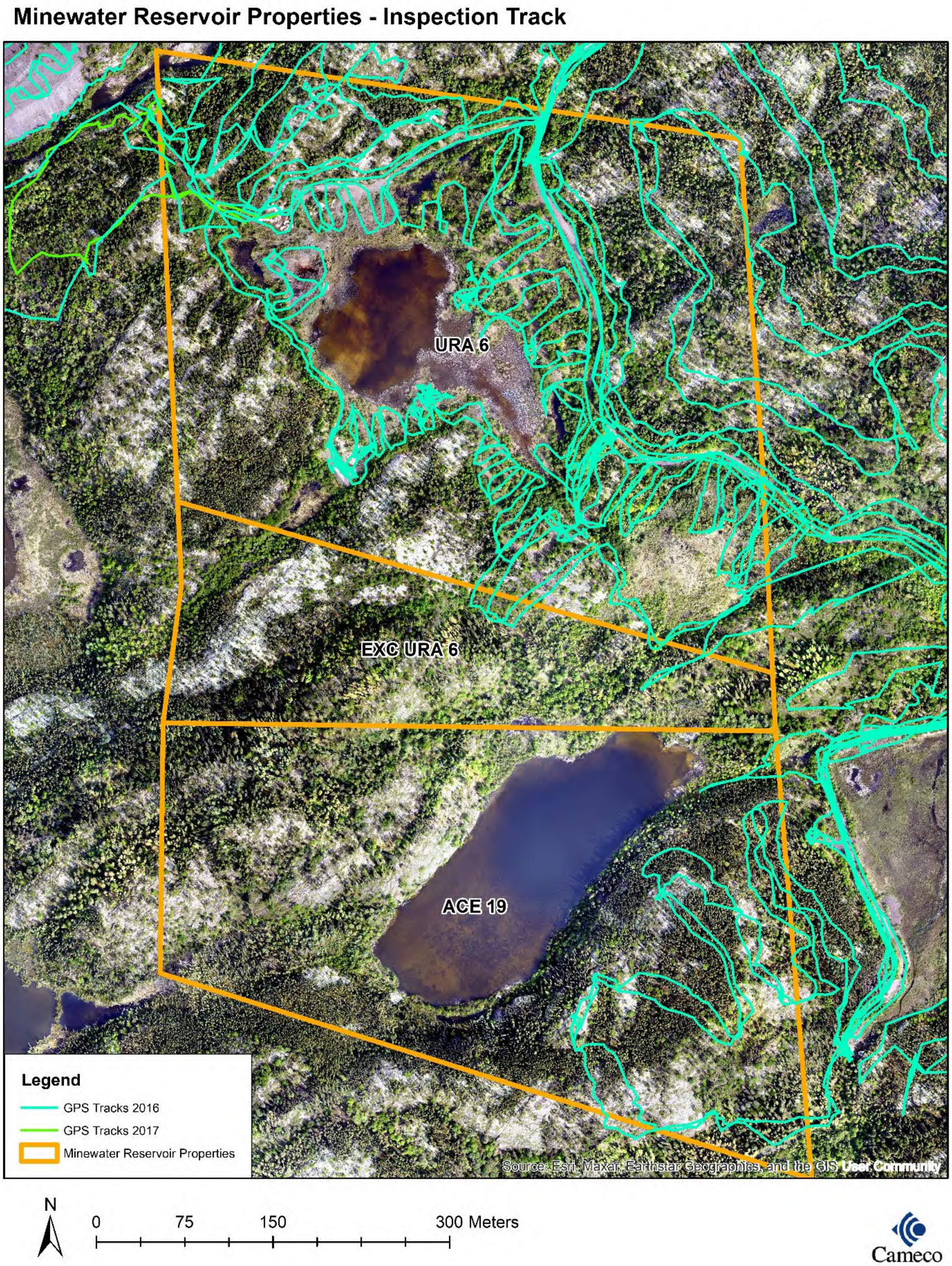



**Figure 22: Minewater Reservoir Properties – Inspection Track**

### 8.4.3 Decommissioning and Reclamation Documentation

Table 16 provides a summary of general documents which include refence to the Fay site and by extension the Minewater Reservoir properties.

**Table 16: Documentation Log – Minewater Reservoir properties**

| Document | Date |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited, | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 3 – Beaverlodge Tailings and Sludges Close-out Engineering Feasibility Studies,* Eldorado Resources Limited | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 – Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Surface Lease Renegotiation, Appendix D – Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
| *Waste Rock Stability Assessments – Former Beaverlodge Sites,* SRK Project No. 4CC008.027, SRK Consulting (Canada) Inc | December 2010 |
| *Surficial Gamma Radiation Survey of Disturbed Areas at the Former Beaverlodge Mine Site*, Final Rev. 1, ARCADIS SENES Canada Inc. | November 2014 |
| *2014 Uranium City Consultation on Land Use*, SENES Consultants & Kingsmere Resources Services | January 2015 |
| *Beaverlodge Site Gamma Radiation Risk Evaluation*, ARCADIS Canada Inc., | June 2015 |
| *Beaverlodge Property – Crown Pillar Assessment (2014-2015*), SRK Project No. 1CC007.048, SRK Consulting (Canada) Inc. | July 2015 |
| *Beaverlodge 2017: Borehole Decommissioning Report*, Cameco Corporation (Cameco). | July 2017 |
| *Remediation of Utility Corridors & Related Infrastructure, Beaverlodge Properties,* Kingsmere Resource Services Inc. | January 2018 |
| *Beaverlodge Property Inspection for Institutional Control Transfer Report,* Kingsmere Resource Services Inc. | January 2018 |

### 8.4.4 Evaluation of Minewater Reservoir Properties

The properties meet the established performance objectives of safe, secure, stable/improving and have no remaining liabilities (see Table 17).

**Table 17: Evaluation of Minewater Reservoir Properties**

| Performance Indicators | Acceptance Criteria | Minewater Reservoir Area |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | NA |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | NA |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | NA |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the properties associated with Minewater Reservoir should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.0/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing Minewater Reservoir properties while under Institutional Control.

### 8.4.5 Institutional Control Considerations and Requirements

#### Engineered Structures

The blasted drainage channel on the south side of Minewater Reservoir can be considered an engineered structure as it was designed to permanently alter the flow from the Minewater catchment area towards the TMA, and away from Ace Creek. The channel is not expected to require maintenance in the future but will require inspection to ensure the flow path continues to promote flow towards the TMA.

### Beaverlodge Post Closure Land Status

The Minewater Reservoir properties described in this section fall within the proposed IC borders and the entire boundaries identified in Table 14 (above at the beginning of this section) and visually in Figure 1, will be included in the Saskatchewan Institutional Control Registry in order to establish administrative controls to restrict future land use.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance (2020)

To meet the requirements of section 22 of the MIEPR, Table 18 provides a summary of aspects of the Minewater Reservoir properties in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 18: Remaining Site Aspects – Minewater Reservoir Properties**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Erosion of residual tailings and precipitate (increased gamma exposure) | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Blockage of blasted channel (resulting in flow towards Ace Creek) | Environment | Unlikely | Minor | Low |
| | Public Health & Safety | Unlikely | Minor | Low |

As noted earlier, the water quality of Fulton Creek watershed will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

The site features associated with Minewater Reservoir properties are shown on **Figure 7**. Based on the historical activities at the Minewater Reservoir properties, the condition of the outlet channel will require inspection under the Province of Saskatchewan's institutional control management framework.

Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation,
- Minewater Reservoir:
    - Condition of Minewater outflow channel
    - Evidence of erosional features
    - Although the saddle dam located west of Minewater Reservoir serves no purpose a note regarding its condition should be included in the monitoring report.

- Condition of vegetation, and
- Water quality.

### Institutional Control Maintenance

Although it is not expected that the Minewater Reservoir properties will require maintenance under institutional control. Cameco has considered the time required for clearing of any potential beaver activity as part of the routine inspection of this area.

# 8.5 URA 1 [MSL 10]

## 8.5.1 Description

**Table 19: URA 1 Property Coordinates**

| AECB License Number | Cameco Number | DNS[1] Number | Area (hectares) | Bounding Coordinates (UTM WGS 84 Zone 12) | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| **MSL 10** | **URA 1** | **200010** | 17.5 | 642464 | 6604147 |
| | | | | 642417 | 6604630 |
| | | | | 642044 | 6604598 |
| | | | | 642046 | 6604543 |
| | | | | 642048 | 6604476 |
| | | | | 642450 | 6604285 |
| | | | | 642060 | 6604178 |

[1] – Department of Northern Saskatchewan

The URA 1 (MSL 10) property is a 17.5 hectare parcel of land and is listed in Appendix A of the Eldorado Resources Limited Decommissioning Approval AECB-DA-142-0 (November 1983) as "Mill annex buildings, $O_2$ plants, waste rock storage." The property is included on the *2006 Beaverlodge Surface Lease Agreement* map as MSL 10 and in the *Property Description Manual* referenced in the LCH, which is referenced in the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025 (Figure 23).

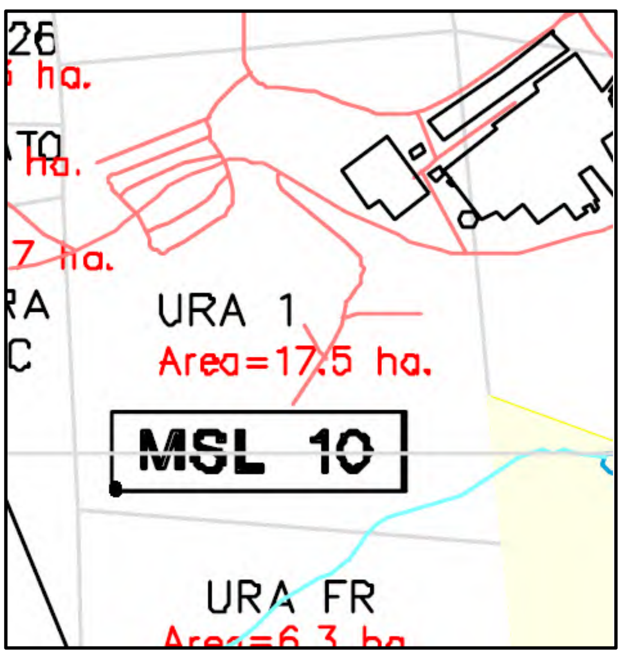



**Figure 23: URA 1 (MSL 10) Property (Source: Beaverlodge Surface Lease Map)**

During operations, the URA 1 property hosted;

- Mill annex buildings
- Oxygen plant
- A small open pit (Lower Fay Pit)
- Waste rock

### 8.5.2 Initial Decommissioning Activities

*Departure with Dignity* (Eldorado 1987) states that the demolition of the mill structures, including the mill annex building and oxygen plant commenced in April 1984 and was undertaken in various campaigns over the following 13 months. During this activity mill related structures were demolished with the material removed and deposited with the voids of the mill proper. After demolition was complete, the entire area was covered and contoured with waste rock to suit the existing topography. A total of approximately 259,100 $m^3$ of waste rock was hauled to the mill complex and placed to cover the mill building and associated infrastructure. Any settling of cover material since decommissioning has been remediated.

Historical records also show that a number of pressure vessels were placed in the mined out Lower Fay Pit and covered with waste rock.

The majority of the telecommunications and electrical transmission poles and related infrastructure on the URA 1 property were originally decommissioned by cutting the poles above the mounting brackets and removing them from the property, leaving the mounting brackets and pole stubs in place. The mounting brackets have since been removed as part of the general site clean-up.

The main haul road and several short spurs roads transect the URA 1 property and were left "as is."

### 8.5.3 Recent Decommissioning Activities and Beaverlodge Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

During 2014, a detailed surficial gamma survey was conducted primarily focusing on the disturbed areas (i.e., Fay area, roads and the former tailings pipeline corridor) of the URA 1 property (ARCADIS SENES 2014). The property was surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2" x 2" sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10). When areas originally scanned in 2014 were disturbed as a result of additional remediation a follow up gamma scan was completed to ensure that gamma levels remain acceptable.

The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008).

As shown in **Figure 24**, the surface gamma survey results ranged from <0.1 µSv/h to 1.0 µSv/h above background (ARCADIS SENES 2014), which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). Therefore, the URA 1 property meets the performance indicator associated with acceptable gamma levels.

In addition to the above, in 2023 the final cover was placed on the Lower Fay Pit. Located on property URA 1, the area was used as a regulatory approved disposal location for debris collected from the Beaverlodge Properties. The debris in the Lower Fay pit was compacted and covered following a regulatory approved remediation plan. The final cover consisted of clean waste rock sourced from road bed material removed from the ACE 3 property. A final gamma scan will be completed in May 2024 to ensure the gamma measurements continue to meet the gamma performance indicator. The results of this gamma survey will be provided to the regulatory agencies once complete.

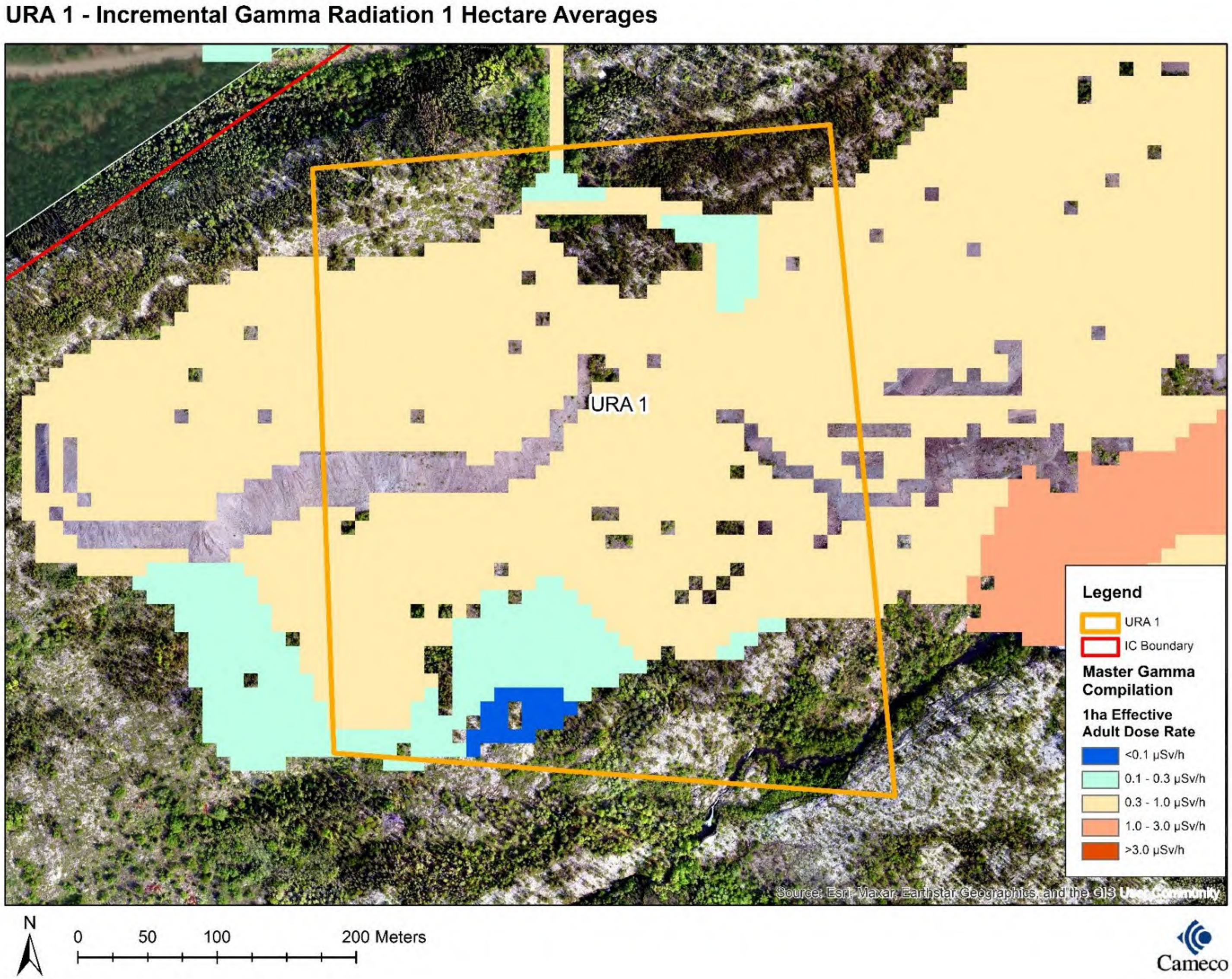



**Figure 24: Incremental Gamma Radiation 1 Hectare Averages: URA 1 Property**

## Boreholes Plugged (Performance Indicator has been met)

Activities completed since 1985 have included sealing exploration boreholes according to accepted methods (Cameco 2017). Surface inspections in support of transferring the properties to IC identified eight exploration bore holes on the URA 1 property. The following provides the designation and location of each hole (**Table 20**).

**Table 20: URA 1 Property Borehole Coordinates**

| *Designation* | *Coordinate System: WGS 84 UTM Zone 12* | | *Year Remediated* |
|---|---|---|---|
| | *Easting* | *Northing* | |
| BH-15 | 642101.665 | 6604192.497 | *2016* |
| BH-31 | 642101.048 | 6604195.52 | *2017* |
| BH-32 | 642260.649 | 6604592.012 | *2017* |
| BH-40 | 642242.735 | 6604550.461 | *2017* |
| BH-43 | 642254 | 6604397 | *2017* |
| BH-011 | 642224.883 | 6604354.110 | *2021* |
| BH-012 | 642224.798 | 6604351.877 | *2021* |
| BH-007 | 642090 | 6604218 | *2011* |

Drills holes BH-011, BH-012, BH-32, BH-40 and BH-43 were found dry. Drill hole BH-43 was located along a bedrock bench at the back of the Lower Fay pit. In 2016 debris was being end dumped into the pit from the top edge of the pit and buried the borehole. As a result, this borehole is no longer exposed at surface. As noted above, BH-43 was found to be dry with no evidence of past discharge. Although the borehole is considered inaccessible the coordinates of this borehole have been recorded in the borehole log as part of the record. Drill holes BH-007, BH-15 and BH-31 have shown evidence of discharges in the past. Notwithstanding the observed condition, all drillholes exposed at surface were plugged with a concrete grout to a depth of 30 m or refusal in accordance with regulatory accepted methods.

As a result of the activities conducted since 1985, the URA 1 property meets the boreholes plugged performance indicator.

## Stable Mine Openings (Performance Indicator is not applicable)

The URA 1 property does not host any mine openings to surface.

## Geotechnical Stability

### *Crown Pillar (Performance Indicator has been met)*

The Fay/Ace/Verna mine discontinued operation in 1982 and the mine allowed to flood. A review of the underground Fay/Ace/Verna mine plan superimposed on the surface maps indicates sections of the Fay mine underground workings extend under the URA 1 property.

In 2014, SRK was retained by Cameco to undertake a geotechnical assessment for the crown pillar stability at six historic Beaverlodge sites including the Fay mine. Based on available information, underground workings and stoping around the Fay shaft area appear to be typically 25m or greater below the ground surface. The report concluded that no additional investigation or remediation was required, and that the Fay mine area has a “low” likelihood of subsidence due to the thickness of the crown pillar and depths of the underground workings (SRK 2015).

The underground workings have been decommissioned for 40 years and no indication of instability or subsidence have been identified in association with the mine workings underlying the URA 1 property.

The URA 1 property therefore meets the crown pillar performance indicator.

***Pit Walls***

There is one relatively small open pit associated with the URA 1 property: the Lower Fay Pit. This pit has been used since 2016 as a regulatory approved depository for materials generated during the final decommissioning of various aspects of the site and the debris collected during the general clean-up of all of the Beaverlodge properties. The material/debris disposed of in the pit was compacted and covered in 2023 with a layer of clean waste rock sourced from road bed material removed from the ACE 3 property in 2021. As a result, the remaining Lower Fay Pit walls are approximately 5 meters high and pose no greater risk than natural landforms found in the area.

***Tailings***

Figure 4.3 of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions* (Eldorado 1983) shows that no tailings spills from the tailings pipeline were present on the URA 1 property at the cessation of operations.

***Waste Rock***

The Fay mine is reported to have produced a total of 3,030,000 tonnes of waste rock which covered an area of approximately 33.0 hectares, the majority of which was deposited on areas south and southwest of the mill with a portion situated on the URA 1 property. During operation, waste rock was used on the URA 1 property as construction material for building foundations, roads, etc. and during initial decommissioning waste rock was re-contoured on the URA 1 property as required. During the summer of 1982, Eldorado collected waste rock samples from various Beaverlodge sites for analysis. Section 4.1 of Eldorado 1983 provides a summary of the volumes and analysis of the waste rock on a variety of the Beaverlodge mine sites.

The uranium content of the waste rock reported in Eldorado 1983 for the Fay area was 0.015%, which is below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%). This is reflected in the gamma survey results provided above showing areas where waste rock is located are typically below 1μSv/hr. In addition, recent waste rock sampling completed by Cameco on the Fay Waste Rock pile has confirmed that the site waste rock has a low potential for acid generation and that the uranium content of the waste rock sampled is less than 0.03%. Visual observation and monitoring of the sites for more than 60 years have not identified any acidic leachate from waste rock piles, nor has it identified any impacts that could be attributed to such a condition.

In 2010, SRK Consulting (Canada) Inc. (SRK) completed a waste rock stability assessment of all the former Eldorado Beaverlodge sites including the Fay waste rock pile, including the waste rock on the URA 1 property. That assessment concluded that there were no signs of instability observed on either the waste rock slope or the adjacent ground downslope and the only risk in terms of stability is predominantly associated with the potential for an occasional rolling rock. The assessment also concluded that there is an insufficient risk that a deep-seated failure, potentially affecting the global stability of the waste rock, will occur in the foreseeable future. Based on the SRK site observations, the waste rock dump at the Fay site is in good condition, the rock is durable and global instability and the risk of a deep-seated failure that would affect the global stability of the dump is judged to be very low (SRK 2010).

### Water Quality within Modelled Predictions (Performance Indicator has been met)

After receiving drainage from the Hab, Dubyna, and Bolger mine sites, Ace Lake discharges into Lower Ace Creek, which passes through a portion of the URA 1 property, and eventually reaches Ace Bay of Beaverlodge Lake. During the 2014 update meeting with the Commission (CNSC 2014), CNSC Staff indicated that the water quality performance indicator for the Lower Ace Creek area would be associated with the URA 1 property based on the potential influence on Lower Ace Creek water quality and the downstream environment. The principal source of constituents measured in Lower Ace Creek is, or have been, the seeps from the former mill area and formerly flowing boreholes. As discussed in the Boreholes Plugged section, identified boreholes have been sealed as one of the remedial activities in an effort to reduce loads from the underground mine workings on surface water bodies. Seep 1 has been identified on the western edge of the URA 1 property, originating at the base of the waste rock pile downgradient of the mill site. Water quality samples and flow measurements were collected opportunistically since 2004 to identify long-term water quality trends; however, flow from the seep is intermittent and is typically limited to freshet and major precipitation events. In 2019, the JRG accepted that the seep monitoring program objective had been met and it was removed from the Beaverlodge Environmental Monitoring Program. Constituent loadings associated with runoff from the main site waste rock and spilled tailings were also considered during the model development and are a small source of the primary constituents of concern (i.e., radium-226, selenium and uranium) when compared to the loadings associated with the formerly flowing boreholes and seeps.

To determine if natural recovery is occurring as expected, water quality has been monitored downstream of the URA 1 property at the outlet of Lower Ace Creek (station AC-14) and concentrations have helped inform modelled predictions. The water quality constituents that are assessed as part of the performance indicator include: radium-226, uranium, and selenium. As shown in **Figure 25, 26, and 27,** and discussed in greater detail in the 2020 Beaverlodge ERA (CanNorth

2020), the following observations can be made that demonstrate the Lower Ace Creek water quality data is meeting the water quality performance indicator as defined by regulatory accepted assessment methodologies:

- Radium-226 and selenium levels in Lower Ace Creek are predicted to remain below the SEQG of 0.11 Bq/L and 1 µg/L, respectively, over the entire simulation period.
- Uranium levels in Lower Ace Creek meet the performance indicator (i.e., predictions) and are expected to continually improve over the long-term.

Water quality measured at AC-14 is within the modelled predictions and therefore the water quality performance indicator has been met for the URA 1 property.

The water quality of Lower Ace Creek will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties located within the entire Ace Lake watershed are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

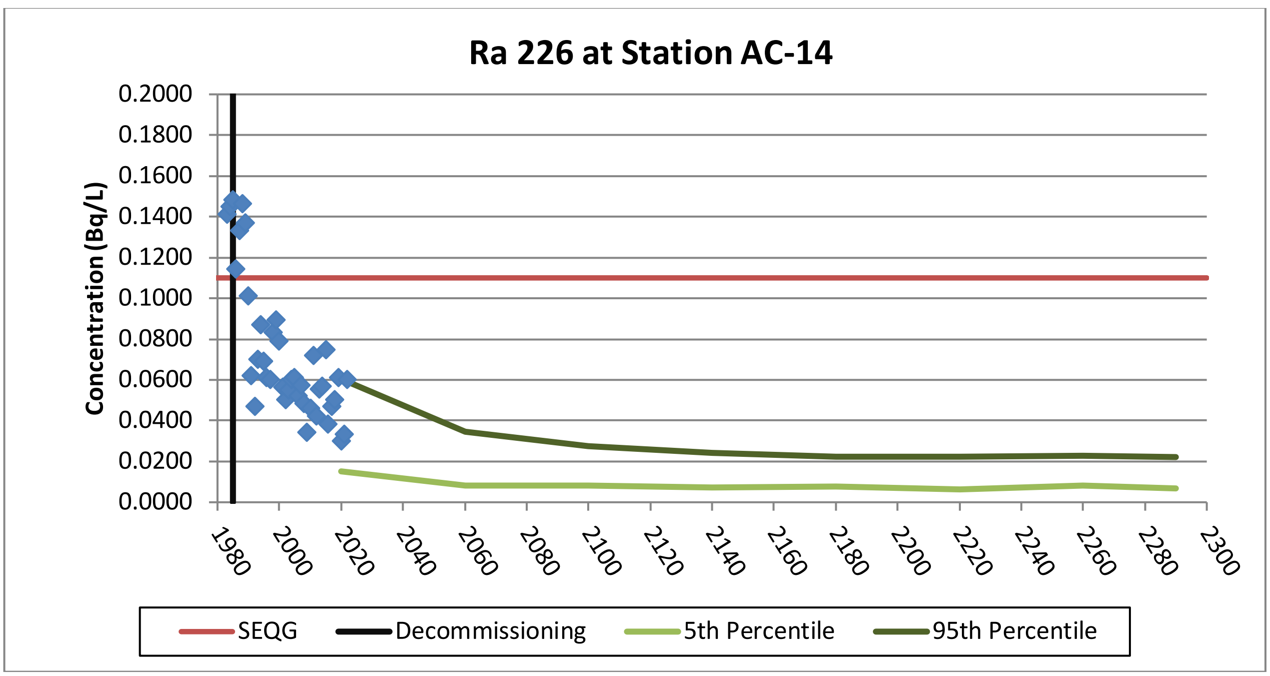



**Figure 25: Ra-226 Performance Indicator at AC-14**

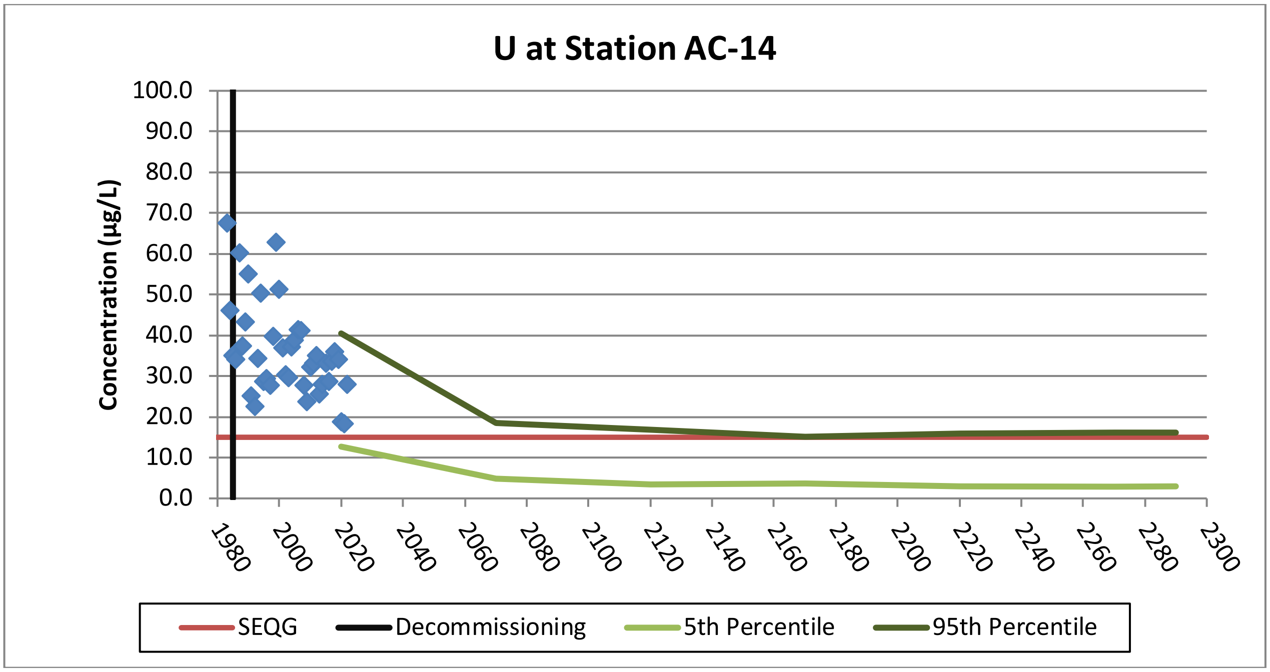



**Figure 26: U Performance Indicator at AC-14**

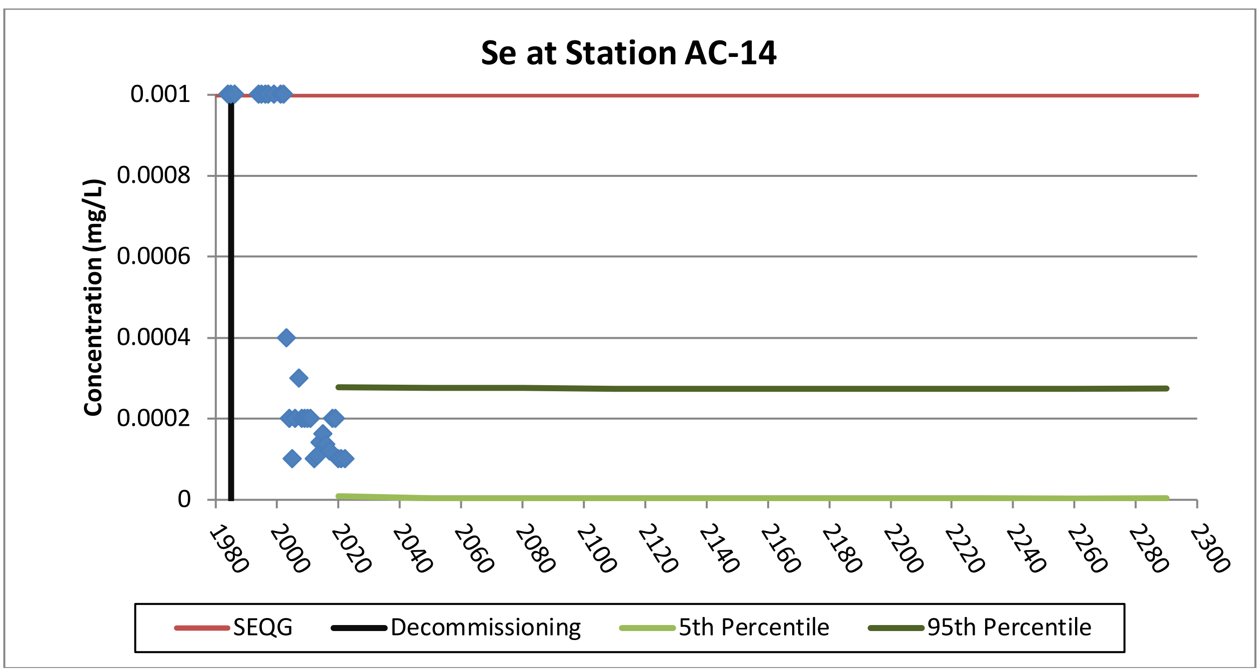



**Figure 27: Se Performance Indicator at AC-14**

*Note: The reduction in Se concentration noted in the figure is the result of a reduction in lab detection limits

### Site Free from Debris (Performance Indicator has been met)

All decommissioned Beaverlodge properties were inspected in an effort to locate historic debris not removed during initial decommissioning. During the main clean-up campaign in 2015 and 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the URA 1 property, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 28**).

Following the above noted inspections, various debris found on the property, including the remaining electrical and power infrastructure (pole brackets) and concrete pilons and anchor bolts used to anchor the tailings line on the URA 1 property were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

The debris disposed of in the Lower Fay pit was compacted and covered following a regulatory approved remediation plan in September 2023 and the final cover consisted of clean waste rock sourced from the ACE 3 property and stockpiled nearby. A final radiation scan will be completed on the covered material in May 2024 to ensure the gamma measurements continue to meet the gamma performance indicator. The results of this gamma survey will be provided to the regulatory agencies once complete.

As a result of this activity, the URA 1 property meets the performance indicator of being free of debris.

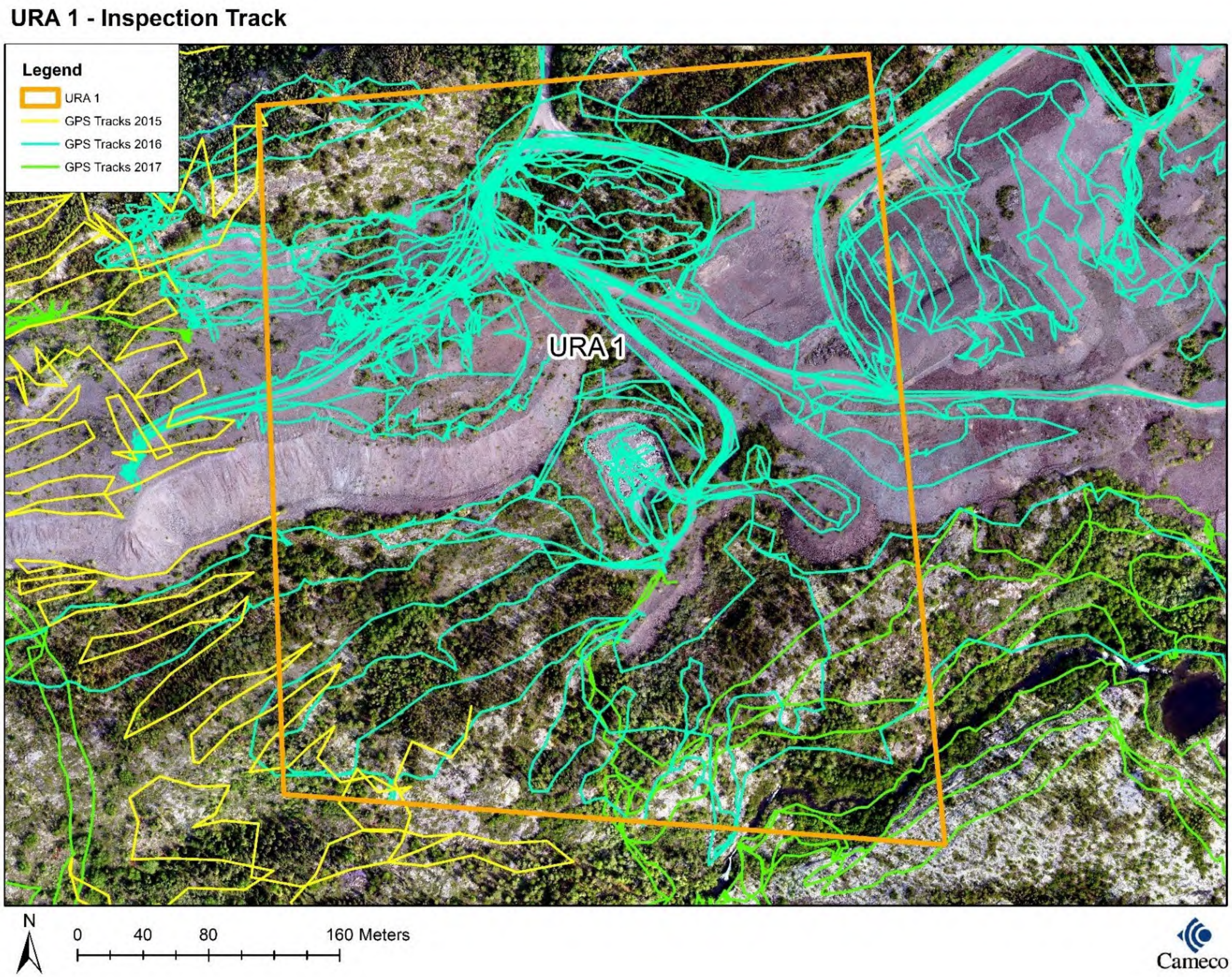



**Figure 28: URA 1 – Inspection Track**

### 8.5.4 Decommissioning and Reclamation Documentation

**Table 21** provides a summary of general documents which include refence to the Fay site and by extension the URA 1 property. The majority of discussion in these documents combines discussion of the Fay mine with the entire Fay/Ace/Verna mine complex.

**Table 21: Documentation Log – URA 1**

| Document | Date |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited, | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 – Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Surface Lease Renegotiation, Appendix D – Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
| *Waste Rock Stability Assessments – Former Beaverlodge Sites,* SRK Project No. 4CC008.027, SRK Consulting (Canada) Inc | December 2010 |
| *Surficial Gamma Radiation Survey of Disturbed Areas at the Former Beaverlodge Mine Site*, Final Rev. 1, ARCADIS SENES Canada Inc. | November 2014 |
| *2014 Uranium City Consultation on Land Use*, SENES Consultants & Kingsmere Resources Services | January 2015 |
| *Beaverlodge Site Gamma Radiation Risk Evaluation*, ARCADIS Canada Inc., | June 2015 |
| *Beaverlodge Property – Crown Pillar Assessment (2014-2015*), SRK Project No. 1CC007.048, SRK Consulting (Canada) Inc. | July 2015 |
| *Beaverlodge 2017: Borehole Decommissioning Report*, Cameco Corporation (Cameco). | July 2017 |
| *Remediation of Utility Corridors & Related Infrastructure, Beaverlodge Properties,* Kingsmere Resource Services Inc. | January 2018 |
| *Beaverlodge Property Inspection for Institutional Control Transfer Report,* Kingsmere Resource Services Inc. | January 2018 |

### 8.5.5 Evaluation of URA 1

The current condition of the property, combined with the limited use of the property by local land users demonstrates that the URA 1 property meets the established performance objectives of safe, secure, stable/improving and has no remaining liabilities (see **Table 22**).

**Table 22: Evaluation of URA 1**

| Performance Indicators | Acceptance Criteria | URA 1 |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | ✓ |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | NA |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | ✓ |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the URA 1 property should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.0/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing URA 1 property while under Institutional Control.

### 8.5.6 Institutional Control Considerations and Requirements

#### Engineered Structures

The URA 1 property hosts no engineered structures.

#### Beaverlodge Post Closure Land Status

The URA 1 property falls entirely within the planned extent of the Beaverlodge IC borders and will therefore be included in the Saskatchewan Institutional Control Registry in order to establish administrative controls to restrict future land use.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance (2020)

To meet the requirements of section 22 of the MIEPR, **Table 23** provides a summary of aspects of the URA 1 property in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 23: Remaining Site Aspects – URA 1 Property**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Waste Rock Slope Failure | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |

As noted earlier, the water quality of Lower Ace Creek will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties located within the entire Ace Lake watershed are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

**Figure 29** outlines the site features associated with URA 1 property. Based on the historical activities at the URA 1 property, the waste rock slopes will require inspection under the Province of Saskatchewan's institutional control management framework.

Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation,
- Condition of waste rock
- Condition of cover in Lower Fay Pit
    - Subsidence of cover
    - Exposed debris (historical)
    - New debris
- Note any seepage from former open pit
- Observe and note condition of Seep 1 at 642442E; 6604345N (UTM WGS 84 Zone 12), and
- Evidence of flow from sealed boreholes that were previously flowing:
    - BH-007 at 642090E and 6604218N;
    - BH-15 at 642101.665E and 6604192.497N;
    - BH-31 at 642101.048E and 6604195.52N (UTM WGS 84 Zone 12)

## Institutional Control Maintenance

No aspect of the URA 1 property will require maintenance in the IC Program.

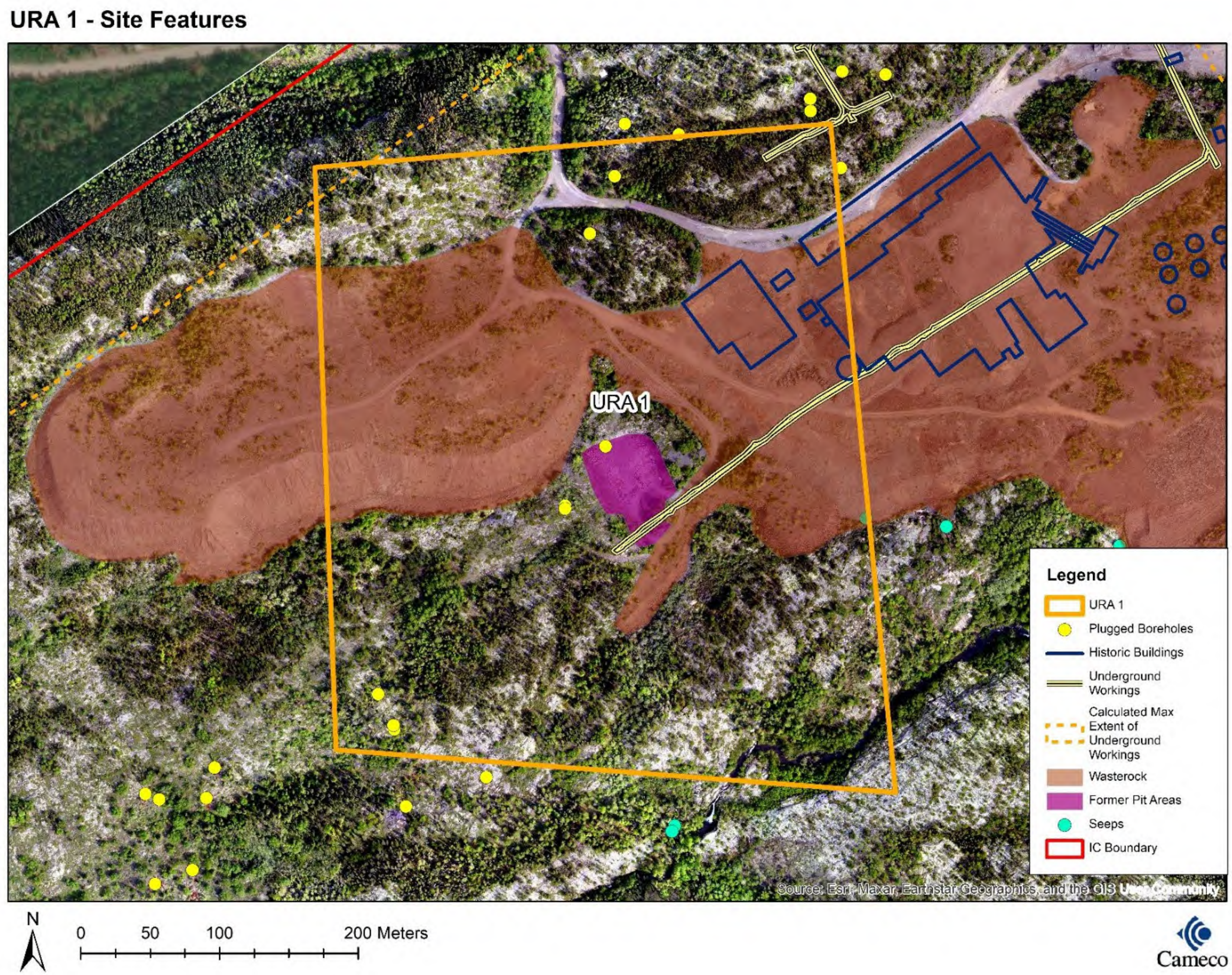



**Figure 29: URA 1 – Site Features**

# 8.6 URA 7 [MSL 15]

## 8.6.1 Description

**Table 24: URA 7 Property Coordinates**

| AECB License Number | Cameco Number | DNS[1] Number | Area (hectares) | Bounding Coordinates (UTM WGS 84 Zone 12) | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| **MSL 15** | **URA 7** | **200015** | 20.9 | 642979 | 6604091 |
| | | | | 642417 | 6604630 |
| | | | | 642957 | 6604545 |
| | | | | 642450 | 6604285 |
| | | | | 642975 | 6604162 |

[1] – Department of Northern Saskatchewan

The URA 7 (MSL 15) property is a 20.9 hectare parcel of land and is listed in Appendix A of the Eldorado Resources Limited Decommissioning Approval AECB-DA-142-0 (November 1983) as "Mill site." The property is included on the *2006 Beaverlodge Surface Lease Agreement (Figure 30)* map as MSL 15 and in the *Property Description Manual* referenced in the LCH, which is referenced in the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025.

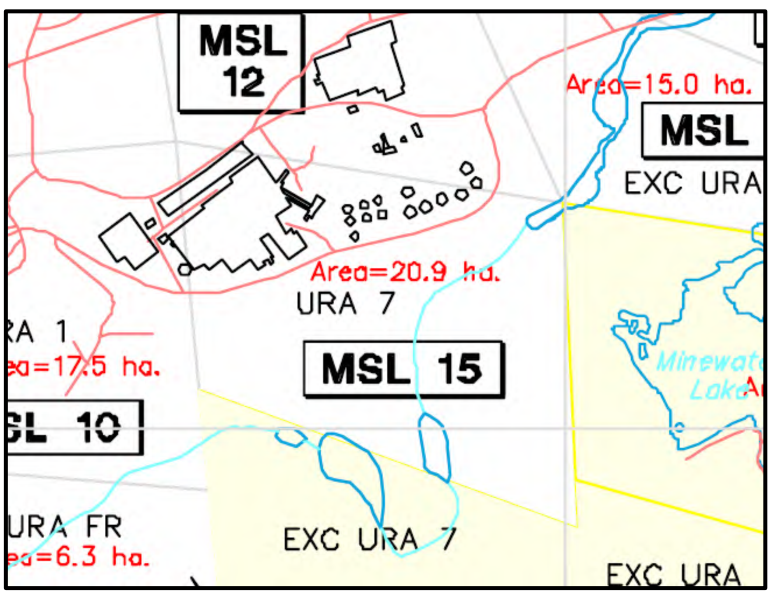



**Figure 30: Mill Facility (Source: Beaverlodge Surface Lease Map)**

During operations, the URA 7 property hosted;

- The mill facility (Figure 30),
- The 1.5 X 1.5 m Sorting Plant Bin located at 642603E: 6604520N (WGS 84 UTM Zone 12) or 59°33'16.64"N, 108°28'36.49"W,

- The 1.5 X 2.4 m Sorting Plant Raise at 642603E: 6604520N (WGS 84 UTM Zone 12) or 59°33'16.64"N, 108°28'36.49"W,
- The 2.4 X 2.4 m CB-1 Access Raise located at 642558E: 6604563N (WGS 84 UTM Zone 12) or 59°33'18.09"N, 108°28'39.25"W,
- The Waste Haulage Adit at 642638E: 6604455N (WGS 84 UTM Zone 12) or 59°33'14.34"N, 108°28'34.43"W, and
- The bulk fuel storage tanks.

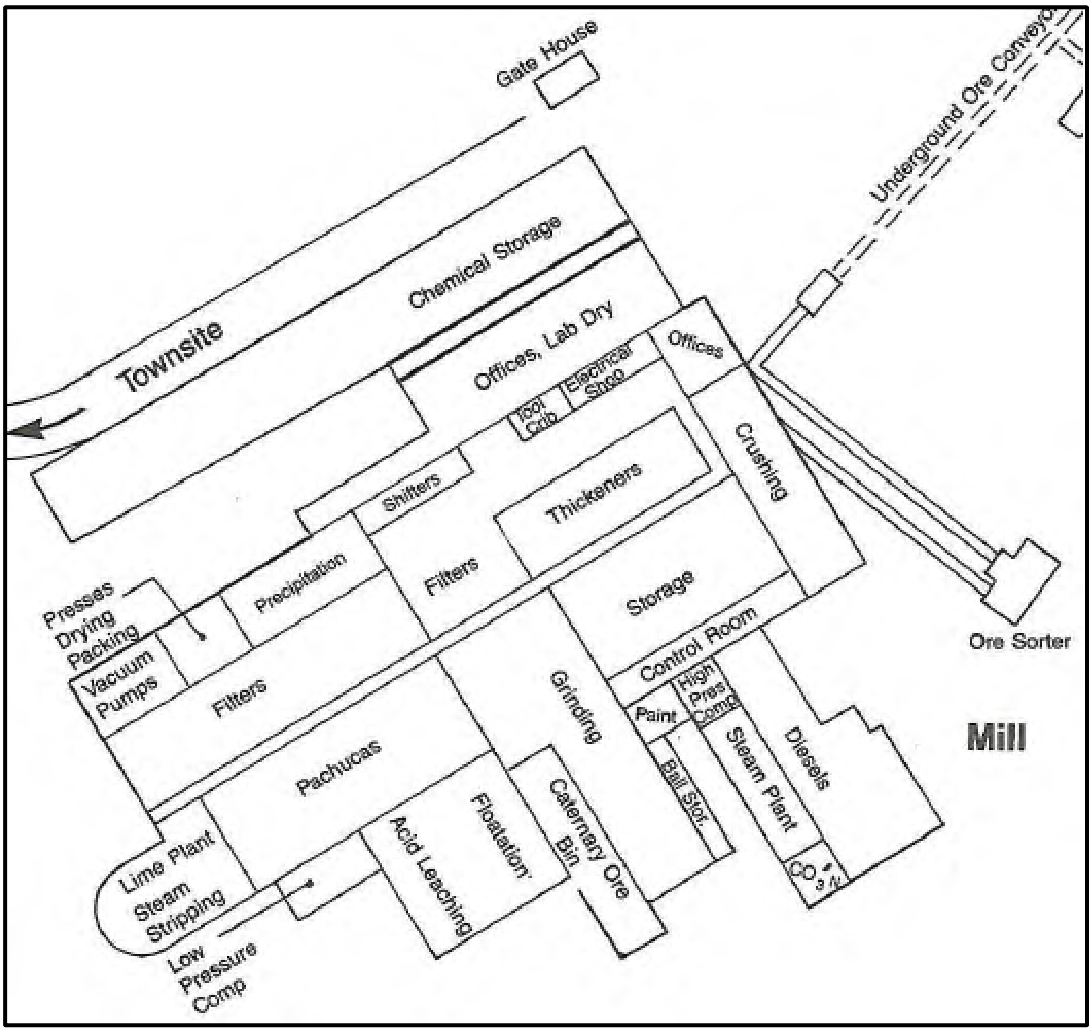



**Figure 31: Beaverlodge Mill Source: Plan View Before Decommissioning 1983, Eldorado Nuclear Ltd.)**

During operations, the URA 7 property also hosted a portion of the telecommunications and electrical power infrastructure that extended from the mill site to the Ace and Verna mine sites.

The Beaverlodge mill operated continuously for nearly 30 years with the decision to permanently shut down announced in December 1981. The last ore was hoisted from the Fay mine on June 25, 1982 and the mill ceased processing in mid-August 1982.

According to Eldorado (1983), the Beaverlodge mill was a carbonate leaching uranium mill with an 1,800 t/ per day rated capacity. During operations between 1953 and 1982, it produced approximately 20 X $10^6$ kilograms of yellowcake from slightly more than 10 X $10^6$ tonnes of ore milled, with an average recovery rate of 90%. Although primarily a carbonate leach mill, a small acid circuit was added to extract the uranium from small amounts of sulphide mineralization present in some ore.

### 8.6.2 Initial Decommissioning Activities

*Departure with Dignity* (Eldorado 1987) states that to render the mill out of service, the following tasks were undertaken:

- Removal of the ore solids and leached solids from the plant,
- Recovery of uranium from the mill solution as yellowcake,
- Removal of residual yellowcake from the precipitation and recovery circuits,
- Implementation of procedures to dispose of mill solutions underground,
- Removal of all saleable supplies, equipment and structures, and
- The development and implementation of procedures for abandonment, demolition and reclamation of the site.

Demolition of the mill structures commenced in April 1984 and was undertaken in various campaigns over the following 13 months. During this activity, mill structures were partially demolished, and the resulting voids were filled with the demolition material and waste rock. After demolition was complete, the entire area was covered and contoured with waste rock to suit the existing topography. A total of approximately 259,100 $m^3$ of waste rock was hauled to the mill complex and placed to cover the mill building. Any settling of cover material since decommissioning has been remediated.

Table 5.1 of *Departure with Dignity* (Eldorado 1987) indicates that the 1.5 X 1.5 m Sorting Plant Bin, the 1.5 X 2.4 m Sorting Plant Raise and the 2.4 X 2.4 m CB-1 Access Raise were all sealed during the Summer/Fall of 1984, however no mention is made of the Waste Haulage Adit.

All tanks from the bulk fuel tank farm area were salvaged and sold.

The majority of the telecommunications and electrical transmission poles and related infrastructure on the URA 7 property were originally decommissioned by cutting the poles above the mounting brackets and removing them from the property, leaving the mounting brackets and pole stubs in place. The mounting brackets have since been removed as part of the general site clean-up and were disposed of in Lower Fay Pit.

The main haul road and a number of short spurs roads transect the URA 7 property and were left "as is."

### 8.6.3 Recent Decommissioning Activities and Beaverlodge Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

During 2014, a detailed surficial gamma survey was conducted primarily focusing on the disturbed areas (i.e., Fay area, roads, waste rock piles and the former tailings pipeline corridors) on the URA 7 property (ARCADIS SENES 2014). The property was surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2" x 2" sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10).

The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 μSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008).

The majority of the surface gamma survey results ranged from <0.1 μSv/h to 1.0 μSv/h above background (ARCADIS SENES 2014), which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008). However, on a portion of the URA 7 property the survey results range from 1.0 μSv/h to 3.0 μSv/h. As such, a risk-based approach was applied to evaluate potential radiation risk at the property and concluded incremental dose from the Beaverlodge properties based on the measured gamma results and the reported land use are well below the public dose criterion of 1 mSv/yr. (ARCADIS 2015) and meet the performance indicator associated with acceptable gamma levels.

Following the gamma survey completed in 2014 material on the URA 7 property was disturbed in the process of performing additional remediation to prepare the sites for long term stability. Material from the former sorted waste pile was removed and added as the base layer of cover material during the closure of the Lower Fay Pit (on the URA 1 property). The Former Mill Site was covered with a layer of clean waste rock, and several former mine openings were exposed to confirm their location prior to being resealed. Following completion of this additional remediation a gamma scan of these areas will be completed in May 2024 to confirm the results of the 2014 survey and risk assessment. The results of this gamma survey will be provided to the regulatory agencies once complete The gamma results provided in **Figure 32** represent to most recent result for all areas reported.

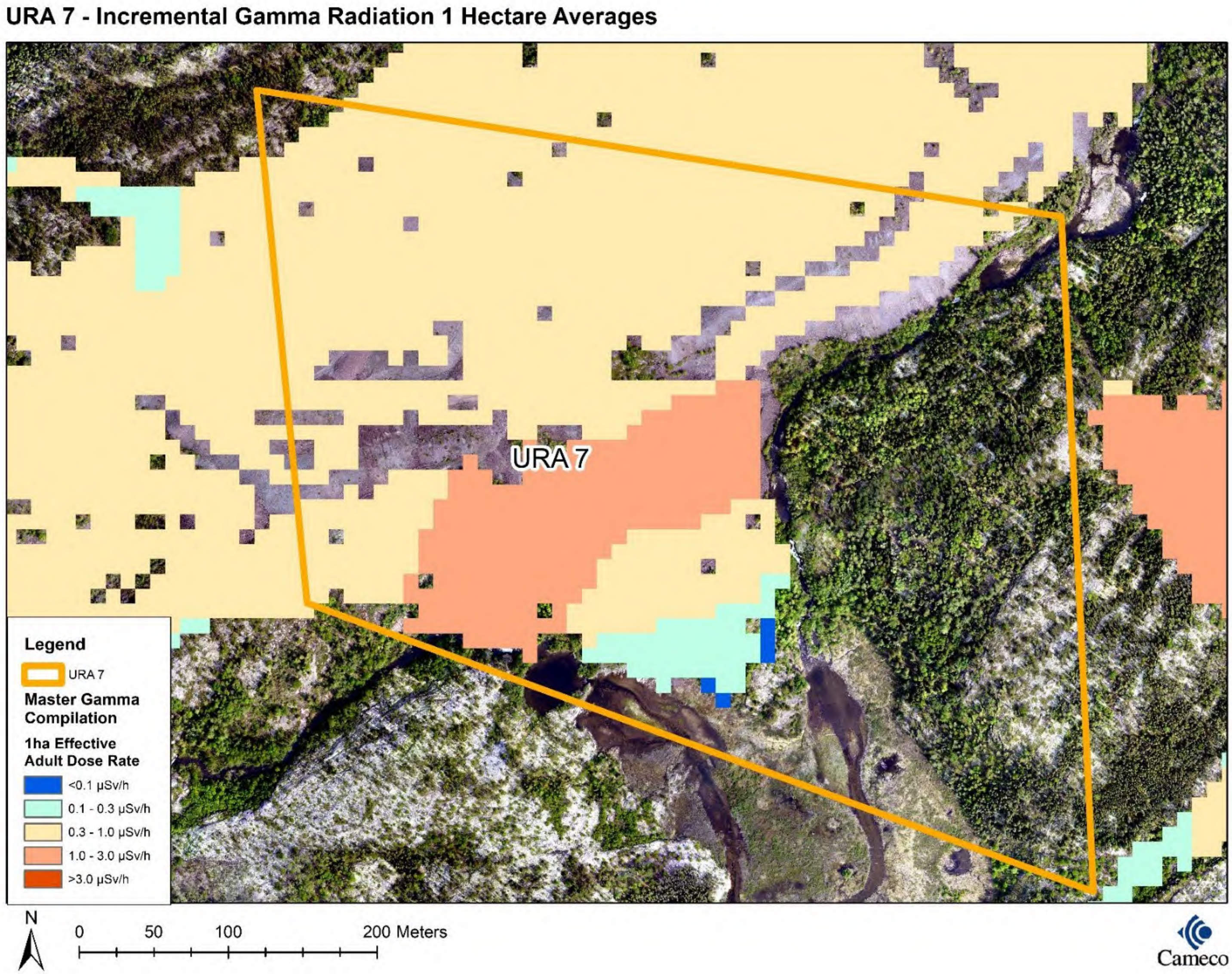



**Figure 32: Incremental Gamma Radiation 1 Hectare Averages: URA 7 Property**

## Boreholes Plugged (Performance Indicator has been met)

Activities completed since 1985 have included sealing exploration boreholes according to accepted methods (Cameco 2017). Surface inspections in support of transferring the properties to IC identified five exploration bore holes on the URA 7 property. The following provides the designation and location of each hole (see **Table 25**).

**Table 25: URA 7 Property Borehole Coordinates**

| Designation | Coordinate System: WGS 84 UTM Zone 12 | | Year Remediated |
|---|---|---|---|
| | Easting | Northing | |
| BH-22 | 642959.407 | 6604439.281 | 2017 |
| BH-23 | 642954.958 | 6604432.3 | 2017 |
| BH-24 | 642940.515 | 6604415.339 | 2017 |
| BH-25 | 642930.8 | 6604406.299 | 2017 |
| BH-33 | 642423.877 | 6604597.892 | 2017 |

Each of the holes was found dry with no evidence of past liquid discharge. Notwithstanding this condition, the drill holes were plugged with a concrete grout to a depth of 30 m or refusal in accordance with regulatory accepted methods in 2017.

As a result of the activities conducted since 1985, the URA 7 property meets the boreholes plugged performance indicator.

## Stable Mine Openings (Performance Indicator has been met)

During operation, waste rock rejected from the milling process (due to insufficient grade) was sent through the Sorting Plant Bin and Sorting Plant Raise to a haulage-way and transported via rail approximately 100 metres to the Waste Haul Adit, where the material was then dumped on surface in an area referred to as the sorted waste rock pile.

In 2016, the Waste Haulage Adit (originally secured in 1982) was excavated and re-secured by placing sorted waste rock into the adit to a depth of more than twice the height of the adit filling the area and creating a slope on surface to prevent erosion and/or subsidence. A summary of the remediation along with a request for exemption from *The Mine Regulations, 2003* Section 407 (2)(3), for the Sealing of a Horizontal Opening was submitted November 21, 2016 and was granted in early 2017 by the Ministry LRWS.

The Sorting Plant Bin, Sorting Plant Raise, and the CB-1 Access Raise were all sealed during the Summer/Fall of 1984. The Sorting Plant Raise and Bin were excavated in 2016 (and again in 2022 to confirm the location), and it was determined that the openings were backfilled and the surface contoured with waste rock to match the surrounding topography. Both the Sorting Plant Raise and Sorting Plant Bin openings are relatively shallow, do not provide access to the underground workings and have showed no evidence of settling in the nearly 40 years since they were decommissioned. Therefore, these openings have been left ‘as is’ with identification markers placed at their locations. In 2021, the CB-1 Access Raise was permanently secured with a regulatory approved engineer designed closure.

The following table provides a summary of the location and final closure methods employed at each of the four openings to surface on the URA 7 property and the year in which the closure was completed. The URA 7 property meets the stable mine openings performance indicator (see **Table 26**).

**Table 26: URA 7 Property Openings**

| **Designation** (Source: *Fay Area Map, Nov. 1986*) | **Location** (UTM WGS 84, 12N) | | **Closure Method** | **Date of Final Closure** |
|---|---|---|---|---|
| | **Easting** | **Northing** | | |
| **Sorting Plant Bin** | 642603 | 6604520 | Backfilled | 1984 |
| **Sorting Plant Raise** | 642603 | 6604520 | Backfilled | 1984 |
| **CB-1 Access Raise** | 642558 | 6604563 | Engineered rock and backfill cover | 2021 |
| **Waste Haulage Adit** | 642638 | 6604455 | Backfilled to a depth of more than twice the height of the adit | 2016 |

## Geotechnical Stability

### *Crown Pillar (Performance Indicator has been met)*

The Fay/Ace/Verna mine discontinued operation in 1982 and the mine allowed to flood. A review of the underground Fay/Ace/Verna mine plan superimposed on the surface maps indicates sections of the Fay mine underground workings extend under the URA 7 property.

In 2014, SRK was retained by Cameco to undertake a geotechnical assessment for the crown pillar stability at six historic Beaverlodge sites including the Fay mine. Based on available information, underground workings and stoping around the Fay shaft area appear to be typically 25m or greater below the ground surface. The report concluded that no additional investigation or remediation was required, and that the Fay mine area has a “low” likelihood of subsidence due to the thickness of the crown pillar and depths of the underground workings (SRK 2015).

The underground workings have been decommissioned for 40 years and no indication of instability or subsidence have been identified in association with the mine workings underlying the URA 7 property.

The URA 7 property therefore meets the crown pillar performance indicator.

### *Pit Walls*

There are no open pits associated with the URA 7 property.

***Tailings***

Figure 4.3 of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions* (Eldorado 1983) shows a small area along the north edge of property experienced a tailings spill associated with the tailings pipeline from the mill. The majority of this identified spill was on the URA 4 property (already in ICP). The area was covered with waste rock at decommissioning.

***Waste Rock***

The Fay mine is reported to have produced a total of 3,030,000 tonnes of waste rock which covered an area of approximately 33.0 hectares, the majority of which was deposited on areas south and southwest of the mill with a portion situated on the URA 7 property. During operation, waste rock was used on the URA 7 property as construction material for building foundations, roads, etc. and during initial decommissioning waste rock was re-contoured on the URA 7 property as required. During the summer of 1982, Eldorado collected waste rock samples from various Beaverlodge sites for analysis. Section 4.1 of Eldorado 1983 provides a summary of the volumes and analysis of the waste rock on a variety of the Beaverlodge mine sites. The uranium content of the waste rock reported in Eldorado 1983 for the Fay area was 0.015%, which is below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%). In addition, recent waste rock sampling completed by Cameco on the Fay Waste Rock pile has confirmed that the site waste rock has a low potential for acid generation and that the uranium content of the waste rock sampled is less than 0.03%. Visual observation and monitoring of the sites for more than 60 years have not identified any acidic leachate from waste rock piles, nor has it identified any impacts that could be attributed to such a condition.

In 2010, SRK Consulting (Canada) Inc. (SRK) completed a waste rock stability assessment of all the former Eldorado Beaverlodge sites including the Fay waste rock pile, including the waste rock on the URA 7 property. That assessment concluded that there were no signs of instability observed on either the waste rock slope or the adjacent ground downslope and the only risk in terms of stability is predominantly associated with the potential for an occasional rolling rock. The assessment concluded that a deep-seated failure affecting the global stability of the waste rock, was unlikely to occur in the foreseeable future. Based on the SRK site observations, the waste rock dump at the Fay site is in good condition, the rock is durable and global instability and the risk of a deep-seated failure that would affect the global stability of the dump is judged to be very low (SRK 2010).

In 2011, SaskPower, as part of ongoing power line right-of-way maintenance, placed cut trees on the sorted waste rock pile on URA 7. As the trees decay, they will provide a source of nutrients for natural encroachment of vegetation.

**Water Quality within Modelled Predictions (Performance Indicator has been met)**

After receiving drainage from the Hab, Dubyna, and Bolger mine sites, Ace Lake discharges into Lower Ace Creek, which passes through the URA 7 property, and eventually reaches Ace Bay of

Beaverlodge Lake. During the 2014 update meeting with the Commission (CNSC 2014), CNSC Staff indicated that the water quality performance indicator for the Lower Ace Creek area would be associated with the URA 7 property based on the potential influence on water quality on Lower Ace Creek and the downstream environment. Historically, Lower Ace Creek has received inputs from Fay waste rock pile drainage; from the former mill site area; runoff/seepage from tailings spill areas; drainage from Ace shaft waste rock pile; drainage from tailings deposited during operation near the former Dorrclone plant; and, formerly flowing boreholes that are connected to the underground mine workings (SENES 2012). The principal source of constituents measured in Lower Ace Creek is, or have been, the seeps from the former mill area and formerly flowing boreholes. As discussed in the Boreholes Plugged section, identified boreholes have been sealed as one of the remedial activities to reduce loads from the underground mine workings on surface water bodies. Seeps 2 and 3 have been identified on the URA 7 property, originating at the base of the waste rock pile downgradient of the mill site. Water quality samples and flow measurements were collected opportunistically since 2004 to identify long-term water quality trends; however, flow from the seep is intermittent and is typically limited to freshet and major precipitation events. In 2019, the JRG accepted that the seep monitoring program objective had been met and it was removed from the Beaverlodge Environmental Monitoring Program. Constituent loadings associated with runoff from the main site waste rock and spilled tailings were also considered during the model development and are a small source of the primary constituents of concern (i.e., radium-226, selenium and uranium) when compared to the loadings associated with the formerly flowing boreholes and seeps.

A detailed discussion on the water quality performance indicator for the Lower Ace Creek is provided in the URA 1 property section to reduce duplication.

Water quality measured at AC-14 is within the modelled predictions and therefore the water quality performance indicator has been met for the URA 7 property.

### Site Free from Debris (Performance Indicator has been met)

All decommissioned Beaverlodge properties were inspected in an effort to locate historic debris not removed during initial decommissioning. During the main clean-up campaign from 2015 to 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the URA 7 property, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 33**).

Following the above noted inspections, various debris found on the property, including the remaining electrical and power infrastructure (pole brackets) and concrete pilons and anchor bolts used to anchor the tailings line on the URA 7 property were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

As a result of this activity, the URA 7 property meets the performance indicator of being free of debris.

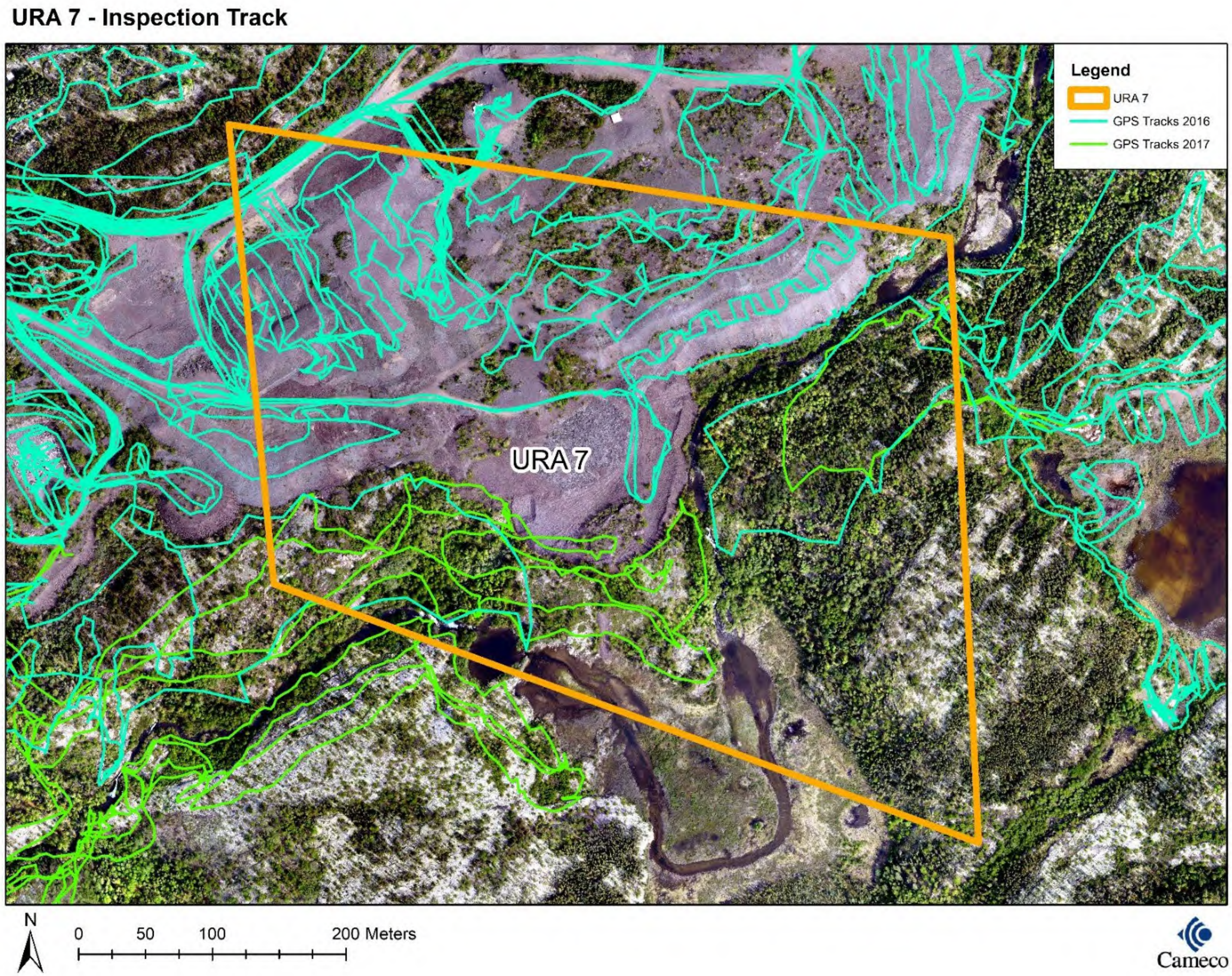



**Figure 33: URA 7 – Inspection Track**

### 8.6.4 Decommissioning and Reclamation Documentation

**Table** provides a summary of general documents which include refence to the Fay site and by extension the URA 7 property. The majority of discussion in these documents combines discussion of the Fay mine with the entire Fay/Ace/Verna mine complex.

**Table 27: Documentation Log – URA 7**

| Document | Date |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited, | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 - Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Surface Lease Renegotiation, Appendix D - Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
| *Waste Rock Stability Assessments – Former Beaverlodge Sites,* SRK Project No. 4CC008.027, SRK Consulting (Canada) Inc | December 2010 |
| *Surficial Gamma Radiation Survey of Disturbed Areas at the Former Beaverlodge Mine Site*, Final Rev. 1, ARCADIS SENES Canada Inc. | November 2014 |
| *2014 Uranium City Consultation on Land Use*, SENES Consultants & Kingsmere Resources Services | January 2015 |
| *Beaverlodge Site Gamma Radiation Risk Evaluation*, ARCADIS Canada Inc., | June 2015 |
| *Beaverlodge Property – Crown Pillar Assessment (2014-2015*), SRK Project No. 1CC007.048, SRK Consulting (Canada) Inc. | July 2015 |
| Beaverlodge Request for Exception from Mines Regulations Section 407 (2) (3) for Sealing of a Horizontal Mine Opening | November 2016 |
| *Beaverlodge 2017: Borehole Decommissioning Report*, Cameco Corporation (Cameco). | July 2017 |
| *Remediation of Utility Corridors & Related Infrastructure, Beaverlodge Properties,* Kingsmere Resource Services Inc. | January 2018 |
| *Beaverlodge Property Inspection for Institutional Control Transfer Report,* Kingsmere Resource Services Inc. | January 2018 |
| *Decommissioned Beaverlodge Properties – As-Builts for Mine Openings Sealed After 2000,* Cameco 2022 | April 2022 |

### 8.6.5 Evaluation of URA 7

The current condition of the property, combined with the limited use of the property by local land users demonstrates that the URA 7 property meets the established performance objectives of safe, secure, stable/improving and has no remaining liabilities (see **Table 28**).

**Table 28: Evaluation of URA 7**

| Performance Indicators | Acceptance Criteria | URA 7 |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | ✓ |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | ✓ |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | ✓ |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the URA 7 property should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.2/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing URA 7 property while under Institutional Control.

### 8.6.6 Institutional Control Considerations and Requirements

#### Engineered Structures

The URA 7 property hosts an engineer designed closure over the CB-1 Access Raise. In addition, openings related to the operation of the mill, Sorting Plant Bin, the Sorting Plant Raise and the Waste Haul Adit have all been backfilled.

#### Beaverlodge Post Closure Land Status

The URA 7 property falls entirely within the planned extent of the Beaverlodge IC borders and will therefore be included in the Saskatchewan Institutional Control Registry in order to establish administrative controls to restrict future land use.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance (2020)

To meet the requirements of section 22 of the MIEPR, **Table 29** provides a summary of aspects of the URA 7 property in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 29: Remaining Site Aspects – URA 7 Property**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Waste Rock Slope Failure | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Erosion of Waste Haulage Adit cover | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Erosion of Sorting Plant Bin cover | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Erosion of Sorting Plant Raise cover | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Erosion of CB-1 Access Raise cover | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |

As noted earlier, the water quality of Lower Ace Creek will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties located within the entire Ace Lake watershed are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

**Figure 34** outlines the site features associated with URA 7 property. Based on the historical activities at the URA 7 property, covers over the openings to surface and waste rock slopes will require inspection under the Province of Saskatchewan's institutional control management framework.

Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation:
- Condition of waste rock,

- Observe and note condition of
  - Seep 2 at 642500: 6604339N (WGS 84 UTM Zone 12); and
  - Seep 3 at 642625E: 6604325N (WGS 84 UTM Zone 12)
- The condition of:
  - The 1.5 X 1.5 m Sorting Plant Bin located at 642603E: 6604520N (WGS 84 UTM Zone 12)

    or 59°33'16.64"N, 108°28'36.49"W,
  - The 1.5 X 2.4 m Sorting Plant Raise at 642603E: 6604520N (WGS 84 UTM Zone 12)

    or 59°33'16.64"N, 108°28'36.49"W,
  - The 2.4 X 2.4 m CB-1 Access Raise located at 642558E: 6604563N (WGS 84 UTM Zone 12) or 59°33'18.09"N, 108°28'39.25"W, and
  - The Waste Haulage Adit at 642638E: 6604455N (WGS 84 UTM Zone 12) or 59°33'14.34"N, 108°28'34.43"W.

### Institutional Control Maintenance

No aspect of the URA 7 property will require maintenance under institutional control.

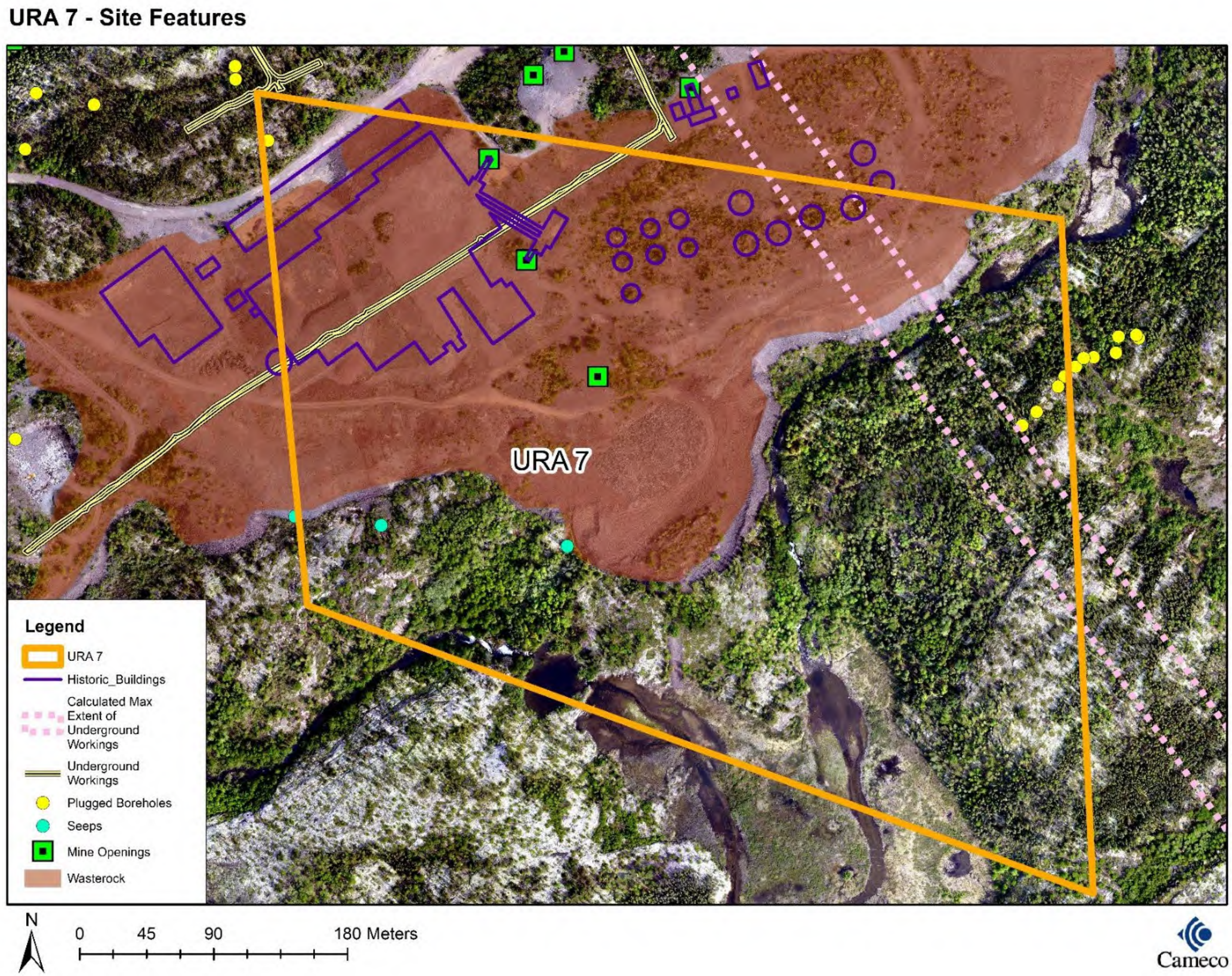



**Figure 34: URA 7 - Site Features**

# 8.7 BOLGER 1 [MSL 10]

## 8.7.1 Description

**Table 30: BOLGER 1 Property Coordinates**

| AECB License Number | Cameco Number | DNS[1] Number | Area (hectares) | Bounding Coordinates (UTM WGS 84 Zone 12) | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| **MSL 132** | **Bolger 1** | **200063** | 11.5 | 646041 | 6606067 |
| | | | | 645600 | 6606081 |
| | | | | 646036 | 6606093 |
| | | | | 645592 | 6606202 |
| | | | | 645641 | 6606347 |
| | | | | 646007 | 6606357 |
| | | | | 646027 | 6606141 |
| | | | | 646008 | 6606113 |
| | | | | 645975 | 6606098 |
| | | | | 645671 | 6606079 |

[1] – Department of Northern Saskatchewan

The BOLGER 1 (MSL 132) property is a 11.5-hectare parcel of land and is listed in Appendix A of the Eldorado Resources Limited Decommissioning Approval AECB-DA-142-0 (November 1983) as "Bolger open pit". The property is included on the *2006 Beaverlodge Surface Lease Agreement* map as MSL 132 (**Figure 35**) and in the *Property Description Manual* referenced in the LCH, which is referenced in the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025.

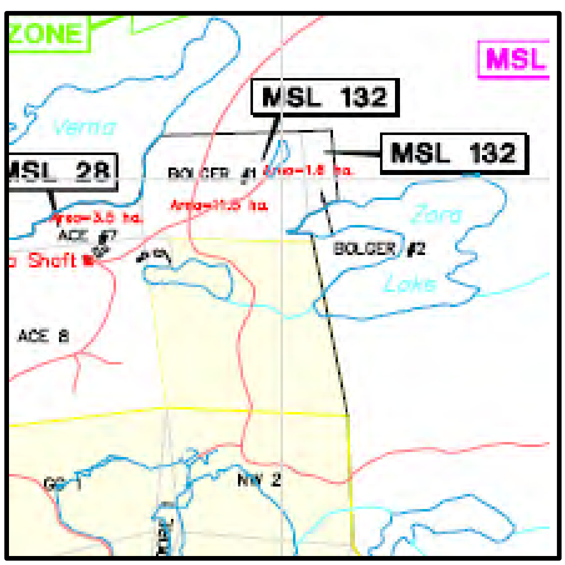



**Figure 35: Bolger 1 (MSL 132) Property (Source: Beaverlodge Surface Lease Map)**

The Bolger pit was operated intermittently between 1958 and 1980 and was the largest pit at the Eldorado Beaverlodge site.

An unusual feature of the Bolger deposit prior to its development was that the overburden in an area of approximately 6,500 square feet (≈ 605 $m^2$) and as much as several feet deep in places was extremely rich in secondary uranium minerals. This overburden was stripped off and approximately 1,440 tons, grading 0.73% was run through the Beaverlodge mill (Beck, 1969).

### 8.7.2 Initial Decommissioning Activities

Bolger was the largest open pit in the region and was partially backfilled over a 42-week period in late 1984 and early 1985. *Departure with Dignity* (Eldorado 1987) states that the Bolger Pit was used for the disposal of a variety of material during decommissioning of various properties and was backfilled with waste rock to natural ground surface at the southwest side, once it was no longer required for scrap disposal.

In addition, the majority of electrical transmission poles and related infrastructure were removed by cutting the poles above the mounting brackets and removing them from the property, leaving the mounting brackets and pole stubs in place. The pole mounting brackets have since been removed as part of the general site clean-up.

### 8.7.3 Recent Decommissioning Activities and Beaverlodge Performance Indicators

**Acceptable Gamma Levels (Performance Indicator has been met)**

Detailed surficial gamma surveys were conducted on the disturbed areas of the BOLGER 1 property in 2014 (ARCADIS SENES 2014). In 2016, following the completion of the Bolger Flow Path Reconstruction Project all areas that were disturbed by the earthworks were rescanned. During each survey, the property was surveyed on a 10 m grid (approximately), as terrain and vegetation allowed considering safety and physical accessibility, with each radiation technician using a Ludlum 2221 ratemeter connected to a 2” x 2” sodium iodide (NaI) crystal scintillation detector (Ludlum 44-10).

The 2014 gamma results were overlapped and replaced where applicable with the 2016 gamma results. The resulting radiation dose rates were then averaged on a 1 ha basis to allow comparison to the 1 µSv/h reference gamma value in the provincial *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008).

As shown in **Figure 36** the entire BOLGER1 property ranged from < 0.1 µSv/h to 1.0 µSv/h above background averaged over 1 ha, which meets the *Guidelines for Northern Mine Decommissioning and Reclamation* (SkMOE 2008) and meets the performance indicator associated with acceptable gamma levels.

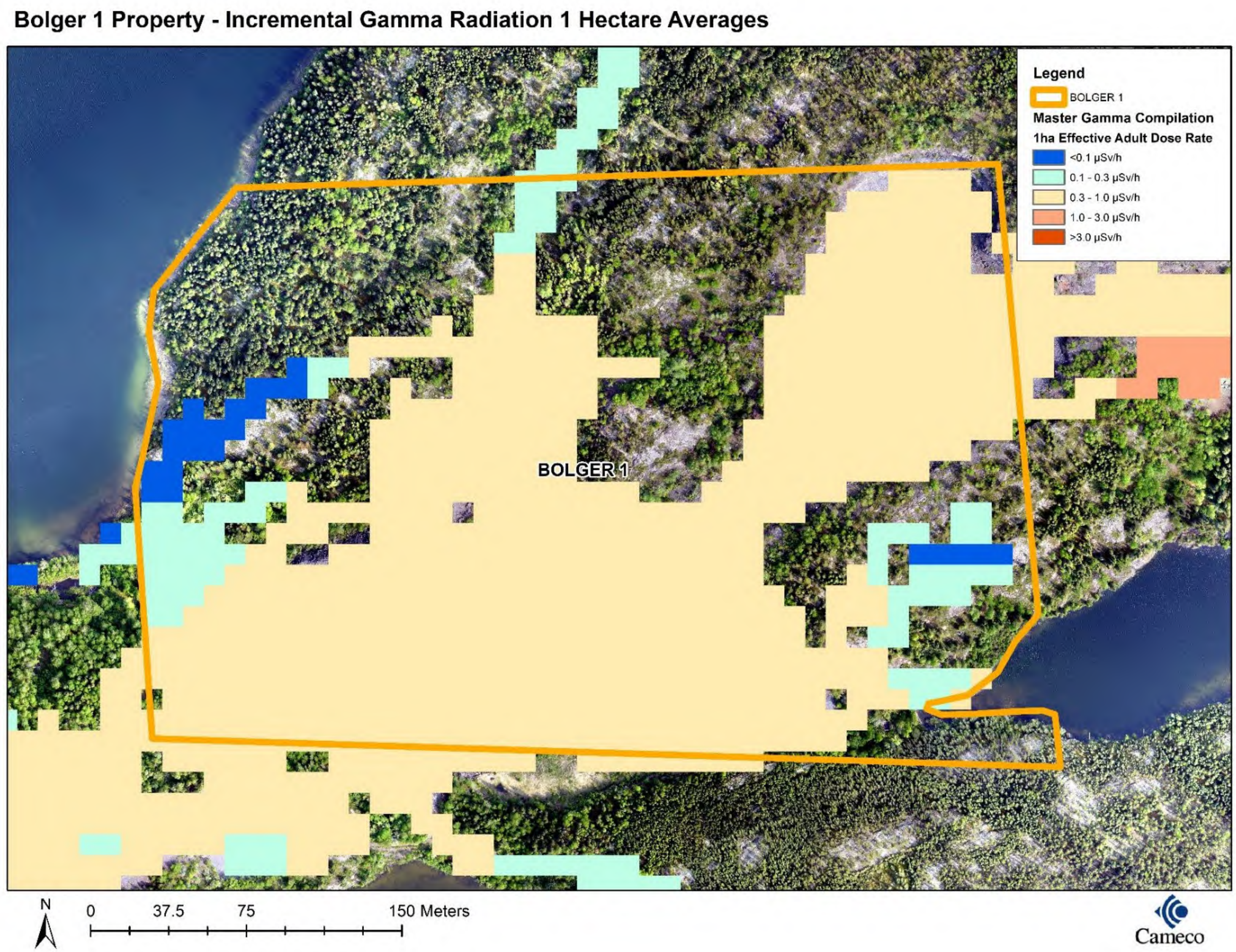



**Figure 36: Incremental Gamma Radiation 1 Hectare Averages: Bolger 1 Property**

## Boreholes Plugged (Performance Indicator has been met)

Activities completed since 1985 have included sealing exploration boreholes according to accepted methods (Cameco 2017). Surface inspections in support of transferring the properties to IC identified two exploration bore holes on the BOLGER 1 property. **Table 31** provides the designation and location of each hole.

**Table 31: BOLGER 1 Property Boreholes**

| Designation | Coordinate System: WGS 84 UTM Zone 12 | | Year Remediated |
|---|---|---|---|
| | Easting | Northing | |
| VR 03 | 645987.422 | 6606161.403 | 2016 |
| VR 05 | 645751.166 | 6606305.443 | 2017 |

Each of the holes was found dry with no evidence of past liquid discharge. Notwithstanding this condition, the drill holes were plugged with a concrete grout to a depth of 30 m or refusal in accordance with regulatory accepted methods in 2017.

As a result of the activities conducted since 1985, the BOLGER 1property meets the boreholes plugged performance indicator.

## Stable Mine Openings (Performance Indicator is not applicable)

The BOLGER 1 property does not host any mine openings to surface.

## Geotechnical Stability

### *Crown Pillar (Performance Indicator has been met)*

The Fay/Ace/Verna mine discontinued operation in 1982 and the mine allowed to flood. A review of the underground Fay/Ace/Verna mine plan superimposed on the surface maps indicates sections of the Verna mine underground workings extend under the BOLGER 1 property.

In 2014, SRK was retained by Cameco to undertake a geotechnical assessment for the crown pillar stability at six historic Beaverlodge sites including the Verna mine. Based on available information, underground workings and stoping around the Verna shaft area appear to be typically 80 m below the ground surface. The report concluded crown pillar collapse is not considered to be a significant risk and no further investigation or assessment is warranted (SRK 2015).

The underground workings have been decommissioned for 40 years and no indication of instability or subsidence have been identified in association with the mine workings underlying the BOLGER 1 property.

The BOLGER 1 property therefore meets the crown pillar performance indicator.

### *Pit Walls*

In 2010, SRK performed an inspection of the Bolger pit and noted that the pit had been backfilled during decommissioning to natural ground surface at the southwest side, leaving rock slopes of approximately 20 to 36 m in height along the west, north and east walls. Overall pit slope angles vary from approximately 50 degrees for the eastern pit walls up to 57 degrees along the west and north pit walls (SRK 2010). The 2010 inspection concluded that the rock mass at Bolger is very competent with moderate jointing and no indications of slope instability. Given the competent nature of the rock mass, slope failure at Bolger is not expected (SRK 2010). During excavation work related to the Bolger Flow Path Reconstruction Project (2014 to 2016), additional waste rock was placed in the pit reducing the pit wall height to approximately 15 m. Geotechnical inspections of Bolger pit have since been completed in 2018 (SRK 2019) and 2020 (SRK 2021) with no concerns noted.

SRK concluded in 2021 that, from a geotechnical perspective, it would be reasonable for Cameco to transfer the property associated with the Bolger pit to the IC Program (SRK 2021).

### *Tailings*

Figure 4.3 of *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions* (Eldorado 1983) shows that no tailings spills from the tailings pipeline were present on the BOLGER 1 property at the cessation of operations.

### *Waste Rock*

The Bolger mine is reported to have produced a total of 639,300 tonnes of waste rock which covered an area of approximately 4.5 hectares, the majority of which was deposited in an area south of the pit and filling the valley that originally connected Zora and Verna Lake on the Bolger property.

During the summer of 1982, Eldorado collected waste rock from various Beaverlodge sites for analysis. Section 4.1 of Eldorado 1983 provides a summary of the volumes and analysis of the waste rock on a variety of the Beaverlodge mine sites. Waste rock analysis completed by Eldorado in 1982 indicated the waste rock piles were not acid generating and the uranium content of the waste rock reported in Eldorado 1983 for the Bolger pit averaged 0.027%, which is below the threshold considered to be special/mineralized waste rock at the operating uranium mines in northern Saskatchewan (0.03%).

One of the remedial options selected for implementation on the Beaverlodge properties, following the 2012 Remedial Options Workshop was the re-establishment of flow from Zora Lake the Verna Lake. Implementing this project resulted in the relocation of waste rock that had previously been place in the valley between Zora and Verna lakes and transporting it to Bolger Pit. Waste rock samples were collected prior to, and during, project implementation for analysis.

Waste rock analysis completed on the Bolger waste rock pile in 2011, 2014 and 2015 confirmed that the average uranium concentration in the Bolger Waste Rock pile is below 0.03%. Waste rock sampling has also shown the waste rock is non-acid generating and visual observation for more than 60 years has not identified any impacts that could be attributed to the generation of acidic conditions.

In 2010, SRK completed a waste rock stability assessment of all the former Eldorado Beaverlodge sites including the waste rock that is located on the BOLGER 1 property. That assessment concluded that the waste rock pile is in good condition, the rock is durable and global instability at this site has a very low risk. Therefore, SRK's opinion is that in the context of the waste rock pile condition and the remoteness of the site, no further remedial works are required.

Between 2014 and 2016, Cameco implemented the Bolger Flow Path Reconstruction project in an effort to improve the immediate downstream water quality by reducing the duration of contact between Zora Creek and the waste rock. Full details of the as constructed channel are provided in the As-Built Report (SRK 2017a). Following construction, inspections have been completed by Cameco personnel since 2016 as well as by a third-party geotechnical expert in 2017 (SRK 2017), 2018 (SRK 2019) and 2020 (SRK 2021) with no observable changes to the landform and no concerns identified.

SRK concluded in 2021 that, from a geotechnical perspective, it would be reasonable for Cameco to transfer the property associated with the Bolger Pit and the Drainage Channel to the IC Program (SRK 2021).

**Water Quality within Modelled Predictions (Performance Indicator has been met)**

The BOLGER 1 property borders Zora Lake to the east and Verna Lake to the west. During the early years of operation of the Bolger mine site, mine water was discharged untreated to Verna Lake, which then discharges to Ace Lake. Waste rock from the open pit mine was placed into the area west of the pit, extending across a valley through which Zora Creek historically flowed and connected Zora Lake to Verna Lake, resulting in flow from Zora Creek filtering through the waste rock pile. To improve water quality from Zora Creek into Verna Lake, flow in Zora Creek was re-established following construction of a channel through the waste rock pile between 2014 and 2016 (SRK 2016, SRK 2017). Water quality was expected to decline in the short term, during and following the re-establishment of Zora Creek, due to an increased loading of uranium that resulted from construction activities disturbing the flow path. Recent improvements in water quality have seen uranium concentrations fall within the performance indicator established for this station.

To determine if the anticipated localized benefits to Verna Lake are being achieved, water quality has been monitored at station AC-6A (located at the outflow of Verna Lake downstream of the BOLGER 1 property) and concentrations have helped inform modelled predictions. The modelled data helped establish WQ performance indicators, which CNSC Staff have deemed appropriate for evaluating the recovery of Verna Lake. The relevant water quality constituents that are assessed as part of the performance indicator include: radium-226, uranium, and selenium. As shown in **Figure 37, 38, and 39** and discussed in greater detail in the 2020 Beaverlodge ERA (CanNorth 2020a), the following observations can be made that demonstrate the Verna Lake water quality data is meeting the water quality performance indicator as defined by regulatory accepted assessment methodologies:

- Selenium concentrations in Verna Lake meet the performance indicator (i.e., predictions) outlined in the 2020 ERA and are predicted to remain below the SEQG value of 1 µg/L, over the entire simulation period.

- Uranium concentrations in Verna Lake have seen recent improvements as water quality in the reconstructed Zora Creek continues to improve and now meets the performance indicator (i.e., predictions) outlined in the 2020 ERA and are expected to continually improve over the long-term.

- Radium-226 levels in Verna Lake meet the performance indicator (i.e., predictions) outlined in the 2020 ERA and are predicted to drop below the SEQG value (0.11 Bq/L) consistently within the next 10 years.

The water quality of Verna Lake will continue to be monitored as part of the Beaverlodge EMP until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

The BOLGER 1 property therefore meets the water quality within modelled predictions performance indicator.

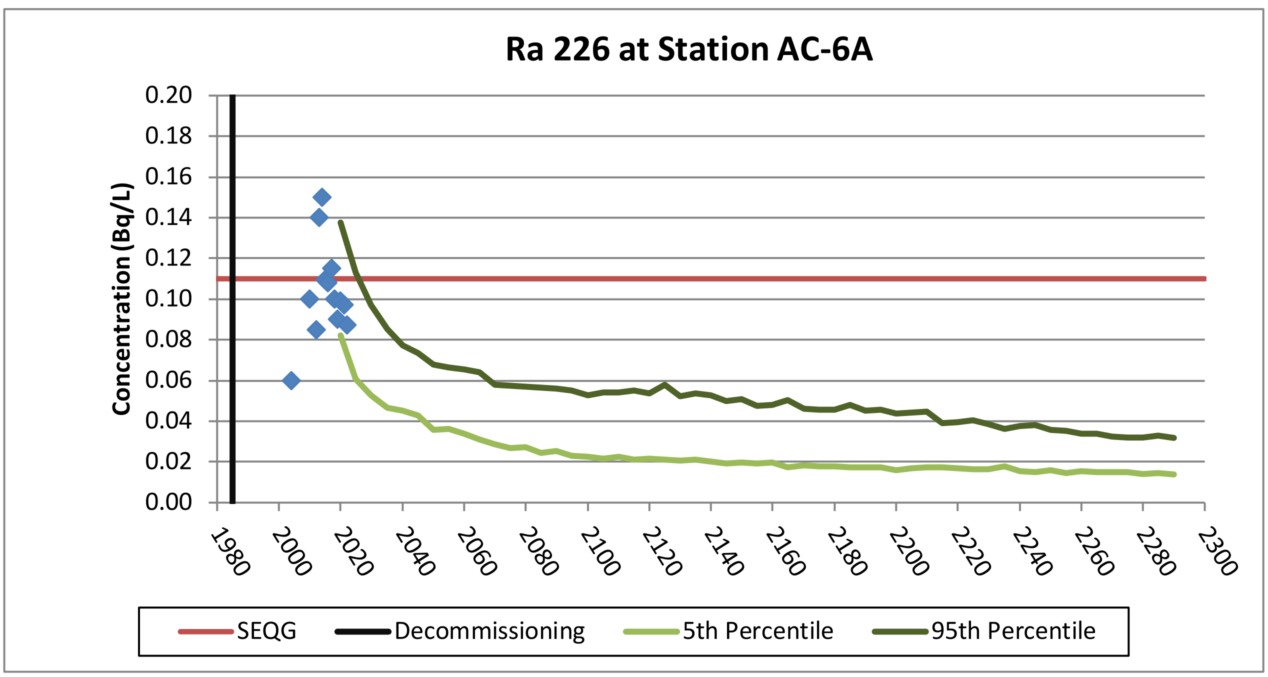



**Figure 37: Ra-226 Performance Indicator at AC-6A**

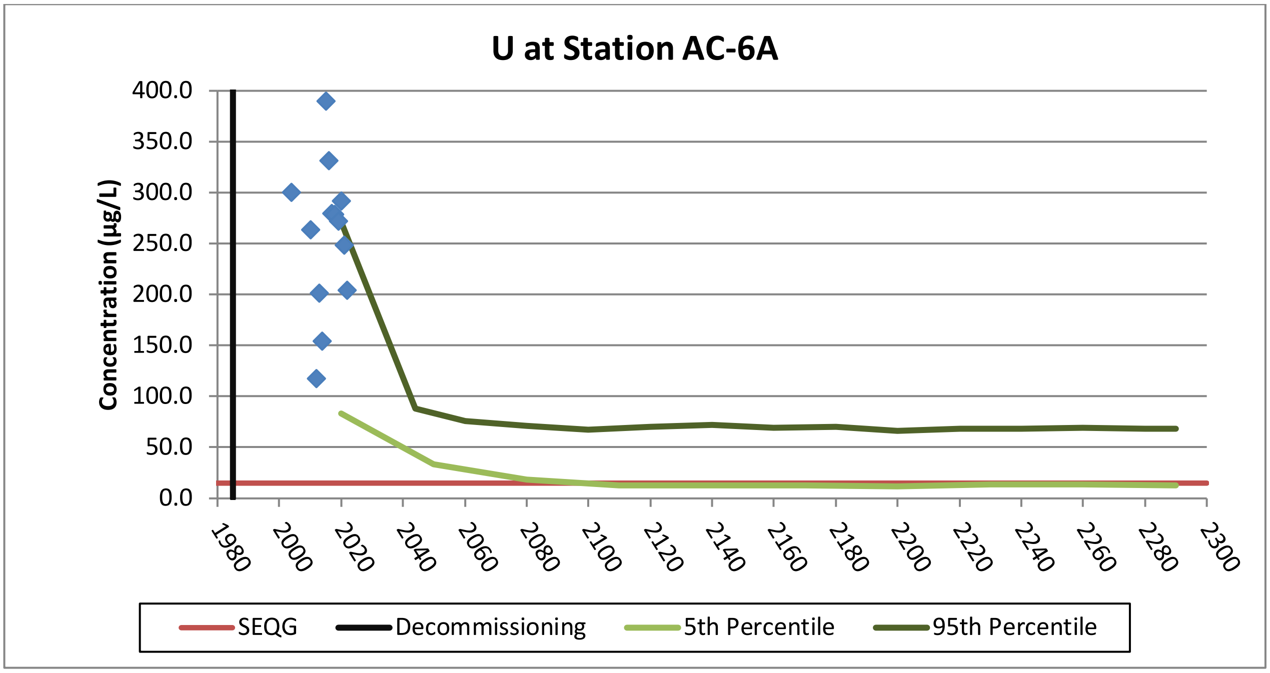



**Figure 38: U Performance Indicator at AC-6A**

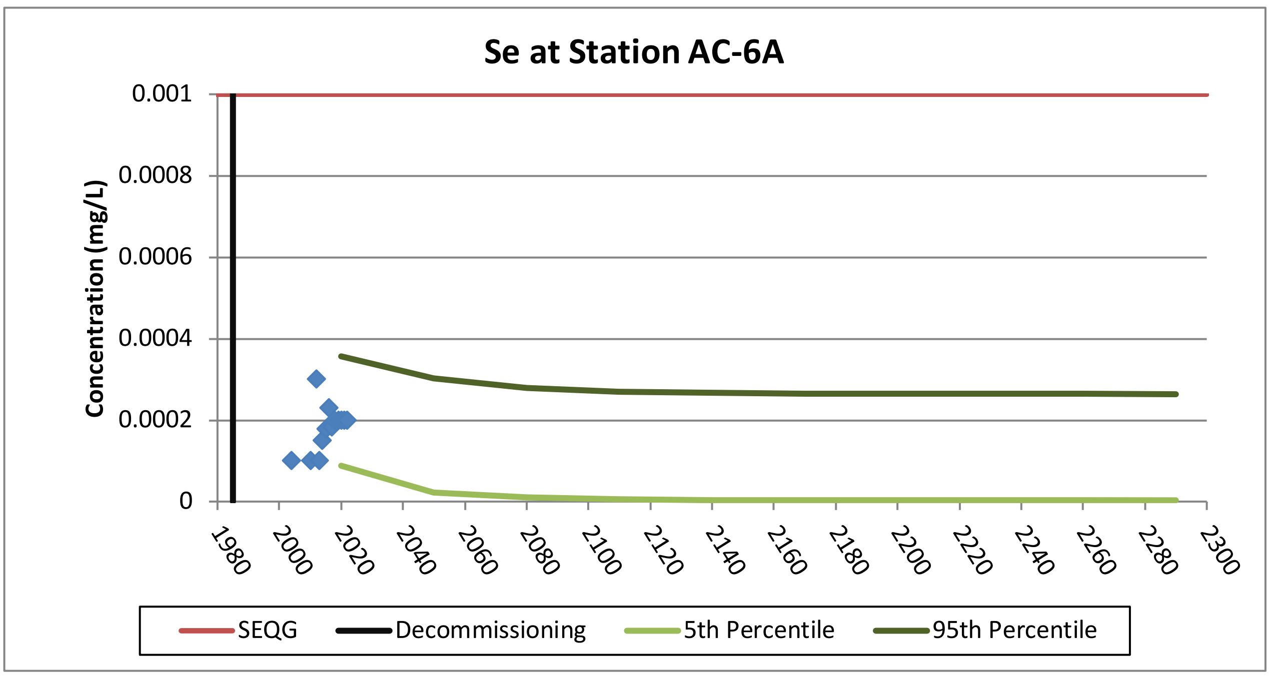



**Figure 39: Se Performance Indicator at AC-6A**

## Site Free from Debris (Performance Indicator has been met)

Following regulatory approval, the Bolger Pit was used as a disposal location for debris gathered from the decommissioned properties. In 2010 a trench approximately 26m long X 15m wide X 1.5m deep was excavated near the entrance to Bolger Pit that received material such as steel, wood and tires gathered from the properties. The types and volumes of material disposed of in Bolger Pit was presented in the corresponding annual reports. The original trench excavated in 2010 was completely backfilled with waste rock during the Bolger Flow Path Reconstruction Project. However, as the Bolger Pit was being filled with waste rock from the channel excavation a small portion in the northwest corner of the pit, against the pit wall (approximate 59°34’10.9” N 108°24’58.3” W), was left open to allow disposal of waste materials encountered during property inspections completed in 2015 and 2016. During this period Bolger Pit received waste, such as tires, wood, metal and drill core. The disposal area was backfilled/covered with waste rock that had been stockpiled nearby for that purpose.

All Beaverlodge related properties were inspected in an effort to locate historic debris not removed during initial decommissioning. During the main clean-up campaign in 2015 and 2017, GPS tracking was utilized to ensure adequate coverage of the properties, including the BOLGER 1 property, unless safety consideration, surface features or significant vegetation prohibited access to a specific area (**Figure 40**).

Subsequent to the above noted inspections, any additional debris found on the property, including the remaining electrical and power infrastructure (pole brackets) on the BOLGER 1 property were removed and disposed of in the Lower Fay Pit as approved by SkMOE. In addition, as final regulatory inspections of the properties occurred, any additional debris located was disposed of in Lower Fay Pit.

As a result of this activity, the BOLGER 1 property meets the performance indicator of being free of debris.

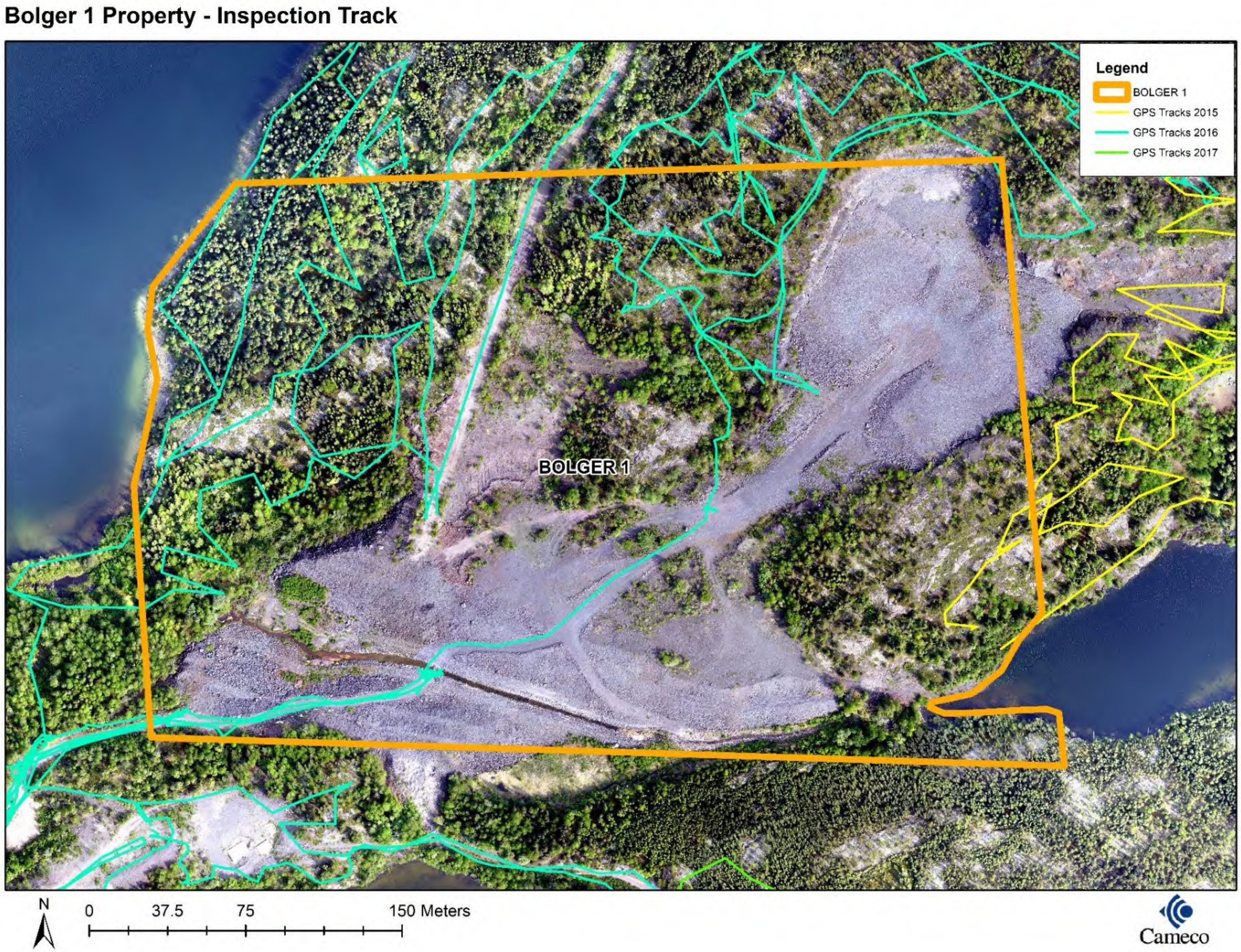



**Figure 40: Bolger 1 – Inspection Track**

### 8.7.4 Decommissioning and Reclamation Documentation

**Table 32** provides a summary of general documents which include refence to the Verna site and by extension the BOLGER 1 property. The majority of discussion in these documents combines discussion of the Bolger mine with the entire Fay/Ace/Verna mine complex.

**Table 32: Documentation Log – BOLGER 1**

| Document | Date |
|---|---|
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 2, Operating History and Environmental Conditions*, MacLaren Plansearch, Eldorado Resources Limited, | February 1983 |
| *Decommissioning of the Beaverlodge Mine/Mill Operations and Reclamation of the Site, Report No. 5 - Plan for the Close Out of the Beaverlodge Site,* Eldorado Resources Limited | August 1983 |
| *Departure with Dignity, Decommissioning of the Beaverlodge Mine/Mill, Operations and Reclamation of the Site,* MacLaren Plansearch, Eldorado Resources Limited | February 1987 |
| *Surface Lease Renegotiation, Appendix D - Decommissioning and Reclamation Plan, Historical Summary: 1981-2005*, Cameco Corporation | November 2006 |
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### 8.7.5 Evaluation of BOLGER 1

The BOLGER 1 property meets the established performance objectives of safe, secure, stable/improving and has no remaining liabilities (see **Table 33**).

**Table 33: Evaluation of BOLGER 1**

| Performance Indicators | Acceptance Criteria | BOLGER 1 |
|---|---|---|
| Acceptable Gamma Levels | Reasonable use scenario demonstrating gamma levels at the site are acceptable. | ✓ |
| Boreholes Plugged | All boreholes have been plugged at the time of transfer to institutional control. | ✓ |
| Stable Mine Openings | Mine openings have been secured and signed off by a qualified person, where applicable. | NA |
| Stable Crown Pillar | Crown pillar assessed, remediated if required, and signed off by a qualified person. | ✓ |
| Site Free from Debris | Site free of former mining debris at the time of transfer to institutional control. | ✓ |
| Water Quality Within Modelled Predictions | Water quality data is stable/improving. | ✓ |

Based on the conclusions of the 2020 ERA the human and ecological risks are acceptable, and all relevant performance indicators have been met. As such, the BOLGER 1 property should be considered for Release from Decommissioning and Reclamation by the SkMOE, released from CNSC License WFOL-W5-2120.0/2025 and transfer to the provincial Institutional Control Program for long term environmental stewardship.

The following section outlines the expectations for managing BOLGER 1 property while under Institutional Control.

### 8.7.6 Institutional Control Considerations and Requirements

#### Engineered Structures

The BOLGER 1 property hosts no engineered structures.

#### Beaverlodge Post Closure Land Status

As previously shown, **Figure 1** provides an outline of the proposed IC borders. The BOLGER 1 property falls entirely within the planned extent of the Beaverlodge IC borders and will therefore be included in the Saskatchewan Institutional Control Registry in order to establish administrative controls to restrict future land use.

### Remaining Site Aspects Requiring Future Monitoring and Maintenance

To meet the requirements of section 22 of the MIEPR, **Table 34** provides a summary of aspects of the BOLGER 1 property in terms of remaining liabilities and an assessment of the significance of the potential hazard posed by each in the unlikely event that it were realized.

**Table 34: Remaining Site Aspects – BOLGER 1 Property**

| Site Aspect | Assessment Endpoint | Likelihood | Severity | Overall Residual Risk |
|---|---|---|---|---|
| Waste Rock Slope Failure | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Pit Wall Failure | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |
| Zora Channel Slope Failure | Environment | Very Unlikely | Minor | Low |
| | Public Health & Safety | Very Unlikely | Minor | Low |

Water quality associated with the Bolger 1 property will continue to be monitored at Station AC-6A as part of the Beaverlodge EMP until all the Beaverlodge properties are transferred to the provincial IC Registry. A long-term water monitoring program will then be implemented under the IC Program and water quality monitoring results from Station AC-6A will continue to be compared to the predicted recovery from the 2020 ERA (CanNorth 2020).

### Institutional Control Monitoring

**Figure 41** outlines the site features associated with BOLGER 1 property. Based on the historical activities at the BOLGER 1 property, waste rock slopes will require inspection under the Province of Saskatchewan's institutional control management framework.

Such an inspection should be conducted of all disturbed areas and focus on the following aspects:

- Evidence of recent human visitation,
- Condition of waste rock,
- Condition of channel,
    - Evidence of new beaver activity
    - Condition of the beaver dam at the outlet of Zora Lake. Sudden failure may result in scour of the area immediately adjacent to the beaver dam and the area downstream of the drainage channel prior to entering Verna Lake,
    - Channel side slopes intact,

  - Note condition of channel base; vegetation growth; flow restriction resulting from excessive sediment accumulation
- Water quality at AC-6A (if flowing).

### Institutional Control Maintenance

No aspect of the BOLGER 1 property will require maintenance under institutional control.

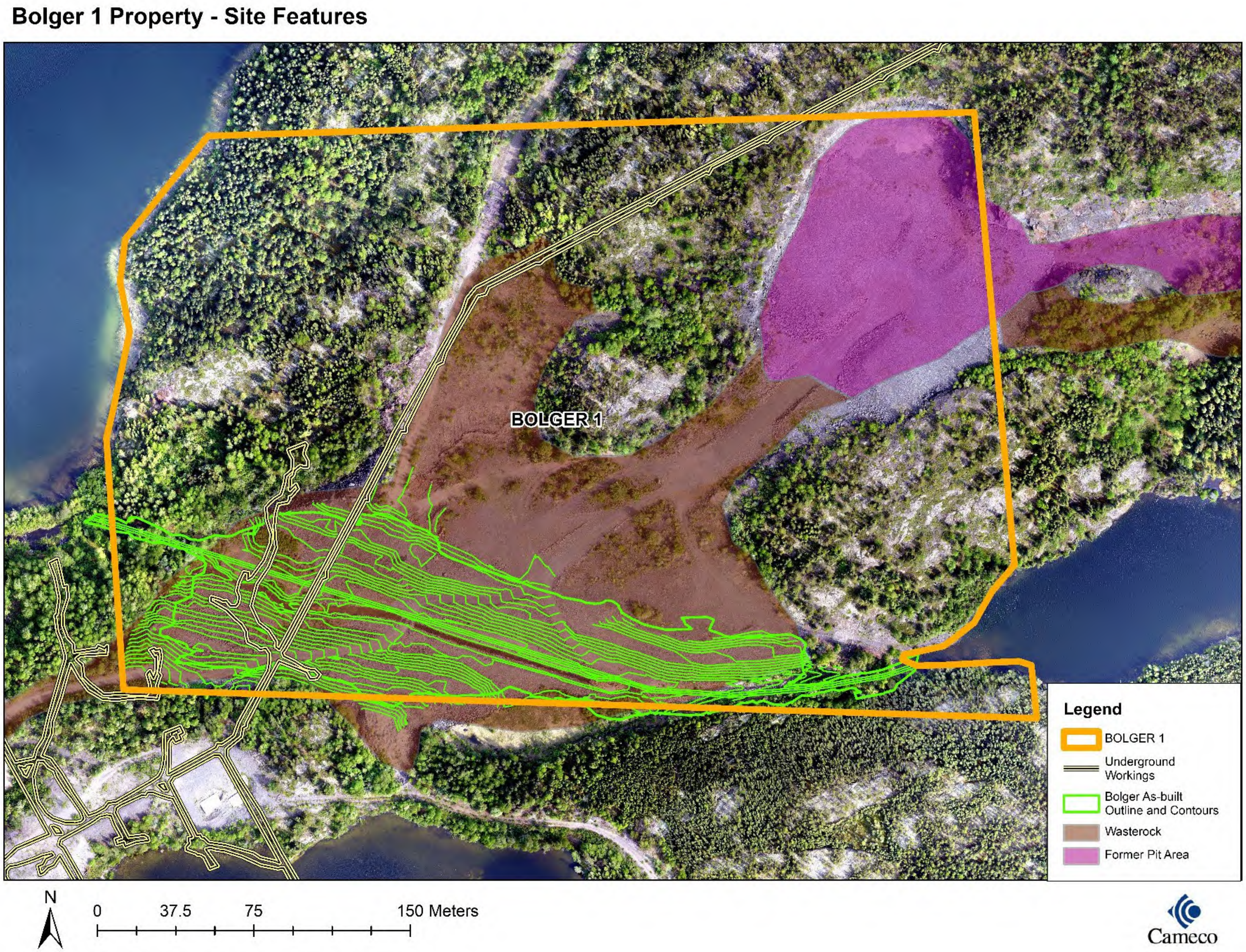


**Figure 41: Bolger 1 - Site Features**

# 9 Summary

**Table 35** provides a summary of the properties that are the subject of this application for a Release from Decommissioning and Reclamation from the SkMOE, removal of the properties from the Saskatchewan Beaverlodge Surface Lease Agreement (December 2006) and a release of the properties from the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025, and for their transfer to the IC Program managed by SkMER.

**Table 35: Summary of Properties**

| Cameco Property Number | AECB Property Number | DNS[1] Property Number | Description[2] | Surface Area (hectares) | Mine Opening to Surface | Tailings Present on Property | Waste Rock Piles on Property | Engineered Structure on Property | Remaining Mine Related Hazard/Risk on Property | Beaverlodge Post Closure Land Status | IC Requirements |
|---|---|---|---|---|---|---|---|---|---|---|---|
| URA 1 | MSL 10 | 200010 | Mill annex buildings, $O_2$ plants, waste rock storage | 17.5 | None | None | Yes | None | Waste rock slope | Managed in IC | Regular inspection of waste rock slope |
| URA 7 | MSL 15 | 200015 | Mill site | 20.9 | Sorting plant bin, sorting plant raise, CB-1 Access raise, waste haulage adit | None | Yes | CB-1 Access Raise; Waste haulage adit | Waste rock slope | Managed in IC | Regular inspection of sorting plant bin, sorting plant raise, CB-1 Access raise, waste haulage adit and waste rock slope |
| Bolger 1 | MSL 132 | 200063 | Bolger open pit | 11.5 | None | None | Yes | None | Waste rock slope | Managed in IC | Regular inspection of waste rock slope, channel, and channel slope |
| Fookes Reservoir Area | N-294 | 300089 | N-294 Tailing's storage and treatment system | 180.4 | None | Yes | No | Fookes Delta, outlet structures at Fookes | Residual tailings | Managed in IC | Regular inspection of residual tailings deltas, water quality |
| Marie Reservoir Area | N-294 | 300089 | N-294 Tailing's storage and treatment system | 133.5 | None | Yes | No | Outlet structures at Marie | Residual tailings | Managed in IC | Regular inspection of residual tailings deltas, water quality |
| Minewater Reservoir Area | N-294 | 300089 | N-294 Tailing's storage and treatment system | 42.5 | None | Yes | No | None | Residual tailings | Managed in IC | Regular inspection of residual tailings, Minewater saddle dam, Minewater outflow channel, condition of Meadow basin concrete dam, water quality |

Note:
The Fookes Reservoir Area consists of the following individual properties (GC 3, EXC GC 3, GC 5, GC 1, GORE 1, NW 2, NW 1, LEE 4, GORE 2, LEE 3, EXC LEE 3, LEE 2);
the Marie Reservoir Area consists of the following individual properties (EXC ACE 18, EXC ACE 17, ACE 17, ACE 15, EXC ACE 14, GORE, EXC GC 2, GC 4, EXC GC 4); and
the Minewater Reservoir Area consists of the following individual properties (EXC URA 6, ACE 19, URA 6)

# 10 Community Engagement

Cameco has developed a Public Information Program (PIP) (Cameco 2021) for Beaverlodge that describes communication with stakeholders. The PIP formalizes the communication process, ensuring that Cameco's activities or plans at the decommissioned Beaverlodge properties are effectively communicated to the public in a manner that complies with established guidelines. It is based on the PLAN-DO-CHECK-ACT model outlined in internationally recognized management standards.

Each year, Cameco hosts a public meeting in Uranium City, typically with the CNSC and SkMOE in attendance, to review the results of any activities completed since the previous meeting and to preview the plans for the upcoming year, including any activities or planned studies that are to be completed. This meeting also provides an opportunity for Cameco to engage local residents regarding the plan and schedule for transferring properties to the Province of Saskatchewan's IC Program. Due to the COVID-19 pandemic, Cameco held the 2020 and 2021 annual public meetings/site tours virtually to ensure the health and safety of its participants. Presentations were provided by Cameco, CNSC, SkMOE and SkMER with an opportunity for participants to ask questions during the meeting or to submit questions at a later date for follow-up. These engagement opportunities allow interested parties to provide feedback to Cameco and the JRG regarding potential concerns with the properties and their suitability for transfer to the IC Program. An in-person meeting was conducted in Uranium City on September 13, 2022. The meeting was held outside on the Beaverlodge properties that are the subject of this document, to allow participants to reconnect with the land and see first-hand the state of the remediation. Presentations describing the conditions of these properties and the plan to transfer them to the IC Program were provided on September 12 and 13, 2023 in Uranium City. The following groups are the focus of such engagement activities as outlined in our PIP:

- Northern Settlement of Uranium City – Only community with year-round road access to the Beaverlodge properties;
- Athabasca sub-committee of the Northern Saskatchewan Environment Quality Committee (EQC) – includes representatives from each of the Athabasca communities (Wollaston Lake, Stony Rapids, Fond du Lac, and Camsell Portage) and First Nations (Hatchet Lake Denésuline Nation and Black Lake Denésuline Nation); and,
- Athabasca Joint Engagement and Environment Subcommittee (AJES) – which is a joint committee of community and industry representatives that meets regularly to discuss operational and environment-related matters of importance to the Athabasca communities and provides a channel for the communities to share traditional knowledge with the companies.

- o Yá thi Néné Land and Resource Office – established to provide support to the AJES subcommittee and the executive director is an AJES member and is invited to attend all public meetings associated with Beaverlodge.

In addition to engagement as per our regulatory approved PIP, the Athabasca Chipewyan First Nation (ACFN) through the Dene Lands and Resources Management (DLRM) and the Métis Nation of Saskatchewan (MN-S) through the Uranium City (Local #50) President were invited to attend the 2020 and 2021 public meetings as they had expressed interest during a previous Commission hearing regarding release of properties from CNSC licensing. Cameco continues to make information publicly available; a recording of the public meeting has been posted to the Beaverlodge website and sent as follow-up to invited participants in an effort to provide further opportunity to elicit feedback.

Based on the most recent Record for Decision (DEC 19-H6; CNSC 2019), Cameco had planned to increase the 'boots on the ground' tours of the Beaverlodge site with First Nations and Métis communities to ensure physical interaction with and provide opportunities for reconnection with the Beaverlodge lands; however, the pandemic forced Cameco to pivot and expand its engagement efforts in other ways. In addition to hosting a virtual public meeting and posting the public meeting to the Beaverlodge website; to help people reconnect with the land, virtual site tours were created in 2020 and 2021. The virtual site tour provides a bird's eye view of many of the properties that are the subject of this request. These virtual site tours are publicly available on the Beaverlodge website. Cameco also uses a range of communication tools including fact sheets, posters, presentations, and a specially-purposed website (www.beaverlodgesites.com) for the Beaverlodge properties to engage and communicate information of interest to the public for routine and non-routine situations, events and activities. Since 2016, meeting summaries and/or presentations have been provided in the corresponding Annual Report.

In preparing for the CNSC hearing regarding the release of the final set of Decommissioned Beaverlodge properties Cameco will prepare an Engagement Report consistent with guidance identified *in REGDOC-3.2.2, Indigenous Engagement,* which will provide a comprehensive update on engagement efforts on the Beaverlodge Project. The engagement report will be provided as a supplementary information to Cameco's Commission Member Document (CMD) prepared in support of the request for these properties to be released from CNSC licensing to ensure that the most recent engagement efforts are provided to Commission.

# 11 Community Related Monitoring

## 11.1 Country Foods Assessment

In 2010, Cameco contracted Canada North Environmental Services (CanNorth) a third party First Nations-owned company to complete a two-year Country Foods assessment with a primary objective of determining whether there were any potential human health risks associated with the consumption of country foods gathered in the Uranium City area by local residents. Information regarding country food consumption habits and locations of country food harvesting were gathered during Year 1. The focus of the Year 2 study was to complete the gathering of samples to determine if locally harvested country foods were safe to consume. Vegetation and animal samples were collected over a two-year period from the Beaverlodge properties, Camsell Portage, and areas around Uranium City by researchers and local land users and sent to Saskatchewan Research Council laboratory for chemical analysis. Maps of the sampling locations were also provided at a public meeting to provide the attendees with a visual aid to see exactly what areas had been sampled. After the tissue sample results were provided by the lab, a risk assessment was conducted, and it was concluded that consumption of country foods does not present health risks to Uranium City residents provided the fish consumption advisories in place are followed (CanNorth and SENES 2012). This report has been submitted and accepted by regulators.

## 11.2 Eastern Athabasca Regional Monitoring Program

The Eastern Athabasca Regional Monitoring Program (EARMP) was established in 2011 under the Province of Saskatchewan's Boreal Watershed Initiative and is currently supported by funding contributions from SkMOE, CNSC, Cameco and Orano. The EARMP was designed to identify potential cumulative effects downstream of uranium mining and milling operations in the Eastern Athabasca region of northern Saskatchewan.

The community-based component of the program partners with communities annually to monitor the safety of traditionally harvested country foods by collecting and testing representative water, fish, berry, and mammal tissue samples from the seven communities located in the region. Harvesting and consuming traditional foods are an important part of the culture in northern Saskatchewan, which contributes to an overall healthy lifestyle through physical activity and healthy eating.

Community members play a key role in the program, as local knowledge is used to determine locations for the water, fish, berry and mammal samples. Locations focus on areas where community members routinely fish, hunt, and gather. Samples are then collected by, or with the aid of, community members.

The 2021/2022 program results continue to show that country foods are safe for consumption with chemical profiles for water, fish, berry, and mammal tissue samples similar to natural background.

The EARMP collected and tested over 850 water and traditional food samples from the Athabasca Region from 2011 to 2021. Results indicate that the measured concentrations in the samples are similar to baseline levels and the regional reference range, and those used in the 2018 Human Health Risk Assessment.

Results from ten years of sampling have consistently demonstrated that water and traditional foods remain safe for consumption, and that they continue to be a safe and healthy dietary choice for residents of the Athabasca Basin. The 10-year summary report, annual reports and data from the programs conducted to date are publicly available at www.earmp.ca.

## 11.3 Community Based Environmental Monitoring Program

Building off eighteen years of data collected through the Athabasca Working Group (AWG) Environmental Monitoring Program (which was a product of the original Impact Management Agreement signed in 1999), the program was enhanced in 2018 to create a Community Based Environmental Monitoring Program (CBEMP) for the Athabasca region. The new CBEMP allows community members to become more involved and provide input to steer the direction of the program in their particular community. The program focuses on individual communities within the region on a rotating basis.

The overall study objective of the CBEMP is to gain an understanding of traditional food use by community members and to assess if these foods remained safe for consumption. The involvement of community members is one of the fundamental goals of the study. The study obtained information regarding the quantity, type, and harvest location of traditional foods through community interviews. To accomplish these objectives, a Traditional Food Frequency Questionnaire is developed in collaboration with community leadership and band members are hired and trained to conduct interviews with community residents.

To date, CBEMP studies have been completed in Black Lake Denesuline First Nation /Stony Rapids, Hatchet Lake Denesuline First Nation/Wollaston Lake, and Fond du Lac Denesuline First Nation. The results of the CBEMP studies have indicated that country foods identified and harvested by members of the communities remain safe and that regular consumption of locally collected fish, meat, berries and vegetation is encouraged. The results of these studies have been shared with local leadership and community members and a publicly available document summarizing the findings is posted on Cameco's northern website.

In 2022, a Human Health Risk Assessment (HHRA) was completed based on information collected through the CBEMP. The HHRA provides an assessment for each community, based on their specific dietary rates and country food information. The HHRA results show that community members should continue regularly eating locally harvested fish, wild game, berries and plants. CBEMP summaries have been updated and include community specific HHRA results.

More recently, the study took place in in Uranium City and Camsell Portage in 2021/2022. In an effort to build capacity and understanding, the program saw increased involvement from the Ya' thi Néné Land and Resource Office. Results from the program indicated that chemicals in traditional foods were generally low and within the range for the region, and were not of concern for the community.

# 12 Road Closure

In recognition that the current road network in the Uranium City area supports traditional activities, public engagement activities conducted in 2023 sought to gather information from local land users so that any potential road closures would not impact the ability to conduct traditional activities. regarding potential road closures related to the former Beaverlodge properties.

Land users were encouraged to provide feedback following the engagement meetings regarding potential road closures on the Beaverlodge properties, based on their current and future land use. Numerous residents stayed after the meetings to discuss their land use and how potential road closures may, or will not, impact their land use. The information that was shared modified the original proposed road closure locations. Based on these targeted discussions, the new planned locations for road closures will have minimal effect on land users' ability to access the land for traditional activities.

Based on feedback from local land users two minor access trails were closed in the September 2023, preventing vehicular access to access to areas within the tailing management area. Additional areas are planned for closure in 2024 based on the 2023 engagement activities. These additional closures will be implemented following a public meeting in Uranium City in 2024 notifying residents that the closure will be taking place, as these future closures will be more visible and potentially affect more vehicular travel.

# 13 Signage and Restrictions

Current warning signs will be replaced with a general warning sign in 2024noting that the area is home to a former Mine/Mill site. The sign will identify some of the remaining hazards on site, which are similar to other wilderness areas (slip, trip and fall hazards), as well as instructions not to dig or remove any materials from the sites without the expressed written consent of the SkMER and CNSC. Public engagement activities conducted in 2023 sought feedback regarding the preferred location and determined the best location for a permanent notification sign to be at the entrance to the Beaverlodge Mine/Mill location, near the access point from the Uranium City airport.

The SkMOE is responsible for maintaining the signage related to the Healthy Fish Consumption Advisory implemented by the Population Health Unit. The Healthy Fish Consumption Advisory is currently in place due to elevated levels of selenium measured in the fish flesh. A fish monitoring program will be implemented to monitor fish flesh to allow the Population Health Unit to remove the Healthy Fish Consumption Advisory, when it is appropriate to do so.

The decommissioned Beaverlodge Properties have been shown to be safe, secure and stable for the long term and do not present an unreasonable risk to casual land users practising traditional activities on the former Beaverlodge properties.

# 14 Monitoring Plan for the IC Program

Following the decommissioning activities completed between 1983 and 1985, regular monitoring and minor maintenance activities have been conducted on the properties to ensure that the site is recovering as expected. Where additional targeted remediation could be done to improve local conditions, those options were implemented and monitored to ensure their success. Monitoring and inspections completed on the Beaverlodge properties by Cameco and the regulatory agencies has confirmed that with the exception of the establishment of natural vegetation, there has been very little observed change. Once the properties are transferred to the IC Program, routine monitoring will continue, and part of a long-term monitoring program (LTMP) and inspections will continue following a detailed inspection checklist and field guide to ensure all relevant aspects of the former sites are inspected and reported consistently.

As the properties are transferred to the IC Program, water quality at various stations will continue to be monitored as part of the IC Program's Monitoring and Maintenance requirements. This monitoring will build on the more that 40 years of data that has been collected since the Beaverlodge mine shut down in 1982.

Additional water quality monitoring stations have been established in various locations downstream of the former Beaverlodge site and will continue to be monitored once the properties have been transferred to the IC Program.

Water quality performance indicators were discussed in the previous sections providing the expected recovery of the water quality monitoring stations directly downstream of the areas being discussed. Water quality predictions were also provided in the 2020 Beaverlodge ERA for the outlet of Beaverlodge Lake (STN BL-5), to which future water quality monitoring will be compared once the properties are in the IC Program. Below Figure 42, 43, and 44 detail the expected natural recovery of Beaverlodge Lake and the recent water quality results.

As shown below, the U, Se, and Radium$^{226}$concentrations in 2022 are within the modeled predictions. Radium$^{226}$ was below the corresponding SEQG value of 0.11 Bq/L and slightly lower than the modelled predictions.

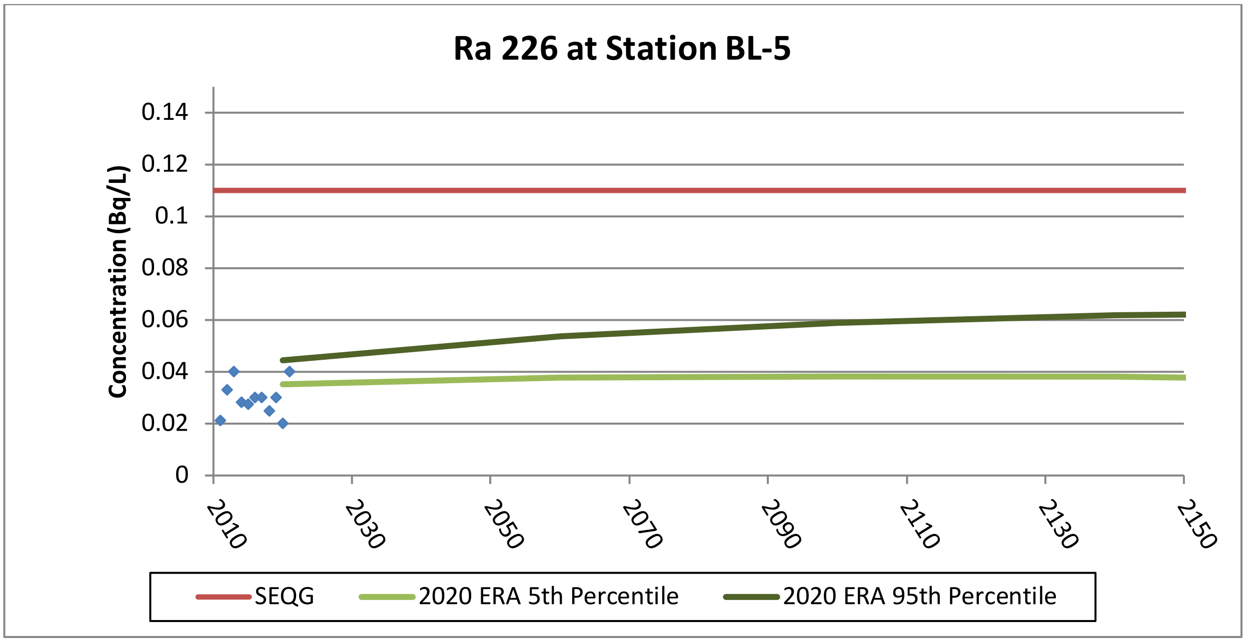


**Figure 42. Ra-226 Expected Natural Recovery at BL-5**

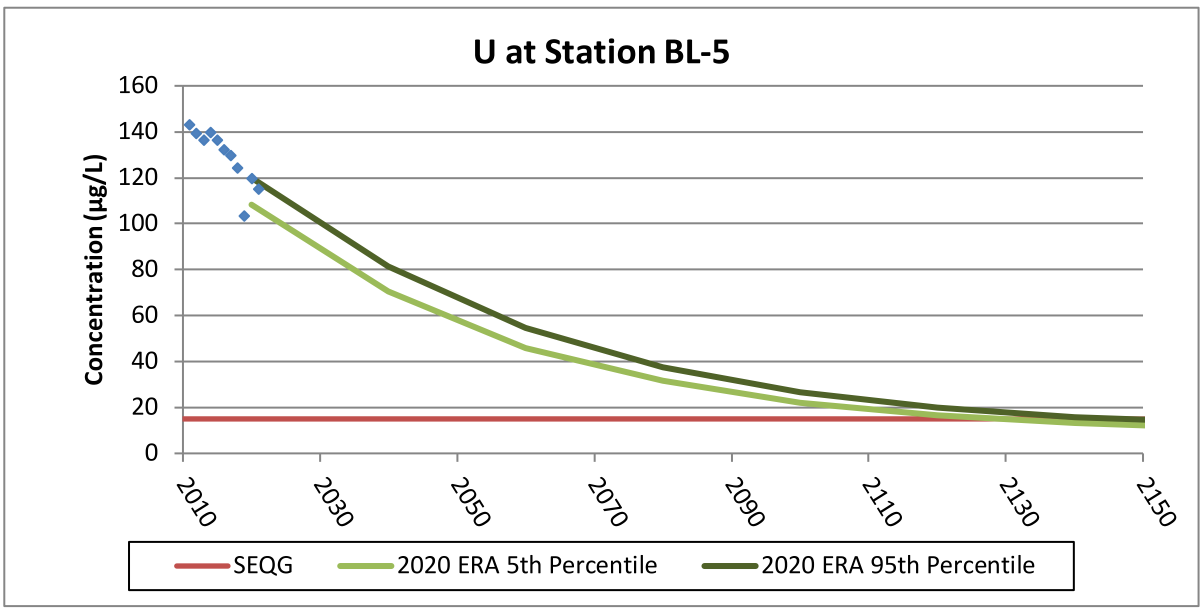


**Figure 43. U Expected Natural Recovery at BL-5**

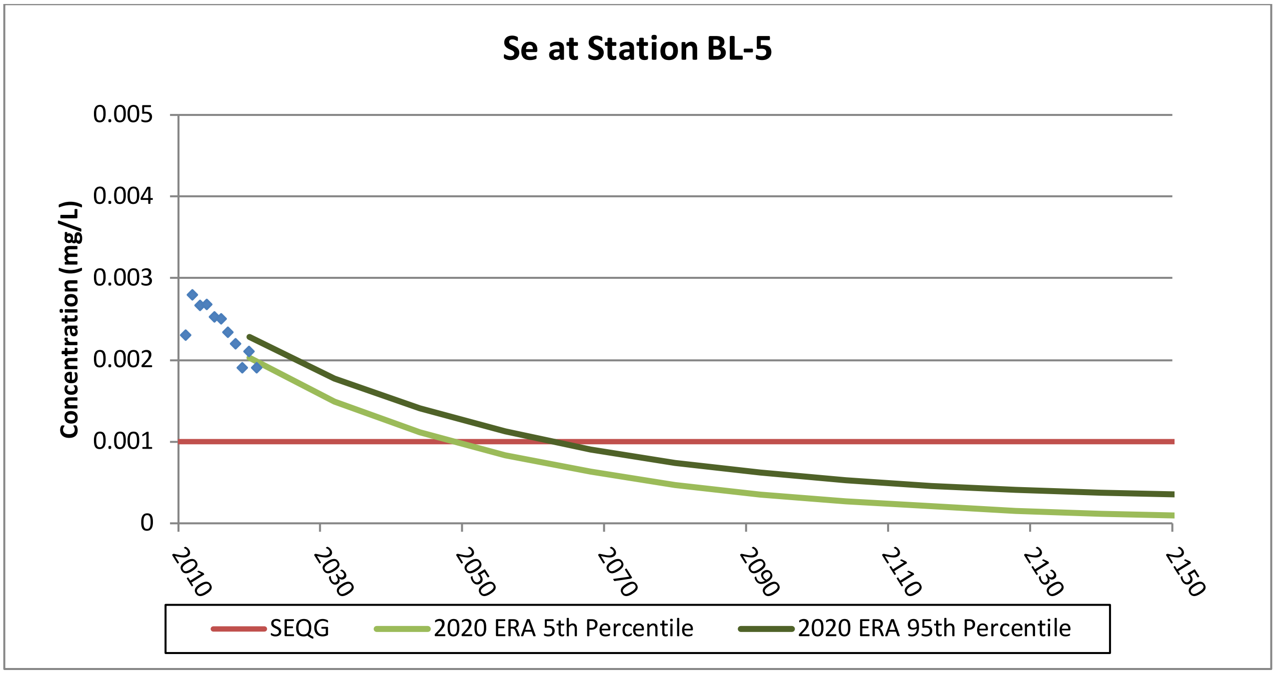


**Figure 44. Se Expected Natural Recovery at BL-5**

The IC Program funding discussion regarding the Monitoring and Maintenance Fund (MMF) and Unforeseen Events Fund (UFE) will occur with SkMER close to the date that the properties are planned for transfer to the IC Program, so that current and accurate costs can be used in the assessment. As the 27 properties that are the subject of this Final Closure Report are the final set of properties to be transferred to the IC Program, the funding requirements will consider the costs associated with on-site and downstream water and fish monitoring, as well as the general monitoring and maintenance of the 43 properties already released from CNSC licensing (42 properties or portions thereof to the IC Program and 1 free released), and the 27 properties that are the subject of this Final Closure Report. Based on 2023 costs, it is expected that the net present value for the total contribution to the MMF and the UFE for to conduct the monitoring and maintenance activities described in the LTMP and the Inspection Field Guide for all the Beaverlodge properties will be more than $1.5M.

## 14.1 Long-term Monitoring Program

Drawing on over 40 years of monitoring completed in the region, as well as input provided by community members and other interested parties, a Long-term Monitoring Program (LTMP) has been developed for implementation when all Beaverlodge properties have been accepted into the IC Program.

In developing the LTMP, a technical evaluation was completed to support development of a program to monitor long-term trends in surface water and fish quality after all the Beaverlodge properties have been released to the IC Program. The objectives of the evaluation was to define monitoring that would confirm long-term water trends continue to recover as expected and provide information to support the eventual removal of the healthy fish consumption guideline and drinking water advisories. The evaluation informed a sampling program that reflected an understanding of the conditions in the area gathered through 40 years of data collected from the site.

In addition to the technical evaluation, various engagement activities were conducted to obtain input from members of rights-bearing First Nation and Métis communities in the Athabasca Basin, residents and/or former residents of Uranium City, northern stakeholder organizations, and provincial and federal regulatory agencies on what they view as a reasonable long-term monitoring program based on their personal experience with these areas and the IC Program.

Along with these specific engagement activities, an in-person workshop was held in June 2023 to exchange information and to invite feedback from various stakeholders on the specific aspects of the program. Following the workshop, the LTMP was presented in Uranium City in the September 2023 regulatory update.

The LTMP consists of two components: surface water and fish chemistry monitoring.

Surface water will be monitored as part of the LTMP which describes the locations and frequencies of water and fish monitoring to be conducted in the IC Program. The objective of the surface water monitoring component of the LTMP is to confirm the trends in water quality are recovering, consistent with predictions made in the 2020 ERA.

The surface water monitoring program follows a graduated approach, with the potential for reduced monitoring frequency if recovery is occurring as expected. While it is expected that the predictions developed in the 2020 ERA will continue to be met, a contingency plan has been developed should unexpected surface water results be encountered. Contingency funds will be provided as part of the MMF which will be sufficient to cover additional costs associated with water quality monitoring, should that be required.

In addition to water quality monitoring, fish chemistry monitoring will be completed to support the removal of the Healthy Fish Consumption Guideline. Sample locations and frequency are detailed in the LTMP and were informed by previous sampling campaigns completed in the region, as well as stakeholder feedback. Based on that feedback, sampling will take place every 10 years in Beaverlodge, Martin and Cinch Lakes and will be discontinued following removal of the guideline in each location.

## 14.2 Institutional Control Inspection Field Guide

The Beaverlodge Institutional Control Inspection Field Guide (Beaverlodge - ICIFG) provides a description of the relevant areas and a summary of the key aspects of the decommissioned Beaverlodge properties that will require future inspection as part of the IC Program. The Beaverlodge ICIFG was developed by reviewing an example of a relevant inspection plan that has been proposed for to the IC Program, past closure reports and commitments agreed up in the CNSC Commission Member Documents and Record of Decisions, previous IC inspection reports from 2014 and 2019, and current regulatory inspections.

The field guide consists of inspection tasks which provides detailed information regarding the different types of inspection tasks and what is required when the field team is conducting the inspection. This guide was developed from the inspection requirements identified in the various property closure reports and were reviewed and accepted by the CNSC, SkMOE, and SkMER as properties were previously released from CNSC licensing and transferred to the IC Program.

The inspection tasks are then classified under the appropriate inspection areas. The former Beaverlodge properties within the area designated as Crown Reserve to be managed within the IC program have been separated into 10 areas: Eagle, Martin Lake, Fay, Ace, Tailings Management Area, Verna/Bolger, Dubyna, Hab, Moran Pit, and Fishhook Bay. Each of these areas have properties that require monitoring and/or inspections. The Moran Pit and Fishhook Bay areas were not subject to CNSC licensing; however, they have been remediated following the same process as the other Beaverlodge properties and will be managed in the IC program with established Crown Reserve areas.

It should be noted that the 10 areas identified in the Beaverlodge ICIFG differ from the original property boundaries identified in the closure reports, and are based on geographical location, accessibility, and the presence of aspects that require inspection. The guide also provides a checklist for conducting the inspections and figures that contain information regarding access points to the areas for inspection as well as the geographic location of some of the key features requiring inspection.

The monitoring frequency used in the calculation of the required funding under the Beaverlodge ICIFG includes inspections every five years, for the next 30 years, then every ten years out until 2125. It is further described in the field guide what type of inspections will occur, including detailed engineer inspections stainless steel caps.

# 15 Conclusion

The decommissioned Beaverlodge site consists of 27 individual properties and is currently managed following the Saskatchewan Beaverlodge Surface Lease Agreement (December 2006) and the CNSC issued Waste Facility Operating License WFOL-W5-2120.0/2025.

Given the completed remedial activities and subsequent assessments, the 27 decommissioned properties discussed herein (*URA 7, URA 1, BOLGER 1, the Fookes Reservoir Area (GC 3, EXC GC 3, GC 5, GC 1, GORE 1, NW 2, NW 1, LEE 4, GORE 2, LEE 3, EXC LEE 3, LEE 2), the Marie Reservoir Area (EXC ACE 18, EXC ACE 17, ACE 17, ACE 15, EXC ACE 14, GORE, EXC GC 2, GC 4, EXC GC 4) Minewater Reservoir Area (EXC URA 6, ACE 19, URA 6*) have been shown to meet the performance objectives of safe, secure and stable/improving, as well as all applicable performance indicators.

Based on these conditions, Cameco is making a request for "Release from Decommissioning and Reclamation" pursuant to Section 22 of *The Mineral Industry Environmental Protection Regulations*, 1996 from the Ministry of Environment Environmental Protection Branch; a request for SkMER review in support of an application for custodial transfer of the properties in accordance with *The Reclaimed Industrial Sites Act*; a request to receive a full Surrender of Surface Lease (Beaverlodge Surface Lease Agreement, 2006) from the Ministry of Environment - Lands Branch; and, an application for the release of the properties from the Waste Facility Operating License (WFOL-W5-2120.0/2025) issued to Cameco by the CNSC.

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| | |
|---|---|
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**Prepared by**

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# 2 Long-Term Monitoring Program

# LONG-TERM MONITORING PROGRAM

## Decommissioned Beaverlodge Mine Site

Prepared for:
Cameco Corporation

Prepared by:
Canada North Environmental

November 2023

CanNorth
Canada North Environmental Services Limited Partnership
A First Nation Environmental Services Company

# DECOMMISSIONED BEAVERLODGE MINE SITE LONG-TERM MONITORING PROGRAM

Prepared by:

Canada North Environmental Services
Saskatoon, Saskatchewan

Prepared for:

Cameco Corporation
Saskatoon, Saskatchewan

*Project No. 4150*

November 2023

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# 1.0 INTRODUCTION

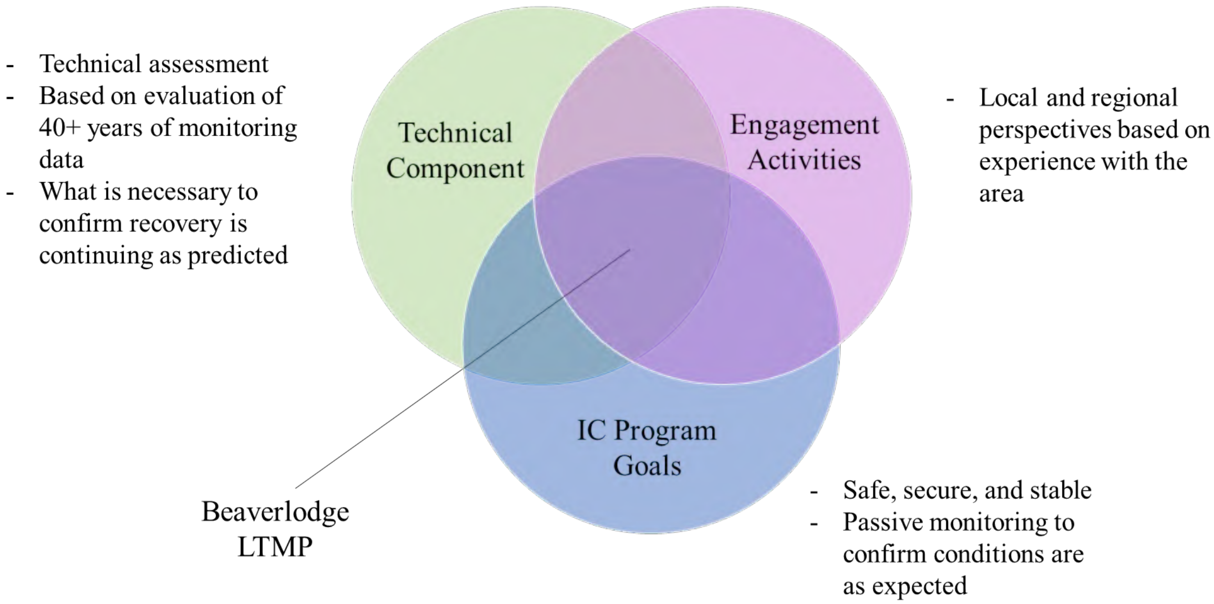
The Beaverlodge Environmental Monitoring Program (EMP) provides the core environmental monitoring requirements for the decommissioned Beaverlodge Mine Site. Once all the decommissioned Beaverlodge properties have been accepted into the Province of Saskatchewan's Institutional Control (IC) Program the EMP is expected to evolve into a Long-Term Monitoring Program (LTMP), which will be implemented at the discretion of Saskatchewan Ministry of Energy and Resources (SkMER).

The goal of managing the decommissioned Beaverlodge properties in transition phase monitoring has been to ensure the properties and areas downstream of the properties are meeting the objectives of being physically and radiologically safe, secure and stable. All physical activities related to the Beaverlodge properties have been completed and the properties are being proposed for transfer to the IC Program, to monitor natural recovery.

The LTMP will be used to confirm that those objectives continue to be assessed once the properties have entered the IC Program. In developing the Beaverlodge LTMP, multiple objectives and perspectives were incorporated. The technical evaluation builds off over 40 years of environmental monitoring and considers how monitoring can evaluate long-term trends while supporting the Saskatchewan Health Authority (SHA) in managing the Healthy Fish Consumption Guideline. Community engagement activities brought various stakeholders together to inform components of the LTMP including sample frequency and location. The expectation that long-term management of the properties under the jurisdiction of SkMER (within the IC Program) should be passive in nature, also informed program design. Together, these aspects were considered in the development of the Beaverlodge LTMP.

As shown below in Figure 1.1, the Beaverlodge LTMP is informed by inputs from a technical evaluation, engagement activities, as well as the goals of the IC Program. The following sections detail the technical evaluation; a summary of themes voiced during engagement activities with Uranium City community members, other communities in the Athabasca basin, the Northern Saskatchewan Environmental Quality Committee, and regulatory agencies; and the proposed LTMP which draws on these aspects.

**Figure 1.1 Inputs to the Beaverlodge LTMP**




## 1.1 IC Program

The Province of Saskatchewan's IC Program was implemented by the Government of Saskatchewan as part of the promulgation of the *Reclaimed Industrial Sites Act* and associated regulations in March 2007. The purpose is to establish a formal process for transferring decommissioned mining and milling properties to provincial responsibility once remediation has been completed and a period of monitoring has shown the properties to be safe, secure, and stable. Funding for the long-term monitoring and maintenance of properties transferred to the IC Program are provided by the former site holder.

The development of a long-term monitoring program for the site (the focus of this report) is necessary to determine how much funding the site holder needs to provide for the Monitoring and Maintenance Fund. As properties accepted into the IC Program will have met the criteria of being safe, secure, and stable, at that point, a passive environmental monitoring program is sufficient to ensure contaminant levels are as expected.

## 2.0 TECHNICAL EVALUATION

This section details the technical evaluation completed to support development of a program to monitor long-term trends in surface water and fish quality after all the Beaverlodge properties have been released to the IC Program. The objectives of the evaluation are to define monitoring that would confirm long-term water trends continue to recover as expected and provide information to support the eventual removal of the healthy fish consumption guideline and drinking water advisories. The aim is to inform a sampling program that reflects an understanding of the conditions in the area gathered through 40 years of data collected from the site. Focusing solely on the technical components and objectives, the potential program consists of surface water and fish programs as presented below in Table 2.1.

**Table 2.1 Technical evaluation to support the Beaverlodge LTMP**

| Sampling program component and locations | Objective | Proposed frequency | Comments |
|---|---|---|---|
| **Surface Water** | | | |
| Ace Creek Watershed (AN-5, DB-6, AC-6A, AC-14) | Confirm that trends in water quality are recovering, consistent with the understanding in the 2020 ERA | Every 5 years initially | Opportunity to decrease frequency after 15 years |
| Fulton Creek Watershed (TL-3, TL-4, TL-7, TL-9) | | | |
| Beaverlodge Lake and Downstream (BL-5, ML-1, CS-1, CS-2) | | | |
| **Fish** | | | |
| Beaverlodge, Martin, and Cinch Lakes | Support the removal of the healthy fish consumption guideline | Every 20 years | Discontinue after healthy fish consumption guideline removed for Beaverlodge, Martin, and Cinch lakes |

Sediment quality and benthic invertebrate community composition change slowly over time while exhibiting high location-to-location variability within a given waterbody. In addition, the current understanding is that, without a substantial additional load to the environment, sediment quality and benthic invertebrate community are expected to continue to recover slowly over time. There is a long history of water quality data collected from the area that has demonstrated that water is the leading indicator for environmental recovery. Extensive watershed modelling has incorporated these monitoring results, and has assessed and predicted water quality in the Ace Creek watershed, Fulton Creek Watershed, Beaverlodge Lake, and downstream through the Crackingstone River. For these reasons surface water is the best indicator of overall aquatic environment recovery. As a result, sediment and benthic invertebrate monitoring are not required as part of LTMP to meet program objectives.

## 2.1 Surface Water

Sampling locations considered for the surface water evaluation are presented below in Figure 2.1 and the sampling frequency is detailed below in Figure 2.2. This evaluation reflects the understanding of future behaviour based on water and sediment predictions developed as part of the 2020 Beaverlodge ERA (CanNorth 2020) and aims to ensure the predictions remain valid.

To meet program objectives, surface water sampling could initially occur every 5 years within the Ace Creek Watershed, Fulton Creek Watershed, Beaverlodge Lake, and farther downstream. As detailed in Figure 2.2, there would be potential to reduce surface water sampling frequency for each location to once every 10 years after 15 years of more frequent sampling if recovery continues to generally be in line with the predicted bounds (i.e., general trends are within the performance indicators established for the location).

The key components of the LTMP (frequency, timing of sample collection, locations, evaluation of results, duration) are discussed in the following text with additional information provided in appendices.

Recovery of the immediate and downstream areas is predicted to be a long process; in this context sampling frequencies ranging from every 5 to every 10 years are short. Some example figures showing program sampling frequency compared to predicted recovery are shown in APPENDIX B.

Historical surface water data was examined to determine the time of year which would best capture seasonality of water quality changes and be most reflective of annual average levels. Considering the results of this analysis as well as number of other important factors (such as water flow and safety considerations), June was determined to be the ideal timeframe for collecting surface water samples associated with this program. This analysis is presented in APPENDIX B to this report.

Consideration was given to discontinuing stations that do not provide a useful indicator of the performance of the Beaverlodge properties. As indicated in Figure 2.1, several locations that are part of the Beaverlodge EMP could be discontinued under this LTMP. These include:

- Upstream station AN-3 is discontinued as part of this long-term program. Measured levels at this station are consistently low.

- Stations TL-6, BL-3, and BL-4 are not included in the LTMP as no Performance Indicators were developed for these stations and stations downstream of these locations will continue to be monitored to ensure recovery is occurring as predicted.

- Monitoring at station AC-8 (the outlet of Ace Lake) will be discontinued as part of this program as measured levels in Ace Lake are consistently at or below SEQGs and have been since 2012.

While no Performance Indicators were developed for ML-1, CS-1, or CS-2, these stations could be monitored within the LTMP to continue to evaluate natural recovery in the downstream environment. The LTMP would include ongoing monitoring at all locations (either within the waterbody or immediately downstream) with a water or fish consumption guideline (PHU and SkMOE 2016) currently in place.

Measured selenium, uranium, and radium-226 levels from the surface water program would be compared to the developed Performance Indicators to ensure recovery is progressing as predicted. Contingency for potential additional investigation if measured levels are above the upper PI bound are discussed in APPENDIX A to this report. The PI bounds were developed using predicted annual averages for comparison to measured annual averages; for this reason single measurements may be outside of the bounds periodically due to extreme conditions (drought, flooding, etc.).

The following are the criteria that could be employed for reducing surface water monitoring at various locations under this program:

- If established performance indicators are being met after 15 years of monitoring the upstream exposure locations within the Beaverlodge Tailings Management Area within Fulton Creek (i.e., TL-3, TL-4, and TL-7) could also be discontinued from the regular monitoring program and ongoing recovery of the system could be monitored at the outlet of Greer Lake (i.e., TL-9).

- Surface water sampling at stations ML-1, CS-1, and CS-2 can be discontinued at the discretion of the province.
- Sampling at the remaining stations can be discontinued when measured levels of selenium, uranium, and radium-226 at that location are consistently (2 consecutive measurements) below SEQGs.

The assessment identified a process for evaluating the recovery of surface water for the Decommissioned Beaverlodge properties under the IC Program. The structure of the developed program is similar to the surface water program for the Cluff Lake Mine Site, which is currently in the process of being transferred to the IC Program (the Canadian Nuclear Safety Commission [CNSC] licence for the Cluff Lake Project was revoked in May of 2023[1]).

[1] Record of Decision: https://www.nuclearsafety.gc.ca/eng/the-commission/pdf/Decision-Orano-CluffLake-23-H8-e.pdf

**Figure 2.1 Summary of technical evaluation Beaverlodge LTMP surface water sampling locations**

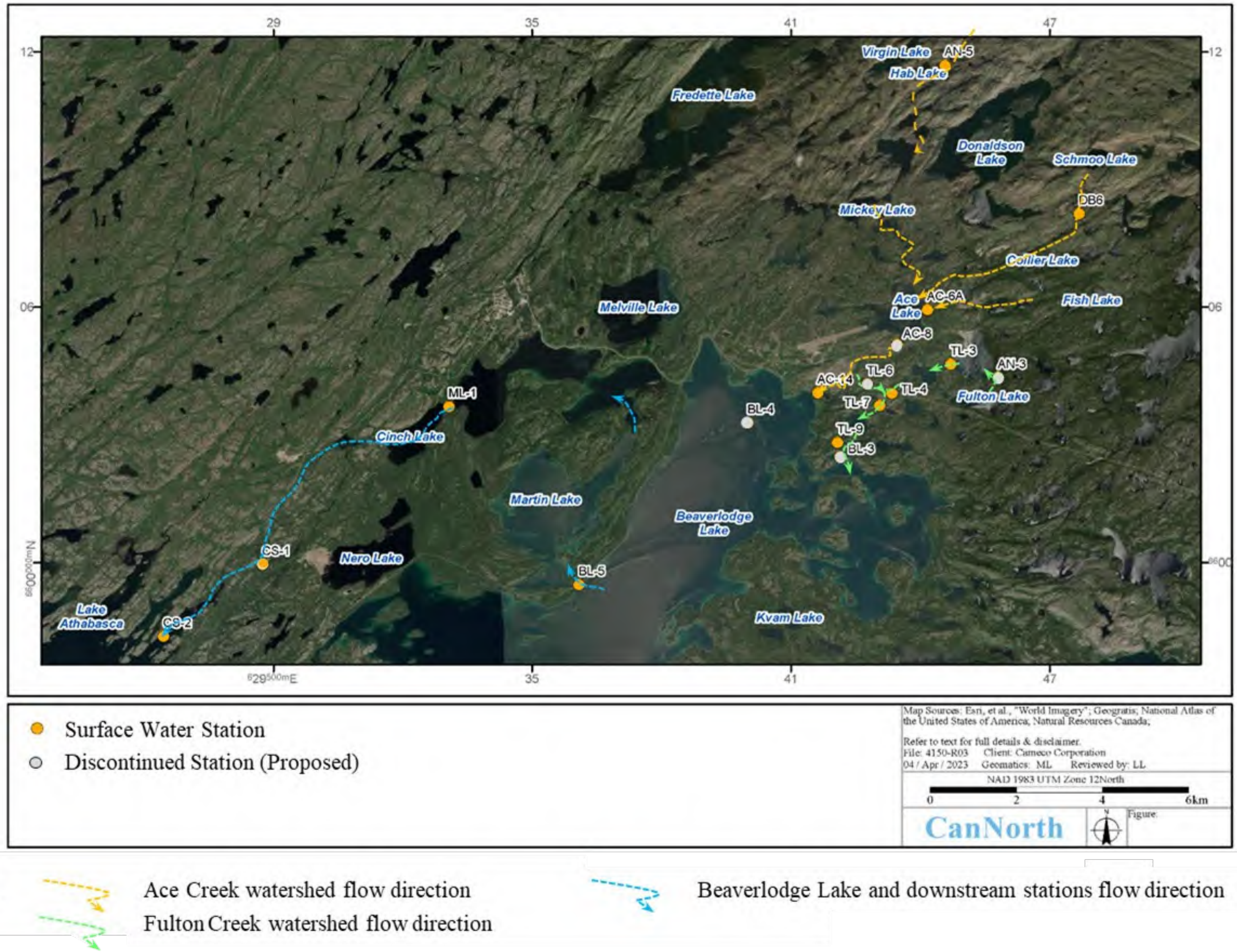
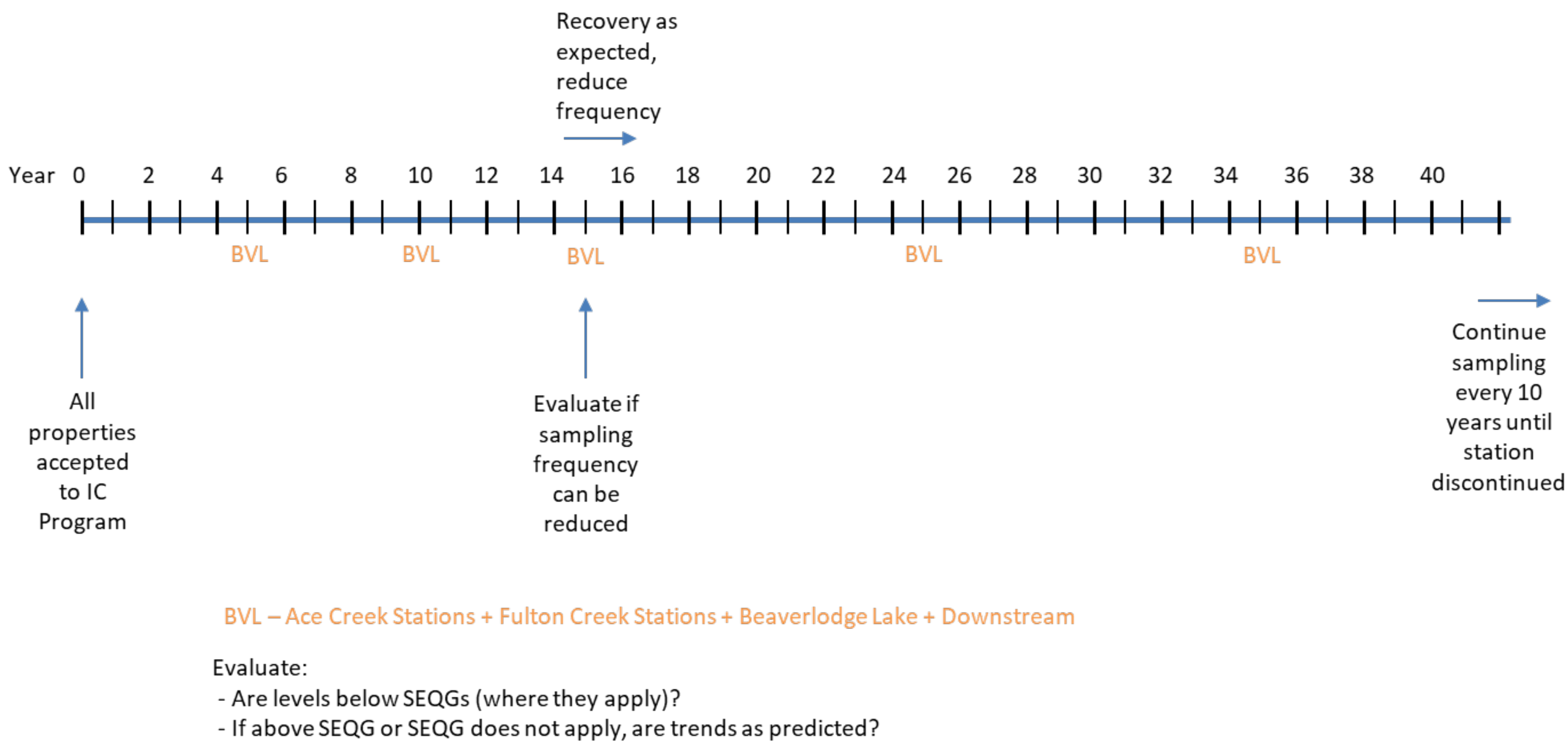


**Figure 2.2 Summary of technical evaluation Beaverlodge LTMP surface water sampling frequency**



## 2.2 Fish Chemistry

The purpose of the long-term fish sampling program is to evaluate long-term trends for the purposes of determining when the fish consumption guideline currently in place for Beaverlodge Martin, and Cinch lakes (PHU and SkMOE 2016) can be updated and eventually removed. A 20-year interval with some potential triggers for more frequent sampling is defensible considering that fish tissue selenium concentration recovery will occur slowly over time as shown with the historical data (APPENDIX C).

In addition, fish surveys are destructive in nature requiring numerous fish samples and so it is preferable for infrequent campaigns to preserve natural fish populations. For example, the fish program conducted in the Beaverlodge area in 2017 collected 100 fish for analysis; this program is similar in size to the IC Program fish campaign (5 waterbodies, two species in each location).

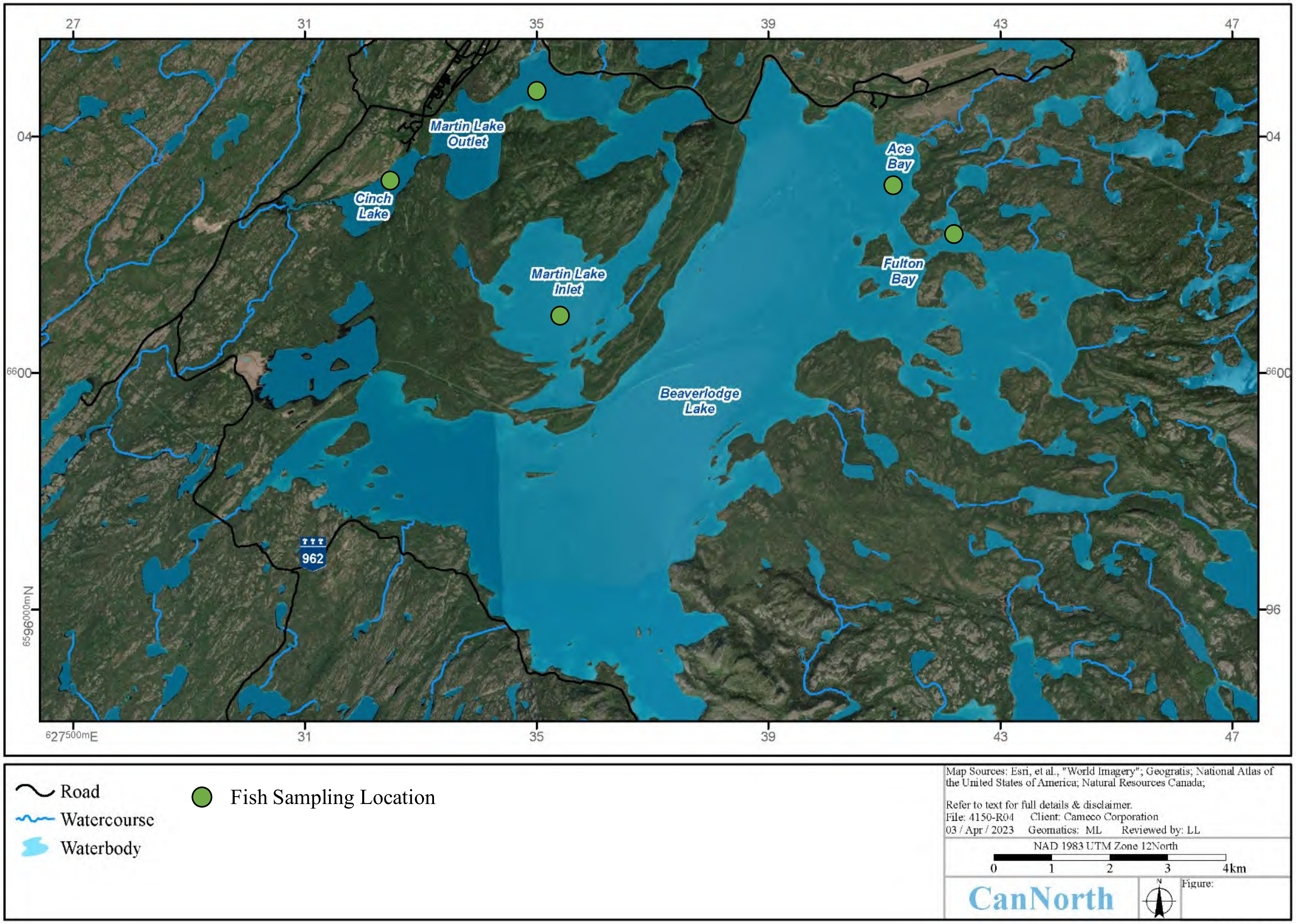
To support program objectives, locations that could be included in the Beaverlodge fish sampling program are indicated below in Figure 2.3 and include three locations in Beaverlodge Lake, locations in the north and south basins of Martin Lake, and within Cinch Lake; these locations are in line with historically sampled areas and cover all areas that currently have a fish consumption guideline in place.

A possible trigger for additional fish sampling between the regular 20-year sampling interval is if the Medical Health Officer or designate has reason to believe there is a good chance the healthy fish consumption guideline could be removed based on measured selenium levels in surface water (Beaverlodge, Martin, and Cinch lakes) or availability of new science/information which changes the understanding of long-term selenium toxicity.

The fish sampling program would be discontinued when the healthy fish consumption guideline is removed in Beaverlodge, Martin, and Cinch lakes.

To support the 20-year sampling interval, a fish sampling program was conducted in the fall of 2023 to update the baseline inventory for Beaverlodge Lake, Martin Lake, and Cinch Lake. The scope of the program was reviewed by the SHA to ensure program objectives would assist in the monitoring and removal of the healthy fish consumption guideline in the future.

**Figure 2.3 Summary of technical evaluation Beaverlodge LTMP fish monitoring locations**



## 3.0 ENGAGEMENT ACTIVITIES

In addition to the technical evaluation (presented above in Section 2.0), various engagement activities were conducted to obtain input from members of rights-bearing First Nation and Métis communities in the Athabasca Basin, residents and/or former residents of Uranium City, northern stakeholder organizations, and provincial and federal regulatory agencies on what they view as a reasonable long-term monitoring program based on their personal experience with these areas and the IC Program. The following sub-sections summarize these activities and the overall themes that were noted.

### 3.1 June 2023 Workshop

To help inform development of the LTMP, Cameco hosted an in-person workshop in Saskatoon in June 2023 to exchange information about the status of Beaverlodge and invite feedback from various stakeholders on specific aspects of the program. An overview of the workshop design and findings related to the water and fish sampling components are provided here.

Workshop design considered the need to balance information sharing, opportunities for questions and clarification, and collection of input and insights on specific areas of the LTMP. The early morning agenda featured an opening presentation from Cameco to provide an overview of the long history of environmental monitoring of the Beaverlodge area. Having set the stage with this information, the purpose of the late morning/afternoon workshop was to invite stakeholder input on specific topic areas for monitoring – primarily water and fish but also other topics of interest to stakeholders, including areas beyond the current scope of the Beaverlodge monitoring program.

Participants were divided into five (5) discussion groups. Groupings were pre-selected to support balanced representation. Facilitated by an external consultant, workshop activities included a series of mapping activities and discussion questions. Cameco employees supported the workshop by being on-hand to greet participants, deliver presentations, answer questions, and serve as facilitators and note-takers for the small group discussions.

Participants included rights-bearing First Nation and Métis communities in the Athabasca Basin, residents and/or former residents of Uranium City, northern stakeholder organizations, provincial and federal regulatory agencies, and Cameco staff. In addition to 11 Cameco staff, 27 people participated in the workshop consisting of 8 people from local communities (Uranium City, Camsell Portage, Fond du Lac, Black Lake, or Stony Rapids), 9 participants from the Ya'thi Néné Land and Resource Office, 3 participants from the Athabasca Joint Engagement and Environment Sub-committee, 1 participant from the Northern Saskatchewan Environmental Quality Committee, 2 representatives from the Canadian Nuclear Safety Commission, 3 personnel from the SkMER, and 1 person from the Saskatchewan Ministry of the Environment.

### 3.1.1 Surface Water and Fish Discussion

To collect input on preferences for water and fish monitoring in the LTMP, participants were asked questions with their table groups and marked their preferred areas for monitoring on maps of the Beaverlodge area. Facilitators kept the discussions going and encouraged participation by all group members. Feedback was captured on flipcharts; this feedback is summarized within the following sub-sections.

#### 3.1.1.1 Surface Water Sampling Program Feedback

Common themes from engagement activities related to the surface water component of the LTMP are discussed below.

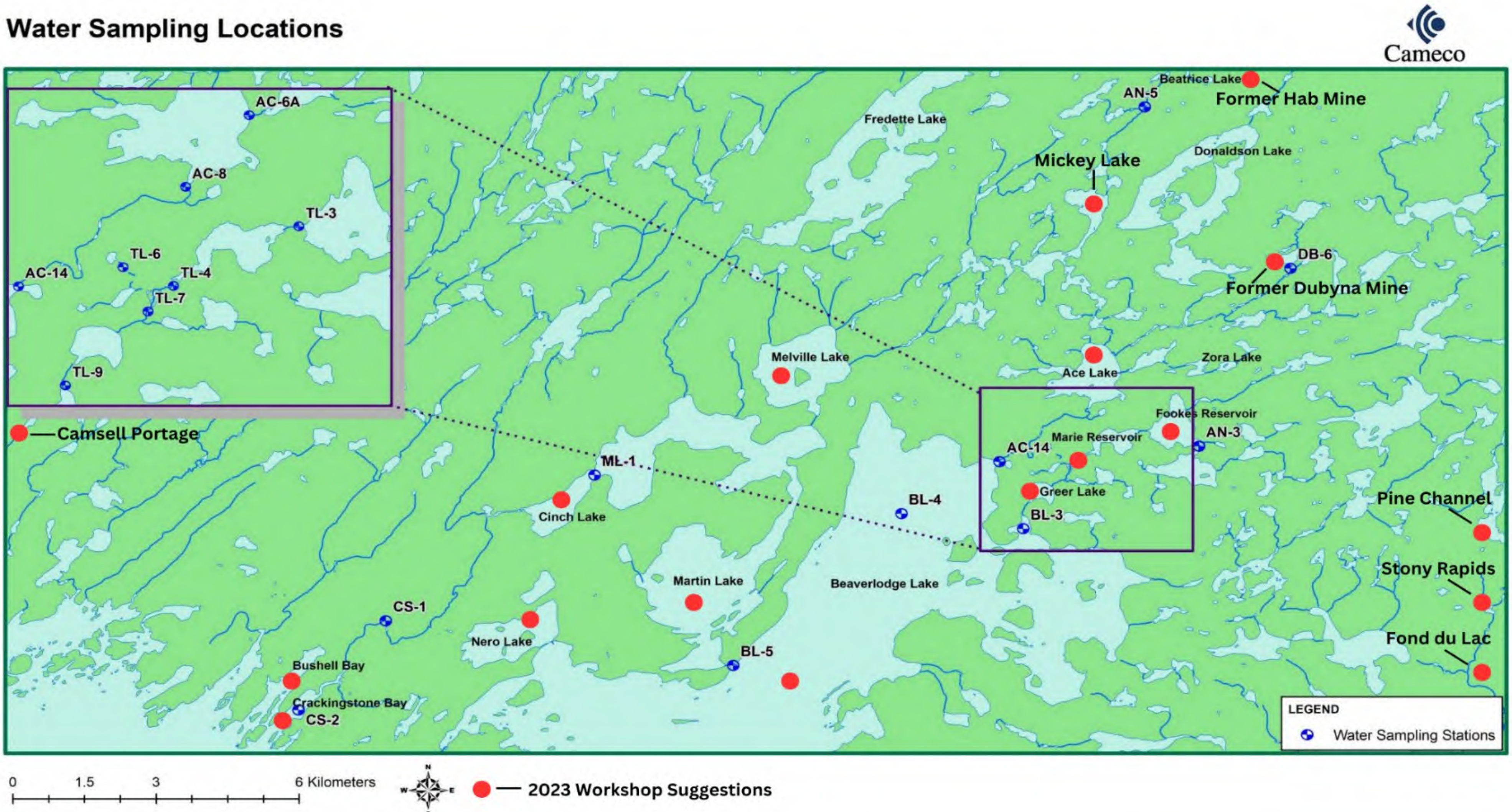
A common topic of conversation was the desire for additional communication to community residents on the monitoring process. This included information such as the collection procedure, how often samples were collected, and what the sample results were.

There was some general discussion about how decisions about future monitoring frequency would be made.

Participants identified many locations where they wanted water to be monitored (see Figure 3.1); not all were associated with the Beaverlodge properties. “Along the shoreline of communities” stood out as an important monitoring location, regardless of water body. Identified areas or waterbodies associated with the immediate or downstream Beaverlodge area included Crackingstone Bay, Dubyna, Greer Lake, Ace Lake, Beaverlodge Lake, Bolger, Cinch Lake, Fookes, Hab, Martin Lake, and Mickey Lake. Areas or waterbodies identified which are not influenced by the Beaverlodge properties include Fond du Lac, Bushell Bay, Camsell Portage, Melville Lake, Nero Lake, Pine Channel, and Stony Rapids.

While there was interest in monitoring water seasonally, the suggested frequency for monitoring ranged from every few months to every few years.

**Figure 3.1 Summary of June 2023 Workshop surface water sampling location suggestions**



#### 3.1.1.2 Fish Sampling Program Feedback

Common themes from engagement activities related to the fish component of the LTMP are discussed below.

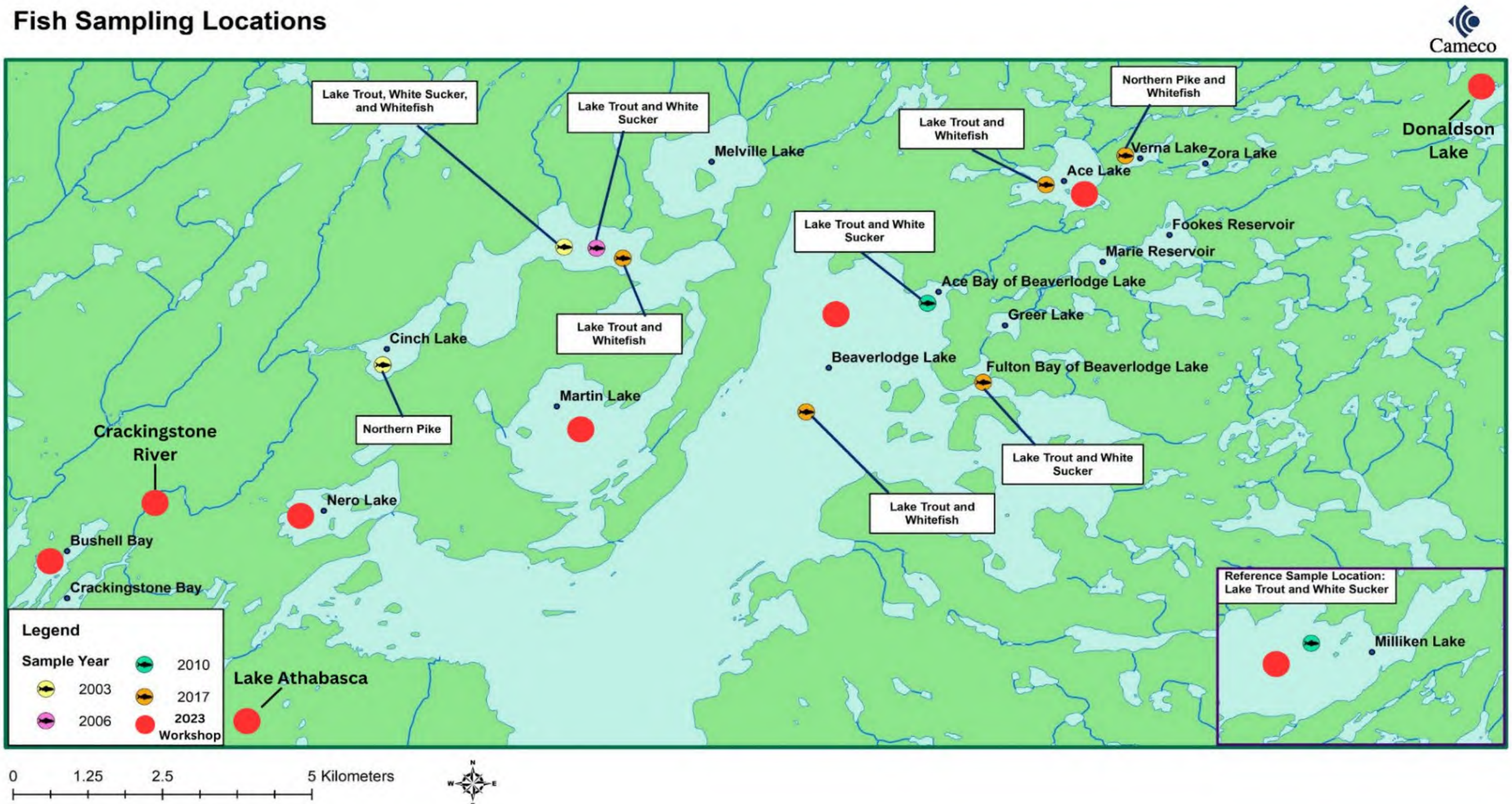
As with the surface water, participants voiced a desire to share even more information with community members about when and where monitoring is happening as well as the results.

The suggested frequency for fish monitoring ranged from annually to every five years, with some suggesting monitoring should be adjusted depending on the results. Waterbodies of interest (shown in Figure 3.2) included some relevant to the Beaverlodge properties (Ace Lake, Beaverlodge Lake, Martin Lake, Crackingstone River) as well as Bushell Bay, Donaldson Lake, Milliken Lake, Lake Athabasca, and Nero Lake.

There was interest in performing a fish study on the lakes that are the subject of the Healthy Fish Consumption Guideline before the properties are all accepted into the IC Program to develop a baseline to compare future sampling to.

Participants indicated the most interest in monitoring pike, lake trout, lake whitefish, sucker, and pickerel. There was general interest in testing what people are actually eating.

**Figure 3.2 Summary of June 2023 Workshop fish quality sampling location suggestions**



#### 3.1.1.3 Insights and Recommendations

A key takeaway from workshop discussions is that Cameco should consider feedback from the workshop along with the results of decades of environmental studies to develop a LTMP that considers both technical recommendations for monitoring locations and frequency with input and concerns raised during engagement opportunities.

Cameco should continue to provide engagement opportunities to keep participants informed about the status of the LTMP until the Beaverlodge properties are accepted into the IC Program and the Provincial Government should continue engagement on the LTMP once the properties are transferred to the IC Program.

During the workshop, it was noted that it would be beneficial to establish a baseline for fish monitoring on the lakes that are the subject of the Healthy Fish Consumption Guideline to evaluate evolution of fish tissue levels moving forward.

## 3.2 Additional Engagement

To obtain additional community feedback related to the development of the draft LTMP, Cameco conducted engagement activities to solicit additional information from various organizations. The engagement included in-person sessions, virtual sessions, and community meetings and is discussed further below.

### 3.2.1 Métis Nation- Saskatchewan

The Métis Nation-Saskatchewan (MN-S) Director of Environment and Northern Region 1 Director attended a meeting on August 1 at the Cameco office in Saskatoon. Representatives from Cameco included the Lead Reclamation Specialist, Beaverlodge; Manager of Environment and Licensing; Environmental Specialist; Manager of Community and Indigenous Relations; and Indigenous Engagement Specialist.

Cameco representatives provided an overview of the Beaverlodge properties (as shown below in Figure 3.3) including a historical summary of the Beaverlodge properties from operation through decommissioning and an overview of the transition phase monitoring. Cameco then presented details of recent engagement activities; past and current activities involving geotechnical inspections; how general inspections are completed and involvement of the regulatory agencies in those inspections; water and fish monitoring completed on and downstream of the Beaverlodge properties; and community-based monitoring programs in the region. The 2021 virtual tour of the Beaverlodge properties was shared as well to provide additional background regarding the Beaverlodge properties and the work that has been completed.

Also included in the discussion was the need for the development of a plan for monitoring under IC Program, including the development of a field inspection guide, in addition to water and fish monitoring programs.

No questions or comments were put forward regarding the development or implementation of the draft LTMP during the August 1 meeting.

Following the meeting on August 1, an additional information session was held with the Métis Local President from Uranium City and MN-S Director of Environment on August 31, 2023 in Saskatoon. Representatives from Cameco included the Lead Reclamation Specialist, Beaverlodge; Manager of Environment and Licensing; Environmental Specialist; Manager of Community and Indigenous Relations; and Indigenous Engagement Specialist. This session was intended to further discuss the Beaverlodge properties and obtain input to assist in the development of the long-term monitoring program.

During the session, a presentation was provided regarding the background of the current environmental monitoring program to facilitate discussion regarding the development of a long-term monitoring program. MN-S representatives were provided maps depicting the various lakes and Beaverlodge properties, and input was solicited with respect to what sample locations, frequency, and media should be included in a long-term monitoring program. In addition, information regarding the location of potential road closures and the location of warning signs to be maintained under the IC Program were also discussed. An example of the map used in this engagement exercise is provided as Figure 3.4, at the end of this section.

Feedback from this meeting aligned with the suggested monitoring frequency and locations noted during the June 2023 Workshop (discussed above). It was noted that an additional sign could be placed along the road on the shore of Beaverlodge Lake providing details of the healthy fish consumption guideline in the languages spoken in the area.

### 3.2.2 Athabasca Chipewyan First Nation

Representatives from the Athabasca Chipewyan First Nation (ACFN) participated in a virtual information session with Cameco representatives on August 31, 2023. Representatives attending the meeting included staff from the Dene Lands and Resource

Management (DRLM) and Elders from ACFN. Representatives from Cameco included the Lead Reclamation Specialist, Beaverlodge; Manager of Environment and Licensing; Environmental Specialist; Manager of Community and Indigenous relations; and Indigenous Engagement Specialist.

The purpose of the session was to continue building a relationship and to seek valuable insights that would assist in developing the long-term monitoring program.

Cameco provided an overview related to the Beaverlodge Site (as presented below in Figure 3.3) layout as well as past and current activities, which included general inspections, geotechnical inspections, the Beaverlodge Environmental Monitoring Program, and historical fish sampling campaigns. Cameco also discussed the transition to the IC Program, input, and next steps. Maps were provided depicting current and historical sampling locations, including both fish and water sampling programs, similar to the detail shown in Figure 3.1 and Figure 3.2.

Information was sought with respect to what ACFN members felt should be considered when developing a long-term monitoring program in the Beaverlodge area. Representatives from Cameco responded to a variety of questions from ACFN representatives on a variety of topics including program objectives, fish mortalities associated with sampling programs, and community-based monitoring in the region.

During the session, ACFN representatives also noted there would be value in conducting a fish sampling campaign in the fall of 2023 to establish baseline conditions in Beaverlodge Lake, Martin Lake and Cinch Lake to assist in managing the Beaverlodge Healthy Fish Consumption Guideline.

No other questions or comments were raised with respect to the LTMP at that time.

Following the August information session, Cameco reached out to provide an opportunity for ACFN to host interviews with a small number of ACFN community members, with the same materials that were shared at the workshop hosted by Cameco in June. The objectives of the interviews were to:

1. Provide ACFN community members with high-level information about current fish and water monitoring; and

2. Identify areas where ACFN members would like monitoring to take place as part of the Beaverlodge LTMP

Cameco provided the same list of questions in an effort to determine what ACFN members wanted to see in a long-term monitoring program related to the Beaverlodge properties and areas downstream. Cameco provide funding for ACFN to hire a consultant to facilitate gathering this information and prepare a report. Cameco received the report from ACFN in November 2023. Respondents reviewed the existing fish sampling and water quality locations, and provided insight as to where monitoring should take place downstream of the properties. Specifically, respondents noted that Beaverlodge Lake, Martin Lake, Cinch Lake, Crackingstone River, Crackingstone Bay and Lake Athabasca were all priority areas for fish and water monitoring. Respondents also suggested that fish should be monitored at Beaverlodge Lake (Pickerel, Suckers, and Whitefish), Martin Lake (Pickerel and Whitefish), Nero Lake, Cinch Lake, Goldfields, Crackingstone River/Crackingstone Bay (Trout, Pike, and Grayling), Milliken Lake, Tazin Lake, areas near the former Gunnar Mine, and locations within Lake Athabasca (Trout, Pike, Pickerel, Whitefish, and Mariah).

### 3.2.3 Uranium City Community

On September 11 and 12, 2023, Cameco, the CNSC, Saskatchewan Ministry of the Environment (SkMOE), and SkMER hosted a regulatory update in Uranium City to discuss the final set of Beaverlodge properties to be released from CNSC licensing and transferred to the IC Program. In addition, Cameco provided an update regarding the development of the LTMP, which would be implemented once the properties have entered the IC Program. Attendees over the two meetings included residents from Uranium City, representatives from MN-S, ACFN, the Northern Saskatchewan Environmental Quality Committee (NSEQC), Fond du Lac Denesųłine First Nation, and the Ya'thi Néné Land and Resource Office.

During the LTMP development update, it was shared how the program was developed, including both the technical assessment and engagement activities completed to date, and how that information was used to establish the frequency and locations for water and fish sampling. Existing monitoring programs in the vicinity of Uranium City, including the Eastern Athabasca Regional Monitoring Program and the Community-based Environmental Monitoring Program, were also discussed.

The proposed LTMP frequency was presented to community members, detailing that water sampling was proposed to take place every 3 years, with fish sampling every 10 years. A question was posed regarding sample frequency, and Cameco responded noting the properties would only be accepted into the IC Program once the performance objectives have been met, including the site being stable. Further, it was noted that more than 40 years of environmental monitoring have indicated that five years would be an acceptable frequency to monitor the trends in water quality, but Cameco has adjusted the frequency to every three years based on feedback received during engagement activities.

In addition, a question was posed as to how the three-year monitoring frequency was determined. Cameco responded by speaking to the objectives of the program, how monitoring has demonstrated water quality remains stable and is anticipated to remain stable over the long-term.

Questions were also raised related to sediment monitoring, and the potential to include this aspect in the LTMP. Cameco responded by noting that sediment monitoring has been completed in the region, which has informed the monitoring being proposed. It was also noted there is a long history of water quality data collected from the area that has demonstrated that water is the leading indicator for environmental recovery which is why sediment was not included in the LTMP.

One participant raised a question related to the seasonality analysis that supported the proposed sampling program. Cameco responded by providing an overview of how seasonality was considered in the LTMP, including environmental and safety aspects.

No other comments or questions were raised with respect to fish or water quality monitoring.

Land users were encouraged to provide feedback following the meeting regarding the locations where signs should be placed to ensure people are aware of the history of mining in the area as well as potential road closures on the Beaverlodge properties, based on their current and future land use. Numerous residents stayed after the meetings to discuss their land use and how potential road closures may, or will not, impact their land use. The information that was shared modified the original proposed road closure locations. Based on these targeted discussions, the new planned locations for road closures will have minimal effect on land users' ability to access the land for harvesting activities. The map that was used in this engagement activity is provided below in Figure 3.4.

### 3.2.4 Ya'thi Néné Land and Resource Office

The Ya'thi Néné Land and Resource Office Executive Director, Environmental Specialist, and Uranium City Community Land Technician attended a meeting on October 13 at the

Cameco office in Saskatoon. Representatives from Cameco included the Lead Reclamation Specialist, Beaverlodge; Manager of Environment and Licensing; Environmental Specialist; Manager of Community and Indigenous Relations; and Indigenous Engagement Specialist. This meeting provided an additional opportunity for Cameco and the Ya'thi Néné Land and Resource Office to discuss the development of the LTMP and monitoring expectations, in follow up to the September 11 meeting in Uranium City.

Cameco provided an overview of the considerations that went into developing the LTMP. Discussion points included the sample locations and frequency of water quality monitoring as well as fish monitoring. Additional information was provided regarding the planned road closures and the locations of signs indicating the Healthy Fish Consumption Advisory, issued by SHA and maintained by SkMOE. The LTMP frequency, as presented to community members, details that water sampling is to take place every 3 years initially, with fish sampling every 10 years. Feedback was received regarding communication and the use of maps and figures to assist in explaining how the LTMP will work moving forward. There was also a question about how much the seasonality impacts the water quality monitoring results. It was clarified that seasonality is generally minor and that a sample taken in spring vs fall would not affect whether a guideline was being met or not.

There were no concerns raised with respect to the proposed sample frequency or locations.

The Community Land Technician from Uranium City also shared that a sign for the Healthy Fish Consumption Guideline should be posted between where Beaverlodge Lake and Lake Athabasca meet for the winter road. It would notify anyone coming onto Beaverlodge Lake by ice road of the guideline. As well, it was suggested that a sign at Bushell Bay would notify people who are accessing the community by boat. It was also noted that there should be a sign posted at Cinch Lake because land users access the area by both boat and snow machine.

**Figure 3.3 Overview of Beaverlodge area Institutional Control inspection areas**

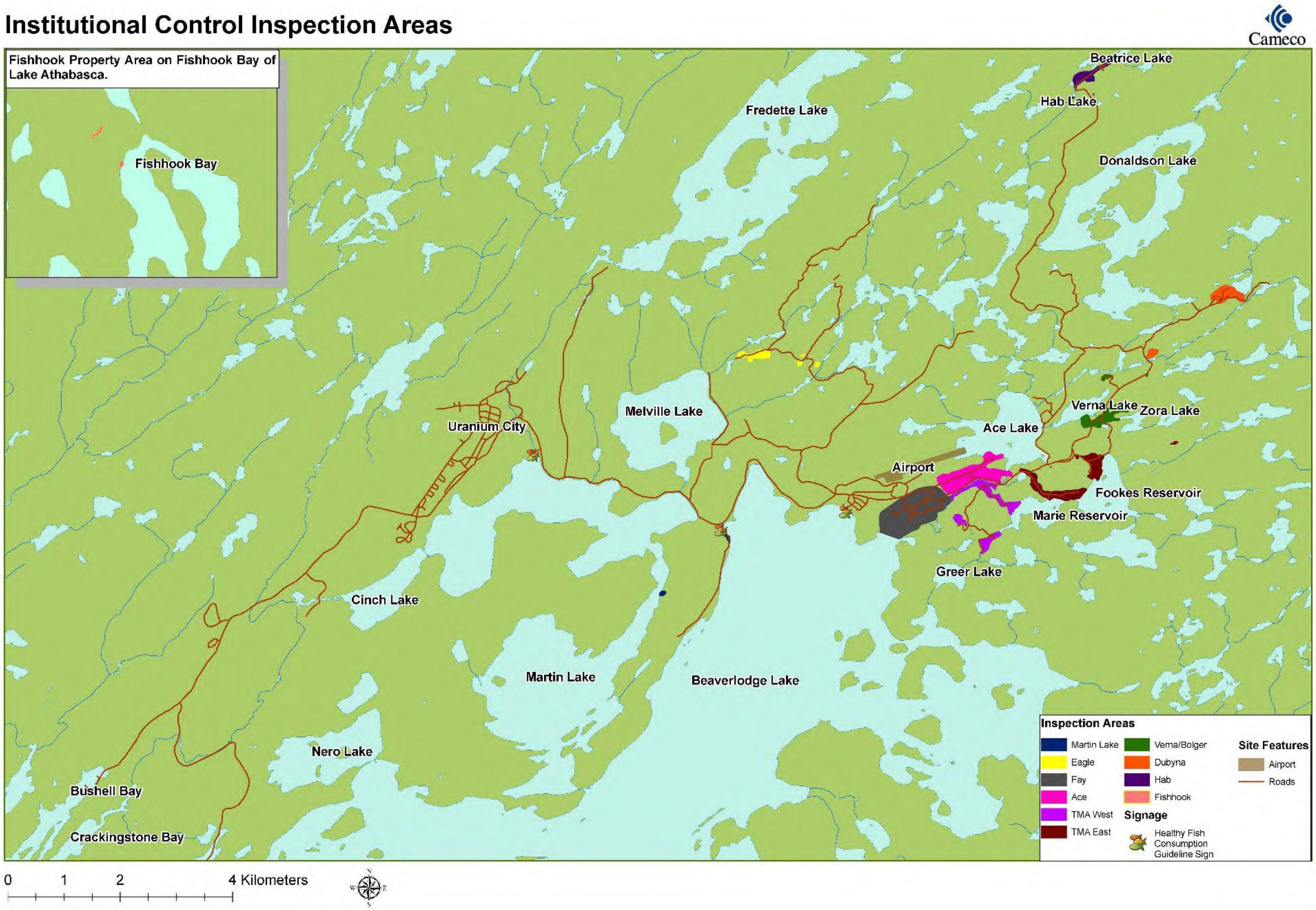
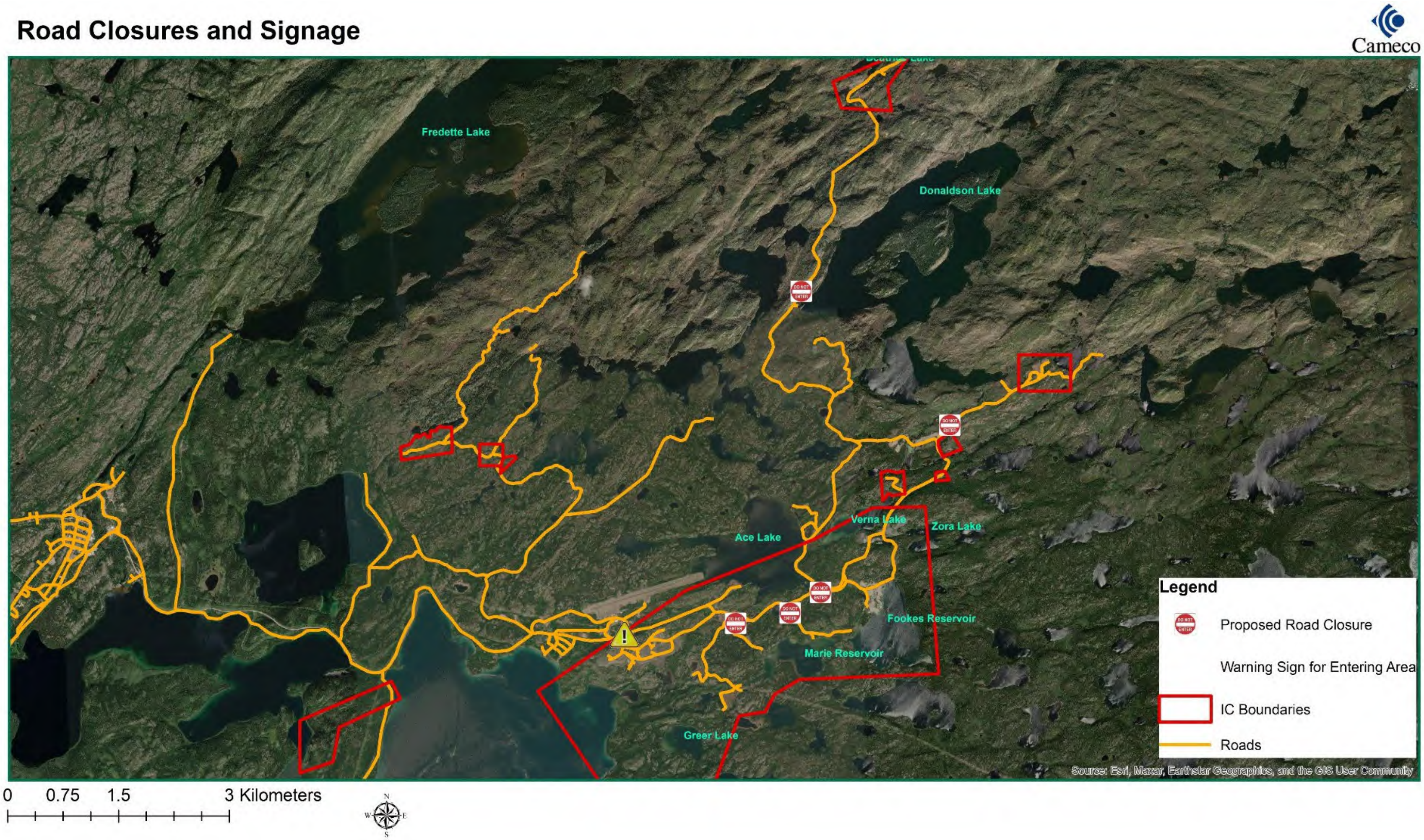


**Figure 3.4 Overview of Beaverlodge area road closures and signage**



# 4.0 BEAVERLODGE LTMP

As discussed above, the Beaverlodge LTMP for implementation once all Beaverlodge properties have been accepted into the IC Program draws from the technical evaluation, community input, and goals of the IC Program. Details of the selected surface water and fish sampling programs under the Beaverlodge LTMP are presented and further discussed below.

## 4.1 Surface Water Sampling Program

A surface water sampling frequency of every 3 years was selected for the Beaverlodge LTMP (as indicated below in Table 4.1); this is based on a 5 year sampling frequency presented within the technical evaluation and in consideration of a range of seasonal to every 5 years suggested by community members during engagement activities. The selected 3 year frequency is in line with the IC Program goals of ensuring environmental conditions remain stable and the area is recovering as expected through a passive sampling program.

**Table 4.1 Beaverlodge LTMP surface water locations and frequency**

| Surface Water Locations | Objective | Frequency |
|---|---|---|
| Ace Creek Watershed (AN-5, DB-6, AC-6A, AC-14) | Confirm that trends in water quality are recovering, consistent with the understanding in the 2020 ERA | Every 3 years initially [b] |
| Fulton Creek Watershed (TL-3, TL-4, TL-7, TL-9) [a] | | |
| Beaverlodge Lake and Downstream (BL-5, ML-1, CS-1, CS-2) | | |

Notes:

a Drop upstream Fulton Creek Watershed stations (i.e., TL-3, TL-4, and TL-7) after 15 years if recovering as predicted.

b Proposed program frequency consistent with the surface water program proposed for the Cluff Lake Mine Site for management within the IC Program.

A graduated approach, similar to the program proposed in the technical evaluation (Section 2.1), is selected for the Beaverlodge LTMP. Under this program, the surface water sampling frequency can be reduced after 15 years of monitoring (to every 5 years) and then further reduced after another 15 years of monitoring (to every 10 years) if recovery continues to occur as expected. Monitoring can be discontinued once SEQG are being met for Se, U, Ra-226 during 2 consecutive sampling events. This graduated approach and the selected sampling frequencies are in line with the proposed surface water sampling for the Decommissioned Cluff Lake Mine Site proposed for transfer to the IC Program.

The contingency plan developed as part of the technical evaluation for implementation if unexpected surface water results are encountered (presented in APPENDIX A) is adopted as part of the Beaverlodge LTMP.

The identified areas of interest within the engagement activities are all either captured by the monitoring stations proposed in the technical evaluation or are areas not influenced by the Decommissioned Beaverlodge Mine Site. Therefore, the surface water stations identified in Section 2.0 were selected as the monitoring network for the Beaverlodge LTMP.

As discussed in the technical evaluation outlined in Section 2.0, upstream stations within the Fulton Creek Watershed (i.e., TL-3, TL-4, and TL-7) can be discontinued after the initial period (after 15 years of monitoring every 3 years) if recovery is occurring as predicted, as ongoing recovery of the system will continue to be monitored at the outlet of the watershed at TL-9 in Greer Lake.

### 4.2 Fish Quality Sampling Program

A fish sampling frequency of every 10 years was selected based on the results of the technical evaluation (20 years), discussions with the SHA, and suggestions from engagement activities ranging from "often" to every 5 years. As discussed above in Section 2.0, recovery of selenium levels in fish flesh is expected to be an extremely lengthy process and there is likely little potential benefit of monitoring fish tissue chemistry more often.

The identified areas of interest within the engagement activities are all either captured by the monitoring stations proposed in the technical evaluation or are areas not influenced by the Decommissioned Beaverlodge Mine Site. Therefore, the waterbodies identified for fish monitoring in Section 2.0 were selected for the Beaverlodge LTMP.

The species of fish to be collected from the three waterbodies are largely consistent with previous campaigns and are presented below in Table 4.1. These species were selected based on community input, fish availability in each waterbody, and to monitor recovery of piscivorous species (i.e., lake trout and northern pike) as well as those with benthic diets (i.e., white sucker and lake whitefish).

While some other fish species were noted as being of interest during the June 2023 workshop and during subsequent engagement activities, these species were not selected for inclusion in the fish program as recovery of these species is expected to mirror the recovery of included fish with similar diets.

**Table 4.2 Fish species to be sampled by location**

| Location | Fish species |
|---|---|
| Beaverlodge Lake | White Sucker, Lake Whitefish, and Lake Trout |
| Martin Lake | White Sucker, Lake Whitefish, and Lake Trout |
| Cinch Lake | Northern Pike |

During the engagement activities, participants indicated some interest in monitoring fish chemistry related to fish species and locations that are currently consumed. The purpose of the fish component of the Beaverlodge LTMP is to identify when the healthy fish consumption guideline can be removed from the three waterbodies it pertains to (i.e., Beaverlodge, Martin, and Cinch lakes) and therefore sampling is focused on these waterbodies. Previous studies have established preferred sampling locations within these waterbodies. As in the past, fish monitoring programs in Martin Lake should split fish capture effort between the north and south basins of the lake, while sampling in Beaverlodge Lake should focus on capturing fish from Ace Bay and Fulton Bay as much as possible.

Another idea captured during the June 2023 workshop was that it would be useful to perform a complete fish study to serve as baseline for fish sampling moving forward under the Beaverlodge LTMP. Cameco took this recommendation under advisement and completed a fish chemistry baseline program for Beaverlodge, Martin, and Cinch lakes in the fall of 2023. The information collected from that program will update the current understanding of selenium in fish flesh and provide the baseline for the review and eventual removal of the healthy fish consumption guideline in the various locations.

### 4.3 Summary of the Beaverlodge LTMP

A summary of the Beaverlodge LTMP, for implementation when all Beaverlodge properties have been accepted into the IC Program, is shown below in Table 4.2 and Figure 4.1 with sampling locations indicated in Figure 4.2 and Figure 4.3.

This program is based on input from a technical evaluation, engagement activities, as well as considering the overall goals of the IC Program.

**Table 4.3 Summary of the Beaverlodge LTMP monitoring frequencies**

<table>
<tr><th>Sampling program component and Locations</th><th>Objective</th><th>Frequency</th><th>Comments</th></tr>
<tr><td colspan="4">Surface Water</td></tr>
<tr><td>Ace Creek Watershed (AN-5, DB-6, AC-6A, AC-14)</td><td rowspan="3">Confirm that the trends in water quality are recovering, consistent with the understanding in the 2020 ERA</td><td rowspan="3">Every 3 years initially [b]</td><td rowspan="3">Opportunity to decrease frequency after 15 years to sampling every 5 years. [b]<br>Opportunity to decrease frequency after another 15 years to sampling every 10 years. [b]</td></tr>
<tr><td>Fulton Creek Watershed (TL-3, TL-4, TL-7, TL-9) [a]</td></tr>
<tr><td>Beaverlodge Lake and Downstream (BL-5, ML-1, CS-1, CS-2)</td></tr>
<tr><td colspan="4">Fish</td></tr>
<tr><td>Beaverlodge, Martin, and Cinch Lakes</td><td>Support the removal of the healthy fish consumption guideline</td><td>Every 10 years</td><td>Discontinue after healthy fish consumption guideline removed for Beaverlodge, Martin, and Cinch lakes</td></tr>
</table>

Notes:

a Drop upstream Fulton Creek Watershed stations (i.e., TL-3, TL-4, and TL-7) after 15 years if recovering as predicted.

b Proposed program frequency consistent with the surface water program proposed for the Cluff Lake Mine Site for management within the IC Program.

**Figure 4.1 Summary of the Beaverlodge LTMP surface water sampling frequency**

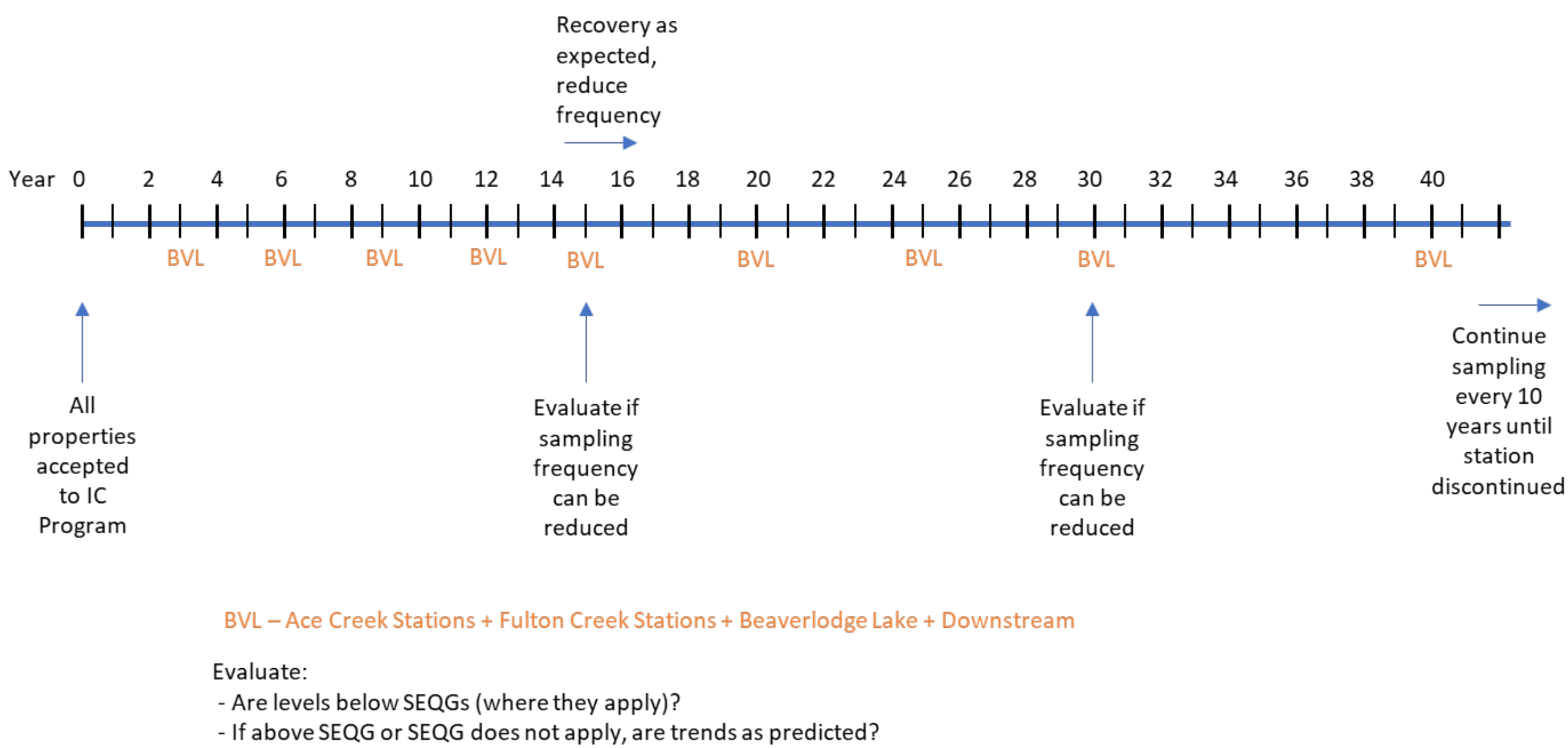


**Figure 4.2 Summary of the Beaverlodge LTMP surface water sampling locations**

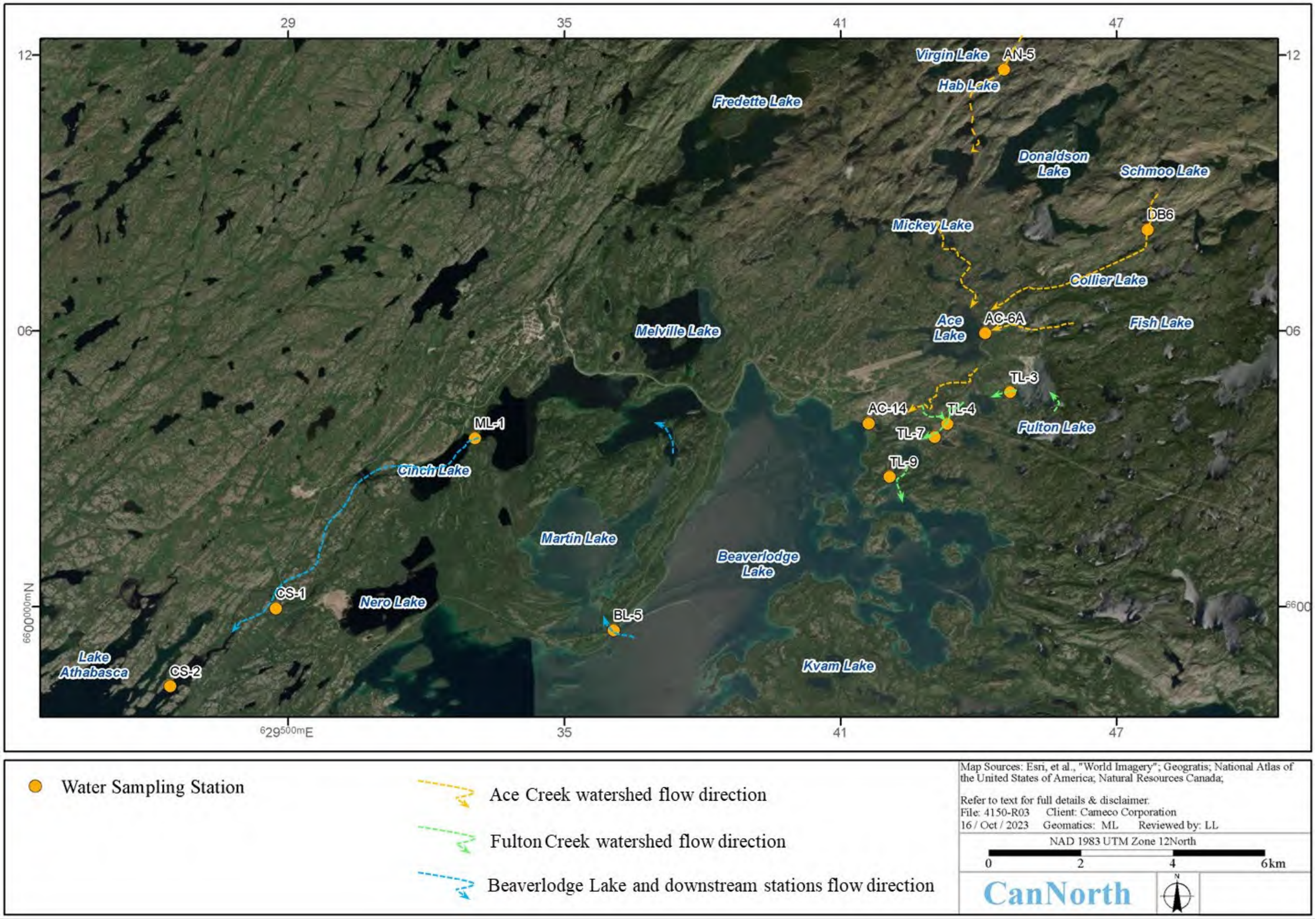
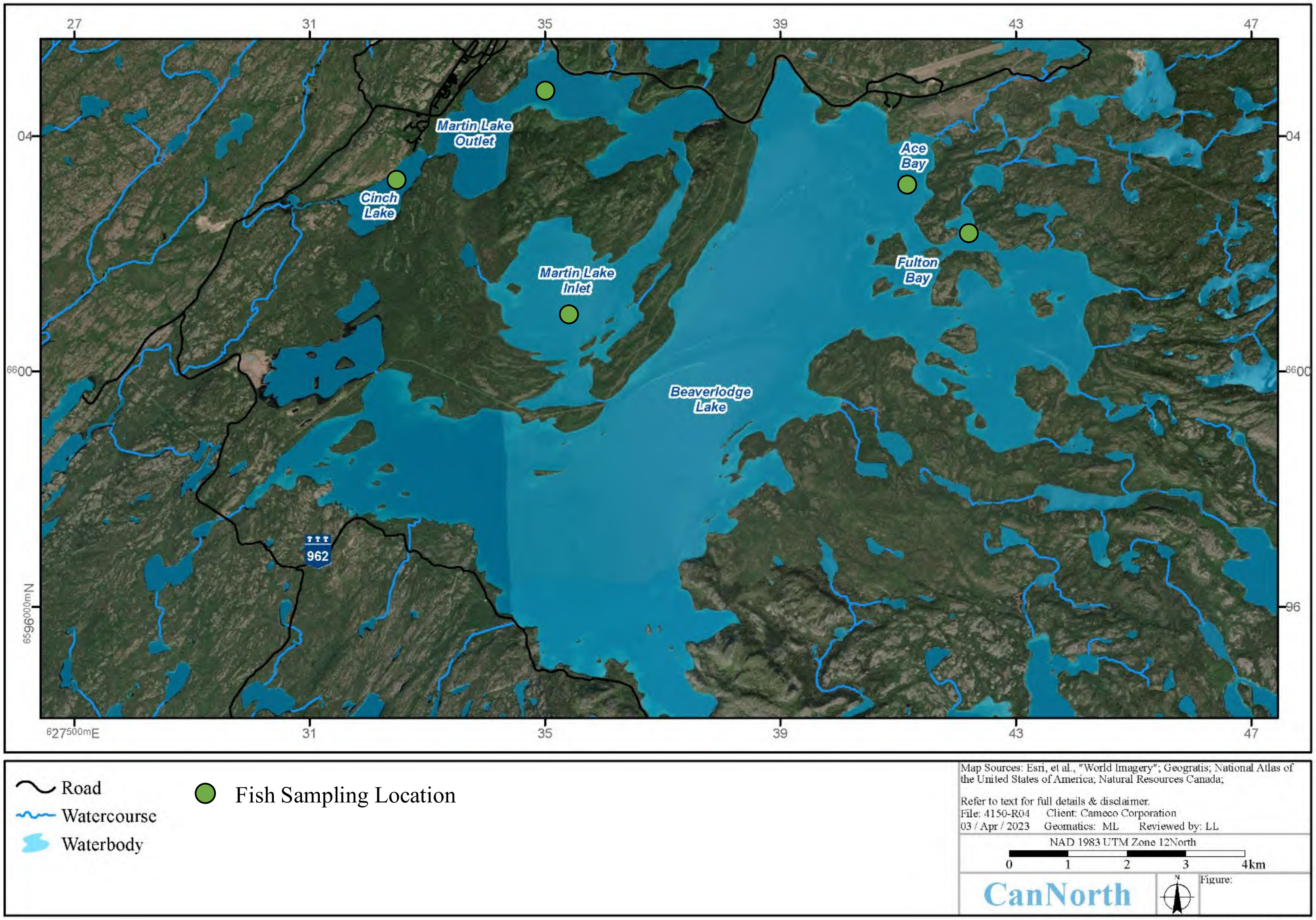


**Figure 4.3 Summary of the Beaverlodge LTMP fish sampling locations**



## 5.0 REFERENCES

CanNorth. 2020. Decommissioned Beaverlodge mine site: model update and environmental risk assessment. Prepared for Cameco Corporation.

PHU and SkMOE. 2016. Healthy Fish Consumption Guideline. Updated September 2016.

Saskatchewan Ministry of Energy and Resources. 2018. Post Closure Management of Decommissioned Mine/Mill Properties Located on Crown Land in Saskatchewan (Institutional Control Program). December.

# APPENDICES

# LIST OF APPENDICES

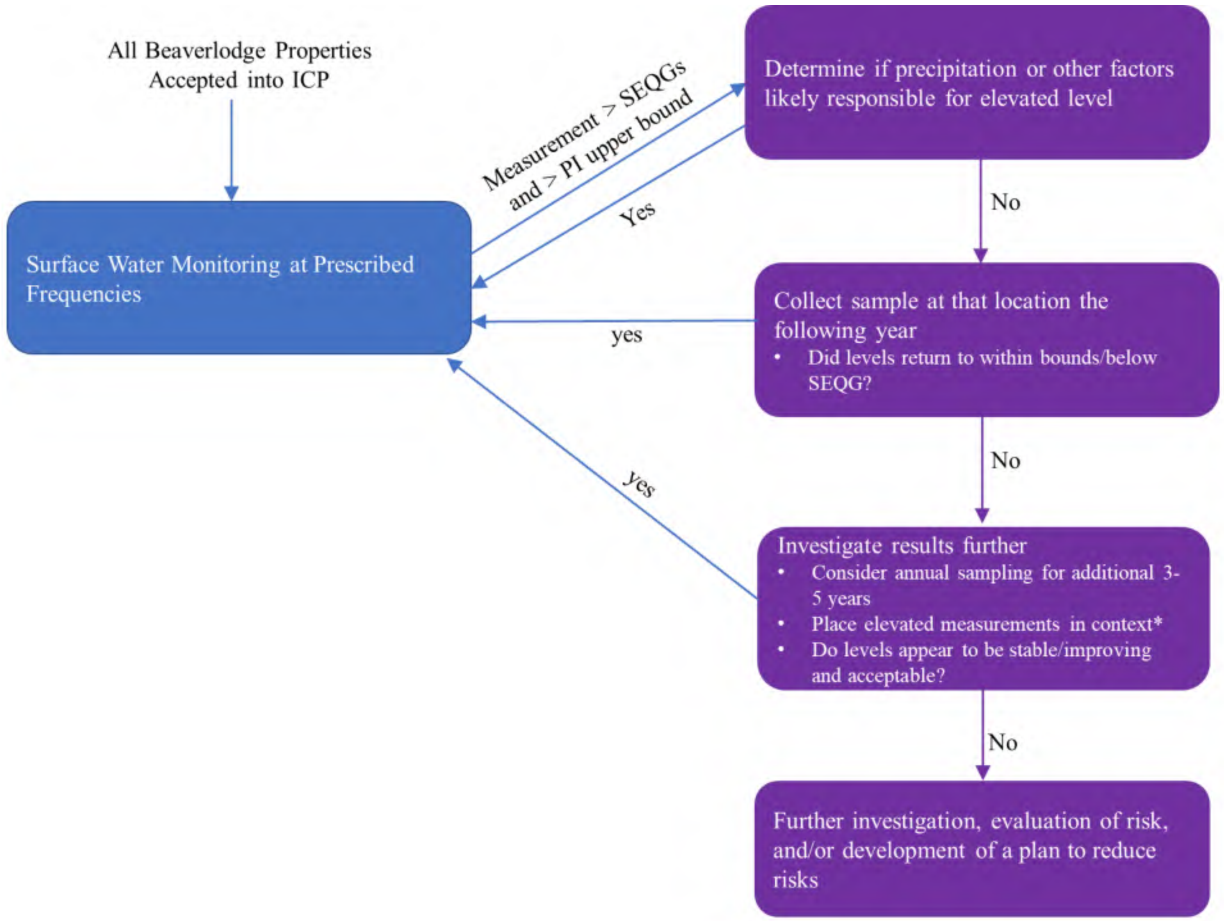
## APPENDIX A: TECHNICAL EVLAUATION SURFACE WATER SAMPLING PROGRAM CONTINGENCY PLAN

To meet program objectives, measured selenium, uranium, and radium-226 levels from the surface water program would be compared to the developed Performance Indicators to ensure recovery is progressing as predicted. Since the PI bounds were developed using predicted annual averages, single measurements will be outside of the bounds some fraction of the time, while the comparisons should be made to the overall predicted trends. If a measured level is above the developed Performance Indicator upper bound, the following framework is proposed to investigate further:

- Look to see if precipitation in the period before sampling was outside of normal or if there are other factors (e.g., beaver activity) that could explain the elevated levels.
    - Some professional judgment may be required when interpreting the data. This includes consideration for climate and physical changes as well as detection limits, extent of the exceedance, and spatial considerations (e.g., only one station in a watershed or multiple).
    - If elevated levels are explained by precipitation or other factors, no additional sampling is needed, continue sampling at the stipulated frequency.
- If elevated levels are not explained by precipitation or other factors, collect another sample from the station the following year to see if levels have returned to be consistent with expectations.
    - If the additional sampling is consistent with expectations (i.e., below SEQG, or below the PI upper bound), continue sampling at the stipulated frequency.
- If measured levels continue to deviate from predictions, investigate results further. This could include continuing annual sampling for an additional 3-5 years; placing elevated levels in context relative to range of observed variability and/or predicted levels for the waterbody; and evaluating if levels are stable/improving and acceptable.
    - If levels/risks are unreasonable conduct further investigation, evaluation of risk, and/or development of plan to reduce risks.

This framework is similar to the contingency in place for the decommissioned Cluff Lake Mine Site in the ICP and is detailed below in Figure A.1.

**Figure A.1 Summary of Proposed Beaverlodge ICP Long-term Monitoring Plan Surface Water component, evaluation of monitoring data**




*Are levels below the upper bound PI for any modelled year (risks associated with those levels were accepted)? Are levels within the range of historical variation at this location?

# APPENDIX B: TECHNICAL EVALUATION SURFACE WATER SAMPLING PROGRAM SUPPORTING INFORMATION

Additional analysis was completed in support of developing the Long-term Surface Water Sampling Program as discussed in this appendix. These lines of investigation include looking at the timescale for recovery in the context of the sampling frequency and examining surface water information to determine best time of year for sampling to occur.

## B.1 Timescale for Recovery

Figure B.1 presents surface water predictions (Performance Indicators and predicted bounds) generated as part of the 2020 Beaverlodge ERA (CanNorth 2020) for selected locations and COPCs as well as indicating surface water sampling years under the developed Long-term Surface Water Sampling Program (assuming all properties are accepted into the ICP in 2025). These plots focus on COPC/location combinations where levels are anticipated to be above the SEQG in the near term. The predicted timeline for recovery in all of these cases is long in comparison to even the longest sampling frequency (i.e., 10 year interval).

For some locations (e.g., uranium in Dubyna and Verna lakes), recovery is predicted to occur more quickly in the near-term, the higher initial sampling frequency will allow these concentration decreases to be observed more closely.

**Figure B.1 Example predicted recovery and sampling frequency**

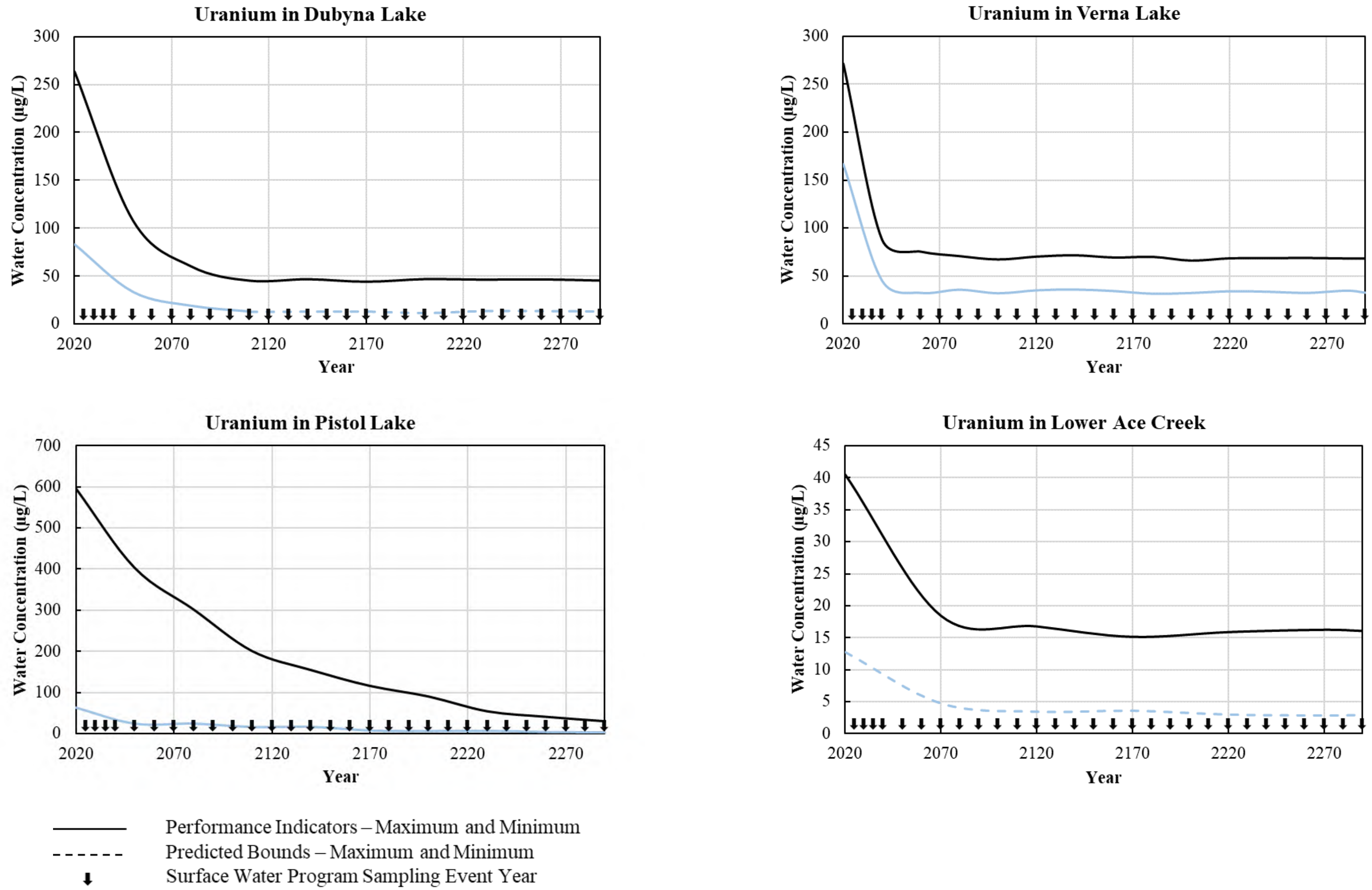


**Figure B.1 Example predicted recovery and sampling frequency (Cont'd)**

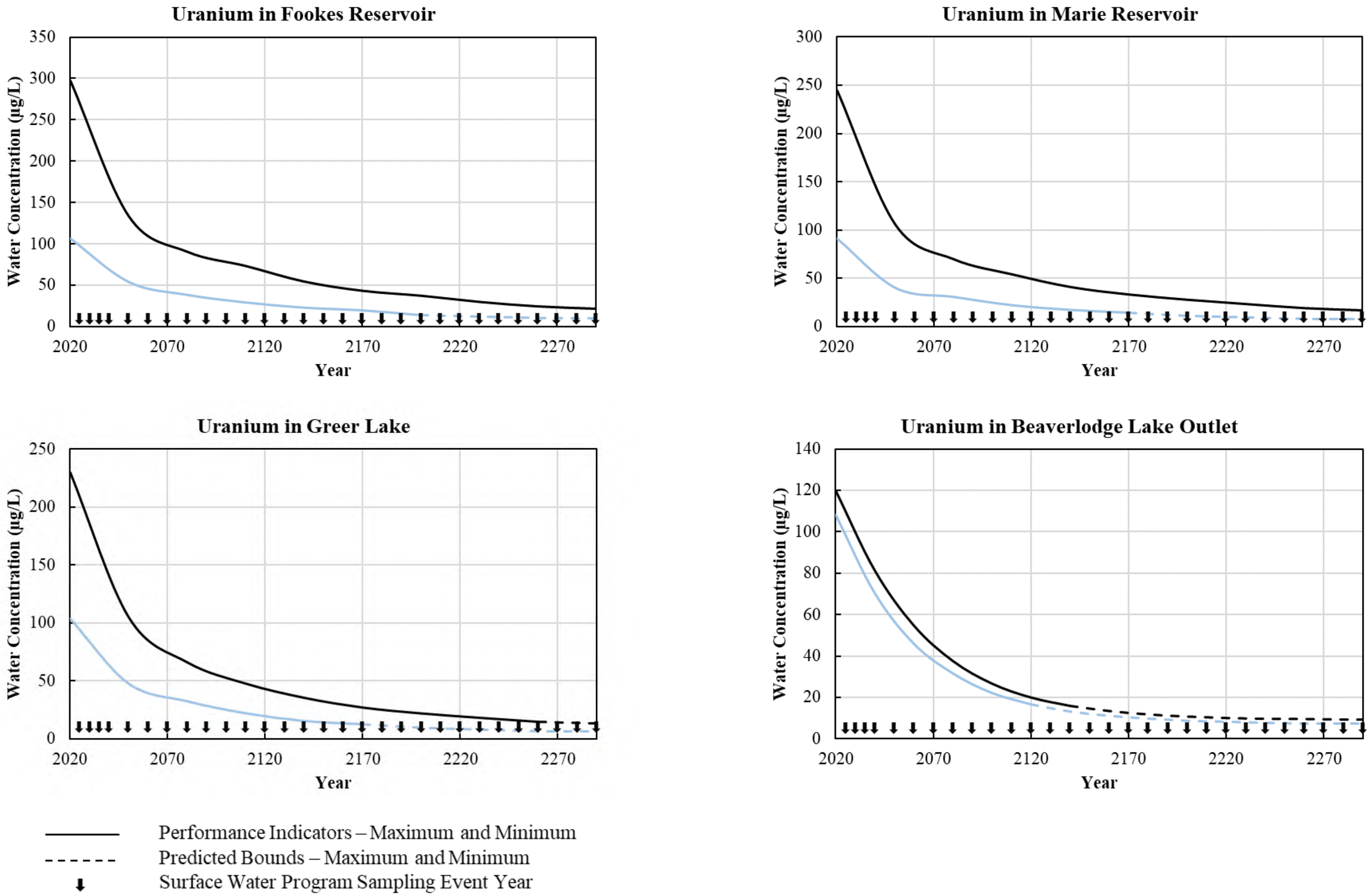


**Figure B.1 Example predicted recovery and sampling frequency (Cont'd)**

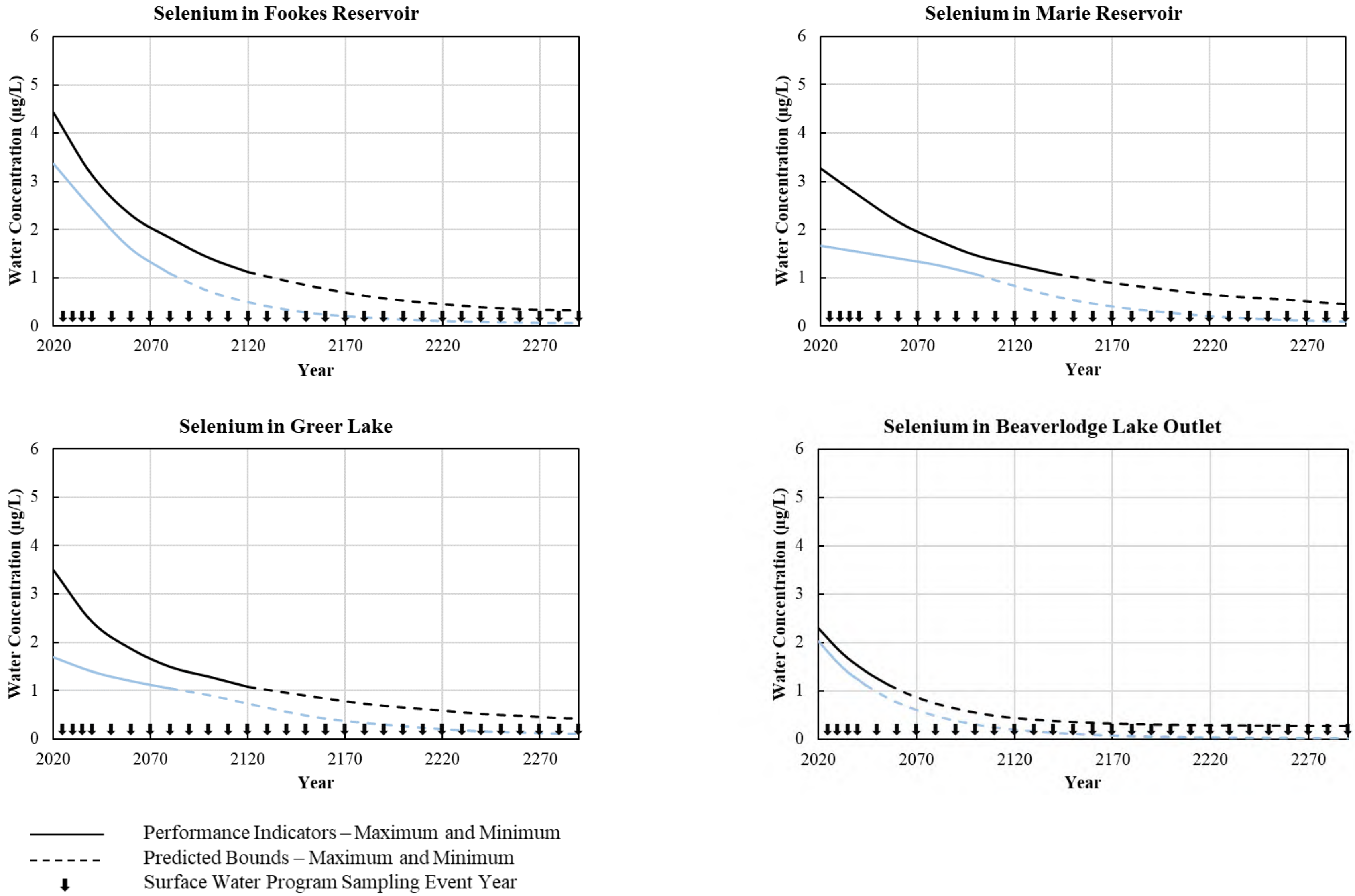
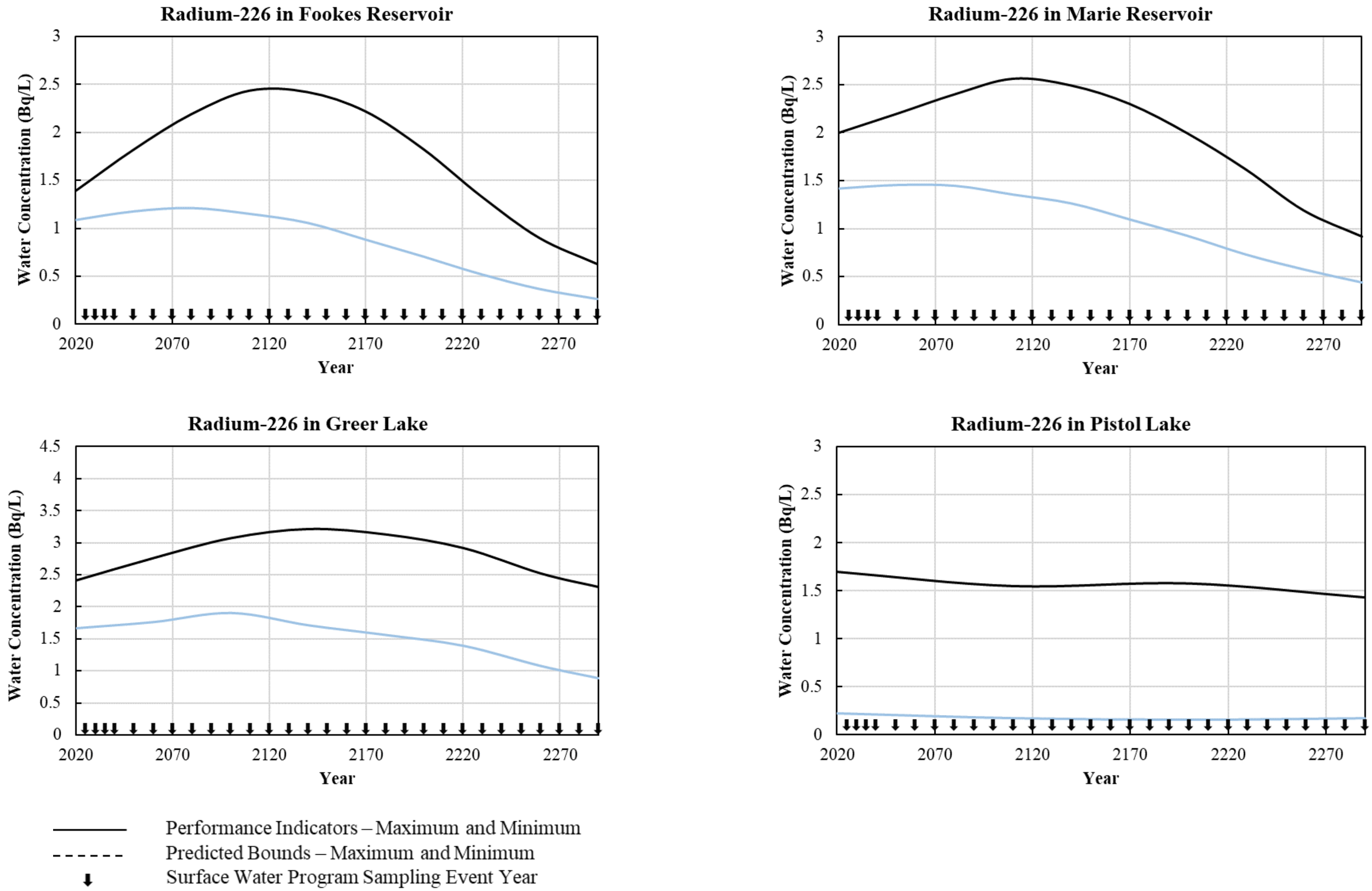


**Figure B.1 Example predicted recovery and sampling frequency (Cont'd)**



## B.2 Seasonality and Surface Water Sampling Timing

Several factors were considered in selecting the most appropriate time of year for surface water sampling to occur. These factors include:

- Which timeframe will give the best representation of annual averages.
- Safety including ice cover/accessibility.
- Flow availability.

The Performance Indicators were developed to represent annual average levels at each location. As the Long-term Surface Water Sampling Program has a single sample collected in a sample year, it is important that sampling occur in the month/season which has the highest chance of the sample representing annual levels. To determine what time of year shows the best agreement with annual average levels, historical surface water measurements were examined. This investigation considered measured selenium, uranium, and radium-226 levels from 1983 to 2022.

For this analysis March, April, and May were taken to represent spring; June, July, and August represent summer; September and October were considered fall; and November, December, and January represent winter. For each year with measured data, the percent difference between the average calculated for samples from each season were compared to the average considering all measured data for that year; this was done for selenium, uranium, and radium-226 at each monitoring station. The results of this analysis are presented below in Table B.1 and Figure B.2.

Figure B.2 presents the deviation from annual average for stations where levels were generally elevated. Extremely high seasonality is seen at the outlet of Pistol Lake (AN-5). This is not surprising as the Pistol Lake area is very small and, as such, is significantly influenced by flow (rainfall and snowmelt).

Overall seasonal deviation from annual averages were calculated for stations where levels of each parameter were generally elevated; these results are presented in Table B.1. Some stations were not included in the analysis presented in Table B.1 so that the overall trends are not overshadowed by results of stations with highly variable data; these are discussed in the table.

Looking at the analysis which considered the entire available dataset (i.e., 1983 to 2022), the data suggest summer and fall are best for radium-226 and selenium while spring and fall are best for uranium.

**Table B.1 Calculated differences between seasonal and annual averages**

| Radium-226 | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| 2018-2022 | 4% | 1% | -5% | 1% |
| 2008-2022 | -1% | 5% | -5% | 1% |
| 1983-2022 | -8% | **2%** | **1%** | 6% |

| Selenium | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| 2018-2022 | 2% | 0% | -3% | 5% |
| 2008-2022 | 5% | -2% | -2% | 2% |
| 1983-2022 | 3% | **-2%** | **-2%** | 5% |

| Uranium | Spring | Summer | Fall | Winter |
|---|---|---|---|---|
| 2018-2022 | 6% | -6% | 2% | 7% |
| 2008-2022 | 3% | -7% | 2% | 7% |
| 1983-2022 | **-2%** | -5% | **3%** | 7% |

Note: Summary of data shown in Figure B.2, however, stations AN-5 (Pistol Lake) and TL-6 (Minewater Reservoir) were not included (where relevant) due to high variability at these small waterbodies.

Considering the other factors discussed above, while flow availability would be good in the spring, accessibility would be uncertain and would need to be based on local environmental conditions each year. In contrast, there are many stations across the Decommissioned Beaverlodge Mine Site which are regularly dry with insufficient flow to collect a sample in the fall. All things considered, June was selected as the sampling window; there is reasonable agreement with annual average levels, and it has the best chance of being both ice-free and having enough flow to sample. Based on the analysis presented in Figure B.2, however, there is the potential for uranium to be underrepresented particularly in the Fulton Creek Watershed.

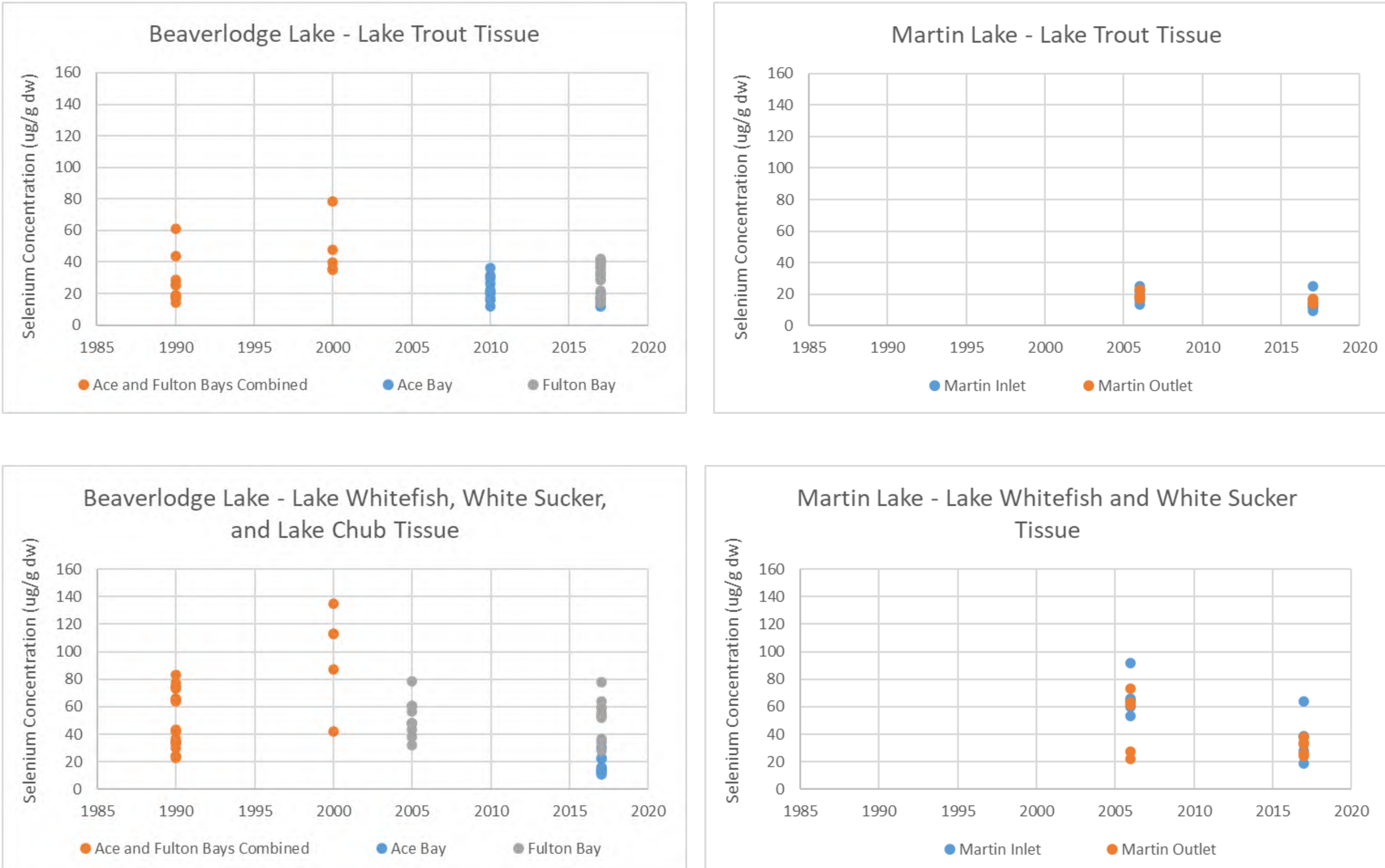
**Figure B.2 Evaluation of seasonality within historical monitoring data**

## APPENDIX C: TECHNICAL EVALUATION FISH SAMPLING PROGRAM ADDITIONAL INFORMATION

Figures C.1 and C.2 below show historical measurements of selenium in fish tissue in Beaverlodge Lake and Martin Lake both as raw data and as averages with standard deviations indicated. Results for a piscivorous species (i.e., lake trout) are shown on the top plots in each figure while species with a benthic diet are shown in the bottom plots. Available data are from 1990 through 2017.

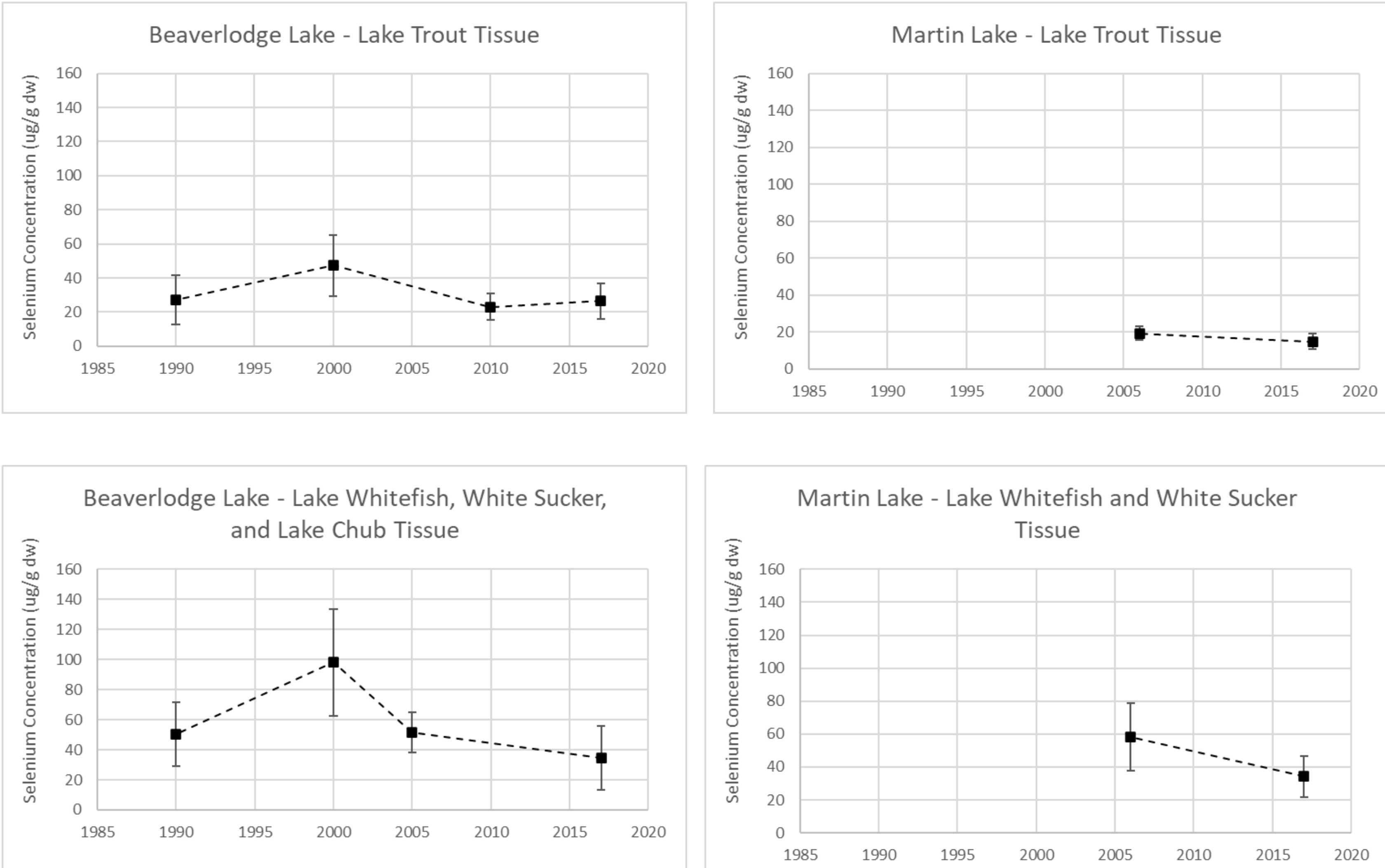
Examining measured fish tissue selenium concentrations from the Beaverlodge area for 1990 through 2017 to illustrate that recovery is occurring very slowly, particularly in Beaverlodge Lake. The proposed 20 year sampling frequency is quite short in comparison to the changes in fish concentrations. It should be noted that the exact approach for setting/removing the healthy fish consumption guideline is up to the SHA.

**Figure C.1 Beaverlodge Lake and Martin Lake Fish Tissue Data**




Note: each point represents a single fish tissue concentration

**Figure C.2 Beaverlodge Lake and Martin Lake Fish Tissue Average and Standard Deviation**




Note: data series represents average concentrations and error bars represent ± a standard deviation

# 3 Healthy Fish Consumption Guideline

POPULATION HEALTH UNIT
Northern Saskatchewan

Saskatchewan
Ministry of
Environment

# Healthy Fish
# Consumption Guideline

## People are recommended to limit fish consumption from Beaverlodge, Martin and Cinch Lakes due to elevated levels of selenium.

You can safely consume **a total of 5 servings of fish a month** on a regular basis from these lakes if you are consuming either jackfish or lake trout or 2 a month if you are consuming either lake whitefish or white sucker:

| | | | |
|---|---|---|---|
| **Lake Trout** | **5 times per month** | **White Sucker** | **2 times per month** |
| **Northern Pike** | **5 times per month** | **Lake Whitefish** | **2 times per month** |

**One serving** is defined as 220 grams and is approximately the size of an adult's hand. For children, one serving is the equivalent of the approximate size of that child's hand.

Selenium is an essential element humans need for good health but, like most elements, too much can be harmful to health.

Fish should **not be consumed** from ***Nero, Marie, Meadow, Minewater, and Greer Lakes****, and from lower* ***Ace Creek (between Ace Lake and Beaverlodge Lake)***.

Saskatchewan Ministry of Environment and the Medical Health Officer with the northern Regional Health Authorities remind people **not to drink water from the following waterbodies** as they may contain elements not eliminated by boiling: ***Beaverlodge, Fookes, Greer, Marie, Martin, Meadow, Minewater, and Nero Lakes; and lower Ace Creek***.

For further information contact Tim Moulding, Saskatchewan Ministry of Environment at 306-933-7063 or Dr. James Irvine, Medical Health Officer, at 306-425-8588.

*Updated September2016*

# 4 Letter – Application for Revocation of the Decommissioned Beaverlodge Properties Licence WFOL-W5-2120.0/2025

Cameco

February 5, 2024

**CAMECO CORPORATION**
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Malaïka Bacon-Dussault
Acting Commission Registrar
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280 Slater Street
P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9

Via Email: Malaika.Bacon-Dussault@cnsc-ccsn.gc.ca

Dear Malaïka Bacon-Dussault:

**Application for Revocation of the Decommissioned Beaverlodge Properties Licence, WFOL-W5-2120.0/2025**

Following the Canadian Nuclear Safety Commission (CNSC) approved Beaverlodge Management Framework, Cameco Corporation (Cameco) has continued to prepare decommissioned properties for transfer to the Province of Saskatchewan's Institutional Control Program (ICP). Originally, the decommissioned Beaverlodge properties (Beaverlodge) consisted of 70 individual properties.

As properties demonstrate that they meet the regulatory accepted performance objectives, Cameco has applied to have them released from CNSC licensing to facilitate their transfer to the ICP or free-released. Through this process, 43 properties have been released from CNSC licensing to date.

Cameco is now requesting a hearing of the Commission regarding the release of the final set of properties resulting in revocation of the Beaverlodge licence WFOL-W5-2120.0/2025 in accordance with Section 24(2) of the *Nuclear Safety and Control Act,* to facilitate the transfer of the final group of 27 Beaverlodge properties to the ICP.

This request is supported by the "Final Closure Report – Beaverlodge Properties URA 7, URA 1, BOLGER 1, Tailings Management Area Properties", provided to CNSC staff and the SKMOE on November 22, 2023.

The current Beaverlodge licence WFOL-W5-2120.0/2025 is valid to May 31, 2025. Revocation of the current licence is required before the Saskatchewan Ministry of Energy and Resources will accept the remaining properties into the ICP. Revocation of the CNSC licence for the remaining properties, to facilitate acceptance into the ICP, will not pose an unreasonable risk to the environment, health and safety of persons, or national security, and will maintain conformity with measures of control and international obligations to which Canada has agreed.

Cameco will file a Commission Member Document (CMD) that will include details related to current and planned engagement related to this application in accordance with the accepted Beaverlodge Public Information Program and following the requirements identified in REGDOC-3.2.2, *Indigenous Engagement.*

We trust this application provides sufficient information to support Cameco's request for a Commission hearing regarding the revocation of the CNSC licence WFOL-W5-2120.0/2025. If you have any questions or if we can provide you any additional information to facilitate CNSC review of this application, then please contact the undersigned at (306) 956-6685 or Michael Webster, Lead Reclamation Specialist, Beaverlodge at (306) 956-6784.

Sincerely,

R. Liam Mooney
Vice–President, Safety, Health, Environment & Quality and Regulatory Relations
Cameco Corporation

c: Cameco: Regulatory Records, M. Webster, K. Nagy, B. Balicki, S. Shirley
CNSC: UMMD / DMUCU, Forms / Formulaires, P. Burton, R. Snider. D. Brown
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# 5 Northern Mine Decommissioning and Reclamation Guidelines

# Northern Mine Decommissioning and Reclamation Guidelines

Ministry of Environment

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EPB 381

Government of Saskatchewan

# 1.0 INTRODUCTION

Planning and management for mine closure is an integral part of overall project development and operations. Mining operations usually progress through the following phases during their development: exploration; feasibility; environmental assessment; construction and operation; and finally decommissioning. Likewise a decommissioning and reclamation plan will evolve over time from the initial conceptual plan that is submitted as part of the environmental assessment of the project to the final plan that is implemented at the closure of the project. Once the decommissioning and reclamation activities are complete and the objectives have been met, the operator may transfer the site back to provincial custodial responsibility.

These guidelines are intended to provide the proponent with an overview of the various factors to be considered during the development of a decommissioning and reclamation plan for a mining site. The first section will provide an overview of the legal requirements for developing and implementing a decommissioning and reclamation plan. The subsequent sections provide a review of some basic planning principles to be considered when designing a decommissioning and reclamation plan (Section 2); a review of the general closure criteria for the various components of a mining site (Section 3); and finally a brief discussion on the role of public consultation in developing, implementing and finally completing a decommissioning and reclamation plan (Section 4).

## 1.1 Provincial Legislation

There are a number of provincial acts and regulations that a proponent should be aware of when developing and implementing a decommissioning and reclamation plan for a mining development (project). The following sections provide an overview of these acts and regulations.

### 1.1.1 Environmental Assessment Act

In Saskatchewan, planning for decommissioning and reclamation of a mining site begins during a project's assessment phase. Under Section 9 of The Environmental Assessment Act a proponent is required to conduct an Environmental Impact Assessment (EIA) of their development and to prepare and submit an Environmental Impact Statement (EIS).

As part of the assessment of mining and mill proposals the proponents are required to submit a conceptual decommissioning and reclamation plan. The *Project Specific Guidelines for the Preparation of an Environmental Impact Assessment*, issued by the Ministry of Environment – Environmental Assessment Branch, contains guidance on the preparation of the conceptual decommissioning and reclamation plan.

After the completion of the Environmental Assessment (EA) process, the minister will decide if the development may or may not proceed. As part of the EA approval, the minister may impose any terms and conditions that are considered to be necessary or advisable. If a development is approved under the EA process, it then proceeds to the regulatory phase in which the proponent applies for the necessary permits and/or approvals to construct and/or operate the various facilities that are associated with a mining operation.

### 1.1.2 Environmental Management and Protection Act, (2002)

The Environmental Management and Protection Act, 2002 (EMPA 2002) is the primary provincial legislation that applies to mining operations. A number of regulations under EMPA 2002 may be applied in the implementation of a decommissioning and reclamation plan.

#### 1.1.2.1 Mineral Industry Environmental Protection Regulations, 1996

The Mineral Industry Environmental Protection Regulations, 1996 (MIEPR 1996) require proponents to apply for approval to construct and operate pollutant control facilities at the mining site. Before receiving an approval to operate pollutant control facilities a proponent must have an approved decommissioning and reclamation plan in place along with an assurance fund that will ensure the completion of the above plan.

The information that is required in an application for approval of a decommissioning and reclamation plan and the various forms for establishing an assurance fund are described respectively in sections 14 and 15 of MIEPR 1996. The application must include the following information:

- a time frame for decommissioning and reclaiming the mine site;
- a description of the proposed methods and procedures of, and time frames for, monitoring the mining site for physical and chemical stability and for detecting spills or the release of pollutants during and after decommissioning and reclamation;
- an estimate of the cost required to carry out the decommissioning and reclamation plan and the cost of monitoring the mining site after the decommissioning and reclamation;
- a proposal for an assurance fund that complies with section 15, to ensure completion of the decommissioning and reclamation plan;
- a proposal for the management and administration of the assurance fund; and
- a proposal respecting the release of all or portions of the assurance fund during the decommissioning and reclamation of the mining site.

As described in Section 15 of the MIEPR 1996, an assurance fund for a decommissioning and reclamation plan may take a variety of forms. Examples of the form of the assurance fund include: cash; irrevocable letters of credit; and term deposits.

As stated in Section 18 of MIEPR 1996, proponents are required to give sixty days notice in writing prior to the initiation of an approved plan to permanently close pollutant control facilities, mines or mills.

If a sufficient period of transition phase monitoring demonstrates that the site has achieved an appropriate level of environmental and physical stability in accordance with the decommissioning and reclamation plan, the operator may make a written application for a Release from Decommissioning and Reclamation. Section 22 of MIEPR 1996 outlines the application procedures for a proponent to follow for obtaining their release from any further obligations that are set out in the decommissioning and reclamation plan.

Based in part on this section of the regulations, the application for Release from Decommissioning and Reclamation should contain, at a minimum:

- a summary of the decommissioning and reclamation activities that have been completed by the operator;
- a description of the performance of the site during the transition (decommissioning and post decommissioning) monitoring phase;
- predictions that are based on the documented performance of the site during the post decommissioning phase monitoring, of any potential ongoing expenditures the province may be expected to accrue in order to adequately maintain and monitor the site if it assumes custodial responsibility for the property;
- a list and assessment of remaining environmental liabilities; and,
- an estimate of the potential costs to the province to address such liabilities should it assume custodial responsibility.

Upon receiving the application, the Ministry of Environment will initiate a detailed review of the application. That review will include opportunities for public input on any conditions that may be applied before the Release from Decommissioning and Reclamation is issued and the type of institutional controls that will be applied to the site.

Only after these steps are completed to the satisfaction of the Minister of Environment will a Release from Decommissioning and Reclamation be issued to the operator and the custodial responsibility for the property is transferred from the operator to the provincial institutional control management framework.

#### 1.1.2.2 The Hazardous Substances and Waste Dangerous Goods Regulations

Section 17 of The Hazardous Substances and Waste Dangerous Goods Regulations (HSWDGR) requires that anyone proposing to remove, abandon, dispose, or permanently close any storage facility for hazardous substances and waste dangerous goods must apply to the minister for approval to decommission and reclaim any storage facilities used for the storage of hazardous substances or waste dangerous goods.

The request for approval should be submitted at least 30 days prior to the work being undertaken. The information to be provided with the request should include the following:

- a description of how the decommissioning will take place;
- how any remaining equipment, hazardous substances, or contaminated materials will be disposed;
- a proposal describing how the site will be decontaminated and reclaimed as well as how the area will be monitored to determine the adequacy of the decommissioning and reclamation plan.

Prior to submitting an application, the proponent is required to undertake a site assessment to determine the degree of contamination and the risks to the environment and to the health and safety of the public.

#### 1.1.2.3 Other EMPA 2002 Regulations

During decommissioning, some activities may require approvals from other branches of the Saskatchewan Ministry of Environment. In particular any work in or near water (i.e. removal of stream crossings) may require an Aquatic Habitat Protection Permit under Section 36 of EMPA 2002.

These permits will describe the conditions under which the work may be undertaken. The following are examples of the types of conditions that may be included in these permits: the timing of when any work in the water may be conducted; the need for sediment and erosion control measures; and measures to limit the deposition of deleterious substances.

### 1.1.3 The Occupational Health and Safety Act 1993, (The Mines Regulations 2003)

The Mines Regulations, 2003 (Mine Regs 2003) which are issued pursuant to The Occupational Health and Safety Act 1993, include a number of sections that relate to the closing of mines. Section 406 of the Mines Regs 2003 states that before a mine or any part of a mine is closed, abandoned or otherwise rendered inaccessible, the employer, contractor or owner must ensure that all plans required pursuant to Subsection 7(2) are updated. Copies of the plans are to be certified as correct by the employer, contractor or owner and forwarded to the chief mines inspector. Subsection 7(2), describes the information that the owner or operator of the mine must provide the Chief Mines Inspector of Saskatchewan Advanced Education, Employment, and Labour prior to initiating final closure activities. The information to be provided includes the following:

- a surface plan showing the boundaries of the property and all lakes, streams, roads, railways, electric transmission lines, main pipelines, buildings, shafts, adits, surface workings, diamond drill holes, boreholes, dumps, and tailings management areas;
- a plan of each underground level, showing all workings, shafts, drifts, crosscuts, diamond drill holes, dams, and bulkheads;
- a plan respecting vertical mine sections at suitable intervals showing all shafts (raises and winzes), drifts, crosscuts, stopes and workings in relation to the surface, including the location of the top of bedrock, the surface of overburden, the position of any unconsolidated deposit, and the position of any known watercourse or body of water, with each section shown on a separate drawing; and,
- a ventilation plan showing the direction and quantity of the main air currents, locations of permanent fans, ventilation doors, stoppings, and connections with adjacent mines.

This information will also be included in the application for Release from Decommissioning and Reclamation discussed previously in Section 1.1.2.

The conditions for the closure of underground mines and open pits are described respectively in Sections 407 and 408 of the Mine Regs 2003. Section 409 describes a number of requirements pertaining to the final closure of any plants that are associated with mines that are being closed.

#### 1.1.4 Reclaimed Industrial Sites Act and The Reclaimed Industrial Sites Regulations

An operator or site holder that plans to return the site into provincial custody after having completed the decommissioning and reclamation and has met the closure objectives and requirements to receive a Release must apply for the transfer of custody into the province's institutional control program. The program is legislated by The Reclaimed Industrial Sites Act and The Reclaimed Industrial Sites Regulations.

The operator may find it beneficial to review the entry requirements of that program in the design and implementation of the decommissioning and reclamation plan.

### 1.2 Federal Legislative Requirements

Some decommissioning activities, in particular those requiring work in or around water (i.e. removal of stream crossings), may require review by various federal authorities such as Fisheries and Oceans Canada (DFO) and/or by the Navigable Waters Protection Program (NWPP) with Transport Canada. If a formal approval is required for these activities, the federal authority may require an Environmental Assessment of the proposal pursuant to Section 5.1(d) of the *Canadian Environmental Assessment Act* (CEAA).

For mines that have been subject to the *Metal Mining Effluent Regulations* (MMER), the proponent will be required under Section 32 of the MMER to apply to Environment Canada for recognition of closed mine status. After a period of three years where the mine has maintained a rate of production at less than 10% of the designed rate of capacity the mine will be granted status as a closed mine.[1] It should be noted that upon attaining the status of a closed mine, that the mine is still subject to Section 36(3) of the *Fisheries Act* for the occurrence of any deposition of a deleterious substance.

The decommissioning of uranium mining sites will require review and approval from the Canadian Nuclear Safety Commission (CNSC). The detailed decommissioning plan is filed with the CNSC for appropriate licensing action under the federal *Nuclear Safety and Control Act* prior to beginning decommissioning activities. Presently, under the CEAA, the CNSC will be required to undertake an environmental assessment of the plan prior to providing a license to decommission the mine site.

## 2.0 BASIC PLANNING PRINCIPLES OF DECOMMISSIONING AND RECLAMATION PLANS

In the following sections, a number of basic planning principles for developing and implementing decommissioning and reclamation plans are presented. These planning principles will aid the proponent in attaining their primary decommissioning and reclamation objective of restoring the mining site to a condition that is similar to the conditions that existed prior to disturbance by mining operations.

### 2.1 Conceptual Plan

In Saskatchewan, as part of the environmental assessment of a mining development, the proponent will be required to present a conceptual plan for the decommissioning and reclamation of the project site. The conceptual plan should identify the following:

- the predicted impacts of the project on the surrounding ecosystems;
- a description of how the impacts will be mitigated and what the residual impacts will be;

[1] As per the amendments in 2006 to the MMER.

- a general overview on how the site will be decommissioned (i.e. buildings removed; pits filled in, etc.); and
- the final decommissioning objective, which will in part be based on the residual impacts of the project.

### 2.2 Operational Decommissioning Plan

As stated previously, mining companies are required pursuant to Section 12 of the MIEPR 1996 to develop decommissioning and reclamation plans that also include the provision of a financial security or assurance. The operational decommissioning plan is developed on a "decommission tomorrow by a third party scenario" that provides the technical details for decommissioning the mining project. Based on the technical details, the financial costs for undertaking the operational plan are calculated. At a minimum, the plan is reviewed at least every five years or sooner when there are significant changes to the mining project such as expansion of the operation or when the minister believes the financial assurance is under funded.

The operational plan should include the following:

- proposed end use of the decommissioned site (if available the proponent should consider any land use plans for the area when formulating the end use objectives);
- the predicted timelines for reclamation of the site;
- a discussion of alternative procedures that may be used for decommissioning the various site facilities (i.e., camp and office buildings, pit mine(s), underground mines and waste rock stockpiles, etc.);
- identification of the preferred procedures for decommissioning the site facilities;
- the time frame and sequence of decommissioning activities;
- environmental mitigation and reclamation measures e.g., contouring of waste rock piles, covering of wastes and re-vegetation;
- post-decommissioning contaminant loadings and residual impacts to the local drainage system and to groundwater;
- monitoring program during the decommissioning and transition (post-decommissioning) phases;
- proposed contingency measures if initial plans are not successful; and
- an estimate of the cost to undertake the decommissioning and reclamation plan and the cost of monitoring the site after decommissioning and reclamation has been completed.

The following are some planning principles that should be utilized when developing the operational plan for decommissioning and reclaiming a mining operation.

#### 2.2.1 Design for Decommissioning

During the design of the various mining facilities at a project site, consideration should be given as to how the facilities will be decommissioned. This may reduce the amount of work required and the costs for decommissioning a facility when it has completed its period of service.

Some of the factors to be considered when designing a facility for decommissioning will include the elimination or at least the minimization of any future impacts from the facility, the long term stability of the facility, any concerns in relation to the long term liability for the facility and its aesthetics (i.e. how well does the decommissioned and reclaimed facility fit in with the surrounding landscape). Preference should be given to systems that allow for passive management in the post decommissioning phases.

#### 2.2.2 Progressive Decommissioning and Reclamation

The majority of the decommissioning and reclamation activities at a mine site usually occur after the completion of the operating phase of the project when the recovery of minerals is no longer economically viable. However, the mine should be developed and operated with a focus on progressive decommissioning and reclamation. For example, the re-vegetation of disturbed areas that will no longer be used will reduce erosion concerns and aid in site water management. Therefore, whenever possible, areas that have reached the end of their productive life should be decommissioned and reclaimed during operations. Progressive decommissioning allows for adaptive management in that various decommissioning strategies may be implemented and evaluated for their effectiveness in achieving the decommissioning and reclamation objectives. This also decreases the amount of work that will have to be done during the decommissioning phase. Areas within the surface lease that are no longer required and have not been disturbed by the mining operation could be considered for release from the custody of the mine operator.

In Saskatchewan, it is a regulatory requirement that the decommissioning and reclamation plan be reviewed every five years. This review can help the mine operator to implement progressive decommissioning over the operating lifetime of the project. The review should summarize any progressive decommissioning that has been completed and any that may be proposed for the future. Depending on the amount of decommissioning and reclamation work that has been undertaken during a five year period and the amount of development that has occurred, the assurance fund could decrease or increase after the review of the plan has been completed.

As part of the progressive decommissioning process, on-going, relevant research on strategic mine closure issues is an important part of decommissioning, reclamation and final closure as it contributes to site specific, regional, and industry knowledge. Research and modeling also provides the information required to make informed decisions in relation to mine closure design outcomes by assisting in the development of achievable completion criteria.

#### 2.2.3 Ecological Risk Assessment

An ecological risk assessment (ERA) is a tool that can be used in the development of the operational plan. An ERA may be undertaken to evaluate the risks associated with the residual impacts of a project after the completion of the decommissioning and reclamation plan. An ERA will help identify potential sources, pathways, and receptors within the impacted ecosystems. The general sources, pathways and receptors that are used in an ERA are described below.

Sources include:

- mining operations (i.e. underground and open pit mines);
- waste rock storage areas;
- tailings areas; and
- effluent release points from treatment facilities.

Pathways:

- air;
- groundwater;
- surface water;
- sediments and soil; and
- food chain.

Receptors

- water quality;
- aquatic biota (i.e., benthic community, fish);
- fur bearing animals;
- ungulates (moose, caribou, etc.);
- vegetation (i.e., berries); and
- humans.

An ERA evaluates the risk that a source may impact a site. Risk can be described as the probability that a receptor will be negatively impacted by its exposure to a source through a pathway. The Canadian Council of Ministers of the Environment (CCME) has prepared a number of documents on undertaking ecological risk assessments (CCME 1996, CCME 1997).

### 2.3 Monitoring

Monitoring of the local environment around a mining operation has three phases (assessment, operational, and transition). During the assessment phase, monitoring provides information on the baseline conditions of the ecosystems that will be potentially impacted by the project. The ecological baseline should describe the natural variability of baseline or undisturbed conditions that occur in the local ecosystems. This would include estimates on the fluctuations in population levels, the range of streamflow conditions, etc. During the assessment phase, care should be taken in establishing reference sites that will also be used during the operational phase of the monitoring program. Reference sites should be representative of the ecological conditions in the local area and of the areas that will be impacted by the mining operations. This will aid in comparisons between the impacted and reference sites during the operational monitoring phase. The reference sites also provide a benchmark for assessing the success of reaching the decommissioning and reclamation objectives. The reference sites will also provide information on any long-term regional trends, which are unrelated to the mining operation that may be having an impact on the local environment.

Operational monitoring confirms or refutes the accuracy of the predictions on the impacts of the project that were made during the environmental assessment. If impacts that were not predicted are observed and are due to the project, then changes to the mitigations that are being used can be made and the decommissioning and reclamation plan can be revised. Monitoring of reference sites will determine if the impacts that are observed are the result of the mining operation or if they are a response to some regional stress that is unrelated to the mining operation. The final stage of the operational monitoring phase at the end of operations will describe conditions prior to the beginning of the decommissioning and reclamation phase.

The transition phase of monitoring will begin with the start of the approved decommissioning and reclamation activities. The objective of this phase of the monitoring program will be to determine the recovery of the impacted areas in response to the implementation of the decommissioning and reclamation plan and the impacts as a result of the shutdown of operations.

As the agreed to post closure land use may take years or even decades to achieve, a set of specific performance indicators should be developed to measure progress in meeting the decommissioning and reclamation criteria. Correctly chosen, the monitoring of these environmental indicators will show whether the ecological processes that will lead to successful rehabilitation are trending in the right direction. This action will also identify and enable early intervention where trends are not positive.

During the transition phase monitoring period, the operator is required to:

- continue monitoring and maintaining the site, as per the requirements in the decommissioning and reclamation plan, at their own expense; and
- maintain an assurance fund of sufficient value to cover the cost of the remaining obligations outlined in the decommissioning and reclamation plan and any monitoring and maintenance requirements for the balance of the transitional period as well as a negotiated contingency for any unexpected occurrences.

## 3.0 FINAL MINE CLOSURE OBJECTIVES AND CRITERIA

The general objective for all mine decommissioning and reclamation plans should be to leave all areas that were disturbed during operations safe for traditional land uses and in an ecological condition that is consistent with the surrounding physical and biological environment. Wherever possible, decommissioning and reclamation activities should also endeavor to leave all areas of the site in a state that requires minimal or no maintenance.

Based on the predicted impacts of a project that are determined during the EIA and the results of the operational monitoring, the site specific closure criteria should be developed in consultation with stakeholders. This will ensure that there is a broad agreement on both the post closure land use objectives and on the basis for measuring the achievement of those objectives (i.e. the decommissioning criteria).

Decommissioning criteria should be flexible enough to adapt to changing circumstances without compromising the agreed to end objective. There should be an agreed process for the periodic review and modification of completion criteria in light of improved knowledge or changed circumstances.

### 3.1 General Site Objectives

In general, the areas disturbed by the mining operations should be reclaimed to an ecological (i.e., physical and biological) condition that will be similar to what was observed in the area prior to disturbance. If information is not available in regards to site conditions prior to disturbance the surrounding undisturbed sites will often be an indicator of what the site conditions were like prior to disturbance. Reclaimed areas should be similar to undisturbed areas in the following ways:

- soil infiltration rates and groundwater movement (pathways and rates) are similar to nearby undisturbed areas. Note that for areas that may be sources of contaminants to groundwater, the soil infiltration rates may be purposefully reduced.
- groundwater chemistry parameters are within the natural range of variation that is found within undisturbed areas. It is recognized that this may not be applicable to the groundwater that is down gradient of mined out pits that have been used for the disposal of tailings and special waste.
- soils should be similar in organic content, layers (horizons), and particle size to what is observed in undisturbed areas.
- vegetation communities should have similar species at densities that are comparable to the natural range of variation in similar local ecosystems.
- if the disturbed site has been restored then it would be expected that local animals will immigrate into and use the reclaimed areas.
- waste rock piles should be shaped as much as possible to blend in with the local topography.
- lake shorelines and riverbanks should be reclaimed to their pre-disturbed condition.
- surface water quality should be within the natural range of variation for the area.

At some mine sites as predicted in the EIA, there may be areas that cannot be fully reclaimed to their original ecological condition. Examples of such sites would include tailings areas, special waste rock piles, and open pits. These sites could be potential sources for contaminants that could migrate from impacted areas within the project sites to ecosystems outside of the project area. This potential should be minimized through site specific mitigation measures that ideally should not require any long term maintenance. Exceedance of predicted impacts may prevent the approval of the Release from Decommissioning and Reclamation.

### 3.2 Reclamation Objectives for Mine Infrastructure

Mining operations involve the construction of a variety of physical works that result in physical changes to the environment. Each of the physical works on the project site will be required to be decommissioned and reclaimed to a standard that will ensure their long term stability (i.e. resistance to erosion, re-establishment of drainage). Closure methods for physical mine works must be approved subject to the Mines Regulations 2003 and closure objectives subject to MIEPR.

The following sections review the environmental and safety concerns associated with the various physical works that may be constructed at mining operations. This is followed by suggestions on how these concerns may be mitigated in order to attain the proposed decommissioning and reclamation objectives for each respective physical work.

### 3.2.1 Open Pits

The primary environmental and safety concerns that relate to open pit mines include:

- the release of contaminants from the walls and floor of the pits and how this may affect both groundwater and surface water quality;
- the stability of the pit walls;
- the types of materials that may be placed in them after mining is completed and how these materials may affect ground and surface water quality; and
- the possibility of people and/or wildlife accidentally falling into the pit and not being able to get out.

The primary options available to the mine operator to mitigate the above concerns are backfilling of the pit and/or allowing the pit to flood. The types of material available for backfilling open pits may include: clean waste rock, special waste rock, tailings, and/or demolition materials. A combination of the above materials may be used to backfill the pit. The volume and characteristics of the materials that are deposited in the open pit must be recorded. One of the primary considerations when selecting the type of material for placement in the pit should be how the material may affect groundwater quality and ultimately surface water quality. Consideration will also have to be given as to how the deposited material may settle over time. This may require that the material backfilled in the pit must be mounded to allow for settling. Completion of backfilling should include the placement of a layer of material that will allow for the development of vegetation.

If the pits are not backfilled they should be allowed to fill with water to a level that coincides with the local water table. If oxidation of the pit walls is a concern and the groundwater inflows are likely to be slow, pumping of surface water should be considered to speed up flooding. However, the volume of water that is being pumped into the pit should not have an impact on streamflows or water levels of the source waterbody. The quality of the surface water within flooded pits should be similar to what is found in local waterbodies. Water quality in deeper zones within flooded pits may be of poorer quality if these zones become isolated through the formation of a chemocline. Stability of chemoclines in flooded pits must be established before release from decommissioning and reclamation requirements will be considered.

Some open pit mines may extend into local waterbodies. This usually will require the construction of dykes to aid in the isolation of pits from waterbodies. One option to be considered when decommissioning and reclaiming these types of pits is the feasibility of re-connecting the pits to the waterbodies. This would entail at least a partial removal of any dykes. In this situation the bottom substrate and slope should be similar to what was present prior to the initial excavation.

### 3.2.2 Mine Openings and Workings

The primary concerns with mine openings and other associated structures are similar to those of open pits. These are impacts on the quality of surface and ground water and safety. One additional concern is the potential for slumping of materials after backfilling has been completed.

Adits, raises, shafts, or other openings to the surface should be backfilled entirely or at least down to an offset when one is present. It is preferable that this be done with clean waste rock but some special waste may be used if it can be shown that this will have negligible effects on ground water quality. The waste rock should be at least flush with the entrance to prevent any entry or for larger openings an engineered bulkhead may be required to be placed at openings. Careful consideration of the long-term risks posed by the accumulation of water behind waste rock barriers must be given. The backfilling of materials within openings as described above may cause water to accumulate in the underground workings to the extent that pressure and/or erosion may eventually dislodge the material used to fill the adits and re-open the holes. This type of work may be done during the operating phase as part of progressive decommissioning.

Underground workings (i.e., drifts and tunnels) should also be backfilled as much as possible during operations as part of progressive decommissioning. This will help reduce the amount of waste rock that remains on the surface and will also help provide stability to the underground workings.

Crown pillars, if they exist on a mine property, must be assessed for long-term stability in order to select the most appropriate closure measures to ensure lasting safety and compatibility with the post closure land use of the property. The assessment should ideally be done during the operational phase of the mine. Whenever possible, unrestricted surface use of the area above the crown pillar should be the ultimate objective in the final closure plan.

### 3.2.3 Waste Rock Piles

Waste rock materials are typically classified as either clean waste rock or special waste rock. Clean waste rock consists of rock that does not contain sufficient quantities of any minerals that could be mobilized and potentially cause an adverse impact if released into the environment. Clean waste rock may still be a source of fine sediments. Special waste rock in contrast may be potentially acid generating and/or contain minerals such as arsenic, nickel, selenium, molybdenum, or others in amounts that when mobilized from the parent material could cause an adverse impact to the receiving environment.

The main issues with waste rock include the following:

- release of contaminants from the waste rock through a number of pathways to the environment;
- erosion from waste rock and subsequent sedimentation in waterbodies or on the adjacent landscape;
- stability of the waste rock piles;
- aesthetics; and
- changes to the local topography.

These issues may be addressed through careful planning in the selection of locations for the placement of waste rock, design of waste rock piles, and progressive decommissioning. Surface waste rock piles can also be reduced through the placement of waste into underground workings, backfilling of pits, and the use of clean waste rock as construction materials for roads, dams, and berms.

Waste rock piles should be located in areas that are away from waterbodies, and that also provide sufficient room for the final configuration of the waste rock pile during decommissioning and reclamation. In addition the location should not interfere with wildlife routes.

Design Criteria

The final configuration of waste rock piles should ensure that they are stable, allow for the re-vegetation of the pile, and if feasible blend into the local landscape. Consideration of the final shape of the waste rock pile, undertaken during the design and placement phase, will significantly reduce the effort and cost required to achieve the desired final slope configuration during decommissioning and reclamation.

The primary objectives in the design of waste rock piles should include the following:

- provision for a surface layer that will allow a suitable plant community to develop;
- the quality of water running off waste rock piles should meet Saskatchewan Surface Water Quality Objectives;
- weathering of near surface material should be limited to maintain the physical and chemical stability of this material; and
- net infiltration of precipitation should be reduced to attenuate the peak concentrations of contaminants in natural watercourses to levels that can be assimilated without an adverse impact to the aquatic ecosystem.

The effective management of acid generating waste rock is to limit the formation of acids at the source by inhibiting the oxidation of the sulphides within the rock. This may be done through the immersion of the waste rock in water or by preventing or reducing the migration of acid drainage to the environment. The latter mitigations relies on the prevention of water contact with the acid drainage through such activities as diversion of surface waters, interception of groundwater, and/or the prevention of infiltration by the use of caps or covers. Price (2005) provides a general guide on the information requirements for addressing concerns with acid generating waste rock and also discusses a number of mitigation measures to limit the generation of acid rock drainage.

### 3.2.4 Dams, Dykes and Other Containment Structures

The stability of any dams and/or other containment structures that will be remaining in place after decommissioning and reclamation activities are completed should be assessed. The stability assessment should consider but not be limited to the following factors:

- evaluation of the design life of the structures;
- the types of materials that were used in construction;
- the extent that the stability of structures will be altered by weathering, frost action, and/or forest fires;
- the slopes of the structures; and
- the impact of maximum runoff events.

The Canadian Dam Association has produced a guideline document for assessing the safety of dams entitled Dam Safety Guidelines: Approved as Principles, October 2005. This document is available on their website (http://www.cda.ca).

If the analysis indicates that changes are required to the configuration (i.e. slopes) of structures then these should be undertaken to ensure long-term stability. The final configuration should ensure that structures can be maintained with little or no maintenance. The minimum design criteria that would be considered acceptable would be a 1:100 year standard.

### 3.2.5 Tailings Management Facilities

Tailings are the materials that remain after the mineral of interest has been extracted during the processing of the ore. As ore processing often involves crushing and/or grinding of the ore, the resulting tailings will consist of materials that are small in particle size. Tailings may contain a number of contaminants of concern that originate from the geochemical matrix of the ore or from introduction during the ore milling process. Tailings are usually transferred as a slurry from the mill to the tailings management facility (TMF). This can result in the tailings at least initially having a high water content.

The potential for a TMF to serve as a source of contaminants must be minimized. This objective should be incorporated as one of the primary considerations in the design of a TMF. The primary pathways would be through mobilization into either surface and/or groundwater. A secondary pathway is through the mobilization of dust particles if the tailings surface is left exposed and allowed to dry. Mitigations to address these concerns should be incorporated and implemented during the design and operational phases of the TMF and continued into decommissioning and reclamation.

Measures to be used to control the transport of contaminants to surface and ground water would include diversion of surface and groundwater around or away from the tailings mass. The actual mechanism for achieving this would be implemented on a site specific basis and would essentially entail developing preferential pathways for water to go around or away from the tailings mass rather than through the tailings. Examples would include the placement of coarse granular material around the tailings in an in-pit facility or the placement of a sloped cover over the tailings for an above ground facility. The movement of water around the tailings mass can also be enhanced through ensuring the tailings are deposited in such a manner that they are well consolidated. Therefore, consideration must be given to how the tailings are deposited into the TMF. Of particular concern is the formation of ice lenses during the winter deposition of tailings. This will limit the consolidation of the tailings and also reduce the total volume of tailings that can be deposited in the TMF Consideration should also be given to include mitigations to limit the solubility of contaminants in the pore water that is within the tailings mass. This will reduce the concentration of contaminants that are transported out of the tailings into the surrounding groundwater.

Decommissioning and reclamation measures should be designed to optimize the following:

- consolidation of the tailings;

- control of infiltration into the tailings;
- enhancement of runoff;
- control of erosion; and
- re-vegetation where appropriate with plants that do not have a tendency to uptake contaminants.

Similar to waste rock piles, the decommissioned TMF, should not require any long-term maintenance. In addition, the areas impacted by any contaminants that are released by tailings should be minimized. The size of the impacted area will be site specific.

### 3.2.6 Camp Infrastructure

Camp infrastructure includes residences, offices, water and sewage treatment systems, landfills, recreational facilities, and other structures that have been constructed to provide support to staff or materials on the project site. Some of these structures will continue to remain in operation during closure until the site is ready for release.

Maximizing the salvage and recycling of appropriate materials during the decommissioning of buildings and other infrastructure will serve to reduce the total amount of material that will have to be effectively disposed during decommissioning and reclamation.

For those materials that cannot be recycled, a strategy should be developed and implemented during building and infrastructure decommissioning that ensures the most appropriate disposal methods are employed and ensures the long-term stability of the disposal area.

Concrete foundations should be broken apart and the pieces disposed of in an appropriate manner. The inclusion of blast tubes within the foundations to aid with the decommissioning would be an example of designing for decommissioning. Where the breakup of the foundations is not practical, holes should be drilled through the foundations and the concrete cracked to facilitate drainage and consideration should be given to burying the foundation with local benign material.

The use of existing landfills should be maximized and the construction of additional landfills should be kept to a minimum within the project site. These facilities should provide containment of any hazardous wastes that may have been deposited. The surface may be raised somewhat to minimize the infiltration of water through the final surface cover. Materials should be segregated and inventoried and the landfill locations must be recorded and monitored with specific information regarding hazardous materials that have been deposited.

### 3.2.7 Transportation Infrastructure

The transportation infrastructure (i.e. roads, water crossings, and airport facilities) will likely be some of the final site infrastructure that will be decommissioned and reclaimed at a project site. Local stakeholders should be consulted prior to any closure of local roads within the mining operation surface lease. After the removal of bridges and culverts, the reclamation of the stream channels and adjacent riparian zone should be undertaken with the objective of establishing a channel form that is similar to what is observed in undisturbed upstream and downstream sections of the stream. The bed, banks and substrate of the channel and the riparian zones should have similar characteristics (i.e., substrate, channel width and depth, bank slopes) as the undisturbed channel. The approaches to the crossings may have to be pulled back as part of the reclamation of the riparian zones.

The road beds and right of ways should be scarified as part of the road decommissioning activity once the operator is assured that no additional remediation or monitoring is required at a particular property that will require road access. Re-vegetation measures may be required particularly for sections of road that are near streams or lakes. The final reclamation objective for the roads and right-of-ways should be to establish plant communities that are similar to undisturbed areas.

### 3.2.8 Wells and Piezometers

Wells may be used at mine sites for a variety of reasons such as sources of water for potable water systems or process water for mill facilities and the de-watering of open pits. Piezometers are used for groundwater monitoring programs and their network may be extensive. Both of these structures could lead to mixing of surface and ground water and of groundwater from different layers. Decommissioning of these structures should be undertaken through the placement of grouting material to ensure that there is no vertical movement between surface water and groundwater and between different groundwater layers. This may involve the complete grouting of the drill hole from surface to the bottom. Casings should be removed to just below the ground surface. How far below the surface will depend on the potential for the surface materials to erode and thus expose the casing.

## 3.3 Re-vegetation

The re-vegetation of the disturbed areas at a project site will be one of the final reclamation steps. One of the most important components of a successful re-vegetation program is to have a suitable substrate for the seed bed. Ideally it is best to use the original topsoil from the disturbed area. In most situations, the topsoil from all areas being cleared should be retained for subsequent reclamation. The topsoil contains the majority of seeds and other plant propagules (such as rhizomes, roots, etc.), soil micro organisms, organic matter, and the more labile (more readily cycled) plant nutrients. Stockpiling of topsoil should be undertaken in the following manner:

- if possible, the stockpiles should be placed in areas that have already been disturbed and the stockpiles should be away from any waterbodies;
- the stockpiles should be revegetated to protect the soil from erosion, discourage weeds, and maintain active populations of beneficial soil microbes; and
- the stockpiles should be located in areas where they will not be disturbed by future activities, as excessive handling will adversely affect soil moisture.

The timing of topsoil stripping can be important for subsequent rehabilitation. Soils should not be stripped or replaced when they are too wet or too dry, as this can lead to compaction, loss of structure, and a loss of variability of seeds and mycorrhizal inoculum (a natural ecosystem component that increases uptake of plant nutrients from the soil).

The surface soils at reclaimed sites may need some preparation prior to re-vegetation. Soil preparation may include the addition of chemical fertilizers, composted sewage sludge and/or mulches. Native plants are likely to require fewer nutrients in comparison to agricultural plants therefore application rates should be examined on test plots before general application. Organic mulches such as wood fibers provide some organic materials for soils and also help to stabilize the soil surface and reduce erosion (Wright 2005).

Sites should be re-vegetated with local, natural seed mixes, shrubs, and trees. A review of species lists for the various plant communities in the project area will provide an indication of the species to use for area re-vegetation. Proponents should check with seed suppliers for the source of their seed stock. While focused on plant communities in the commercial forest area of Saskatchewan, Kosowan and Smith (2004) provide suggestions on what native species to use for re-vegetation based on the characteristics of the sites. Many of the suggested species also occur in northern Saskatchewan.

It will not be necessary to restore disturbed sites to the final climax community but rather to a successional community that will be consistent with local undisturbed vegetation. The species present and their density should be within the range in variation that is observed in local undisturbed plant communities.

Some small disturbed areas that are no greater than 2 ha in surface area may be re-vegetated through natural encroachment of local native vegetation. This is provided that the areas are relatively flat and are not near surface waterbodies so that erosion is not a concern. It is best that this approach is used during active operations so that if the encroachment of natural vegetation is slow, active re-vegetation may be undertaken.

The placement of shrub species and tree saplings should be conducted in a random pattern. Placement of shrubs and trees in straight lines results in an artificial look for a re-vegetated area. The initial planting densities may be somewhat higher than what is observed in natural undisturbed areas. This will allow for some mortality during the planting of the shrubs and trees.

### 3.4 Radiation

For uranium mines and mills, an additional concern is the level of gamma radiation that remains after site reclamation. The final radiation levels at reclaimed sites should not be greater than a mean of 1 μSv/hr above the natural range in variability that is observed at reference locations (i.e. background radiation levels) The mean value will be taken from a 100 m by 100 m area (1 ha). Measurements are to be taken from approximately 1 m above the surface. The frequency of readings within the sample grid would in part be determined by the variability in the individual readings. However, the minimum density of readings should be 1 gamma reading per 100 $m^2$. Reclaimed sites should be matched with reference locations that are similar in terms of soils and plant communities.

## 4.0 PUBLIC CONSULTATION AND DECOMMISSIONING AND RECLAMATION PLANS

The process of consultation for decommissioning should begin early during the final closure phase. Consultation should not be on a selective basis, but should involve all stakeholders in the project. Other parties, such as conservation organizations and other non-government organizations may have an interest in the project and may be included in the consultation process. To be effective, communication must not only provide information on the predicted impacts of a project and the mine closure proposals and activities but must also include listening to, and considering, public comments, concerns and feedback.

Depending on the type of impacts there may be restrictions on the type of land use for certain areas of the reclaimed site. Consultation will therefore help to avoid building false expectations about the outcomes of decommissioning and final closure.

Stakeholders will include:

- local First Nation and Metis (Environmental Quality Committees, impacted aboriginal communities) - local Aboriginals provide a vital link to communities. Early consultation and planning is essential to minimize disruption to communities and address concerns for the physical rehabilitation of the site.
- leaseholders, neighbours and nearby residents - these groups may be physically affected by the closure and may have particular needs and desires that can be incorporated into rehabilitation planning. These groups may include trappers, commercial fisherman, and outfitters.
- local governments (northern villages and hamlets) - local governments provide a vital link with the community. Early consultation and planning is essential to minimize disruption to community services.
- local and regional business and service providers - the economic effects of mine closure on local and regional business and service providers may be severe and consultation is important to assist them in their own planning for the transition.
- NGOs and Community Groups (Environmental Groups, land use planning groups) - these groups will be the most varied and often represent different points of view from those elements in the community that are physically and/or financially affected by the mine closure.

**REFERENCES AND ADDITIONAL SUGGESTED READINGS**


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Wright, M.A. (Ed.) 2005. Practical guide to reclamation in Utah.

## GLOSSARY

A number of definitions of terms that relate to decommissioning and reclamation plans are provided in Section 2 of The Mineral Industry Environmental Protection Regulations, 1996. These definitions include:

- **decommission** means to remove or retire permanently from service or take any action to remove or retire all or part of a mining site;

- **decommissioning and reclamation plan** means a plan, including any amendments to a plan, to decommission and reclaim all or part of a mining site;

- **mining site** means: a pollutant control facility, a mine, a mill, and any land, water, or watercourses used or disturbed by the construction or operation of a pollutant control facility, mine or mill;

- **pollutant control facility** means: a facility or area for the collection, containment, storage, transmission, treatment or disposal of any pollutant arising from mining operation or from the development of or the exploration for any mineral, and includes the environmental protection components of: i) a mine or a mill; ii) a tailings management area; iii) an ore storage facility; iv) a waste rock disposal area; v) a mine overburden or spoil disposal area; vi) a waste treatment plant; vii) a fuel storage facility; viii) a chemical storage facility; ix) a waste sump; x) a site drainage control; xi) a groundwater dewatering system; xii) any equipment used for exploration; and xiii) all associated machinery and equipment, including pumps, pipes, conveyors, launders, and ditches used in connection with facilities or areas mentioned in subclauses (i) to (xii).

- **reclaim** means to rehabilitate all or part of the land, water, or watercourses used or disturbed by the construction or operation of a pollutant control facility, mine or mill.

# 6 Saskatchewan Environmental Quality Guidelines

## Saskatchewan Environmental Quality Guidelines

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | VARa | mg/L | (i) |
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 2.9 | mg/L | (i) |
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 5.0 | mg/L | (i) |
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 5.0 | mg/L | (i) |
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | VARa | mg/L | (i) |
| General and Inorganic Parameters, Metals | Aluminum | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | NV | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.006 | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Irrigation (Surface Water) | NV | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | NV | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.006 | mg/L | (i) |
| Metals | Antimony | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Arsenic (inorganic) | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.005 | mg/L | (i) |
| Metals | Arsenic (inorganic) | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.01 | mg/L | (i) |
| Metals | Arsenic (inorganic) | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.16 | mg/L | (i) |
| Metals | Arsenic (inorganic) | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.025 | mg/L | (i) |
| Metals | Arsenic (inorganic) | Natural | Surface | NA | Tier 1 (Surface Water) | 0.005 | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| | | Area | Water | | | | | |
| Metals | Arsenic (inorganic) | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | NV | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 2.0 | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Irrigation (Surface Water) | NV | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | NV | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 2.0 | mg/L | (i) |
| Metals | Barium | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 1.5 | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 5.0 | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 1.0 | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 5.0 | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 1.0 | mg/L | (i) |
| Metals | Boron | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Cadmium | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | VARa | mg/L | (i) |
| Metals | Cadmium | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.007 | mg/L | (i) |
| Metals | Cadmium | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.0082 | mg/L | (i) |
| Metals | Cadmium | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.08 | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| Metals | Cadmium | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | VARa | mg/L | (i) |
| Metals | Cadmium | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.001 | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.008 | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.001 | mg/L | (i) |
| Metals | Chromium (hexavalent) | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Irrigation (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Chromium (total) | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (trivalent) | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.0089 | mg/L | (i) |
| Metals | Chromium (trivalent) | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | NV | mg/L | (i) |
| Metals | Chromium (trivalent) | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.0049 | mg/L | (i) |
| Metals | Chromium (trivalent) | Natural | Surface | NA | Livestock Water (Surface | 0.05 | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| | | Area | Water | | Water) | | | |
| Metals | Chromium (trivalent) | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.0049 | mg/L | (i) |
| Metals | Chromium (trivalent) | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.007 | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 1.0 | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.2 | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.5 | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.007 | mg/L | (i) |
| Metals | Copper | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.3 | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.3 | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 5.0 | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | NV | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.3 | mg/L | (i) |
| Metals | Iron | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Lead | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | VARa | mg/L | (i) |
| Metals | Lead | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.005 | mg/L | (i) |
| Metals | Lead | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.2 | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| Metals | Lead | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.1 | mg/L | (i) |
| Metals | Lead | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | VARa | mg/L | (i) |
| Metals | Lead | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | NV | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.02 | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.2 | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | NV | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.02 | mg/L | (i) |
| Metals | Manganese | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.000005 | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.001 | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Irrigation (Surface Water) | NV | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.003 | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.000005 | mg/L | (i) |
| Metals | Mercury (total) | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Molybdenum | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 31 | mg/L | (iv) |
| Metals | Molybdenum | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 31 | mg/L | (iv) |
| Metals | Nickel | Natural | Surface | NA | Aquatic Life (Surface | VARa | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| | | Area | Water | | Water) | | | |
| Metals | Nickel | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | NV | mg/L | (i) |
| Metals | Nickel | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.2 | mg/L | (i) |
| Metals | Nickel | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 1.0 | mg/L | (i) |
| Metals | Nickel | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | VARa | mg/L | (i) |
| Metals | Nickel | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.002 | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.02 | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.002 | mg/L | (i) |
| Metals | Selenium | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.0001 | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | NV | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.02 | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.05 | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.0001 | mg/L | (i) |
| Metals | Silver | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| Metals | Uranium | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.015 | mg/L | (i) |
| Metals | Uranium | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.02 | mg/L | (i) |
| Metals | Uranium | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 0.01 | mg/L | (i) |
| Metals | Uranium | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 0.2 | mg/L | (i) |
| Metals | Uranium | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.01 | mg/L | (i) |
| Metals | Uranium | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Aquatic Life (Surface Water) | 0.03 | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 5.0 | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Irrigation (Surface Water) | 1.0 | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Livestock Water (Surface Water) | 50 | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Tier 1 (Surface Water) | 0.03 | mg/L | (i) |
| Metals | Zinc | Natural Area | Surface Water | NA | Wildlife Water (Surface Water) | NV | mg/L | (i) |

# Saskatchewan Environmental Quality Guidelines

| Classification | Chemical | Land Use | Media | SubMedia | Parameter | Value | Units of Measure | Data Source |
|---|---|---|---|---|---|---|---|---|
| Radionuclides | Radium-226 | Agricultural | Surface Water | NA | Drinking Water (Surface Water) | 0.11 | Bq/L | (iii) |
| Radionuclides | Radium-226 | Commercial | Surface Water | NA | Drinking Water (Surface Water) | 0.11 | Bq/L | (iii) |
| Radionuclides | Radium-226 | Industrial | Surface Water | NA | Drinking Water (Surface Water) | 0.11 | Bq/L | (iii) |
| Radionuclides | Radium-226 | Natural Area | Surface Water | NA | Drinking Water (Surface Water) | 0.11 | Bq/L | (iii) |
| Radionuclides | Radium-226 | Residential/Parkland | Surface Water | NA | Drinking Water (Surface Water) | 0.11 | Bq/L | (iii) |

**Abbreviations and Value Sources**

Hide

BDL - Below Detection Limit
NA - Not applicable. Calculated value exceeds 1,000,000 mg/kg or pathway excluded.
NGR - No guideline required; calculated guideline exceeds solubility limit.
VARa - Variable value, dependent on other factors. See aquatic life pathway from SEQG data source.
VARb - Variable value, dependent on other factors. See Carcinogenic PAHs from SEQG data source.
NV - No value
(i) - Value obtained from 2022 Alberta Tier 1 Soil and Groundwater Remediation Guidelines [January 2023]
(ii) - Value obtained from Saskatchewan Ministry of Environment 2017
(iii) - Value obtained from EPB #602: Radium-226 in Surface Water Environmental Quality Guideline, July 7, 2016
(iv) - Value obtained from Saskatchewan Water Security Agency, WSA 514 - Saskatchewan Water Quality Objective for the Protection of Aquatic Life - Molybdenum, 2019
(v) - Value obtained from CCME Guidelines for Compost Quality, Table 1 Category A, 2005

# 7 Beaverlodge Institutional Control Inspection Field Guide

BEAVERLODGE

# Beaverlodge Institutional Control Inspection Field Guide

**Prepared for:**

**Ministry of Energy and Resources**

**Government of Saskatchewan**

**Prepared by:**

**Cameco Corporation**

Issued Date: March 2024

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# 1.0 INTRODUCTION

The Beaverlodge Institutional Control Inspection Field Guide (Beaverlodge - ICIFG) provides a description of the relevant areas and a summary of the key aspects of the decommissioned Beaverlodge properties that will require future inspection as part of the Institutional Control (IC) monitoring program.

## 1.1 Local Environment

The decommissioned Beaverlodge properties are located approximately 8km east of the northern hamlet of Uranium City, within the Taiga Shield ecoregion which is the northernmost ecozone of the province of Saskatchewan. The area is subject to cold winters and low precipitation and is underlain by the crystalline rocks of the Precambrian shield, with poor soil development, covered in areas by glacial drift. The poor drainage and rolling post-glacial topography result in numerous lakes. Most of the rocky hilltops and upper slopes have a sparse, patchy tree cover interspersed with bare or lichen covered rock. The tree cover is made up of jack pine, aspen, birch, black spruce, and white spruce. The lower hillsides and hill bases often have a denser tree cover composed of black spruce with Alaskan paper birch and green alder in some locations. Undergrowth consists of lichens, grasses, ferns and low growing shrubs.

## 1.2 Institutional Control Boundaries

During 2016, discussions were held with the Saskatchewan Ministry of Environment (SkMOE) and the Saskatchewan Ministry of Economy (now known as Saskatchewan Ministry of Energy and Resources (SkMER)) to establish the expected Beaverlodge IC boundaries. The boundaries developed during those discussions reflect the expected IC boundaries once all the properties are transferred to IC and are based on areas of historic mining/milling activities requiring long term monitoring or administrative controls to ensure future land use restrictions are maintained. These areas have been identified in the area outlined in red in Figure 1. Appendix A provides the bounding IC coordinates.

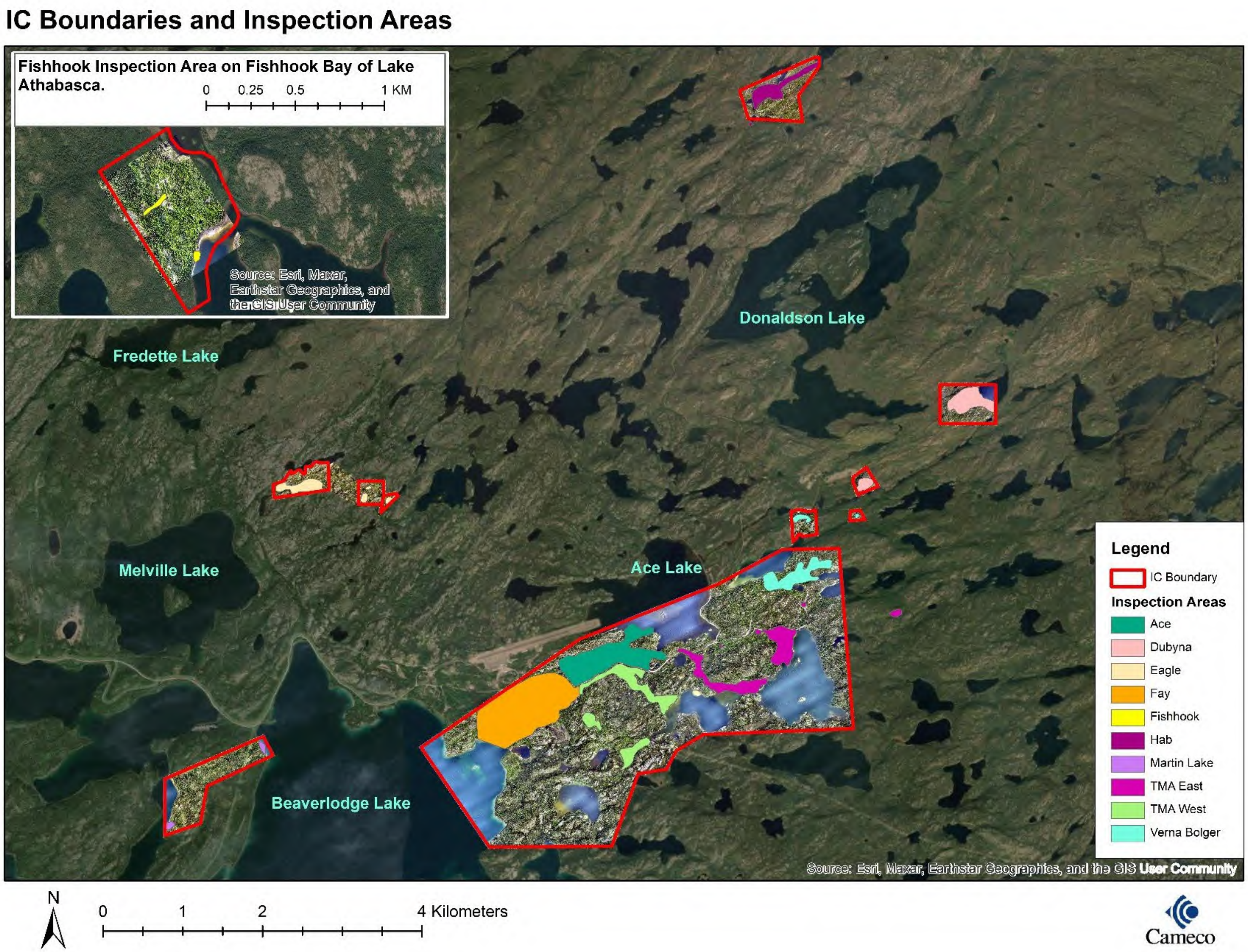


**Figure 1. IC Boundaries**

## 2.0 SUPPORTING DOCUMENTS

Additional detail and more information on the properties included in this guide can be found in the following closure reports:

1. Final Closure Report Beaverlodge Mines: K260, 11 Zone, 46 Zone & Eagle Area (September 2008)
2. Final Closure Report Beaverlodge Properties: HAB 3, HAB 6, EXC 2, RA 6, RA 9, EAGLE 1, BOLGER 2, ATO 26, EXC ATO 26, URA MC, EXC ACE 1, ACE 10, ACE 2 & EXC ACE 3 (March 2016)
3. Final Closure Report Beaverlodge Properties: URA 3, URA 5, EXC URA 5, ACE 5, JO-NES, and HAB 2A (March 2018)
4. Final Closure Report Beaverlodge Properties: ACE 1, ACE 3, ACE 7, ACE 8, ACE 9, ACE 14, ACE MC, EXC ACE 15, EXC URA 7, GC 2, NW 3 Ext, NW 3, URA 4, URA FR, EMAR 1, EXC 1, HAB 1, and HAB 2 (January 2021)
5. Final Closure Report Beaverlodge Properties: URA 7, URA 1, BOLGER 1, and Tailings Management Properties (To be posted).

The following appendices in this guide will provide additional information regarding the planned monitoring.

Appendix A: Bounding coordinates for Beaverlodge areas in IC

Appendix B: Borehole Coordinates

Appendix C: Geotechnical Inspection (Doc. No. BVL-EMP-00-00-01)

Appendix D: Stainless Steel Cap Long-Term Periodic Inspection Checklist

Appendix E: As-Built Package – Engineered Covers for Mine Openings

Appendix F: SRK Geotechnical Inspection Checklist for Zora Creek

# 3.0 MONITORING FREQUENCY

All remedial activities have been completed and the property areas have met the established performance objectives. The properties have been monitored annually since decommissioning was completed (1985) with very little physical change observed. The decommissioned Beaverlodge properties have been transferred to the IC Program following a staged approach, with each stage having their own monitoring program and schedule. The monitoring programs from properties transferred in 2009 and 2019 have coincided with a 5-year frequency.

The Beaverlodge ICIFG is specific to monitoring the physical aspects of the decommissioned Beaverlodge properties. Table 1 provides the frequency of monitoring for the ICIFG. The frequency was informed by inspections completed thus far, and includes inspections conducted every 5 years until 2039, followed by inspections every 10 years thereafter, or at the discretion of SkMER.

**Table 1. Monitoring Frequency**

| Monitoring Year | Monitoring Activities |
|---|---|
| **2029** | Physical inspection |
| **2034** | Physical inspection |
| **2039** | Physical inspection and detailed engineer inspection of the stainless-steel caps |
| **2044** | Physical inspection |
| **2049** | Physical inspection |
| **2059** | Physical inspection and detailed engineer inspection of the stainless-steel caps |
| **2069** | Physical inspection |
| **2079** | Physical inspection, detailed engineer inspection of the stainless-steel caps, and assessment of the Eagle Shaft Cap condition |
| **2089** | Physical inspection |
| **2099** | Physical inspection and detailed engineer inspection of the stainless-steel caps |
| **2100** | Replace Eagle Cap if necessary (consider replacing with a stainless-steel cap) |
| **2109** | Physical inspection |
| **2119** | Physical inspection and detailed engineer inspection of the stainless-steel caps |

# 4.0 MONITORING PLAN

Monitoring of the decommissioned Beaverlodge properties should be conducted by a team consisting of technical field staff and a local guide. The field team will be responsible for performing visual inspections and other required activities. Additional details related to the inspections are outlined below in Section 4.1.

## 4.1 Inspection Tasks

This list provides detailed information regarding the different types of inspection tasks and what is required when the field team is conducting the inspection. This list was developed from the inspection requirements identified in the various property closure reports and were reviewed and accepted by the Canadian Nuclear Safety Commission (CNSC) and SkMOE as properties were previously released from CNSC licensing and transferred to the IC Program. Specific requirements for each area are discussed in Section 5.

1. General site condition
   - i. Unexpected erosion of reclaimed structures or aspects related to former properties within IC boundary.
   - ii. Disturbance to roads (e.g., excavation).
   - iii. Condition of vegetation
     - a. Note general condition of vegetation on site, including age, class, and diversity in comparison to surrounding undisturbed natural forest.
     - b. Take photos at prescribed locations.
     - c. Use photos from previous inspection for comparison.
   - iv. Note presence of wildlife utilizing the sites
     - a. Take photos if applicable.
   - v. Evidence of recent human visitation
     - a. Record signs of visitation and land use (make note and take photos).
     - b. Focus on areas that are easily accessible (i.e., trails, open areas, or power line right of way).
   - vi. Tailings
     - a. Evidence of disturbance to covered or exposed tailings. Record any evidence of anthropogenic activity, such as skidders, or other large equipment accessing areas, or creating new access trails.
     - b. If evidence of disturbance is identified, determine extent of disturbance.
   - vii. Beaver dams
     - a. Condition of dams in the area (make note if they are active or dormant)
     - b. Monitor how they are impacting water levels and potentially downstream water quality.
     - c. Take photos.

viii. Formerly flowing boreholes
   a. Record general condition in area around formerly flowing boreholes.
   b. Record evidence of artesian flow on previously sealed flowing boreholes (e.g., iron staining).
   c. Take photos at prescribed locations.
   d. See Appendix B for location details.

ix. Sand cover for gamma (Eagle area)
   a. Note any anthropogenic disturbance or erosion of the cover.
   b. Take photo of cover for comparison.

x. Pit wall condition
   a. Record general condition, specifically noting any failure or sloughing.
   b. Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.

xi. Waste rock condition
   a. Record general condition, specifically noting any evidence of subsidence or slope failure (take photos).
   b. Evidence of anthropogenic disturbance.
   c. Evidence of acid rock drainage (iron staining of rocks and streams, confirm with lab analysis if suspected)
   d. Take photos as appropriate to record conditions.

2. Condition of access trails and areas adjacent to access trails
   i. Evidence of anthropogenic activity, such as skidder, or other large equipment accessing areas, or creating new access trails.
   ii. Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.
   iii. If evidence of disturbance is identified, determine and record extent of disturbance.

3. General geotechnical inspections (Appendix C and F)
   i. Conducted at the following areas:
      a. Fookes Reservoir Delta
      b. Two outlet spillways at Fookes and Marie Reservoirs
      c. Marie Reservoir Delta
      d. Ace Stope crown pillar area
      e. Hab crown pillar area
      f. Dubyna crown pillar area
      g. Bolger Flow Path between Zora Lake and Verna Lake
   ii. Confirm that each is continuing to perform as expected, based on previous inspections and the as-built reports, where applicable. This will be completed every time there is a field team on site.

4. Stainless-steel caps
    i. Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.
    ii. Take photos of caps and any notable concerns (i.e. Deformity, damage, displacement, or loose or missing bolts fastened to bedrock).
    iii. Kova Engineering has prepared a long-term inspection checklist specifically to monitor the stainless-steel caps. Long-term inspection of the stainless-steel caps should be assessed by a qualified engineer every 25 years, unless visual monitoring identifies cause for investigation prior to that (see Appendix D for information on the design of the stainless-steel caps and recommended inspection frequency and requirements).
5. Backfilled mine openings
    i. Monitor and record any subsidence. Look for any evidence of seepage, i.e., increased vegetation, settling or erosion.
    ii. Take photos.
    iii. See Appendix E.

## 4.2 Drone Imagery

Baseline drone imagery has been collected on all areas within the Beaverlodge IC Boundaries, identified in Figure 1. This data will be provided to the Ministry of Energy and Resources at the time of transfer of all remaining properties to the IC program.

Costs related to ongoing monitoring and maintenance of the Beaverlodge properties have been calculated based on the assumption of physical inspections occurring on the Beaverlodge properties. However, there is potential, as drone technology becomes more widely accepted, the imagery may play a role in future inspections. The drone imagery serves as a baseline for future imagery.

## 4.3 Water and Fish Monitoring

Surface water quality monitoring and fish monitoring will be conducted under the Long-term Monitoring Program. Informed by over 40 years of monitoring data, community engagement activities, and the goals of the IC Program, the LTMP will be used to confirm the established objectives in areas downstream of the decommissioned Beaverlodge properties are being met (Cameco 2023[1]).

Details related to the LTMP have been provided under a separate cover.

[1] Decommissioned Beaverlodge Mine Site Long-Term Monitoring Program. 2023. Cameco Corporation.

# 5.0 INSPECTION AREAS

The properties within the area designated as Crown Reserve to be managed within the IC program have been separated into 10 areas: (1) Eagle, (2) Martin Lake, (3) Fay, (4) Ace, (5) Tailings Management Area, (6) Verna/Bolger, (7) Dubyna, (8) Hab, (9) Moran Pit, and (10) Fishhook Bay. Each of these areas have properties that require monitoring and/or inspections.

The Moran Pit and Fishhook Bay areas were not subject to CNSC licensing; however, they have been remediated following the same process as the other Beaverlodge properties and will be managed in the IC program with established Crown Reserve areas.

It should be noted that the ten areas identified differ from the original property boundaries identified in the closure reports, and are based on geographical location, accessibility, and the presence of aspects that require inspection.

This guide is focused on areas disturbed as a result of past mining and milling activities, that require future inspection within the IC monitoring program (undisturbed areas do not require inspection). The guide also provides a checklist for conducting the inspections and figures that contain information regarding access points to the areas for inspection as well as the geographic location of some of the key features requiring inspection.

## 5.1 Eagle Area

The Eagle area includes the former EAGLE, EAGLE 4, and EAGLE 7 properties. The Eagle area included the decommissioned 12 Zone pit, 12 Zone pit Extension, 02 Zone pit, 42 Zone pit, 32 zone pit, and the Eagle underground mine.

A concrete cap was placed over the shaft in the late 1950s after a fire destroyed the head frame (see Table 2 for openings on property area). The 42 Zone pit was mined during 1974 and 1975 along with the nearby 32 Zone pits. Mining of the 02 Zone was conducted in 1979 and resulted in a small horseshoe shaped open pit, which was decommissioned by partially filling with waste rock in June 1985. Decommissioning of the 42 Zone and 32 Zone pits took place in three separate campaigns in August and November 1982, June and July 1983 and April and May 1985, during which the various pits were partially backfilled with waste rock. At the same time various support facilities and associated infrastructure including the freshwater intake in Shaft Lake and associated piping was removed.

The majority of the pit areas have been backfilled, leaving a series of low northeast trending bedrock ridges generally less than 2 m high. The original concrete cap and collar was replaced with an engineer approved cap and collar in 2000. Areas of elevated gamma (typically associated with the open pits) was covered with a layer of sand in 2009 to reduce gamma levels. The areas are accessible by a road, which branches off Highway 962 approximately 1 km west of the airport. See Figure 2 for the Eagle inspection area.

The 12 Zone Pit, 12 Zone extension and 02 Zone were sometimes referred to as the Intermediate Zone in the Beaverlodge closure documents. The 3 pits of the Intermediate

Zone were mined intermittently between 1975 and 1981 and were in-filled with rock blasted on site in June 1985. The closure documents list an adit of unknown size at the Intermediate Zone that was sealed in June 1985. It is assumed this adit was associated with the 12 Zone open pit and was backfilled in the pit that is flooded.

**Table 2. Eagle Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | |
|---|---|---|---|---|
| | | | Easting | Northing |
| **Shaft** | Vertical | Concrete Cap | 639549 | 6607252 |
| **Adit*** | Horizontal | Backfilled/Flooded | 640379 | 6607245 |

*Located in the flooded 12-Zone pit (no inspection required)

### 5.1.1 Eagle Monitoring Requirements

Monitoring requirements at the Eagle Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Pit wall condition.
4. Waste rock condition.
5. Condition of sand gamma cover.
6. Status of flooded 12 Zone pit (note any changes in water, take picture).
7. Condition of concrete cap (shaft).
8. Note any flow from sealed borehole (59° 34' 50.7" N, 108° 31' 54.9" W)

Eagle Inspection Area

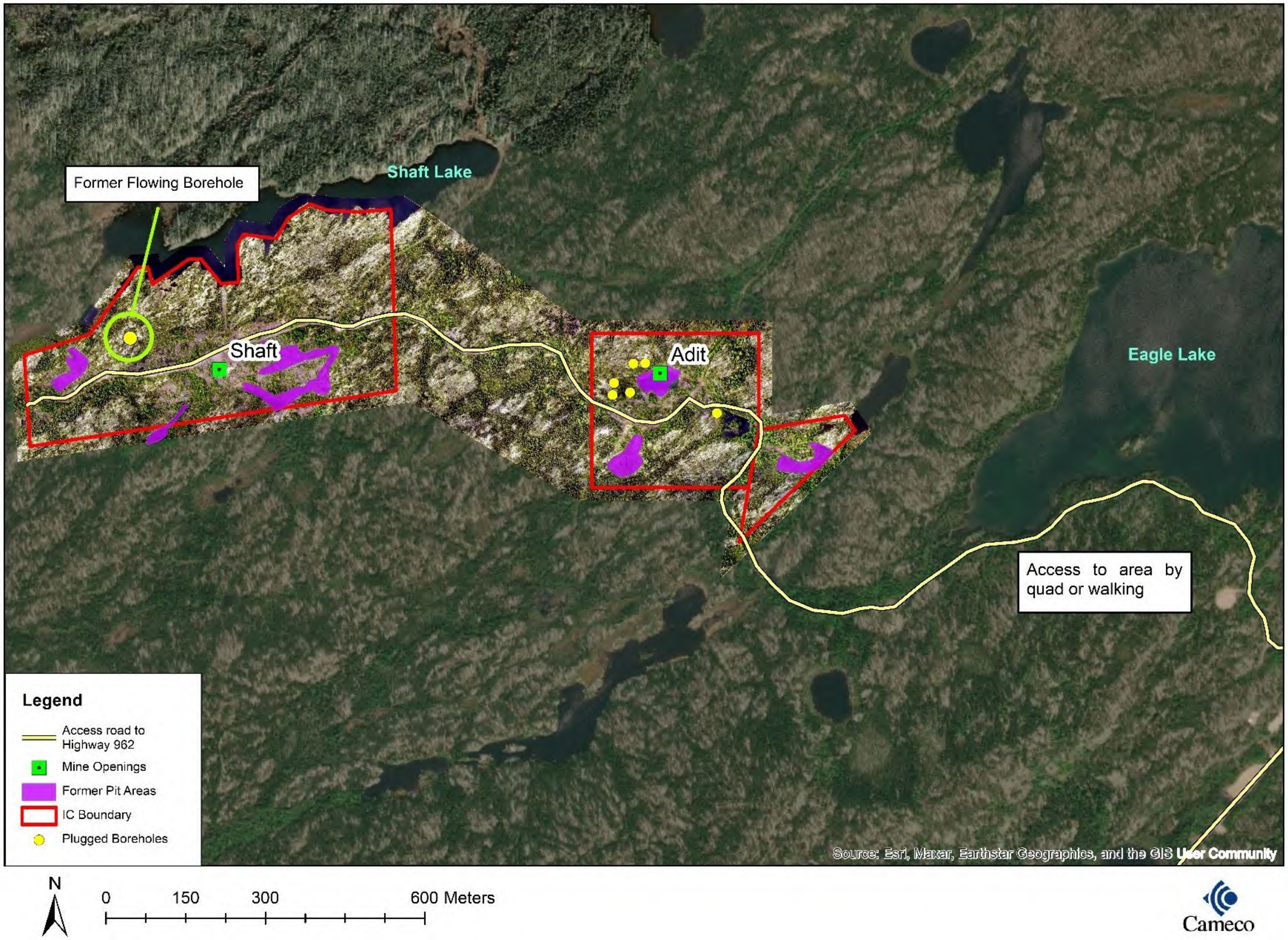


**Figure 2. Eagle Inspection Area**

**Table 3. Eagle Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity)* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photos (at points indicated on figure of area).* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photo locations*<br>1. *Looking 242° SW at 59° 34'45" N, 108° 31'49" W.*<br>2. *Looking 261° W at 59° 34'47" N, 108° 31'33" W.*<br>3. *Looking 98° E at 59° 34'46" N, 108° 3'39" W. ).* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.*<br>1. *Eagle 2 Pit: looking 38° NE at 59°34'40" N, 108° 30'35" W,*<br>2. *Eagle 12 Zone Extension Pit: looking 118° SE at 59° 34'42" N, 108° 30'55" W.*<br>3. *Eagle 4/7: looking 261° W at 59° 34'47" N, 108° 31'33" W.*<br>4. *Eagle 4/7 Extension: looking 253° W at 59° 34'48" N, 108° 32'1" W.* | |
| | *Additional comments:* | |

| | | |
|---|---|---|
| **Condition of concrete cap** | *Check for any signs of subsidence from around the cap.* | |
| | *Photo of cap - note changes from previous.*<br>1. *Looking 24°NE at 59° 34'48" N, 108° 31'44" W.* | |
| | *Additional comments:* | |
| **Eagle Property Area sand gamma cover** | *Note any anthropogenic disturbance or erosion to cover.* | |
| | *Take photo of cover.*<br>1. *Looking 261° W at 59° 34'47" N, 108° 31'32" W.*<br>2. *Looking 39° NE at 59° 34'47" N, 108° 31'32" W.*<br>3. *Looking 5° N at 59° 34'50" N, 108° 31'41" W.* | |
| | *Additional comments:* | |
| **Status of flooded 12 Zone pit** | *Water level change (yes or no). If yes, provide detail.* | |
| | *Take photo of pit.*<br>1. *Looking 50° NE at 59° 34'45" N, 108° 30'52" W.* | |
| | *Additional comments:* | |
| **Formerly flowing borehole** | *Borehole located at Easting 639381.01 and Northing 6607311.13. Record general condition in area around formerly flowing boreholes and record evidence of artesian flow on previously sealed flowing boreholes (e.g., rust staining).* | |
| | *Take photos if located.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments* | |

## 5.2 Martin Lake

The Martin Lake area includes the former properties RA6 and RA9. The decommissioned Martin Lake mine openings straddle the narrow strip of land that separates Martin Lake from Beaverlodge Lake. The original site of the mine development was the advance of an adit on the east shore of Martin Lake in 1948. In 1952 to 1953, a second adit was developed from the west shore of the north end of Beaverlodge Lake and driven to connect with the previous underground workings and to establish a haulage way for ore. Mining operations in the Martin Lake mine ceased in the 1950's.

The Martin Lake area does not include any mined-out pits or artificially created slopes other than a short slope of waste rock to the lake on the Martin Lake side and the small slope created by the final closure of the adit on the Beaverlodge Lake side. See Table 4 for location of mine openings and Figure 3 for the Martin Lake inspection area.

**Table 4. Martin Lake Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | |
|---|---|---|---|---|
| | | | Easting | Northing |
| Adit (BVL) | Horizontal | Backfill | 639081 | 6603934 |
| Adit (MRTN) | Horizontal | Partial Backfill, Steel Grate | 638063 | 6602968 |

### 5.2.1 Martin Lake Monitoring Requirements

Monitoring requirements at the Martin Lake area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Waste rock condition.
4. Evidence of subsidence near (above) adit openings.
5. Condition of backfilled adits and ID sign (Beaverlodge Lake side).
6. Evidence of surface seeps from the adit.
7. Condition of the steel grate on adit and ID sign (Martin Lake side).

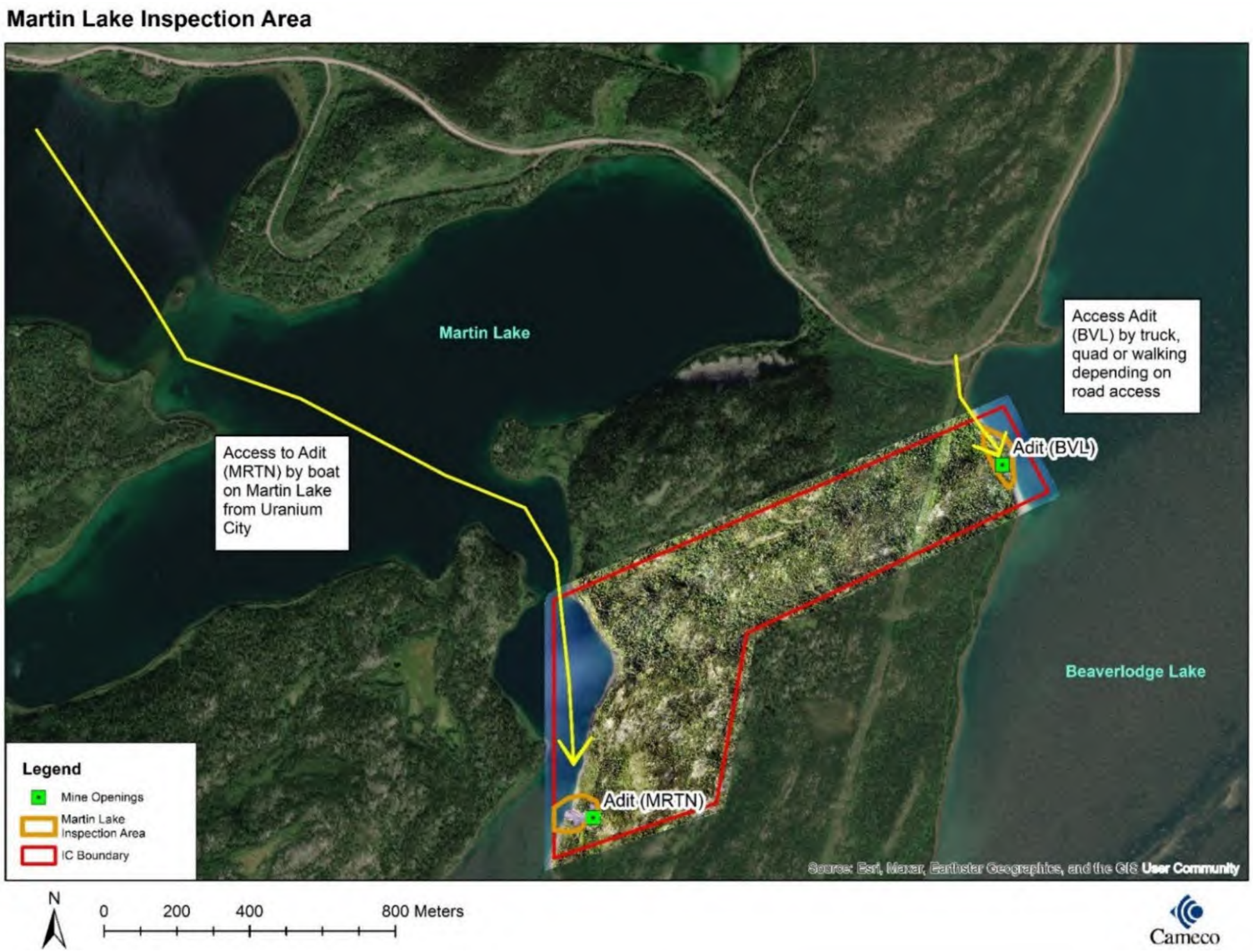


**Figure 3. Martin Lake Inspection Area**

**Table 5. Martin Lake Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (e.g., campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo location Martin Lake Adit (Beaverlodge Lake side)*<br>*1. Looking 240° SW at 59° 33'2"N, 108° 32'23"W).* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photo location*<br>*1. Looking 169° S at 59° 33'2"N, 108° 32'23"W*<br>*2. Also require photos of Martin Lake Adit from Martin Lake side* | |
| | *Additional comments:* | |
| **Condition of the backfilled adit (Martin Lake side)** | *Note any subsidence, if present.* | |
| | *Photo near adit opening.* | |
| | *Additional comments:* | |
| **Condition of backfilled adit (Beaverlodge Lake side)** | *Note any subsidence.* | |
| | *Photo location*<br>*1. Looking 220° SW at 59° 33'2"N, 108° 32'24"W and looking 225° SW at 59° 33'2"N, 108° 32'24"W. Bottom photo is a close-up of the upper left corner of the picture on the top. It is provided as a reference to evaluated if there is any settlement or erosion of the adit cover along the south edge of the cover.* | |
| | *Additional comments:* | |
| | *Note if there is any evidence of seeps.* | |
| | *Photos of any seeps.* | |

| | | |
|---|---|---|
| **Evidence of surface seeps from the adits** | *Additional comments:* | |
| **Condition of the steel grate on adit (Martin Lake side)** | *Note condition of the grate, rust, or wear. Check welds and attachment points.* | |
| | *Photo of adit.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.3 Fay Area

The Fay Area consisted of URA 7, URA MC, URA 1, URA 4, URA 3, ATO 26, EXC ATO, URA FR, EXC URA 7, URA 5, and EXC URA 5 individual properties. The Fay Area included the Fay Shaft and various support infrastructure (such as the office, mine dry change room, warehouse, hoist house, etc.), various mine openings (see Table 6), mill annex buildings, mill facility, oxygen plant, Lower Fay Pit, bulk fuel storage tanks, waste rock, seeps from waste rock pile, sealed artesian boreholes, and spilled tailings. See Figure 4 for the Fay inspection area. It should be noted, only 11 openings appear on Figure 4 due to Custom Ore Raise also including Custom Ore Bin, and Sorting Plant Bin and Sorting Plant Raise are marked at the same location covered with waste rock.

**Table 6. Fay Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID |
|---|---|---|---|---|---|
| | | | Easting | Northing | Plate Coordinates |
| Shaft | Vertical | Stainless-steel | 642676 | 6604704 | 59°33'22.51"N, 108°28'31.42"W |
| Custom Ore Raise | Vertical | Engineered cover using rock | 642623 | 6604658 | 59°33'21.0"N, 108°28'34.0"W |
| Custom Ore Bin | Vertical | Engineered cover using rock | 642637 | 6604656 | 59°33'21.0"N, 108°28'34.0"W |
| Fay Ladder Access | Vertical | Engineered cover using rock | 642606 | 6604655 | 59°33'21.0"N, 108°28'34.0"W |
| CB-1 Access Raise | Vertical | Engineered cover using rock | 642558 | 6604563 | 59°33'18.09"N, 108°28'39.25"W |
| Surface Dump Raise | Vertical | Stainless-steel | 642595 | 6604639 | 59°33'20.5"N, 108°28'36.7"W |
| Sorting Plant Raise | Vertical | Backfilled | 642603 | 6604520 | 59°33'16.64"N, 108°28'36.49"W |
| Sorting Plant Bin | Vertical | Backfilled | 642603 | 6604520 | 59°33'16.64"N, 108°28'36.49"W |
| Waste Haul Adit | Horizontal | Backfilled | 642638 | 6604450 | |
| Fine Ore Dump | Vertical | Stainless-steel | 642667 | 6604715 | 59°33'22.86"N, 108°28'31.96"W |

| | | | | | |
|---|---|---|---|---|---|
| Pipe Drift Raise | Vertical | Backfilled | | | N/A |
| 25373 Raise | Vertical | Stainless-steel | 642253 | 6604665 | 59°33'21.77"N, 108°28'58.44"W |
| 24094 Raise (Vent) | Vertical | Stainless-steel | 642702 | 6604631 | 59°33'20.1"N, 108°28'29.9"W |

### 5.3.1 Fay Monitoring Requirements

Monitoring requirements at the Fay Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Condition of cover on Lower Fay Pit.
4. Pit wall condition.
5. Waste rock condition.
6. Condition of mill cover and note areas of any subsidence.
7. Condition of the previously flowing boreholes BH-001, BH-002, BH-003, BH-004, BH-005, BH-006, BH-007, BH-15, and BH-31.
8. Evidence of disturbance to covered tailings.
9. Evidence of any seepage from former open pit (Lower Fay Pit).
10. Condition of the stainless-steel capped mine openings, engineered rock covered mine openings, and backfilled openings and the related ID plates.
11. Beaver dams (if applicable)

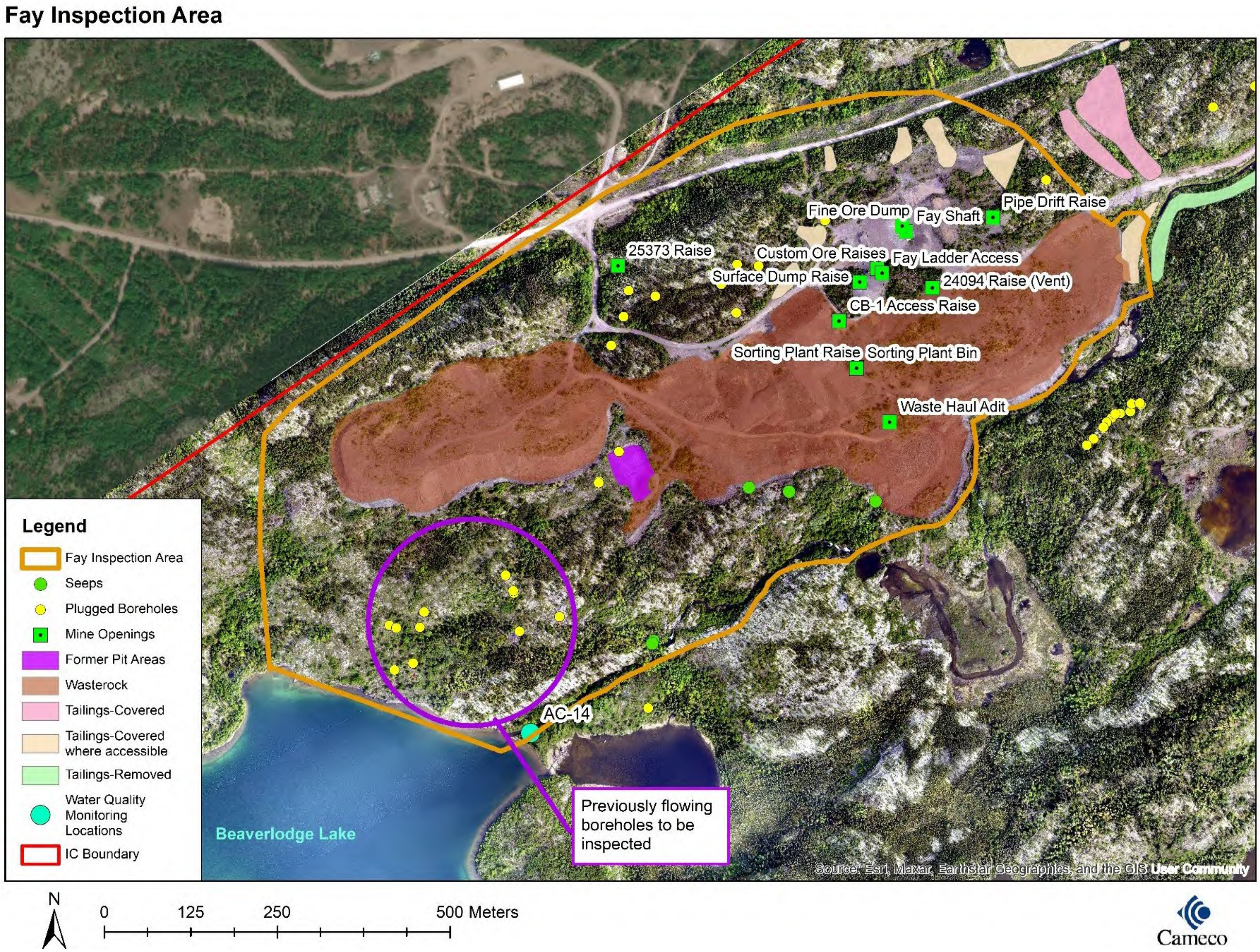


**Figure 4. Fay Inspection Area**

**Table 7. Fay Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity)* | |
| | *Additional comments* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photos (at points indicated on figure of area)* | |
| | *Additional comments* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photos (at points indicated on figure of area). Note: no image of Seep 1 was available to share.* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.* | |
| | *Additional comments:* | |
| **Condition of cover on Lower Fay Pit and seepage** | *Note any subsidence of cover or exposed debris. Also note any seepage from the pit.* | |
| | *Take photo of cover and any evidence of flow from seeps.* | |
| | *Additional comments:* | |
| **Condition of mill cover** | *Note of any areas of subsidence or erosion.* | |
| | *Take photo of cover.* | |
| | *Additional comments:* | |

| | | |
|---|---|---|
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |
| | *Take photos of caps and any notable concerns.* | |
| | *Additional comments:* | |
| **Condition of backfilled and rock covered openings** | *Note any subsidence.* | |
| | *Take photos of opening locations.* | |
| | *Additional comments:* | |
| **Tailings Disturbance** | *Note any disturbance to covered tailings.* | |
| | *Take photos if disturbed.* | |
| | *Additional comments:* | |
| **Formerly flowing boreholes** | *Evidence of any flow from boreholes BH-001, BH-002, BH-003, BH-004, BH-005, BH-006, BH-007, BH-15, and BH-31. Record general condition in area around formerly flowing boreholes and record evidence of artesian flow on previously sealed flowing boreholes (e.g., rust staining).* | |
| | *Take photo if there is flow.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.4 Ace Area

The Ace Area includes the former ACE 1, ACE MC, ACE 2, ACE 14, EXC ACE 3, ACE 3, EXC ACE 1, and ACE 10 individual properties. The Ace Area included various mine openings (see Table 8), the dorrclone facility, backfill concrete plant, a freshwater pumphouse and related piping to the Fay freshwater reservoir, and a portion of the tailings line that went between the Fay mill and the Dorrclone, Fay-Verna service corridor, the Ace heating building, an electrical substation, electrical transmission and communication infrastructure (poles, mounting brackets and wire lines), main haul road between the former Fay and Verna mine sites which transects the area, and a portion of the former tailings pipeline corridor to the Marie and Fookes Reservoirs, and spilled tailings as identified in Figure 5.

At decommissioning a borehole was drilled to drain water from the Ace Stope area into the 2157 Raise, before it entered Ace Creek. As the mine workings are now flooded water has been observed flowing into the borehole, or out of the borehole depending on local groundwater levels. As a result, the borehole was sealed in 2021. The sealed borehole (AC-24) is located within a shallow stream bed between the main access road and Ace Creek and may be difficult to distinguish during inspection.

**Table 8. Ace Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID Plate Coordinates |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| Shaft | Vertical | Stainless-steel | 643711 | 6605394 | 59°33'43.52"N, 108°27'23.86"W |
| 2157 Raise | Vertical | Stainless-steel | 643347 | 6605117 | 59°33'35.0"N, 108°27'47.7"W |
| 2157 Finger Raise | Vertical | Stainless-steel | 643340 | 6605107 | 59°33'34.7"N, 108°27'48.2"W |
| 130 Raise | Vertical | Stainless-steel | 643773 | 6605390 | 59°33'43.3"N, 108°27'19.9"W |
| 195 Access Raise | Vertical | Backfilled | 643512 | 6605180 | 59°33’36.8”N, 108°27’37.0”W |
| 195 Raise | Vertical | Backfilled | 643512 | 6605180 | 59°33’36.8”N, 108°27’37.0”W |
| 105*2 Raise | Vertical | Engineered cover using rock | 643584 | 6605288 | 59°33’40.2”N, 108°27’32.2”W |
| 201 Raise | Vertical | Backfilled | 643615 | 6605277 | 59°33'39.8”N, 108°27’30.3”W |

The * noted for the opening 105*2 Raise does not have any meaning in the table. It is reflective of the way the name of the raise is listed in the decommissioning documents.

### 5.4.1 Ace Monitoring Requirements

Monitoring requirements at the Ace Area will consist of:

1. Evidence of recent human visitation
2. Condition of vegetation.
3. Evidence of disturbance to covered tailings.
4. Evidence of disturbance of the waste rock covered tailings.
5. Evidence of crown pillar subsidence
6. Condition of the stainless-steel caps and the covered raises.
7. Waste rock condition.
8. Condition of the previously flowing borehole AC-24 (if located)
9. Beaver dams (if applicable).

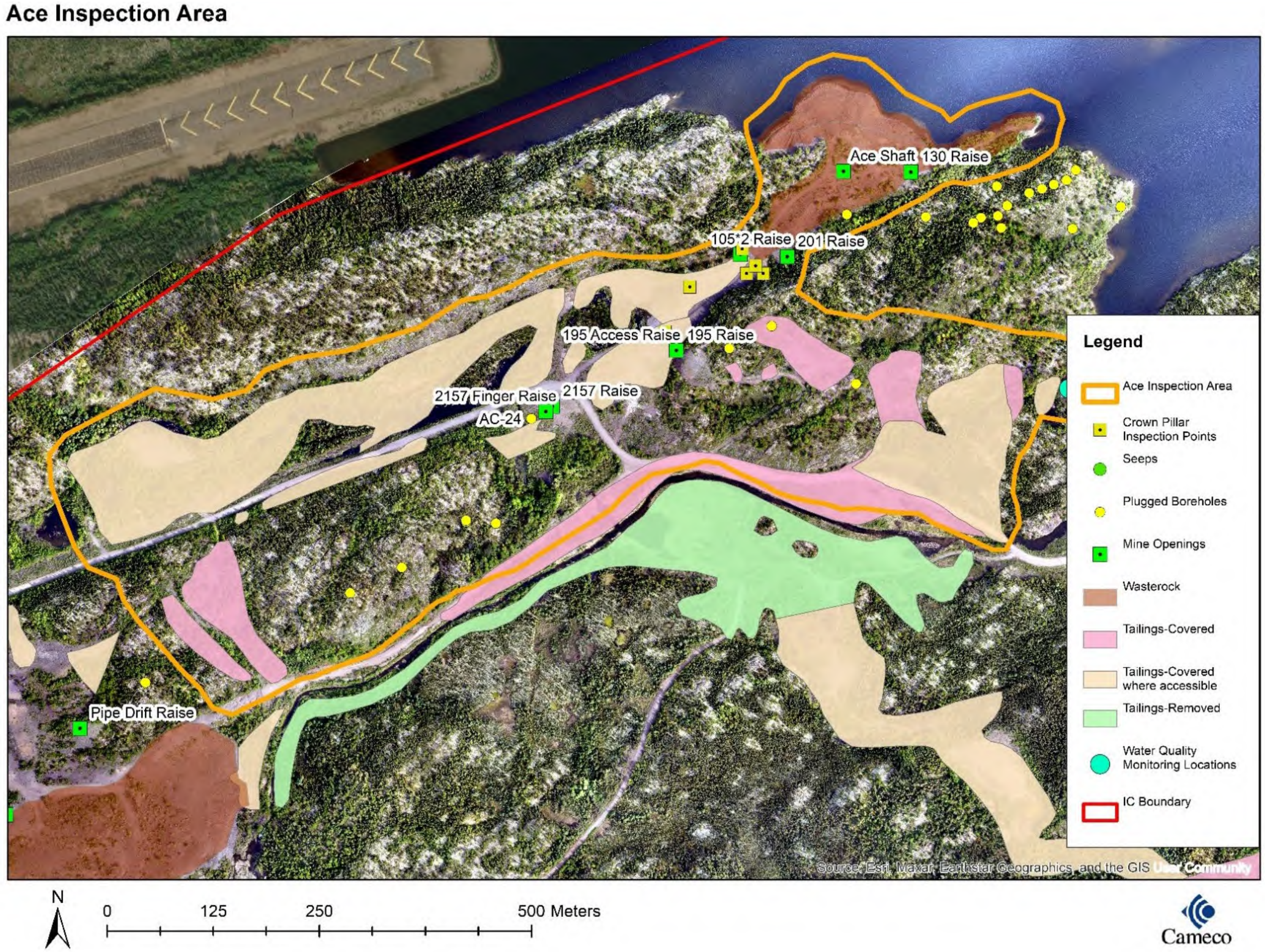


**Figure 5. Ace Inspection Area**

**Table 9. Ace Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of Access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo location*<br>*1. Looking 290° W at 59° 33’36” N, 108°27’37” W.* | |
| | *Additional comments:* | |
| **Tailings Disturbance** | *Note any disturbance to covered tailings.* | |
| | *Take photos if disturbed.*<br>*1. Looking 23° NE at 59° 33’36” N, 108°27’48” W.* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photo location*<br>*1. Looking 96° E at 59° 33’46” N, 108°27’25” W.* | |
| | *Additional comments:* | |
| **Evidence of crown pillar subsidence** | *Conduct geotechnical inspection as per task specific requirement* | |
| | *Take photos as per geotechnical inspection guidelines.* | |
| | *Additional comments:* | |

| | | |
|---|---|---|
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |
| | *Take photos of caps and any notable concerns.*<br>*1. 130 Raise: looking 228° SW at 59° 33'43" N, 108°27'19" W.*<br>*2. Shaft: looking 300° NW at 59° 33'43" N, 108°27'24" W.*<br>*3. 2157 Raise: looking 256° W at 59° 33'34" N, 108°27'47" W.*<br>*4. 2157 Finger Raise: looking 43° NE at 59°33'34" N, 108°27'48" W..* | |
| | *Additional comments:* | |
| **Condition of backfilled and rock covered openings** | *Note any subsidence.* | |
| | *Take photos of opening locations.*<br>*1. 201 Raise Cover: looking 157° SE at 59° 33'40" N, 108°27'30" W.*<br>*2. 105*2 Raise Cover: looking 32° NE at 59° 33'40" N, 108°27'33" W.*<br>*3. 195 Raise and 195 Access Raise: looking 127° NE at 59° 33'36" N, 108°27'39" W.* | |
| | *Additional comments:* | |
| **Formerly flowing boreholes** | *Borehole AC-24 located at N 59° 33' 36" W 108° 27' 50.4". Note of any flow on ground (e.g., rust staining). Record general condition in area around formerly flowing boreholes and record evidence of artesian flow on previously sealed flowing boreholes (e.g., rust staining).* | |
| | *Take photos if located.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.5 Tailings Management Area

The Tailings Management Area (TMA) represents the area where tailings were deposited from the milling process. The individual properties that made up the TMA were EXC ACE 15, GC 2, GC 3, EXC GC 3, GC 5, GC 1, GORE 1, NW 2, NW 1, LEE 4, GORE 2, LEE 3, EXC LEE 3, LEE 2, EXC ACE 18, EXC ACE 17, ACE 9, ACE 17, ACE 15, EXC ACE 14, GORE, EXC GC 2, GC 4, EXC GC 4, URA 6, EXC URA 6, and ACE 19.

At the start of milling operations in 1953, tailings were deposited in Minewater Reservoir. In 1954, the tailings line was moved to Marie Reservoir, and to Fookes Reservoir in 1957. In 1970 Minewater Reservoir, which originally discharged to Ace Creek, and was used for tailings deposition during the initial milling period, was re-directed to flow into the Fulton watershed as the waterbody was being used as a settling pond for treated minewater from the Fay shaft. A channel was blasted in the bedrock south of Minewater Reservoir following decommissioning to permanently change the drainage of the Minewater Reservoir towards the TMA, making the saddle dam constructed in 1970 obsolete. Dams were constructed at the outlets of Fookes and Marie reservoirs in 1969 and 1971 respectively, to maintain water levels.

In 1976 a water treatment plant was constructed at the outlet of Marie Reservoir, and the Meadow Settling Pond was created by the construction of the Meadow Basin dam (TL-7) in 1977 (Eldorado 1983). The control structure of the Meadow Basin dam was removed in 2021 and only the concrete structure remains.

An area approximately 100 m to the north and west of the Marie Outlet was built up with large angular rip-rap, to prevent water from flowing through an alternate path. Greer Lake has been impacted by historical milling activities and has been included within the boundaries proposed for transfer to the IC Program. The decommissioning of the TMA was carried out between the winter of 1983 and the summer of 1985.

To assist with ease of access for monitoring the property areas, the TMA has been separated into two areas: TMA West (Marie and Minewater Reservoirs) and TMA East (Fookes Delta and Reservoir). See Figure 6 and Figure 7 for the respective inspection areas.

### 5.5.1 TMA West Area Monitoring Requirements

1. Evidence of recent human visitation
2. Condition of vegetation.
3. Condition of Marie Delta cover.
4. Make note of the ponded water in Ace Uplands (size, extent, take photos for comparison).
5. Evidence of disturbance to the covered tailings delta and tailings line right of way.
6. Condition of concrete structure that was formerly the foundation of the Meadow basin dam.
7. Geotechnical inspection of Marie Outlet structure.
8. Check secondary outlet of Marie and powerline right-of-way.

9. Inspection of Minewater outflow channel for blockages of the channel (sloughing, beaver dams, etc.)
10. Note condition of obsolete Minewater saddle dam.
11. Evidence of obvious and significant erosion of the Ace Creek channel in the Ace Lowlands area (may also be inspected as part of the Ace inspection area).
12. Beaver dams (specifically the outlet of Marie Reservoir, Outlet of Meadow Fen, along Lower Ace Creek).

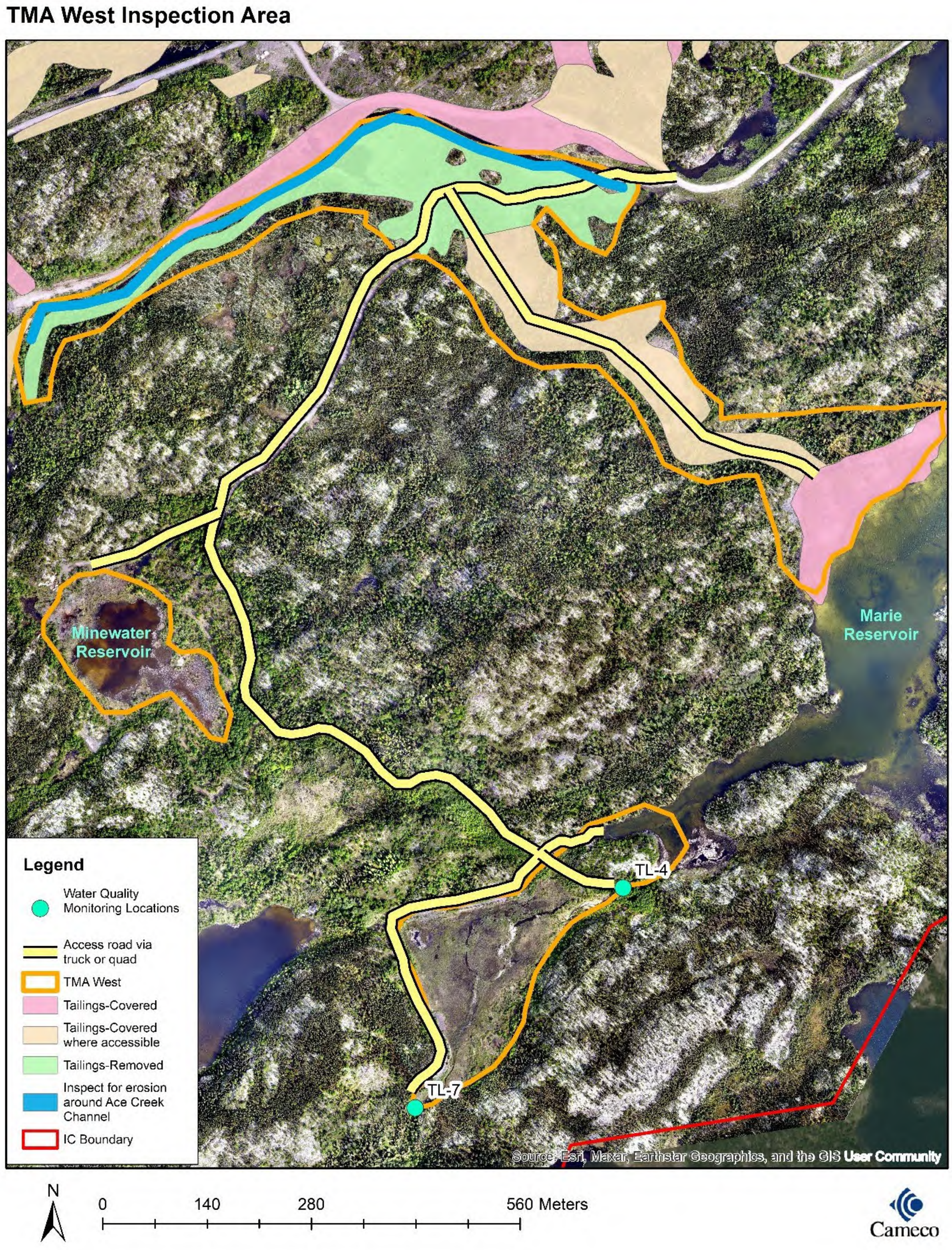


**Figure 6. TMA West Inspection Area**

### Table 10. TMA West Inspection Checklist

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo locations*<br>*1. Minewater berm: looking 258° W at 59° 33’4” N, 108°28’4” W.*<br>*2. Marie (potential) secondary Outlet: looking 34° NE at 59° 32’59” N, 108°27’22” W.* | |
| | *Additional comments:* | |
| **Condition of Marie Delta cover** | *Note any erosion or disturbance to cover.* | |
| | *Take photo of cover for comparison.*<br>*Photo location*<br>*1. Looking 28° NE at 59° 33’12” N, 108°27’1” W.* | |
| | *Additional comments:* | |
| **Make note of the ponded water in Ace Uplands** | *Note size and extent of pond.* | |
| | *Take photo of pond for previous comparison.* | |
| | *Additional comments:* | |
| **Tailings Disturbance** | *Note any disturbance to covered tailings, and tailings right-of-way.* | |
| | *Take photos if disturbed.* | |
| | *Additional comments:* | |
| **Condition of remaining concrete structure at the outlet of the Meadow basin** | *Note condition of dam (for reference only structure is not of concern).* | |
| | *Photo locations:*<br>*1. Looking 220° NE at 59° 32’49” N, 108°27’37” W.*<br>*2. Looking 41° NE at 59° 32’48” N, 108°27’38” W.* | |
| | *Additional comments:* | |

| | | |
|---|---|---|
| **Geotechnical inspection of Marie Outlet structure** | *Conduct geotechnical inspection of outlet. Also inspect potential alternate outlet for erosion and powerline right-of-way for disturbance.*<br><br>*Check the condition of the spillway channel, with a view to confirming the grout-intruded rip-rap is still in place.*<br><br>*Check the condition of the rip-rap on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event* | |
| | *Take photos as per geotechnical inspection guidelines.* | |
| | *Additional comments:* | |
| **Inspection of Minewater outflow channel** | *Monitor for any blockages of the channel, including sloughing, beaver dams, etc.* | |
| | *Take photo of channel for comparison.*<br>*1. Looking 125° SE at 59° 33’4” N, 108°27’53” W.*<br>*2. Looking 3° N at 59° 33’4” N, 108°27’53” W.* | |
| | *Additional comments:* | |
| **Condition of Minewater saddle dam** | *Note condition of dam (for reference only as structure is not of concern).* | |
| | *Take photos of former saddle dam.*<br>*1. Looking 291° W at 59° 33’5” N, 108°28’3” W.*<br>*2. Looking 338° N at 59° 33’4” N, 108°28’4” W.*<br>*3. Looking 258° W at 59° 33’4” N, 108°28’4” W.*<br>*4. Looking 358° N at 59° 33’5” N, 108°28’4” W.* | |
| | *Additional comments:* | |
| **Evidence of obvious and significant erosion of the Ace creek channel in the Ace Lowlands area** | *Note of any erosion.* | |
| | *Take photo of channel for comparison.*<br>*1. Looking 64° NE at 59° 33’29” N, 108°27’45” W.*<br>*2. Looking 244° SW at 59° 33’29” N, 108°27’45” W.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

### 5.5.2 TMA East Monitoring Requirements

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Condition of the 72 Zone Portal plug and ID Plate (59°33'53.03"N, 108°25'07.7"W).
4. Condition of Bored Raise and ID plate (59°33'37.5"N, 108°26'15.8"W).
5. Evidence of disturbance to the covered tailings delta.
6. Geotechnical inspection of Fookes Outlet structure and Delta.
7. Evidence of disturbance of spilled tailings along tailings ROW.
8. Subsidence of waste disposal area.
9. Beaver dam (specifically Fookes Reservoir Outlet)

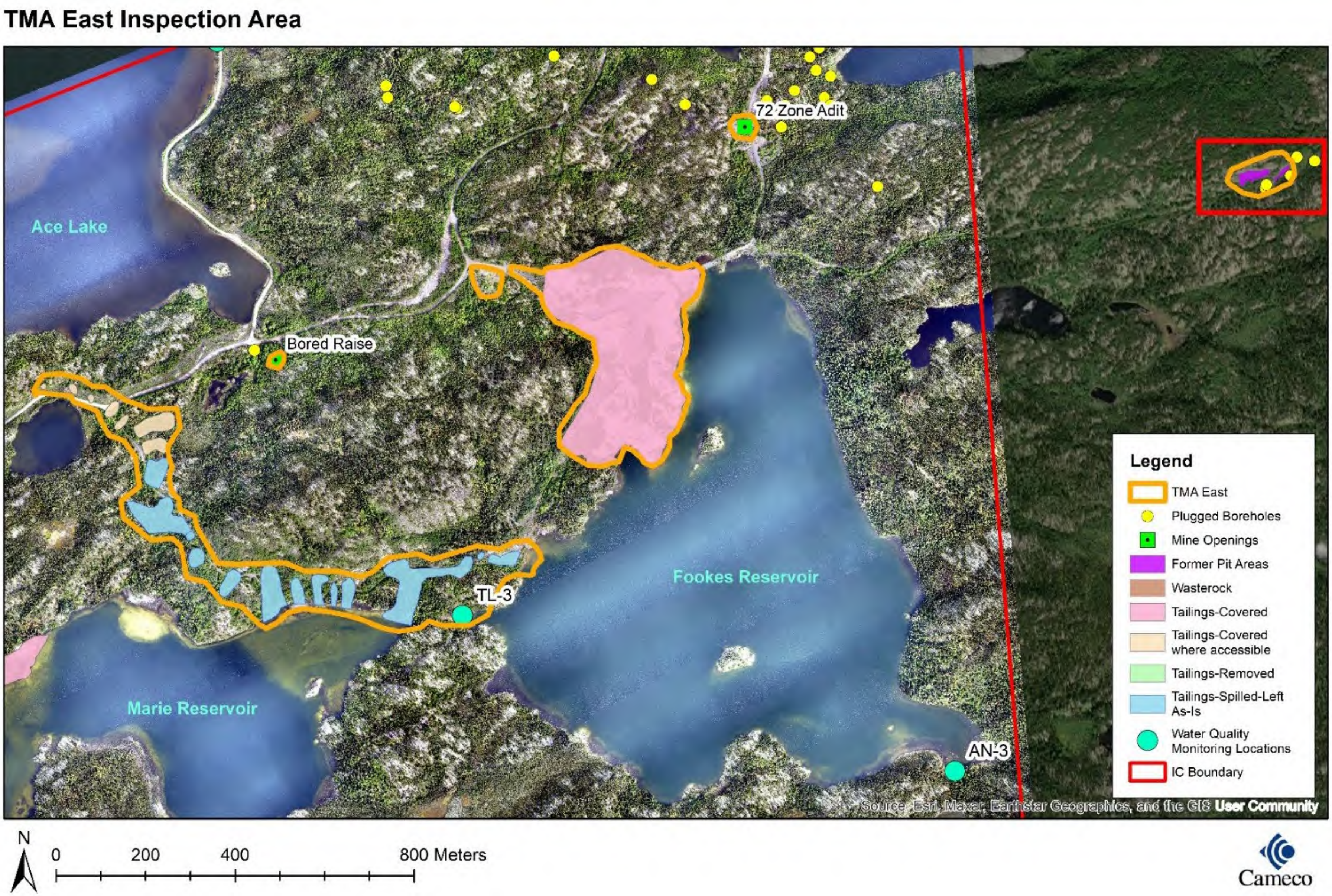


**Figure 7. TMA East Inspection Area**

**Table 11. TMA East Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of Access trails and areas adjacent to access trails** | Note condition of access road (physical condition and vegetation), to aid expectations for future inspections. | |
| | Photos (any signs of activity). | |
| | Additional comments: | |
| **Evidence of recent human visitation on previously disturbed areas** | Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way) | |
| | Photos (any signs of activity). | |
| | Additional comments: | |
| **Condition of vegetation** | Note general condition of vegetation on site. | |
| | *Photo location*<br>1. *Looking 286° W at 59° 33’42” N, 108°25’20” W.* | |
| | Additional comments: | |
| **Condition of the 72 Zone Portal plug** | Note of any subsidence. | |
| | *Take photos of opening.* | |
| | Additional comments: | |
| **Condition of Bored Raise** | Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement. | |
| | *Take photos of opening.*<br>*1. Looking 183° S at 59° 33’37” N, 108°26’15” W.* | |
| | Additional comments: | |
| **Tailings Disturbance** | Note disturbance of tailings along the tailings line corridor (see Figure 7 for tailings extent). | |
| | Take photos if disturbed. | |
| | Additional comments: | |
| **Geotechnical inspection of Fookes Outlet structure and Delta** | Conduct geotechnical inspection of outlet.<br><br>*Check the condition of the spillway channel, with a view to confirming the grout-intruded rip-rap is still in place*<br><br>*Check the condition of the rip-rap on either side of the spillway, with a view to confirming no erosion has occurred due to* | |

| | | |
|---|---|---|
| | *overtopping associated with an extreme flood event* | |
| | Take photos as per geotechnical inspection guidelines. | |
| | Additional comments: | |
| **Subsidence of waste disposal area** | Note of any subsidence. | |
| | *Photo location*<br>*1. Looking 196° S at 59° 33’43” N, 108°25’45” W.* | |
| | Additional comments: | |
| **General observations** | Evidence of wildlife or any other activity. | |
| | Take photos as required. | |
| | Additional comments: | |

## 5.6 Verna and Bolger

The Verna/Bolger property Area previously consisted of BOLGER 1, BOLGER 2, ACE 5, ACE 7, ACE 8, NW 3, NW 3 Ext, EMAR 19 (11 Zone), EMAR 21 (46 Zone) individual properties.

The area included the Bolger pit and the adjacent spur pit, utility corridors, waste rock piles from the Verna shaft and Bolger Pit excavation, freshwater intake and related infrastructure, and mine openings. The Bolger pit was operated intermittently between 1958 and 1980 and was the largest pit at the Eldorado Beaverlodge site and was partially backfilled with decommissioned mining infrastructure, and capped with waste rock, over a 42-week period in late 1984 and early 1985. The Bolger Pit was also used as a disposal location for debris gathered from the decommissioned properties as they were being prepared for final release. The spur pit was mined during the initial to mid-development phase of the Bolger pit and that no decommissioning waste was disposed of within the spur pit.

During the early years of operation waste rock from the Bolger open pit mine was placed into the area west of the pit, extending across a valley through which Zora Creek historically flowed and connected Zora Lake to Verna Lake, resulting in disruption of flow from Zora Creek to Verna Lake. The flow path of Zora Creek was re-established following construction of a channel through the waste rock pile between 2014 and 2016

The main powerline and a communication line from the Fay site crossed Ace Lake and traveled directly over the hill to the Verna powerhouse. The area also hosts the main road from the Fay site and was the site of two explosive storage magazines located approximately 250 and 350 m south of the Verna Shaft location. The former magazines are accessed by a trail which departs from the main road approximately 340 m south of the Verna Shaft area. There were eight mine openings on the Verna/Bolger Area, see Table 12. All openings, with the exception of the Shaft Adit, were identified and marked during the final preparation of the site for release from CNSC licensing and transfer to the IC Program. The Shaft Adit is thought to be buried under the waste rock pile that surrounds the Verna Shaft and could not be located. See Figure 8 for the Verna/Bolger inspection area.

The area also contains the 11 Zone Pit and a small slash pit located east of the main pit on the backslope of the bedrock ridge that formed the 11 Zone Pit. This pit was operated intermittently from the mid-70’s until 1981. The pit was backfilled in 1982, with the most recent cover being added to the main pit area in 2003 to address erosion issues that were noted following a previous cover installation. The slash pit was completely backfilled and does not require inspection.

The 46 Zone property contained an open pit as well as an adit. Mining on this property occurred for 2 years in 1980/81. Both the pit and the adit were decommissioned in September 1982, with the adit being backfilled with waste rock and the pit being partially filled with waste rock.

**Table 12. Verna/Bolger Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID Plate Coordinates |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| Shaft | Vertical | Stainless-steel | 645470 | 6606022 | 59°34'1.6"N, 108°25'30.4"W |
| 026594 Raise | Vertical | Stainless-steel | 645638 | 6606025 | 59°34'1.5"N, 108°25'19.7"W |
| 026594 Finger Raise | Vertical | Stainless-steel | 645667 | 6606030 | 59°34'1.6"N, 108°25'17.8"W |
| 72 Zone Portal | Horizontal | Backfilled | 645836 | 6605771 | Have not recorded |
| Shaft Adit | Horizontal | Backfilled | | | N/A |
| 46 Zone Portal | Horizontal | Backfilled | 645318 | 6607236 | Have not recorded |
| Verna Ladder Access | Vertical | Stainless-steel | 645669 | 6606036 | 59°33'37.5"N, 108°26'15.8"W |

### 5.6.1 Verna/Bolger Area Monitoring Requirements

Monitoring requirements at the Verna/Bolger Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Waste rock condition (note of any subsidence of the Verna Waste rock pile, which may indicate the location of the Verna Shaft Adit).
4. Pit wall condition (Bolger, 11 Zone, 46 Zone).
5. Condition of channel and channel slope
6. Condition of the stainless-steel caps.
7. Condition of backfilled openings, including evidence of instability of crown pillar above portals.
8. Beaver dam.

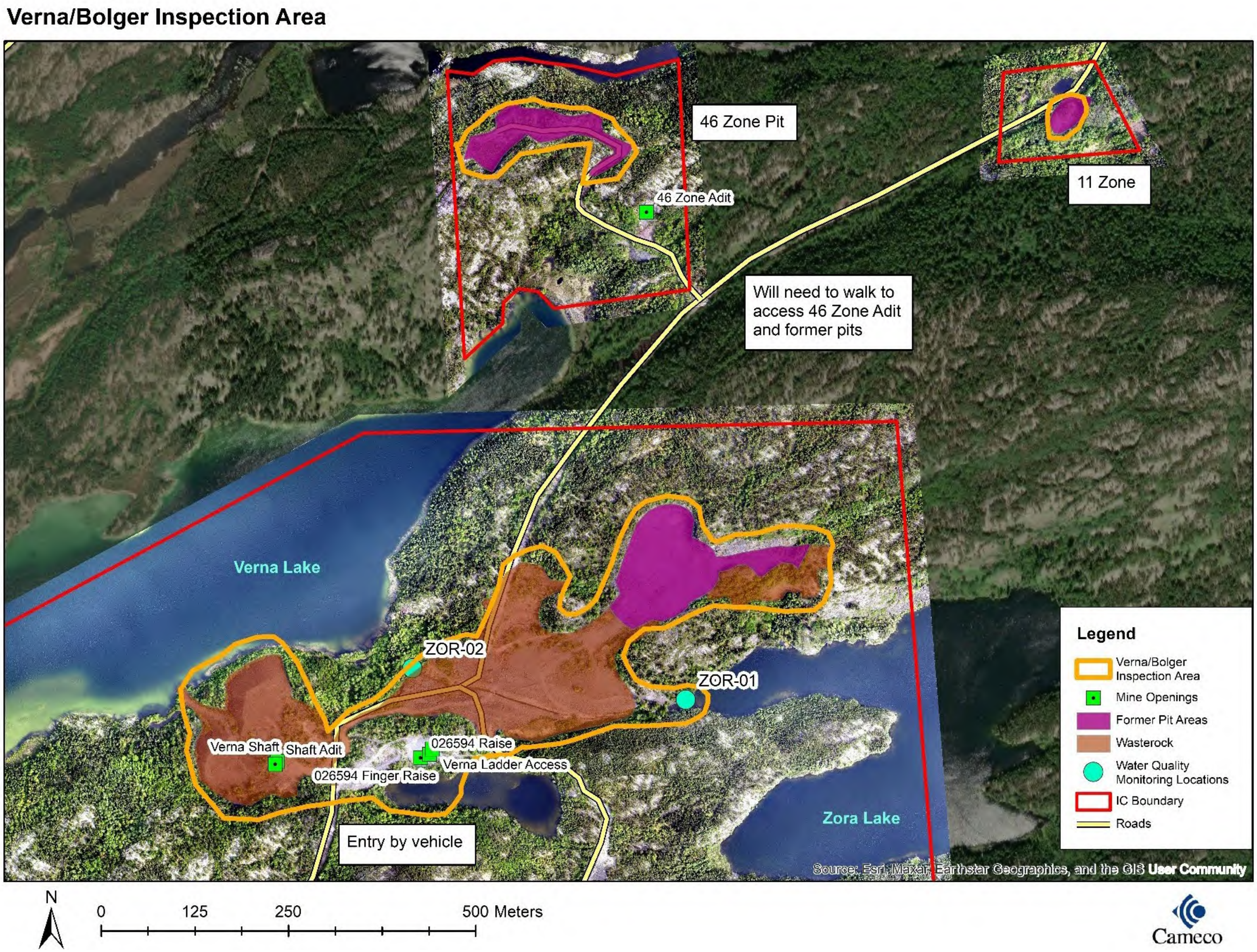


**Figure 8. Verna/Bolger Inspection Area**

**Table 13. Verna/Bolger Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photo location*<br>*1. Looking 231° SW at 59° 34’12” N, 108°25’7” W.* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo location*<br>*1. Looking 68° E at 59° 34’25” N, 108°24’34” W.* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Verna Waste Rock Pile: Record general condition, specifically noting any evidence of subsidence (which may indicate the location of the Verna Shaft Adit), slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Bolger Waste Rock Pile: Note any subsidence, anthropogenic disturbance, and acid rock drainage.* | |
| | *Photo locations*<br>*1. Verna: looking 3° N at 59° 34’1” N, 108°25’37” W.*<br>*2. Stream reconstruction slope: looking : looking 112° E at 59° 34’4” N, 108°25’16” W.*<br>*3. Iron staining at Bolger Pit: looking : 68° E at 59° 34’5” N, 108°25’4” W.* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.* | |

| | | |
|---|---|---|
| | *1. 11 Zone: looking 192° S at 59° 34’28” N, 108°24’4” W.*<br>*2. 46 Zone Pit: 59°34’28” N, 108°25’12” W.*<br>*3. Bolger Pit: looking 31° NE at 59° 34’9” N, 108°24’58” W.*<br>*4. Bolger Spur Pit: looking 63°NE at 59° 34’9” N, 108°24’54” W.* | |
| | *Additional comments:* | |
| **Condition of channel and slope** | *Conduct geotechnical inspection.* | |
| | *Photos* | |
| | *Additional comments:* | |
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |
| | *Take photos of caps and any notable concerns.*<br>*1. Verna Ladder Access: looking 202° S at 59° 34’1” N, 108°25’18” W.*<br>*2. 026594 Finger Raise: looking 195° S at 59° 34’1” N, 108°25’18” W.*<br>*3. 026594 Raise Cover: looking 30° NE at 59° 34’1” N, 108°25’19” W.*<br>*4. Shaft: looking 347° N at 59° 34’1” N, 108°25’31” W.* | |
| | *Additional comments:* | |
| **Condition of backfilled openings** | *Note of any subsidence and evidence of instability of crown pillar above portals.* | |
| | *Take photo of openings.*<br>*1. 46 Zone Portal: looking 84° E at 59° 34’24” N, 108°24’58” W.* | |
| | *Additional comments:* | |
| **Beaver Activity** | *Note of condition of beaver dam at the outlet of Zora Lake (if applicable).* | |
| | *Take photo of dam.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.7 Dubyna Area

The Dubyna Area includes the former JO-NES, EMAR 1, and EMAR 16 (K260) individual properties.

The area includes the former Dubyna mine site which is located on a ridge separating Foot Bay (Donaldson Lake) from Dubyna Lake. The site is accessible by road and is located approximately 6.4 km northeast of the former Beaverlodge mine/mill facilities. Drainage from this site flows towards Dubyna Lake then into upper Ace Creek, through Ace Lake and Lower Ace Creek into Beaverlodge Lake.

Historic mining activities consisted of a series of three small and shallow open pits and portions of the property overlay sections of the Dubyna underground mine. The open pit development was initiated in 1977 and concluded in 1982 with the pits being partially backfilled. Underground development commenced in 1978 and was completed in 1981 and consisted of an adit with a decline ramp system from surface and two separate ventilation raises to surface (see Table 14). During operations, mine water was treated underground at the Dubyna mine and the treated effluent discharged to Dubyna Lake.

There were previously flowing boreholes that have been sealed but are located within Dubyna lake and therefore will not require inspection.

The area includes a small decommissioned open pit (K260) located approximately 2km, via road, from the Dubyna site. The K260 Pit access point is located approximately 200m south of the main access road to the former Dubyna mine site. See Figure 9 for the Dubyna inspection area.

**Table 14. Dubyna Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID Plate Coordinates |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| 810394 Raise | Vertical | Stainless-steel | 647794 | 6608256 | 59°35’10.8”N, 108°22’57.0”W |
| 820694 Raise | Vertical | Stainless-steel | 647820 | 6608451 | 59°35’16.9”N, 108°22’54.7”W |
| Dubyna Portal (Adit) | Horizontal | Backfill | 647806 | 6608229 | 59°35’9.92”N, 108°22’56.17W |

### 5.7.1 Dubyna Monitoring Requirements

Monitoring requirements at the Dubyna Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Pit wall condition (Dubyna pits and K260).
4. Waste rock condition.
5. Evidence of crown pillar subsidence.
6. Condition of stainless-steel capped and backfilled mine opening, checking for subsidence or erosion.
7. Beaver dam.

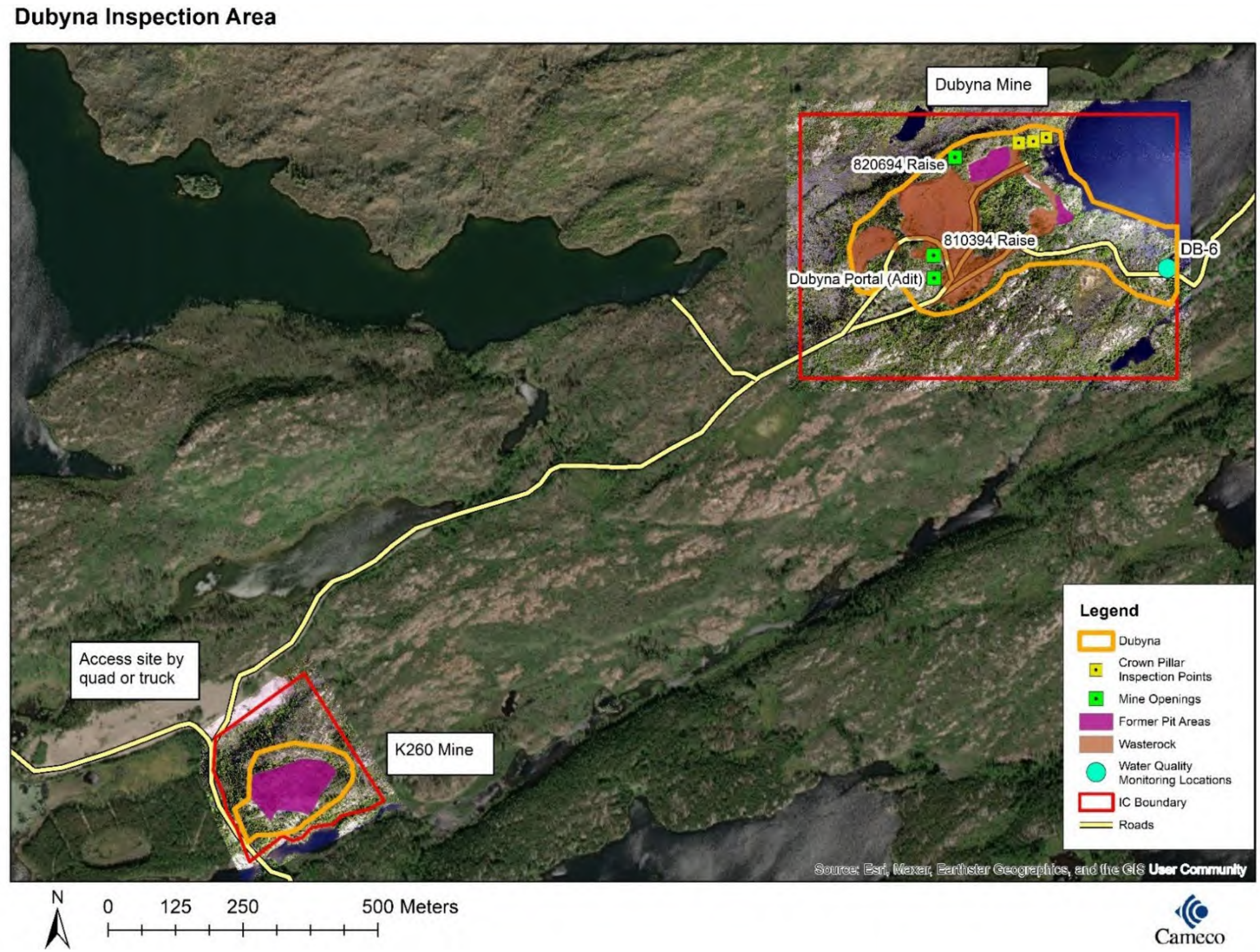


**Figure 9. Dubyna Inspection Area**

**Table 15. Dubyna Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional Comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Record photo location.* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photo location*<br>*Looking 252° NW at 59° 35'17" N, 108°22'48" W.* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *1. Dubyna pit wall: looking 298° NW at 59° 35'16" N, 108°22'50" W.*<br>*2. Dubyna minor pit: looking 100° E at 59° 35'14" N, 108°22'42" W.*<br>*3. K260 Pit wall* | |
| | *Additional comments:* | |
| **Evidence of crown pillar subsidence** | *Conduct geotechnical inspection* | |
| | *Take photos as per geotechnical inspection. guidelines.* | |
| | *Additional comments:* | |
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |

| | | |
|---|---|---|
| | *Take photos of caps and any notable concerns.*<br>*1. 810394 Raise: looking 147° SE at 59° 35’10” N, 108°22’57” W.*<br>*2. 820694 Raise: looking 264° W at 59° 35’16” N, 108°22’54” W.* | |
| | *Additional comments:* | |
| **Condition of backfilled opening** | *Note of any subsidence.* | |
| | *Take photos of openings.*<br>*Dubyna Portal (adit): looking 306° NW at 59° 35’9” N, 108°22’58” W.* | |
| | *Additional comments:* | |
| **Beaver Activity** | *Note the condition of the beaver dam at the outlet of Dubyna Lake (if applicable)* | |
| | *Take photo of dam.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.8 Hab Area

The Hab Area was the location of the former satellite Hab mine site. The site was host to an underground operation with 11 mine openings (see Table 16), as well as an open pit and waste rock pile. Ore was hauled approximately 8km from the Hab mine site to the Beaverlodge mill for processing along a paved road. As a result, there are no tailings located in the Hab Area.

**Table 16. Hab Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID Plate Coordinates |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| 13904 Raise | Vertical | Stainless-steel | 645227 | 6612202 | 59°37'21.5"N, 108°25'30.6"W |
| 13905 Raise | Vertical | Stainless-steel | 645248 | 6612213 | 59°37'21.8"N, 108°25'29.2"W |
| 13918 Raise | Vertical | Backfill | 645304 | 6612236 | 59°37’22.5”N, 108°25’25.6”W |
| 13927 Raise | Vertical | Stainless-steel | 645296 | 6612227 | 59°37'22.2"N, 108°25'26.1"W |
| 13909 Raise | Vertical | Backfill | 645338 | 6612244 | 59°37’22.7”N, 108°25’23.4”W |
| 13929 Raise | Vertical | Backfill | 645381 | 6612243 | 59°37’22.6”N, 108°25’20.7”W |
| 13810 Raise | Vertical | Stainless-steel | 645561 | 6611886 | 59°37'21.0"N, 108°25'12.55"W |
| Shaft | Vertical | Stainless-steel | 645568 | 6612132 | 59°37'18.8"N, 108°25'9.0"W |
| Heater Raise | Vertical | Stainless-steel | 645510 | 6612198 | 59°37'21.0"N, 108°25'12.55"W |
| Haulage Adit (west) | Horizontal | Backfill | 645505 | 6612189 | 59°37’20.7”N, 108°25’12.9”W |
| Service Adit (east) | Horizontal | Backfill | 645519 | 6612201 | 59°37’21.1”N, 108°25’12.0”W |

A feature on the Hab Area to be aware of during future inspections is that the outflow from the southeastern arm of Beatrice Lake flows down an established channel to the edge of the waste rock pile, where it disappears into the waste rock pile and presumably enters the mine workings and eventually resurfaces in Pistol Lake. This feature is important to recognize as the beaver dam at the outlet of the southeastern arm of Beatrice Lake has the potential to divert outflow to the southwestern arm of Beatrice Lake. This could potentially result in water quality fluctuations at the monitoring station downstream of Pistol Lake as the surface water would by-pass the Hab mine site. See Figure 10 for Hab inspection area.

### 5.8.1 Hab Monitoring Requirements

Monitoring requirements at the Hab Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Waste rock trail leading to Milmine Lake. If there is no disturbance of the trailhead near the Hab mine site, it can be assumed that the waste rock used to construct the trail beyond the mine site has not been disturbed. If there is evidence of disturbance at the trailhead then conduct an inspection to document the extent of the disturbance.
4. Pit wall condition.
5. Waste rock condition.
6. Beaver dam. Specifically the condition of the beaver dam at the southeast outlet of Beatrice Lake and evidence of flow from the southwest arm of Beatrice Lake. Also, the condition of the dam at the outlet of Pistol Lake.
7. Evidence of crown pillar subsidence.
8. Condition of backfilled mine openings (checking for subsidence) and condition of the stainless-steel capped mine openings (see Table 16 above).

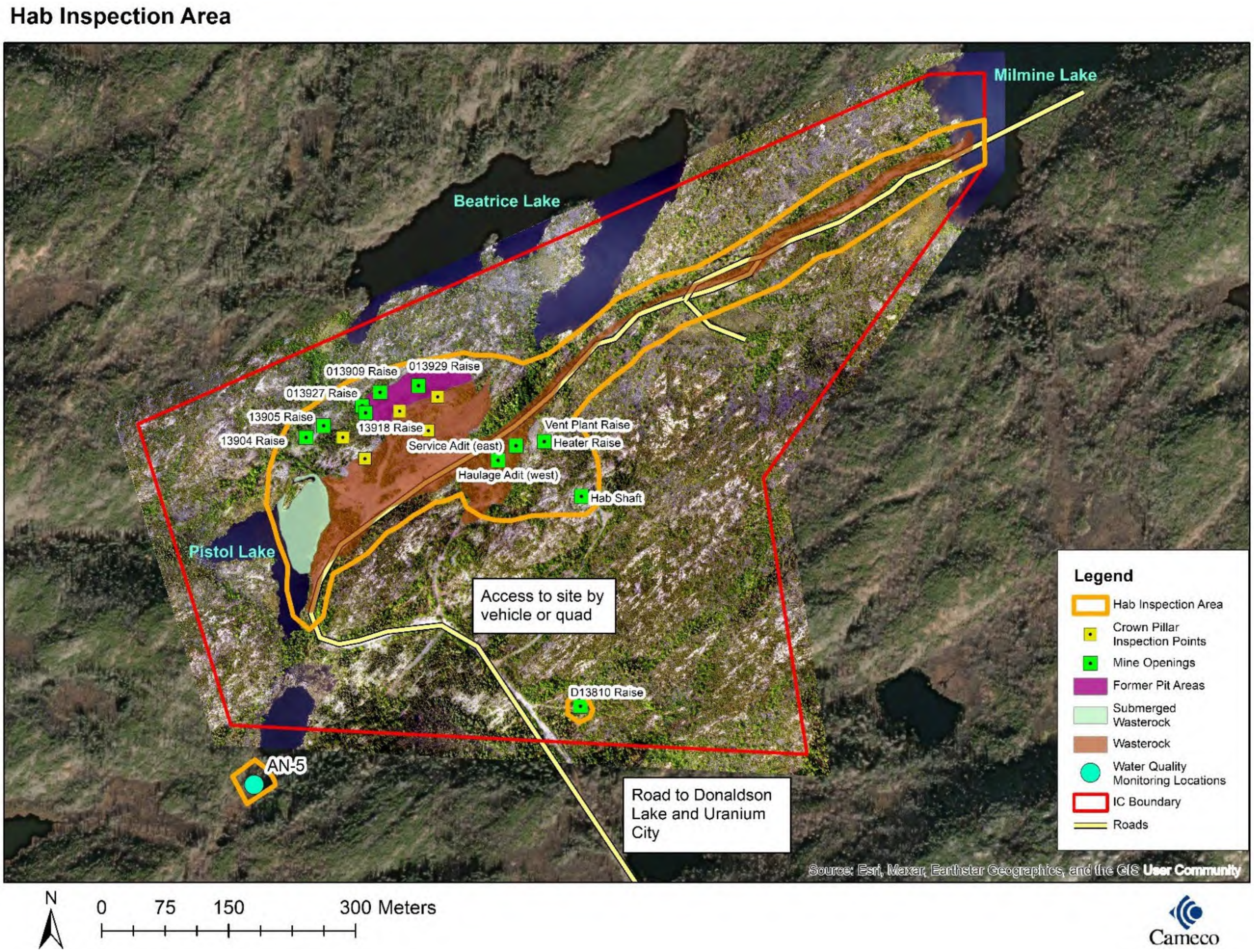


**Figure 10. Hab Inspection Area**

**Table 17. Hab Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity)* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo location*<br>*1. Looking 55° NE at 59° 37’18” N, 108°25’26” W.* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Waste rock trail leading to Milmine Lake. If there is no disturbance of the trailhead near the Hab mine site, it can be assumed that the waste rock used to construct the trail beyond the mine site has not been disturbed. If there is evidence of disturbance at the trailhead, then conduct an inspection to document the extent of the disturbance.* | |
| | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photo location*<br>*1. Looking 55° NE at 59° 37’18” N, 108°25’26” W.* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.* | |
| | *Additional comments:* | |
| **Evidence of crown pillar subsidence** | *Conduct geotechnical inspection.* | |
| | *Take photos as per geotechnical inspection guidelines.* | |
| | *Additional comments:* | |
| | *Note any subsidence.* | |

| | | |
|---|---|---|
| **Condition of backfilled openings** | *Take photos of openings.*<br>*1. Service Adit (east): looking 165° SE at 59° 37'20" N, 108°25'15" W.*<br>*2. Haulage Adit (west): looking 218° SW at 59° 37'20" N, 108°25'15" W.*<br>*3. 13918 Raise: looking 228° SW at 59° 37'20" N, 108°25'15" W.*<br>*4. 13909 Raise: looking 271° W at 59° 37'22" N, 108°25'22" W.*<br>*5. Hab 13929 Raise: looking 127° SE at 59° 37'22" N, 108°25'21" W.* | |
| | *Additional comments:* | |
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |
| | *Take photos of caps and any notable concerns.*<br>*1. Shaft: looking 285° W at 59° 37'18" N, 108°25'9" W.*<br>*2. Heater Raise: looking 98° E at 59° 37'20" N, 108°25'13" W.*<br>*3. Hab 013904: looking 3° N at 59° 37'21" N, 108°25'30" W.*<br>*4. Hab 13905: looking 61° NE at 59° 37'21" N, 108°25'29" W.*<br>*5. Hab 13927: looking 30° NE at 59° 37'22" N, 108°25'26" W.*<br>*6. Hab 13810 Raise: looking 301° NE at 59° 37'10" N, 108°25'10" W.* | |
| | *Additional comments:* | |
| **Beaver Activity** | *Note of condition of beaver dam at the southeast outlet of Beatrice Lake and evidence of flow from the southwest arm of Beatrice Lake. Also note the condition of the beaver dam at the outlet of Pistol Lake.* | |
| | *Take photo of dam.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.9 Moran Pit Area

The Moran Pit Area is approximately 1.3 km east of the Fookes Reservoir. The Moran Pit Area was not subject to licensing by the CNSC. Significant vegetation has re-established on the access to trail to the Moran Pit area making it essentially impassable by passenger type vehicles. In addition, large boulders have been placed at the start of the access trail which further restrict vehicular access. There were no mine openings in the Moran Pit Area. Moran Pit is included on Figure 7 TMA East inspection area due to its proximity to the TMA East area and the shared access points.

### 5.9.1 Moran Pit Monitoring Requirements

Monitoring requirements at the Moran Pit Area will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Waste rock condition.
4. Pit wall condition.

**Table 18. Moran Pit Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photos* | |
| | *Additional comments:* | |
| **Waste rock condition** | *Record general condition, specifically noting any evidence of subsidence, slope failure, anthropogenic disturbance, or acid rock drainage.* | |
| | *Photos* | |
| | *Additional comments:* | |
| **Pit wall condition** | *Record general condition, specifically noting any failure or sloughing.* | |
| | *Take pictures of pit wall and base of pit from prescribed locations to compare to previous inspection photos.*<br>*1. Looking W at 59° 33.78' N, 108° 23.88' W.*<br>*2. Looking E at 59° 33.78' N, 108° 23.94' W.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 5.10 Fishhook Bay Area

The Fishhook Bay Area included the location of an underground mine located approximately 11 km southeast of the Uranium City Airport. Fishhook Bay was not subject to licensing by the CNSC. In 1957, Fishhook Bay property was leased to Black Bay Uranium Mines who sank a shaft. In addition, an adit was developed to connect with the shaft above the first level and provide a haulage way for ore. Operations were suspended in 1958 but were recommenced in late 1959 when the first level was dewatered, and ore was shipped to the Beaverlodge Eldorado Mill. At the end of mining, in 1962 the camp was abandoned with little to no decommissioning. The site was decommissioned by Eldorado in Q1 of 1985. The headframe and buildings were burned, the shaft was bulkheaded with a concrete cap and waste rock was placed in the adit opening.

The original concrete cap on the shaft was replaced with a stainless-steel cap in 2020 (see Table 19). The material in the adit opening was excavated and resealed using regulatory approved methods. The raise was backfilled sometime after the original decommissioning. There has been no evidence if subsidence in the area of the raise and the location has been marked with a plaque on a large rock for future inspections. See Figure 9 for the Fishhook inspection area.

**Table 19. Fishhook Bay Mine Openings**

| Opening | Type | Type of Cover | WGS 84 UTM Zone 12 | | As-Built ID Plate Coordinates |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| Shaft | Vertical | Stainless-steel | 646742 | 6594815 | 59°27'57.57"N, 108°24'37.69"W |
| Raise | Vertical | Backfilled | | | 59° 28’ 01.42” N, 108° 24’ 29.90” W |
| Adit | Horizontal | Backfilled | 646809 | 6594864 | 59° 27’ 59.58” N, 108° 24’ 32.83” W |

### 5.10.1 Fishhook Bay Monitoring Requirements

Monitoring requirements at the Fishhook Bay will consist of:

1. Evidence of recent human visitation.
2. Condition of vegetation.
3. Evidence of a crown pillar subsidence.
4. Condition of stainless-steel caps and mine openings.

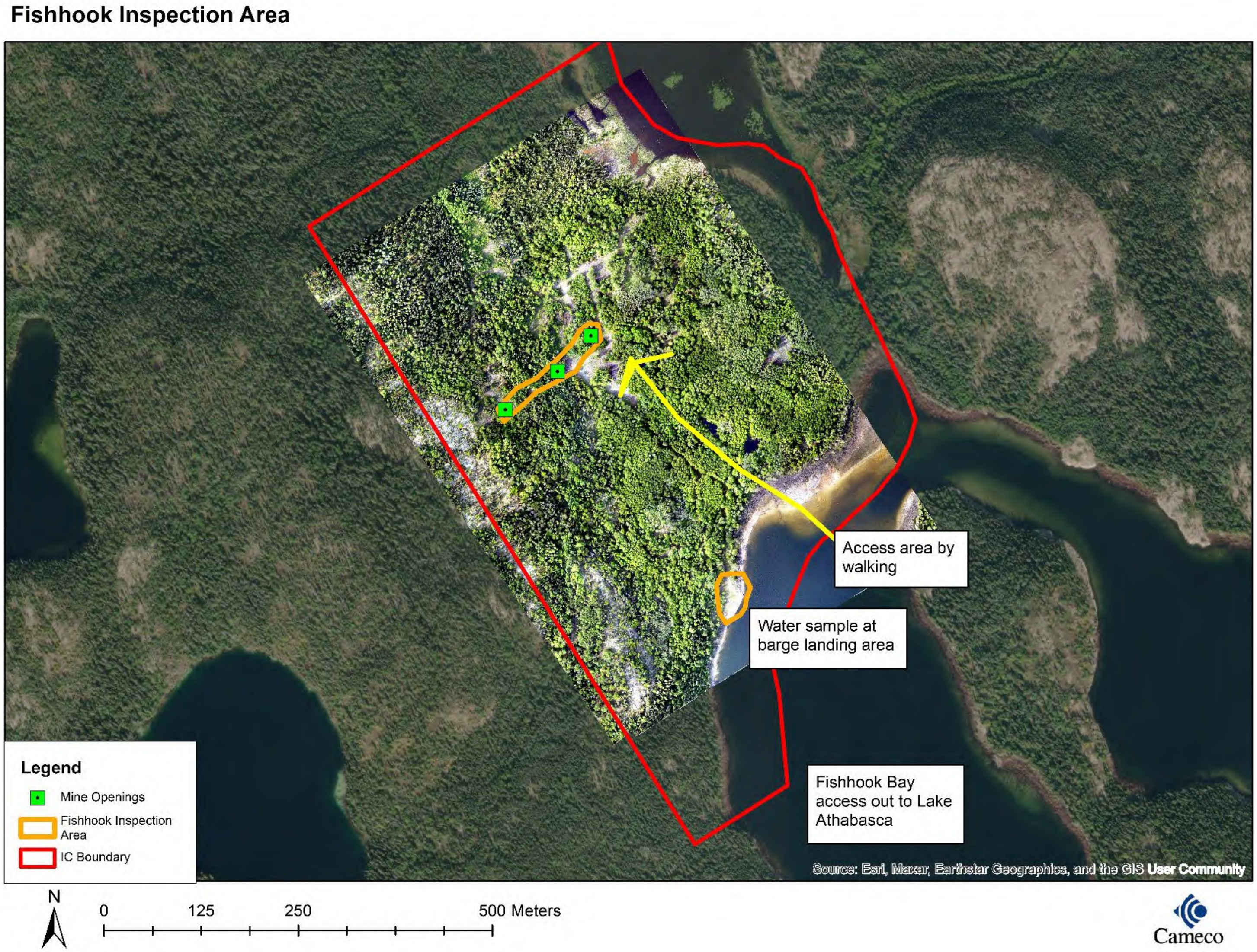


**Figure 11. Fishhook Inspection Area**

**Table 20. Fishhook Bay Inspection Checklist**

| Inspection Task | Inspection Activity | Inspection Observations and Findings |
|---|---|---|
| **Condition of access trails and areas adjacent to access trails** | *Note condition of access road (physical condition and vegetation), to aid expectations for future inspections.* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Evidence of recent human visitation on previously disturbed areas** | *Recent signs of visitation? (campfires, cut trees, trails, powerline rights-of-way)* | |
| | *Photos (any signs of activity).* | |
| | *Additional comments:* | |
| **Condition of vegetation** | *Note general condition of vegetation on site.* | |
| | *Photo location*<br>*1. Looking 304° NW at 59° 28’2” N, 108°24’34” W.* | |
| | *Additional comments:* | |
| **Evidence of crown pillar subsidence** | *Note any subsidence.* | |
| | *Photo location*<br>*1. Looking 69° E at 59° 28’1” N, 108°24’31” W.* | |
| | *Additional comments:* | |
| **Condition of stainless-steel caps** | *Visual monitoring of the stainless-steel caps at every inspection. Inspect caps for general condition of stainless steel including obvious signs of deformity, damage, or displacement.* | |
| | *Take photos of caps and any notable concerns.*<br>*1. Looking 125° SE at 59° 27’58” N, 108°24’37” W.* | |
| | *Additional comments:* | |
| **Condition of backfilled opening** | *Note any subsidence.* | |
| | *Take photos of opening.*<br>*1. Looking 260° W at 59° 27’59” N, 108°24’31” W.* | |
| | *Additional comments:* | |
| **General observations** | *Evidence of wildlife or any other activity.* | |
| | *Take photos as required.* | |
| | *Additional comments:* | |

## 6.0 EQUIPMENT

The following equipment is recommended for the site inspection:

1. Beaverlodge Decommissioned Properties Field Guide
2. Truck and/or quad rental for accessing sites.
3. Tool (e.g., pickaxe), to remove dense vegetation or beaver activity in certain areas (may require a permit from the Ministry of Environment).
4. Chainsaw for cutting trees blocking access routes.
5. Gamma meter
6. Fully calibrated water field measurement probe (pH, temp, conductivity)
7. Small hand tools to remove vegetation, litter, etc. that may have accumulated on the caps and ID plates.
8. GPS device
9. Geotagged camera for recording site photographs
10. Safety and first-aid equipment
11. Satellite Phone
12. Typical field equipment (e.g., daypack, rain gear, notebook, bear spray, water, first aid kit, etc.)
13. Long-Term Inspection Checklist (stainless-steel caps) when required (and related equipment). See Appendix D for more detailed information.
14. Geotechnical Inspection Checklist. See Appendix C for more detailed information.
15. The inspector should also be familiar with the closure reports indicated in Section 2.0 that provide detailed background information on the properties.

# APPENDIX A: IC BOUNDARY COORDINATES

**IC Boundary Coordinates**

| Shape | Name | Type | Easting | Northing | Latitude | Longitude | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|
| Point | Martin Lake | IC Boundary Line | 639055.5291 | 6604116.285 | 59° 33' 7.904" N | 108° 32' 23.164" W | 59.552196 | -108.539768 |
| Point | Martin Lake | IC Boundary Line | 639178.5179 | 6603882.921 | 59° 33' 0.220" N | 108° 32' 15.889" W | 59.550061 | -108.537747 |
| Point | Martin Lake | IC Boundary Line | 638350.7093 | 6603495.034 | 59° 32' 48.680" N | 108° 33' 9.464" W | 59.546856 | -108.552629 |
| Point | Martin Lake | IC Boundary Line | 638267.1401 | 6603028.308 | 59° 32' 33.705" N | 108° 33' 15.874" W | 59.542696 | -108.554409 |
| Point | Martin Lake | IC Boundary Line | 637820.9118 | 6602876.937 | 59° 32' 29.346" N | 108° 33' 44.611" W | 59.541485 | -108.562392 |
| Point | Martin Lake | IC Boundary Line | 637820.9118 | 6603586.487 | 59° 32' 52.263" N | 108° 33' 42.954" W | 59.547851 | -108.561932 |
| Point | Eagle Zone | IC Boundary Line | 640250 | 6607030 | 59° 34' 40.574" N | 108° 31' 0.235" W | 59.577937 | -108.516732 |
| Point | Eagle Zone | IC Boundary Line | 640250 | 6607320 | 59° 34' 49.940" N | 108° 30' 59.545" W | 59.580539 | -108.51654 |
| Point | Eagle Zone | IC Boundary Line | 640545 | 6607030 | 59° 34' 40.217" N | 108° 30' 41.452" W | 59.577838 | -108.511515 |
| Point | Eagle Zone | IC Boundary Line | 640565 | 6607320 | 59° 34' 49.559" N | 108° 30' 39.487" W | 59.580433 | -108.510969 |
| Point | Eagle Zone | IC Boundary Line | 640565.018 | 6607138.785 | 59° 34' 43.706" N | 108° 30' 39.918" W | 59.578807 | -108.511088 |
| Point | 02 Zone | IC Boundary Line | 640527.7734 | 6606927.308 | 59° 34' 36.921" N | 108° 30' 42.794" W | 59.576923 | -108.511887 |
| Point | 02 Zone | IC Boundary Line | 640565.018 | 6607138.785 | 59° 34' 43.706" N | 108° 30' 39.918" W | 59.578807 | -108.511088 |
| Point | 02 Zone | IC Boundary Line | 640726.6069 | 6607165.745 | 59° 34' 44.381" N | 108° 30' 29.565" W | 59.578995 | -108.508212 |
| Point | 02 Zone | IC Boundary Line | 640746.2164 | 6607137.656 | 59° 34' 43.450" N | 108° 30' 28.383" W | 59.578736 | -108.507884 |
| Point | 02 Zone | IC Boundary Line | 640527.7734 | 6606927.308 | 59° 34' 36.921" N | 108° 30' 42.794" W | 59.576923 | -108.511887 |
| Point | Eagle Zone | IC Boundary Line | 639872.0467 | 6607553.979 | 59° 34' 57.953" N | 108° 31' 23.056" W | 59.582765 | -108.523071 |
| Point | Eagle Zone | IC Boundary Line | 639882.1764 | 6607212.266 | 59° 34' 46.904" N | 108° 31' 23.223" W | 59.579696 | -108.523117 |
| Point | Eagle Zone | IC Boundary Line | 639192.5662 | 6607107.478 | 59° 34' 44.349" N | 108° 32' 7.382" W | 59.578986 | -108.535384 |
| Point | Eagle Zone | IC Boundary Line | 639181.3937 | 6607278.898 | 59° 34' 49.898" N | 108° 32' 7.688" W | 59.580527 | -108.535469 |
| Point | Eagle Zone | IC Boundary Line | 639304.5495 | 6607318.338 | 59° 34' 51.024" N | 108° 31' 59.753" W | 59.58084 | -108.533265 |
| Point | Eagle Zone | IC Boundary Line | 639395.5739 | 6607444.01 | 59° 34' 54.974" N | 108° 31' 53.659" W | 59.581937 | -108.531572 |
| Point | Eagle Zone | IC Boundary Line | 639414.6572 | 6607444.373 | 59° 34' 54.963" N | 108° 31' 52.443" W | 59.581934 | -108.531234 |
| Point | Eagle Zone | IC Boundary Line | 639423.0187 | 6607412.36 | 59° 34' 53.919" N | 108° 31' 51.986" W | 59.581644 | -108.531107 |
| Point | Eagle Zone | IC Boundary Line | 639491.1169 | 6607459.49 | 59° 34' 55.359" N | 108° 31' 47.538" W | 59.582044 | -108.529872 |
| Point | Eagle Zone | IC Boundary Line | 639514.2636 | 6607460.222 | 59° 34' 55.355" N | 108° 31' 46.062" W | 59.582043 | -108.529462 |
| Point | Eagle Zone | IC Boundary Line | 639552.6603 | 6607413.178 | 59° 34' 53.790" N | 108° 31' 43.729" W | 59.581608 | -108.528814 |
| Point | Eagle Zone | IC Boundary Line | 639585.1631 | 6607416.122 | 59° 34' 53.846" N | 108° 31' 41.652" W | 59.581624 | -108.528237 |
| Point | Eagle Zone | IC Boundary Line | 639582.8477 | 6607486.915 | 59° 34' 56.135" N | 108° 31' 41.632" W | 59.58226 | -108.528231 |
| Point | Eagle Zone | IC Boundary Line | 639594.4286 | 6607506.206 | 59° 34' 56.744" N | 108° 31' 40.848" W | 59.582429 | -108.528013 |
| Point | Eagle Zone | IC Boundary Line | 639655.6721 | 6607498.344 | 59° 34' 56.416" N | 108° 31' 36.967" W | 59.582338 | -108.526935 |
| Point | Eagle Zone | IC Boundary Line | 639679.2649 | 6607537.976 | 59° 34' 57.668" N | 108° 31' 35.371" W | 59.582686 | -108.526492 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Point | Eagle Zone | IC Boundary Line | 639720.64 | 6607563.571 | 59° 34' 58.445" N | 108° 31' 32.675" W | 59.582901 | -108.525743 |
| Point | Eagle Zone | IC Boundary Line | 639751.4798 | 6607552.022 | 59° 34' 58.035" N | 108° 31' 30.739" W | 59.582787 | -108.525205 |
| Point | Eagle Zone | IC Boundary Line | 639810.4012 | 6607548.396 | 59° 34' 57.847" N | 108° 31' 26.995" W | 59.582735 | -108.524165 |
| Point | Eagle Zone | IC Boundary Line | 639872.0467 | 6607553.979 | 59° 34' 57.953" N | 108° 31' 23.056" W | 59.582765 | -108.523071 |
| Point | Main Site | IC Boundary Line | 646274.4476 | 6606475.415 | 59° 34' 15.231" N | 108° 24' 38.051" W | 59.570898 | -108.41057 |
| Point | Main Site | IC Boundary Line | 646455.4929 | 6604217.251 | 59° 33' 2.077" N | 108° 24' 32.135" W | 59.550577 | -108.408926 |
| Point | Main Site | IC Boundary Line | 644574.7202 | 6604141.981 | 59° 33' 2.001" N | 108° 26' 31.967" W | 59.550556 | -108.442213 |
| Point | Main Site | IC Boundary Line | 644238.3916 | 6603940.947 | 59° 32' 55.926" N | 108° 26' 53.855" W | 59.548868 | -108.448293 |
| Point | Main Site | IC Boundary Line | 644107.8617 | 6603704.659 | 59° 32' 48.457" N | 108° 27' 2.735" W | 59.546794 | -108.45076 |
| Point | Main Site | IC Boundary Line | 643756.3587 | 6603648.249 | 59° 32' 47.070" N | 108° 27' 25.232" W | 59.546408 | -108.457009 |
| Point | Main Site | IC Boundary Line | 643426.2184 | 6602741.07 | 59° 32' 18.180" N | 108° 27' 48.436" W | 59.538383 | -108.463454 |
| Point | Main Site | IC Boundary Line | 641891.3395 | 6602729.202 | 59° 32' 19.679" N | 108° 29' 26.076" W | 59.5388 | -108.490577 |
| Point | Main Site | IC Boundary Line | 641035.225 | 6603981.293 | 59° 33' 1.159" N | 108° 30' 17.532" W | 59.550322 | -108.50487 |
| Point | Main Site | IC Boundary Line | 643027.0079 | 6605339.635 | 59° 33' 42.595" N | 108° 28' 7.526" W | 59.561832 | -108.468757 |
| Point | Main Site | IC Boundary Line | 644751.4362 | 6606024.445 | 59° 34' 2.575" N | 108° 26' 16.105" W | 59.567382 | -108.437807 |
| Point | Main Site | IC Boundary Line | 645562.3903 | 6606459.591 | 59° 34' 15.615" N | 108° 25' 23.415" W | 59.571004 | -108.423171 |
| Point | Moran Pit | IC Boundary Line | 647130 | 6605740 | 59° 33' 50.401" N | 108° 23' 45.428" W | 59.564 | -108.395952 |
| Point | Moran Pit | IC Boundary Line | 646850 | 6605740 | 59° 33' 50.756" N | 108° 24' 3.247" W | 59.564099 | -108.400902 |
| Point | Moran Pit | IC Boundary Line | 646850 | 6605580 | 59° 33' 45.588" N | 108° 24' 3.646" W | 59.562663 | -108.401013 |
| Point | Moran Pit | IC Boundary Line | 647130 | 6605580 | 59° 33' 45.234" N | 108° 23' 45.827" W | 59.562565 | -108.396063 |
| Point | 46 Zone | IC Boundary Line | 645675.4015 | 6606944.322 | 59° 34' 31.127" N | 108° 25' 15.023" W | 59.575313 | -108.42084 |
| Point | 46 Zone | IC Boundary Line | 645710.3551 | 6606939.812 | 59° 34' 30.938" N | 108° 25' 12.809" W | 59.575261 | -108.420225 |
| Point | 46 Zone | IC Boundary Line | 645738.1636 | 6606957.683 | 59° 34' 31.480" N | 108° 25' 10.994" W | 59.575411 | -108.419721 |
| Point | 46 Zone | IC Boundary Line | 645774.9657 | 6606961.017 | 59° 34' 31.542" N | 108° 25' 8.643" W | 59.575428 | -108.419068 |
| Point | 46 Zone | IC Boundary Line | 645802.305 | 6606955.816 | 59° 34' 31.339" N | 108° 25' 6.916" W | 59.575372 | -108.418588 |
| Point | 46 Zone | IC Boundary Line | 645843.7193 | 6606950.611 | 59° 34' 31.119" N | 108° 25' 4.292" W | 59.575311 | -108.417859 |
| Point | 46 Zone | IC Boundary Line | 645899.8964 | 6606937.786 | 59° 34' 30.635" N | 108° 25' 0.747" W | 59.575176 | -108.416874 |
| Point | 46 Zone | IC Boundary Line | 645984.2775 | 6606959.772 | 59° 34' 31.239" N | 108° 24' 55.321" W | 59.575344 | -108.415367 |
| Point | 46 Zone | IC Boundary Line | 645999.2287 | 6606652.017 | 59° 34' 21.281" N | 108° 24' 55.132" W | 59.572578 | -108.415314 |
| Point | 46 Zone | IC Boundary Line | 645818.0216 | 6606626.886 | 59° 34' 20.697" N | 108° 25' 6.729" W | 59.572416 | -108.418536 |
| Point | 46 Zone | IC Boundary Line | 645796.8025 | 6606649.274 | 59° 34' 21.447" N | 108° 25' 8.025" W | 59.572624 | -108.418896 |
| Point | 46 Zone | IC Boundary Line | 645770.8468 | 6606653.32 | 59° 34' 21.610" N | 108° 25' 9.667" W | 59.572669 | -108.419352 |
| Point | 46 Zone | IC Boundary Line | 645750.7674 | 6606634.869 | 59° 34' 21.039" N | 108° 25' 10.991" W | 59.572511 | -108.41972 |
| Point | 46 Zone | IC Boundary Line | 645749.4892 | 6606606.606 | 59° 34' 20.128" N | 108° 25' 11.142" W | 59.572258 | -108.419762 |

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|---|---|---|---|---|---|---|---|---|---|
| Point | 46 Zone | IC Boundary Line | 645698.7131 | 6606559.785 | 59° 34' 18.680" N | 108° 25' 14.490" W | 59.571855 | -108.420692 |
| Point | 46 Zone | IC Boundary Line | 645675.4015 | 6606944.322 | 59° 34' 31.127" N | 108° 25' 15.023" W | 59.575313 | -108.42084 |
| Point | 11 Zone | IC Boundary Line | 646417.844 | 6606941.875 | 59° 34' 30.115" N | 108° 24' 27.764" W | 59.575032 | -108.407712 |
| Point | 11 Zone | IC Boundary Line | 646539.5711 | 6606957.049 | 59° 34' 30.451" N | 108° 24' 19.977" W | 59.575125 | -108.405549 |
| Point | 11 Zone | IC Boundary Line | 646600.1432 | 6606838.05 | 59° 34' 26.532" N | 108° 24' 16.417" W | 59.574037 | -108.40456 |
| Point | 11 Zone | IC Boundary Line | 646412.0661 | 6606822.399 | 59° 34' 26.264" N | 108° 24' 28.429" W | 59.573962 | -108.407897 |
| Point | 11 Zone | IC Boundary Line | 646417.844 | 6606941.875 | 59° 34' 30.115" N | 108° 24' 27.764" W | 59.575032 | -108.407712 |
| Point | K 260 | IC Boundary Line | 646618.7964 | 6607491.55 | 59° 34' 47.613" N | 108° 24' 13.603" W | 59.579892 | -108.403779 |
| Point | K 260 | IC Boundary Line | 646767.2201 | 6607255.707 | 59° 34' 39.809" N | 108° 24' 4.740" W | 59.577725 | -108.401317 |
| Point | K 260 | IC Boundary Line | 646739.6093 | 6607239.895 | 59° 34' 39.333" N | 108° 24' 6.538" W | 59.577592 | -108.401816 |
| Point | K 260 | IC Boundary Line | 646688.6496 | 6607228.019 | 59° 34' 39.014" N | 108° 24' 9.812" W | 59.577504 | -108.402725 |
| Point | K 260 | IC Boundary Line | 646631.3545 | 6607204.967 | 59° 34' 38.342" N | 108° 24' 13.517" W | 59.577317 | -108.403755 |
| Point | K 260 | IC Boundary Line | 646616.0763 | 6607187.563 | 59° 34' 37.799" N | 108° 24' 14.533" W | 59.577166 | -108.404037 |
| Point | K 260 | IC Boundary Line | 646597.3064 | 6607181.022 | 59° 34' 37.611" N | 108° 24' 15.744" W | 59.577114 | -108.404373 |
| Point | K 260 | IC Boundary Line | 646578.3241 | 6607190.194 | 59° 34' 37.932" N | 108° 24' 16.930" W | 59.577203 | -108.404703 |
| Point | K 260 | IC Boundary Line | 646517.3136 | 6607142.314 | 59° 34' 36.462" N | 108° 24' 20.933" W | 59.576795 | -108.405815 |
| Point | K 260 | IC Boundary Line | 646493.5482 | 6607204.298 | 59° 34' 38.494" N | 108° 24' 22.292" W | 59.577359 | -108.406192 |
| Point | K 260 | IC Boundary Line | 646475.0099 | 6607235.292 | 59° 34' 39.518" N | 108° 24' 23.395" W | 59.577644 | -108.406499 |
| Point | K 260 | IC Boundary Line | 646468.3644 | 6607268.574 | 59° 34' 40.602" N | 108° 24' 23.735" W | 59.577945 | -108.406593 |
| Point | K 260 | IC Boundary Line | 646449.9388 | 6607311.68 | 59° 34' 42.017" N | 108° 24' 24.801" W | 59.578338 | -108.406889 |
| Point | K 260 | IC Boundary Line | 646454.1062 | 6607372.563 | 59° 34' 43.978" N | 108° 24' 24.385" W | 59.578883 | -108.406773 |
| Point | K 260 | IC Boundary Line | 646618.7964 | 6607491.55 | 59° 34' 47.613" N | 108° 24' 13.603" W | 59.579892 | -108.403779 |
| Point | K 260 | IC Boundary Line | 646671.9091 | 6607211.652 | 59° 34' 38.506" N | 108° 24' 10.918" W | 59.577363 | -108.403033 |
| Point | K 260 | IC Boundary Line | 646653.9858 | 6607210.029 | 59° 34' 38.477" N | 108° 24' 12.063" W | 59.577355 | -108.403351 |
| Point | Dubyna | IC Boundary Line | 648240 | 6608530 | 59° 35' 19.089" N | 108° 22' 27.768" W | 59.588636 | -108.37438 |
| Point | Dubyna | IC Boundary Line | 647540 | 6608530 | 59° 35' 19.981" N | 108° 23' 12.348" W | 59.588884 | -108.386763 |
| Point | Dubyna | IC Boundary Line | 647540 | 6608040 | 59° 35' 4.157" N | 108° 23' 13.576" W | 59.584488 | -108.387104 |
| Point | Dubyna | IC Boundary Line | 648240 | 6608040 | 59° 35' 3.265" N | 108° 22' 29.002" W | 59.58424 | -108.374723 |
| Point | Hab | IC Boundary Line | 646029.8945 | 6612633.444 | 59° 37' 34.409" N | 108° 24' 38.328" W | 59.626225 | -108.410647 |
| Point | Hab | IC Boundary Line | 646030.1333 | 6612525.791 | 59° 37' 30.932" N | 108° 24' 38.581" W | 59.625259 | -108.410717 |
| Point | Hab | IC Boundary Line | 645768.8101 | 6612155.292 | 59° 37' 19.296" N | 108° 24' 56.162" W | 59.622027 | -108.4156 |
| Point | Hab | IC Boundary Line | 645820.2653 | 6611828.732 | 59° 37' 8.685" N | 108° 24' 53.692" W | 59.619079 | -108.414914 |
| Point | Hab | IC Boundary Line | 645139.484 | 6611863.264 | 59° 37' 10.655" N | 108° 25' 37.003" W | 59.619626 | -108.426945 |
| Point | Hab | IC Boundary Line | 645029.4172 | 6612218.865 | 59° 37' 22.276" N | 108° 25' 43.142" W | 59.622855 | -108.42865 |

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|---|---|---|---|---|---|---|---|---|
| Point | Hab | IC Boundary Line | 645964.7105 | 6612631.711 | 59° 37' 34.435" N | 108° 24' 42.488" W | 59.626232 | -108.411802 |
| Point | Fishhook | IC Boundary Line | 647096 | 6595139 | 59° 28' 8.075" N | 108° 24' 13.929" W | 59.468910 | -108.403869 |
| Point | Fishhook | IC Boundary Line | 647123 | 6595126 | 59° 28' 7.640" N | 108° 24' 12.256" W | 59.468789 | -108.403405 |
| Point | Fishhook | IC Boundary Line | 647138 | 6595101 | 59° 28' 6.797" N | 108° 24' 11.369" W | 59.468555 | -108.403158 |
| Point | Fishhook | IC Boundary Line | 647147 | 6595072 | 59° 28' 5.872" N | 108° 24' 10.900" W | 59.468298 | -108.403028 |
| Point | Fishhook | IC Boundary Line | 647162 | 6595047 | 59° 28' 5.029" N | 108° 24' 10.013" W | 59.468064 | -108.402781 |
| Point | Fishhook | IC Boundary Line | 647171 | 6595019 | 59° 28' 4.127" N | 108° 24' 9.492" W | 59.467813 | -108.402637 |
| Point | Fishhook | IC Boundary Line | 647270 | 6594802 | 59° 27' 57.000" N | 108° 24' 3.737" W | 59.465833 | -108.401038 |
| Point | Fishhook | IC Boundary Line | 647262 | 6594772 | 59° 27' 56.016" N | 108° 24' 4.359" W | 59.465560 | -108.401211 |
| Point | Fishhook | IC Boundary Line | 647246 | 6594740 | 59° 27' 55.020" N | 108° 24' 5.439" W | 59.465283 | -108.401511 |
| Point | Fishhook | IC Boundary Line | 647205 | 6594695 | 59° 27' 53.606" N | 108° 24' 8.119" W | 59.464891 | -108.402255 |
| Point | Fishhook | IC Boundary Line | 647151 | 6594648 | 59° 27' 52.179" N | 108° 24' 11.660" W | 59.464494 | -108.403239 |
| Point | Fishhook | IC Boundary Line | 647109 | 6594567 | 59° 27' 49.617" N | 108° 24' 14.557" W | 59.463783 | -108.404044 |
| Point | Fishhook | IC Boundary Line | 647086 | 6594485 | 59° 27' 46.979" N | 108° 24' 16.185" W | 59.463050 | -108.404496 |
| Point | Fishhook | IC Boundary Line | 647098 | 6594406 | 59° 27' 44.416" N | 108° 24' 15.620" W | 59.462338 | -108.404339 |
| Point | Fishhook | IC Boundary Line | 647105 | 6594331 | 59° 27' 41.985" N | 108° 24' 15.375" W | 59.461662 | -108.404271 |
| Point | Fishhook | IC Boundary Line | 646986 | 6594255 | 59° 27' 39.697" N | 108° 24' 23.135" W | 59.461027 | -108.406426 |

# APPENDIX B: BOREHOLE LOG

**Table 1**: Borehole summary including the coordinates of exploration drill holes located to date in and adjacent to the former Eldorado Beaverlodge properties. The table also identifies the condition of each hole when it was initially identified and the year in which each was permanently plugged.

| Area | Designation | Coordinate System: WGS 84 UTM Zone 12 | | Status When Located | Year Remediated | Associated Property |
|---|---|---|---|---|---|---|
| | | Easting | Northing | | | |
| Ace | AC 01 | 644022.013 | 6605350.955 | Dry | 2013 | ACE MC |
| | AC 02 | 643881.016 | 6605325.928 | Dry | 2013 | ACE MC |
| | AC 03 | 643969.014 | 6605393.956 | Dry | 2013 | ACE MC |
| | AC 04 | 643958.014 | 6605381.941 | Dry | 2013 | ACE MC |
| | AC 05 | 643943.013 | 6605376.906 | Dry | 2013 | ACE MC |
| | AC 06 | 643929.017 | 6605371.911 | Dry | 2013 | ACE MC |
| | AC 07 | 643914.011 | 6605366.988 | Dry | 2013 | ACE MC |
| | AC 09 | 643888.017 | 6605351.946 | Dry | 2013 | ACE MC |
| | AC 10 | 643876.015 | 6605374.894 | Dry | 2013 | ACE MC |
| | AC 11 | 643965.016 | 6605324.914 | Dry | 2013 | ACE MC |
| | AC 12 | 643877.017 | 6605339.931 | Dry | 2013 | ACE MC |
| | AC 13 | 643857.016 | 6605337.938 | Dry | 2013 | ACE MC |
| | AC 14 | 643848.015 | 6605331.908 | Dry | 2013 | ACE MC |
| | AC 15 | 643792.014 | 6605338.902 | Dry | 2013 | ACE MC |
| | AC 16 | 643560.257 | 6605183.669 | Dry | 2017 | ACE 1 |
| | AC 17 | 644021.3 | 6604729.1 | Dry | 2017 | ACE 9 |
| | AC 18 | 642872.1 | 6604789.8 | Dry | 2018 | ACE URA 5 |
| | AC 22 | 645034 | 6605863 | 2 holes/Dry | 2019 | |
| | AC 23 | 645038 | 6605837 | Dry | 2019 | |
| | AC 24 | 643327 | 6605101 | 2 holes/1 flowing | 2021 | ACE 1 |
| Lower Ace | BH-001 | 641929 | 6604081 | Discharging | 2012 | |
| | BH-002 | 641956 | 6604091 | Discharging | 2011 | |
| | BH-003 | 641922 | 6604146 | Discharging | 2011 | |
| | BH-004 | 641932 | 6604142 | Discharging | 2012 | |
| | BH-005 | 641966 | 6604143 | Discharging | 2011 | |
| | BH-006 | 641972 | 6604165 | Discharging | 2011 | |
| | BH-007 | 642090 | 6604218 | Discharging | 2011 | URA 1 |
| | BH-009 | 642110 | 6604137 | Discharging | 2012 | URA FR |
| | BH-011 | 642224.883 | 6604354.110 | Dry | 2021 | URA 1 |
| | BH-012 | 642224.798 | 6604351.877 | Dry | 2021 | URA 1 |
| | BH-014 | 642168 | 6604158 | Discharging | 2011 | URA FR |
| | BH-15 | 642101.665 | 6604192.497 | Dry/past discharge | 2016 | URA 1 |
| | BH-16 | 643009.193 | 6604465.019 | Dry | 2017 | URA 6 |
| | BH-17 | 642993.852 | 6604455.146 | Dry | 2017 | URA 6 |
| | BH-18 | 642995.637 | 6604466.051 | Dry | 2017 | URA 6 |
| | BH-19 | 642978.88 | 6604452.098 | Dry | 2017 | URA 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Lower Ace | BH-20 | 643007.541 | 6604467.124 | Dry | 2017 | URA 6 |
| | BH-21 | 642966.862 | 6604445.757 | Dry | 2017 | URA 6 |
| | BH-22 | 642959.407 | 6604439.281 | Dry | 2017 | URA 7 |
| | BH-23 | 642954.958 | 6604432.3 | Dry | 2017 | URA 7 |
| | BH-24 | 642940.515 | 6604415.339 | Dry | 2017 | URA 7 |
| | BH-25 | 642930.8 | 6604406.299 | Dry | 2017 | URA 7 |
| | BH-26 | 642972.143 | 6604451.532 | Dry | 2017 | URA 6 |
| | BH-27 | 643250.316 | 6604979.231 | Dry | 2017 | URA 5 |
| | BH-28 | 643113.492 | 6604895.363 | Dry | 2017 | URA 5 |
| | BH-29 | 643174.26 | 6604925.548 | Dry | 2017 | URA 5 |
| | BH-30 | 643285.271 | 6604977.469 | Dry | 2017 | URA 5 |
| | BH-31 | 642101.048 | 6604195.52 | Discharging | 2017 | URA 1 |
| | BH-32 | 642260.649 | 6604592.012 | Dry | 2017 | URA 1 |
| | BH-33 | 642423.877 | 6604597.892 | Dry | 2017 | URA 7 |
| | BH-34 | 642401.708 | 6604647.831 | Dry | 2017 | URA 3 |
| | BH-35 | 642268.019 | 6604629.757 | Dry | 2017 | URA 3 |
| | BH-36 | 643698.938 | 6605341.629 | Dry | 2017 | ACE MC |
| | BH-37 | 642456.049 | 6604665.374 | 2 holes/dry | 2017 | URA 4 |
| | BH-38 | 642424.846 | 6604667.596 | Dry | 2017 | URA 4 |
| | BH-39 | 643709.725 | 6605142.015 | Dry | 2017 | ACE MC |
| | BH-40 | 642242.735 | 6604550.461 | Dry | 2017 | URA 1 |
| | BH-41 | 642296.4 | 6604025.8 | Dry | 2017 | URA FR |
| | BH-42 | 642552.3 | 6604731 | Dry | 2017 | URA 4 |
| | BH-43 | 642254 | 6604397 | Dry | Covered with debris | URA 1 |
| | BH-44 | 642402 | 6604639 | Dry | 2019 | URA 3 |
| | BH-45 | 643250 | 6604981 | 2 holes/Dry | 2019 | URA 5 |
| | BH-46 | 643610.340 | 6605209.997 | Dry | 2021 | ACE MC |
| | BH-47 | 642306.845 | 6604621.952 | Dry | 2021 | URA 1 |
| Ace-Verna | Ace 01 | 645193.055 | 6605813.101 | Dry | 2016 | ACE 8 |
| | EXC 01 | 644740.299 | 6605272.359 | Dry | 2016 | ACE 3 |
| | Ace 02 | 645409.239 | 6605930.196 | Dry | 2017 | ACE 8 |
| | Ace 03 | 645627.645 | 6605877.357 | Dry | 2017 | ACE 8 |
| | Ace 04 | 645187.707 | 6605816.337 | Dry | 2017 | ACE 8 |
| Dubyna | DB 01 | 648069.018 | 6608350.909 | Dry | Not located** | EMAR 1 |
| | DB 02 | 648021.018 | 6608416.903 | Discharging | 2011 | |
| | DB 03 | 648010.017 | 6608430.961 | Discharging | 2012 | |
| | DB 04 | 648009.018 | 6608430.921 | Dry | 2013 | |
| | DB 05 | 648074.019 | 6608329.926 | Dry | 2013 | EMAR 1 |
| | DB 06 | 648059.016 | 6608350.96 | Dry | Not located** | EMAR 1 |
| | DB 07 | 648060.013 | 6608305.962 | Dry | 2013 | EMAR 1 |
| | DB 08 | 648047.018 | 6608326.964 | Dry | 2013 | EMAR 1 |
| | DB 09 | 648004.013 | 6608445.996 | Dry | 2011 | EMAR 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | DB 10 | 647927.019 | 6608395.914 | Dry | 2013 | EMAR 1 |
| | DB 11 | 647906.016 | 6608372.901 | Dry | 2013 | EMAR 1 |
| | DB 12 | 647907.015 | 6608373.943 | Dry | 2013 | EMAR 1 |
| | DB 13 | 647922.017 | 6608349.899 | Dry | 2013 | EMAR 1 |
| | DB 13A | 647937.016 | 6608388.951 | Dry | 2013 | EMAR 1 |
| | DB 14 | 647942.019 | 6608319.921 | Discharging | 2011 | EMAR 1 |
| | DB 15 | 647912.017 | 6608307.923 | Dry | 2013 | EMAR 1 |
| | DB 16 | 648002.017 | 6608424.96 | Discharging | 2012 | EMAR 1 |
| | DB 17 | 647310.016 | 6608147.994 | Dry | 2013 | |
| | DB 18 | 647296.012 | 6608143.988 | Dry | 2013 | |
| | DB 19 | 647294.014 | 6608148.926 | Dry | 2013 | |
| | DB 20 | 647291.018 | 6608147.917 | Dry | 2013 | |
| | DB 21 | 647289.015 | 6608145.943 | Dry | 2013 | |
| | DB 22 | 647285.016 | 6608153.923 | Dry | 2013 | |
| | DB 23 | 647282.019 | 6608145.891 | Dry | 2013 | |
| | DB 24 | 647351.018 | 6608172.904 | Dry | 2013 | |
| | DB 25 | 648014.014 | 6608458.988 | Discharging | 2011 | |
| | DB 26 | 647374.017 | 6608190.976 | Dry | 2013 | |
| | DB 27 | 647379.02 | 6608180.916 | Dry | 2013 | |
| | DB 28 | 647715.679 | 6608234.967 | Dry | 2017 | JO-NES |
| | DB 29 | 647513.47 | 6608225.766 | Dry | 2017 | JO-NES |
| | DB 30 | 647413.386 | 6608235.144 | Dry | 2017 | JO-NES |
| | DB 31 | 647411.222 | 6608290.178 | Dry | 2017 | JO-NES |
| | DB 32 | 647603.393 | 6608298.979 | Dry | 2017 | JO-NES |
| **Dubyna** | DB 33 | 646948.652 | 6608333.328 | Dry | 2017 | |
| | DB 34 | 645934.9 | 6607576 | 2 holes/dry | 2016 | |
| | DB 35 | 645991.5 | 6607578.2 | Dry | 2017 | |
| | DB 36 | 647421 | 6608222 | Dry | 2017 | JO-NES |
| | DB 37 | 647661.2 | 6608361.3 | Dry | 2017 | JO-NES |
| | DB 38 | 647561.2 | 6608066.9 | Dry | 2017 | JO-NES |
| | DB 39 | 647742.5 | 6608236 | Dry | 2017 | JO-NES |
| | DB 40 | 647593.6 | 6608297.4 | Dry | 2017 | JO-NES |
| | DB 41 | 647611 | 6608249.4 | Dry | 2018 | JO-NES |
| | DB 42 | 647579.4 | 6608258.1 | Dry | 2018 | JO-NES |
| | DB 43 | 647579.4 | 6608255 | Dry | 2018 | JO-NES |
| | DB 44 | 647585.8 | 6608256.1 | Dry | 2018 | JO-NES |
| | DB 45 | 647572 | 6608231.8 | Dry | 2018 | JO-NES |
| | DB 46 | 647521.1 | 6608238.1 | 2 holes/Dry | 2018 | JO-NES |
| | DB 47 | 647572.5 | 6608251.3 | Dry | 2018 | JO-NES |
| | DB 48 | 647575.6 | 6608248.3 | Dry | 2018 | JO-NES |
| | DB 49 | 647572.3 | 6608242.3 | Dry | 2018 | JO-NES |
| | DB 50 | 647558.3 | 6608239.3 | Dry | 2018 | JO-NES |

| | | | | | | |
|---|---|---|---|---|---|---|
| Dubyna | DB 51 | 647547 | 6608230.5 | Dry | 2018 | JO-NES |
| | DB 52 | 647578.7 | 6608236.1 | Dry | 2018 | JO-NES |
| | DB 53 | 647427.7 | 6608225.5 | Dry | 2018 | JO-NES |
| | DB 54 | 647419 | 6608244.3 | Dry | 2018 | JO-NES |
| | DB 55 | 647413.4 | 6608238.8 | Dry | 2018 | JO-NES |
| | DB 56 | 647395.2 | 6608229.4 | Dry | 2018*** | |
| | DB 57 | 647406.3 | 6608226.8 | Dry | 2018 | JO-NES |
| | DB 58 | 647417.4 | 6608225.7 | Dry | 2018 | JO-NES |
| | DB 60 | 647613.1 | 6608506.8 | 2 holes/Dry | 2018 | |
| | DB 61 | 647683.9 | 6608518.9 | Dry | 2018 | |
| | DB 62 | 647785.2 | 6608518.5 | Dry | 2018 | |
| | DB 63 | 647703.9 | 6608176.9 | Dry | 2018 | JO-NES |
| | DB 64 | 647946 | 6608148 | Dry | 2021 | EMAR 1 |
| | HAB 01 | 645518.015 | 6612550.898 | Dry | 2013 | HAB 1 |
| Hab | HAB 02 | 645531.009 | 6612559.987 | Dry | 2013 | HAB 1 |
| | HAB 03 | 645560.017 | 6612566.911 | Dry | 2013 | HAB 1 |
| | HAB 04 | 645559.011 | 6612570.997 | Dry | 2013 | HAB 1 |
| | HAB 05 | 645570.017 | 6612585.916 | Dry | 2013 | HAB 1 |
| | HAB 06 | 645516.013 | 6612592.957 | Dry | 2013 | HAB 1 |
| | HAB 07 | 645490.014 | 6612737.978 | Dry | 2013 | |
| | HAB 08 | 645473.016 | 6612730.963 | Dry | 2013 | |
| | HAB 09 | 645458.015 | 6612730.938 | Dry | 2013 | |
| | HAB 10 | 645444.016 | 6612727.941 | Dry | 2013 | |
| | HAB 11 | 645428.014 | 6612729.995 | Dry | 2013 | |
| | HAB 12 | 645531.017 | 6612306.94 | Dry | 2013 | HAB 1 |
| | HAB 13 | 645454.012 | 6612205.961 | Dry | 2013 | EXC 1 |
| | HAB 14 | 645203.016 | 6612156.978 | Dry | 2013 | EXC 1 |
| | HAB 15 | 645180.016 | 6612129.889 | Dry | 2013 | HAB 3 |
| | HAB 16 | 645197.013 | 6612184.948 | Dry | 2013 | EXC 1 |
| | HAB 17 | 645236.014 | 6612327.921 | Dry | 2013 | HAB 1 |
| | HAB 18 | 645265.016 | 6612338.968 | Dry | 2013 | HAB 1 |
| | HAB 19 | 645265.016 | 6612338.968 | Dry | 2013 | HAB 1 |
| | HAB 20* | 645244.013 | 6612340.94 | Dry | No Remediation | HAB 1 |
| | HAB 21* | 645216.013 | 6612306.969 | Dry | No Remediation | HAB 1 |
| | HAB 22* | 645206.015 | 6612316.948 | Dry | No Remediation | |
| | HAB 23 | 645196.016 | 6612315.891 | Dry | 2013 | |
| | HAB 24* | 645157.014 | 6612278.93 | Dry | No Remediation | |
| | HAB 25* | 645195.017 | 6612271.932 | Dry | No Remediation | |
| | HAB 26* | 645193.013 | 6612334.948 | Dry | No Remediation | |
| | HAB 27 | 645199.014 | 6612341.981 | Dry | 2013 | |
| | HAB 28 | 645237.012 | 6612367.979 | Dry | 2013 | HAB 1 |
| | HAB 29 | 645186.014 | 6612187.977 | Dry | 2013 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | HAB 30 | 645196.016 | 6612166.962 | Dry | 2013 | EXC 1 |
| | HAB 31 | 645188.016 | 6612161.97 | Dry | 2013 | |
| | HAB 32 | 645188.016 | 6612161.97 | Dry | 2013 | |
| | HAB 33 | 645184.017 | 6612166.942 | Dry | 2013 | |
| | HAB 34 | 645185.015 | 6612332.966 | Dry | 2013 | |
| | HAB 35 | 645170.015 | 6612318.896 | Dry | 2013 | |
| | HAB 36 | 645146.014 | 6612300.909 | Dry | 2013 | |
| | Hab 37 | 645635.866 | 6611795.114 | Dry | 2016 | EXC 2 |
| | Hab 38 | 645957.616 | 6612503.136 | Dry | 2016 | HAB 6 |
| | Hab 39 | 645944.833 | 6612429.845 | Dry | 2016 | HAB 6 |
| | Hab 40 & 41 | 645134.075 | 6611789.562 | 2 holes/dry | 2016 | HAB 3 |
| | Hab 42 & 43 | 645047.948 | 6611855.227 | 2 holes/dry | 2016 | HAB 3 |
| | Hab 44 | 645155.8 | 6612277.4 | Dry | 2016 | |
| | Hab 45 | 645120.288 | 6612036.091 | Dry | 2017 | HAB 3 |
| | Hab 46 | 645119.989 | 6612043.82 | Dry | 2017 | HAB 3 |
| | Hab 47 | 645737.923 | 6612087.024 | Dry | 2017 | HAB 2A |
| | Hab 48 | 645053.768 | 6611971.583 | Dry | 2017 | HAB 3 |
| | Hab 49 & 50 | 645291.031 | 6612001.84 | 2 holes/dry | 2017 | HAB 2 |
| | Hab 51 | 644786.442 | 6611947.92 | Dry | 2017 | |
| | Hab 52 | 645309.971 | 6612079.678 | Dry | 2017 | HAB 2 |
| | Hab 53 | 644794.3 | 6611948.2 | Dry | 2017 | |
| | Hab 54 | 645613.7 | 6611925.2 | Dry | 2017 | HAB 2A |
| **Hab** | Hab 55 | 645670.8 | 6612093.7 | Dry | 2017 | HAB 2A |
| | Hab 56 | 645653.1 | 6612056.8 | Dry | 2017 | HAB 2A |
| | Hab 57 | 645680.6 | 6612065.6 | Dry | 2017 | HAB 2A |
| | Hab 58 | 644798.2 | 6612050.6 | Dry | 2017 | HAB 2A |
| | Hab 59 | 645648.7 | 6611994.7 | Dry | 2017 | HAB 2A |
| | Hab 60 | 645671.6 | 6612016.6 | Dry | 2017 | HAB 2A |
| | Hab 61 | 645622.4 | 6611980.3 | Dry | 2017 | HAB 2A |
| | Hab 62 | 645076.2 | 6611788.8 | Dry | 2017 | HAB 3 |
| | Hab 63 | 645737 | 6612086.1 | Dry | 2018 | HAB 2A |
| | Hab 64 | 645685.9 | 6612061.4 | Dry | 2018 | HAB 2A |
| | Hab 65 | 645655.5 | 6612055.3 | Dry | 2018 | HAB 2A |
| | Hab 66 | 645412 | 6611924 | Dry | 2019 | HAB 2A |
| | Hab 67 | 645332 | 6611876 | Dry | 2019 | HAB 2A |
| | Hab 68 | 645631 | 6612339 | Dry | 2019 | HAB 1 |
| | Hab 69 | 645276 | 6612220 | Dry | 2021 | EXC 1 |
| | Hab 70 & 71 | 645704 | 6612168 | Dry | 2021 | EXC 1 |
| | VR 01 | 645583.015 | 6605976.917 | Dry | 2013 | ACE 8 |
| | VR 02 | 645612.016 | 6605959.984 | Dry | 2013 | ACE 8 |
| **Verna-Bolger** | VR 03 | 645987.422 | 6606161.403 | Dry | 2016 | BOLGER 1 |
| | VR 04 | 644794.274 | 6611948.222 | Dry | 2017 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | VR 05 | 645751.166 | 6606305.443 | Dry | 2017 | BOLGER 1 |
| | VR 06 | 645976.488 | 6606405.551 | Dry | 2017 | |
| | VR 08 & 09 | 645934.866 | 6607575.955 | 2 holes/dry | 2016 | |
| | VR 10 | 645991.476 | 6607578.159 | Dry | 2017 | |
| | VR 11 | 646037.829 | 6605999.498 | Dry | 2021 | NW 3 |
| | VR 12 | 645997.589 | 6605976.863 | Dry | 2021 | NW 3 |
| | VR 13 | 646052.176 | 6605975.309 | Dry | 2021 | NW 3 |
| | VR 14 | 646001.812 | 6605948.268 | Dry | 2021 | NW 3 |
| | VR 15 | 645995.007 | 6605897.840 | Dry | 2021 | NW 3 |
| | VR 16 | 645946.764 | 6605852.599 | Dry | 2021 | NW 3 |
| | VR 17 | 645885.294 | 6605830.366 | Dry | 2021 | NW 3 |
| | VR 18 | 645925.276 | 6605820.439 | Dry | 2021 | NW 3 |
| | VR 19 | 645917.392 | 6605771.530 | Dry | 2021 | NW 3 |
| | VR 20 | 646013.386 | 6605836.910 | Dry | 2021 | NW 3 |
| | VR 21 | 646027.817 | 6605820.750 | Dry | 2021 | NW 3 |
| | VR 22 | 646132.041 | 6605638.424 | Dry | 2021 | NW 3 |
| | VR 23 | 645702.416 | 6605821.699 | Dry | 2021 | NW 3 |
| | VR 26 | 645981.109 | 6605927.954 | Dry | 2021 | NW 3 |
| | VR 27 | 646027.259 | 6605884.492 | Dry | 2021 | NW 3 |
| | EG 01 | 640289.749 | 6607204.128 | Dry | 2016 | EAGLE 1 |
| **Eagle** | EG 02 | 640322.527 | 6607209.033 | Dry | 2016 | EAGLE 1 |
| **Eagle** | EG 03 | 640292.348 | 6607226.853 | Dry | 2016 | EAGLE 1 |
| | EG 04 | 640328.697 | 6607263.213 | Dry | 2016 | EAGLE 1 |
| | EG 05 | 640351.111 | 6607264.052 | Dry | 2016 | EAGLE 1 |
| | EG 06 | 640486.081 | 6607170.013 | Dry | 2016 | EAGLE 1 |
| | MC 1 | 638979.011 | 6604055.98 | Dry | 2013 | RA 9 |
| **Martin Lake** | OP 01 | 647251.597 | 6607892.5 | Dry | 2017 | |
| **Off Property**[1] | OP 02 | 646998.6 | 6605635.1 | Dry | 2017 | |
| | OP 03 | 647108.6 | 6605695.2 | Dry | 2017 | |
| | BH-8202 | 641471 | 6604205 | Dry | 2017 | |
| | BH-NW01 | 641343.6 | 6604130.1 | Discharging | 2017 | |
| | AC 19[2] | 647069 | 6605704 | Dry | 2019 | |
| | AC 20[2] | 647055 | 6605663 | Dry | 2019 | |
| | AC 21[2] | 647001 | 6605642 | Dry | 2019 | |

*Recent exploration activity (Not Eldorado/Cameco)
**DB 01 and DB-06 were found to be dry when first identified; however, boreholes could not be relocated despite extensive searches when remediation equipment was brought to the site.
***Assuming DB 56 was remediated in 2018 with other boreholes.
Note: AC 08, VR 07, and DB 59 have been removed from past records due to coordinate error and are not reflected in the 238 identified below.
Note: Total number of boreholes is 238, this includes 229 remediated (all with an associated year), 6 were not remediated due to being recent exploration (HB 20, Hab 21, Hab 22, HAB 24, HAB 25, and HAB 26), 2 were not located (DB 01 and DB 06), and 1 was covered with debris (BH-43).

[1] The 'Off Property' areas were operated as part of the former Eldorado Beaverlodge activities; however, these areas were not listed in the *Eldorado Resources Limited Decommissioning Approval AECB-DA-142-0*. In addition, these areas do not appear on the current Beaverlodge surface lease or in the Canadian Nuclear Safety Commission licence; however, Cameco intends to prepare these areas for transfer into the IC Program and has remediated the boreholes identified in these areas accordingly.
[2] Previously listed under the "Ace" area mistakenly. These boreholes are located off Beaverlodge property, in the Moran Pit area.

# APPENDIX C: CAMECO GEOTECHINCAL INSPECTION REPORT

# Beaverlodge

## Decommissioned Beaverlodge Mine/Mill Site

## 2023 Geotechnical Inspection Report

August 2023

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# 1.0 INTRODUCTION

From May 24 – May 29, 2023, Cameco Corporation (Cameco) personnel were on site to conduct a field test of the Beaverlodge Institutional Control Inspection Field Guide (ICIFG) and the annual geotechnical inspection. As a result, all the Beaverlodge properties, those in the Institutional Control program and those still under CNSC licence, were inspected following the ICIFG to ensure the relevant aspects of each area were inspected and continue to behave as expected and that conditions remain safe, secure and stable. The ICIFG report will serve as a baseline for future IC inspections.

As part of this inspection, geotechnical components were evaluated using the regulatory accepted criterion-based checklist developed with SRK Consultants. The geotechnical inspection completed in 2023 consisted of inspecting conditions at the Fookes Delta, the two outlet spillways at Fookes and Marie reservoirs and the relevant crown pillars associated with the former Hab, Dubyna and Ace mining areas.

The 2015 geotechnical inspection completed by SRK concluded that overall; the Fookes cover, and the two outlet structures were performing as expected. The report concluded that it would be reasonable for Cameco to move towards final close out and a return to Institutional Control for the properties associated with the cover and outlet structures (*SRK, 2016*). SRK recommended that in the meantime, documented inspections by Cameco and/or regulators should continue on an annual basis. A follow-up inspection was completed in 2020 by SRK, who noted that there were no observable changes to the landform and no concerns identified. Following the 2020 inspection, SRK recommended that Cameco continue with annual inspections using the existing inspection protocols, and that once the properties are transferred to the IC Program that they are inspected every five years for two cycles, then less frequently after that if the areas remain stable.

**Figure 1** provides the locations of the Fookes Delta and the outlet structures. Additional details are provided in **Section 5.0**, including **Figure 4**, **Figure 5**, and **Figure 6,** which provide the locations of applicable crown pillar monitoring.


**Figure 1. Geotechnical Inspection Locations**

# 2.0 OUTLET STRUCTURE INSPECTIONS (FOOKES & MARIE RESERVOIR)

Both spillway structures consist of a rip-rap lined open channel (with trapezoidal cross-section), which discharge into a rip-rap lined stilling basin. The rip-rap lining in both the spillway channels and the stilling basins was intruded with grout for added erosion protection; however, the rip-rap in the spillway was designed to be stable in the absence of grout intrusion. The spillways are capable of passing a 500-year flood event with a depth of 0.3 m (680 L/sec) and 0.35 m (760 L/sec) at the entrances of the Fookes and Marie reservoir outlet spillways, respectively.

The cracking and displacement of the grout-intruded rip-rap within the two spillways was anticipated in their original designs and does not affect the performance of either outlet spillway. Additional cracking and ice-jacking are anticipated over time, but the condition of the two outlet spillways continues to be satisfactory and is expected to remain so moving forward (SRK 2021).

## 2.1 General Observations

Local land users have noted water levels have been significantly higher than normal since 2020 and snowpack in 2023 followed that trend, with the last 4 years being the highest snowpacks recorded since Beaverlodge began tracking that information in 2005. However, 2023 saw freshet come early and the snowpack was largely gone by the first week of May. May 2023 was also significantly warmer than May 2022 with the average daytime high being more than 10 degrees warmer in May 2023. Lake Athabasca was completely ice free at the end of May 2023, which is uncommon.

Comparisons of photos between inspection years is presented in **Section 4.0**. Photos taken in 2023 were from late May. Due to the early freshet and the abnormally mild May the vegetation growth is lusher in 2023 than it was in 2022.

## 2.2 Inspection Checklist for Outlet Structures

The specific elements to be evaluated during these inspections include the following:

I. Check the condition of the spillway channel, with a view to confirming the grout-intruded rip-rap is still in place.
II. Check the condition of the rip-rap on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event.
III. Document conditions with photographs.

## 2.3 Marie Reservoir Outlet Inspection

*I. Check the condition of the spillway channel, with a view to confirming the grout-intruded rip-rap is still in place.*

Previously, SRK identified that the grout-intruded rip-rap is relatively intact, except near the spillway entrance where one large block and several smaller ones on the right side of the spillway (looking downstream from Marie Reservoir) have been displaced due to ice-jacking.

In addition to the comparison photos provided in **Section 4.0,** photos taken during the 2023 inspection providing photographic record of the condition of the Marie Reservoir spillway channel are included in **Appendix A**. Despite the continued elevated flows over the past 4 years the spillway channel remains in a similar condition as observed in previous inspections.

The observations and photographic record from the 2023 inspection support the observations made by SRK that the spillway continues to perform as designed (*SRK 2021*).

II. *Check the condition of the rip-rap on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event*

In previous years it has been noted that higher than normal water levels over the last number of years have resulted in some natural debris and dimensional lumber along the leading edge of the rip-rap on either side of the spillway as well as the edges of the channel. Following the 2022 inspection, all dimensional lumber was removed from the area as part of the final clean-up in preparation for transferring properties to the Province of Saskatchewan's Institutional Control Program. Despite the increased flows the spillway appears to be performing as expected with no erosion of the rip-rap embankment on either side of the spillway. No new debris was noted in the channel in 2023.

Despite the unusually high flows observed over the past 4 years the Marie Reservoir outlet spillway has, in general, changed little since 2004. Photographic comparison to previous inspection photos is provided in **Section 4.0**. The grout-intruded rip-rap is relatively intact except near the spillway entrance where one large block slab and several smaller ones on the left side of the spillway (looking upstream) continued to be displaced due to ice-jacking (**Appendix A, Photo A1**).

As noted in previous geotechnical inspections beaver activity at the outlet of Marie Reservoir has resulted in construction of a small dam. The crest of the beaver dam appears to be similar to previous years, although the water level behind the dam appears to be slightly lower. This condition will continue to be monitored during future inspections. There are currently no plans to remove the beaver dam as it is naturally occurring. A photo of the Marie Outlet structure documenting the beaver dam is located in **Section 4.0**.

## 2.4 Fookes Reservoir Outlet Inspection

I. *Check the condition of the spillway channel, with a view to confirming the grout-intruded rip-rap is still in place*

Similar to the Marie Outlet, SRK also identified that the grout-intruded rip-rap along the length of the Fookes Reservoir outlet spillway shows signs of cracking. In addition, there has been some ice-jacking, with the most significant displacements located near the upper part of the spillway (i.e., on the sides of the spillway, within 5 to 6 m of the spillway entrance) (**Appendix B, Photo B1)**. The base of the channel does not show signs of significant displacement, and the middle to lower parts of the spillway remain in good condition.

*II.* In addition to the comparison photos provided in **Section 4.0,** photos taken during the 2023 inspection providing photographic record of the condition of the Fookes Reservoir spillway channel are included in **Appendix B**. Following the 2022 inspection, all dimensional lumber was removed from the area as part of the final clean-up in preparation for transferring properties to the Province of Saskatchewan's Institutional Control Program. No new debris was noted in 2023.*Check the condition of the rip-rap on either side of the spillway, with a view to confirming no erosion has occurred due to overtopping associated with an extreme flood event*

Despite the increased flows the spillway appears to be performing as expected with no erosion of the rip-rap embankment on either side of the spillway. Photographic comparison to previous inspection photos is provided in **Section 4.0**.

# 3.0 FOOKES DELTA

## 3.1 General Observations

Historically, the area along the northeast side of the Fookes Delta has contained standing water. The Fookes Delta cover in this area was purposefully graded to establish an overall preferential gradient towards Fookes Reservoir. **Figure 2** provides an overview of the cover design (*SRK, 2008*), with the surface drainage paths outlined. As per the SRK design for the Fookes cover, the northern drainage ditch area of the delta was never intended to provide fully channelized flow to Fookes Reservoir. As a result, some ponding in higher precipitation years was anticipated and may be expected to occur.

During the 2023 inspection of Fookes Delta, it was noted that the drainage area running along the north side of the delta contained water and was performing as designed, while the drainage channel to Fookes Reservoir was dry. The small amount of ponded water was that was observed at the base of the north access ramp on the waste rock cover (**Appendix C, Photo C2**) during the 2022 inspection was dry in 2023.

Generally, the cover was in good condition showing no areas of excessive erosion, despite greater than normal precipitation and the elevated water levels seen in Fookes Reservoir over the past number of years, discussed in Section 2.4. The east and west berms were in good condition with no evidence they have been breached by vehicular traffic. In 2022, there was some localized ATV traffic noted on the Fookes Delta cover, however no new disturbance was noted in 2023. Vegetation is well established within 50 m of the shoreline and the engineered drainage structures. Vegetation continues to gradually encroach and thicken over much of the delta.

Photographic comparison to previous inspection photos is provided in **Section 4.0**. Photos showing the conditions encountered during the site inspection are provided in **Appendix C**.

## 3.2 Inspection Checklist

I. Check for evidence of new tailing boils or tailings exposure due to frost action

II. Check for evidence of significant erosion of the cover material
   a. Trench along the northeast edge of the delta (sand flows, erosion of waste rock, slumping, etc.) – maintain photographic and GPS record (identify areas of concern on map).
   b. Cover limit along its contact with Fookes Reservoir – maintain photographic and GPS record (identify areas of concern on map) where sand from the delta cover extends into the reservoir.

III. Ensure erosion-protection devices are performing as expected on former north access road
   a. Waterbars (chevrons)
   b. Diversion ditches
   c. Erosion of cover adjacent to the former access road

IV. Ensure earthen berms are in place to limit access to the delta

## 3.3 Fookes Cover Inspection

*I. Check for evidence of new tailing boils or tailings exposure due to frost action*

No new boil development was noted on the delta.

*II. Check for evidence of significant erosion of the cover material*

The shoreline, where the edge of the sand cover contacts Fookes Reservoir, was inspected and was in good condition. Photos taken in 2023 continue to show significant vegetation coverage along the shoreline.

The 2023 inspection showed that water is being captured in the drainage channels as per design and there is no evidence of any significant erosion of the cover. The drainage channel continues to vegetate heavily as can be seen in the photos in Section 4 and **Figure 2**.

The Fookes Delta cover is in good condition and showed no sign of excessive erosion. As vegetation continues to establish on the shoreline, it will increase the stability of the cover.

*III. Ensure erosion protection devices are performing as expected on former north access road*

As part of the design and installation of the covers in 2005 and 2007, the area considered most vulnerable to erosion was in the area on and below the access ramp at the northwest corner of the delta (*SRK*, *2010*). The general condition of the ramp is very good. Access to this ramp is closed off by a windrow of material at the top of the ramp, except for the small access trail to allow the remediation of the piezometer standpipes. The water bars (chevrons, **Figure 3**) are performing as expected and continue to show little sign of erosion (**Appendix C, Photo C1**).

In addition to the chevrons, run-out structures were installed to carry away excessive water during extreme run-off events. These run-out structures are also in good shape with no observed additional eroded material beyond that observed during previous inspections (**Appendix C, Photo C3**).

*IV. Ensure earthen berms are in place to limit access to the delta*

Since the earthen berms protecting the east and west access points to the Fookes Delta were repaired and reinforced in 2011 and 2012 respectively, there has not been any new evidence of passenger vehicular traffic accessing the delta. In 2022, there was some localized ATV traffic noted on the Fookes Delta cover, however no new disturbance was noted in 2023. A photo of the berm located on the east access point is provided in Appendix C (**Photo C7**).

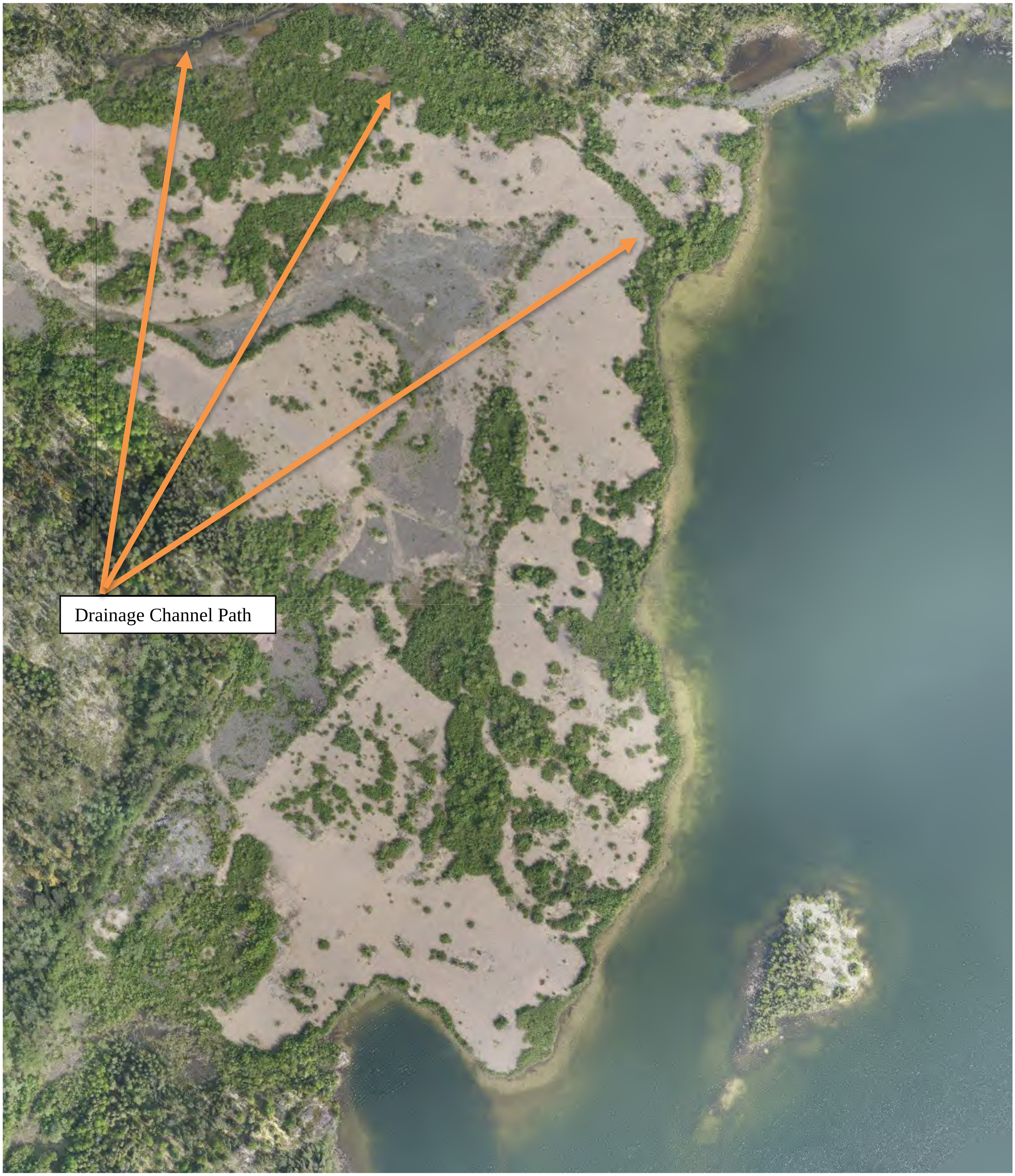



**Figure 2. Fookes Overview**


**Figure 3. Fookes chevron and runout structure**

# 4.0 PHOTOGRAPHIC COMPARISONS

## Beaver dam constuction at the outlet structure for Marie Reservoir


August 2021


May 2022

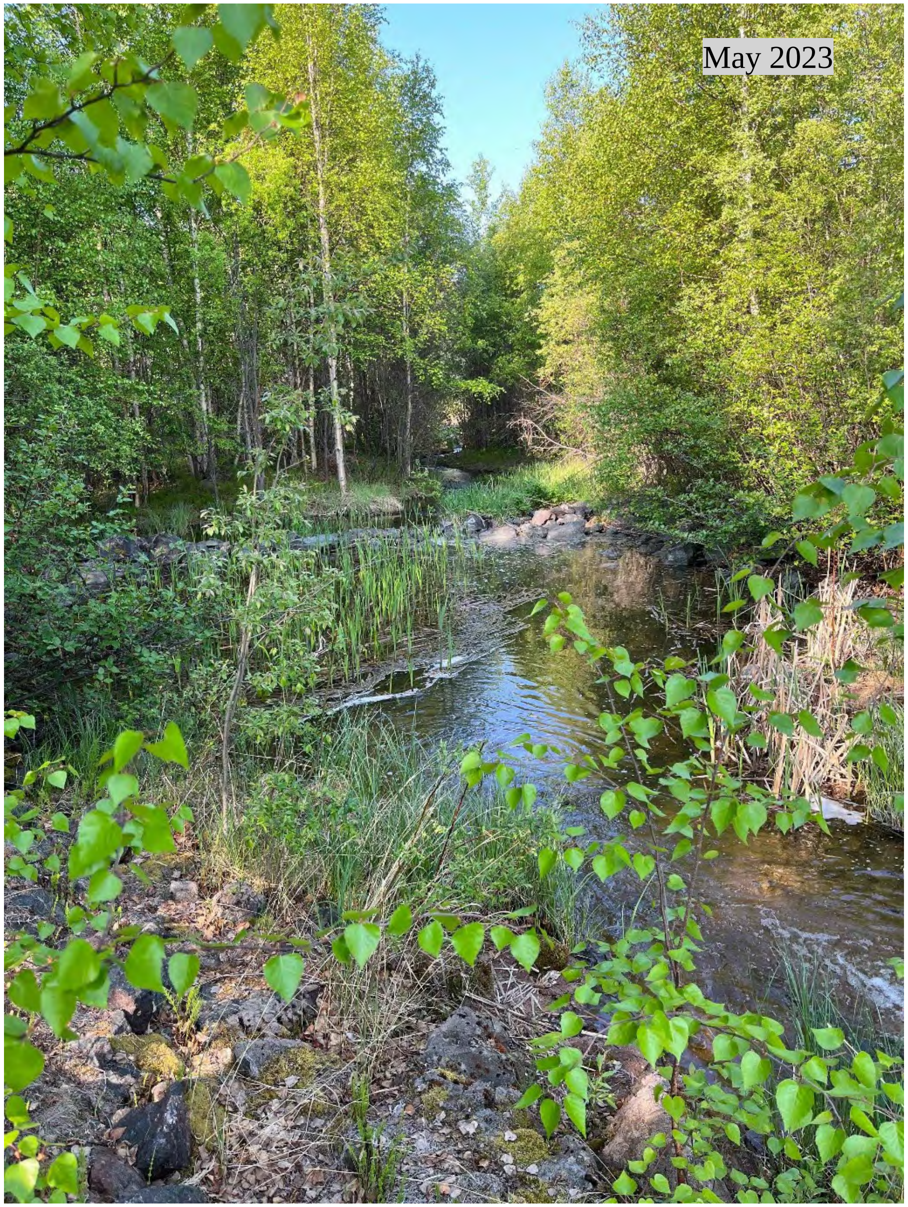

May 2023

# Marie Outlet Structure looking upstream



# Marie Outlet Structure looking downstream







**Marie Reservoir Outlet Structure**

**– Ice jacked block of grout intruded rip-rap**

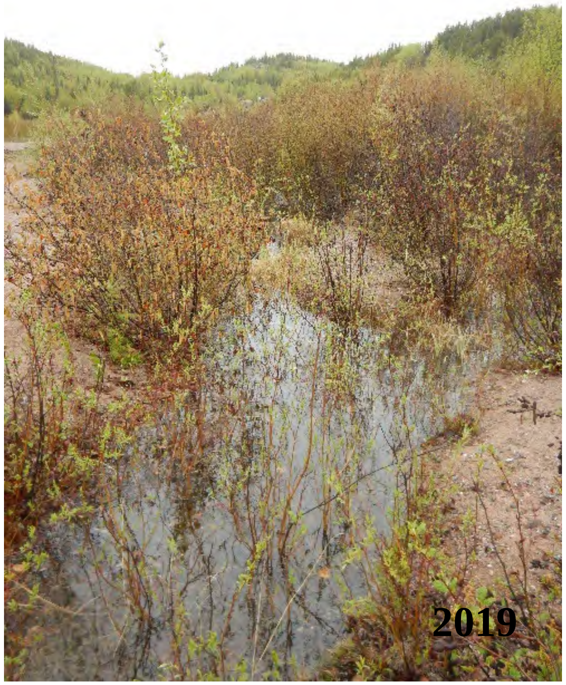
## Fookes Outlet Structure looking upstream



## Fookes Outlet Structure looking downstream



**Drainage area looking NW towards access point on hill**



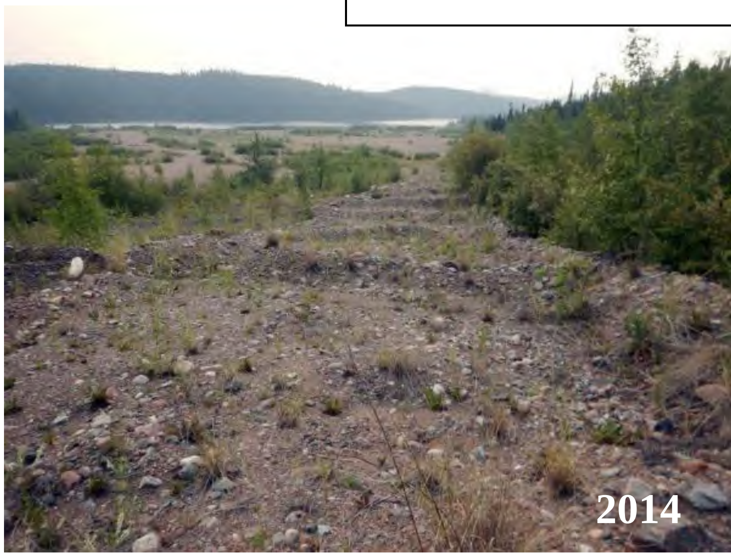


# Fookes Cover Shoreline




Note: pictures are not taken from the exact same locations

# Chevrons in place on north access point to the Fookes Delta





# 5.0 CROWN PILLAR AREAS

In 2016, the Geotechnical Inspection Checklist was updated to include the identified crown pillar areas at the Hab, Dubyna and Ace areas as per recommendations from SRK. Cameco committed to perform assessments of the relevant crown pillar locations annually until such time as the properties are transferred to the IC Program, where monitoring will continue under that program. As the Hab, Dubyna and Ace areas had not been transferred to the IC program at the time of the 2023 inspection Cameco completed the inspections of these crown pillars in 2023.

**Table 1** and **Table 2** provide GPS points for locations associated with the Dubyna and Hab areas where visual monitoring was recommended. As shown in **Figure 4**, for the Dubyna area, the area between inspection points are expected to coincide with the Level 1 stoping area where crown pillar thicknesses would be expected to be the thinnest. As shown in **Figure 5**, for the Hab area, inspection points are expected to align roughly with the 2$^{nd}$ level workings where stoping of the Hab 039 Zone was conducted. **Figure 6** provides the layout of the Ace Stope Area cover along with the locations of historic subsidence observed in the area, where inspections typically focus.

**Table 1. Visual Monitoring Location Recommendations for Dubyna**

| Location | Position | Elevation (approx.) | Comment |
|---|---|---|---|
| **DUB-01** | Zone:12 V 647946, 6608477 | 339 m | In mine waste backfill |
| **DUB-02** | Zone:12 V 647973, 6608480 | 339 m | Near edge of waste rock backfill |
| **DUB-03** | Zone:12 V 647997, 6608487 | 333 m | Close to lake |

**Table 2. Visual Monitoring Location Recommendations for Hab**

| Location | Position | Elevation (approx.) | Comment |
|---|---|---|---|
| **HAB039-01** | Zone:12 V 645272, 6612203 | 408 m | Near the edge of the mine waste backfill |
| **HAB039-02** | Zone:12 V 645339, 6612234 | 415 m | Covered by mine waste backfill in the pit |
| **HAB039-03** | Zone:12 V 645384, 6612251 | 419 m | Covered by mine waste backfill, near the edge of the pit rim |

| | | | |
|---|---|---|---|
| **HAB039-04** | Zone:12 V 645373, 6612211 | 408 m | Approximately above the 2nd level workings |
| **HAB039-05** | Zone:12 V 645298, 6612178 | 403 m | Approximately above the 2nd level workings |

Inspections of the Ace, Hab and Dubyna crown pillars occurred on May 25 – 29, 2023. Photographs of the covered Ace Stope Area and the crown pillar areas at Hab and Dubyna are provided in **Appendix D**.

At the Ace area, the cover material over the stopes was inspected by walking the toe of the cover material, as well as the interface between the cover material and natural ground. No signs of tensions cracks or visible depressions were observed along the Ace stope cover material in 2023.

The crown pillar monitoring points at Hab and Dubyna were located, and a visual walking inspection was completed at each site. The inspection involved walking between and around the points identified in **Tables 1** and **2**. Observations at both areas did not show any evidence of tension cracks or slumping in 2023.

It was noted at Dubyna that recent beaver activity resulted in significant clearing along the crown pillar inspection area. As well, a beaver lodge was constructed along the shore of Dubyna Lake near furthest extent of the crown pillar.

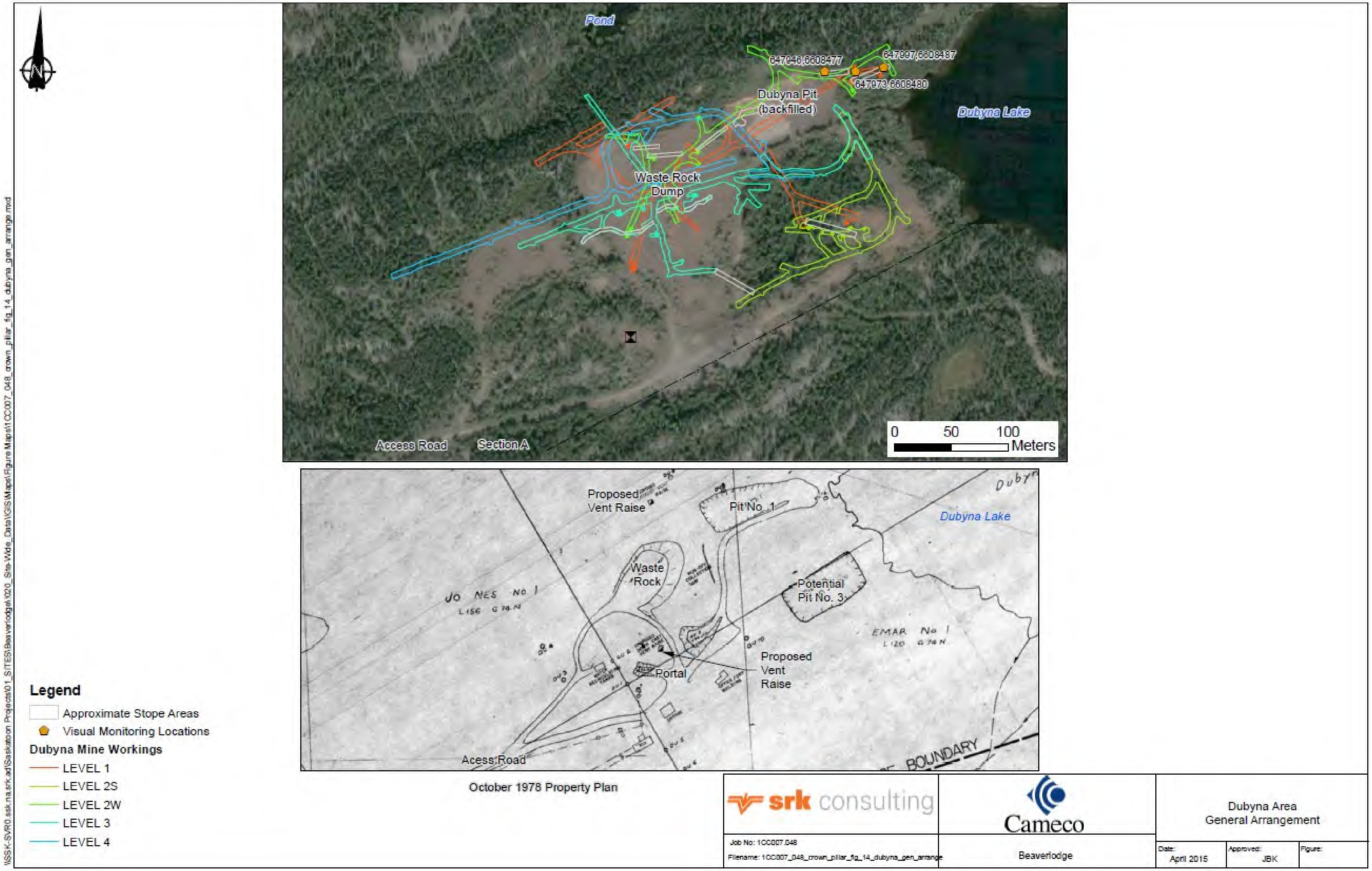



**Figure 4. Dubyna area general arrangement**

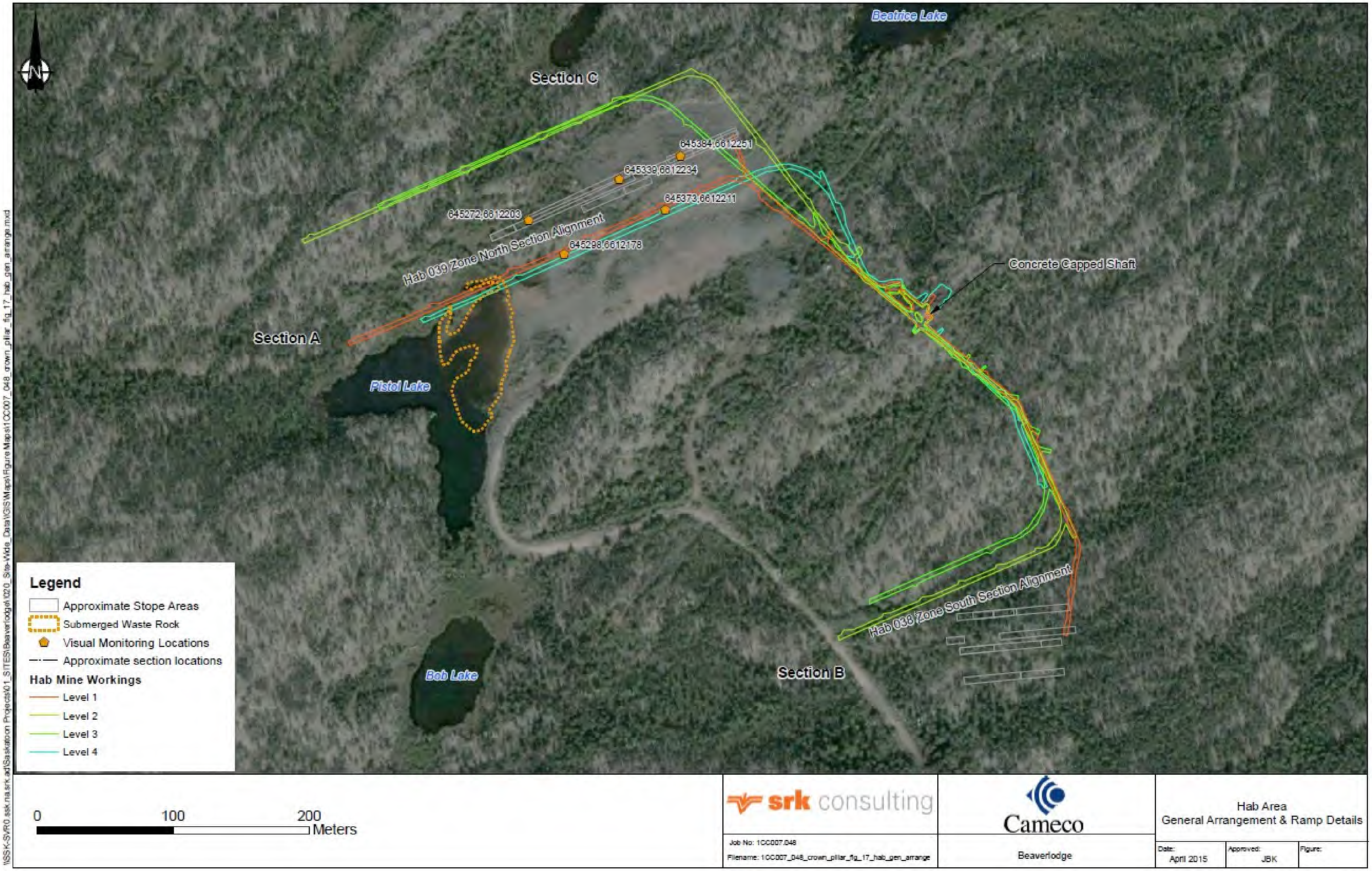



**Figure 5. Hab area general arrangement and ramp details**

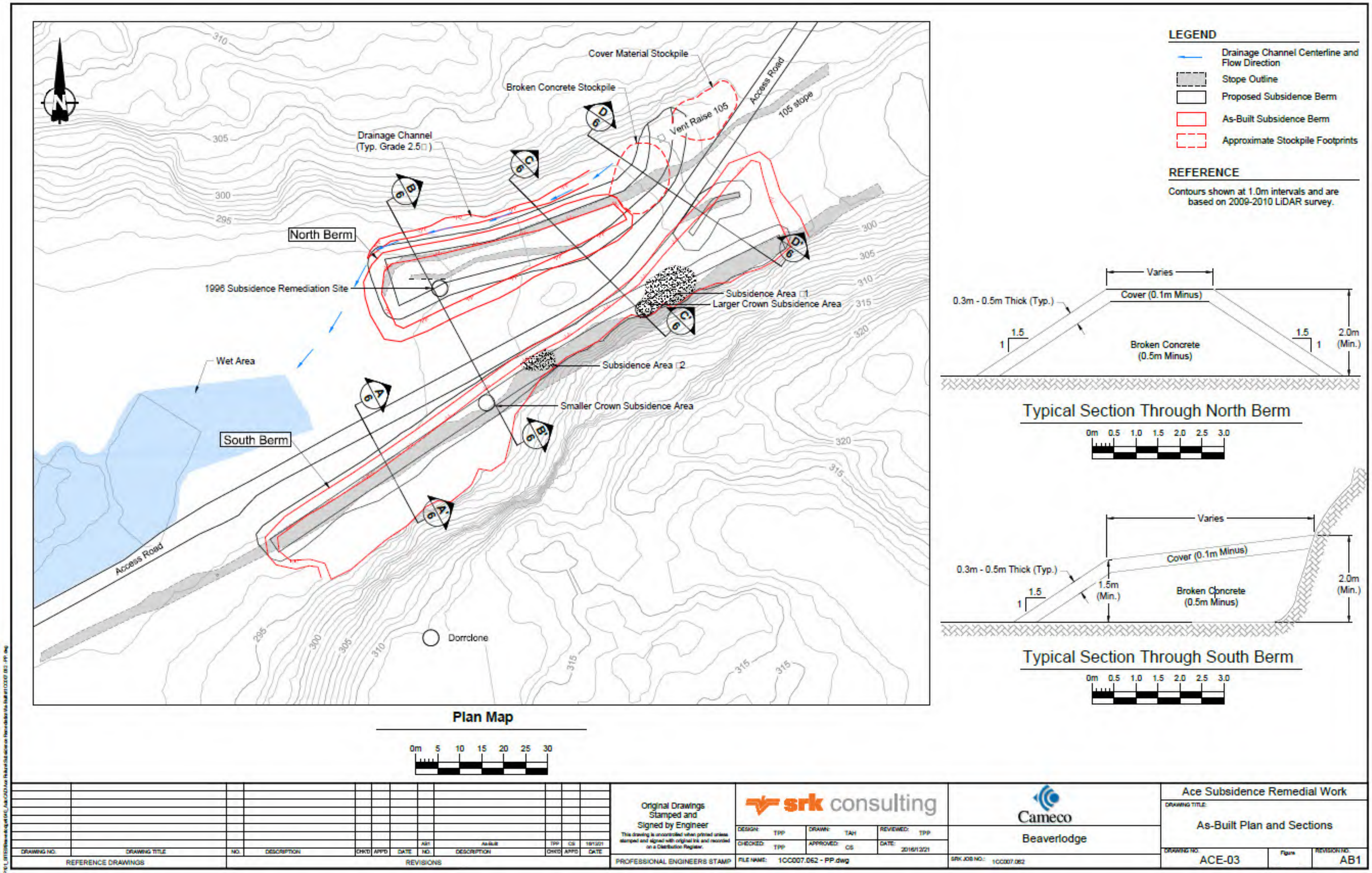



**Figure 6. Ace crown pillar remediation**

# 6.0 ZORA STREAM RECONSTRUCTION

Remedial work completed at the Bolger Pit site from 2014 to 2016 included the excavation of a channel through the existing Bolger Waste Rock Pile and the relocation of the excavated waste rock to the Bolger Pit. The intent of this work was to improve water quality, specifically uranium concentrations, in both Zora Creek and Verna Lake and to re-establish a more natural Zora Creek flow path.

In the Zora Creek Design Report (SRK, 2014), it was recommended to complete a geotechnical inspection in each of the first two years following construction. Subsequently, SRK completed geotechnical inspections in 2017 (SRK, 2017c) and 2018 (SRK, 2019) of the reconstructed Zora Creek flow path. Both the 2017 and 2018 inspections found that there were no immediate or significant areas of concern with regards to the performance or geotechnical stability of the reconstructed flow path. Continued monitoring of water quality and the potential presence of accumulated sediment were recommended. In addition, it was recommended that the next geotechnical inspection occur in 2023, or earlier if requested by Cameco (SRK, 2019). Cameco requested a geotechnical inspection for the area be completed in 2020 to align with other geotechnical inspections at the decommissioned Beaverlodge properties.

The 2020 SRK inspection identified that from a geotechnical perspective, it would be reasonable for Cameco to transfer the properties associated with the Bolger Pit and the Drainage Channel to the IC Program. However, in the interim it was recommended that Cameco continue with annual inspections of the area as part of the annual regulatory inspection. It was also noted that involvement by a geotechnical engineer should not be required except in the unlikely event that significant geotechnical concerns arise.

The Zora Creek Stream Reconstruction area was inspected on May 26, 2023. Overall, the conditions observed had not changed from previous years in that water quality results are performing as expected and no significant accumulation of sediment has been observed. The results of the 2023 assessment of the Bolger Pit and the Drainage Channel can be summarized as follows:

- The beaver dam located at the outlet of Zora Lake (inlet to the stream reconstruction) remains intact.
- The embankments along the sides of the channel remain stable with no evidence of sloughing or instability.
- Vegetation along the downstream portion of the channel (near the stilling basin) is now well established and thickening.

Photographic record of the inspection is provided in **Appendix E**.

# 7.0 REFERENCES

SRK Consulting (2008). Beaverlodge Decommissioning: 2007 Construction Activities at the Fookes Lake Delta. Report prepared for Cameco Corporation, February, 2008.

SRK Consulting (2010). Beaverlodge Project: Inspection of Fookes Delta and Outlet Structures at Fookes Reservoir and Marie Reservoir. Report prepared for Cameco Corporation, September, 2010.

SRK Consulting (Canada) Inc. (2015). Beaverlodge Property – Crown Pillar Assessment (2014 – 2015), Project Number: 1CC007.048. Report submitted to Cameco Corporation, July 2015.

SRK Consulting (2016). Beaverlodge Project: Inspection of Select Areas within the Fookes and Marie Reservoirs and Ace Creek Catchment. Report prepared for Cameco Corporation, January, 2016.

SRK Consulting (Canada) Inc. (2021). Beaverlodge Project – 2020 Geotechnical Inspection Report - Decommissioned Beaverlodge Mine/Mill Site. Prepared for Cameco Corporation

# 8.0 APPENDICES

Appendix A – Marie Reservoir Outlet photos

Appendix B – Fookes Reservoir Outlet photos

Appendix C – Fookes Delta photos

Appendix D – Ace and Hab crown pillar inspection photos

Appendix E – Zora Stream Reconstruction photos

# Appendix A
# Marie Outlet Photos


**Photo A1 – Marie Reservoir Spillway looking upstream (May 2023)**


**Photo A2 - Marie Reservoir Spillway inlet; beaver dam first noted in 2018**

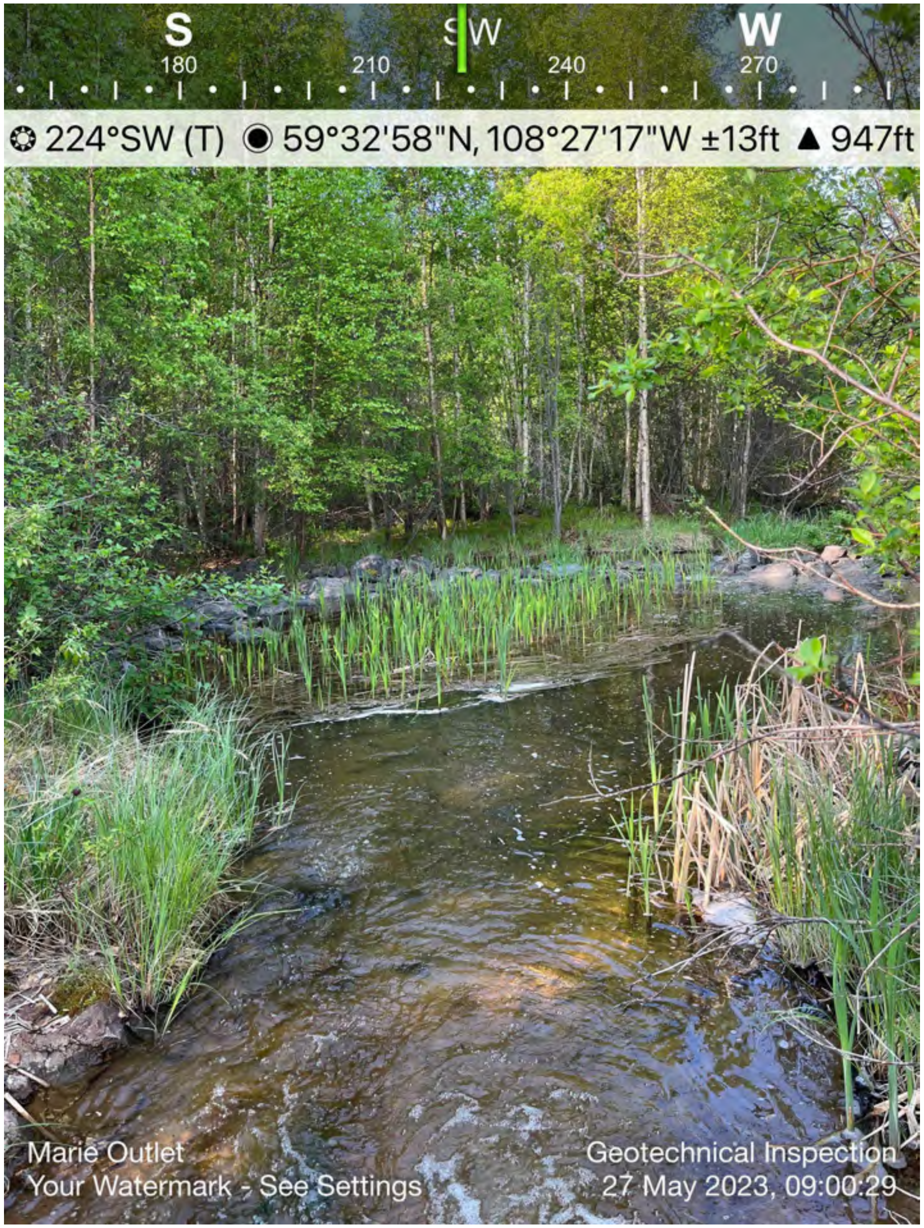



**Photo A3 – Marie Reservoir Spillway (water flowing into stilling basin) (May 2023)**


**Photo A4 – Marie Reservoir Spillway looking northeast (May 2023)**

# Appendix B
# Fookes Outlet Photos


**Photo B1 – Fookes Reservoir Spillway looking into Fookes Reservoir**

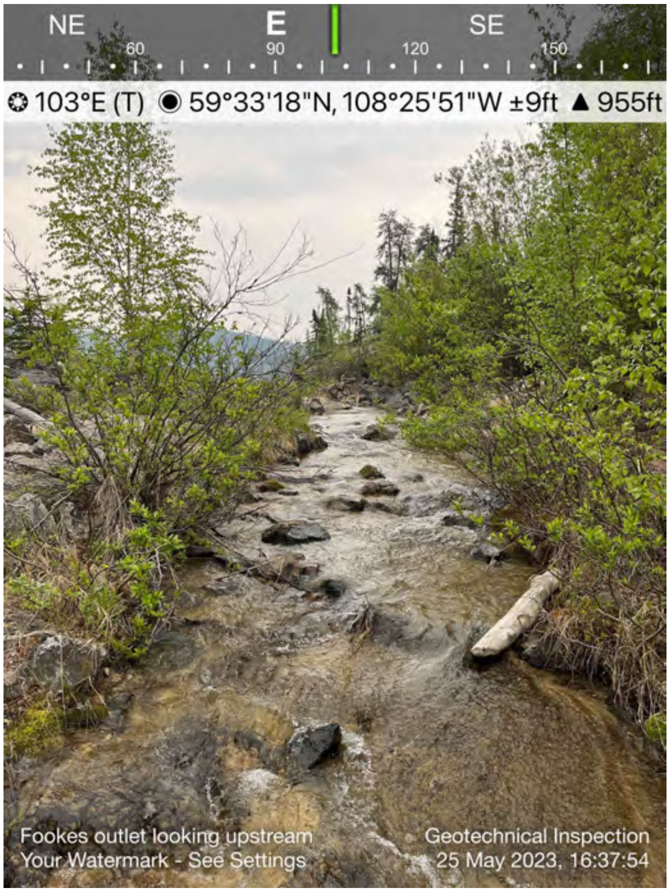



**Photo B2 – Fookes Reservoir Spillway looking upstream**

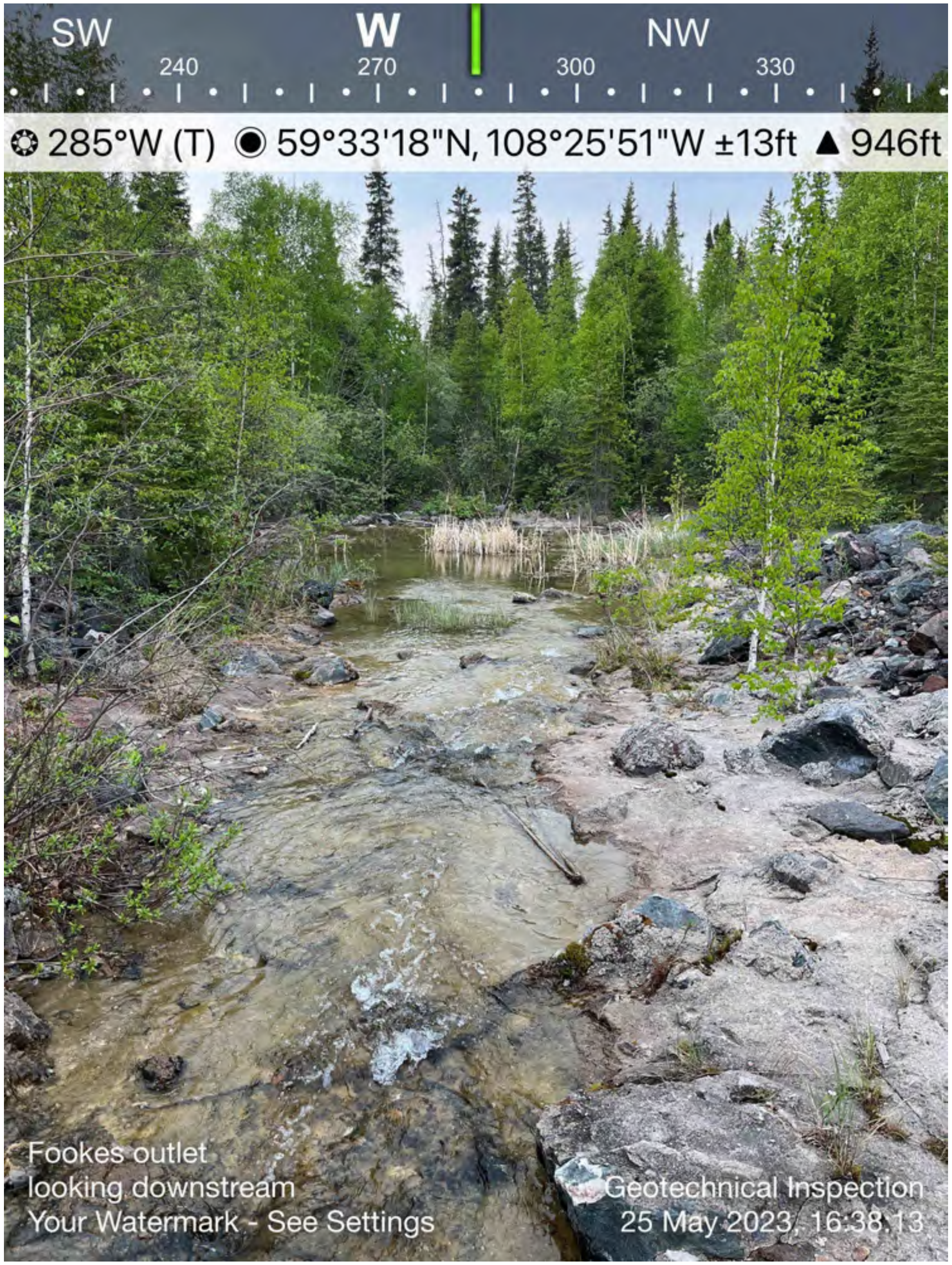



**Photo B3 – Fookes Reservoir Spillway looking downstream (mid channel)**


**Photo B4 – Fookes Reservoir Spillway stilling basin**

**Photo B5 – Fookes Reservoir Spillway showing broken rip-rap on north and south sides of channel. Note debris has been removed since 2022 inspection.**

# Appendix C
# Fookes Delta Photos


**Photo C1 – Chevrons in place on north access point to the Fookes delta looking south (May 2023)**


**Photo C2 – no ponded water (May 2023). This area previously had ponded water on waste rock cover at bottom of hill near north access road during freshet in 2022.**

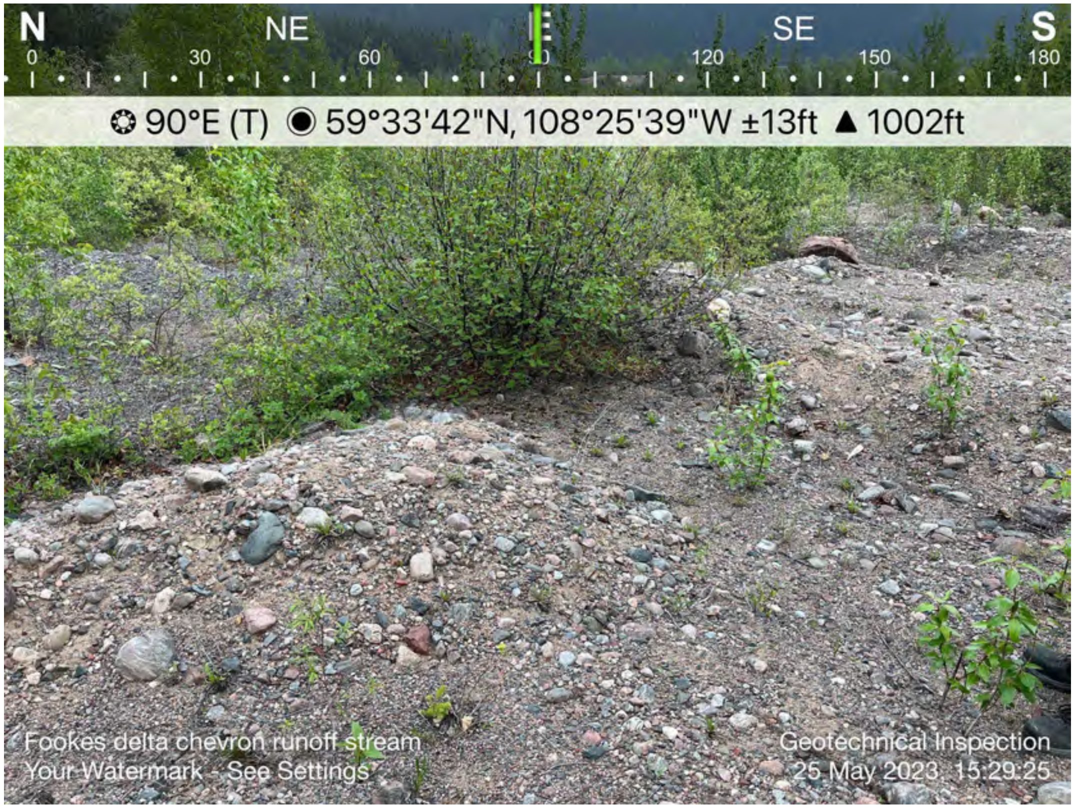



**Photo C3 – Chevron run-out structure along north access road**


**Photo C4 – Drainage collection area on edge of Fookes Tailings Delta approximately 100m from access point**

**Photo C5a-b – Panoramic views of the Fookes cover (Photos taken May 2023) vegetations is yet to leaf-out**

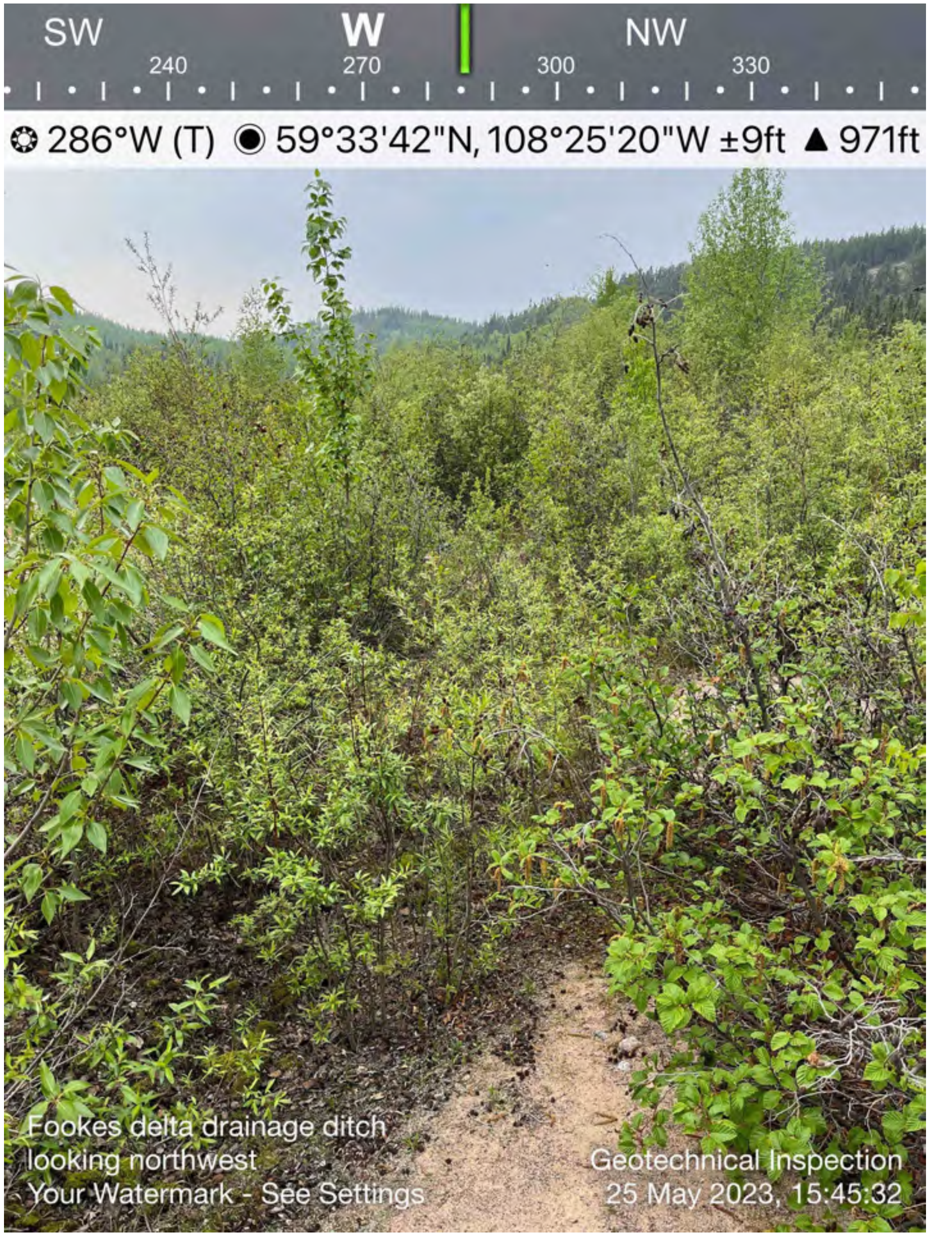



**Photo C6 – View of vegetation establishing along drainage channel (May 2023).**


**Photo C7 – View of east berm looking onto the delta. No evidence of traffic crossing the berm (May 2023).**

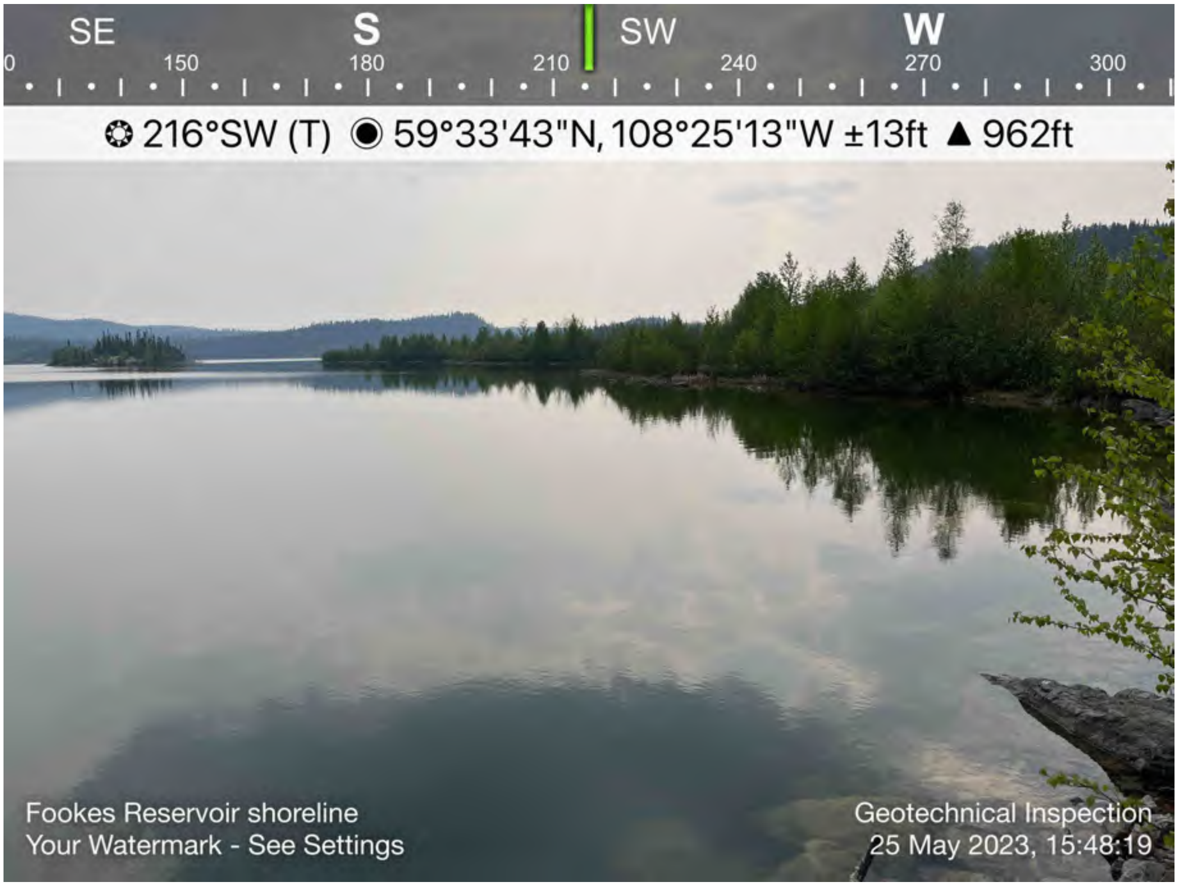



**Photo C8—Fookes Reservoir shoreline (looking west) Note vegetation along shoreline is well**

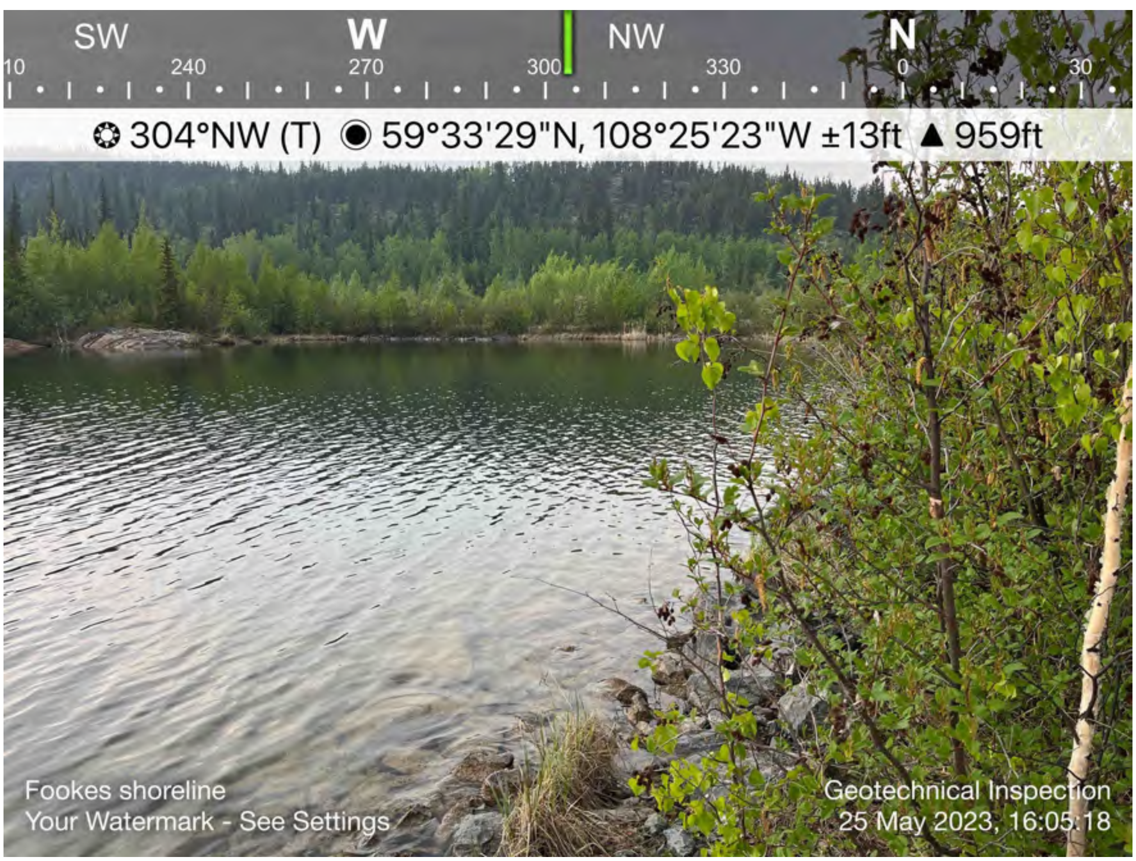



**Photo C9—Fookes Reservoir shoreline (looking west).**

# Appendix D
# Crown Pillar Area Photos


**Photo D1 - View of the cover placed over Ace 201 Stope**


**Photo D2 - view of Ace 105 and 208 Stope cover**


**Photo D3—Dubyna CP-1 location (looking east)**

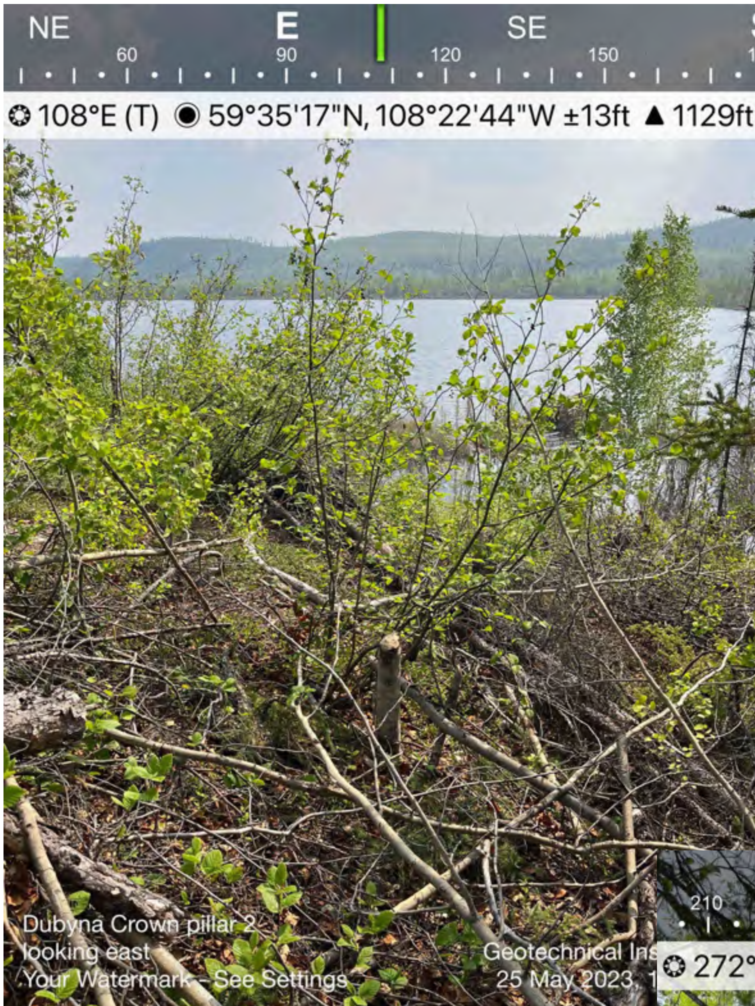



**Photo D4—Dubyna CP- 2 location (looking east)**


**Photo D5—Dubyna CP-2 location (looking west)**


**Photo D6—Dubyna CP– 3 location (looking west)**

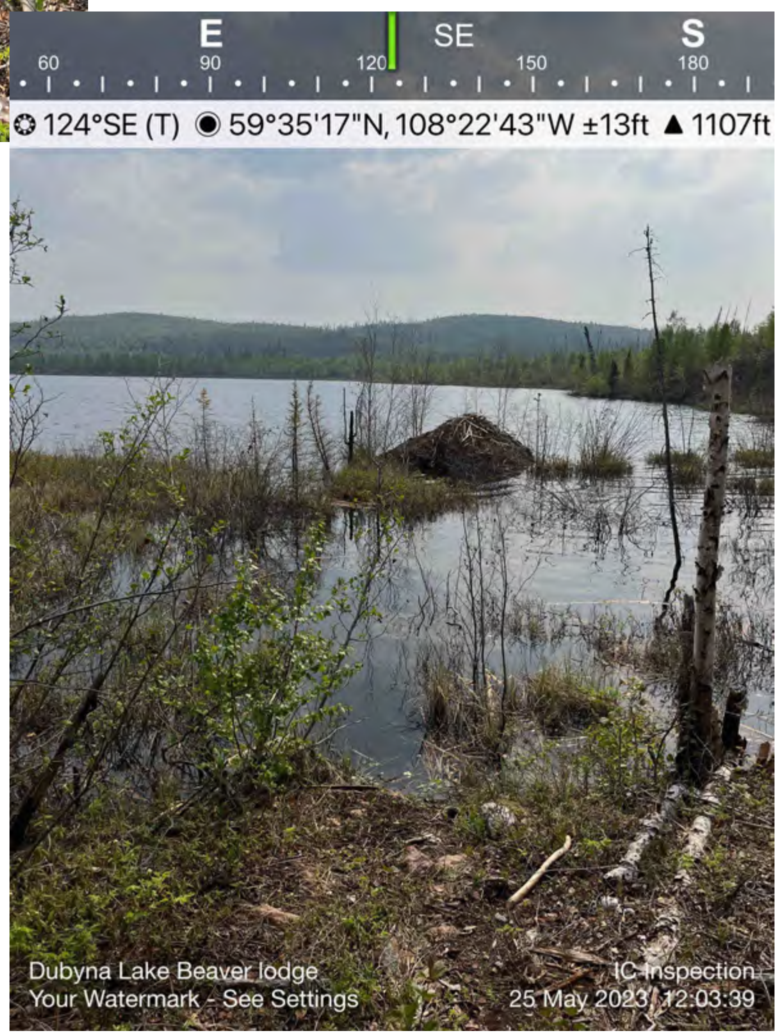



**Photo D7—Dubyna CP– 3 location (looking east to Dubyna Lake)**


**Photo D8—HAB039-01 location (looking northeast)**

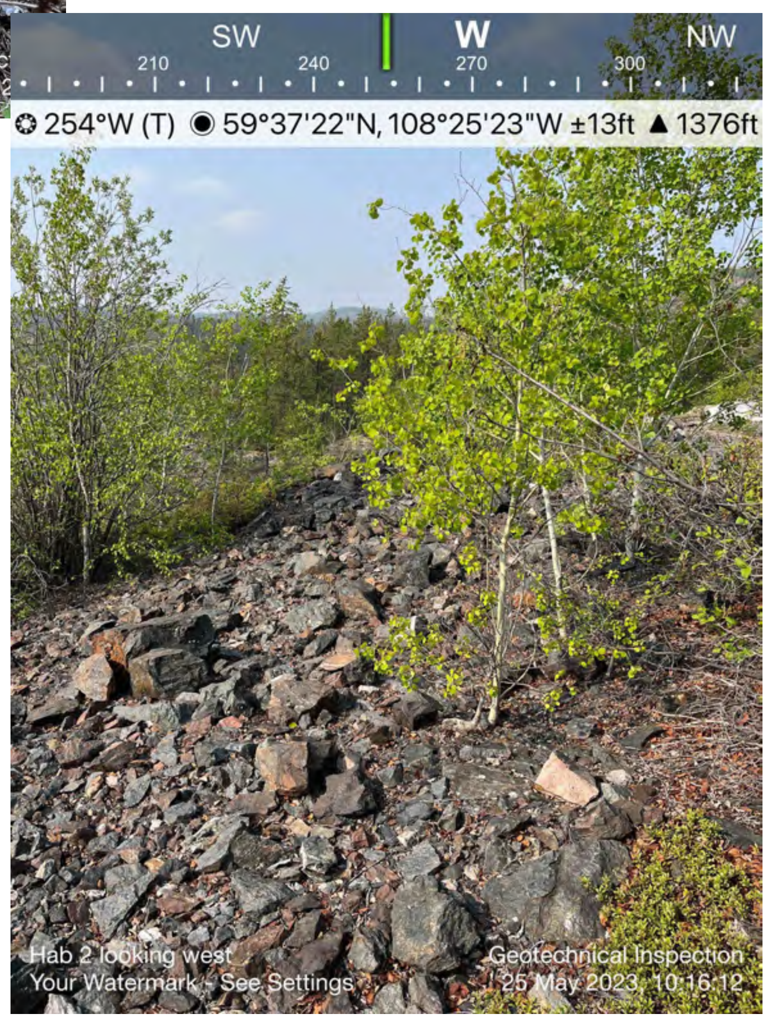



**Photo D9—HAB039-02 looking west**

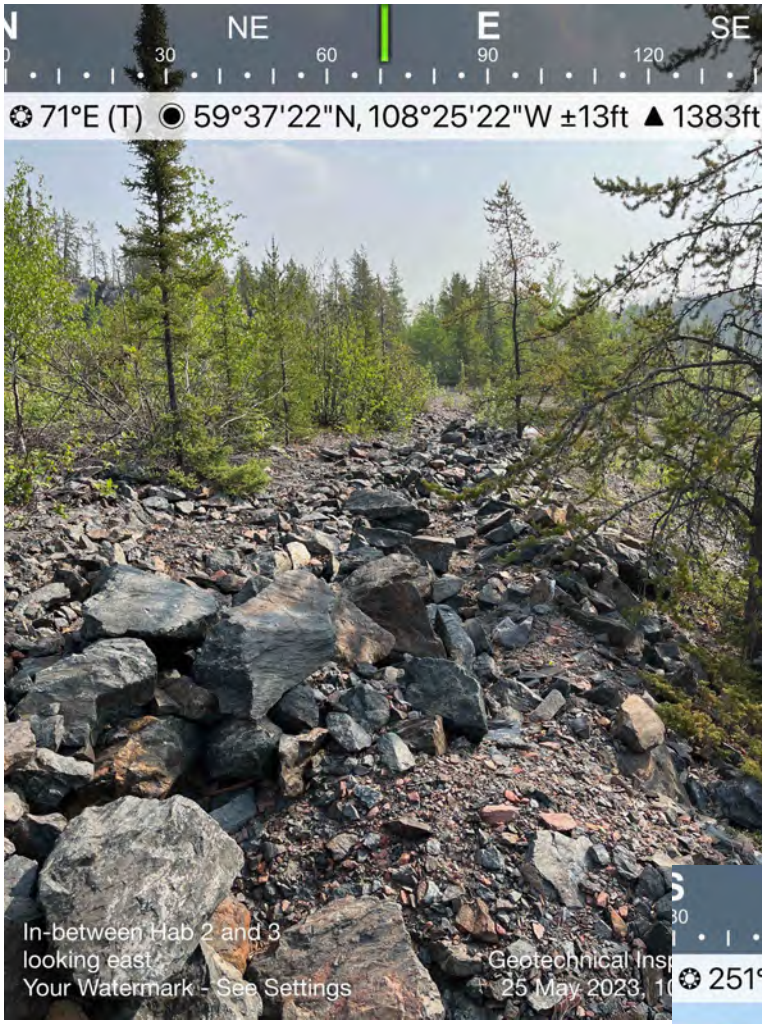



**Photo D10—HAB039-02 location (looking east)**

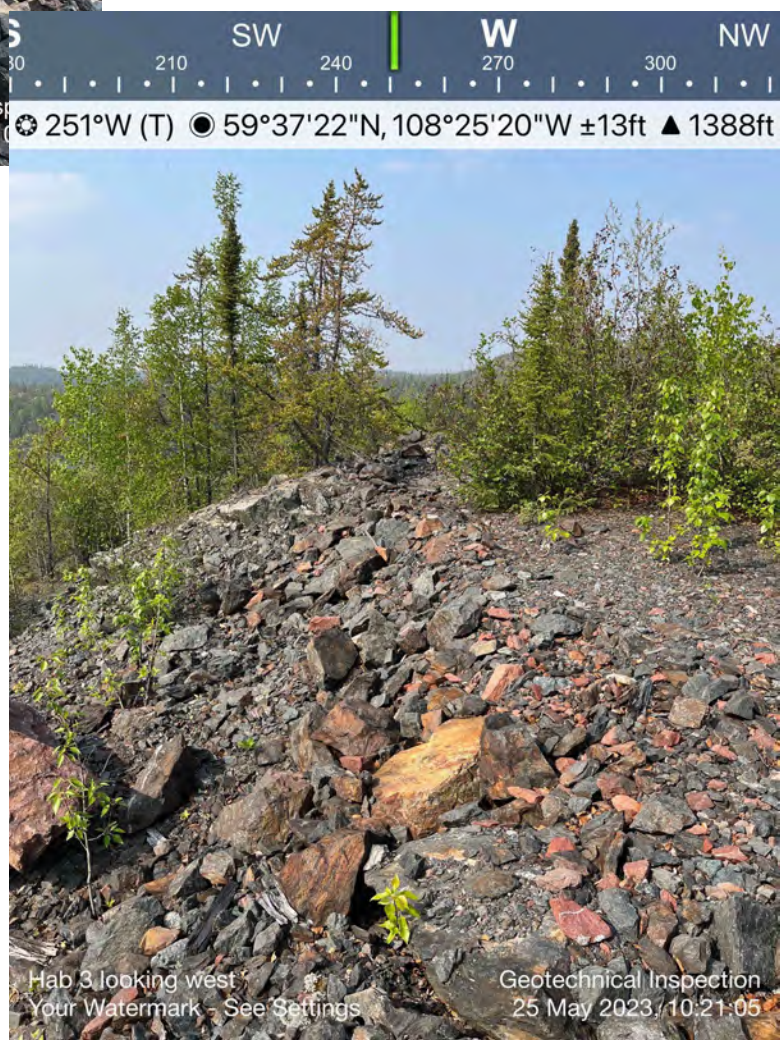



**Photo D11—HAB039-03 looking west**


**Photo D12—HAB039-04 looking west**

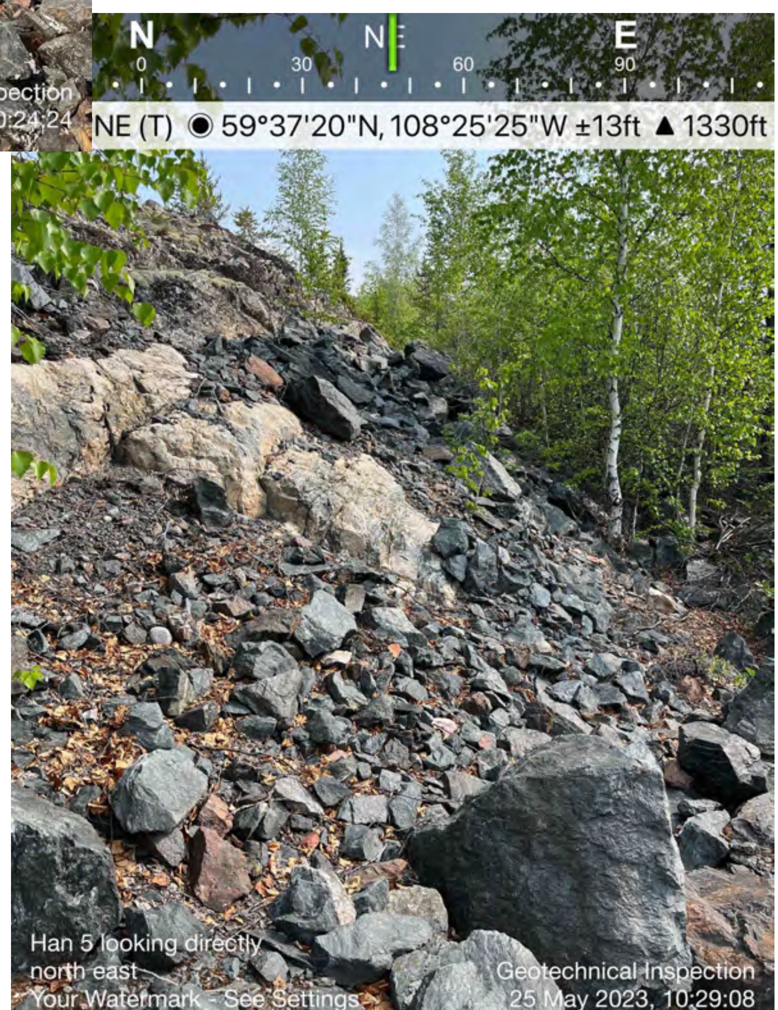



**Photo D13—HAB039-05 location (looking east)**

# Appendix E
# Zora Creek Reconstruction Photos

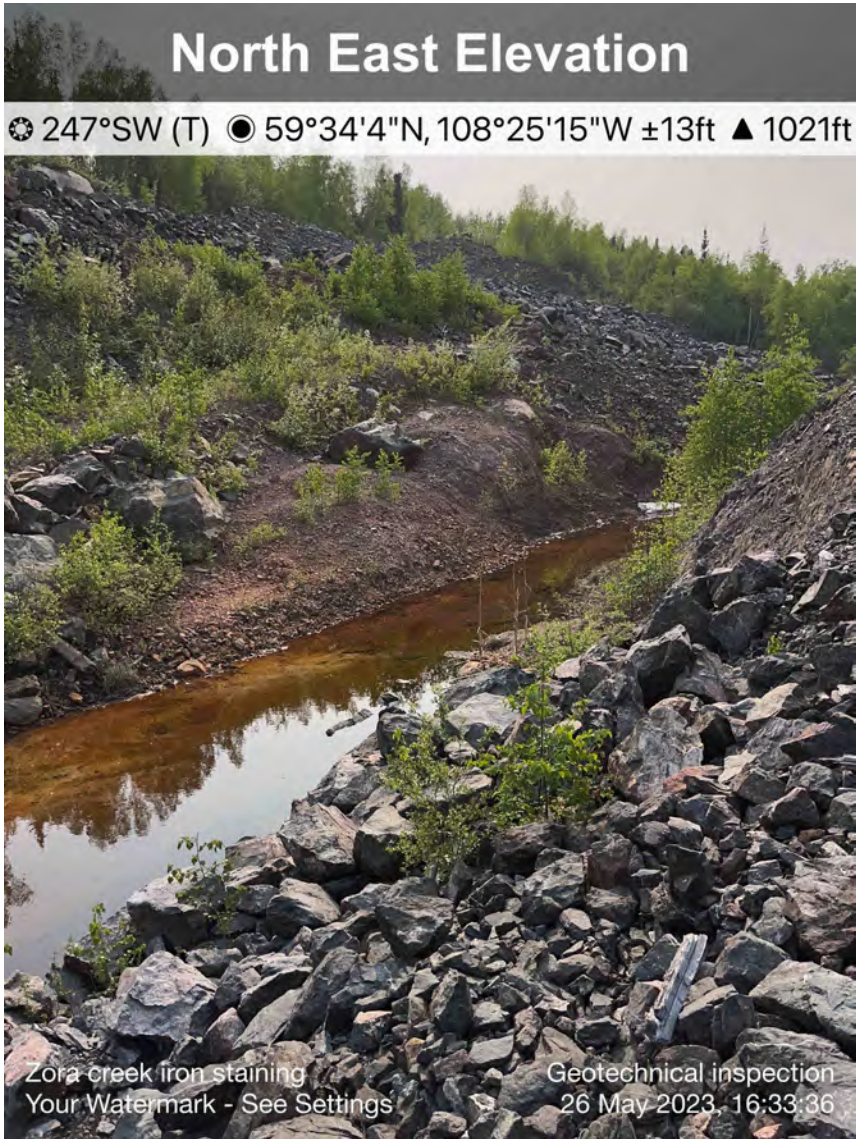



**Photo E01—View looking downstream towards Verna Lake (May 2023)**

**Photo E02—View from level crossing looking upstream towards Zora Lake (May 2023)**

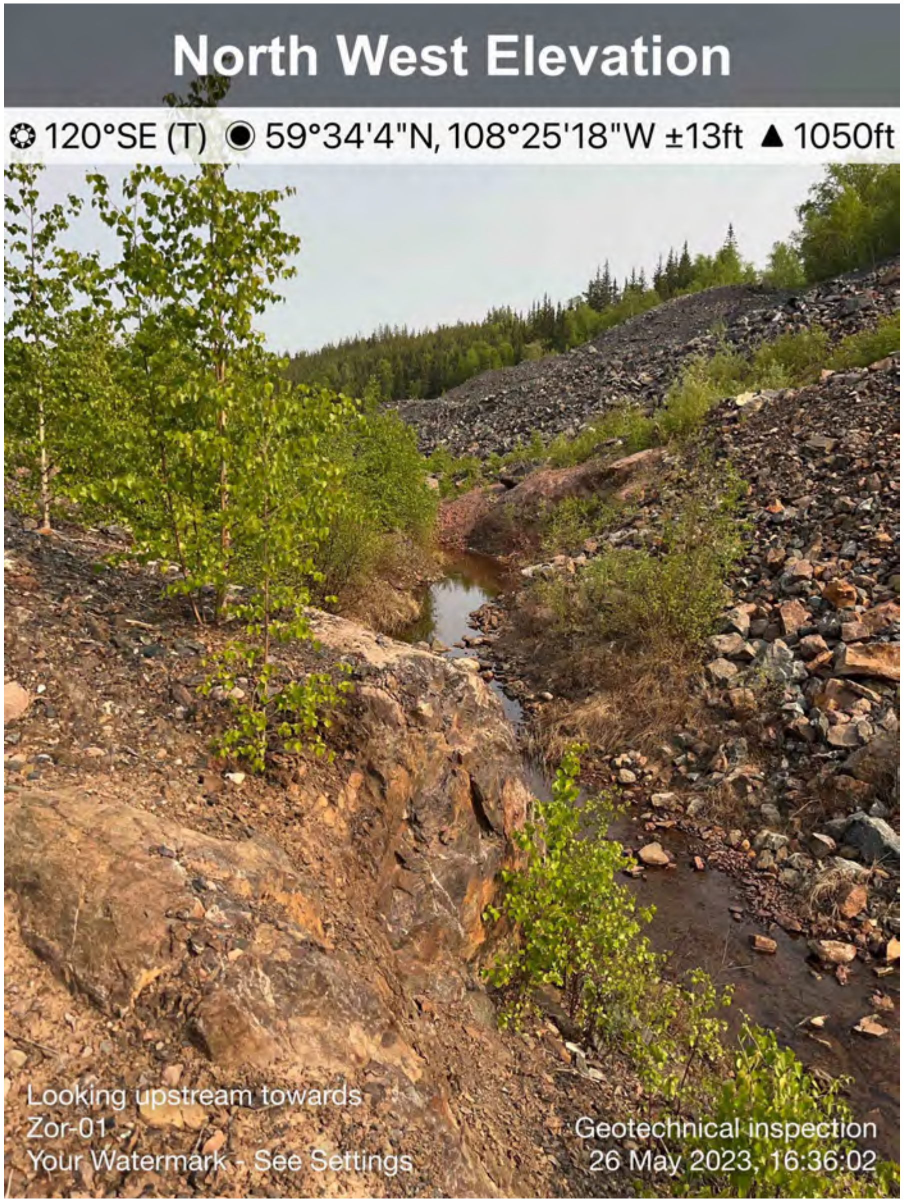



**Photo E03—View near stilling basin looking upstream (May 2023)**

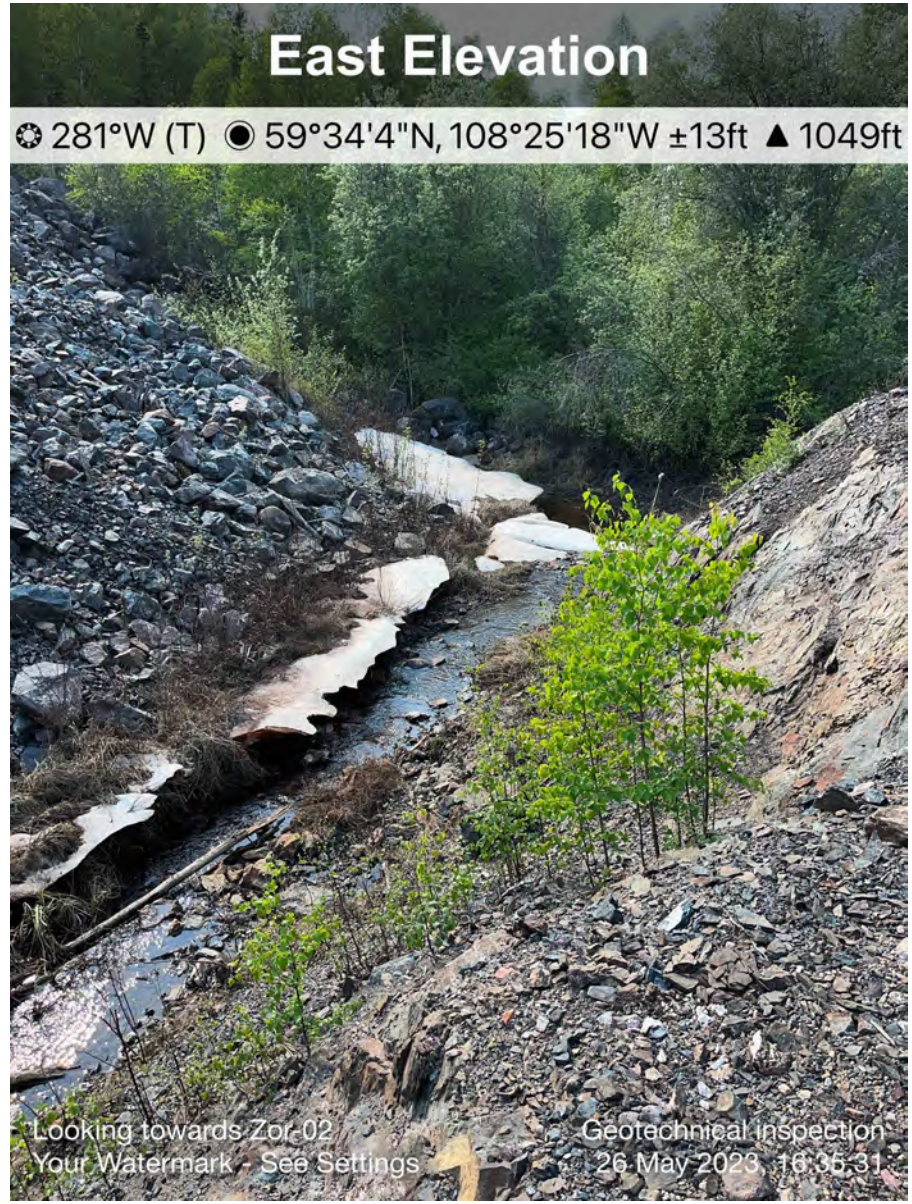



**Photo E04—View near stilling basin, looking downstream at stilling basin (May 2023). Note the glaciation remaining from the late spring**

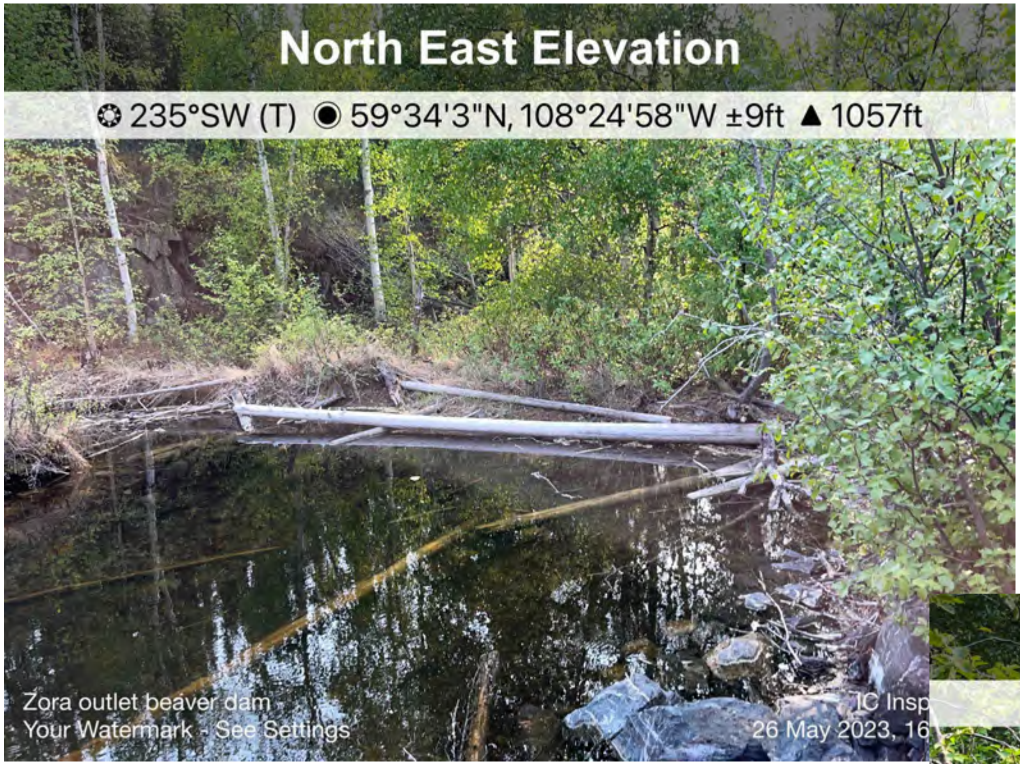



**Photo E05—View of well-established beaver dam at the outlet of Zora Lake, looking downstream (May 2023)**


**Photo E06—View near well-established beaver dam at outlet of Zora Lake, looking across Zora Creek looking south (May 2023)**


**Photo A1 – Marie Reservoir Spillway looking upstream (May 2023)**

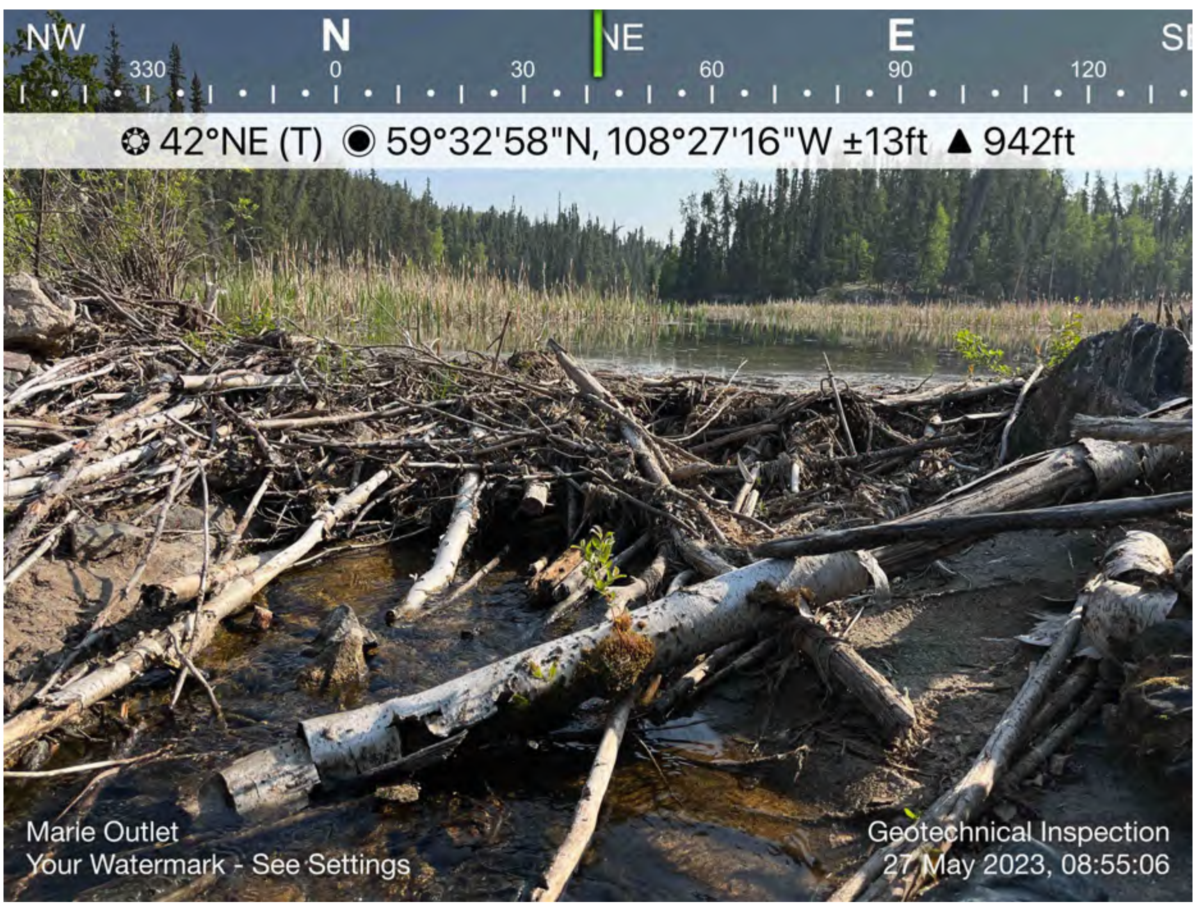



**Photo A2 - Marie Reservoir Spillway inlet; beaver dam first noted in 2018**

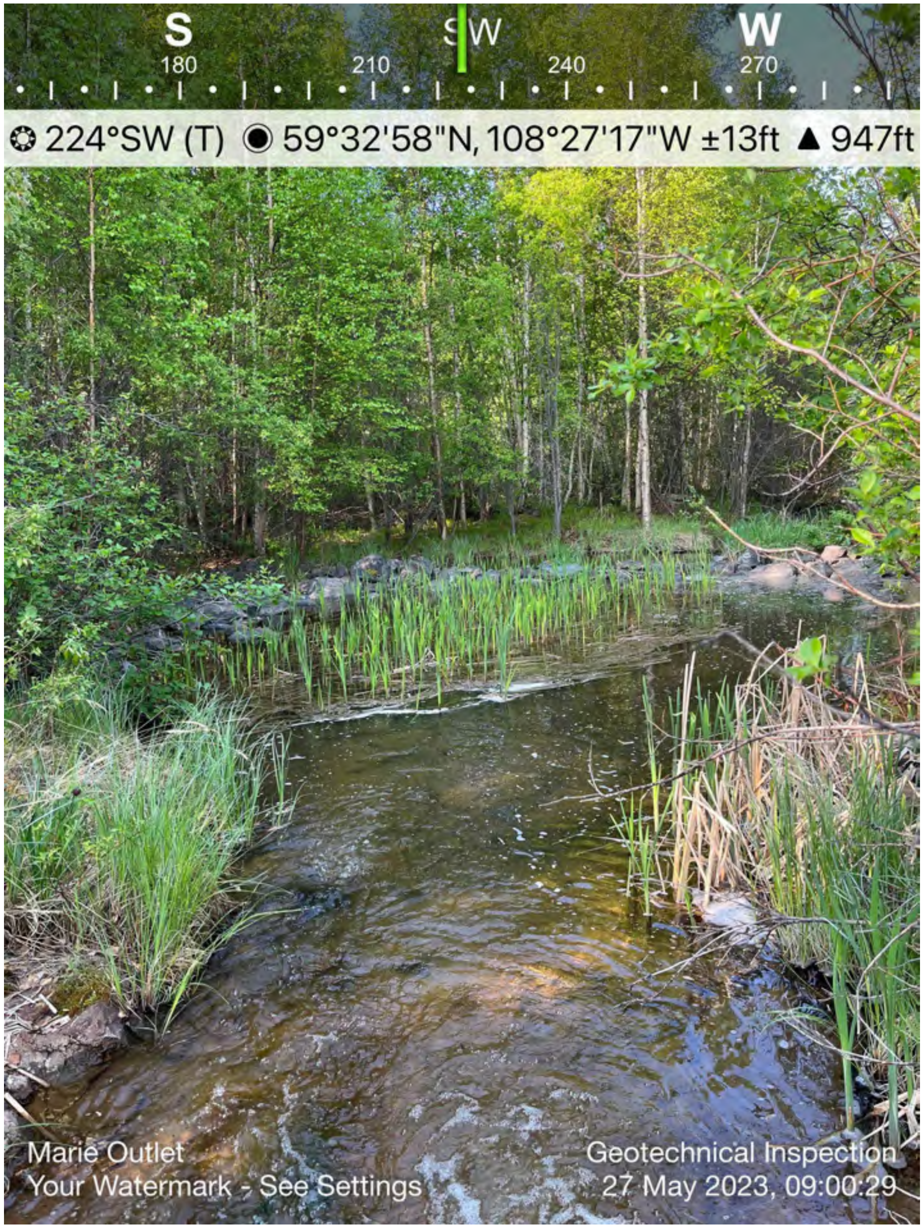



**Photo A3 – Marie Reservoir Spillway (water flowing into stilling basin) (May 2023)**


**Photo A4 – Marie Reservoir Spillway looking northeast (May 2023)**


**Photo B1 – Fookes Reservoir Spillway looking into Fookes Reservoir**

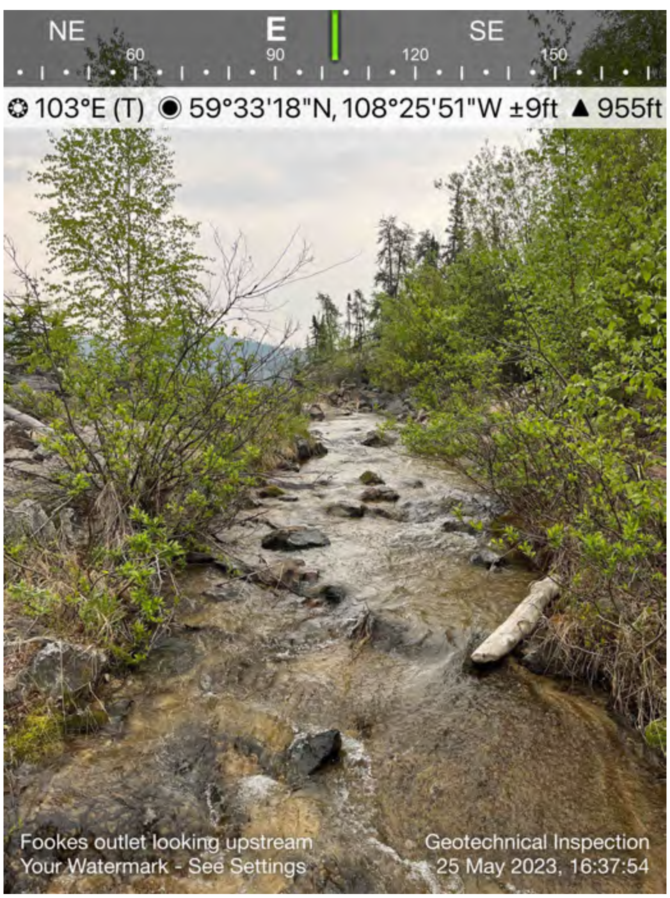



**Photo B2 – Fookes Reservoir Spillway looking upstream**

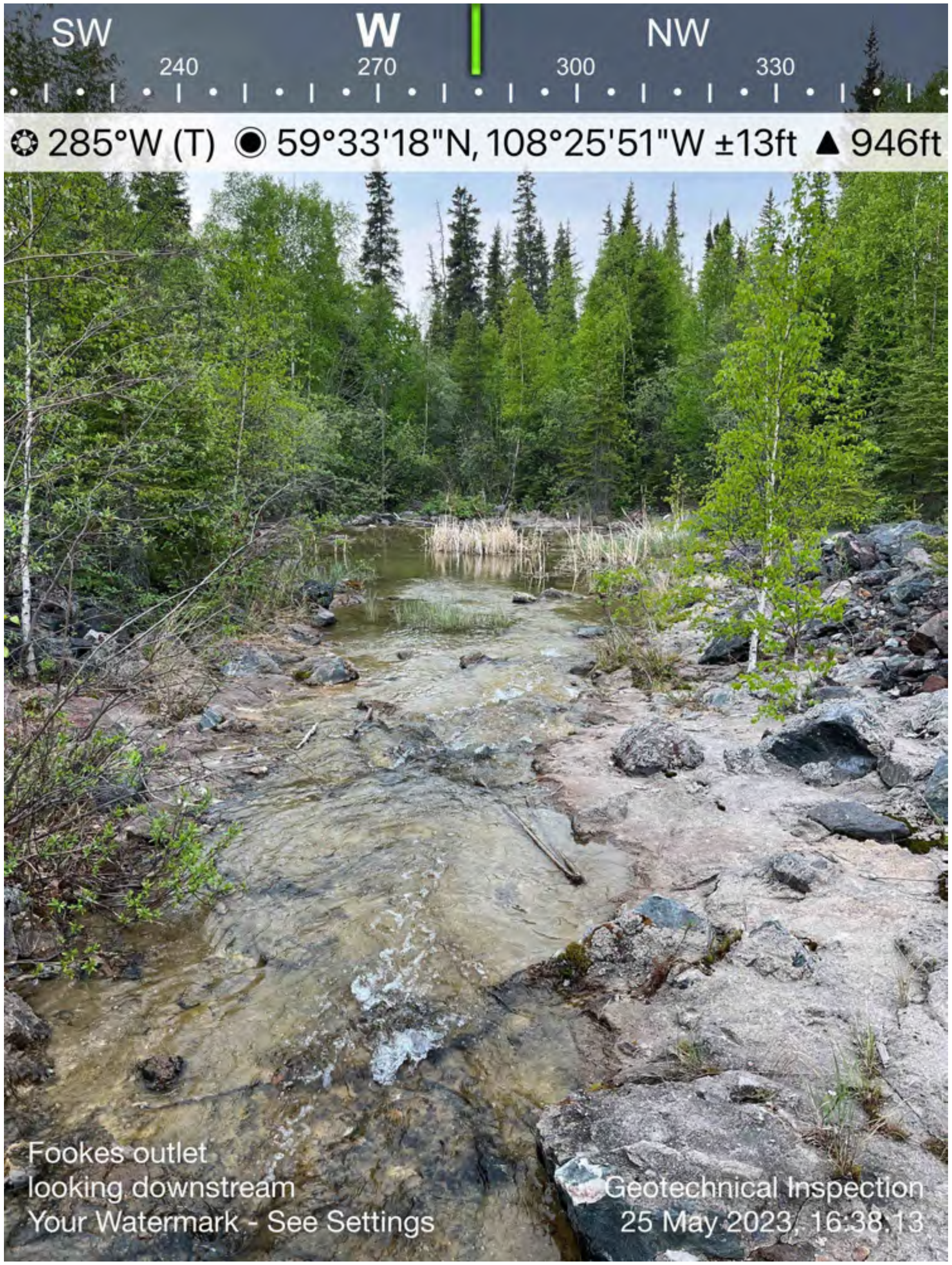



**Photo B3 – Fookes Reservoir Spillway looking downstream (mid channel)**


**Photo B4 – Fookes Reservoir Spillway stilling basin**

**Photo B5 – Fookes Reservoir Spillway showing broken rip-rap on north and south sides of channel. Note debris has been removed since 2022 inspection.**


**Photo C1 – Chevrons in place on north access point to the Fookes delta looking south (May 2023)**


**Photo C2 – no ponded water (May 2023). This area previously had ponded water on waste rock cover at bottom of hill near north access road during freshet in 2022.**

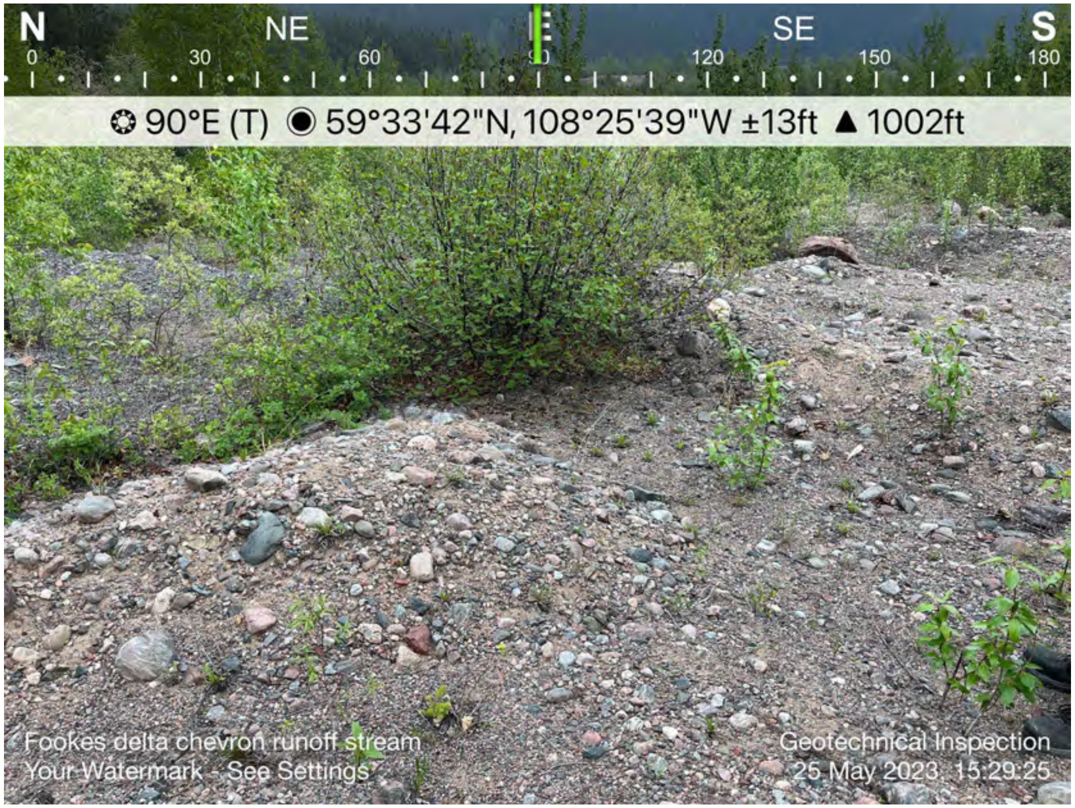



**Photo C3 – Chevron run-out structure along north access road**


**Photo C4 – Drainage collection area on edge of Fookes Tailings Delta approximately 100m from access point**

**Photo C5a-b – Panoramic views of the Fookes cover (Photos taken May 2023) vegetations is yet to leaf-out**

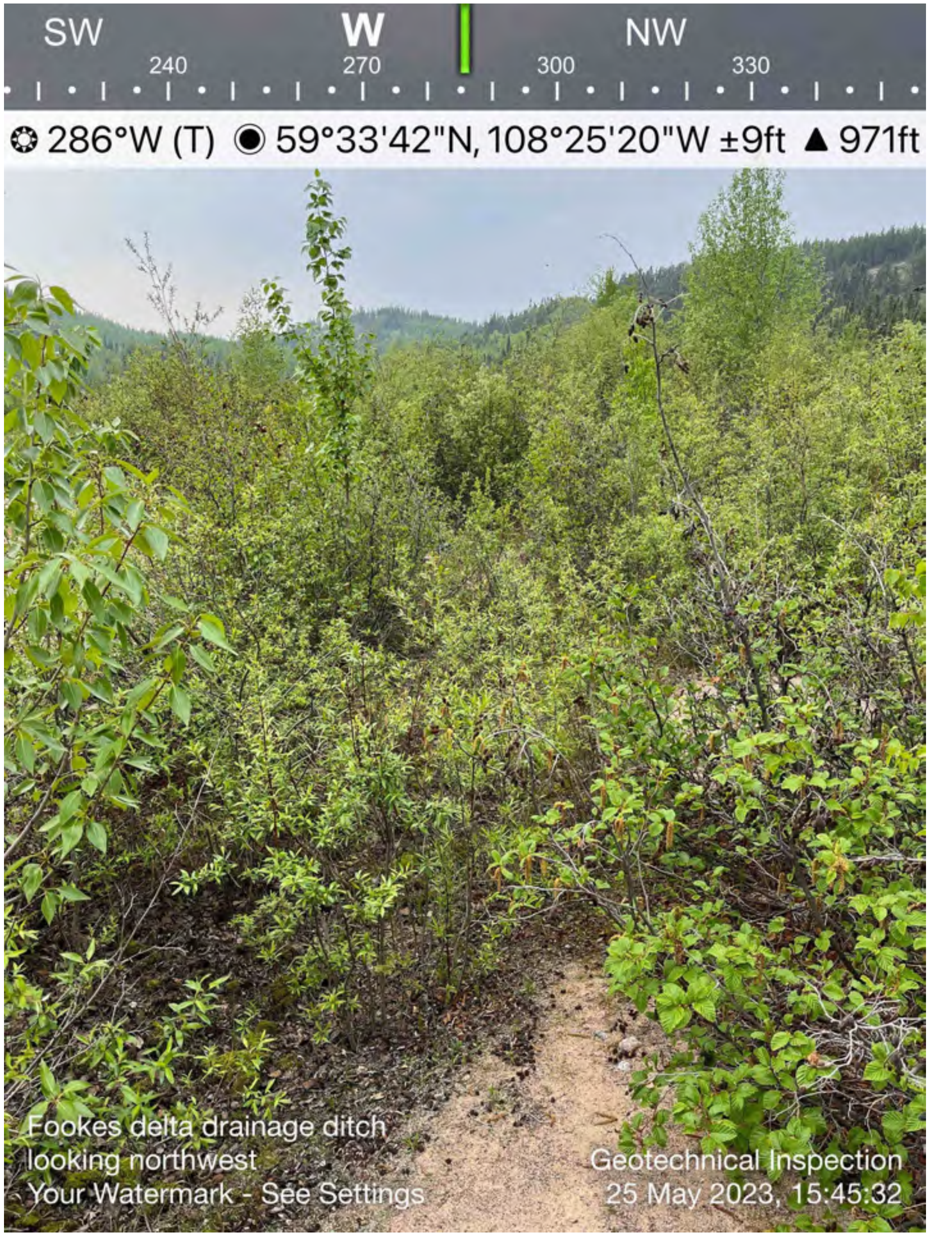



**Photo C6 – View of vegetation establishing along drainage channel (May 2023).**


**Photo C7 – View of east berm looking onto the delta. No evidence of traffic crossing the berm (May 2023).**

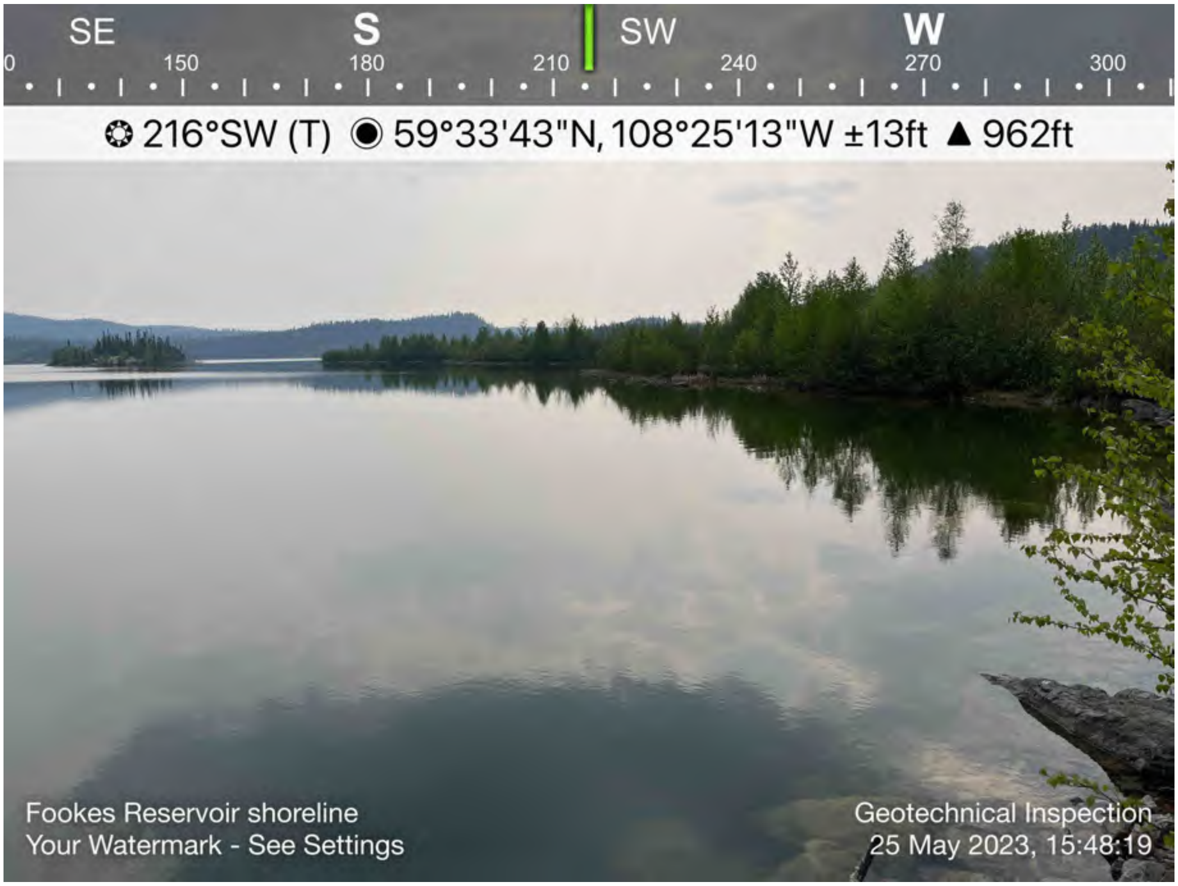



**Photo C8—Fookes Reservoir shoreline (looking west) Note vegetation along shoreline is well**

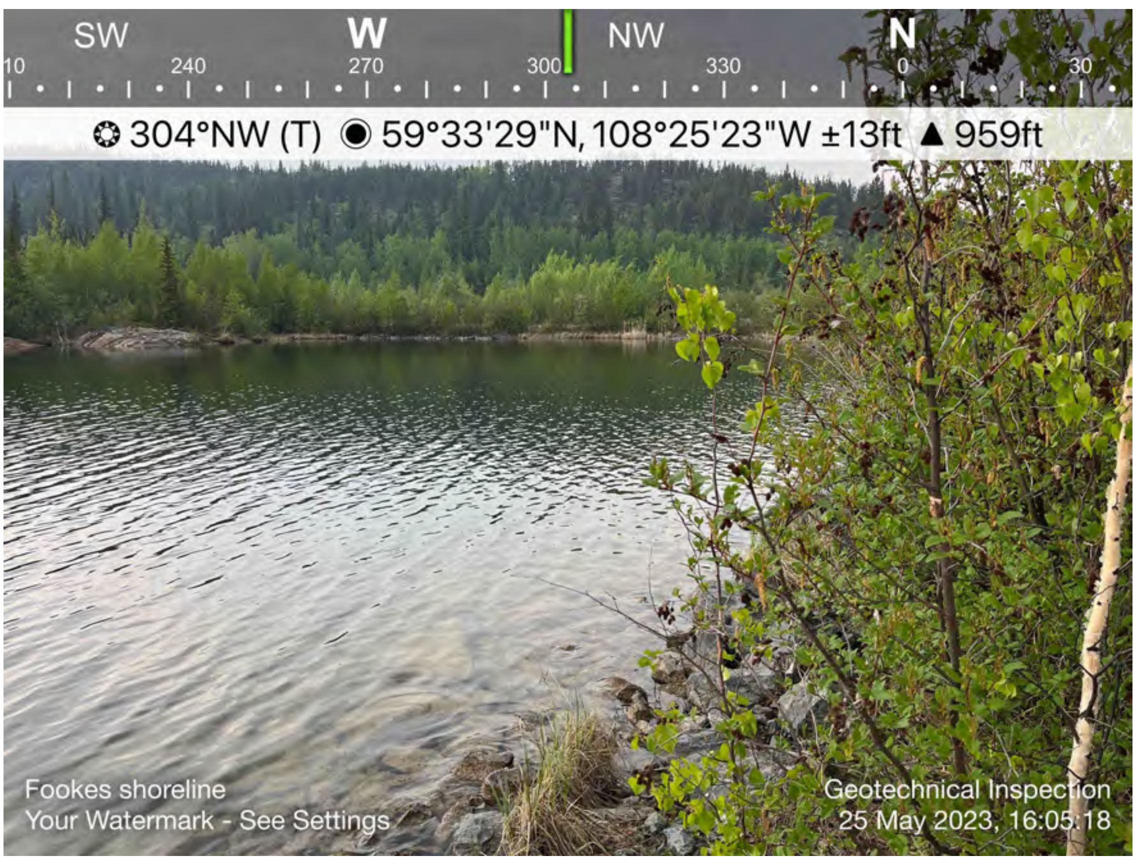



**Photo C9—Fookes Reservoir shoreline (looking west).**


**Photo D1 - View of the cover placed over Ace 201 Stope**


**Photo D2 - view of Ace 105 and 208 Stope cover**


**Photo D3—Dubyna CP-1 location (looking east)**

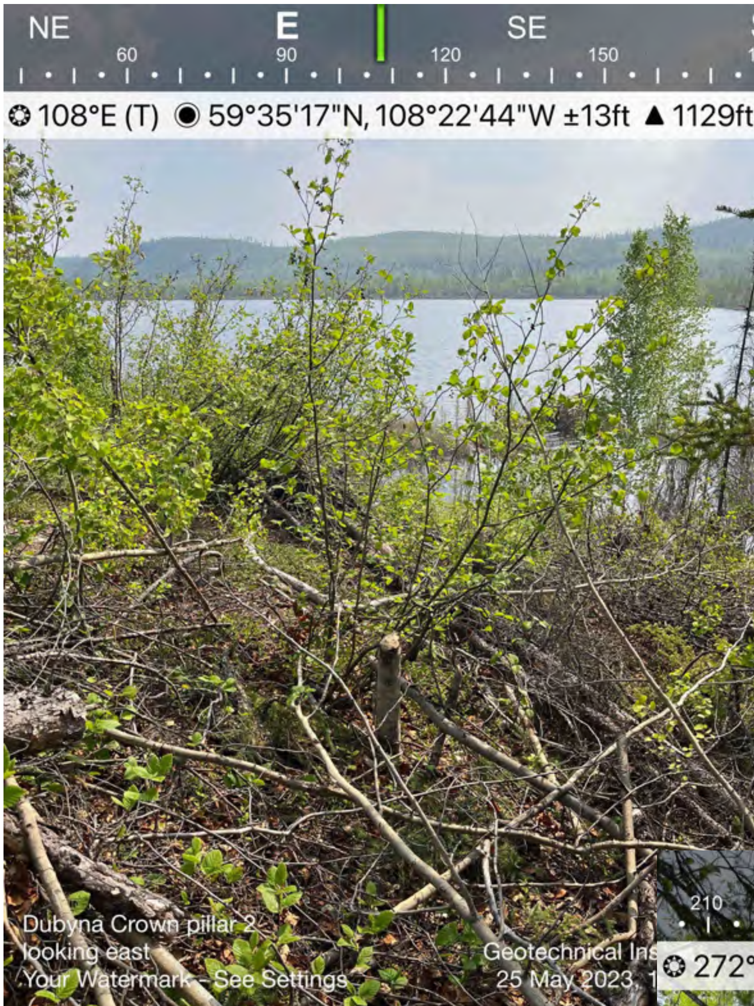



**Photo D4—Dubyna CP- 2 location (looking east)**


**Photo D5—Dubyna CP-2 location (looking west)**


**Photo D6—Dubyna CP– 3 location (looking west)**

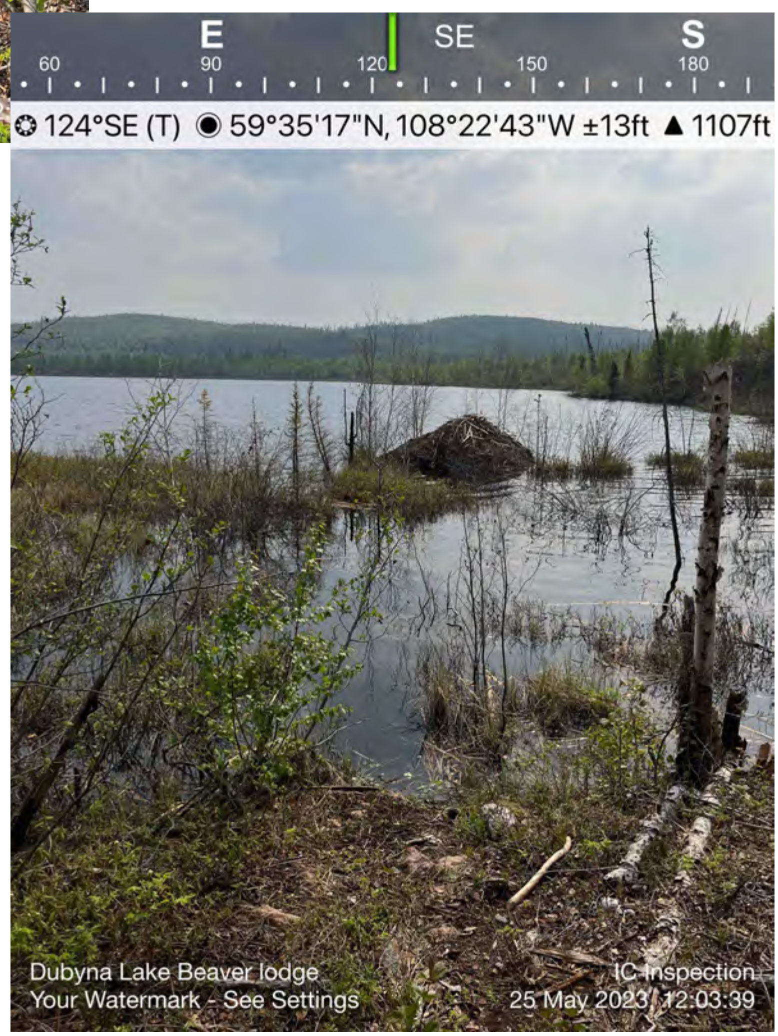



**Photo D7—Dubyna CP– 3 location (looking east to Dubyna Lake)**


**Photo D8—HAB039-01 location (looking northeast)**

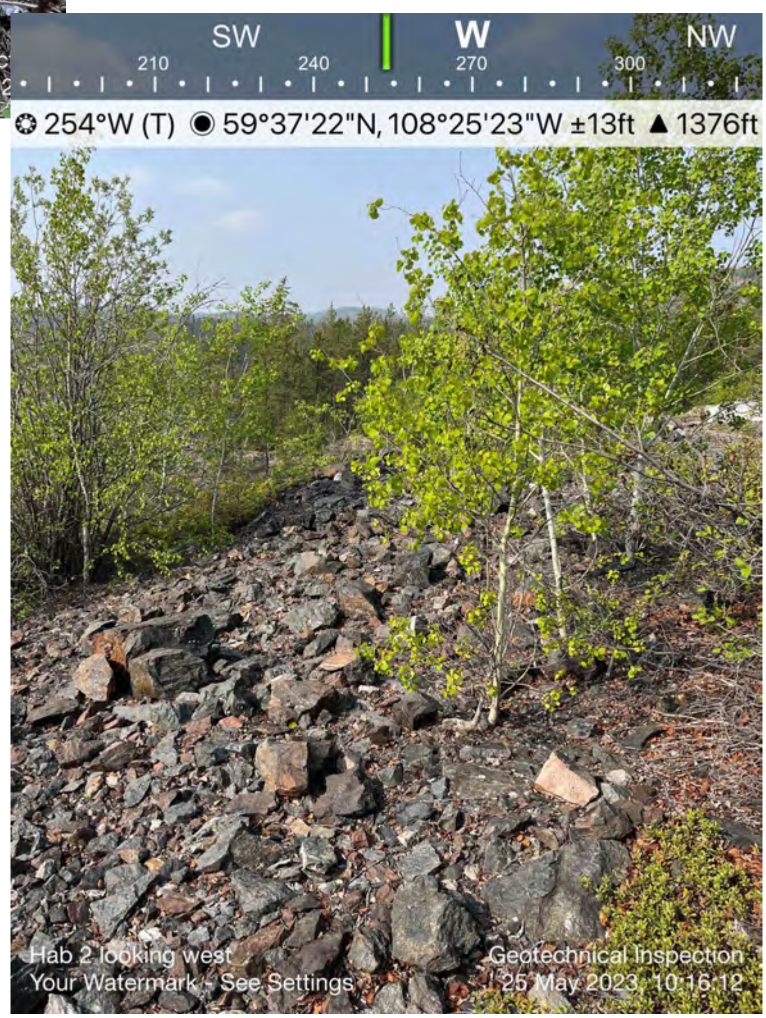



**Photo D9—HAB039-02 looking west**

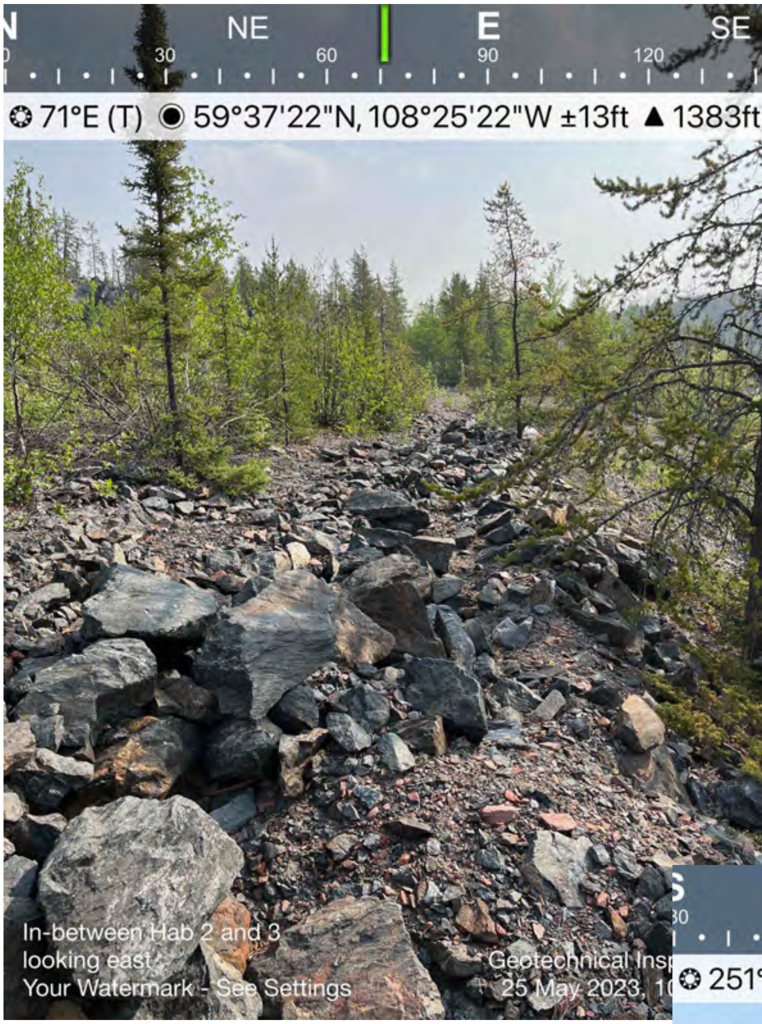



**Photo D10—HAB039-02 location (looking east)**

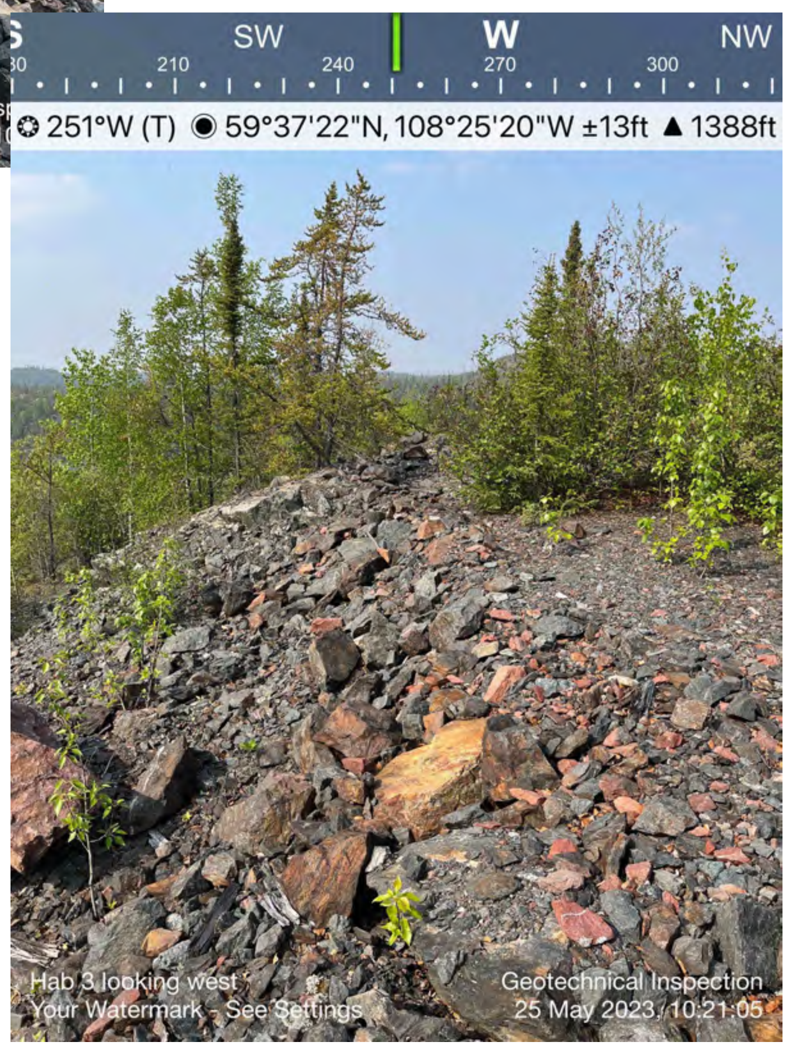



**Photo D11—HAB039-03 looking west**


**Photo D12—HAB039-04 looking west**

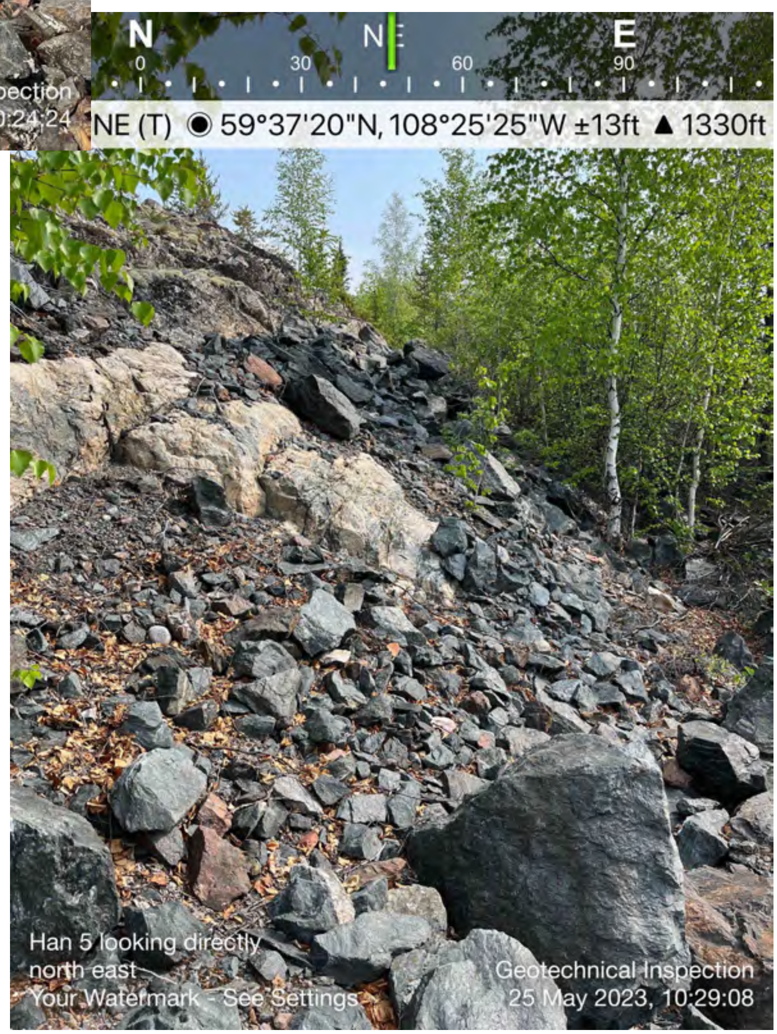



**Photo D13—HAB039-05 location (looking east)**

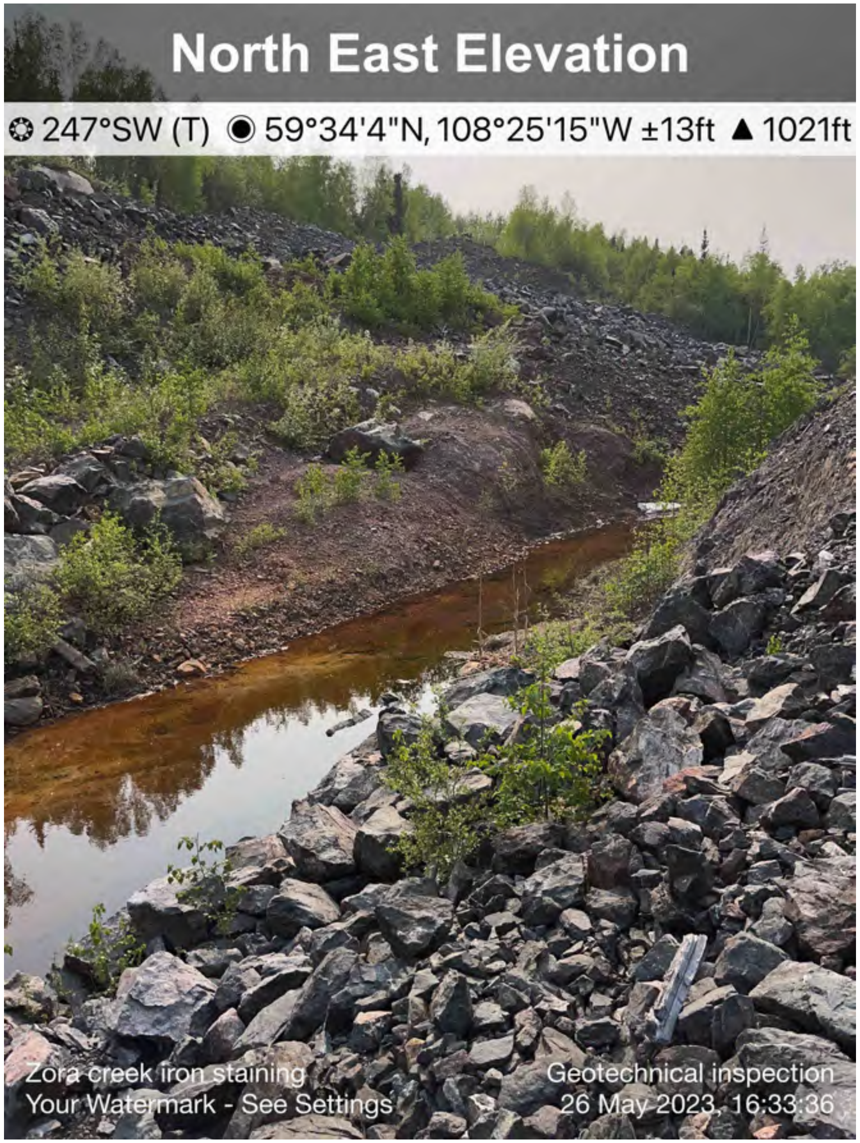



**Photo E01—View looking downstream towards Verna Lake (May 2023)**

**Photo E02—View from level crossing looking upstream towards Zora Lake (May 2023)**

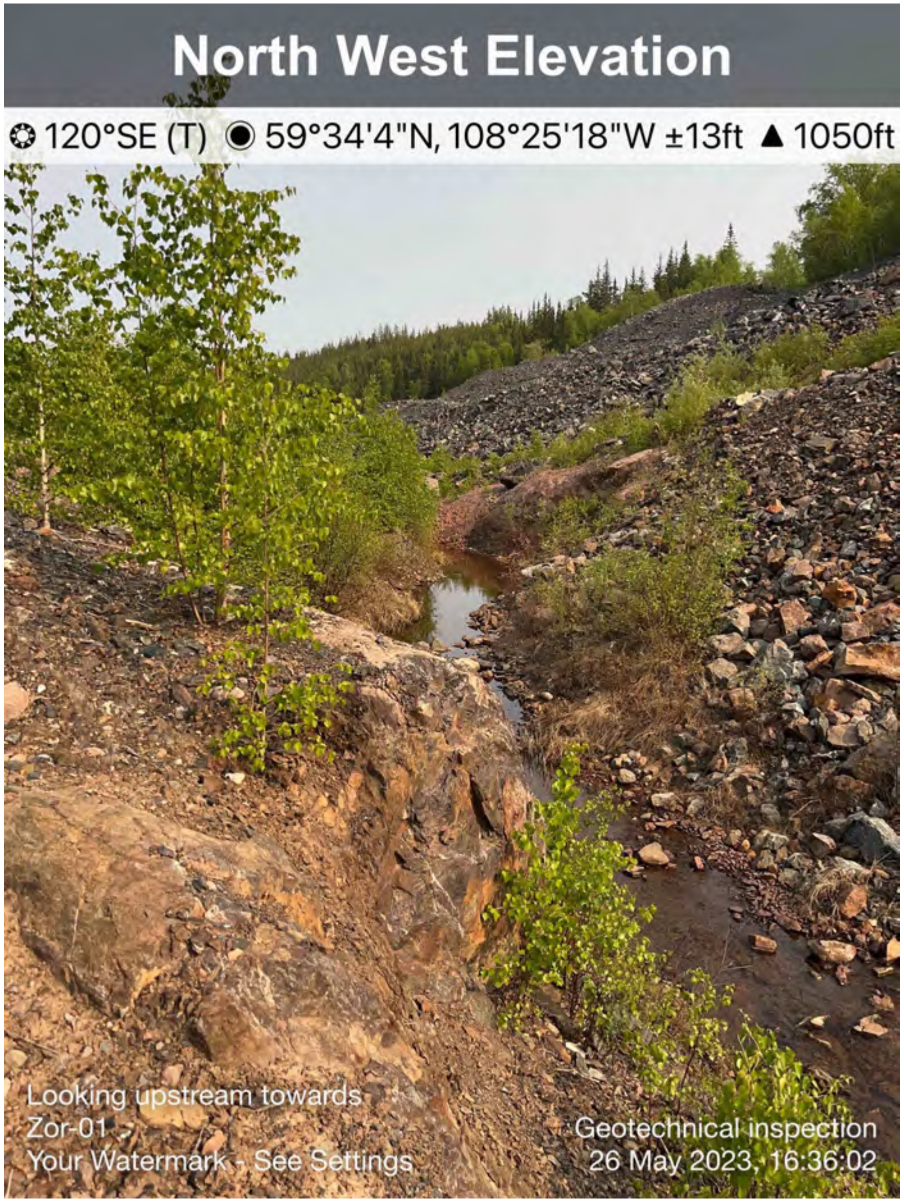



**Photo E03—View near stilling basin looking upstream (May 2023)**

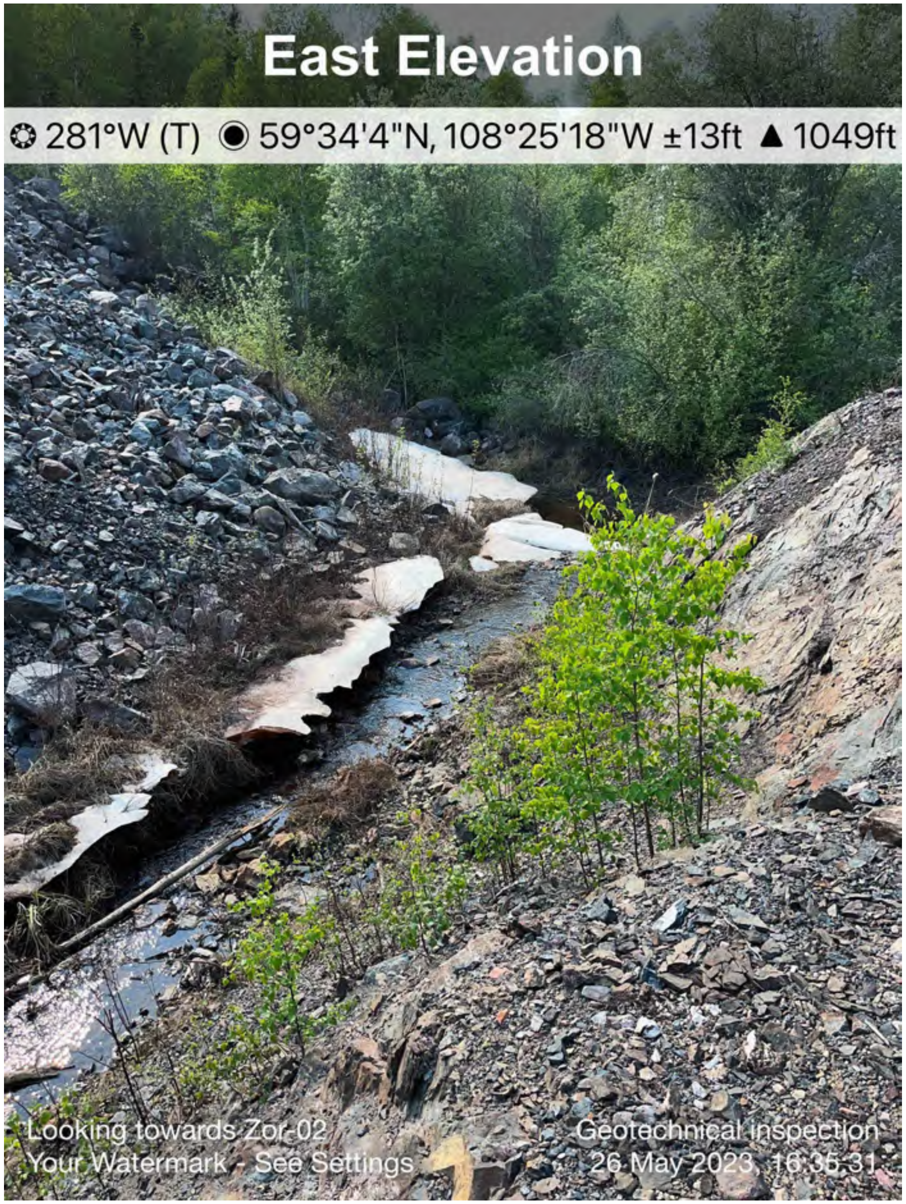



**Photo E04—View near stilling basin, looking downstream at stilling basin (May 2023). Note the glaciation remaining from the late spring**


**Photo E05—View of well-established beaver dam at the outlet of Zora Lake, looking downstream (May 2023)**


**Photo E06—View near well-established beaver dam at outlet of Zora Lake, looking across Zora Creek looking south (May 2023)**

# APPENDIX D: LONG-TERM PERIODIC CHECKLIST FOR STAINLESS STEEL COVERS

# Appendix C - Long-Term Periodic Inspection Checklist

This appendix contains the checklist for long-term periodic cover inspections that are to be executed following release of the Beaverlodge property to Institutional Control. Personnel executing long-term inspections are to utilize the inspection checklist and report all findings.

Table C1: Beaverlodge Permanent Stainless Steel Cover Inspection Checklist

Cover Name (on ID Tag):

GPS Location (on ID Tag):

GPS Location (Verified using Field Tools):

Sealed (Year, on ID Tag):

| Item Description: | Inspection Recommendation Notes: | Condition Notes: |
|---|---|---|
| 1) Surrounding vegetation | Visually examine the site and surrounding vegetation. Confirm vegetation roots are not tending to cause rock fractures or increase width of existing fractures in bedrock adjacent to the opening or near the anchor bolts. | |
| 2) Bedrock near the anchor bolts and adjacent to the opening | Review the final field review report photographs, and visually examine the existing rock for any changes to previously-photographed fractures (fracture widening, or relative translation or rotation of one side of the fracture with respect to the other), development of new fractures and material loss. | |
| 3) ID plate | Visually examine the ID plate. Confirm the data on the ID plate concurs with the data on the respective as-built drawing and final field review report. | |
| 4) Anchor bolts | Visually examine anchor bolt nuts for relative rotation with respect to the position shown in the final field review report photographs. Visually examine anchor bolts for changes in relative elevation between column baseplates and anchor bolt nuts with respect to those shown in the final field review report photographs. Apply torque of 20 ft-lb to each anchor bolt nut. Confirm the nut does not rotate with the torque applied. Visually examine for signs of corrosion on the anchor bolt nuts and threaded rods. | |
| 5) Columns and baseplates | Visually examine columns and baseplates for obvious mechanical damage including cracks, gouges, dents, and bends. Measure column plumbness with respect to the orientation shown on the respective as-built drawing set. Visually examine column welds for surface cracks. Measure corrosion by subtracting the originally specified material thickness from the thickness measured. Note any corrosion, and report any corrosion at or in excess of 1.0mm. | |
| 6) Skirts | Visually examine cover skirts for obvious mechanical damage including cracks, gouges, dents, and bends. Visually examine skirt welds for surface cracks. Measure skirt corrosion by subtracting the originally specified material thickness from the thickness measured. Note any corrosion, and report any corrosion at or in excess of 1.0mm. | |
| 7) Perimeter members | Visually examine cover perimeter members for obvious mechanical damage including cracks, gouges, dents, and bends. Visually examine perimeter member welds for surface cracks. Measure perimeter member corrosion by subtracting the originally specified material thickness from the thickness measured. Note any corrosion, and report any corrosion at or in excess of 1.0mm. | |
| 8) Top cover plate | Visually examine the cover's top plate for obvious mechanical damage including cracks, gouges, dents, and bends. Measure top plate member corrosion by subtracting the originally specified material thickness from the thickness measured. Note any corrosion, and report any corrosion at or in excess of 1.0mm. | |
| 9) Interior stiffeners | Visually examine interior stiffeners with the use of an inspection camera inserted through a perimeter member inspection hole. Look for signs of obvious mechanical damage including cracks, gouges, dents, and bends. Mechanical damage will be unlikely to occur without visual signs of mechanical damage on the exterior. | |
| 10)Interior surfaces | Visually examine interior surfaces with the use of an inspection camera inserted through a perimeter member inspection hole. Examine surfaces for signs of discoloration, iron oxide, and other signs of corrosion. | |
| 11) Exterior surfaces | Visually examine exterior surfaces for signs of discoloration, iron oxide, and other signs of corrosion. | |

Table C2: Recommended Tools, Equipment and Documents for Inspections

| **Tool/Equipment/Document** | **Used for** |
|---|---|
| As-built drawing set for cover | Comparison to inspected condition |
| Final field review report | Comparison to inspected condition |
| Small shovel with 316 stainless steel metal components | Potentially excavating soil and other debris from the cover and surrounding bedrock |
| GPS locating device | Safety and confirming location coordinates match with coordinates on drawings, field inspection report and cover ID plate |
| Digital camera | Documenting condition for inspection report |
| Plumb bob or level | Measuring plumbness of columns |
| Measuring tape | Measuring thickness and relative position of cover components |
| Calipers | Measuring thickness of cover components and calibrating ultrasonic thickness measuring device |
| Ultrasonic thickness measuring device | Measuring thickness of cover components |
| Inspection camera (maximum head diameter of 25mm) | Visual examination of interior components and surfaces |
| Safety and personal protective equipment | As required for field conditions |

# APPENDIX E: BVL AS-BUILT PACKAGE

# Decommissioned Beaverlodge Properties

## As-Builts for Mine Openings Sealed After 2000

Compiled by Cameco Corporation
April 2022

# 2000 Cover Installation

**MRTN 2 - Adit (MRTN)**

**MRTN 2 - Adit (MRTN)**

As-Built Construction Report
Martin Lake Adit
Uranium City, Saskatchewan

Cameco Corporation

S1232.1 28 June 2001

Prepared by:

Clifton Associates Ltd.
a partner in the
Pihkan Askiy/Nih-Soreldhen (PANS)
Joint Venture

Clifton Associates Ltd. engineering science technology

# PANS JV

• Environmental • Engineering • Constructors

28 June 2001
CAL: S1232.1

Cameco Corporation
2121 – 11th Street West
Saskatoon, Saskatchewan
S7M 1J3

Attn: Mr. Bob Phillips
Manager, Environmental Protection

Dear Bob:

Re: As – Built Construction Report, Martin Lake Adit

We are pleased to present our report regarding the rehabilitation work conducted at the Martin Lake adit.

Thank you for the opportunity to be of service to you and Cameco Corporation.

Yours truly,

PANS JV

Ron G. Barsi, P.Geo.
President
RGB/rb

Distribution: Cameco – 3 copies
PANS – 1 copy
Clifton Associates Ltd. – 2 copies

Box 1889 La Ronge, Saskatchewan S0J 1L0 •**Tel**: (306) 425-5825 • **Fax:** (306) 425-5777
**Saskatoon**: 720 – 45th Street West, Saskatoon SK. S7K 0V4 • **Tel**: (306) 651-3400 • **Fax**: (306) 651-3500

## Table of Contents                    Page No.

# 1.0 Introduction

Cameco Corporation engaged the service of PANS to supervise, construct and provide quality assurance quality control (QA/QC) for the sealing of the Fish Hook Bay Adit. The design detail of the sealing of the adit was provided to PANS (Cameco Corporation submission for regulatory approval dated 03 September 1999). Notification to proceed with this work, was given via Purchase Order on 04 May 2000.

This report presents a summary of the construction details for the Fish Hook Bay Adit project.

# 2.0 Project Management

## 2.1 PANS Project Management Structure and Responsibilities

PANS is a joint venture between Keewatin/Procon, Clifton Associates Ltd. Athabasca Economic Development and Training Corporation and CanNorth. On all projects, PANS assigns a lead partner who is responsible for the overall project. Other partners may provide services as required under the direction of the lead partner. The Fish Hook Bay adit sealing project required services from two of the four partners to complete the work.

Keewatin/Procon, as lead partner, was responsible for the overall project. This included accessing all available equipment, labour, safety, cost control, daily reporting and communication with Cameco Corporation and the overall execution of the work. Athabasca Economic Development Corporation was responsible for acquiring northern labour and equipment at the request of the lead partner, Keewatin/Procon.

## 2.2 Project Personnel

Several key personnel were involved in the project. Mr. Jon Braaten, as general manager PANS, was responsible for the overall project, including communication between the partners within PANS as well as with Cameco Corporation. Mr. Dan Derby of Keewatin/Procon was the on site construction supervisor responsible for all aspects of the project. Mr. Dean Klassen, Athabasca Economic Development Corporation was responsible for the acquisition of northern labour and equipment.

## 3.0 Construction Activity

### 3.1 Construction Methodology and Schedule

Construction was performed 23 August to 25 August 2000. The Martins Lake Adit work sequence consisted of the following:

- Tour and mobilize gear to site, scale portal and area above, cut out old screen fence 23 August 2000.
- Move rail into Martin Bay portal, drill, weld, begin closure and begin demobilization 24 August 2000.
- Complete demobilization 25 August 2000

Photographs 1 to 4, appended to this report, document the sequence of construction events.

### 3.2 Contractor Equipment and Hours

The following is a list of equipment utilized to complete the project.

On-site equipment was:

Uranium City Contracting

- Truck
- Boat and trailer
- Water truck
- Torches
- Torch cart
- Chop saw
- Wheelbarrow

Keewatin/Procon

- Genset welder
- Miscellaneous hand tools (skill saws, hammer drills, shovels, levels, etc.)
- Safety equipment (harnesses, glasses, etc.)
- ¾″ electric impact
- 100′ weld lead
- Gas plugger
- 2′, 4′, 6′, drill steel
- Chipping, sledge hammer

The equipment and corresponding equipment hours are presented in Table 3.1.

**Table 3.1**
**Martins Lake Adit**
**Equipment Hours**

| | | |
|---|---|---|
| 23 August 2000<br>Truck<br>Boat<br>Torches | 12 | Tour site with Mr. Bob Phillips, mobilize gear to site, scale portal and area above, cut our old screen fence, remove existing barrier, haul scrap rail inside adit. |
| 24 August 2000<br>Truck<br>Boat<br>Hand tools<br>Genset<br>Chop saw<br>Oxy-Acy torches | 12 | Fuel up at U/C bulk fuel, transport gen set to site, finish moving rail into portal, drill and install rebar with epoxy, cut and weld frame work and welded track rails onto frame, completed closure and moved material back to Uranium city. |
| 25 August 2000<br>Pluggers<br>Truck<br>Boat | 12 | Finish demobilize from Martin Lake Adit. |

Schedule of materials used is presented in Table 3.2.

**Table 3.2**
**Schedule of Materials Used**

| |
|---|
| 10 # rails |
| Rebar wire |
| Weld rod (2 boxes) |
| Chop saw blades |
| Nails |
| Fuel |
| 2-10′x4″ plates steel |
| Weld gloves |
| Leather gloves |
| Safety (dust masks, ear plugs) |

## 3.3 Martin Lake As-Built

The approved plan (see Page 1, Lines 3 and 4) called for 0.5 inch rebar (12.7 mm). It was decided to use 10 # rail that was located on the waste rock, outside of the adit instead of the rebar. The rail made a heavier more robust bulkhead; in addition the rebar did not have to be hauled to the remote site. The extra rail as well as other materials were picked up and placed in the adit.

## 3.4 Quality Assurance Quality Control and Safety

Overall quality assurance quality control was ensured by the supervision of the construction supervisor on the project. Detailed field notes were kept throughout the project. The project was completed in accordance with PANS safety procedures. A copy of the safety manual was provided to Cameco Corporation prior to initiation of the work.

Clifton Associates Ltd.
engineering science technology

Photographs

Photograph 1: View of the initial fencing that was removed and replaced with bolted and welded structure.

Photograph 2: Rock bolting and welding on the sides of the structure.

Photograph 3: Debris removed approximately 2 ft. to rock and backfilled on completion at bottom end.

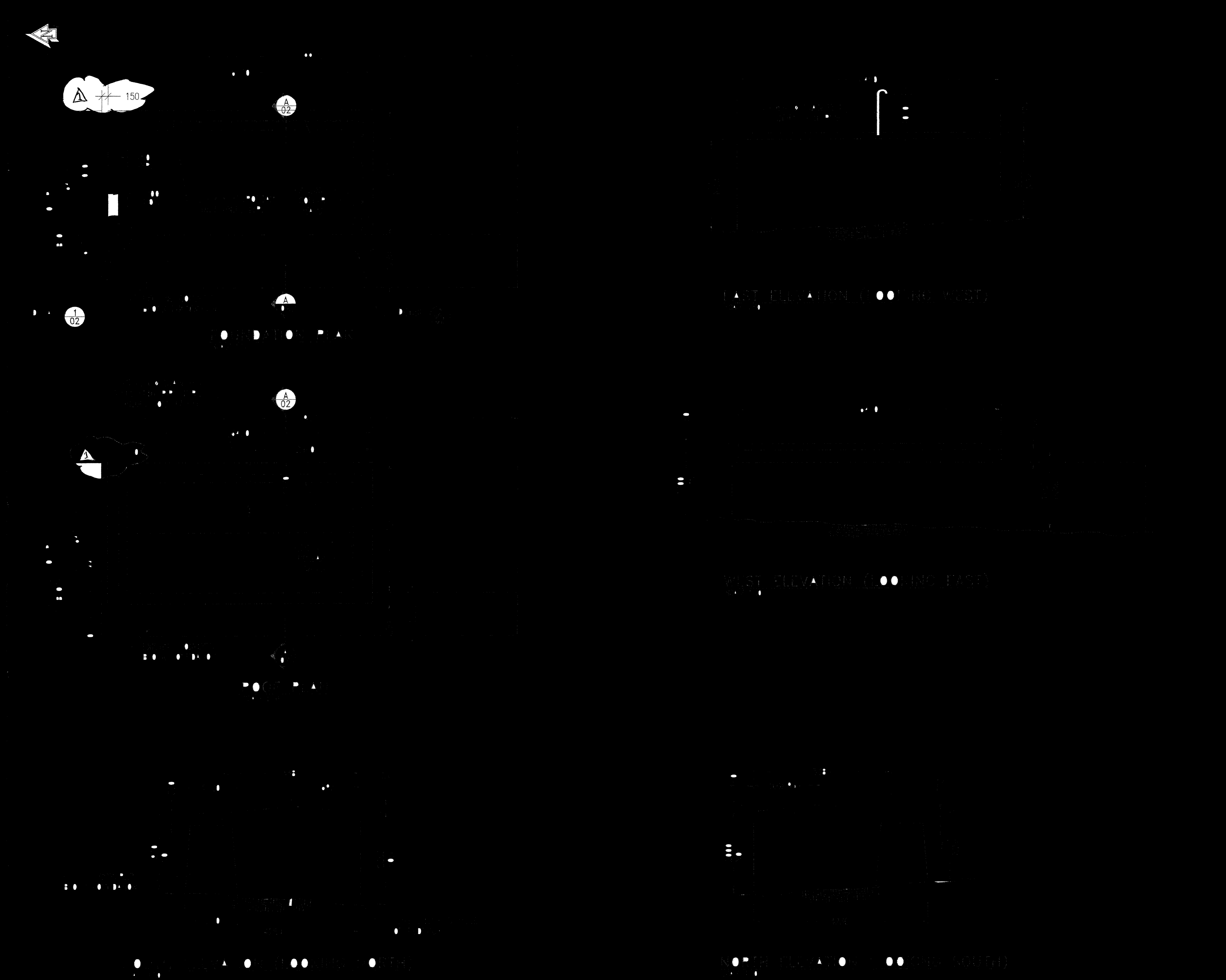
Photograph 4: Structure rock bolted and welded in place.

Photograph 5: View of welds at all cross members.

# 2001 Cover Installation

EAGLE 1 - Shaft

EAGLE 1 - Shaft




ASSOCIATION OF PROFESSIONAL ENGINEERS
& GEOSCIENTISTS OF SASKATCHEWAN
CERTIFICATE OF AUTHORIZATION
HEISLER ENGINEERING LTD.
NUMBER C943
PERMISSION TO CONSULT HELD BY:

| DISCIPLINE | SASK. REG. No. | SIGNATURE |
|---|---|---|
| Structural | 4738 | |

PROFESSIONAL ENGINEER
T.L.HEISLER
SASKATOON
Oct 19/2006
SASKATCHEWAN

Cameco
CORPORATION

| | | |
|---|---|---|
| SCALE: | AS SHOWN | DATE |
| DESIGNED: | LAD | 01-JUN-06 |
| DRAWN: | LAD | 02-JUN-06 |
| CHECKED: | TLH | 22-JUN-06 |
| APPROVED: | | |
| APPROVED: | | |

AREA

TITLE
SHAFT COVER
REINFORCED CONCRETE
PLANS, ELEVATIONS AND GENERAL NOTES

PROJECT No.
FIG. No.
DRAWING No. MIS-2006-RC01
REV 1

| REFERENCE |
|---|
| DWG No. |

| REFERENCE |
|---|
| DWG No. |

| REVISIONS | | | | |
|---|---|---|---|---|
| | DATE | BY | CHK | AP |
| | | LD | | |
| | | LD | | |
| | | LD | | |



| | | | |
|---|---|---|---|
| Cameco CORPORATION | | LOCATION | EAGLE MINE SHAFT |
| | | AREA | |
| SCALE: AS SHOWN | DATE | TITLE | SHAFT COVER REINFORCED CONCRETE SECTIONS AND DETAILS |
| DESIGNED: LAD | 01-JUN-0 | | |
| DRAWN: LAD | 08-JUN-0 | | |
| CHECKED: | 22-Jun-0 | PROJECT No. | FIG. No. |
| APPROVED: | | | |
| APPROVED: | | DRAWING No. MIS-2006-RC02 | REV 0 |

REFERENCE

ASSOCIATION OF PROFESSIONAL ENGINEERS
& GEOSCIENTISTS OF SASKATCHEWAN
CERTIFICATE OF AUTHORIZATION
HEISLER ENGINEERING LTD.
NUMBER C943
PERMISSION TO CONSULT HELD BY:

| DISCIPLINE | SASK. REG. No. | SIGNATURE |
|---|---|---|
| Structural | 4738 | [signature] |

PROFESSIONAL ENGINEER
T.L. HEISLER
SASKATOON
Oct 19/2000
SASKATCHEWAN

Cameco
CORPORATION

LOCATION: EAGLE MINE SHAFT

AREA:

TITLE: SHAFT COVER
REINFORCED CONCRETE
SECTIONS AND DETAILS

| SCALE: AS SHOWN | DATE |
|---|---|
| DESIGNED: LAD | 01-JUN-00 |
| DRAWN: LAD | 08-JUN-00 |
| CHECKED: TLH | 22-JUN-00 |
| APPROVED: | |
| APPROVED: | |

PROJECT No.
FIG. No.
DRAWING No. MIS-2006-RC02 REV 1

| No. | DATE | DESCRIPTION | BY | CHK |
|---|---|---|---|---|
| 1 | 19/10/00 | [illegible] | TH | TH |
| 0 | 22/06/00 | [illegible] | LD | TH |
| B | 15/06/00 | [illegible] | LD | TH |
| A | 07/06/00 | [illegible] | LD | TH |

| REFERENCE DWG No. | DESCRIPTION |
|---|---|
| | |

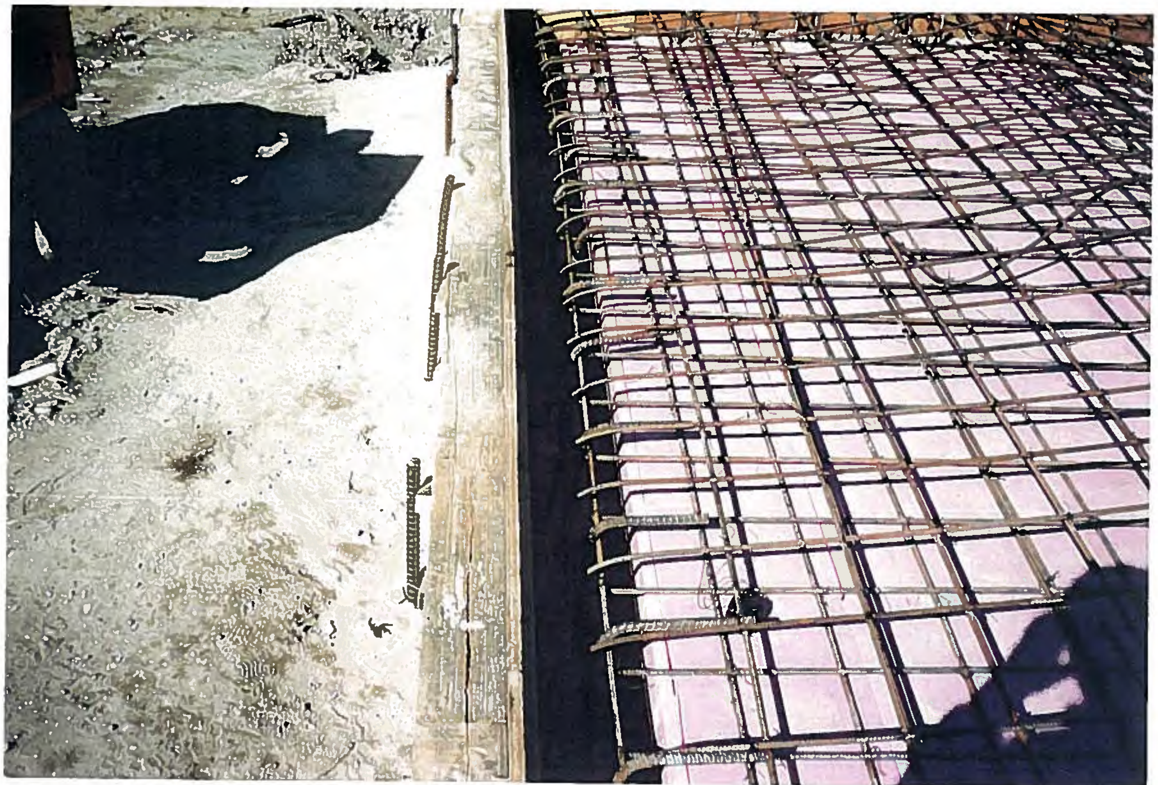
| REFERENCE DWG No. | REVISIONS No. | DATE | BY | AP |
|---|---|---|---|---|
| | | | | |

Photograph 1: Excavation around existing Eagle Mine shaft cap.

Photograph 2: Demolition of the existing ridge cap.

Photograph 3: Form break and rebar on the walls. Note: the rebar detail was revised to tie into existing wall.

Photograph 4: Form work and false work on the walls.



Photograph 5: Roof slab rebar placement. Note: the clearance of the rebar to the existing walls.

Photograph 6: Roof slab after the steel trowel finish.

Photograph 7: Completed structure after the forms were removed.

Photograph 8: Completed structure after placement of fill.

**HEISLER ENGINEERING LTD.**
527 Mendel Terrace
Saskatoon, Sask. S7J 5J6
Phone/Fax No. (306) 653-1688
E-Mail: heisler.eng@sk.sympatico.ca

October 19, 2000

Clifton Associates
101, 116 Research Drive
Saskatoon, Sask. S7N 3R3

Attention: Mr. Ron Barsi, P. Geo.

Reference: Cameco's Eagle Shaft
Concrete Cover As-Built Drawings

Dear Ron:

Attached are Drawings MIS-2006-RC01, Rev. 1 and MIS-2006-RC02, Rev. 1 representing as-built drawings for the construction of the concrete shaft cover near Uranium City, Saskatchewan.

The drawings accurately depict the actual field conditions that were encountered during the construction of the shaft cover. It is my understanding that the structure was constructed in strict accordance to the original construction drawings except for the changes as noted on the current drawings. These changes had been discussed with me previously during construction and had been approved by me.

Further, I have been provided with numerous concrete test reports of which I have reviewed the results. It is conclusive that the actual concrete used in the construction of the shaft cover meets and exceeds the original design criteria with regards to both strength and durability.

It has been a pleasure to be involved on this project with its long-term technical requirements. Please call at your convenience should you have any questions.

Yours truly

T.L. (Tim) Heisler, M.Sc., P.Eng.
Senior Structural Engineer

# CONCRETE TEST REPORT

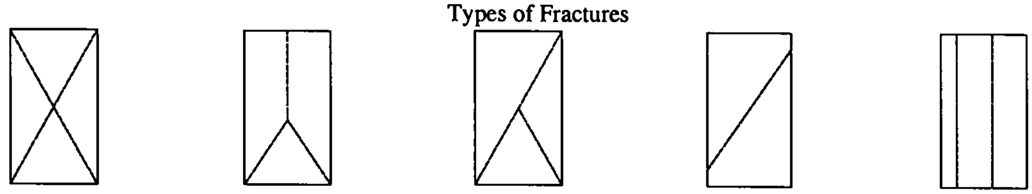
Project No.: **S1232** Ref No.: **3179** Client Ref No.: Test No.: **1**

Design Strength: **30.0 MPa**

Date Cast: **AUG 31 2000** Date Received in Lab: **SEP 6 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1762** | | **SEP 7 2000** | **7** | **33.2** | **D** | **YES** |
| **1763** | | **SEP 28 2000** | **28** | **39.4** | **C** | **YES** |
| **1764** | | **SEP 28 2000** | **28** | **39.5** | **C** | **YES** |
| **1765** | | **OCT 26 2000** | **56** | **44.6** | **D** | **YES** |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **40** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **5.8** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **11**
Temp. of Atmosphere (deg C) : **9**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **09:30**
Time Load Arrived : **00:00**
Time Sampled : **09:35**
Time Cylinders Cast : **09:40**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **20**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **South wall. First lift.**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: of

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

**Per** ____________

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# CONCRETE TEST REPORT

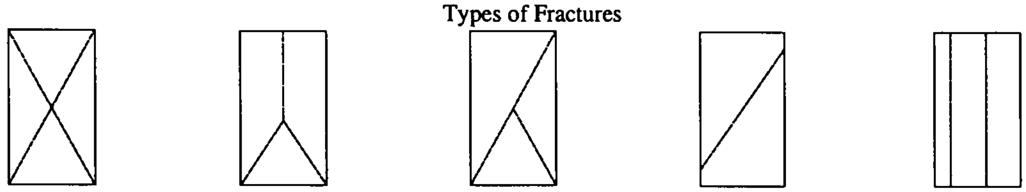
Project No.: **S1232** Ref No.: **3180** Client Ref No.: Test No.: **2**

Design Strength: **30.0** MPa

Date Cast: **AUG 31 2000** Date Received in Lab: **SEP 6 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1766** | | **SEP 7 2000** | **7** | **28.7** | **A** | **YES** |
| **1767** | | **SEP 28 2000** | **28** | **36.7** | **C** | **YES** |
| **1768** | | **SEP 28 2000** | **28** | **37.0** | **C** | **YES** |
| **1769** | | **OCT 26 2000** | **56** | **38.0** | **D** | **YES** |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **20** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **7.2** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **13**
Temp. of Atmosphere (deg C) : **13**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **11:40**
Time Load Arrived : **00:00**
Time Sampled : **11:45**
Time Cylinders Cast : **11:50**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **20**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **South wall. Second lift.**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

**Per** ____________________

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# CONCRETE TEST REPORT

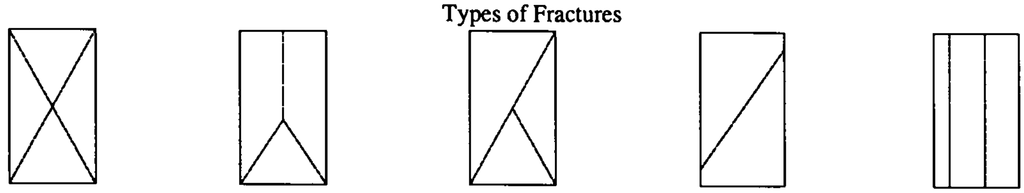
Project No.: **S1232** Ref No.: **3181** Client Ref No.: Test No.: **3**

Design Strength: **30.0** MPa

Date Cast: **AUG 31 2000** Date Received in Lab: **SEP 6 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1770** | | **SEP 7 2000** | **7** | **30.8** | **C** | **YES** |
| **1771** | | **SEP 28 2000** | **28** | **37.5** | **A** | **YES** |
| **1772** | | **SEP 28 2000** | **28** | **37.2** | **D** | **YES** |
| **1773** | | **OCT 26 2000** | **56** | **40.6** | **D** | **YES** |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **20** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **6.8** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **13**
Temp. of Atmosphere (deg C) : **13**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **12:30**
Time Load Arrived : **00:00**
Time Sampled : **12:40**
Time Cylinders Cast : **12:35**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **20**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **South wall. Third lift.**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

Per ____

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# CONCRETE TEST REPORT

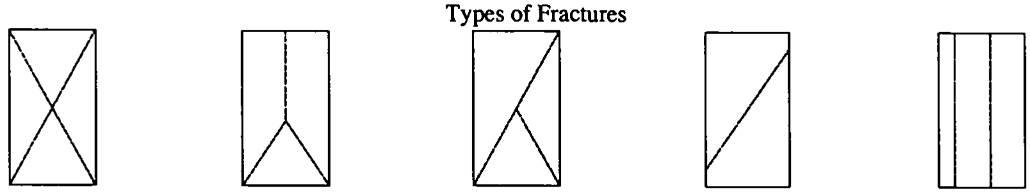
Project No.: **S1232** Ref No.: **3182** Client Ref No.: Test No.: **4**

Design Strength: **30.0** MPa

Date Cast: **AUG 31 2000** Date Received in Lab: **SEP 6 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1774** | | **SEP 7 2000** | **7** | **30.2** | **C** | **YES** |
| **1775** | | **SEP 28 2000** | **28** | **38.4** | **C** | **YES** |
| **1776** | | **SEP 28 2000** | **28** | **39.1** | **A** | **YES** |
| **1777** | | **OCT 26 2000** | **56** | **41.6** | **C** | **YES** |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **30** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **7.4** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **15**
Temp. of Atmosphere (deg C) : **15**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **14:40**
Time Load Arrived : **00:00**
Time Sampled : **14:45**
Time Cylinders Cast : **14:50**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **20**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **North wall. Final lift.**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

SP

Per ____________

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# CONCRETE TEST REPORT

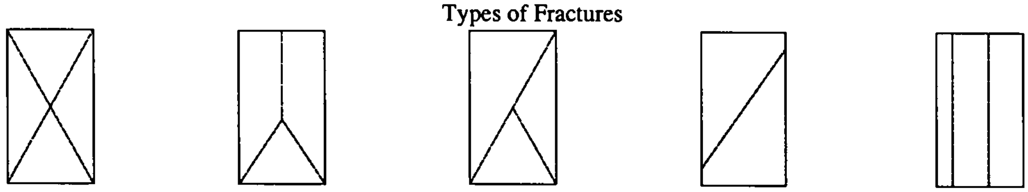
Project No.: **S1232** Ref No.: **3196** Client Ref No.: Test No.: **5**

Design Strength: **30.0** MPa

Date Cast: **SEP 4 2000** Date Received in Lab: **SEP 7 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| 1782 | | SEP 11 2000 | 7 | 28.8 | D | YES |
| 1783 | | OCT 2 2000 | 28 | 35.7 | D | YES |
| 1784 | | OCT 2 2000 | 28 | 36.6 | D | YES |
| 1785 | | OCT 30 2000 | 56 | 36.6 | D | YES |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **120** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **10.8** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **12**
Temp. of Atmosphere (deg C) : **12**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **10:30**
Time Load Arrived : **00:00**
Time Sampled : **10:35**
Time Cylinders Cast : **10:40**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **25**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **Roof slab - south side.**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

Per ____________

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# CONCRETE TEST REPORT

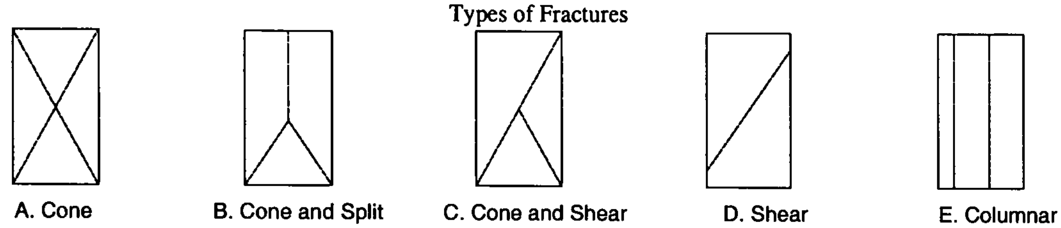
Project No.: **S1232** Ref No.: **3197** Client Ref No.: Test No.: **6**

Design Strength: **30.0** MPa

Date Cast: **SEP 4 2000** Date Received in Lab: **SEP 7 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1786** | | **SEP 11 2000** | **7** | **27.7** | **D** | **YES** |
| **1787** | | **OCT 2 2000** | **28** | **33.7** | **C** | **YES** |
| **1788** | | **OCT 2 2000** | **28** | **34.8** | **C** | **YES** |
| **1789** | | **OCT 30 2000** | **56** | **35.5** | **C** | **YES** |

Types of Fractures




*Type of Cement : **10**
Measured Slump : **90** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **12.0** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **15**
Temp. of Atmosphere (deg C) : **15**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **12:20**
Time Load Arrived : **00:00**
Time Sampled : **12:25**
Time Cylinders Cast : **12:30**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **25**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **Roof slab - centre**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

Per ____________

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

Decommissioned Beaverlodge Properties

# CONCRETE TEST REPORT

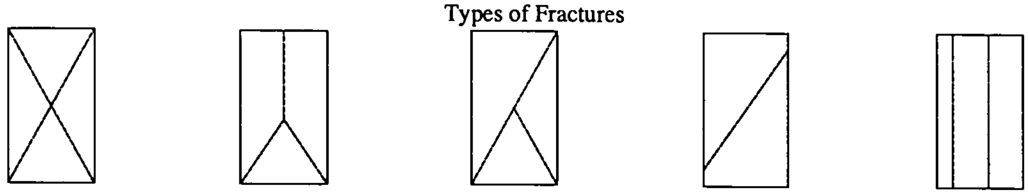
Project No.: **S1232** Ref No.: **3198** Client Ref No.: Test No.: **7**

Design Strength: **30.0** MPa

Date Cast: **SEP 4 2000** Date Received in Lab: **SEP 7 2000**

| Lab No. | Client No. | Date Tested | Age (Days) | Compressive Strength (MPa) | Type of Fracture | Fractured Aggregate |
|---|---|---|---|---|---|---|
| **1790** | | **SEP 11 2000** | **7** | **30.0** | **C** | **YES** |
| **1791** | | **OCT 2 2000** | **28** | **38.1** | **C** | **YES** |
| **1792** | | **OCT 2 2000** | **28** | **39.3** | **D** | **YES** |
| **1793** | | **OCT 30 2000** | **56** | **41.7** | **C** | **YES** |

Types of Fractures



A. Cone B. Cone and Split C. Cone and Shear D. Shear E. Columnar

*Type of Cement : **10**
Measured Slump : **40** mm Specified: mm ± mm
From: **75** mm to: **125** mm
Measured Air : **12.0** % Specified: % to: %
From: **5.0** % to: **7.0** %
*Admixtures : **AEA**
*Maximum Aggregate Size: **12.0** mm
Water Added on Job: litres
Authorized By:
* From Concrete Producers Delivery Ticket

Temp. of Concrete (deg C) : **15**
Temp. of Atmosphere (deg C) : **15**
*Ticket Number : **N/A**
*Truck Number : **N/A**
*Time Load Left Plant : **14:05**
Time Load Arrived : **00:00**
Time Sampled : **14:10**
Time Cylinders Cast : **14:15**
Type of Molds Used : **PVC**

Cylinders are 100 mm (4") diameter X 200mm (8") Length unless otherwise noted
Cylinders cured in water as of this date unless otherwise specified :
Initial 24 hour curing temperatures: Minimum (deg C): **15** Maximum (deg C): **25**
Cylinders cast in Field : **4** Cylinders cast in Laboratory :
Location on Structure : **Roof slab - north side**

Density of Fresh Concrete : kg/m^3 Density of Hardened Test Cylinder : kg/m^3
Condition of Cylinders when received in Laboratory : **Good**
Cast by : **D. McDonald** of **Clifton Associates Ltd.**
Submitted by: **M. New** of **Clifton Associates Ltd.**

Remarks:

Report Distribution:
**Tim Heisler (653-1688)**
**Procon - Jon Braaten (651-3500)**
**Cameco - Bob Phillips (956-6590)**

We Certify Testing Procedures in Accordance with C.S.A. Standards for that portion of the testing performed by this Company

Per

**Clifton Associates Ltd.**
engineering science technology

Client: **PANS**
Project: **Eagle Mine Shaft**
Location: **Uranium City, Saskatchewan**
Contractor: **Procon**
Concrete Producer: **Procon**

# 2010 Cover Installation

# MRTN 1 - Adit (BVL)

MRTN 1 - Adit (BVL)

**Figure 1 – Approximately 12" diameter opening in Martin Lake adit (Beaverlodge Lake Side)**

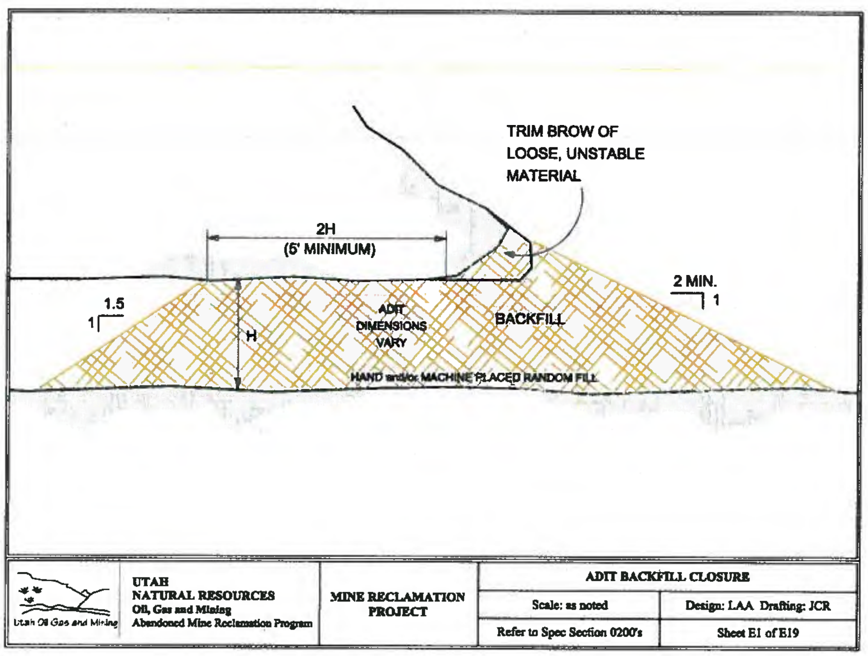



**Figure 2 – Adit Backfill Closure Plan**

**Figure 3 – Exposed Adit**

**Figure 4 – Adit Closure**

**Figure 5 –Adit Following Closure Activities**

# 2016 Cover Installations

## ACE 1 – Ace Shaft

ACE 1 – Ace Shaft

GENERAL NOTES:
1. ALL STRUCTURAL PLATE MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS IF REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN AROUND SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 9785 LB
5. DO NOT BACK FILL WALLS OF COVER.

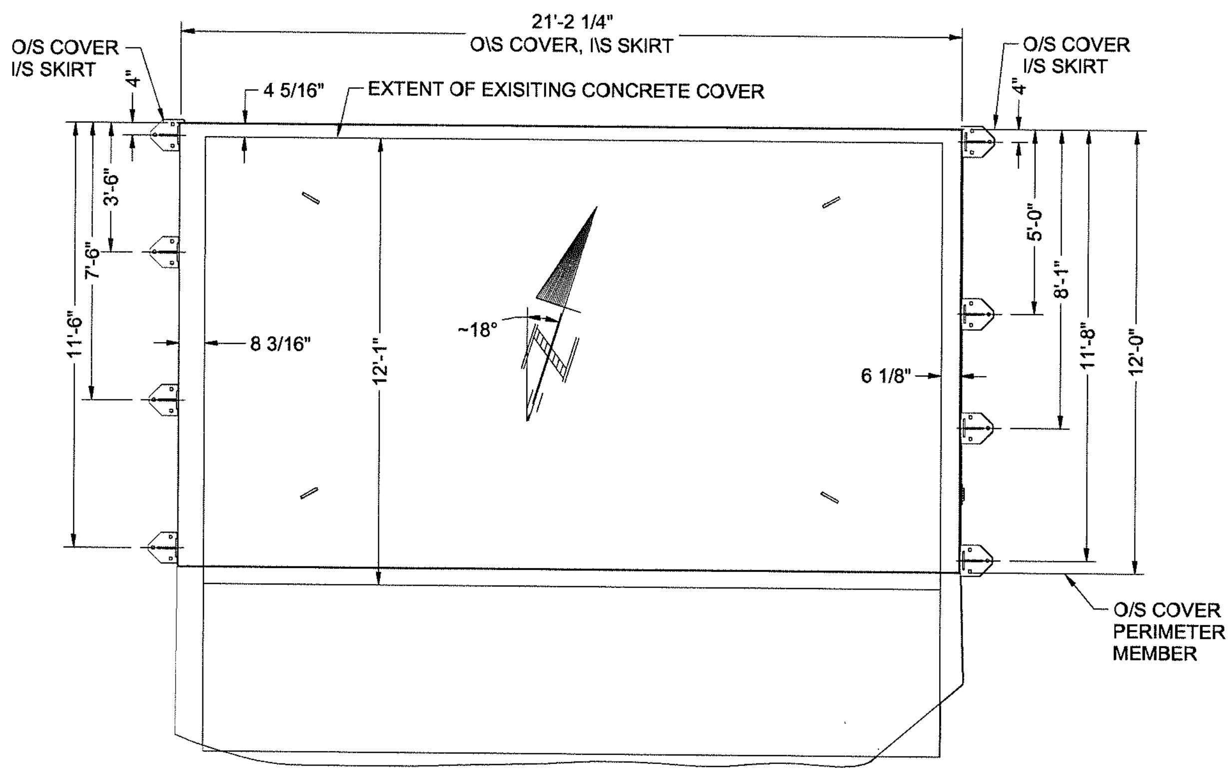
BEAVERLODGE ACE 1 SHAFT OPENING COVER
GPS LOCATION: 59° 33'43.52N, 108° 27'23.86W
SEALED: 2016
CONTACT THE SK MINISTRY OF ENVIRONMENT IF DAMAGED

ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

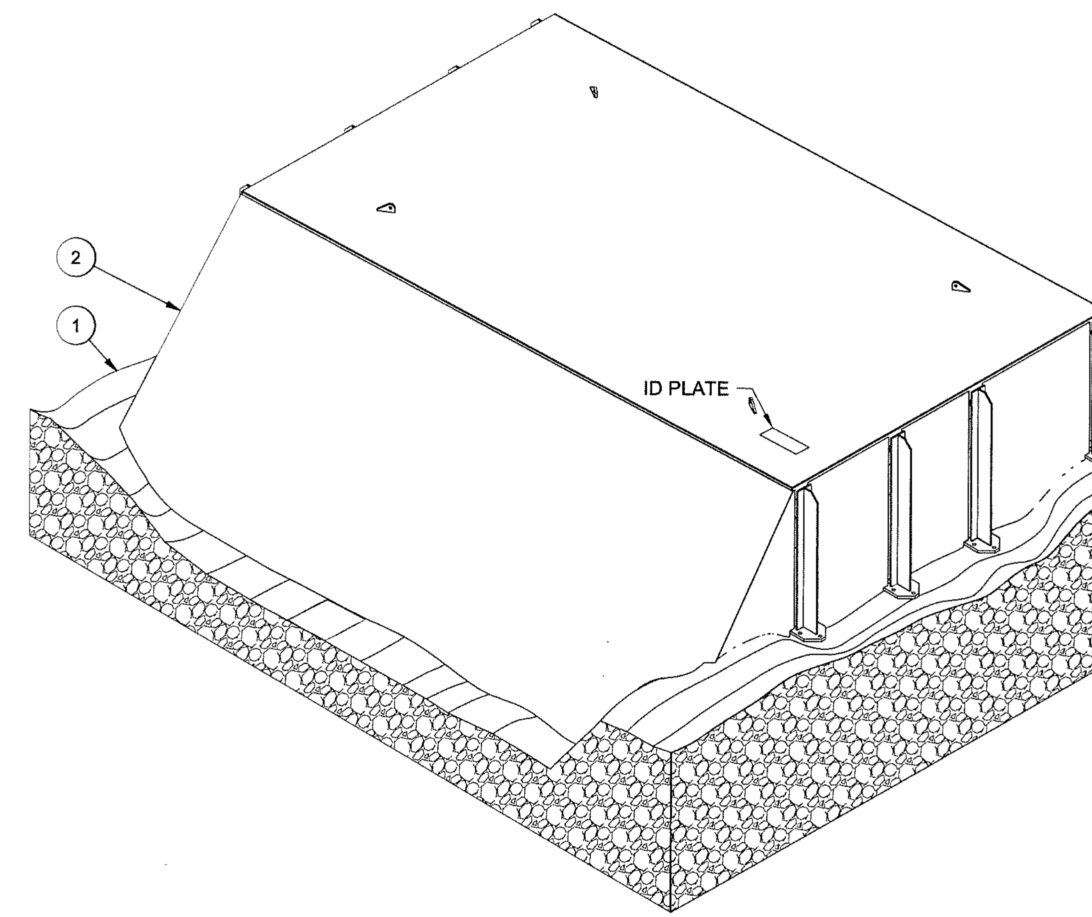
LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | | (E) ROCK BED | | | |
| 2 | 1 | (N) OPENING COVER | MK#S17550-A-201 | | 2 |

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 6245 LB
AS INSTALLED: 9785 LB




PLAN VIEW - ACE 1 SHAFT OPENING COVER




ISO VIEW - LOOKING NORTHEAST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 30/Jan/17 | KD |
| | | 0 | ISSUED FOR CONSTRUCTION | 30/Nov/15 | JG |
| | | A | ISSUED FOR REVIEW | 26/Nov/15 | JG |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES
DRWN BY: JG
DATE: 13/Nov/15
CHK'D BY: PC
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 01 30
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

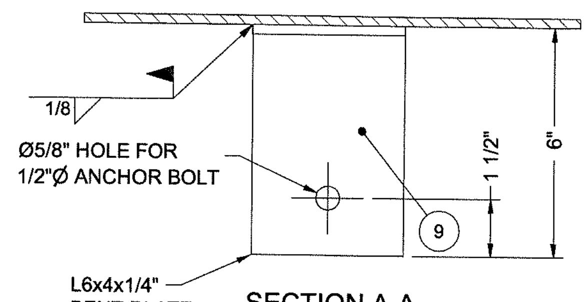
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| STRUCTURAL | 14318 | |



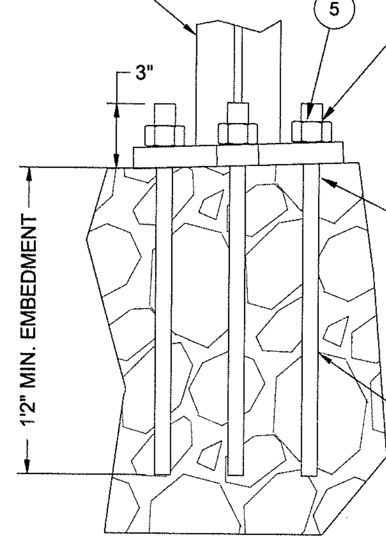
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 1 SHAFT OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'43.52N 108°27'23.86W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 5
DWG. NO.: S17550-02-1 REV 1

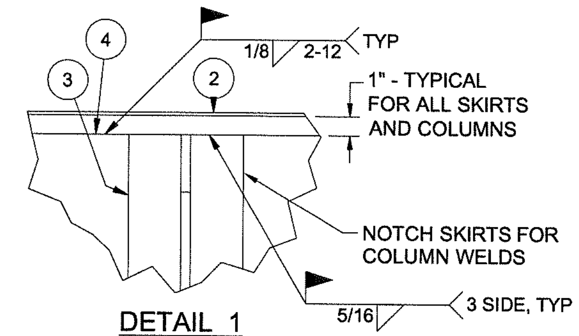
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




SECTION A-A



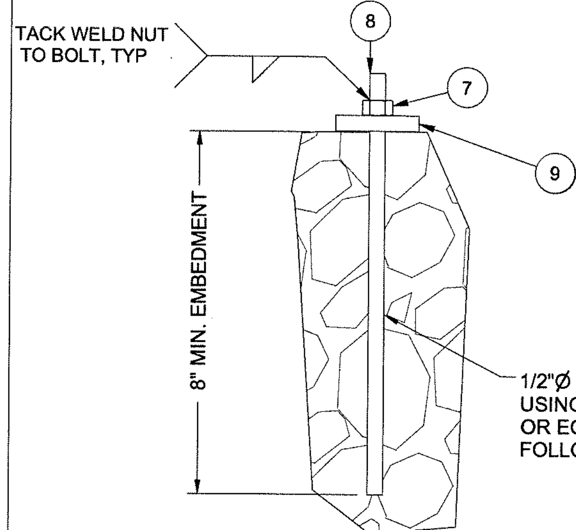

TYPICAL COLUMN ANCHOR BOLT DETAIL



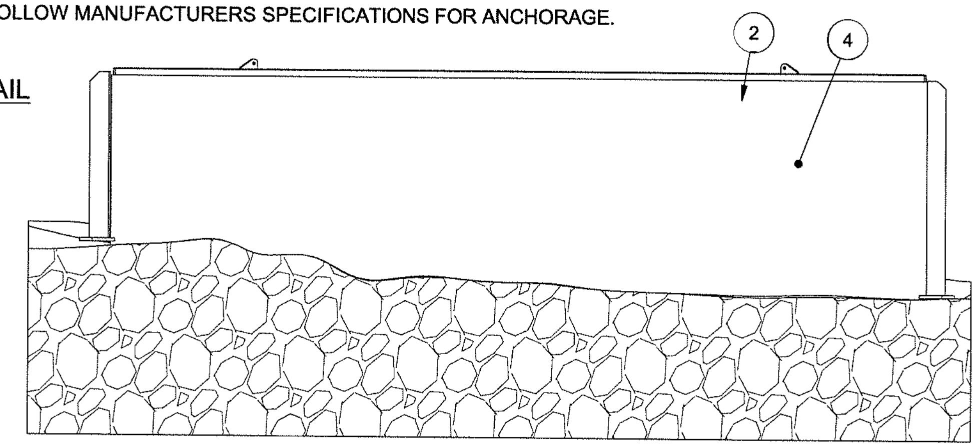

DETAIL 1

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | | (E) ROCK BED | | | |
| 2 | | (N) OPENING COVER | MK#S17550-A-202 | | 3 |
| 3 | 8 | (N) COLUMN ASSEMBLY | MK#S17550-A-203 | | 4 |
| 4 | | (N) 12ga SKIRT SHEETING | | ASTM A240-316L | |
| 5 | 24 | (N) Ø1" HEAVY HEX NUT | | ASTM A194 GRADE B8M | |
| 6 | 24 | (N) Ø1" ALL THREAD | | ASTM A194 GRADE B8M | |
| 7 | 20 | (N) Ø1/2" HEAVY HEX NUT | | ASTM A194 GRADE B8M | |
| 8 | 20 | (N) Ø1/2" ALL THREAD | | ASTM A193 GRADE B8M | |
| 9 | 20 | (N) 1/4" SKIRT TAB | | ASTM A240-316L | |
| 10 | | (N) 3/16" SKIRT SHEETING | | ASTM A240-316L | |

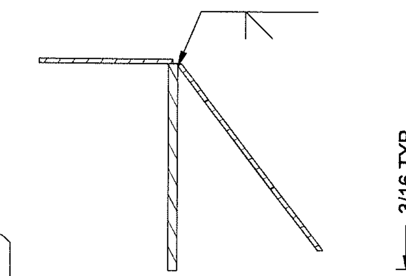
ESTIMATED TOTAL COLUMN LENGTH 40'-1" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH BE SUPPLIED PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.



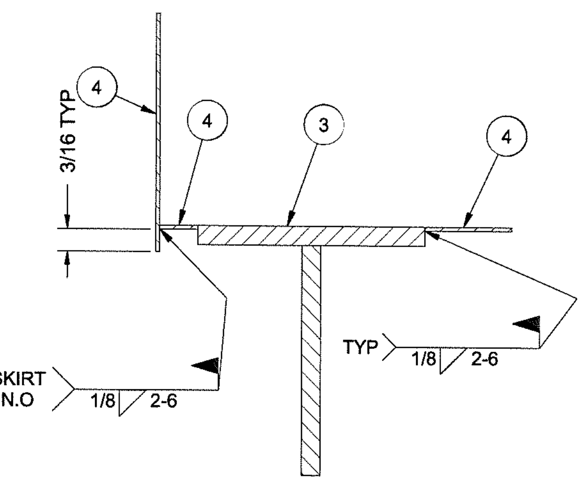

TYPICAL SKIRT ANCHOR DETAIL




OPENING COVER - LOOKING SOUTH



SECTION C-C

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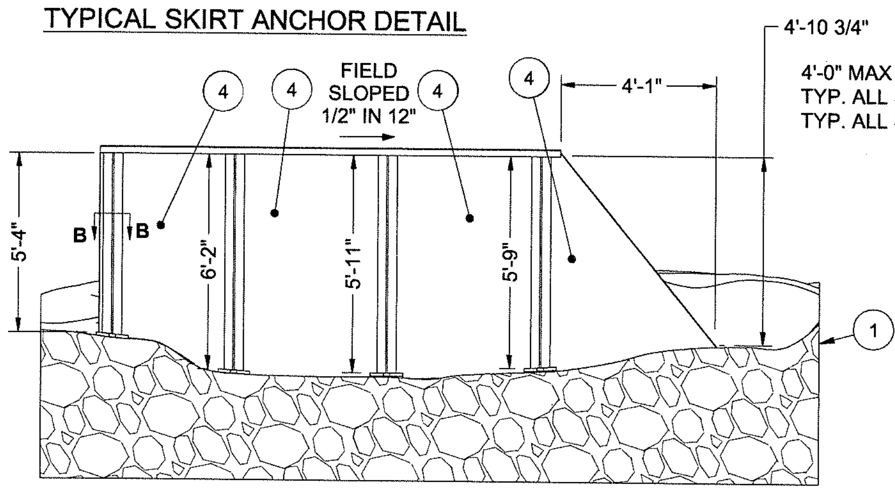
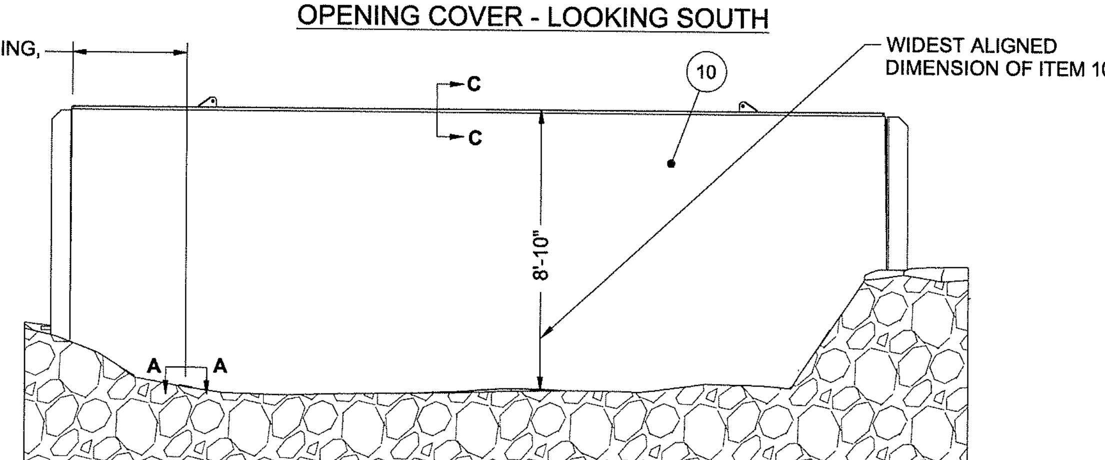
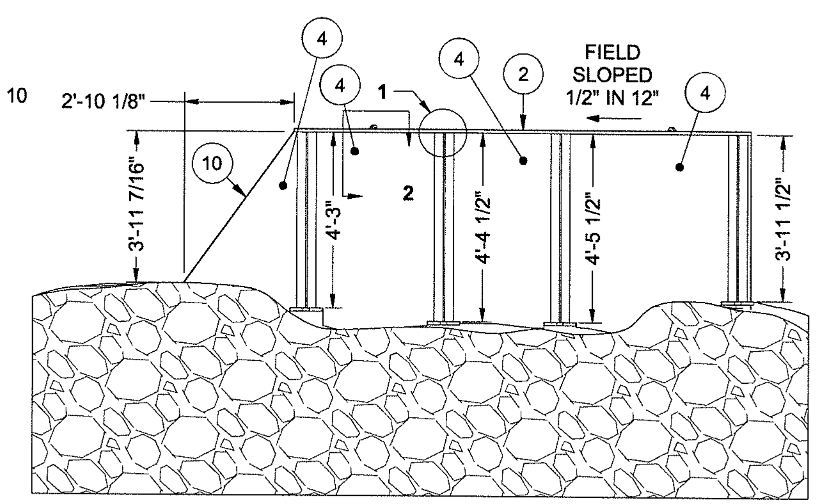



OPENING COVER - MK#S17550-A-201 - LOOKING EAST




OPENING COVER - LOOKING NORTH




OPENING COVER - LOOKING WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 30/Jan/17 | KD |
| | | 0 | ISSUED FOR CONSTRUCTION | 30/Nov/15 | JG |
| | | A | ISSUED FOR REVIEW | 26/Nov/15 | JG |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 13/Nov/15
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 01 30
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: STRUCTURAL | Sk. Reg. No.: 14318 | Signature

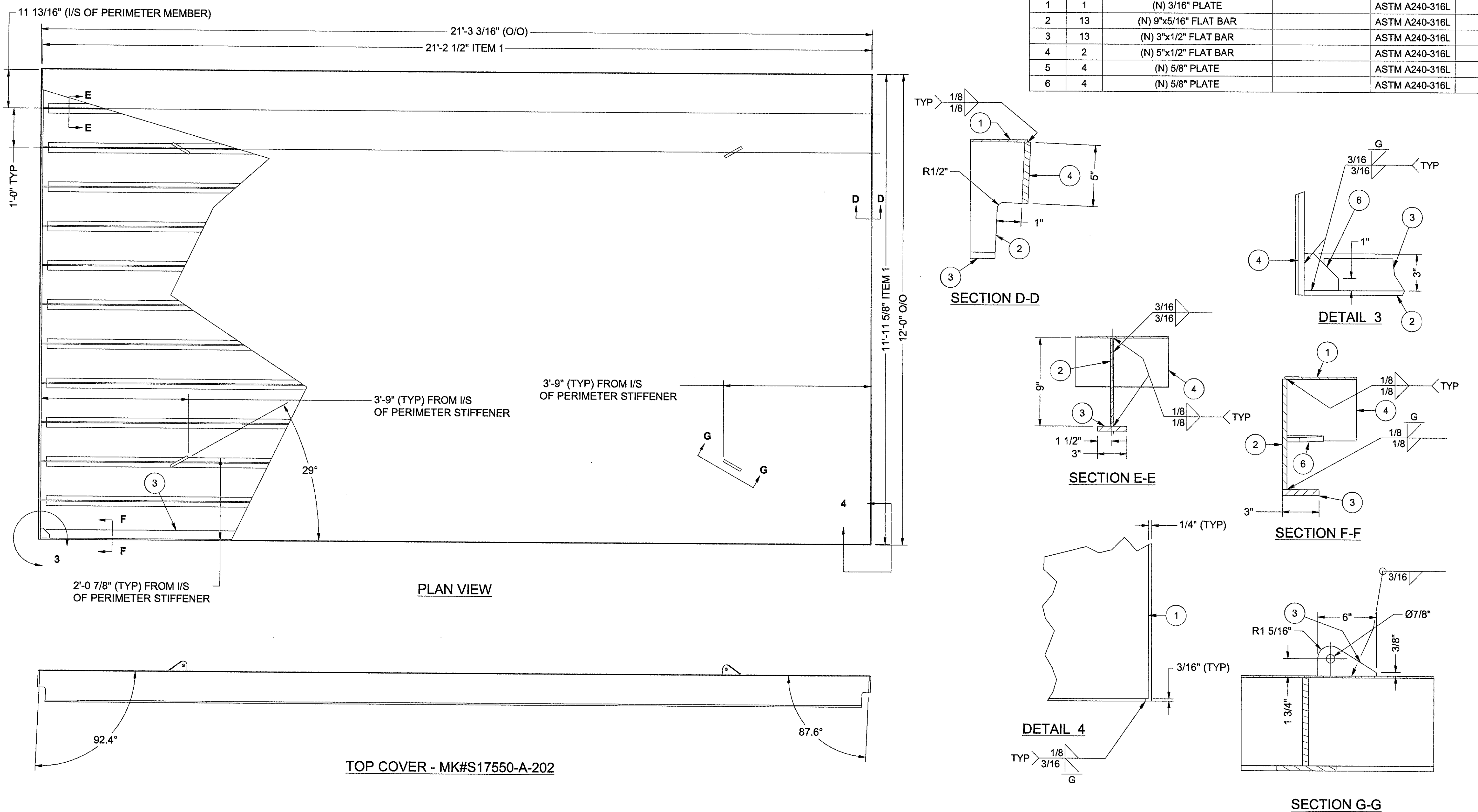


**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 1 SHAFT OPENING
INSTALLATION DETAILS
LOCATION: 59°33'43.52N 108°27'23.86W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 5
DWG. NO.: S17550-02-2
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (N) 3/16" PLATE | | ASTM A240-316L | |
| 2 | 13 | (N) 9"x5/16" FLAT BAR | | ASTM A240-316L | |
| 3 | 13 | (N) 3"x1/2" FLAT BAR | | ASTM A240-316L | |
| 4 | 2 | (N) 5"x1/2" FLAT BAR | | ASTM A240-316L | |
| 5 | 4 | (N) 5/8" PLATE | | ASTM A240-316L | |
| 6 | 4 | (N) 5/8" PLATE | | ASTM A240-316L | |






| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 30/Jan/17 | KD |
| | | 0 | ISSUED FOR CONSTRUCTION | 30/Nov/15 | JG |
| | | A | ISSUED FOR REVIEW | 26/Nov/15 | JG |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 13/Nov/15
CHK'D BY: PC
ENG BY: PC

PROFESSIONAL ENGINEER — P.D. CAUGHLIN — MEMBER 14318 — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: STRUCTURAL — Sk. Reg. No.: 14318 — Signature

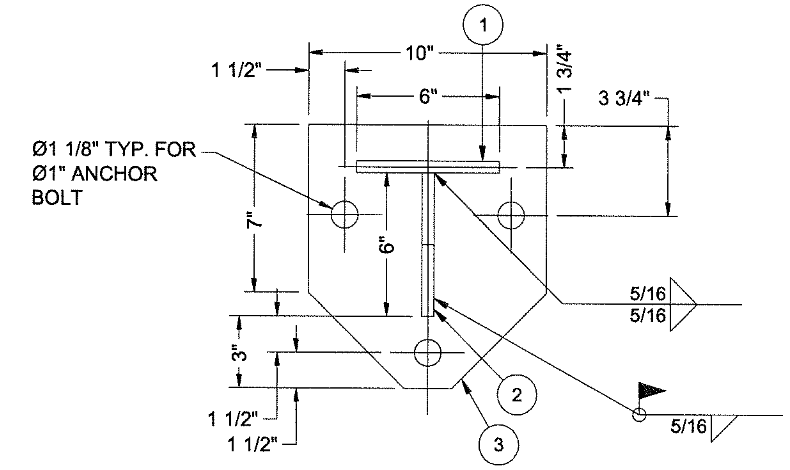
**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 1 SHAFT OPENING
TOP COVER FABRICATION DETAILS
LOCATION: 59°33'43.52N 108°27'23.86W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 5
DWG. NO.: S17550-02-3 — REV 1

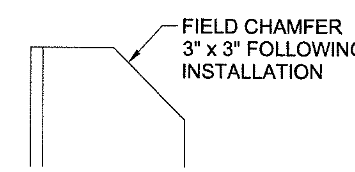
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (N) 6"x1/2" FLAT BAR | | ASTM A240-316L | |
| 2 | 1 | (N) 6"x1/2" FLAT BAR | | ASTM A240-316L | |
| 3 | 1 | (N) 1" PLATE | | ASTM A240-316L | |

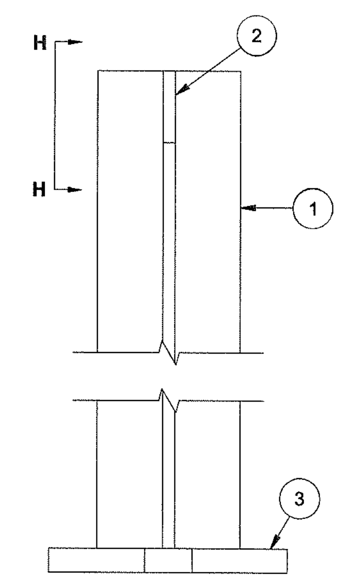
NOTE: QUANTITIES IN BILL OF MATERIALS ARE FOR ONE OF EACH ASSEMBLY ONLY. EIGHT (8) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.




TYPICAL COLUMN PLAN




SECTION H-H




TYPICAL COLUMN ELEVATION
MK#S17550-A-203



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 30/Jan/17 | KD |
| | | 0 | ISSUED FOR CONSTRUCTION | 30/Nov/15 | JG |
| | | A | ISSUED FOR REVIEW | 26/Nov/15 | JG |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 13/Nov/15
CHK'D BY: PC
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 01 30
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

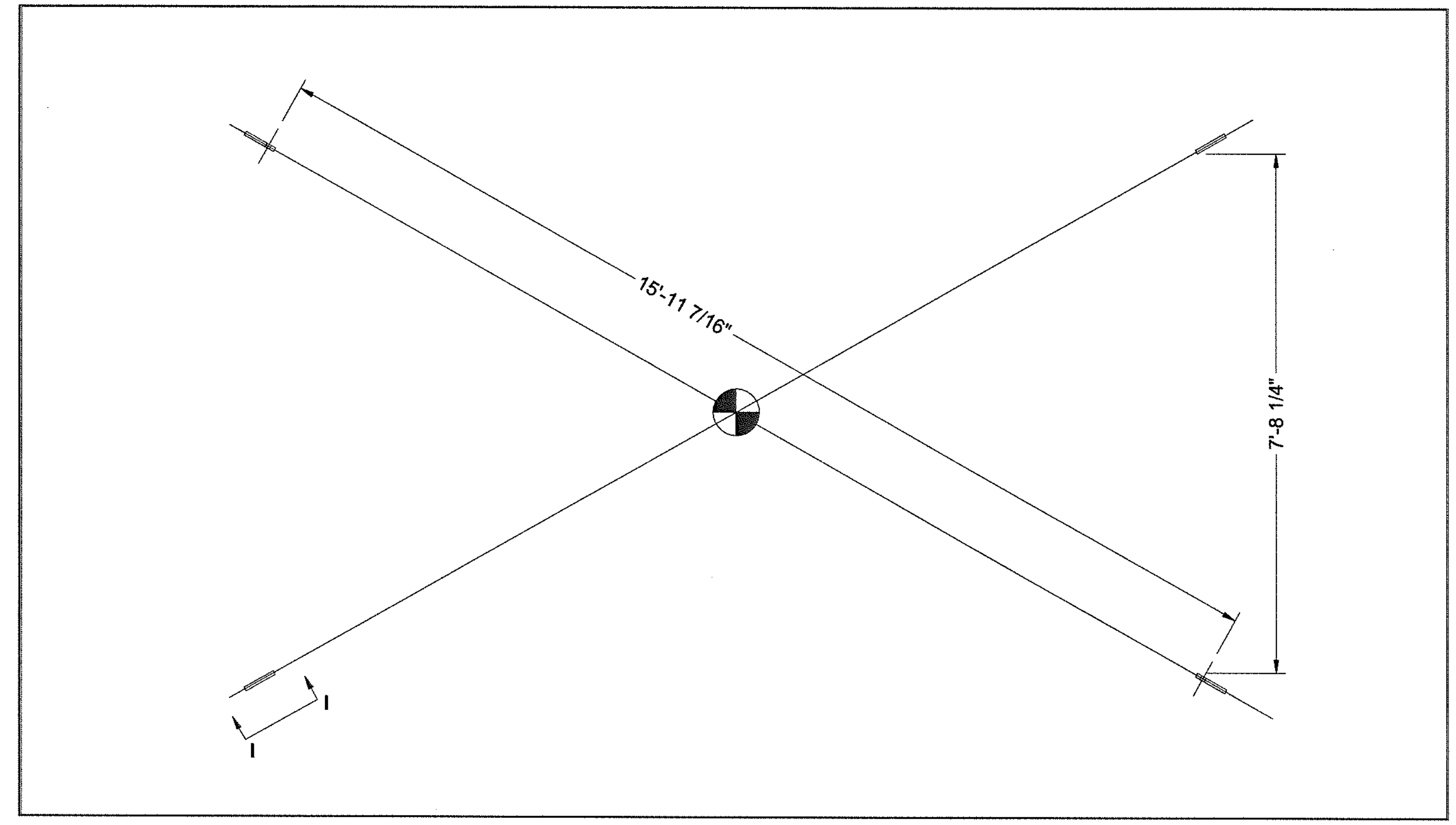
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| STRUCTURAL | 14318 | |

Kova Engineering Saskatchewan Ltd.

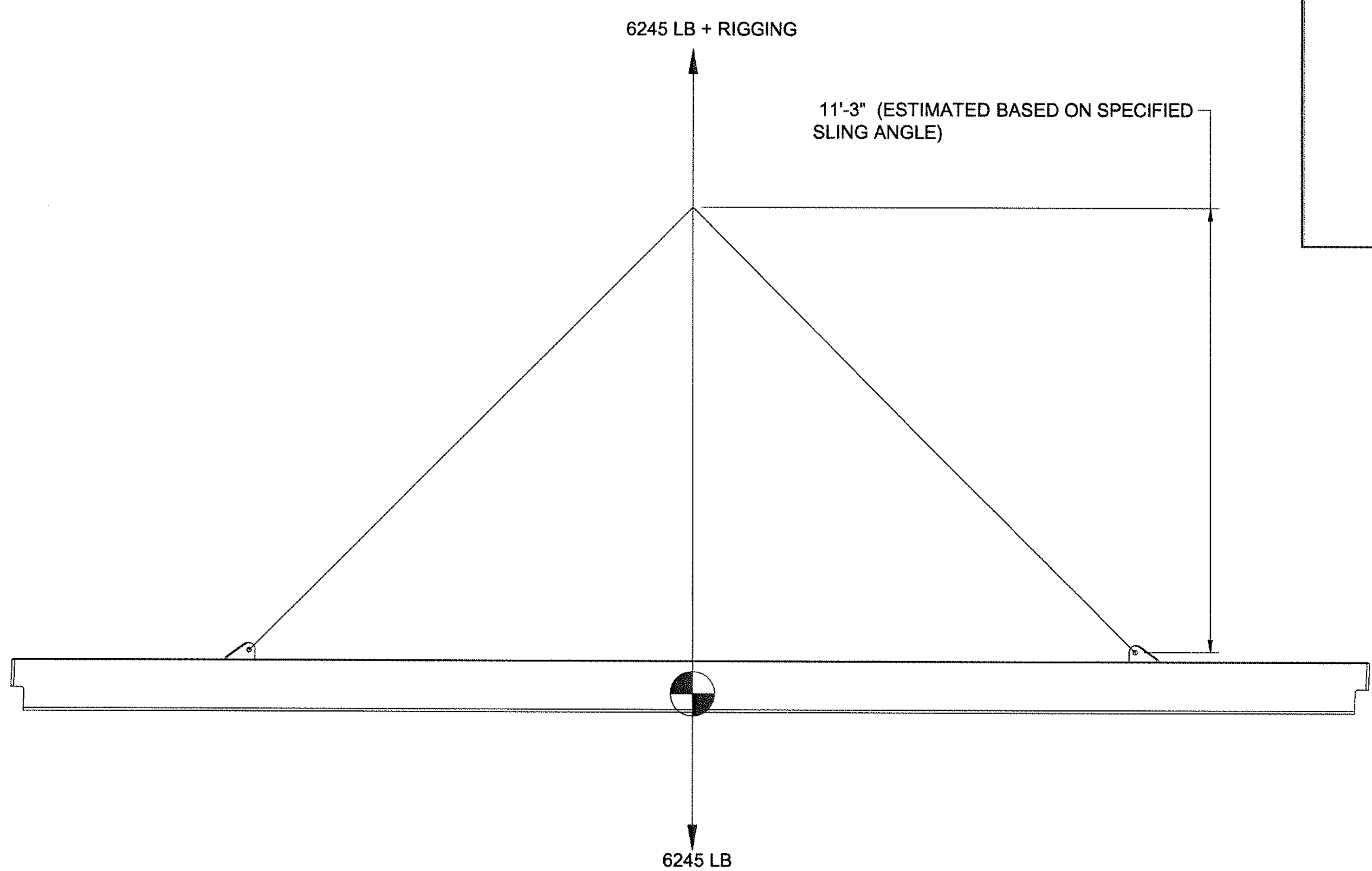
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 1 SHAFT OPENING
INSPECTION HATCH AND COLUMN ASSEMBLY FABRICATION DETAILS
LOCATION: 59°33'43.52N 108°27'23.86W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 5
DWG. NO.: S17550-02-4
REV: 1

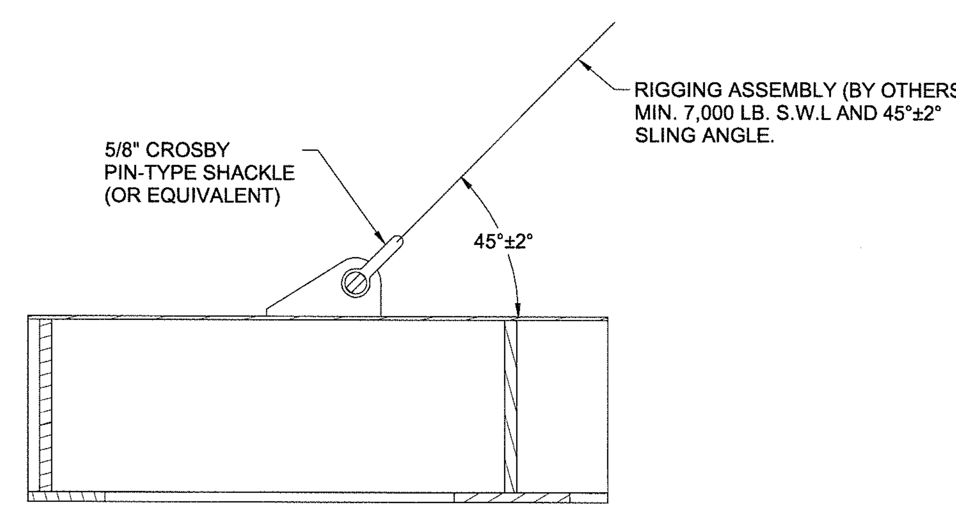
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - PLAN VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW




SECTION I-I



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 30/Jan/17 | KD |
| | | 0 | ISSUED FOR CONSTRUCTION | 30/Nov/15 | JG |
| | | A | ISSUED FOR REVIEW | 26/Nov/15 | JG |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 13/Nov/15
CHK'D BY: PC
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 01 30
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| STRUCTURAL | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 1 SHAFT OPENING
COVER LIFTING DETAILS
LOCATION: 59°33'43.52N 108°27'23.86W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 5
DWG. NO.: S17550-02-5 REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# FAY 12 - Waste Haul Adit

FAY 12 - Waste Haul Adit


**NOTE:**
Coordinate System: UTM WGS 1984 Zone 12

Image source: Saskatchewan Geospatial Imagery Collaborative 2012-2016

0 70 140 Meters

srk consulting

Job No: 1CC007.054

Filename: 1CC007_054__fig_01_fay_mill_area

Cameco

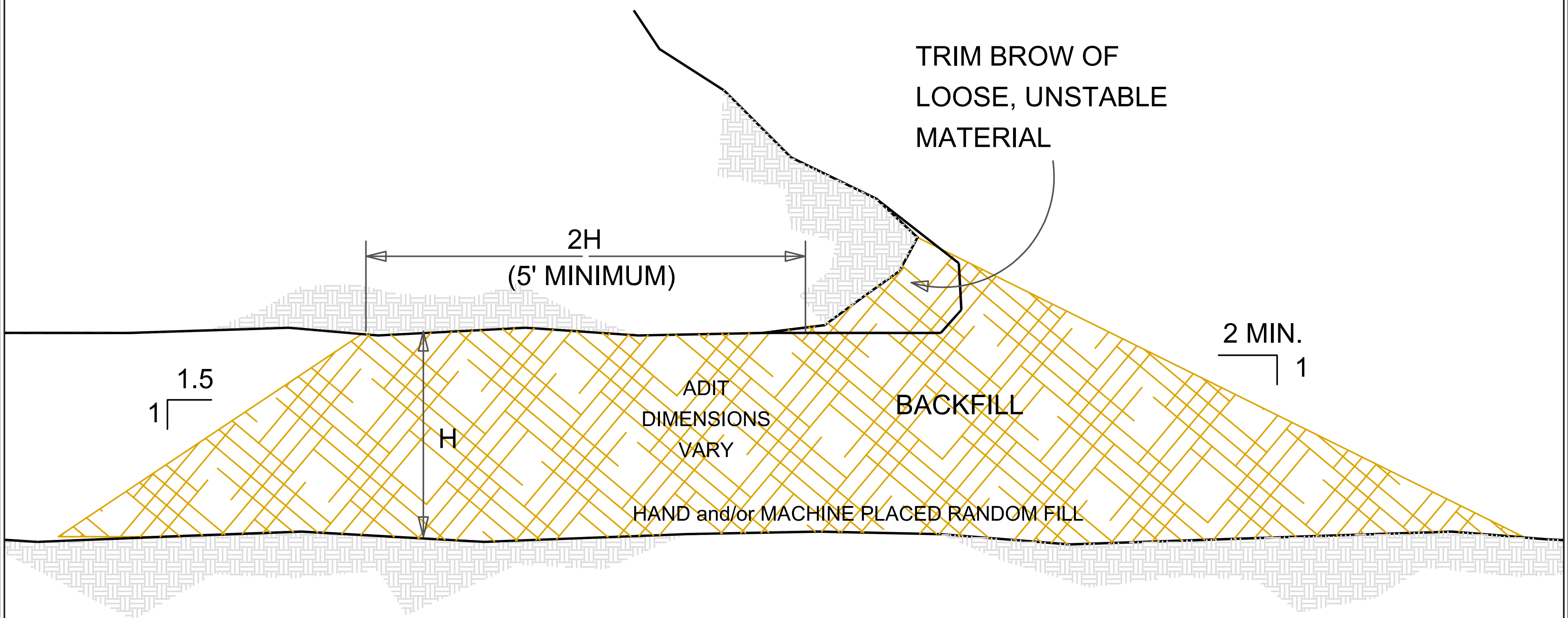
CAMECO CORPORATION

Mine Opening Investigation

FAY AREA

| Date: | Approved: | Figure: |
|---|---|---|
| Aug 2016 | | 1 |

\\SSK-SVR0.ssk.na.srk.ad\Saskatoon Projects\01_SITES\Beaverlodge\!020_Site-Wide_Data\GIS\Maps\Figure Maps\1CC007_054__fig_01_fay_mill_area.mxd




Utah Oil Gas and Mining

**UTAH**
**NATURAL RESOURCES**
**Oil, Gas and Mining**
Abandoned Mine Reclamation Program

**MINE RECLAMATION PROJECT**

| **ADIT BACKFILL CLOSURE** | |
|---|---|
| Scale: as noted | Design: LAA Drafting: JCR |
| Refer to Spec Section 0200's | Sheet E1 of E19 |

**Figure 1: Subsidence Observed Above the Waste Haulage Adit**

**Figure 2: Partially Excavated Adit with Steel Encountered in Backfill**

**Figure 3: Excavated Adit**

**Figure 4: Backfilling Adit with Loader Attachment**

**Figure 5: Sorted Waste Rock Used for Backfill Material**

**Figure 6: Backfilled Adit**

**Figure 7: Placing Sorted Waste Rock in Adit Entrance**

**Figure 8: Backfilled Adit Entrance with Material Placed to Original Slope**

**Figure 9: Completed project**

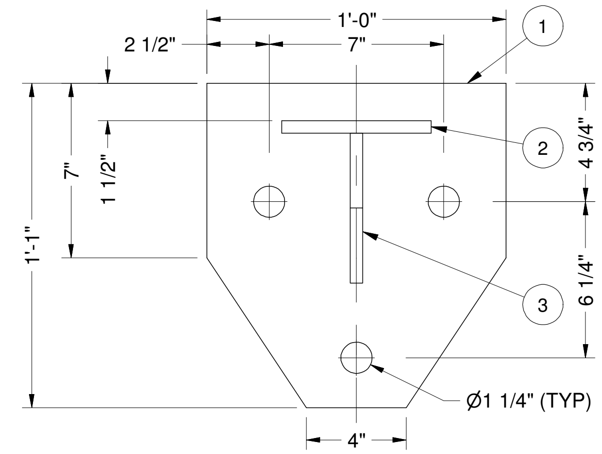
# 2017 Cover Installations

**2017 Stainless Steel Cover Details**

- **Columns Details and Notes**
- **Bedrock Anchor Details**
- **Welding Details**
- **Lift Lug Design**

**2017 Stainless Steel Cover Details**

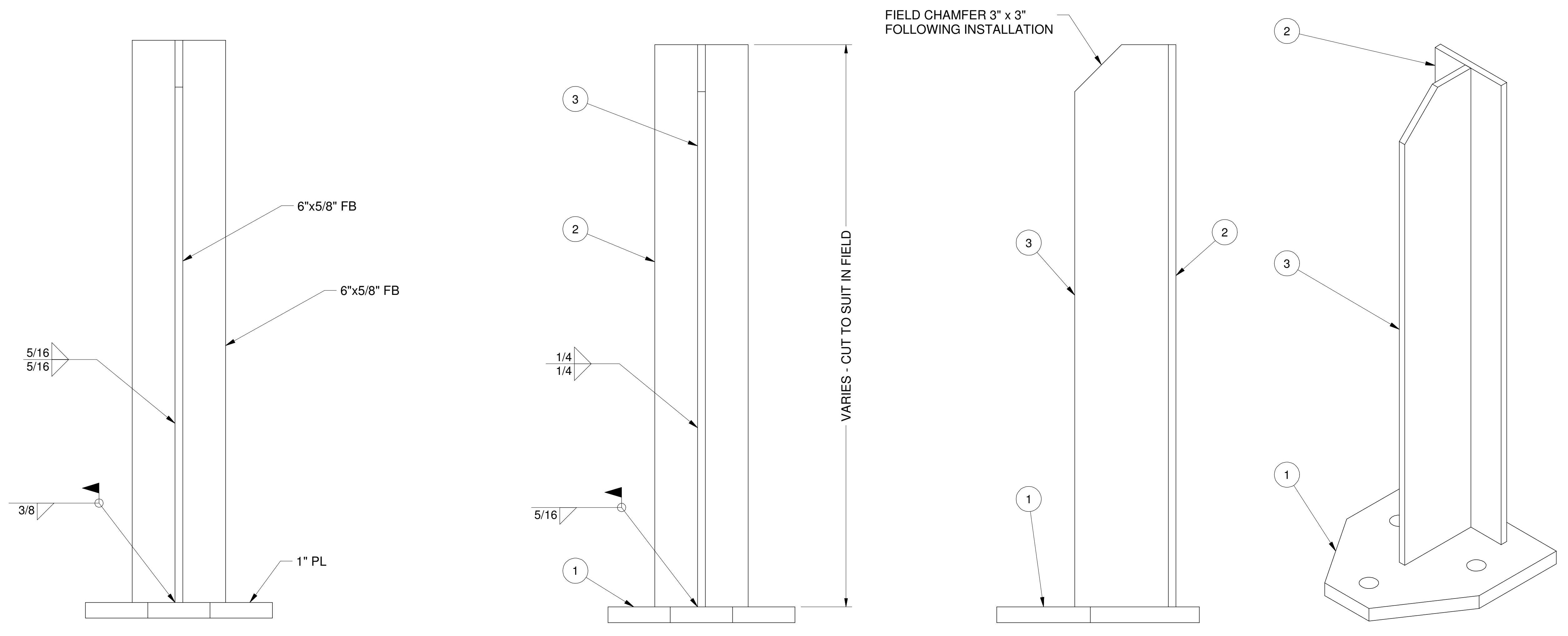
GENERAL NOTES:
1. ALL STRUCTURAL PLATE MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
5. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
6. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
7. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
8. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.




TOP VIEW

BILL OF MATERIALS

| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
|---|---|---|---|---|---|
| 1 | 1 | 1" PL | | ASTM A240-316L | |
| 2 | 1 | 6" x 1/2" FB | | ASTM A240-316L | |
| 3 | 1 | 6" x 1/2' FB | | ASTM A240-316L | |




ALTERNATIVE COLUMN DETAIL
5/8" PLATE COLUMNS

COLUMN DETAIL

SIDE VIEW

ISO VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △2 | AS-BUILT REVISIONS | 11/3/2017 | A.R. |
| | | △1 | ISSUED FOR CONSTRUCTION | 10/26/2016 | A.R. |
| S18678-01~11 | KOVA DWGS - COVERS FOR SHAFT OPENINGS | △A | ISSUED FOR REVIEW | 10/6/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/30/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 11 03
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

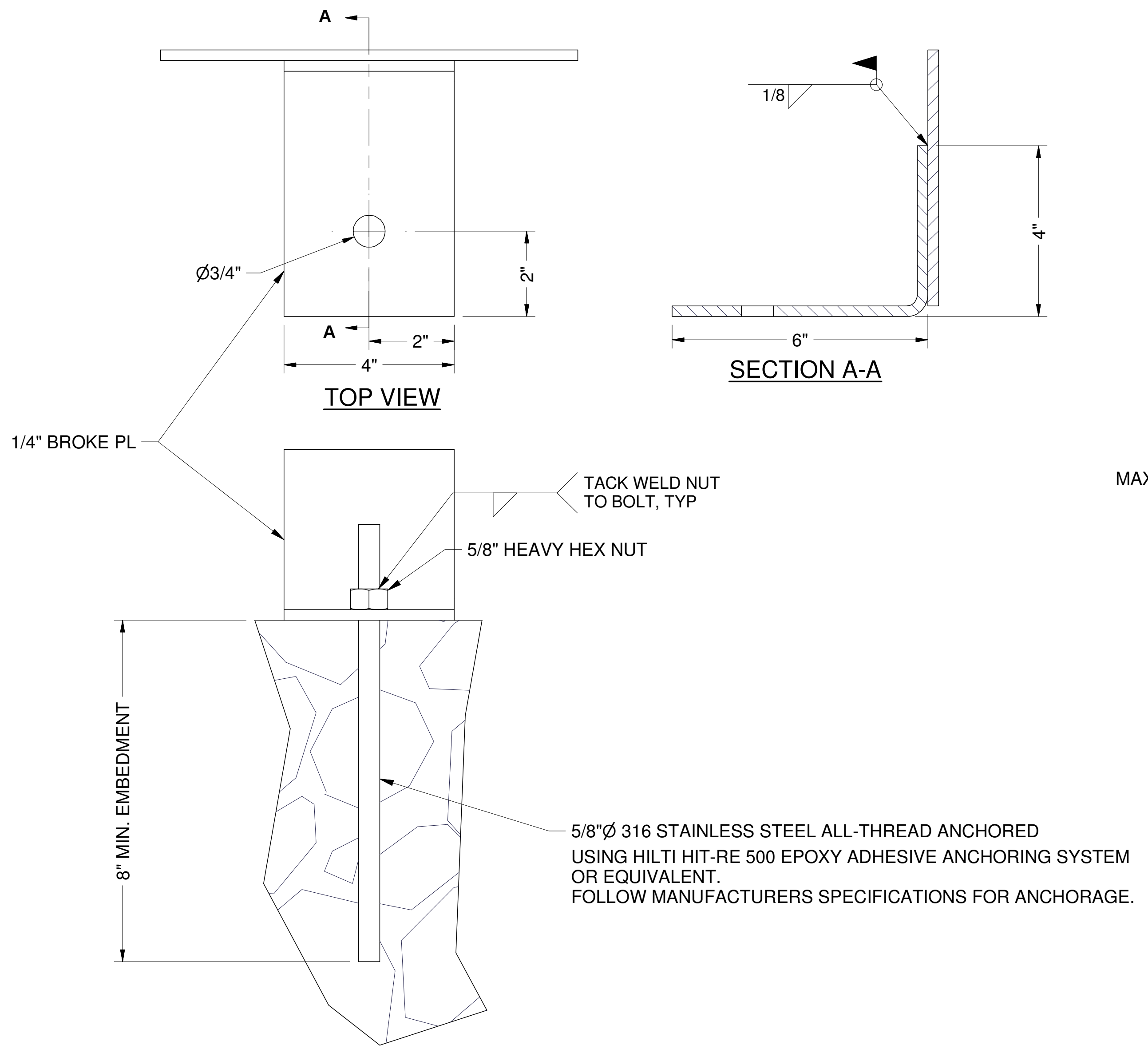
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

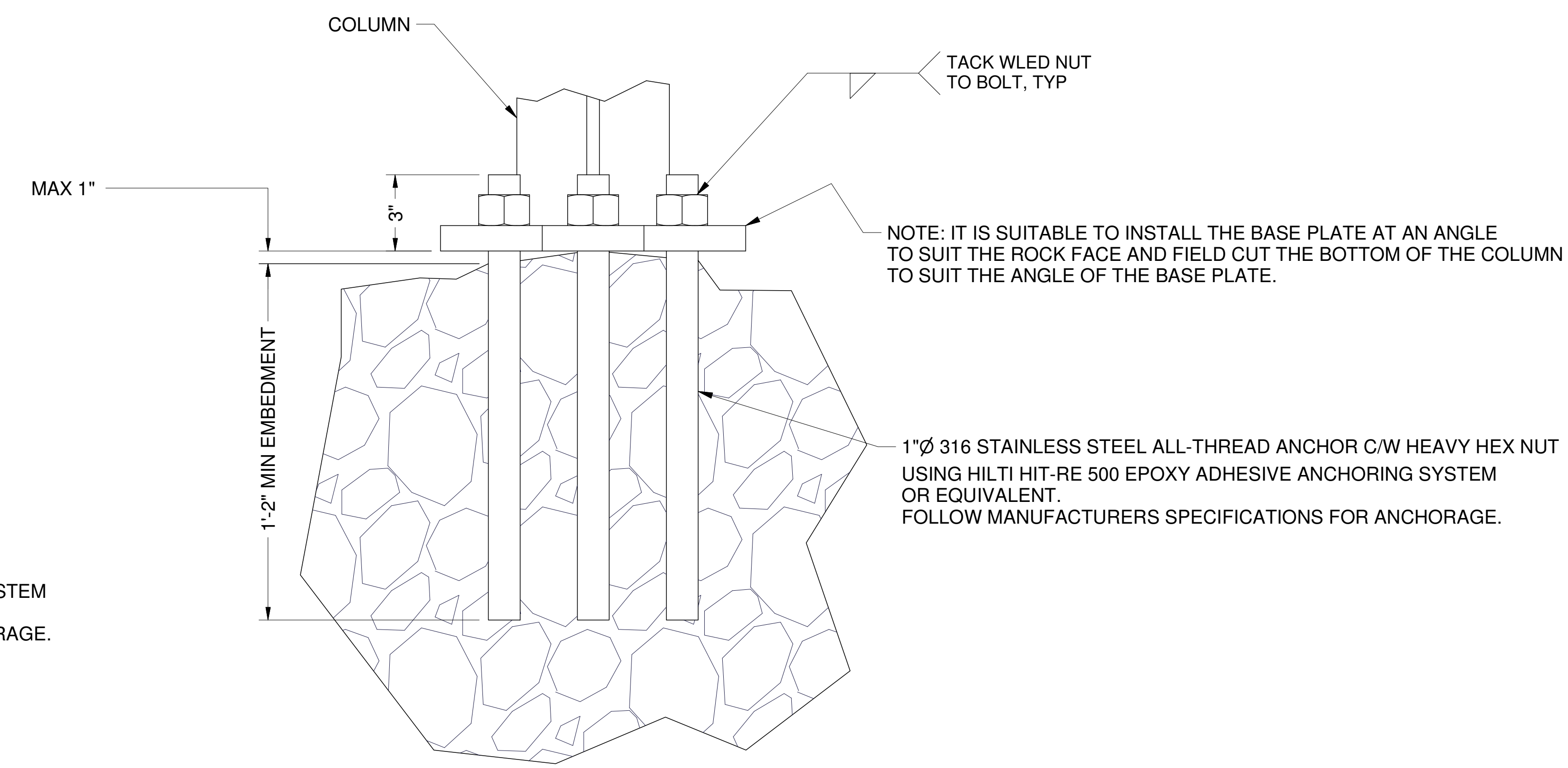
PROJECT: BEAVERLODGE PERMANENT COVERS FOR SHAFT OPENINGS - STANDARD DETAILS
COLUMN DETAILS & NOTES
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 4
DWG. NO.: S18678-12-1 △1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TYPICAL SKIRT ANCHOR DETAIL




TYPICAL COLUMN ANCHOR BOLT DETAIL



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT REVISIONS | 11/3/2017 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/26/2016 | A.R. |
| S18678-01~11 | KOVA DWGS - COVERS FOR SHAFT OPENINGS | A | ISSUED FOR REVIEW | 10/6/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/30/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 11 03
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Number C672
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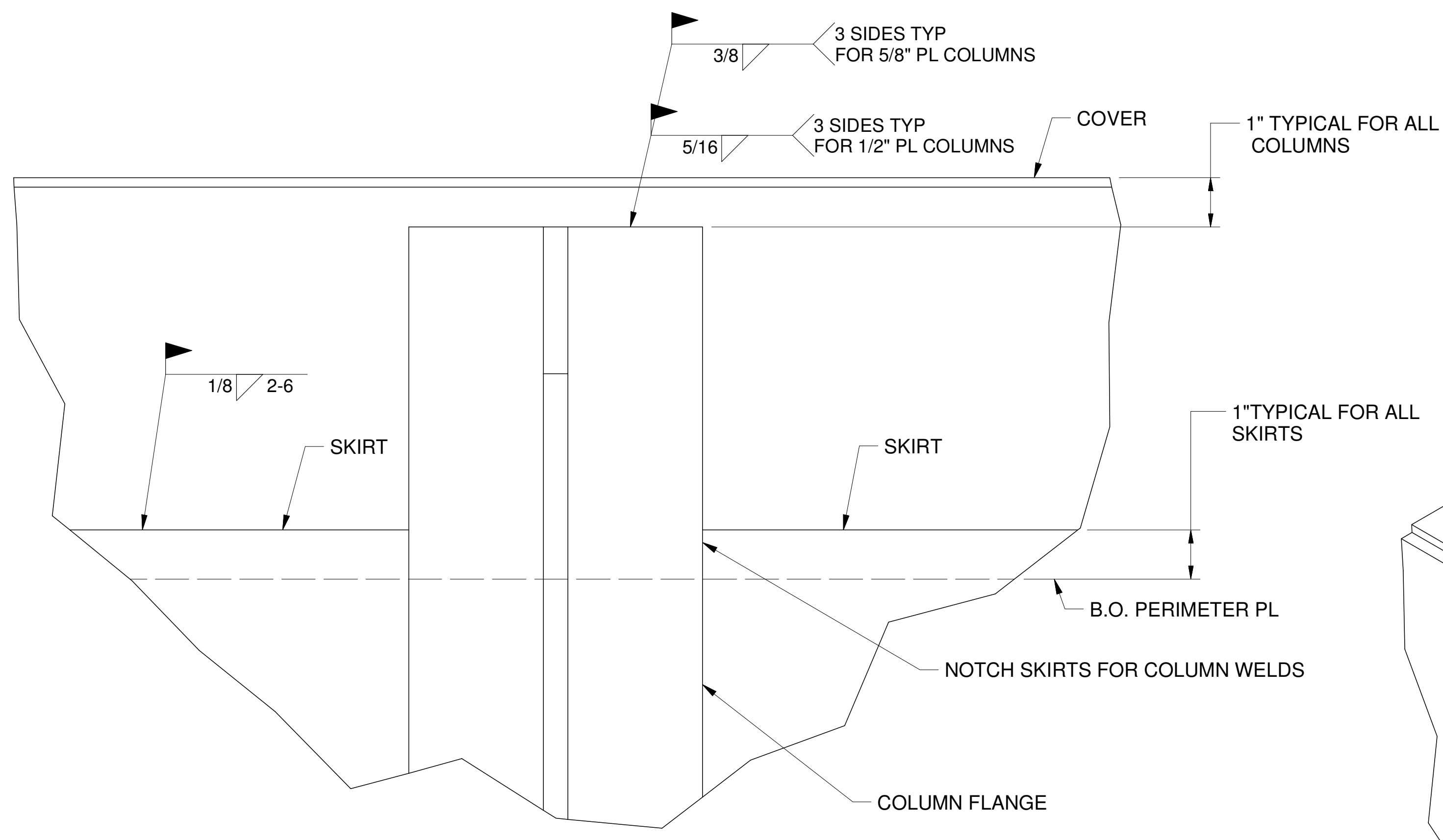
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

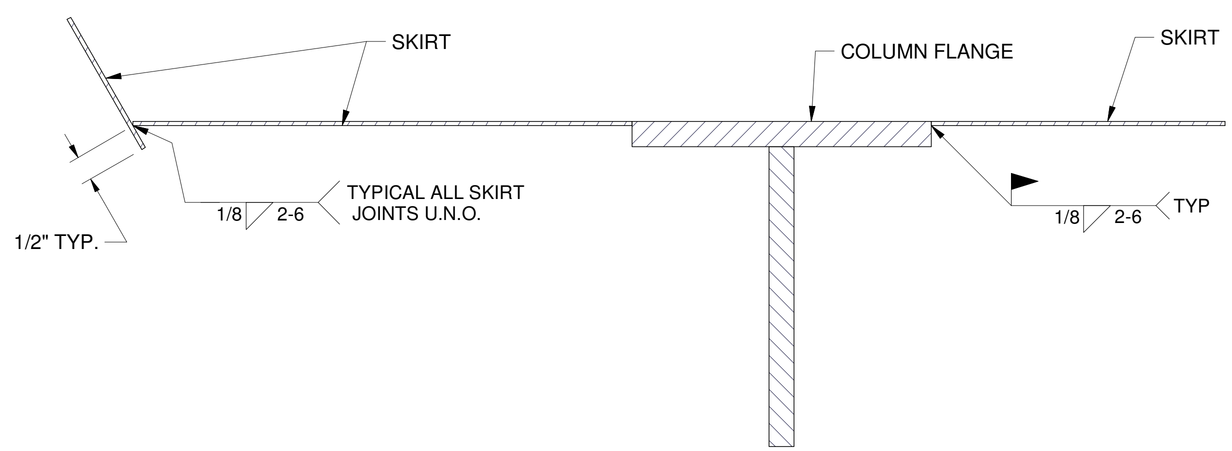
**Kova Engineering Saskatchewan Ltd.**

PROJECT: BEAVERLODGE PERMANENT COVERS FOR SHAFT OPENINGS - STANDARD DETAILS
ANCHOR DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 4
DWG. NO.: S18678-12-2
1

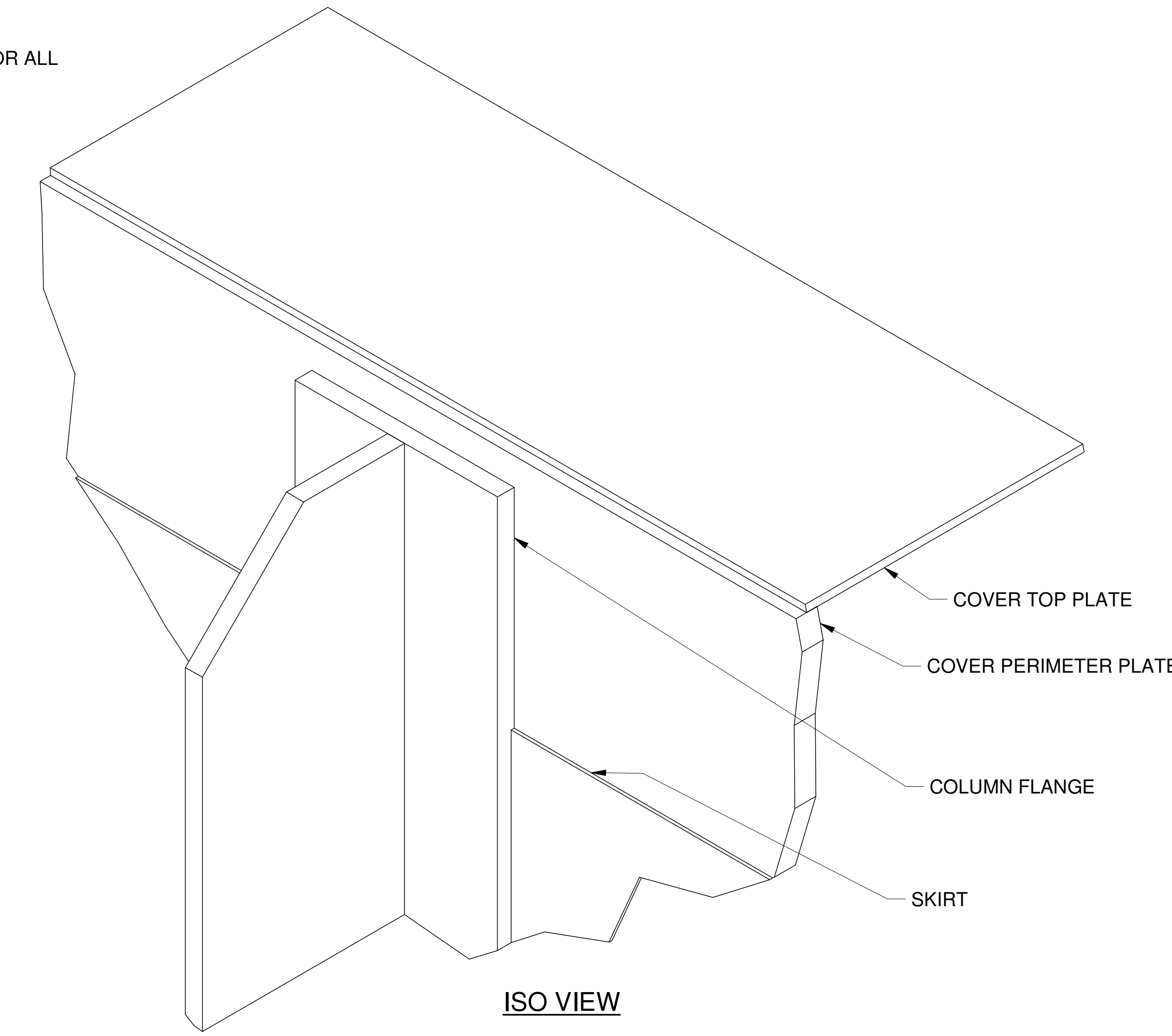
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




WELDING COLUMN
AND SKIRT TO COVER




SKIRT WELDING




ISO VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 2 | AS-BUILT REVISIONS | 11/3/2017 | A.R. |
| | | 1 | ISSUED FOR CONSTRUCTION | 10/26/2016 | A.R. |
| S18678-01~11 | KOVA DWGS - COVERS FOR SHAFT OPENINGS | A | ISSUED FOR REVIEW | 10/6/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/30/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 11 03
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

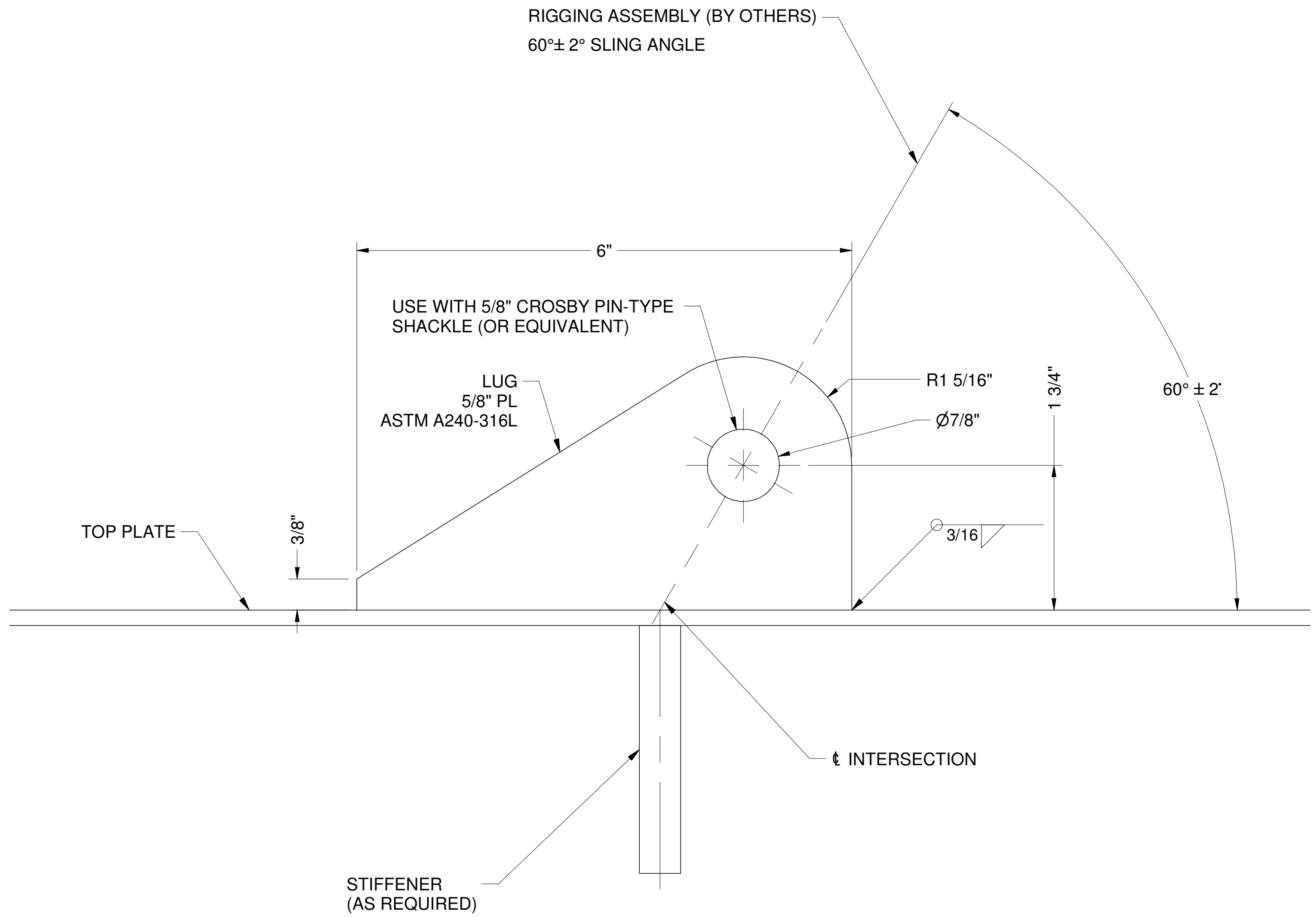
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR SHAFT OPENINGS - STANDARD DETAILS
WELDING DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 4
DWG. NO.: S18678-12-3
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




LUG DETAIL



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT REVISIONS | 11/3/2017 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/26/2016 | A.R. |
| S18678-01~11 | KOVA DWGS - COVERS FOR SHAFT OPENINGS | A | ISSUED FOR REVIEW | 10/6/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/30/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |



Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR SHAFT OPENINGS - STANDARD DETAILS
LIFT LUG DESIGN
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 4
DWG. NO.: S18678-12-4 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# ACE 2 – 2157 Raise

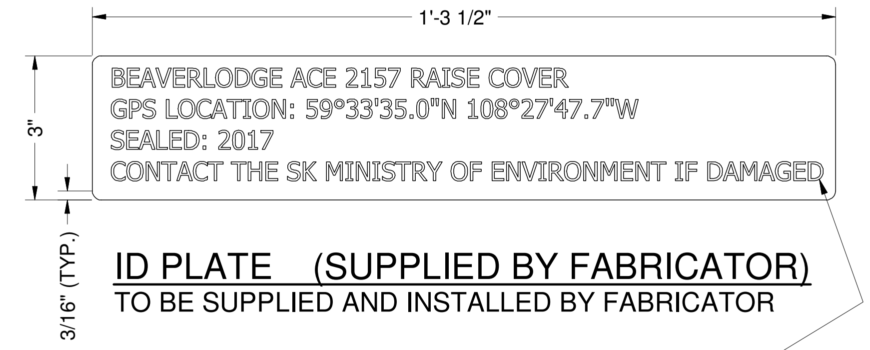
ACE 2 – 2157 Raise

GENERAL NOTES:

1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

COVER CHARACTERISTICS:

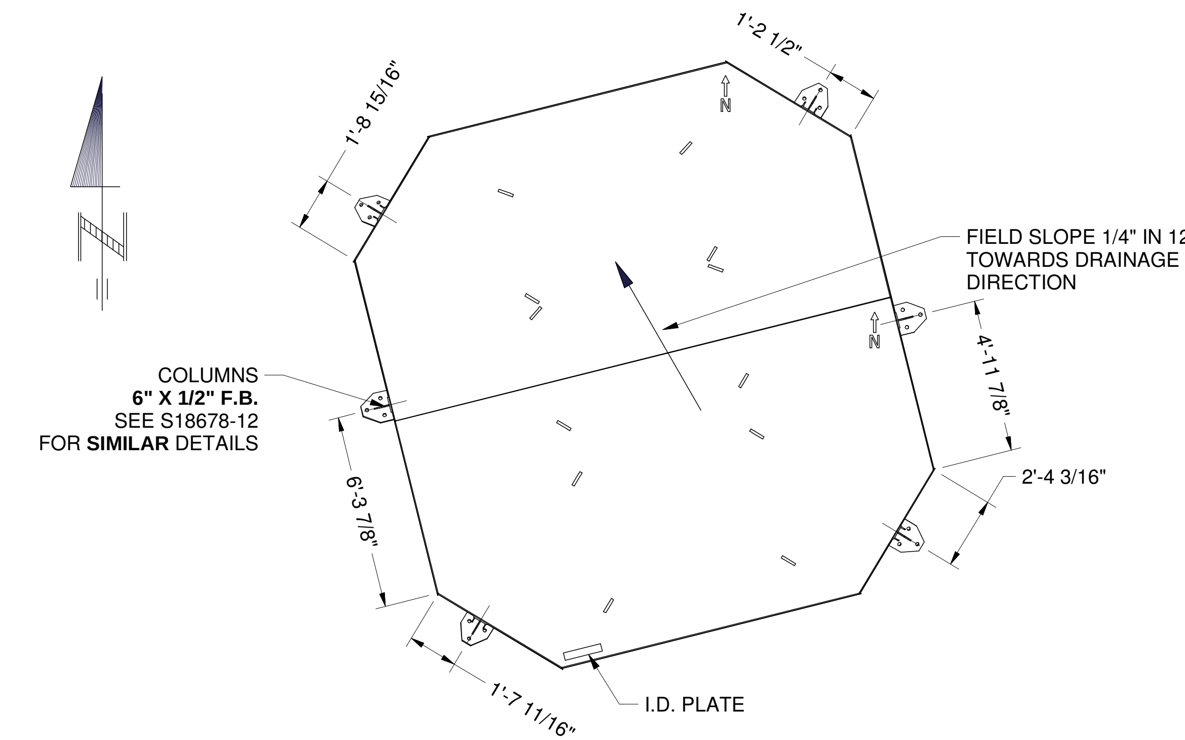
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 7515 LB
5. DO NOT BACK FILL WALLS OF COVER.



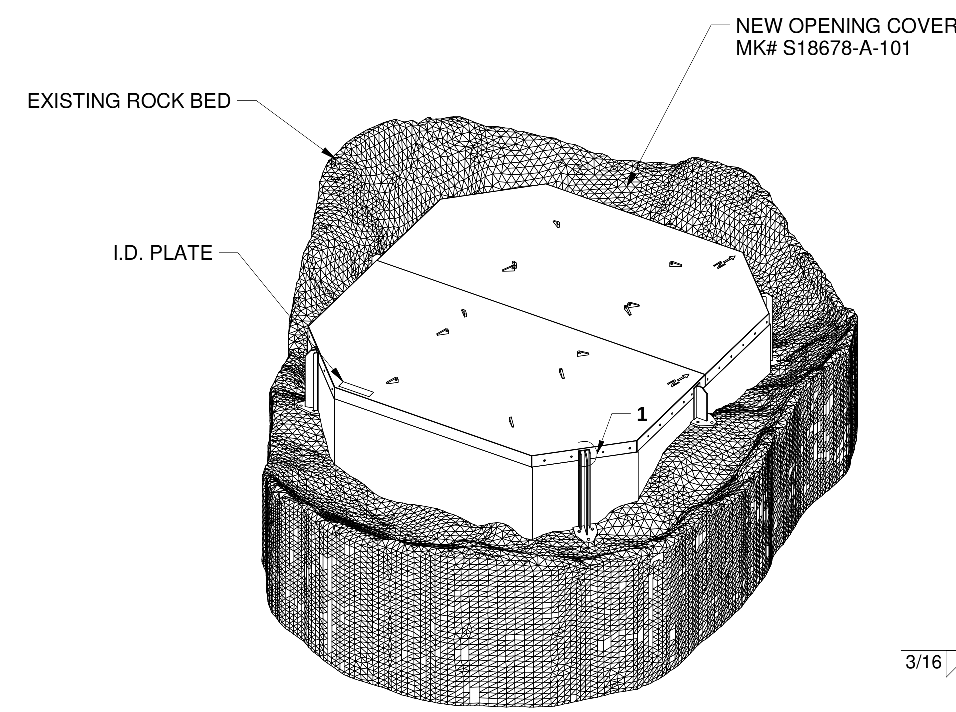

ID PLATE (SUPPLIED BY FABRICATOR)

TO BE SUPPLIED AND INSTALLED BY FABRICATOR

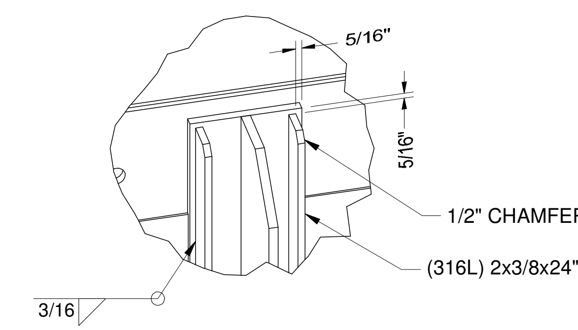
ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 5609 LB
AS INSTALLED: 7515 LB




PLAN VIEW - ACE 2 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST




DETAIL 1
CORNER COLUMNS (4X)



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

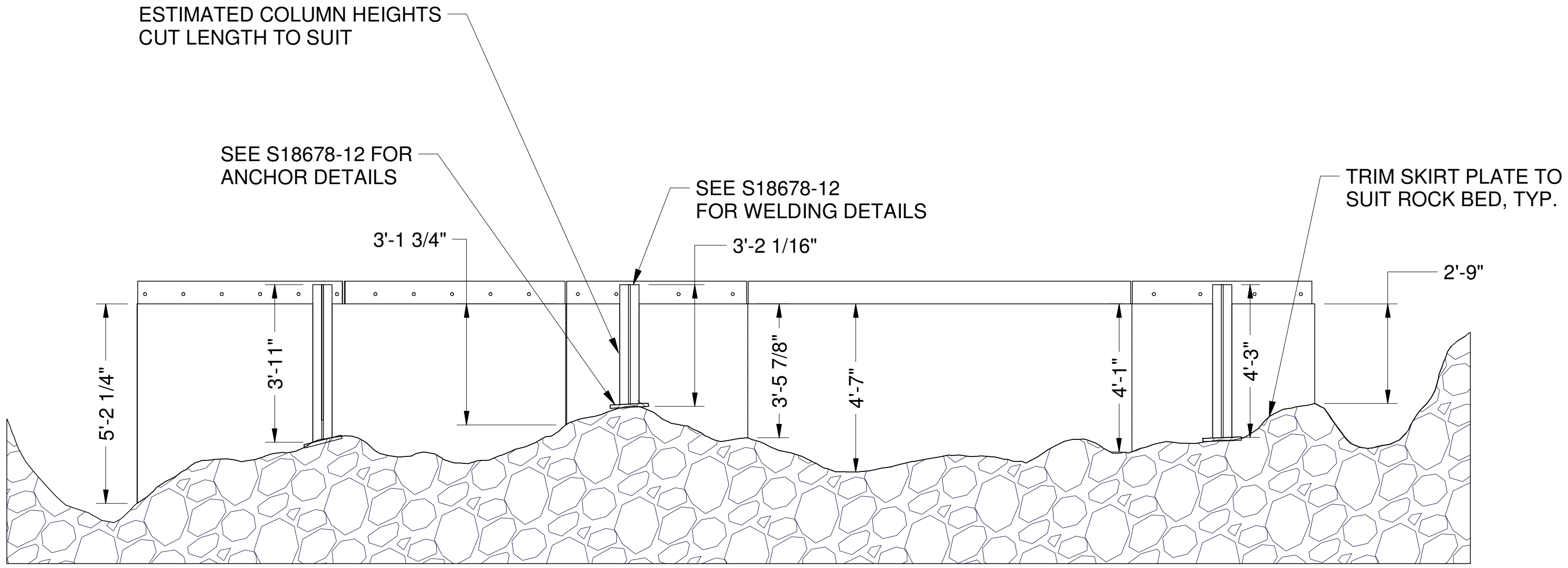
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

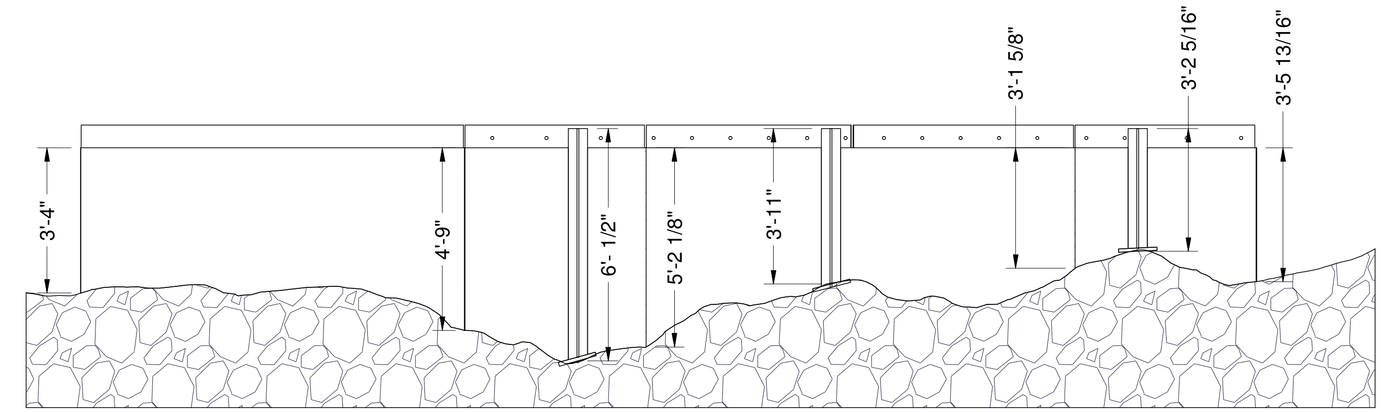
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: S18678-01-1
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

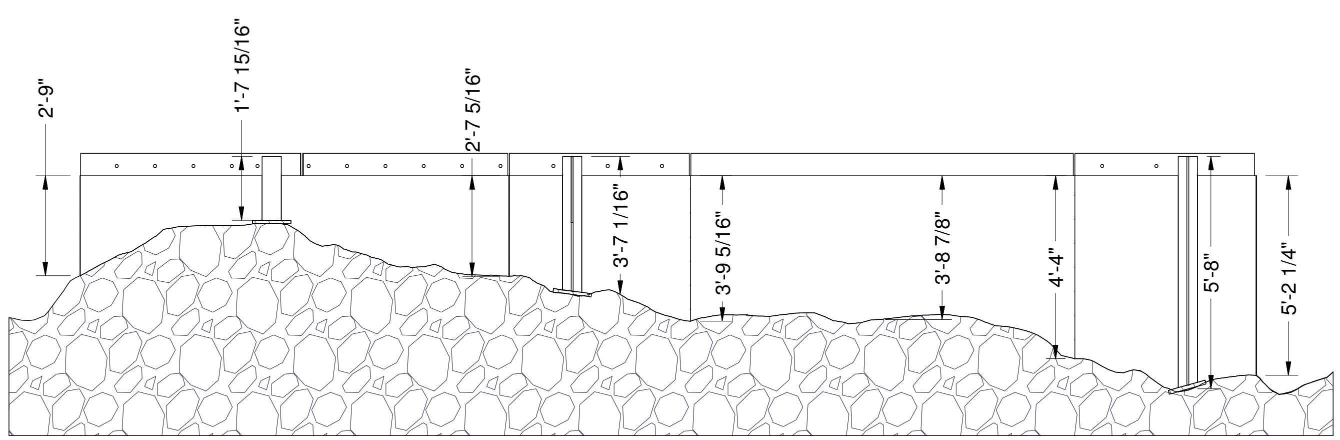
ESTIMATED TOTAL COLUMN LENGTH 270" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



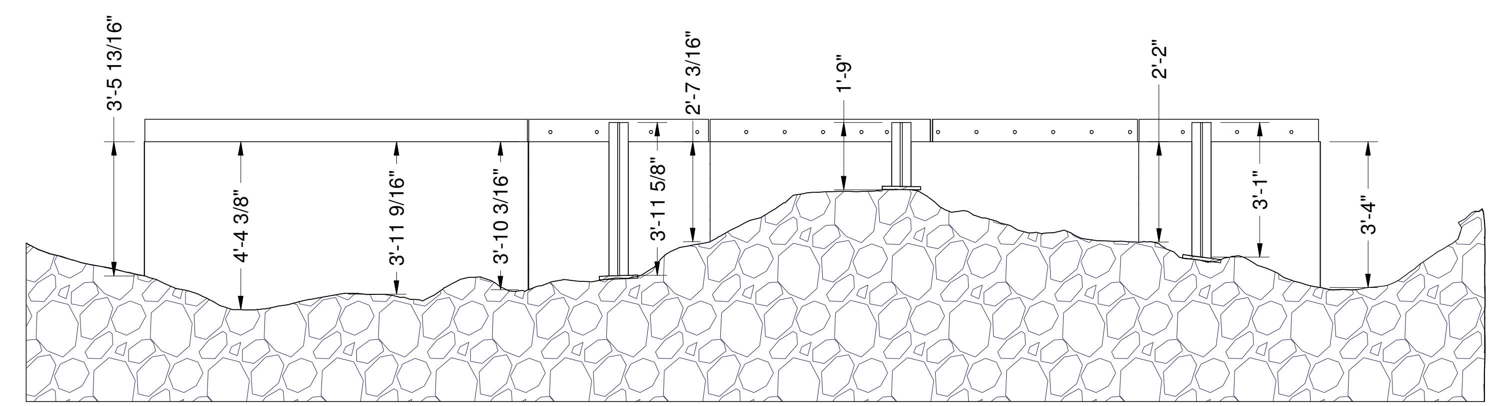

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING EAST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER SASKATCHEWAN — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY)

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

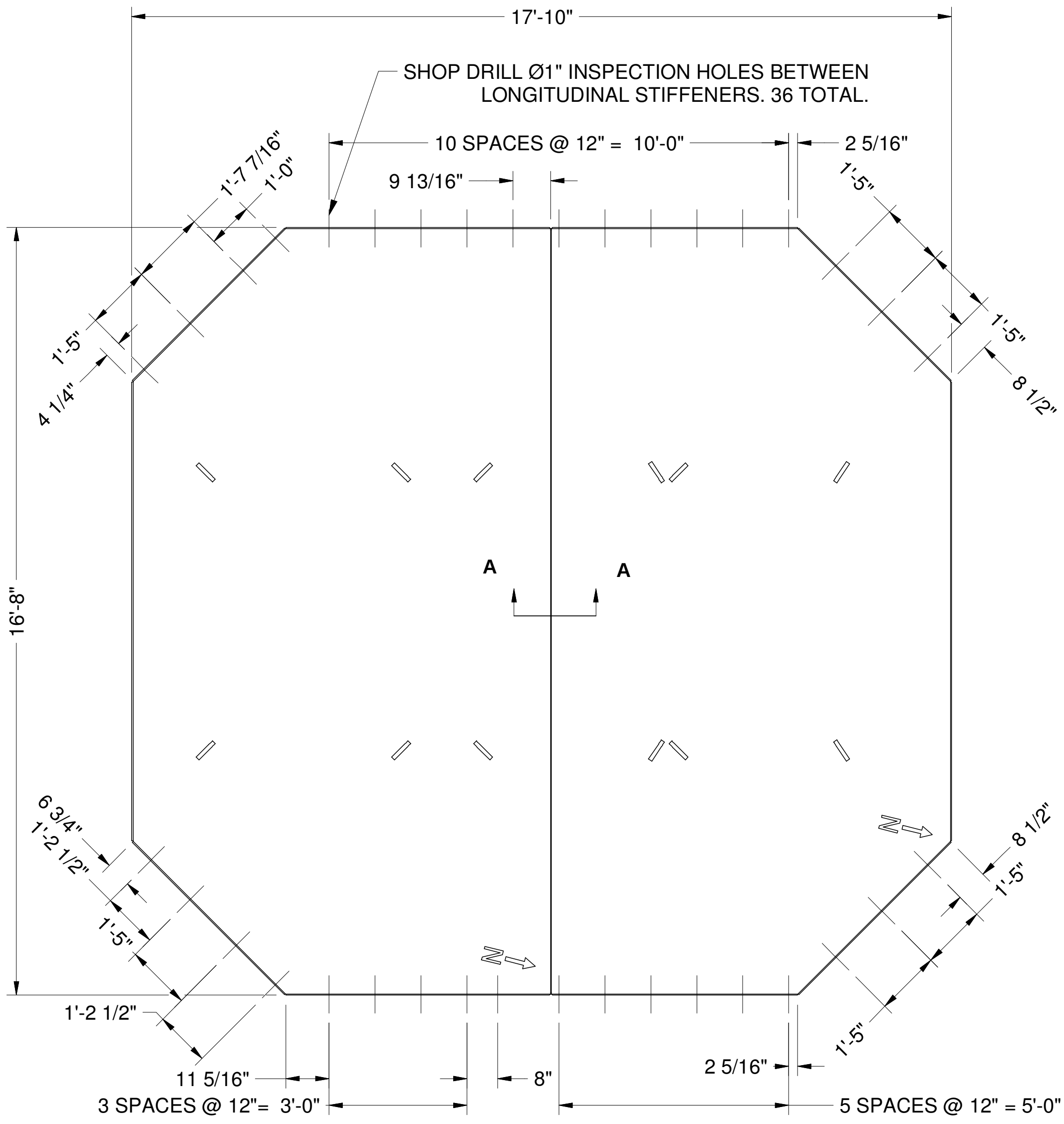
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

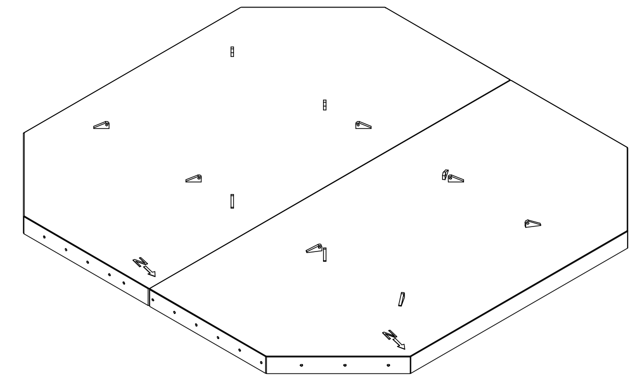
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: S18678-01-2 REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

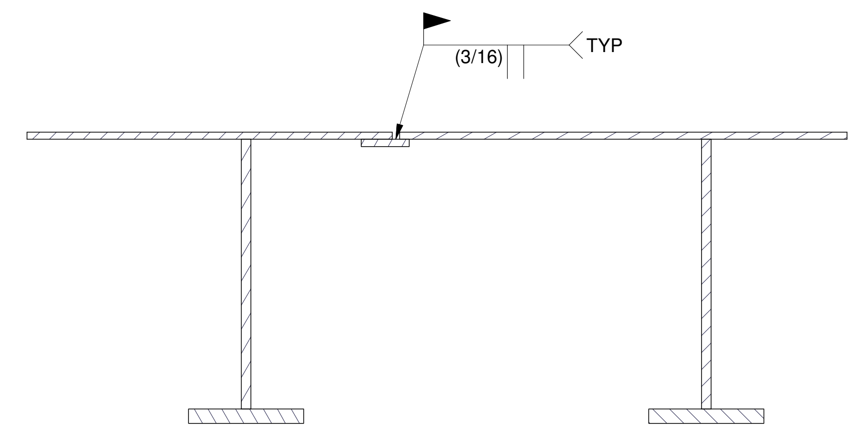
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 4 | 1 | TOP COVER SECTION 1 | S18678-A-103 | | 4 |
| 5 | 1 | TOP COVER SECTION 2 | S18678-A-102 | | 4 |



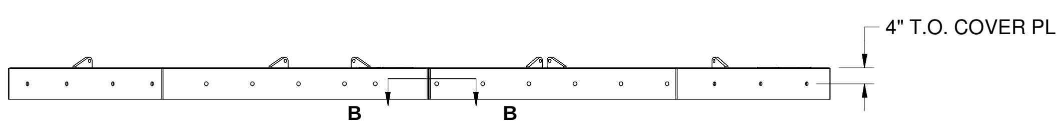

S18678-A-101 - TOP VIEW
TOP PLATE DIMENSIONS



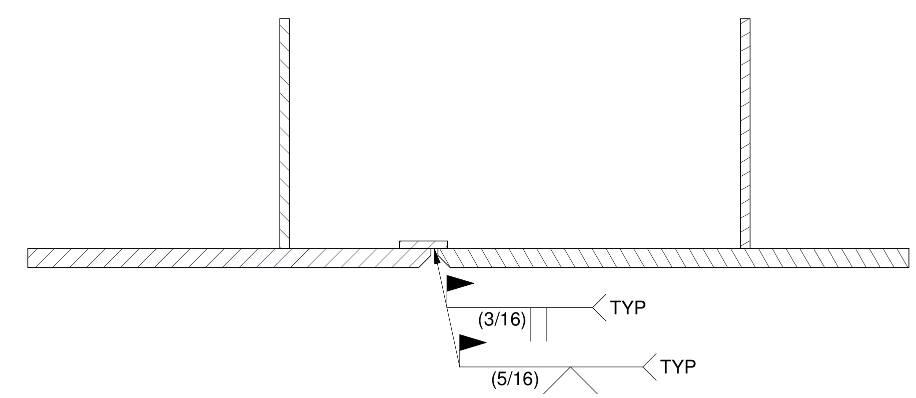
S18678-A-101 - ISO VIEW




SECTION A-A




SIDE VIEW




SECTION B-B



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

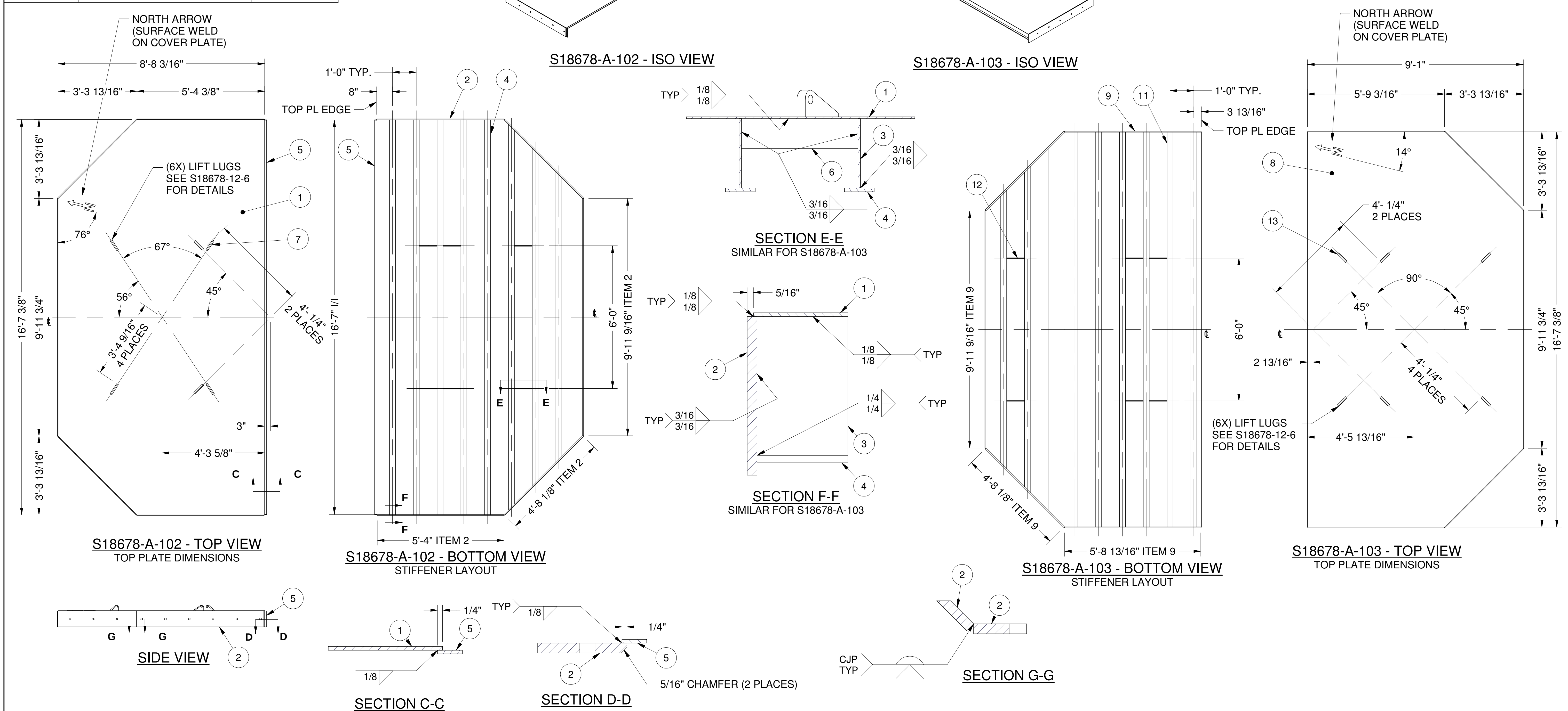
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING
TOP COVER DETAILS
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: S18678-01-3
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 3/16" PL | ASTM 1240-316L |
| 2 | | 8"x1/2" FB | ASTM 1240-316L |
| 3 | | 7"x1/4" FB | ASTM 1240-316L |
| 4 | | 3"x3/8" FB | ASTM 1240-316L |
| 5 | | 1 1/4"x1/4" FB | ASTM 1240-316L |
| 6 | 6 | 3"x3/8" FB | ASTM 1240-316L |
| 7 | 6 | 5/8" PL | ASTM 1240-316L |

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 8 | 1 | 3/16" PL | ASTM 1240-316L |
| 9 | | 8"x1/2" FB | ASTM 1240-316L |
| 10 | | 7"x1/4" FB | ASTM 1240-316L |
| 11 | | 3"x3/8" FB | ASTM 1240-316L |
| 12 | 6 | 3"x3/8" FB | ASTM 1240-316L |
| 13 | 6 | 5/8" PL | ASTM 1240-316L |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY) — SASKATCHEWAN

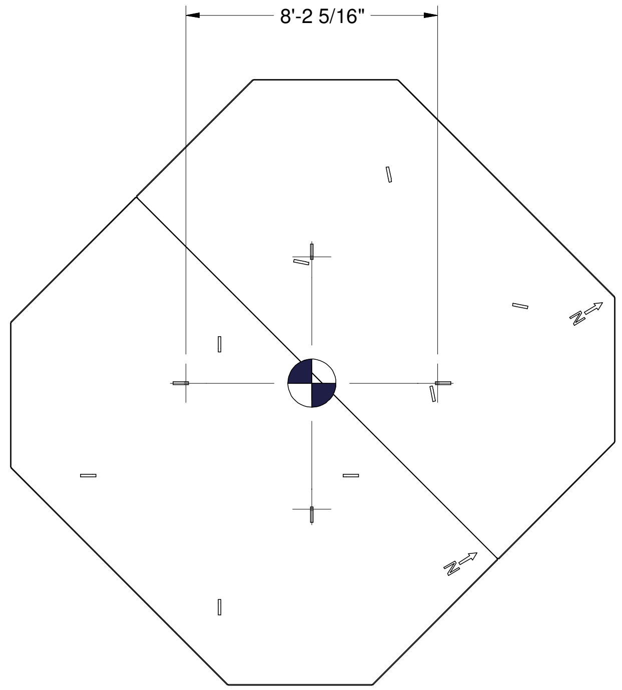
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

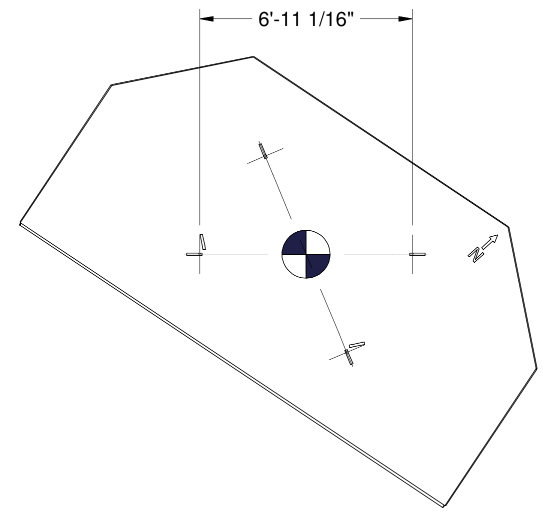
**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING
TOP COVER SECTIONS
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 6
DWG. NO.: S18678-01-4 — REV 2

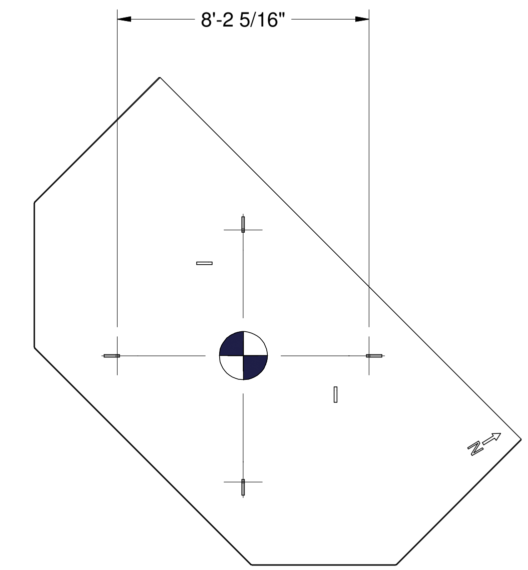
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



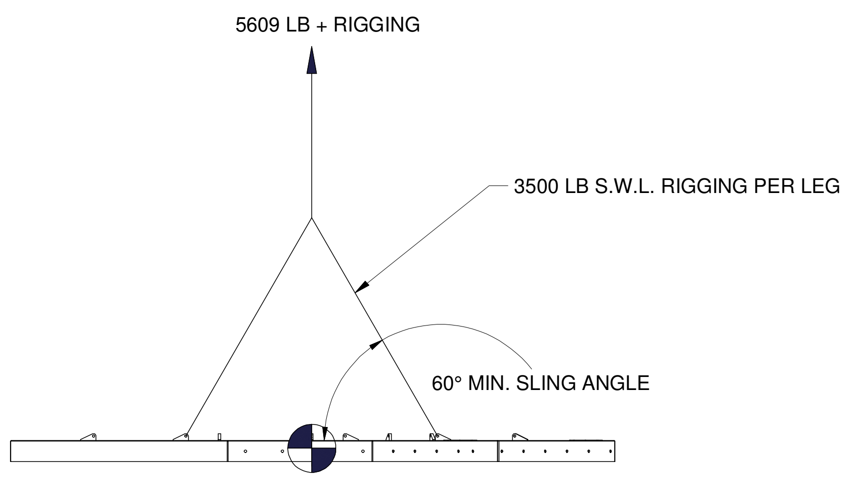

TOP COVER LIFTING DIAGRAM
S18678-A-101



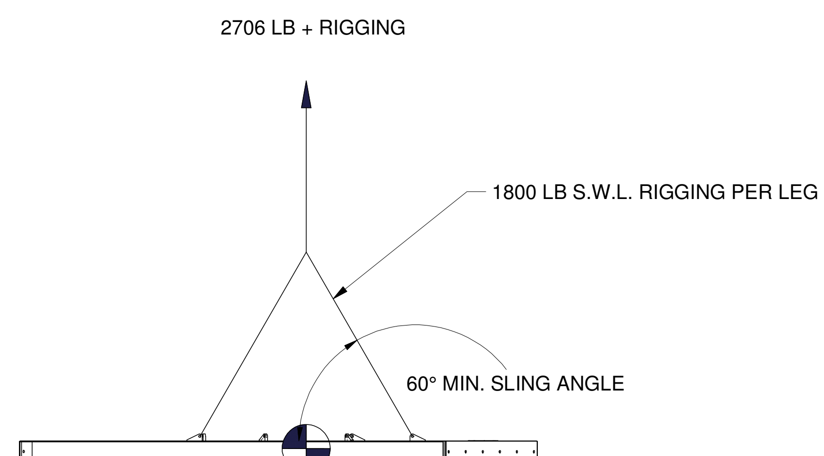

TOP COVER LIFTING DIAGRAM
S18678-A-102



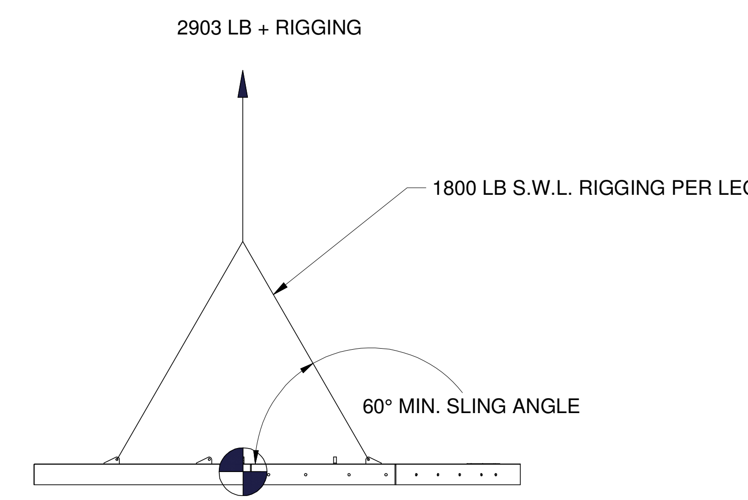

TOP COVER LIFTING DIAGRAM
S18678-A-103




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-101




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-102




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-103



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

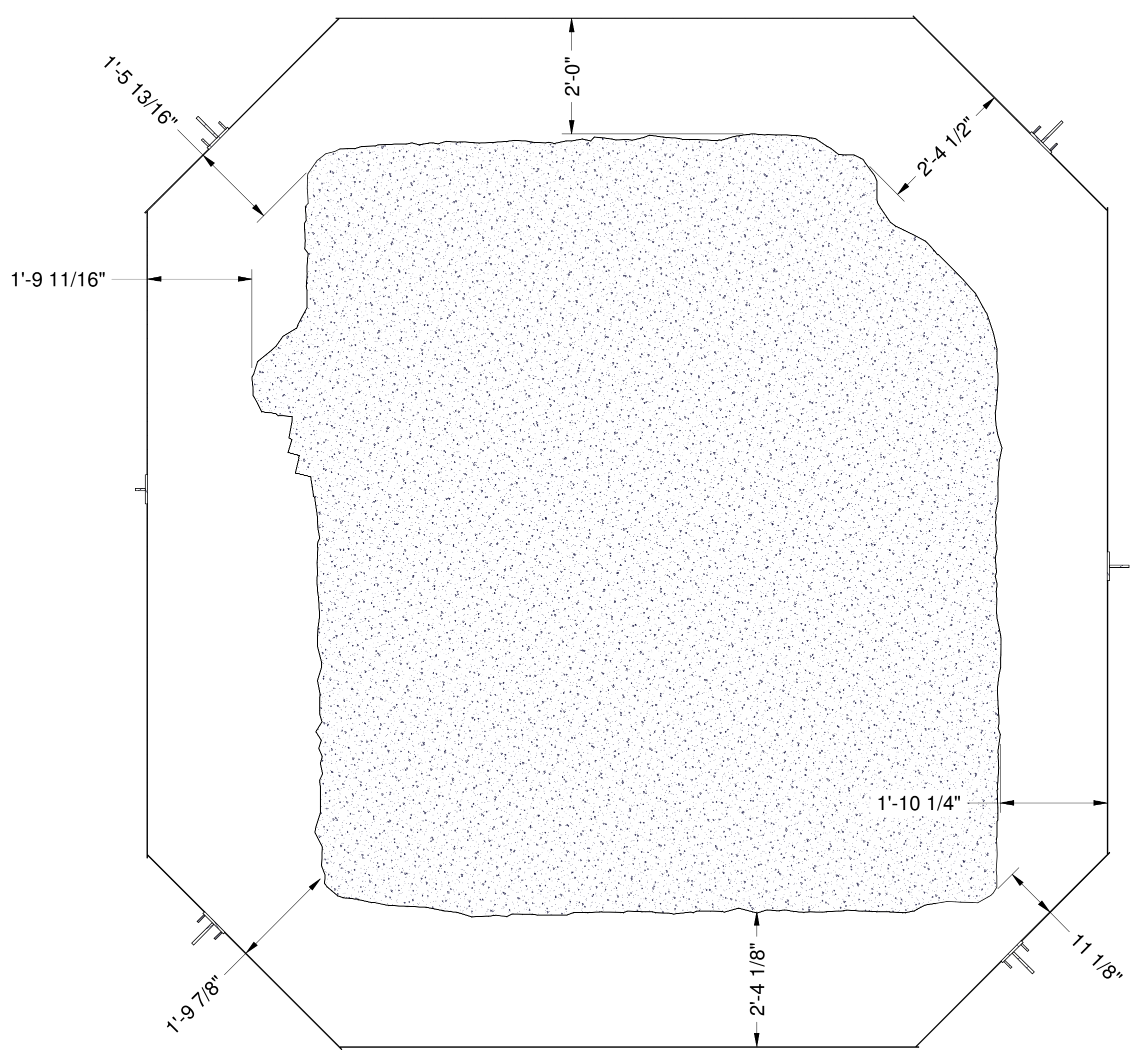
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

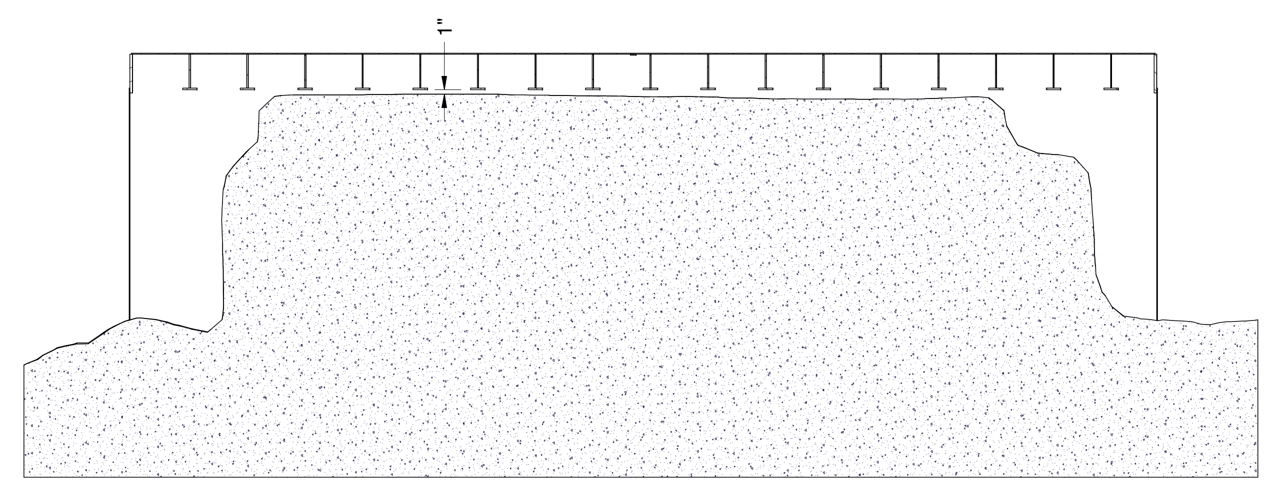
## Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING
LIFTING DETAILS
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: S18678-01-5
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 2 OPENING CLEARANCES
LOCATION: 59°33'35.0"N 108°27'47.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: S18678-01-6
2

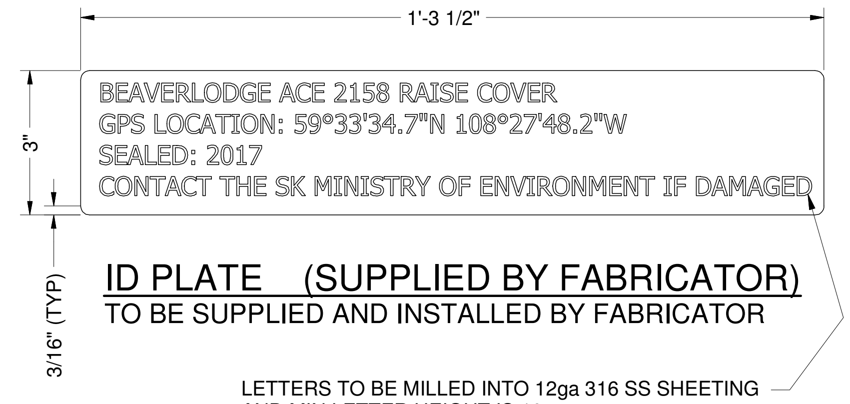
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## ACE 3 – 2158 Raise

ACE 3 – 2158 Raise

GENERAL NOTES:
1. ALL STRUCTURAL PLATE MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

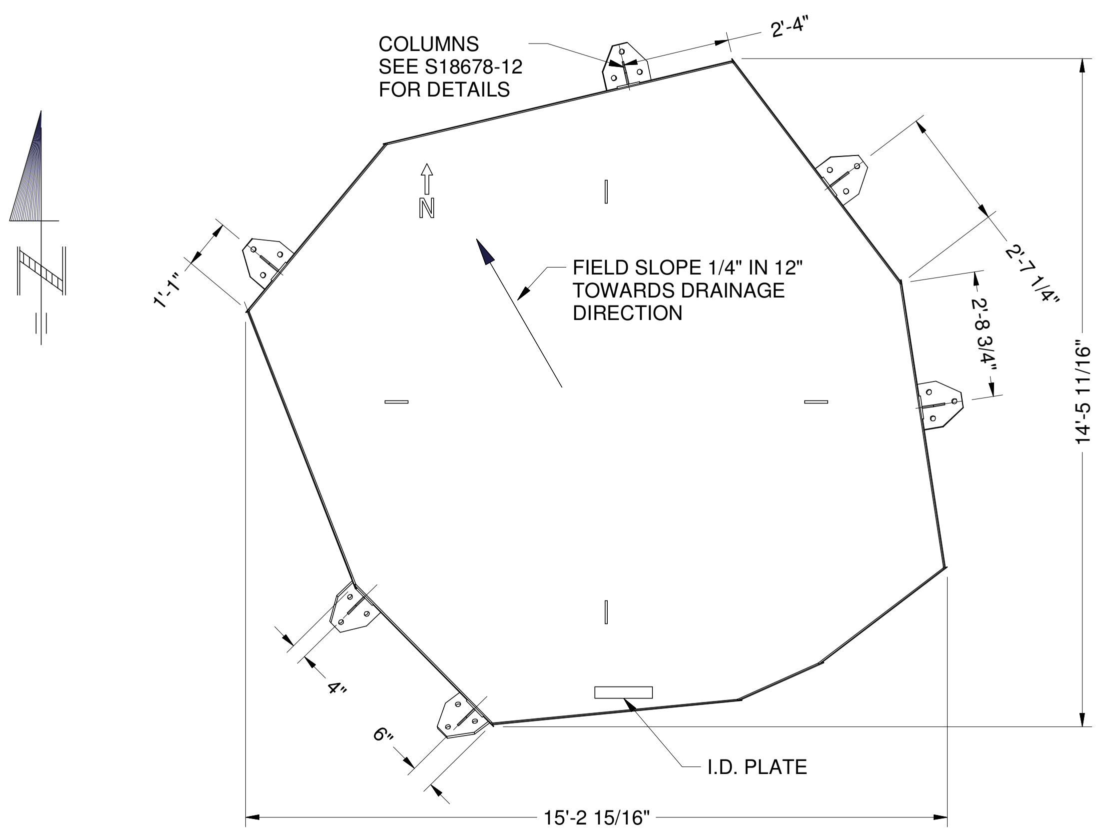
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 5796 LB
5. DO NOT BACK FILL WALLS OF COVER.



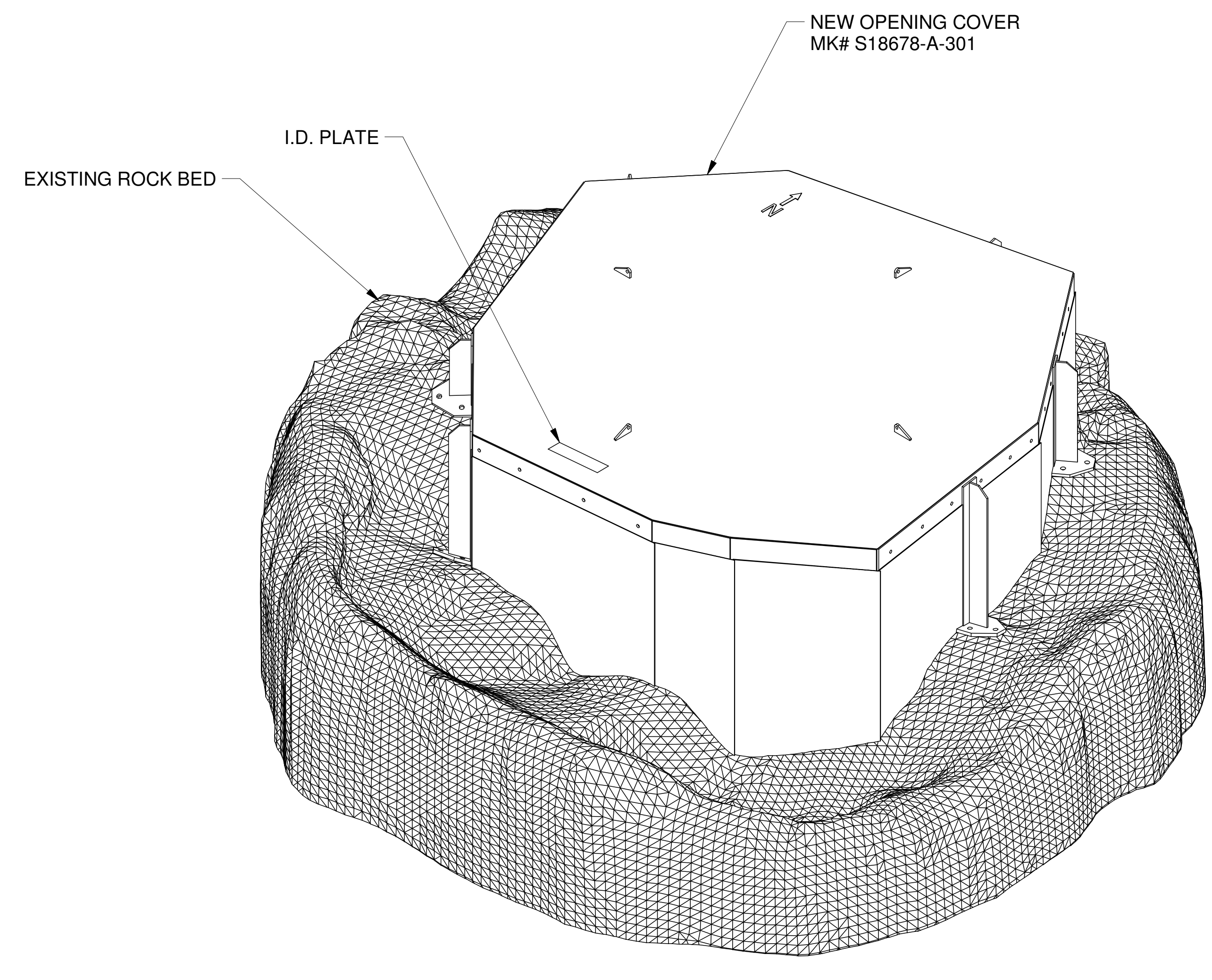

ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 4285 LB
AS INSTALLED: 5796 LB




PLAN VIEW - ACE 3 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BULT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

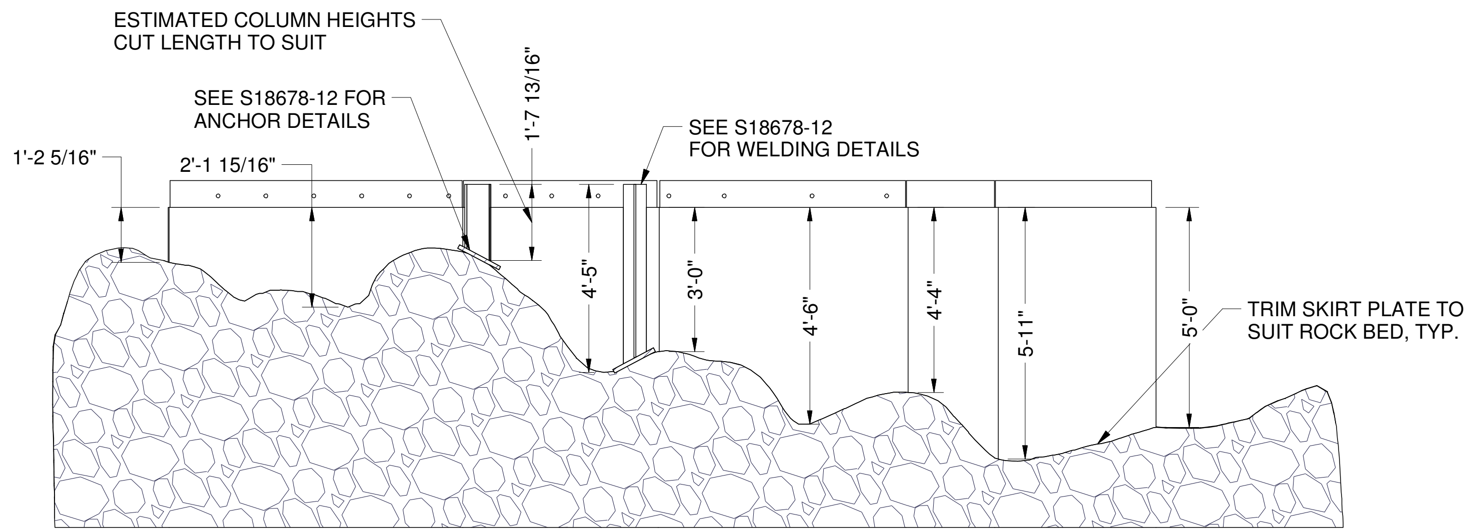
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

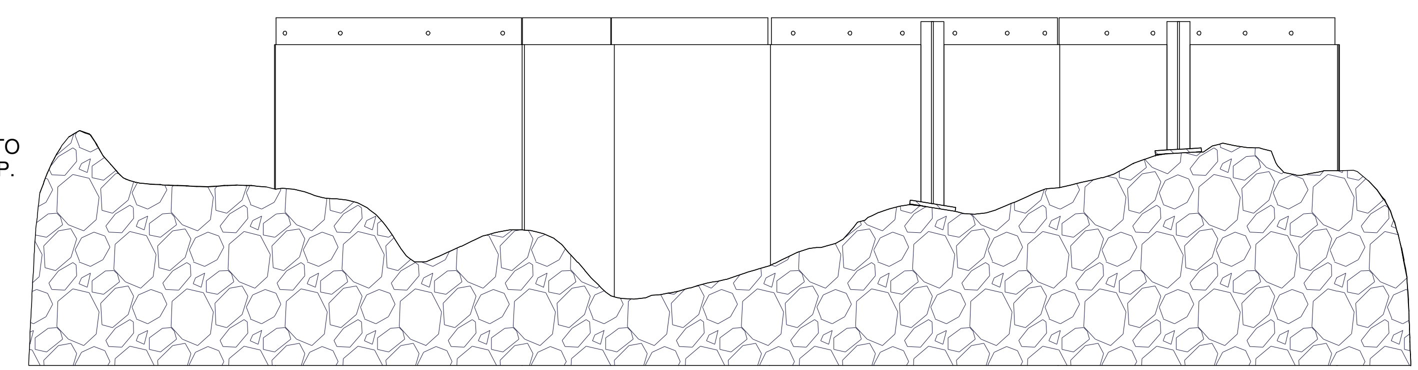
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: S18678-03-1
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

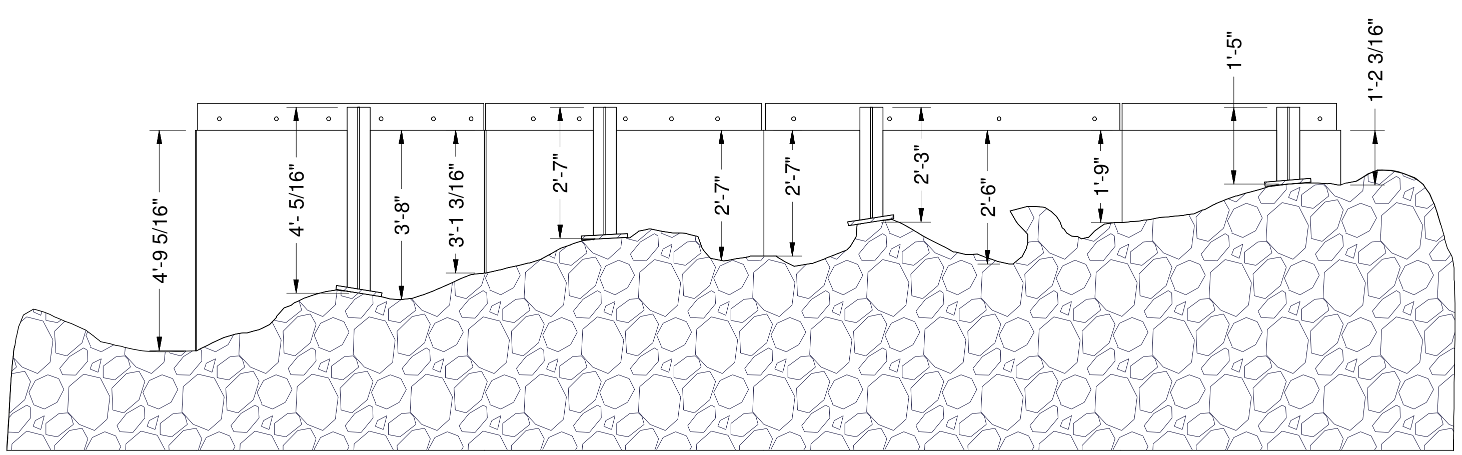
ESTIMATED TOTAL COLUMN LENGTH 196" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE
OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



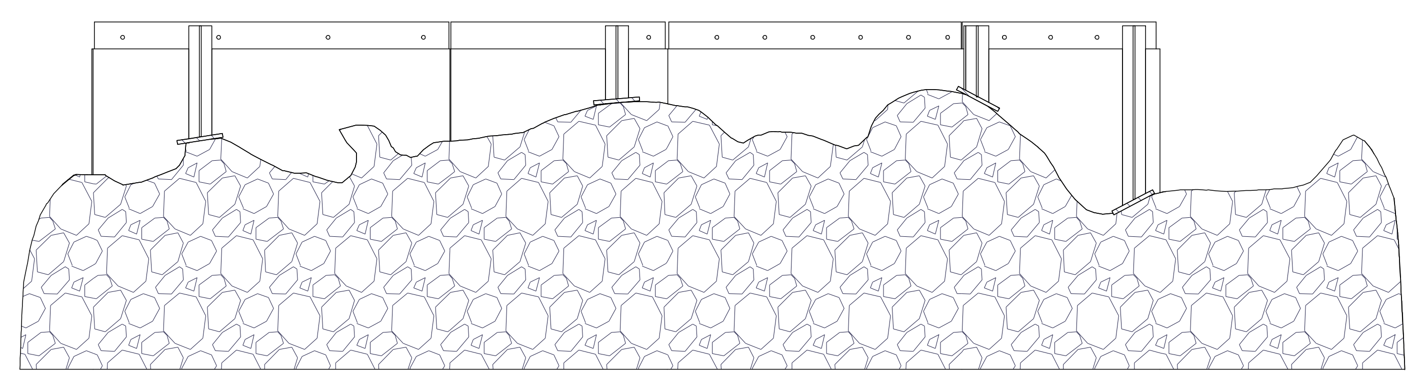

ELEVATION - LOOKING NORTH



ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH



ELEVATION - LOOKING EAST

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BULT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

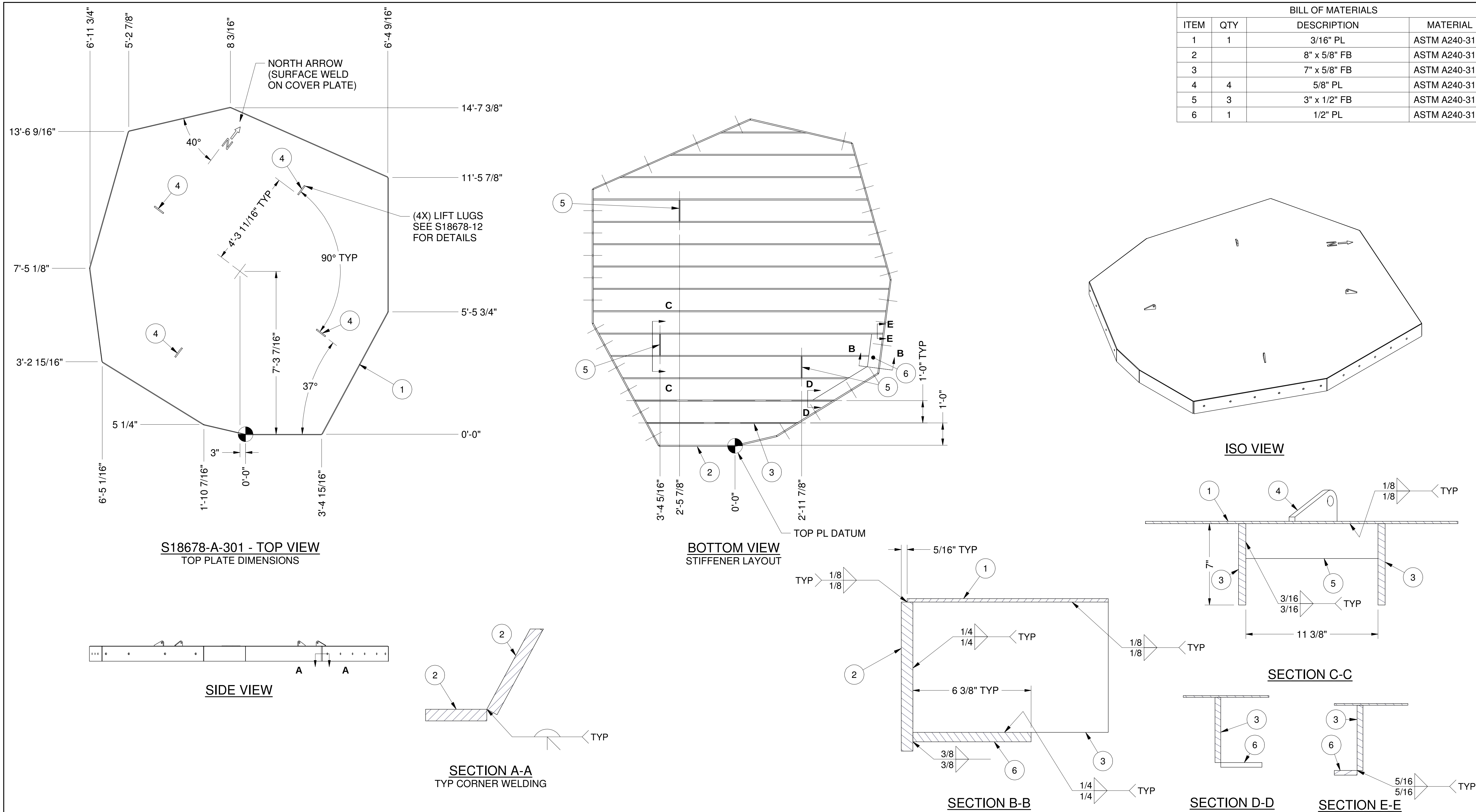
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: S18678-03-2
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 3/16" PL | ASTM A240-316L |
| 2 | | 8" x 5/8" FB | ASTM A240-316L |
| 3 | | 7" x 5/8" FB | ASTM A240-316L |
| 4 | 4 | 5/8" PL | ASTM A240-316L |
| 5 | 3 | 3" x 1/2" FB | ASTM A240-316L |
| 6 | 1 | 1/2" PL | ASTM A240-316L |

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BULT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — SASKATCHEWAN — 17 10 31 (YR. MN DAY)

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

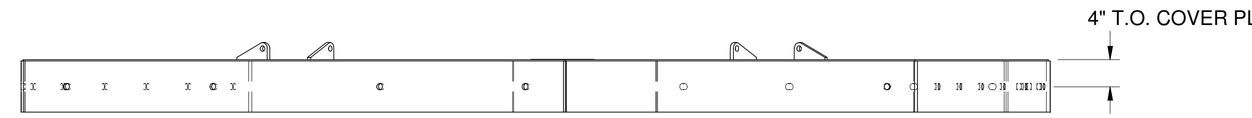
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

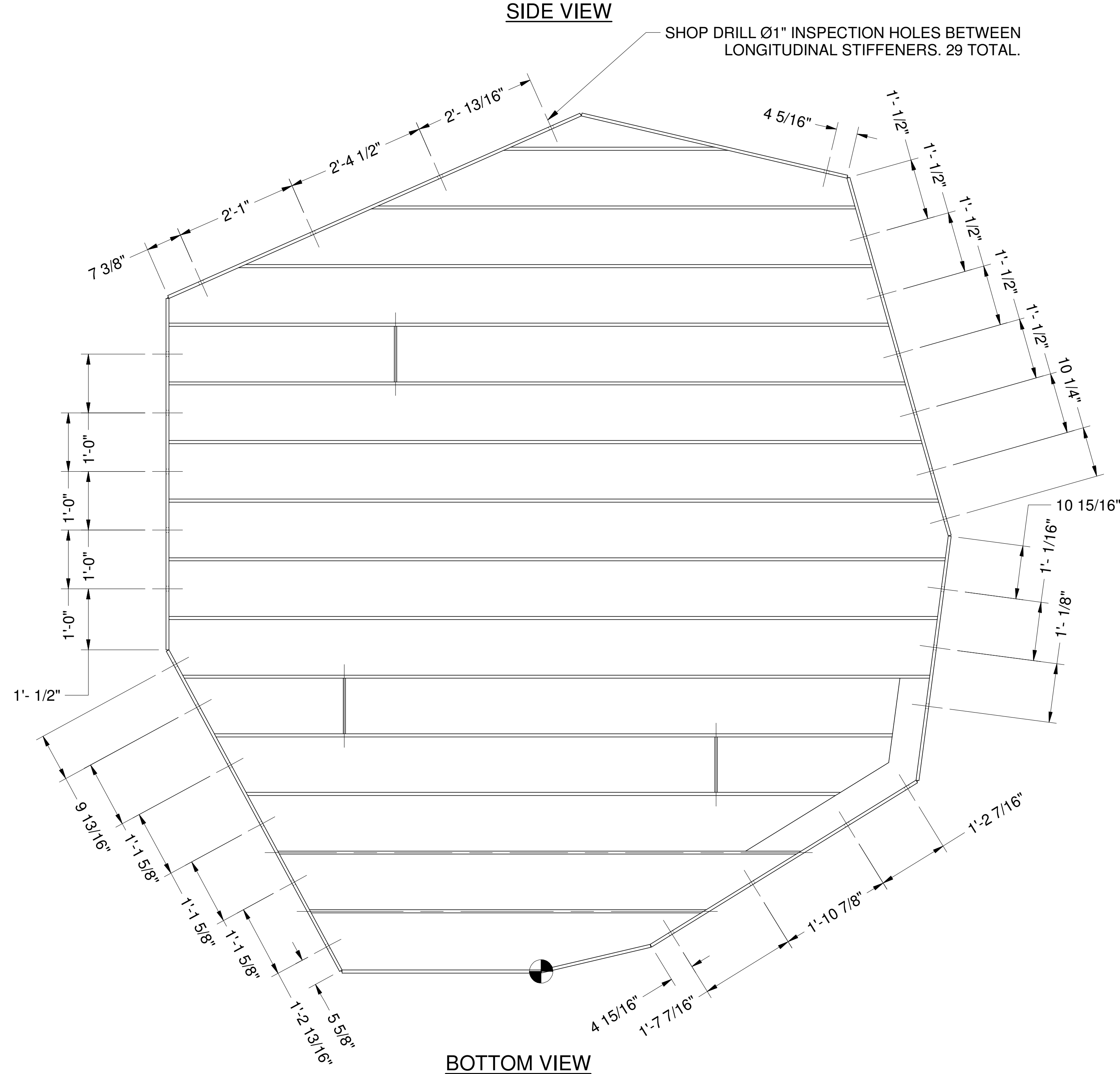
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING
TOP COVER DETAILS
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: S18678-03-3
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




## SIDE VIEW




## BOTTOM VIEW

INSPECTION HOLE LAYOUT





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BULT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

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|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

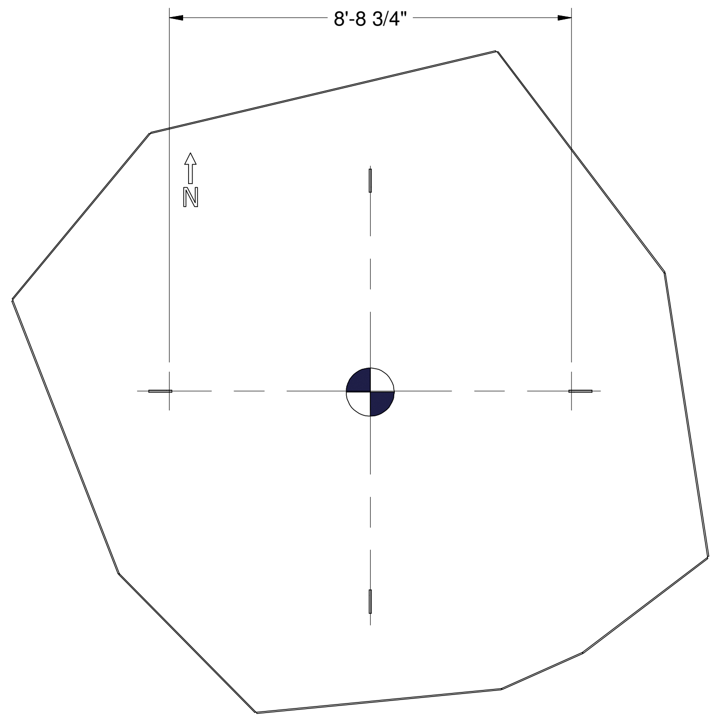
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING
INSPECTION HOLE LOCATIONS
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS

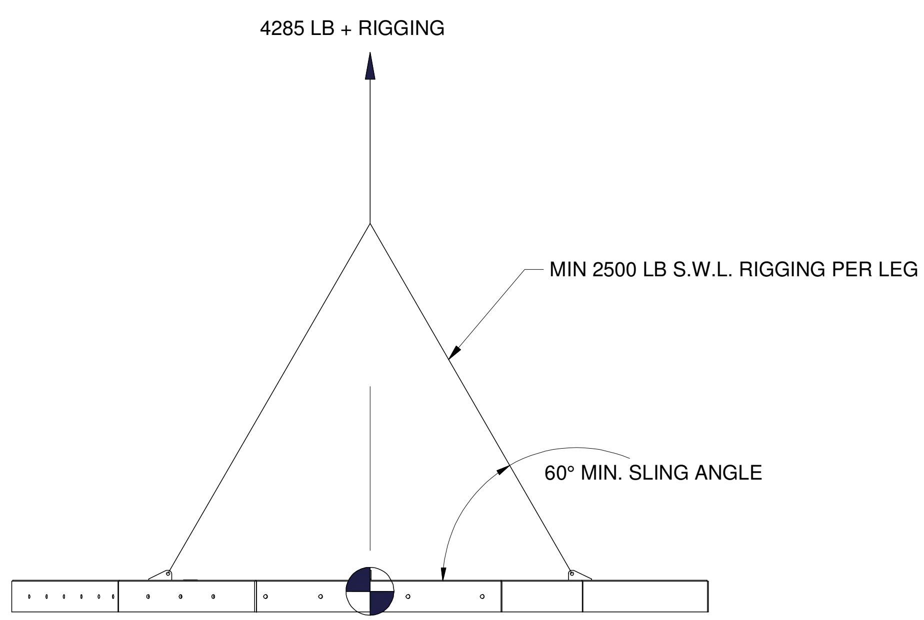
SHEET NO.: 4 OF 6

DWG. NO.: S18678-03-4 — 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BULT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
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ANGULAR DIMS: ± 1 deg.
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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

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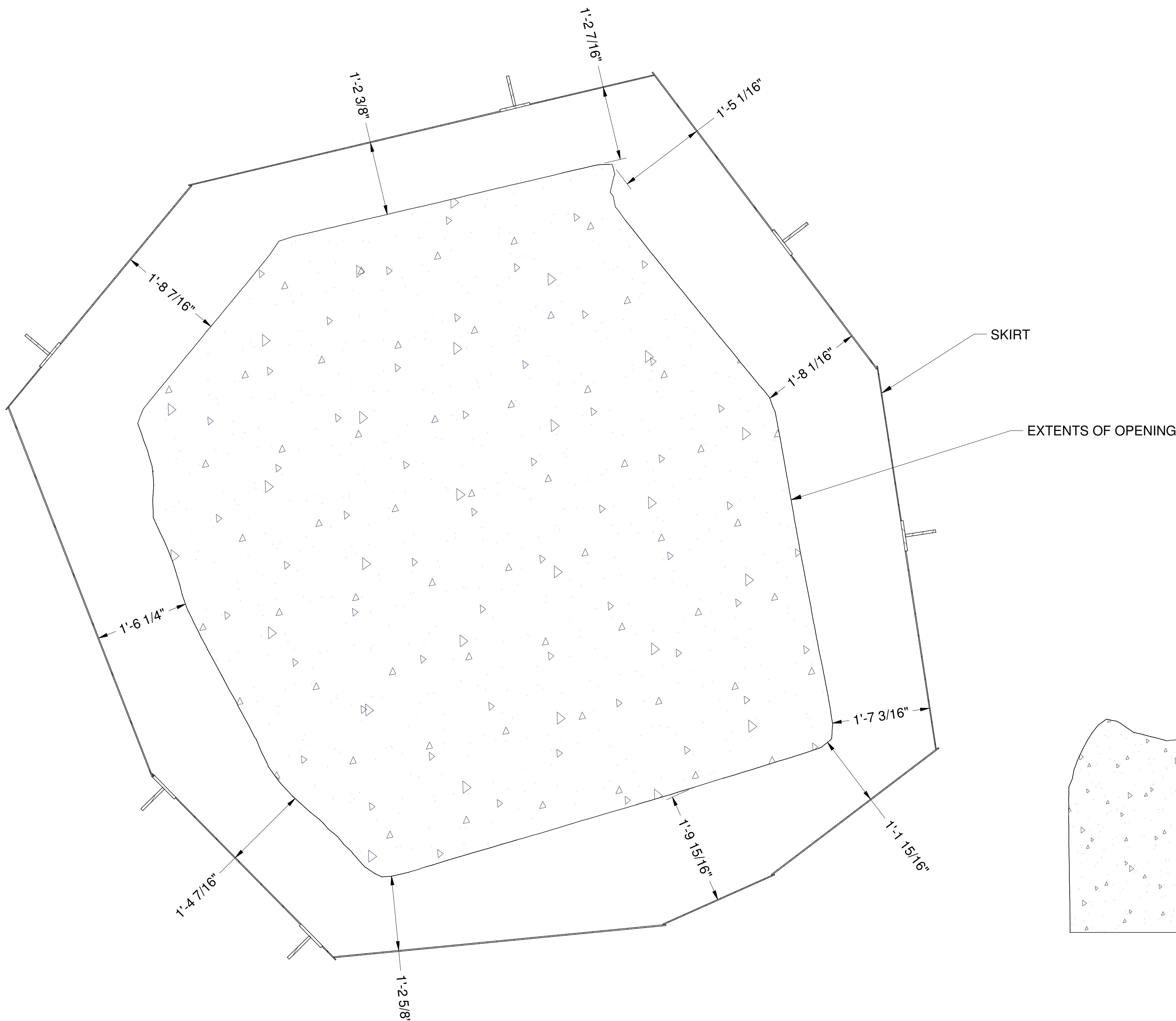
| Structural | 14318 | |

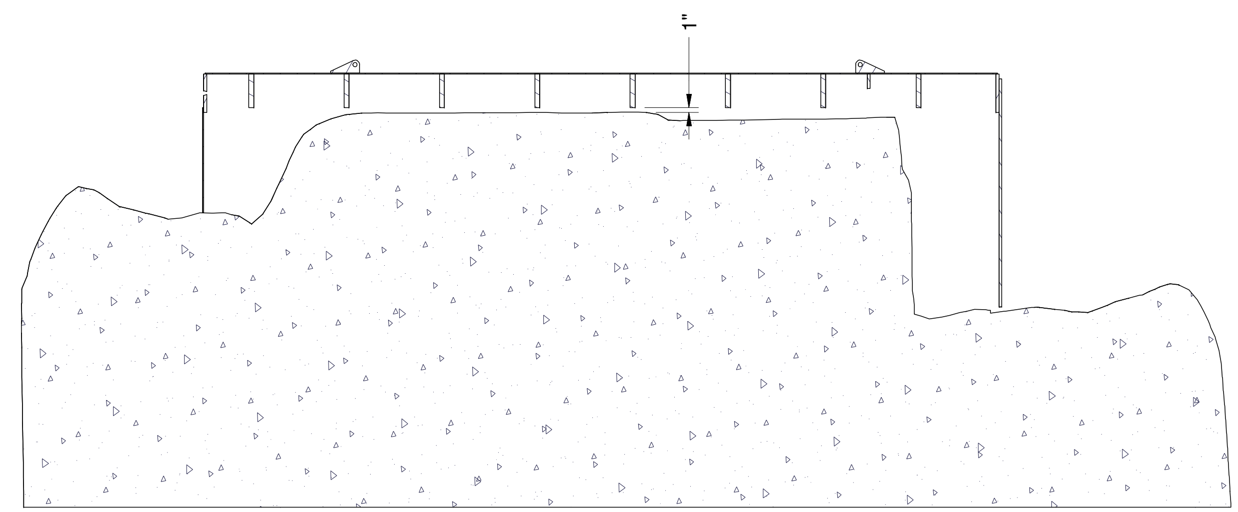
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING
LIFTING DETAILS
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-03-5 REV 2
SHEET NO.: 5 OF 6

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



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ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

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| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

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Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 3 OPENING CLEARANCES
LOCATION: 59°33'34.7"N 108°27'48.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: S18678-03-6
2

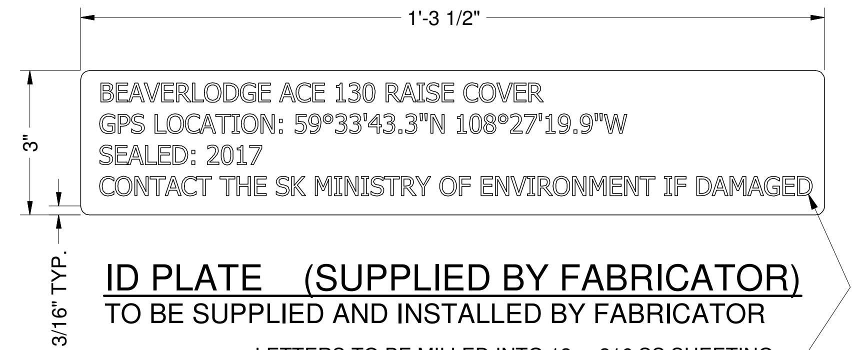
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# ACE 4 – 130 Raise

ACE 4 – 130 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 4,810 LB
5. DO NOT BACK FILL WALLS OF COVER.

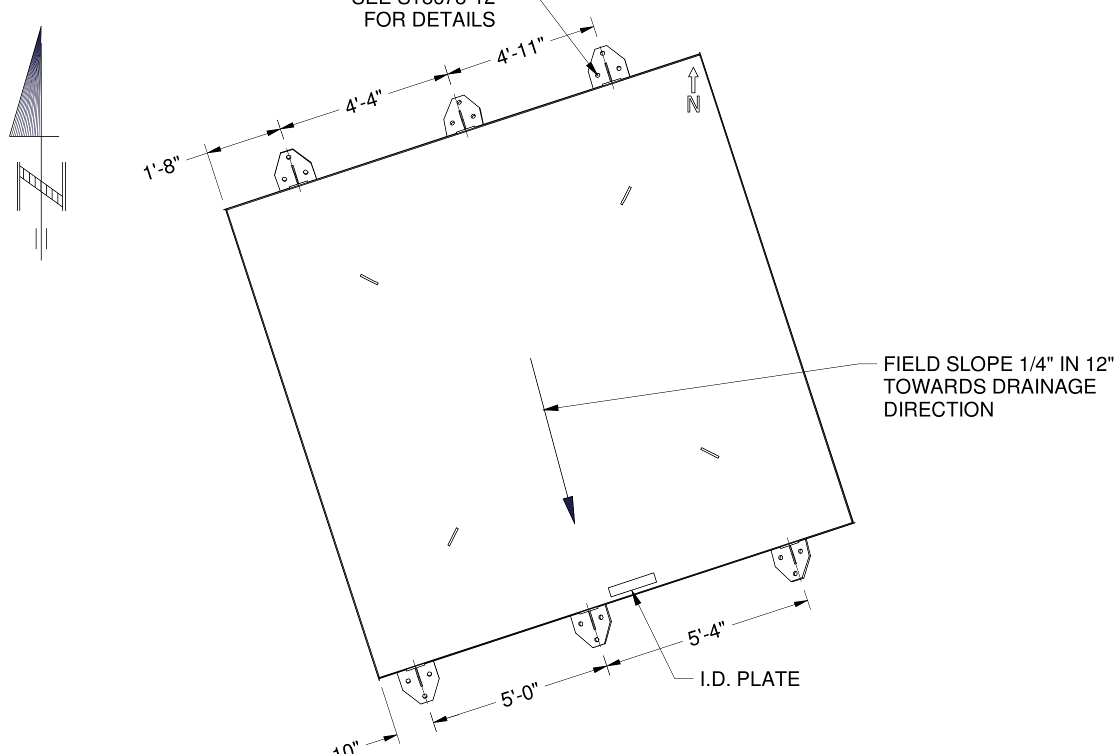



ID PLATE (SUPPLIED BY FABRICATOR)

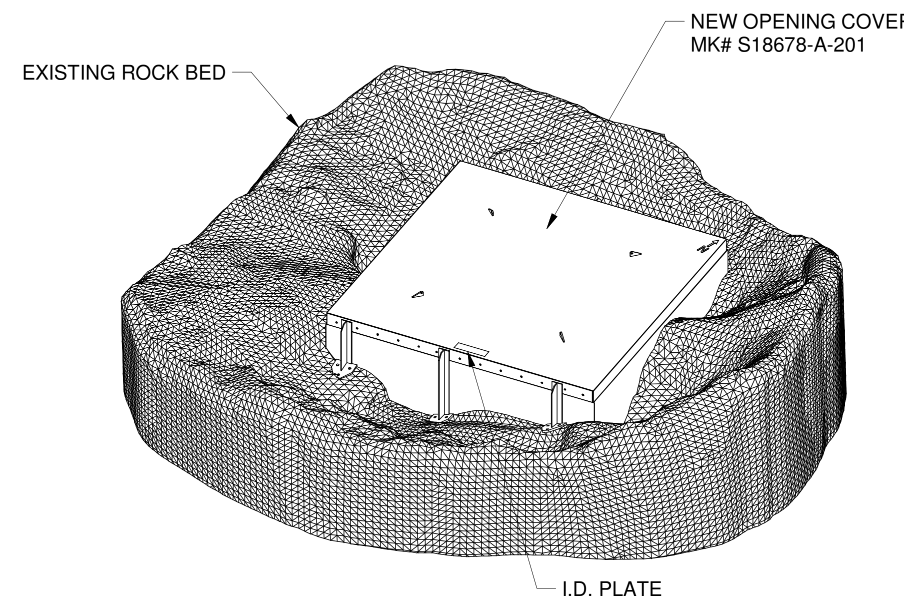
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 3,805 LB
AS INSTALLED: 4,810 LB




PLAN - ACE 4 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
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| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

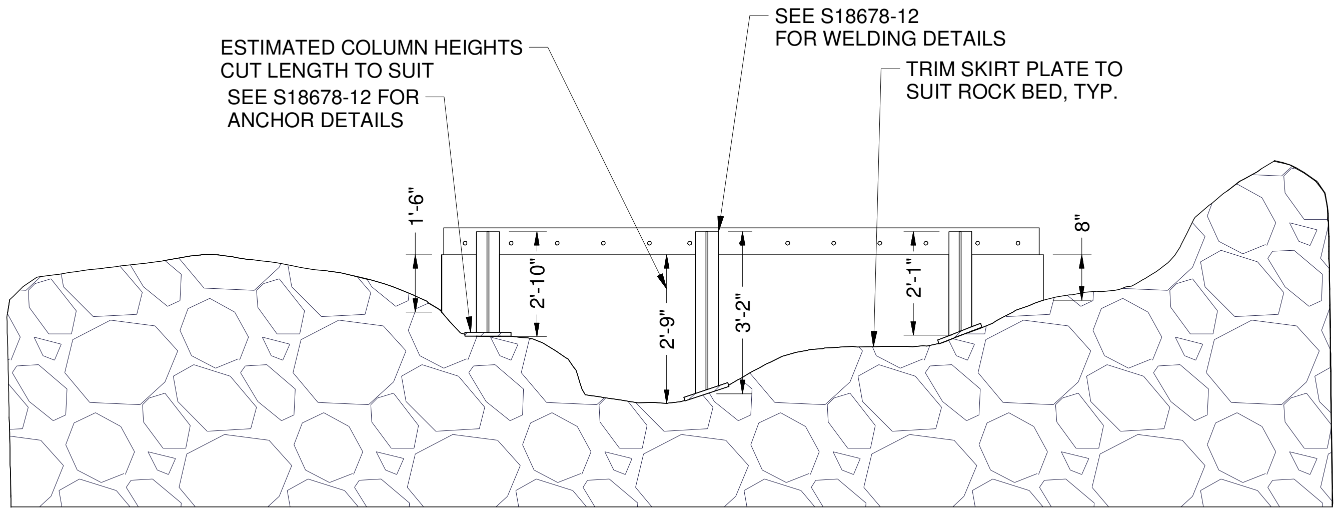
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 4 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'43.3"N 108°27'19.9"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

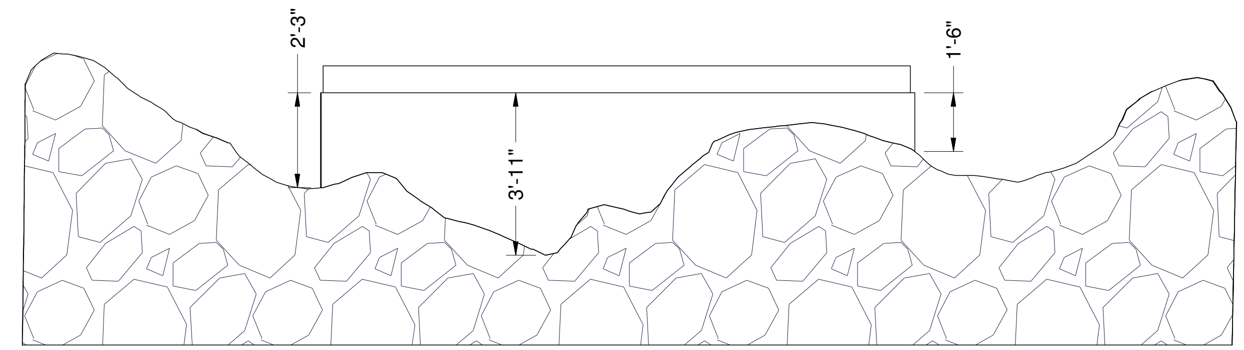
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 5
DWG. NO.: S18678-02-1
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

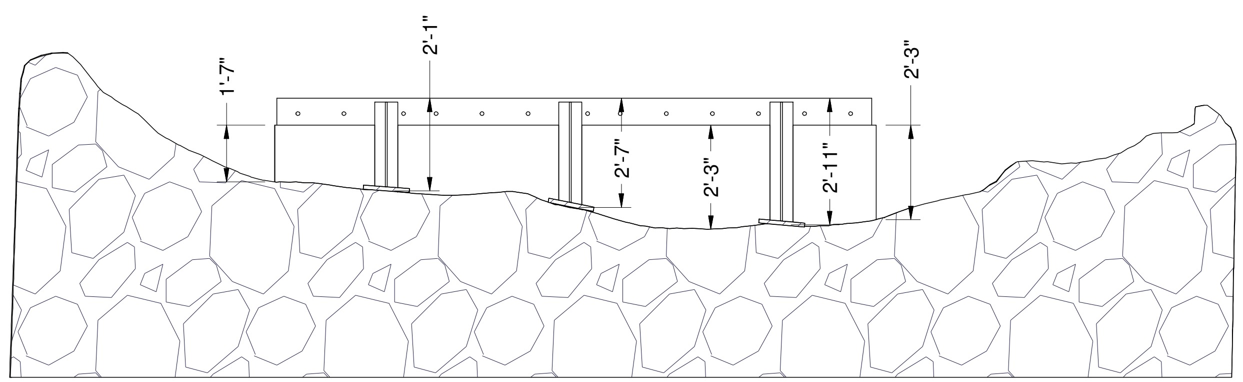
ESTIMATED TOTAL COLUMN LENGTH 182" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



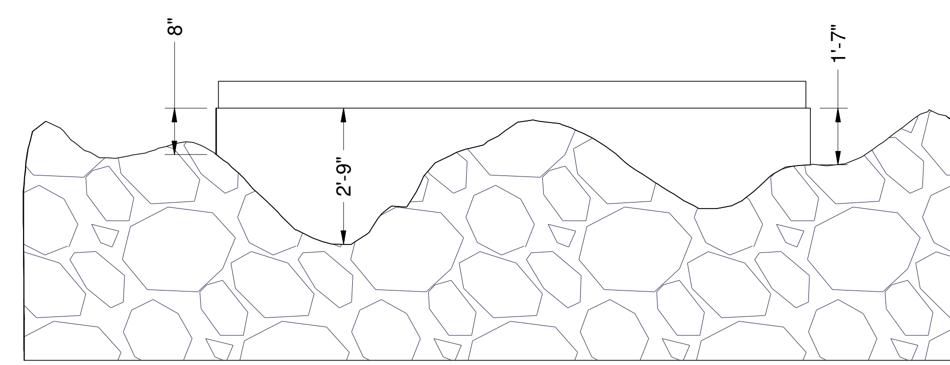

ELEVATION - LOOKING NORTH-WEST




ELEVATION - LOOKING NORTH-EAST




ELEVATION - LOOKING SOUTH-EAST




ELEVATION - LOOKING SOUTH-WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
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| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
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Kova Engineering (Saskatchewan) Ltd.
Number C672
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| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

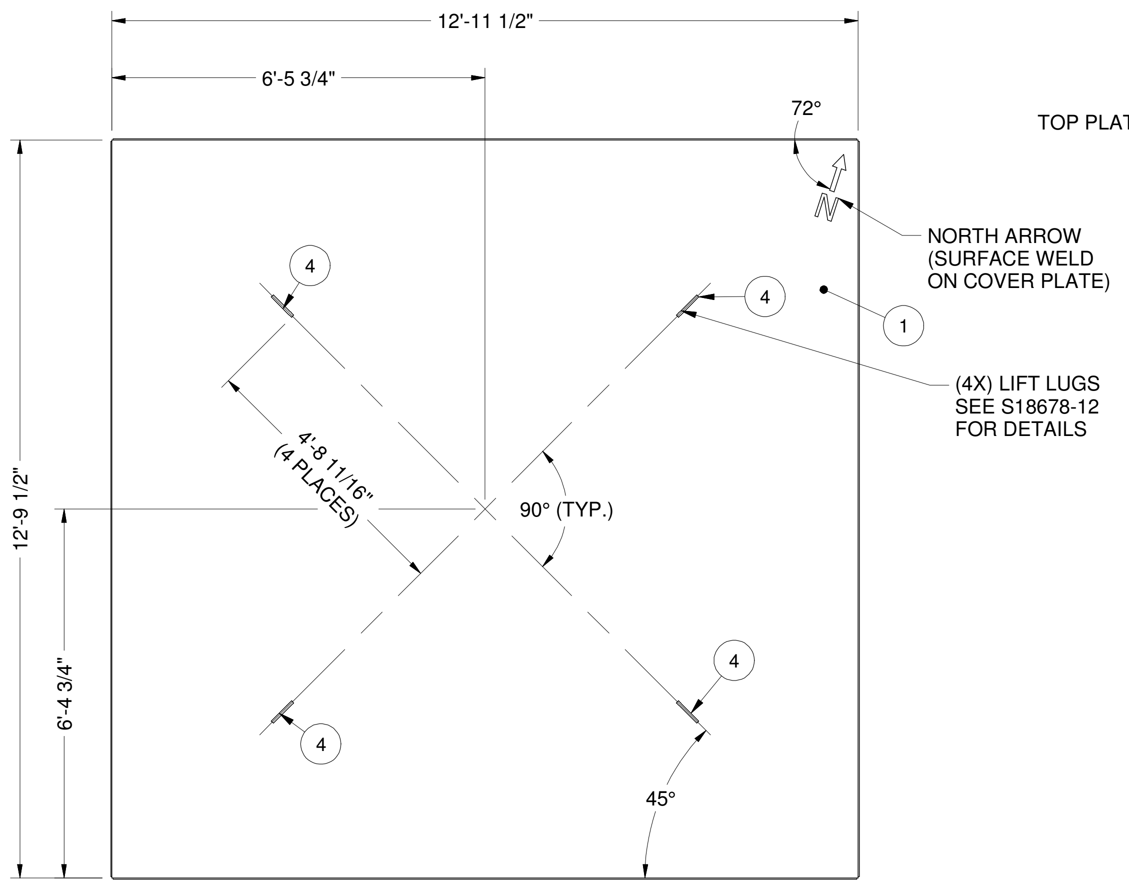
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 4 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°33'43.3"N 108°27'19.9"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

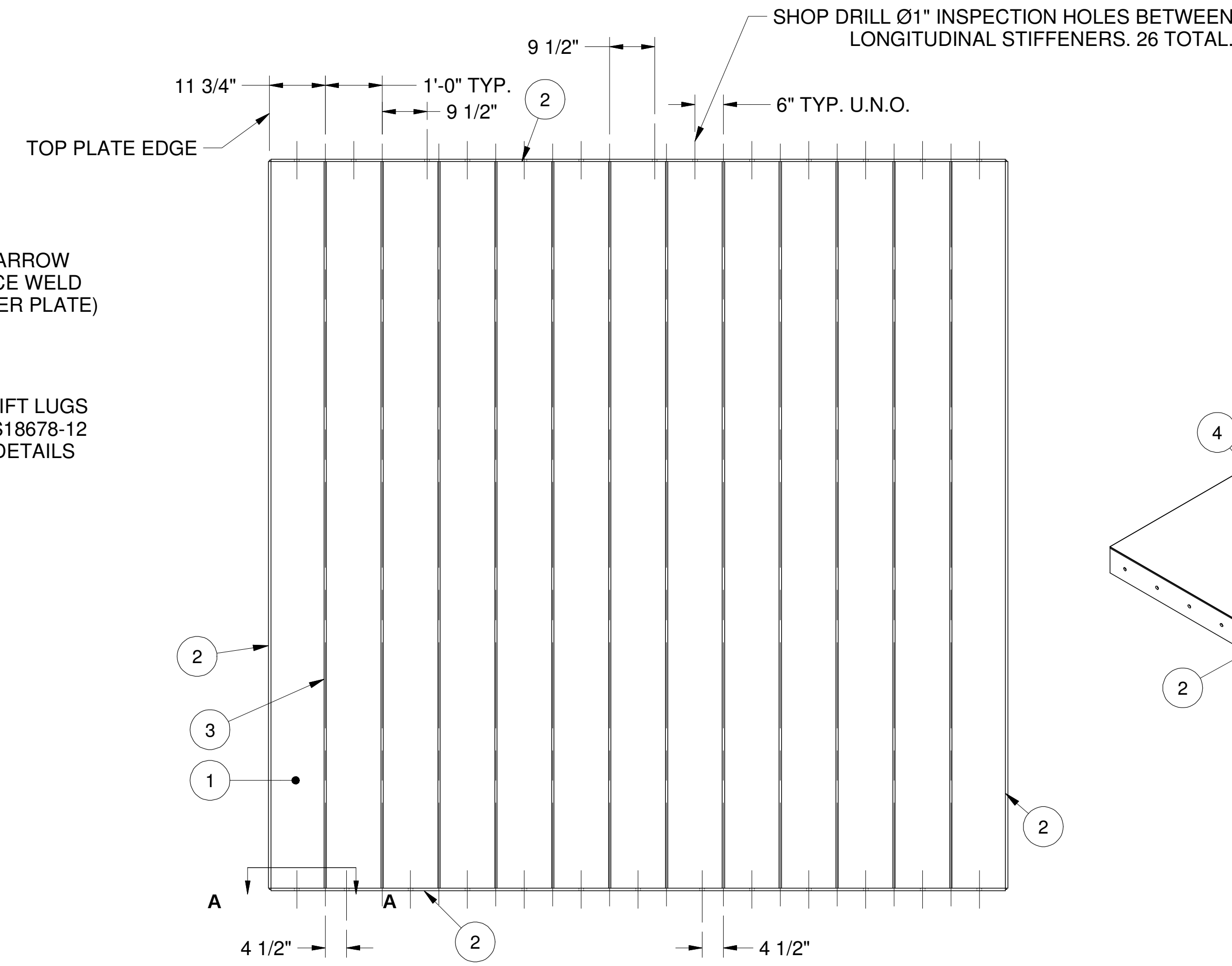
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 5
DWG. NO.: S18678-02-2
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

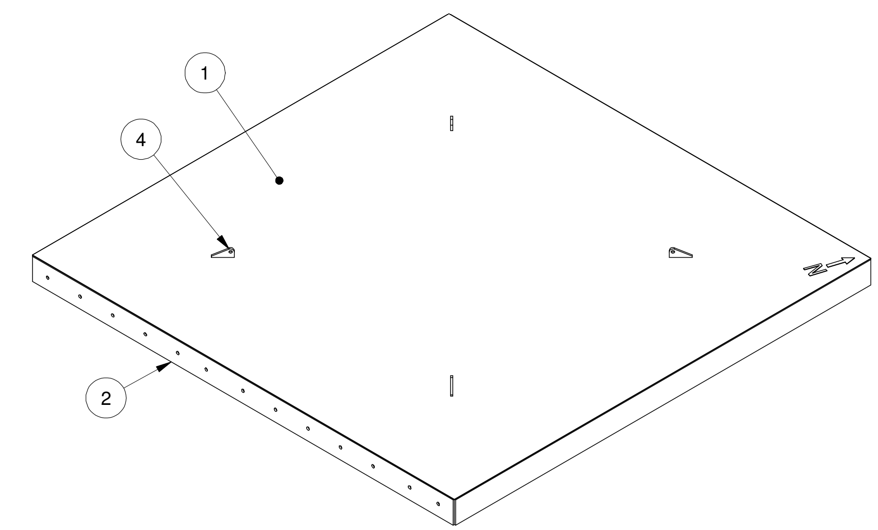
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL | SHT# |
| 1 | 1 | 3/16" PL | ASTM A240-316L | |
| 2 | | 8" x 1/2" FB | ASTM A240-316L | |
| 3 | | 7" x 1/2" FB | ASTM A240-316L | |
| 4 | 4 | 5/8" PL | ASTM A240-316L | |



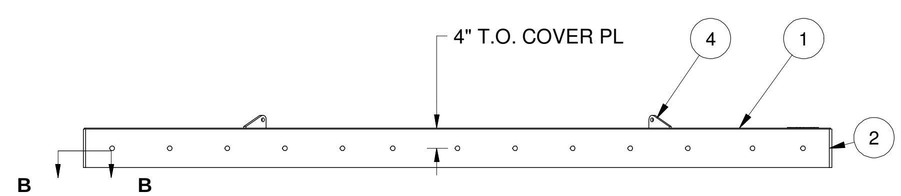

S18678-A-201 - TOP VIEW
TOP PLATE DIMENSIONS



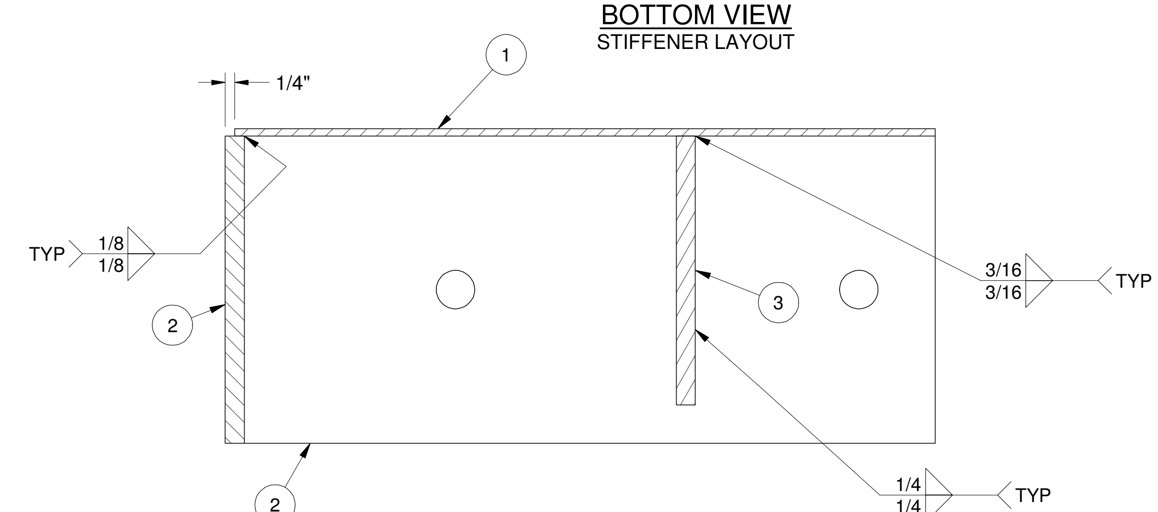

BOTTOM VIEW
STIFFENER LAYOUT



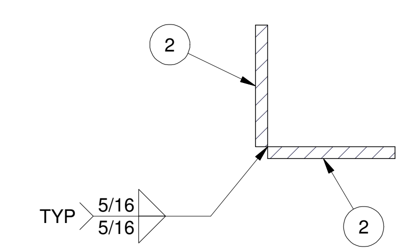
ISO VIEW




SIDE VIEW




SECTION A-A




SECTION B-B



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
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| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
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DRWN BY: A.R.
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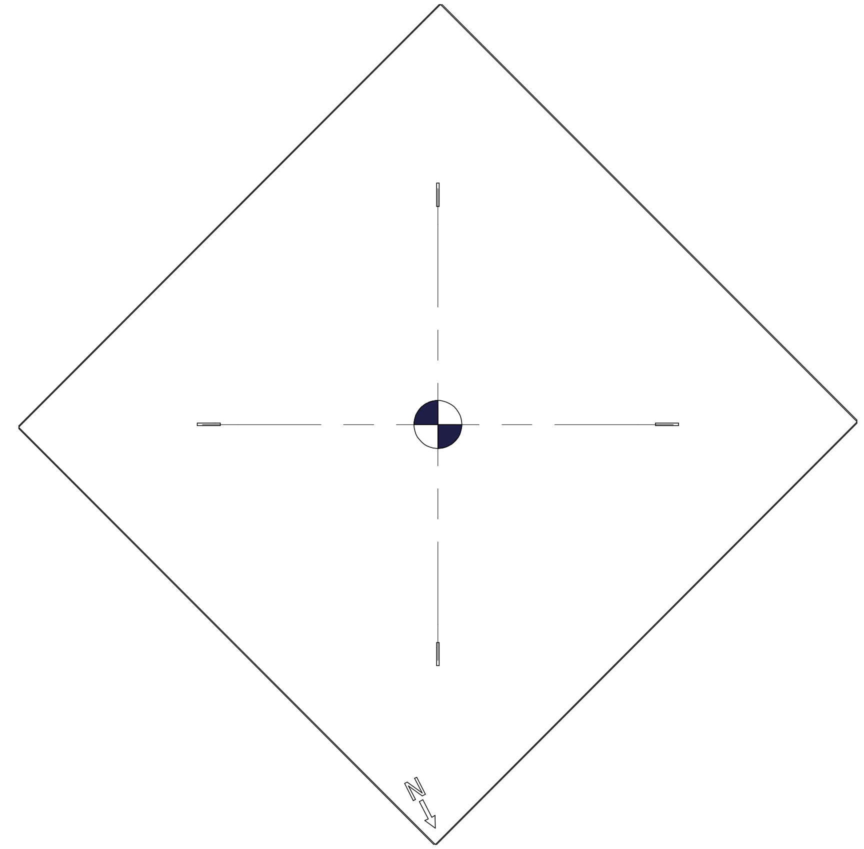
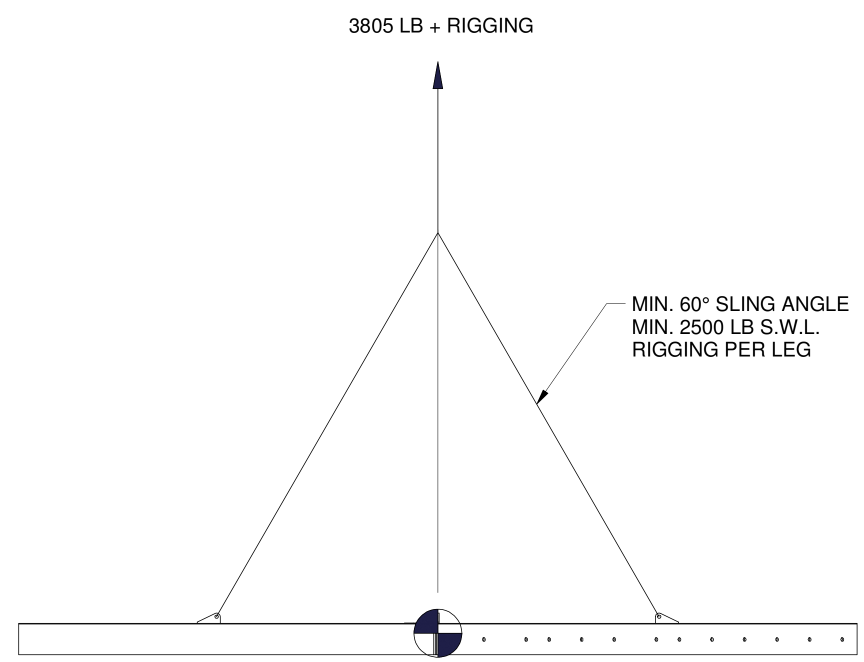
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 4 OPENING
TOP COVER DETAILS
LOCATION: 59°33'43.3"N 108°27'19.9"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 5
DWG. NO.: S18678-02-3
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
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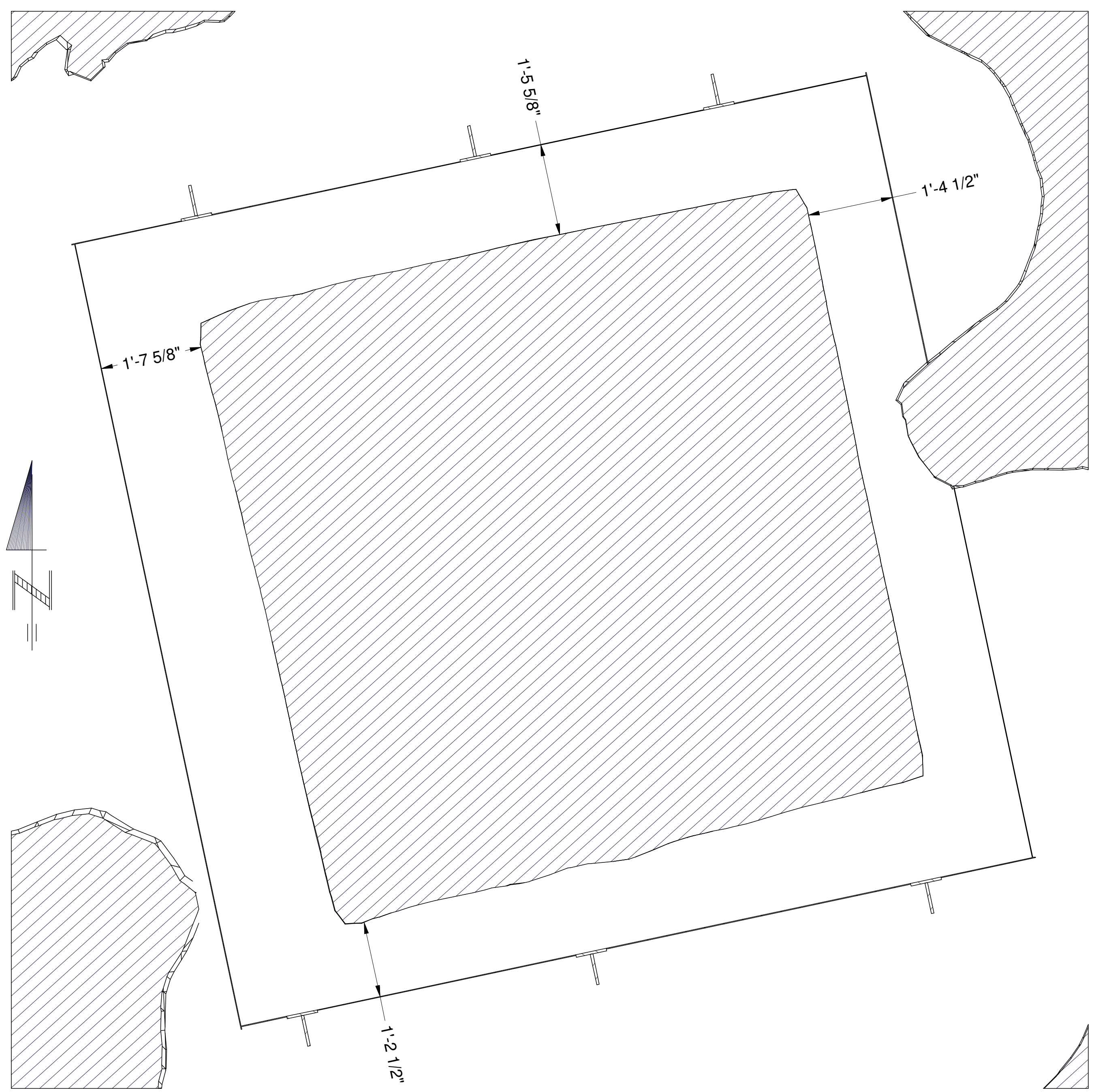
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

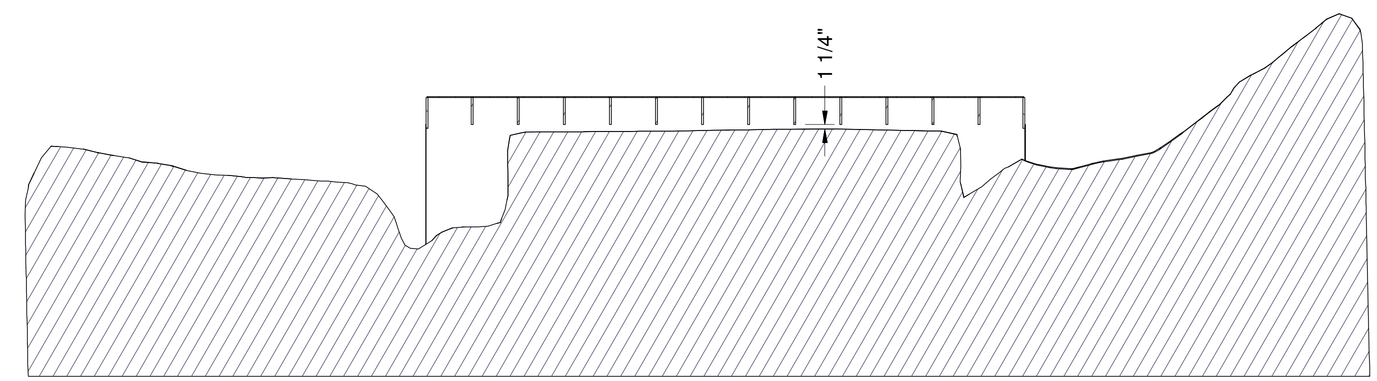
PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 4 OPENING
LIFTING DETAILS
LOCATION: 59°33'43.3"N 108°27'19.9"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 5
DWG. NO.: S18678-02-4
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/24/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE ACE 4 OPENING CLEARANCES
LOCATION: 59°33'43.3"N 108°27'19.9"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-02-5 REV 2
SHEET NO.: 5 OF 5

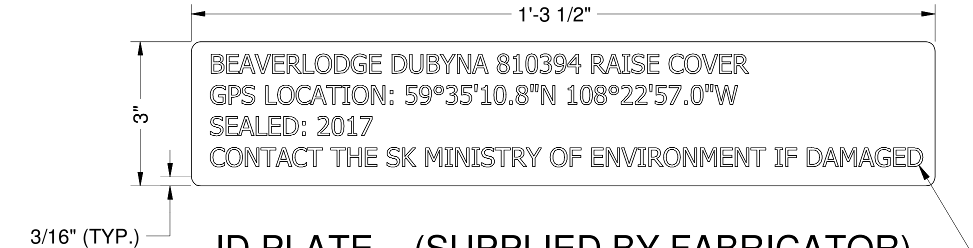
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## DUBYNA 1 - 810394 Raise

DUBYNA 1 - 810394 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

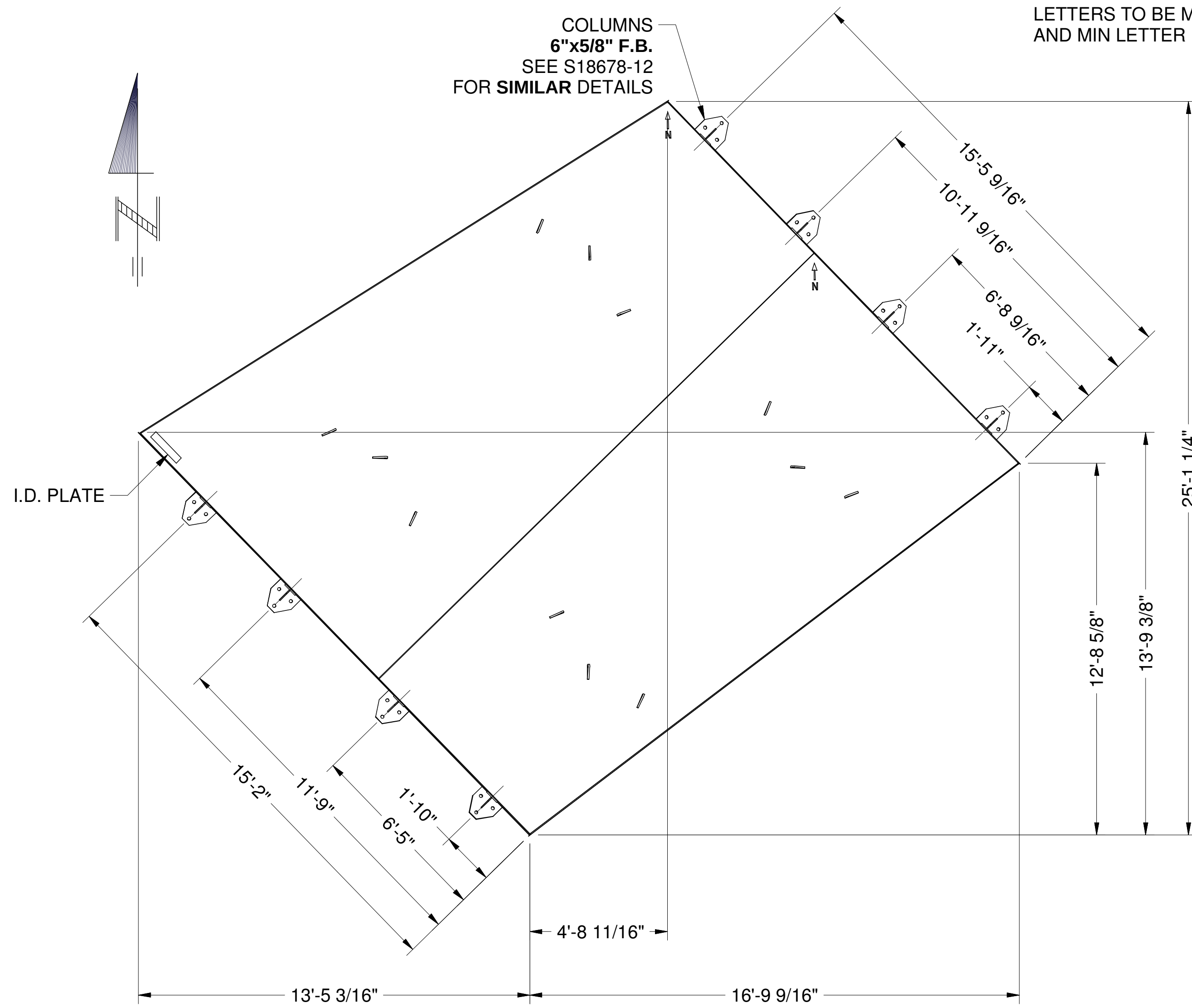
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 12,244 LB
5. DO NOT BACK FILL WALLS OF COVER.

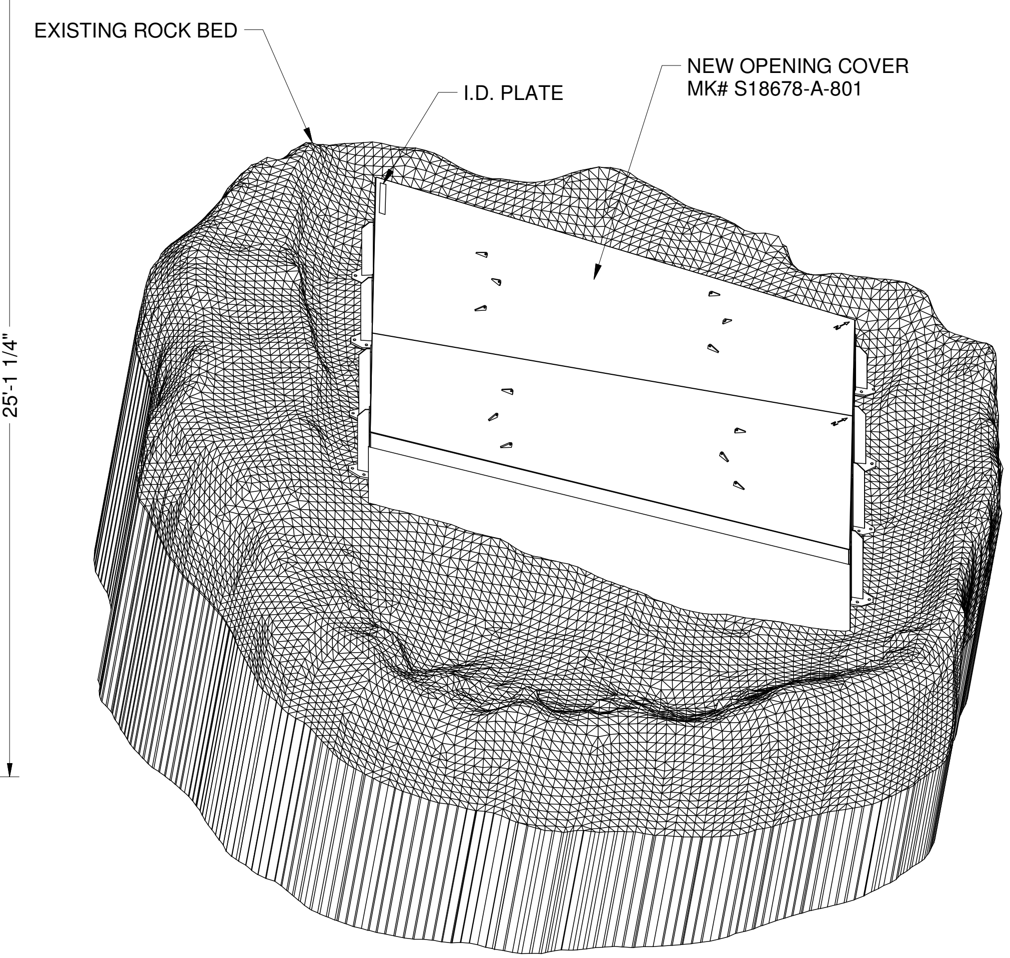



ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 10,435 LB
AS INSTALLED: 12,244 LB




ISO VIEW
LOOKING NORTH WEST

PLAN VIEW - DUBYNA 1 OPENING COVER
(HORIZONTAL PROJECTED DIMENSIONS SHOWN)



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

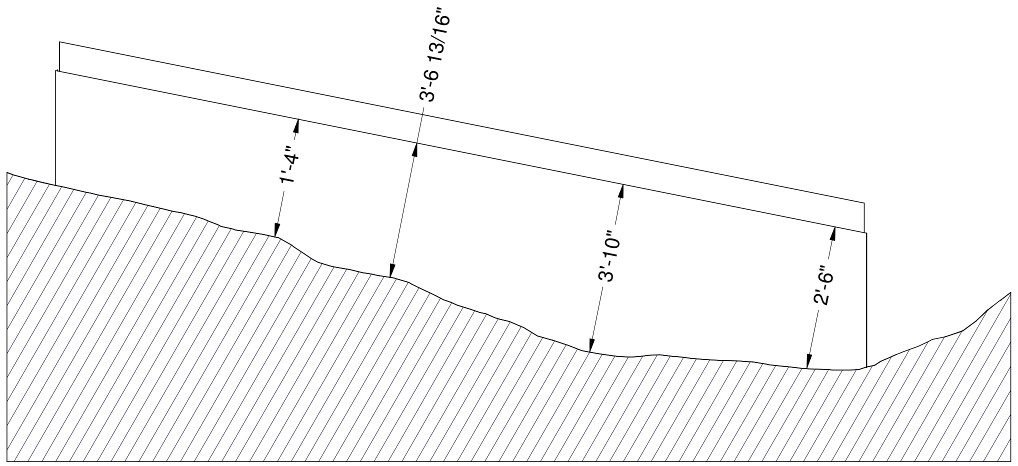
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

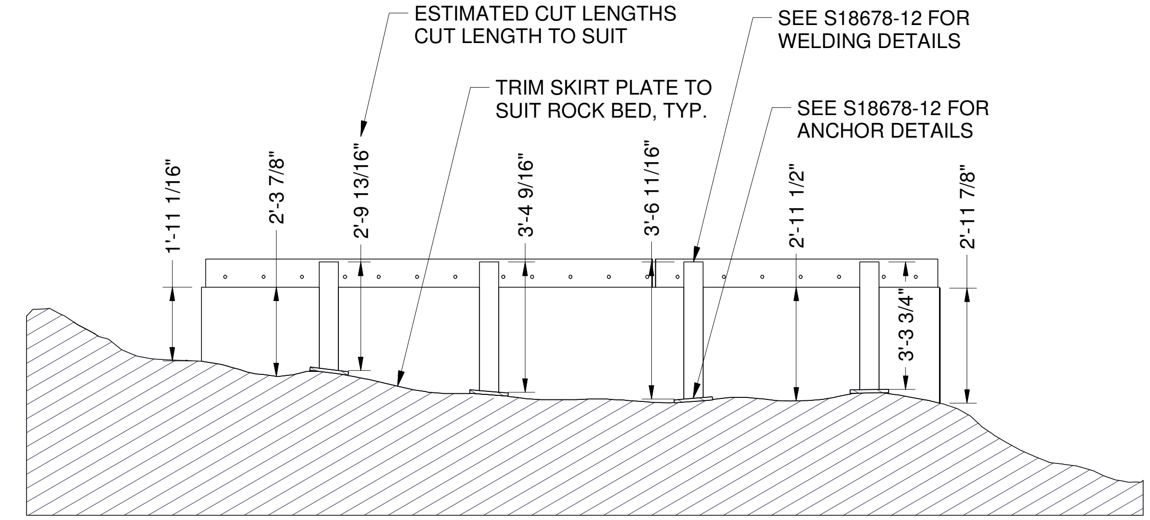
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: S18678-08-1
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

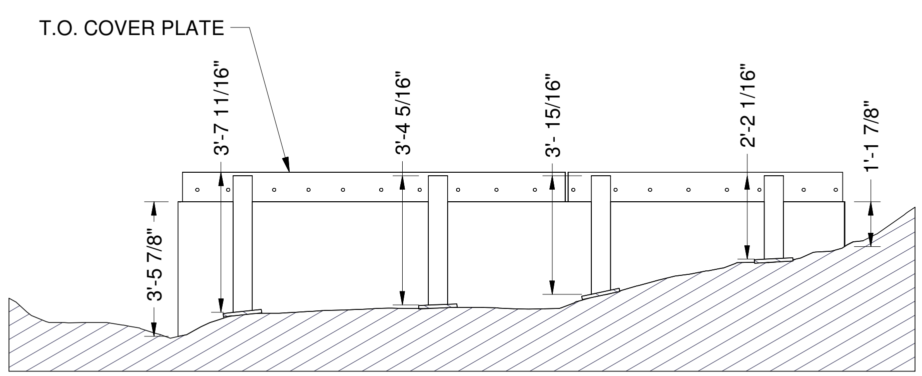
ESTIMATED TOTAL COLUMN LENGTH 303" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
EIGHT (8) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



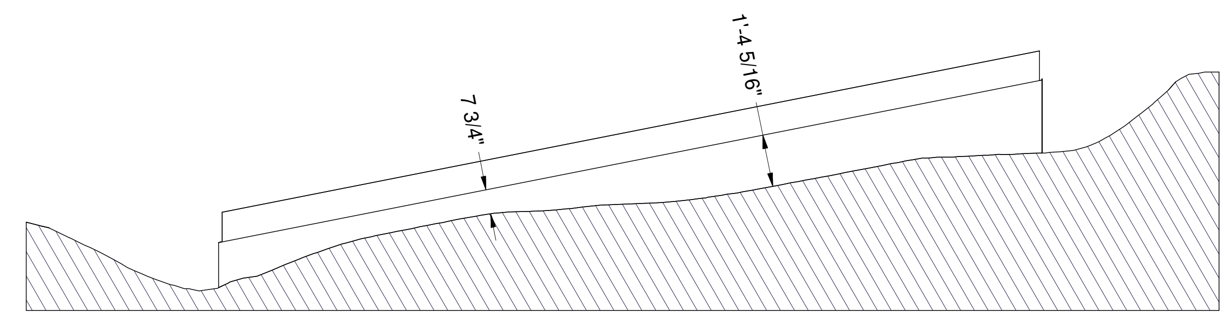

ELEVATION - LOOKING NORTH WEST




ELEVATION - LOOKING NORTH EAST




ELEVATION - LOOKING SOUTH WEST




ELEVATION - LOOKING SOUTH EAST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

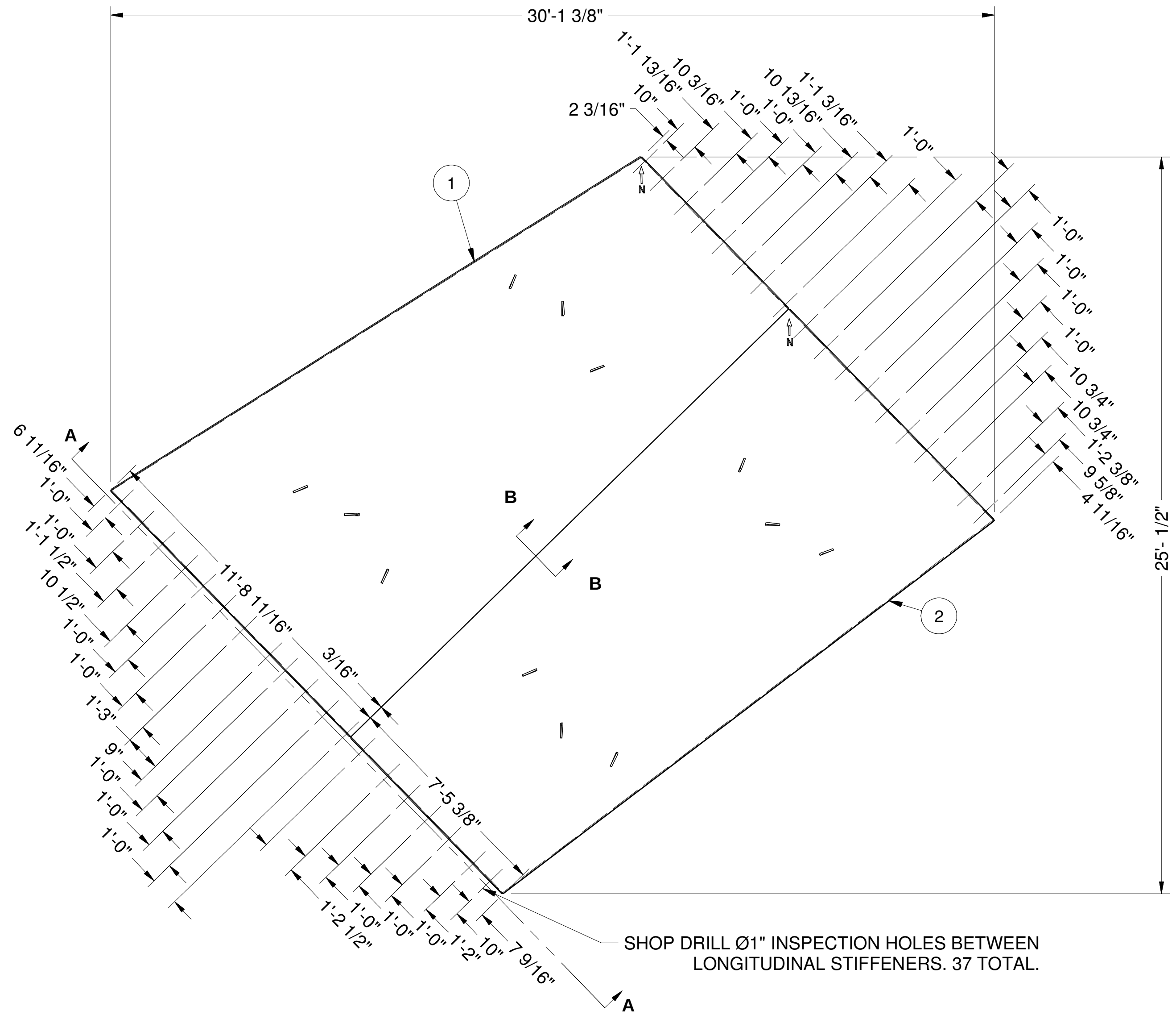
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

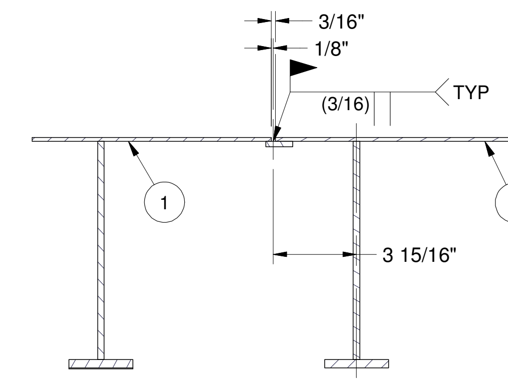
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: S18678-08-2
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

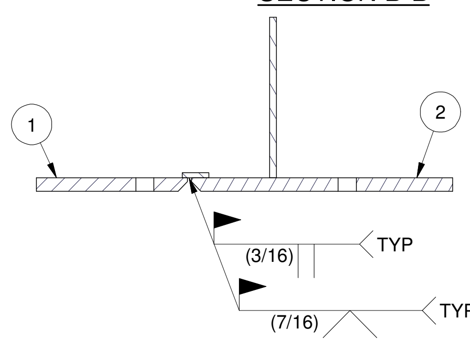
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | TOP COVER SECTION 1 | S18678-A-802 | | 4 |
| 2 | 1 | TOP COVER SECTION 2 | S18678-A-803 | | 5 |



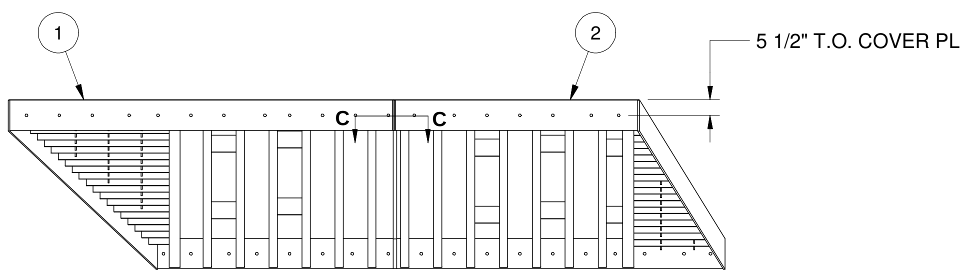

S18678-A-801 - TOP VIEW
TOP PLATE DIMENSIONS
(HORIZONTAL PROJECTED DIMENSIONS SHOWN)



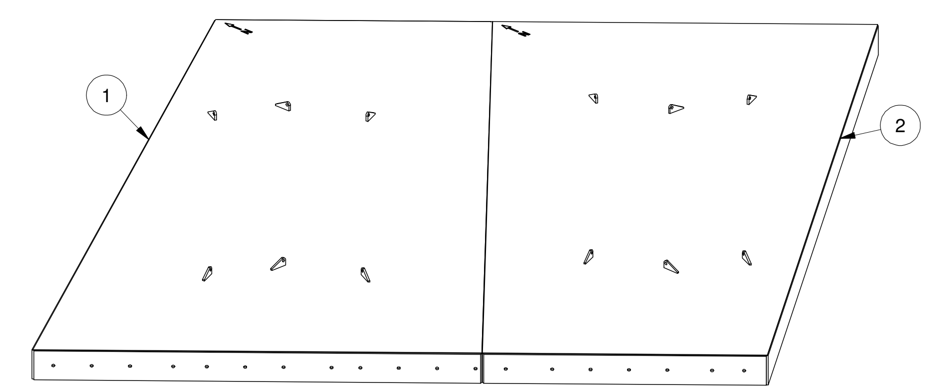

SECTION B-B




SECTION C-C




SECTION A-A




ISO VIEW

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

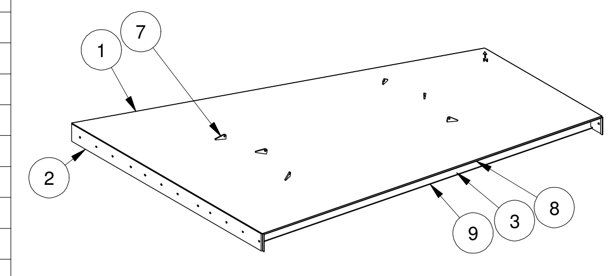
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

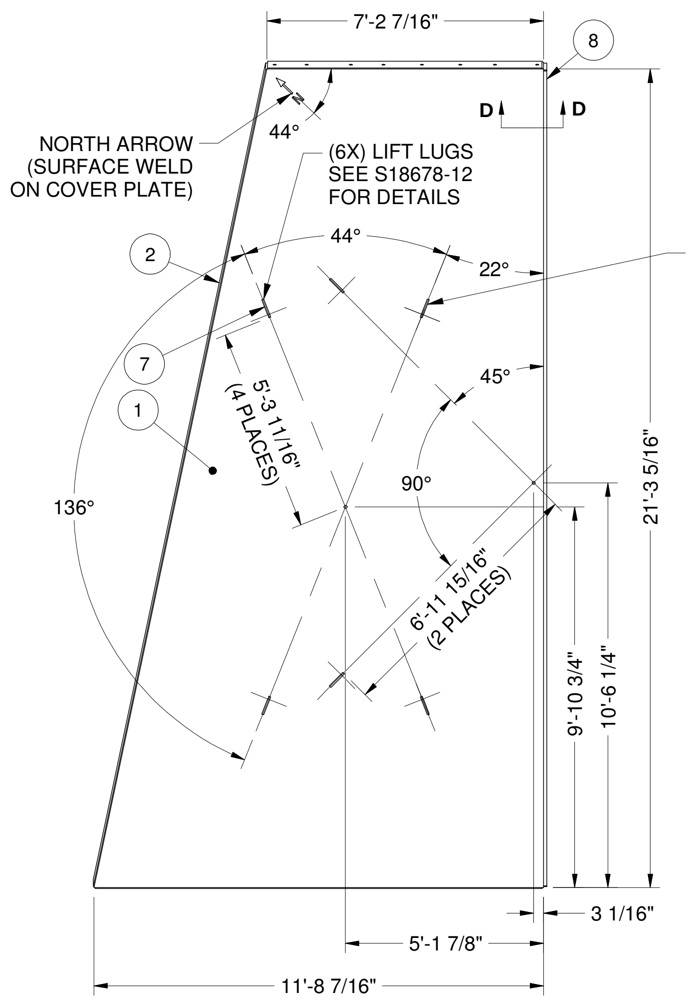
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING
TOP COVER DETAILS
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: S18678-08-3
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

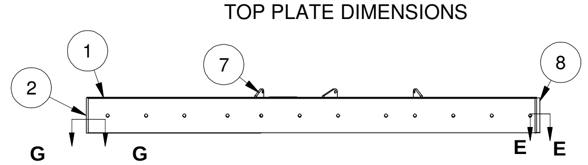
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL | SHT# | EST. LENGTH |
| 1 | 1 | 3/16" PL | ASTM A240-316L | | |
| 2 | | 11"x5/8" FB | ASTM A240-316L | | |
| 3 | 7 | 10"x5/16" FB | ASTM A240-316L | | |
| 4 | 1 | 4"x3/8" FB | ASTM A240-316L | | |
| 5 | 4 | 6"x1/2" FB | ASTM A240-316L | | |
| 6 | | 5"x3/8" FB | ASTM A240-316L | | |
| 7 | 6 | 5/8" PL | ASTM A240-316L | | |
| 8 | | 1 1/4"x1/4" FB | ASTM A240-316L | | |
| 9 | 6 | 3"x3/8" FB | ASTM A240-316L | | |
| 10 | 35 | 4"x3/8" FB | ASTM A240-316L | | |



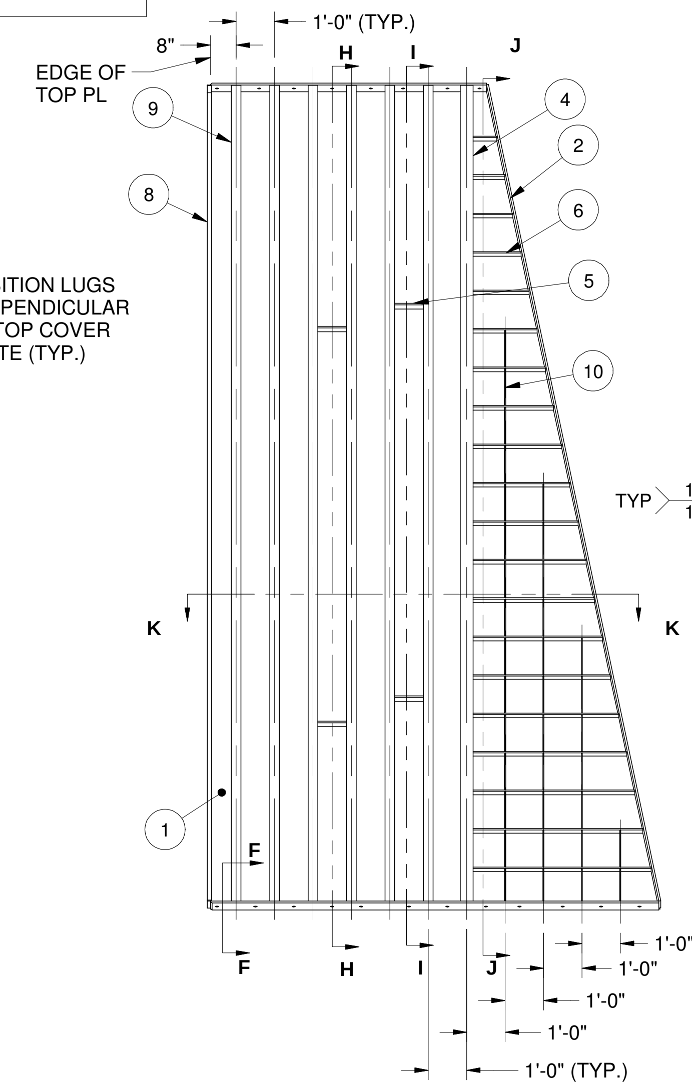
S18678-A-802 - ISO VIEW



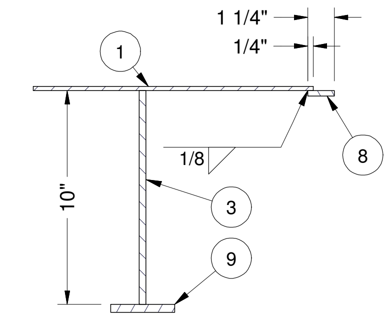

S18678-A-802 - TOP VIEW
TOP PLATE DIMENSIONS



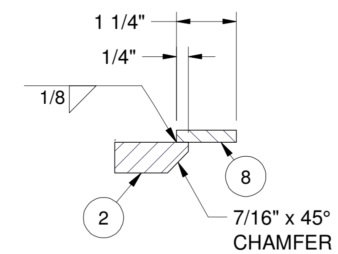

S18678-A-802 - SIDE VIEW



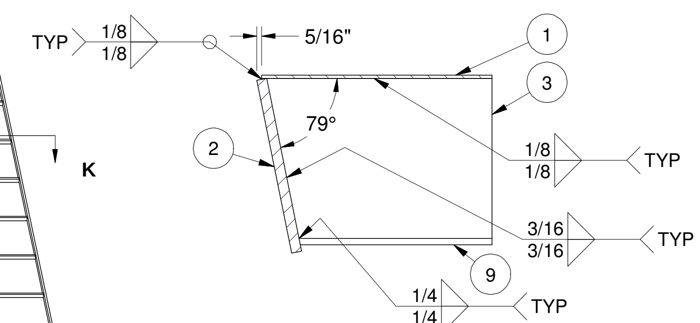

S18678-A-802 - BOTTOM VIEW
STIFFENER LAYOUT



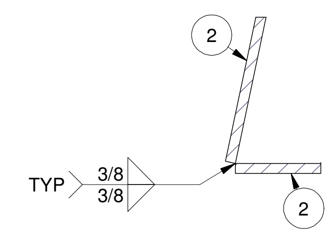

SECTION D-D



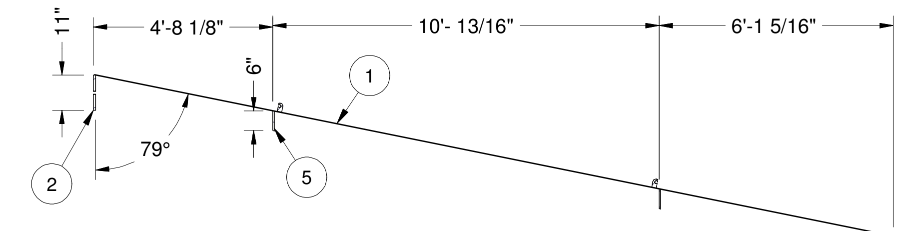

SECTION E-E



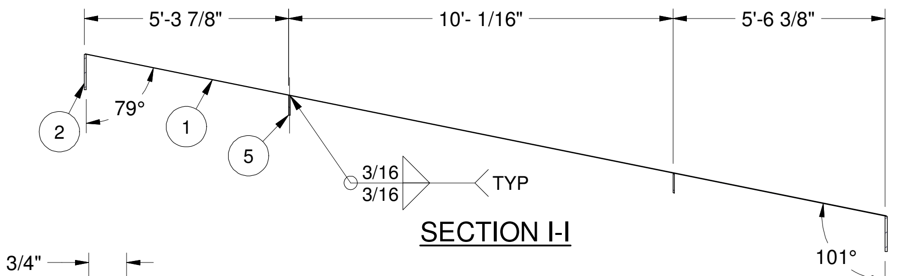

SECTION F-F
SIMILAR FOR S18678-A-803



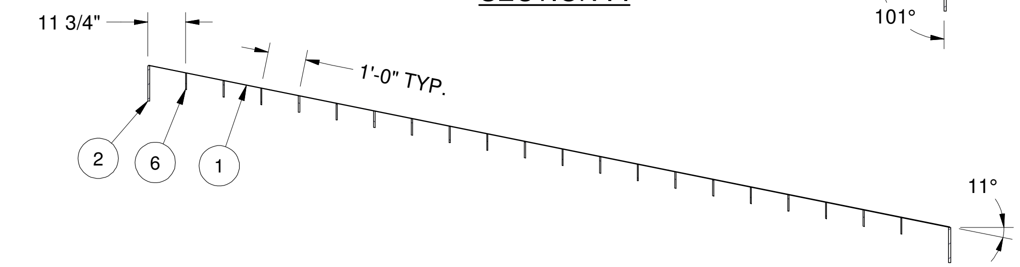

SECTION G-G
SIMILAR FOR S18678-A-803



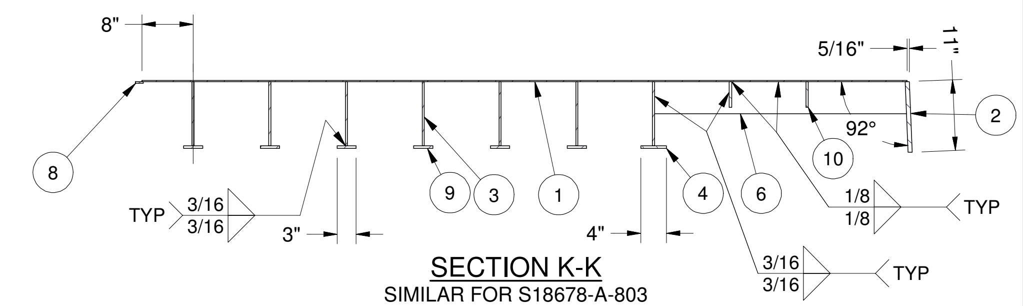

SECTION H-H




SECTION I-I




SECTION J-J
SIMILAR FOR S18678-A-803




SECTION K-K
SIMILAR FOR S18678-A-803



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/5/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — C.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

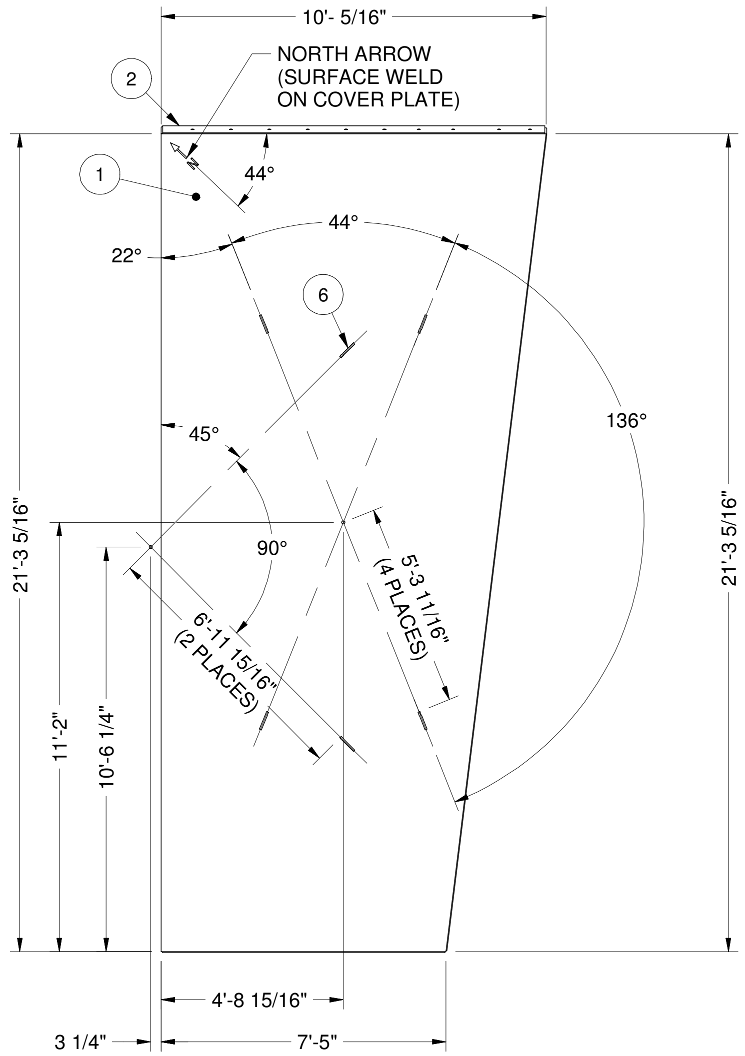
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING
TOP COVER SECTION 802
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
DWG. NO.: S18678-08-4 REV 2
SHEET NO.: 4 OF 7

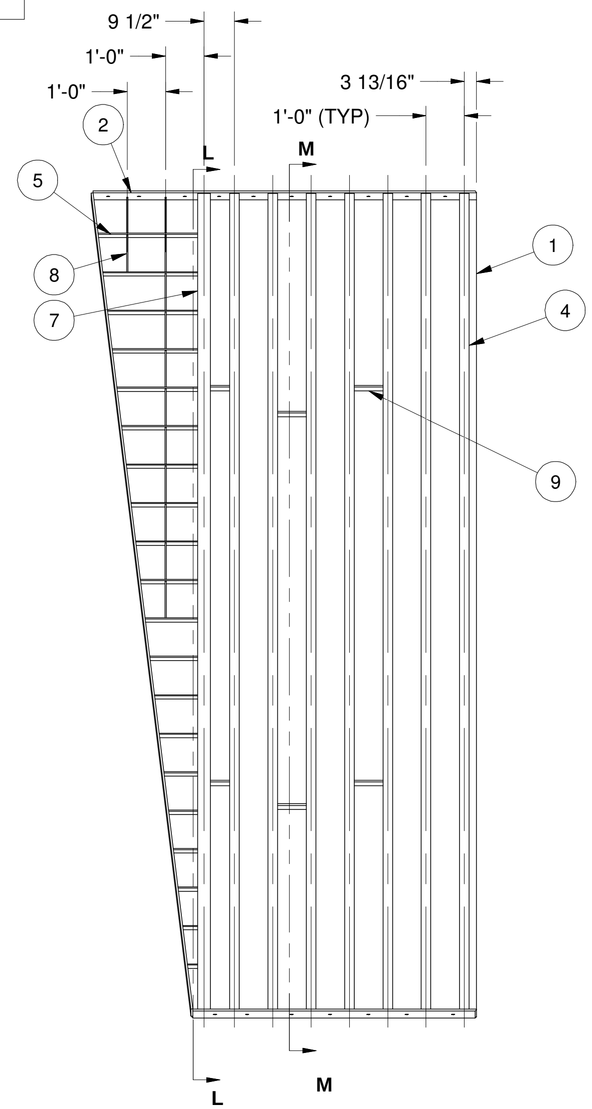
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

BILL OF MATERIALS

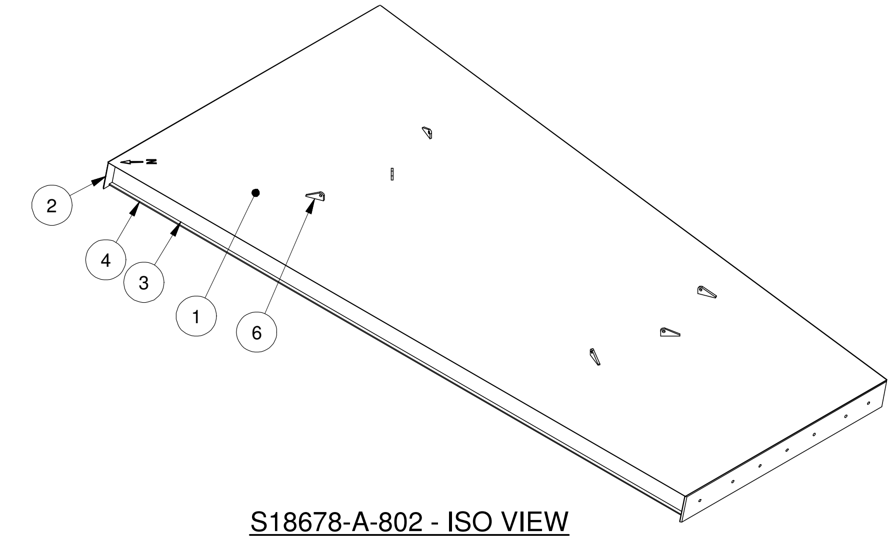
| ITEM | QTY | DESCRIPTION | MATERIAL | SHT# | EST. LENGTH |
|---|---|---|---|---|---|
| 1 | 1 | 3/16" PL | ASTM A240-316L | | |
| 2 | | 11"x5/8" FB | ASTM A240-316L | | |
| 3 | 8 | 10"x5/16" FB | ASTM A240-316L | | |
| 4 | 7 | 3"x3/8" FB | ASTM A240-316L | | |
| 5 | | 5"x3/8" FB | ASTM A240-316L | | |
| 6 | 6 | 5/8" PL | ASTM A240-316L | | |
| 7 | 1 | 4"x3/8" FB | ASTM A240-316L | | |
| 8 | 13 | 4"x3/8" FB | ASTM A240-316L | | |
| 9 | 6 | 6"x1/2" FB | ASTM A240-316L | | |



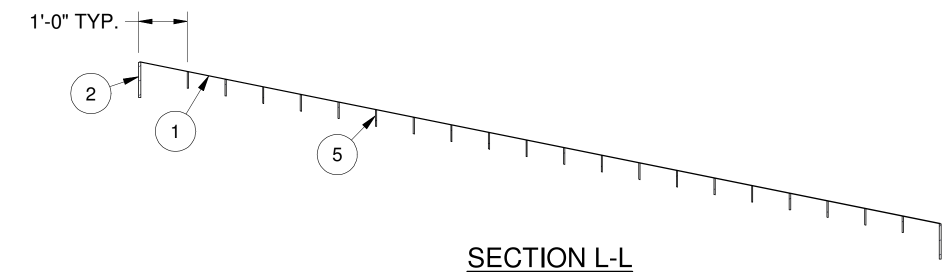

S18678-A-803 - TOP VIEW
TOP PLATE DIMENSIONS



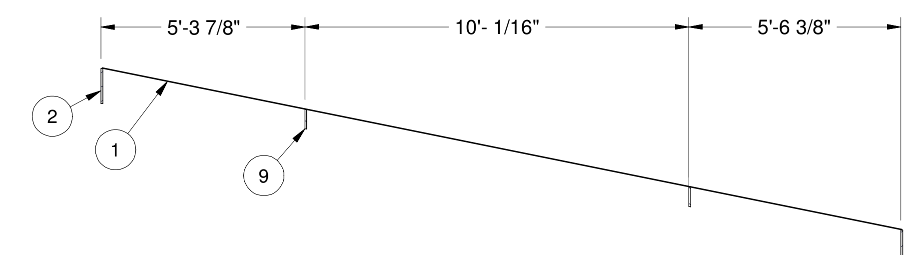

S18678-A-803 - BOTTOM VIEW
STIFFENER LAYOUT




S18678-A-802 - ISO VIEW




SECTION L-L




SECTION M-M





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/5/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER SASKATCHEWAN
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

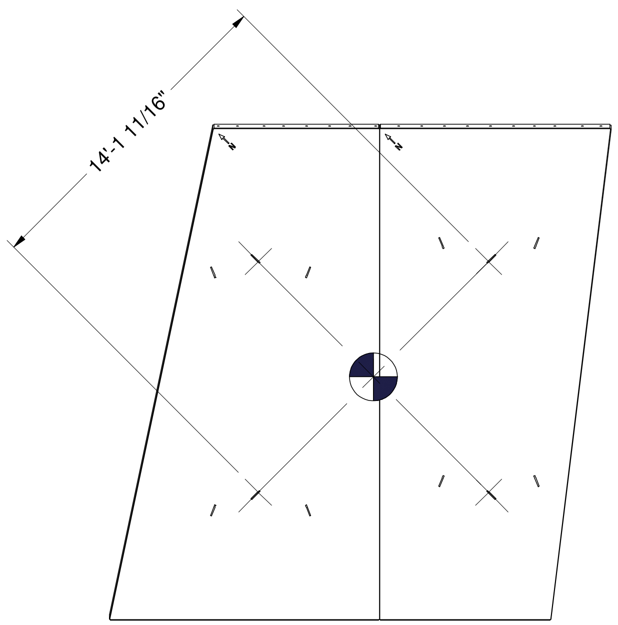
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

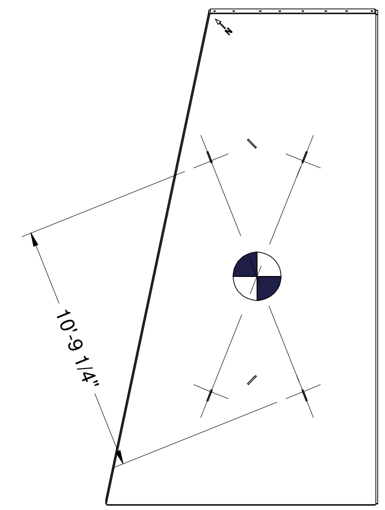
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING
TOP COVER SECTION 803
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
DWG. NO.: S18678-08-5
SHEET NO.: 5 OF 7
REV 2

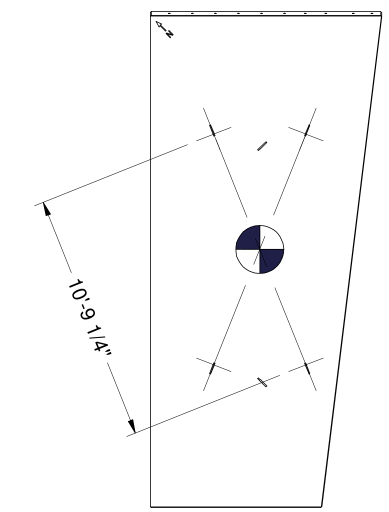
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



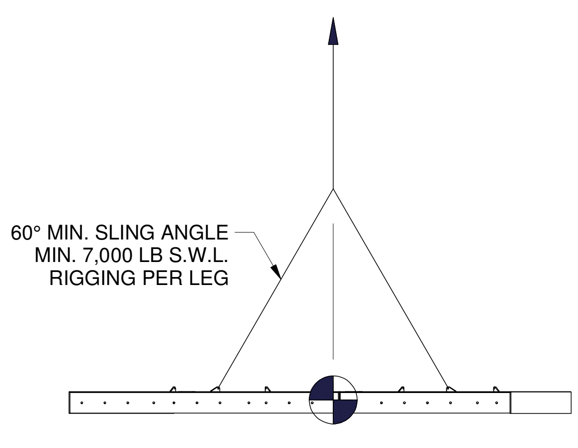

TOP COVER LIFTING DIAGRAM - TOP VIEW



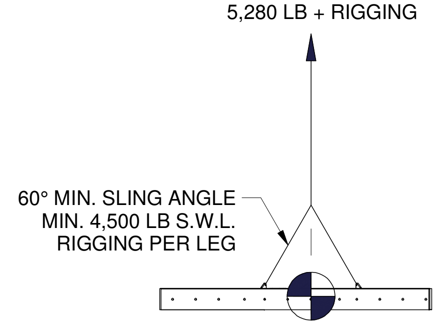

S18678-A-802 LIFTING DIAGRAM - TOP VIEW



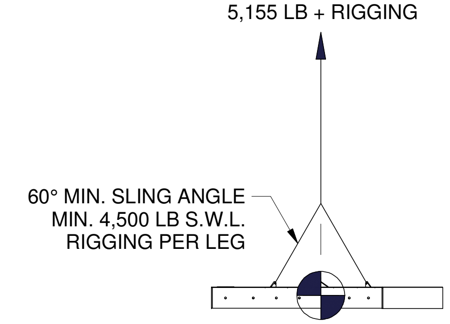

S18678-A-803 LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW




S18678-A-802 LIFTING DIAGRAM - SIDE VIEW




S18678-A-803 LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

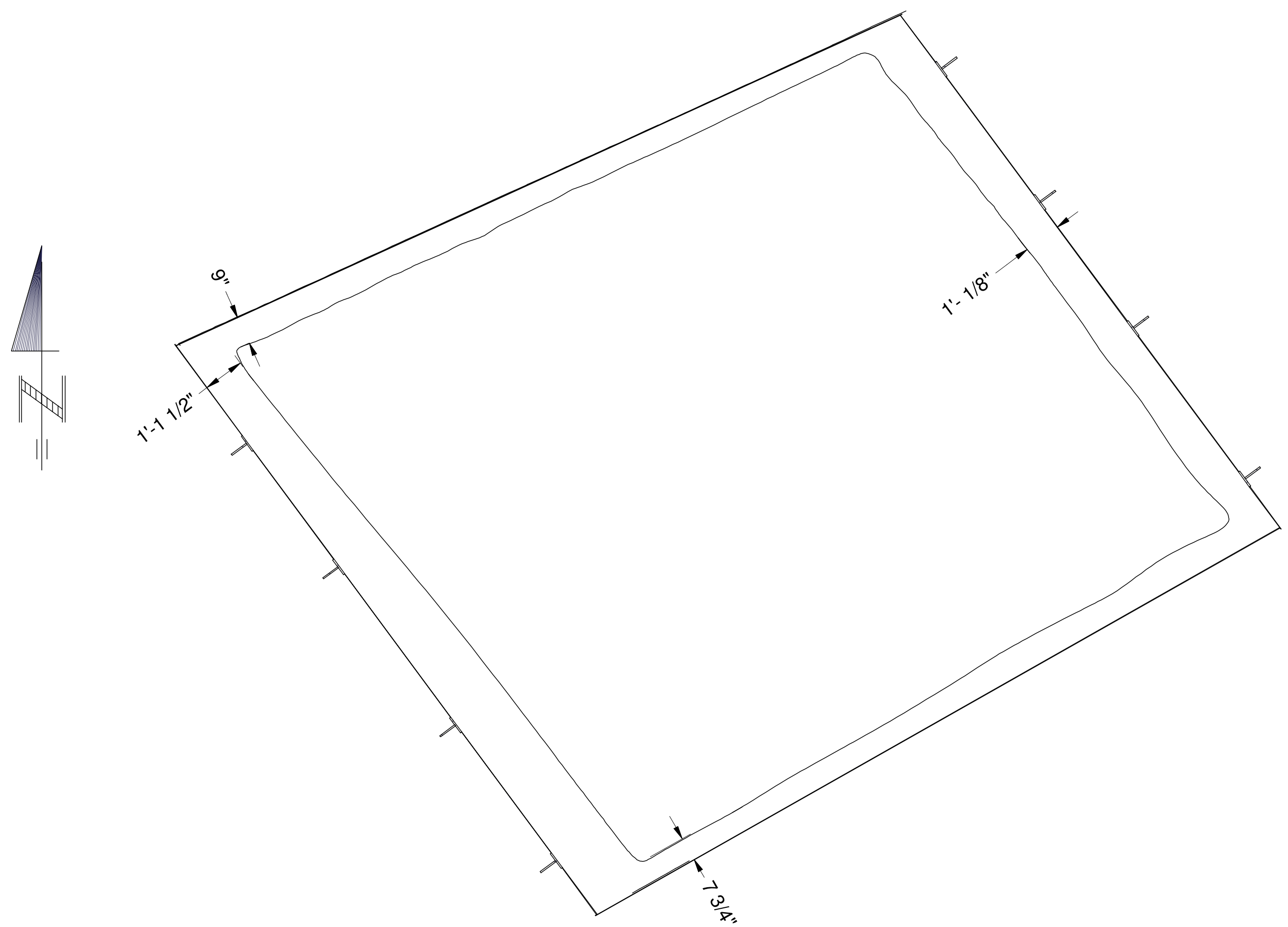
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

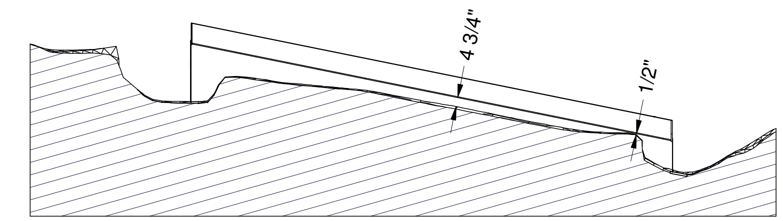
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING LIFTING DETAILS
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: S18678-08-6
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/5/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 1 OPENING CLEARANCES
LOCATION: 59°35'10.8"N 108°22'57.0"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: S18678-08-7
2

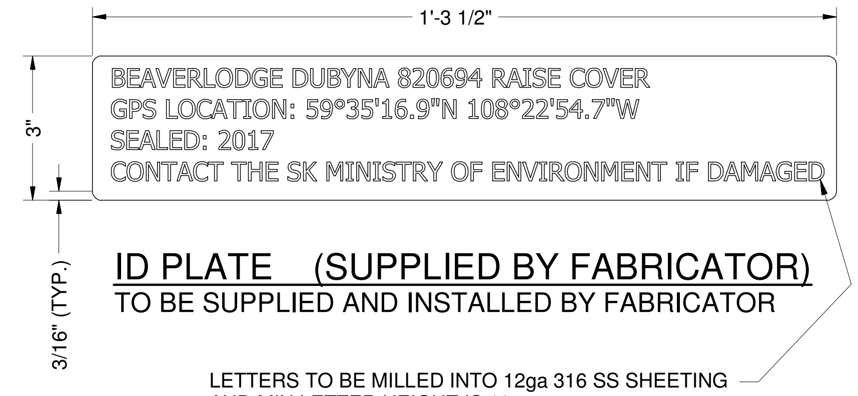
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## DUBYNA 2 - 820694 Raise

DUBYNA 2 - 820694 Raise

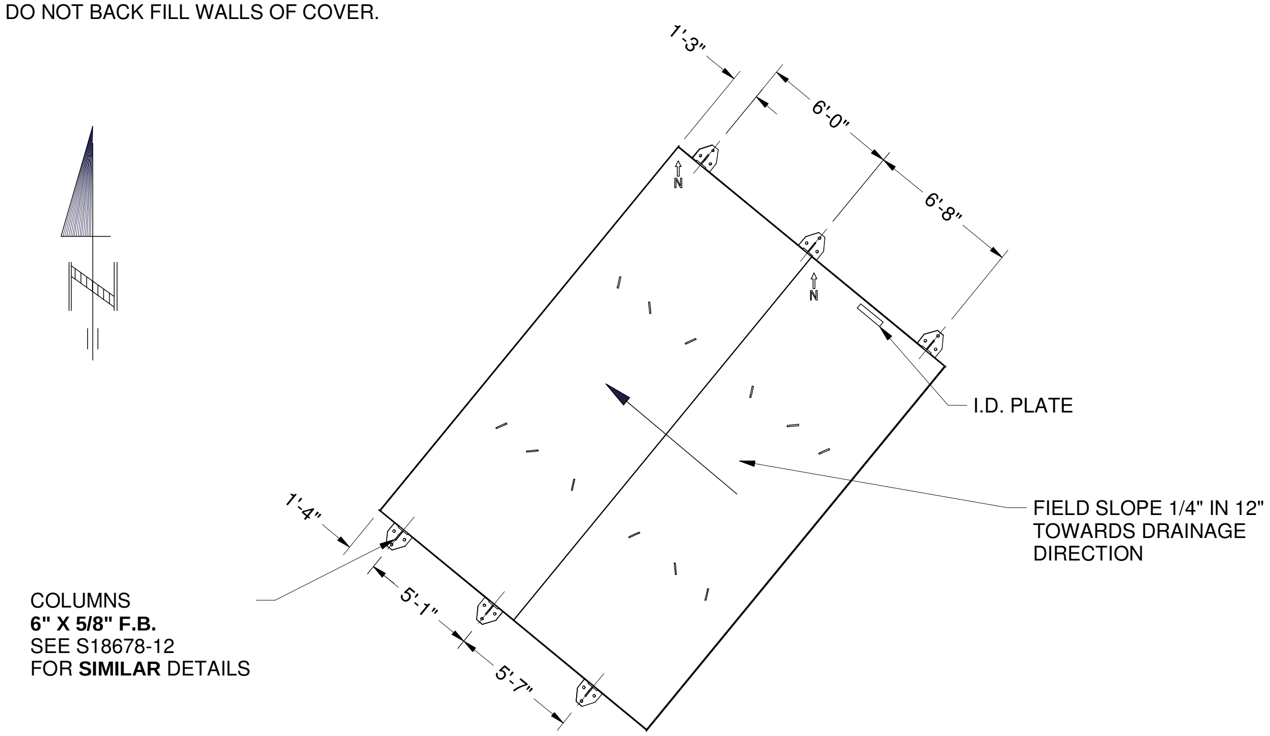
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 9,490LB
5. DO NOT BACK FILL WALLS OF COVER.

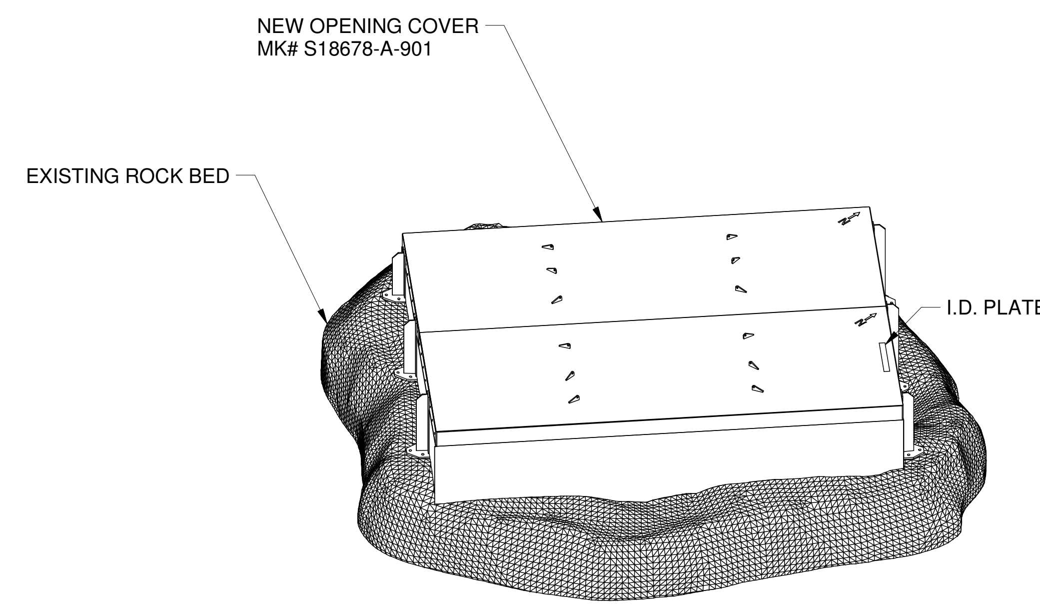



ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 7,750 LB
AS INSTALLED: 9,490 LB




PLAN VIEW - DUBYNA 2 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

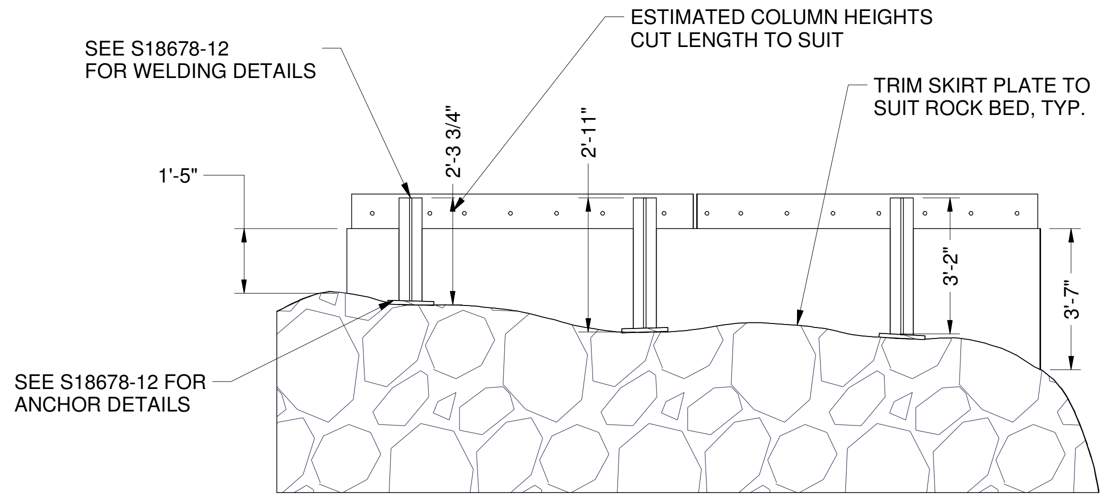
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

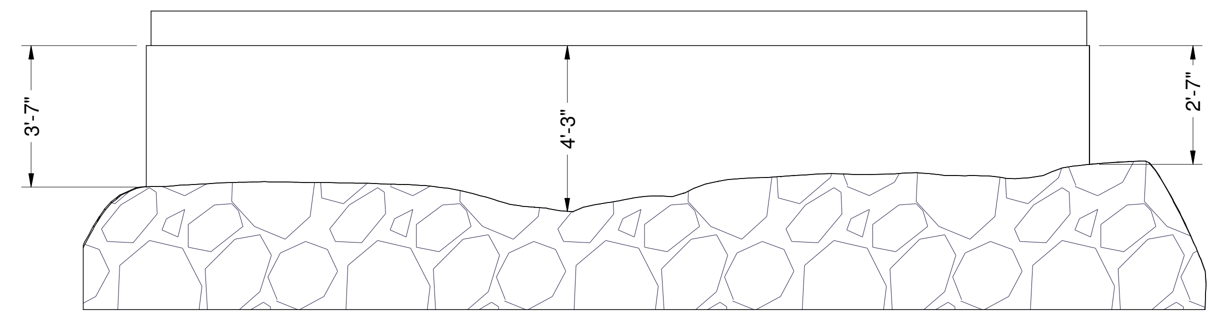
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: S18678-09-1
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

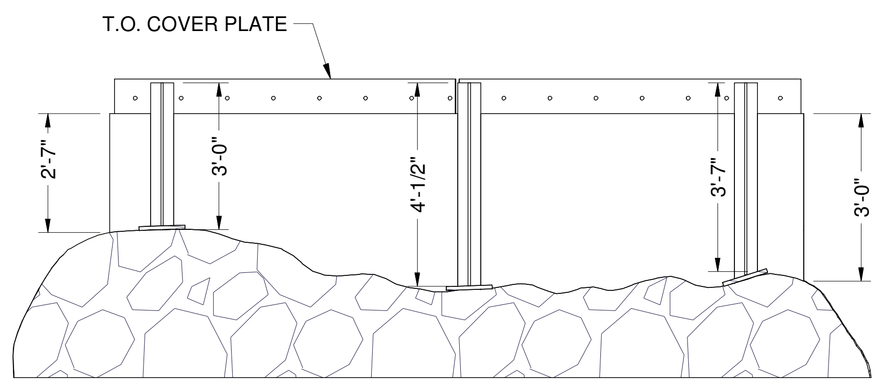
ESTIMATED TOTAL COLUMN LENGTH 244" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE
OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



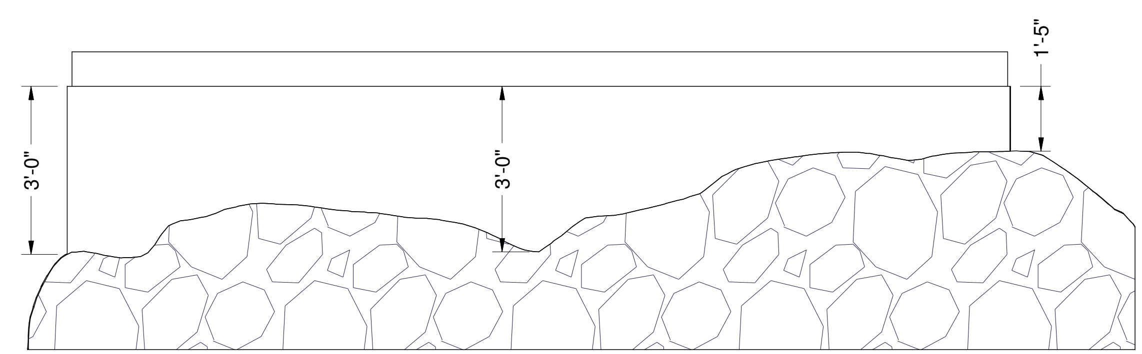

ELEVATION - LOOKING NORTH-EAST




ELEVATION - LOOKING NORTH-WEST




ELEVATION - LOOKING SOUTH-WEST




ELEVATION - LOOKING SOUTH-EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

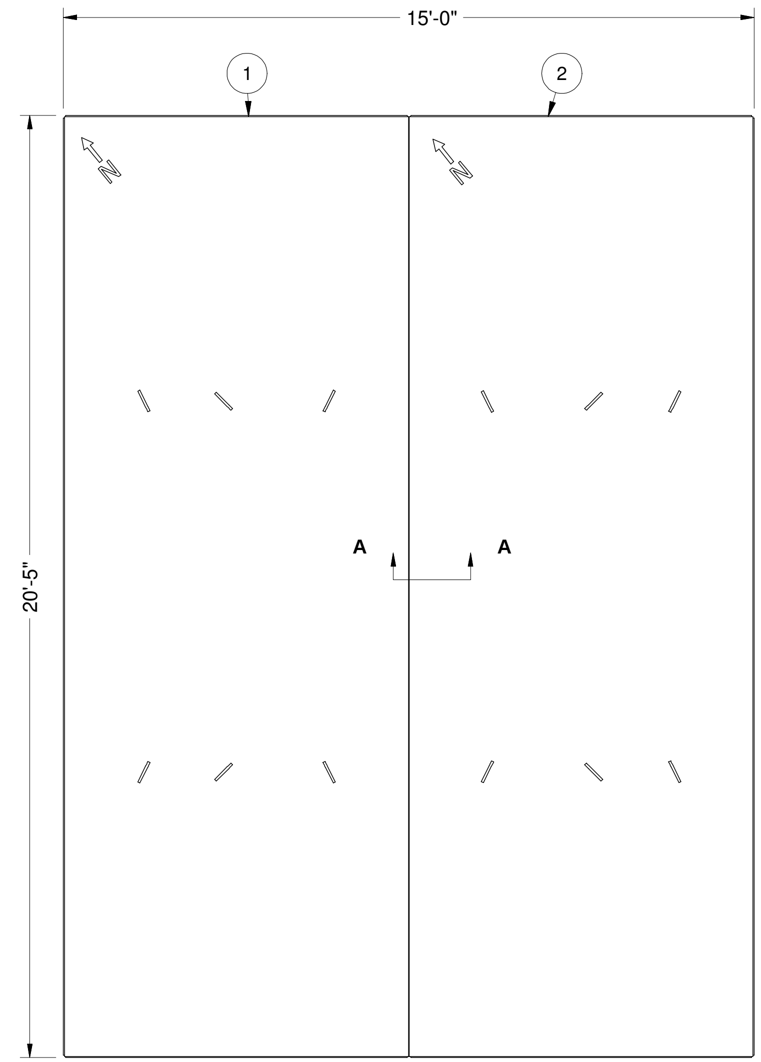
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

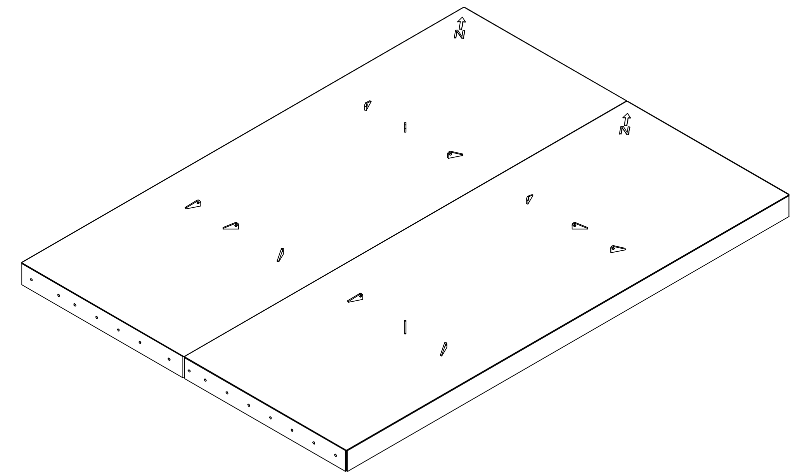
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: S18678-09-2
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

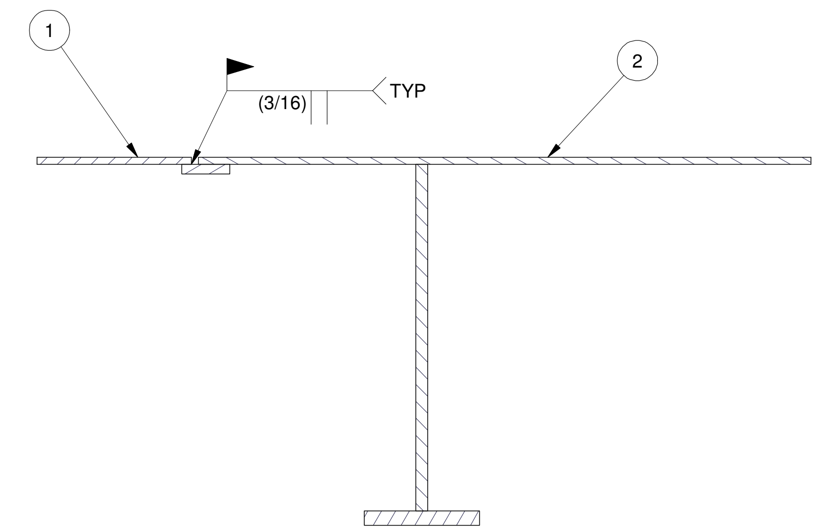
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | S18678-A-902 | | |
| 2 | 1 | COVER SECTION 2 | S18678-A-903 | | |



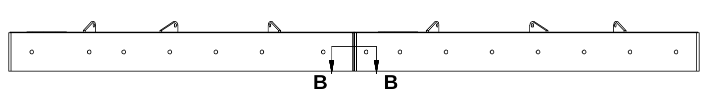

S18678-A-901 - TOP VIEW
TOP PLATE DIMENSIONS



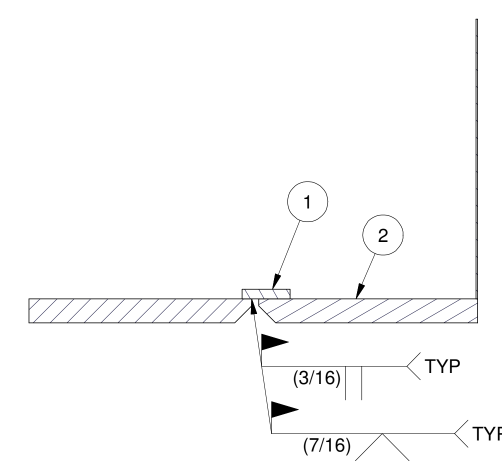
S18678-A-901 - ISO VIEW




SECTION A-A




S18678-A-901 - SIDE VIEW




SECTION B-B





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
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| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

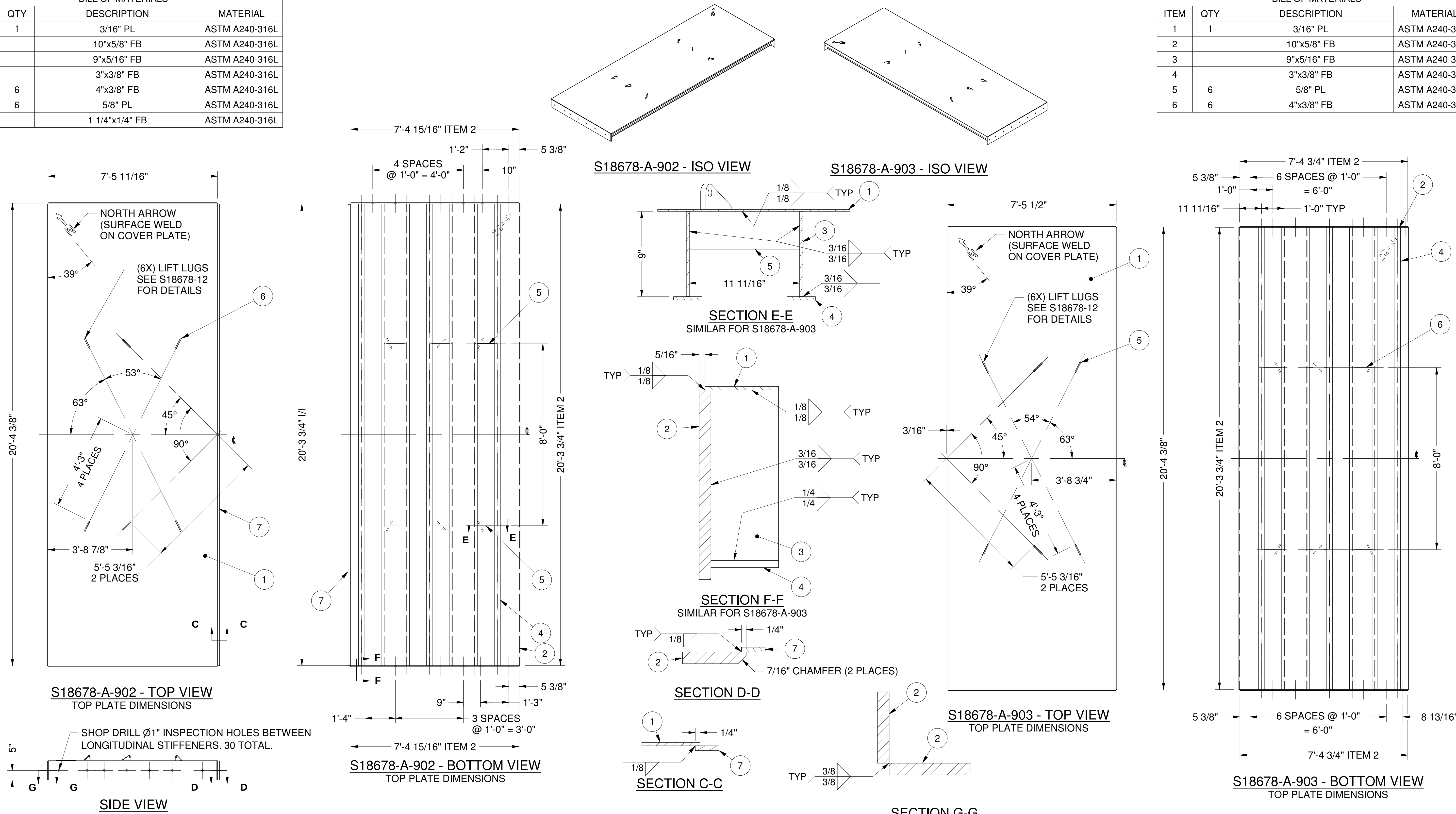
PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING
TOP COVER DETAILS
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: S18678-09-3
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 3/16" PL | ASTM A240-316L |
| 2 | | 10"x5/8" FB | ASTM A240-316L |
| 3 | | 9"x5/16" FB | ASTM A240-316L |
| 4 | | 3"x3/8" FB | ASTM A240-316L |
| 5 | 6 | 4"x3/8" FB | ASTM A240-316L |
| 6 | 6 | 5/8" PL | ASTM A240-316L |
| 7 | | 1 1/4"x1/4" FB | ASTM A240-316L |

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 3/16" PL | ASTM A240-316L |
| 2 | | 10"x5/8" FB | ASTM A240-316L |
| 3 | | 9"x5/16" FB | ASTM A240-316L |
| 4 | | 3"x3/8" FB | ASTM A240-316L |
| 5 | 6 | 5/8" PL | ASTM A240-316L |
| 6 | 6 | 4"x3/8" FB | ASTM A240-316L |

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. LAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY) — SASKATCHEWAN

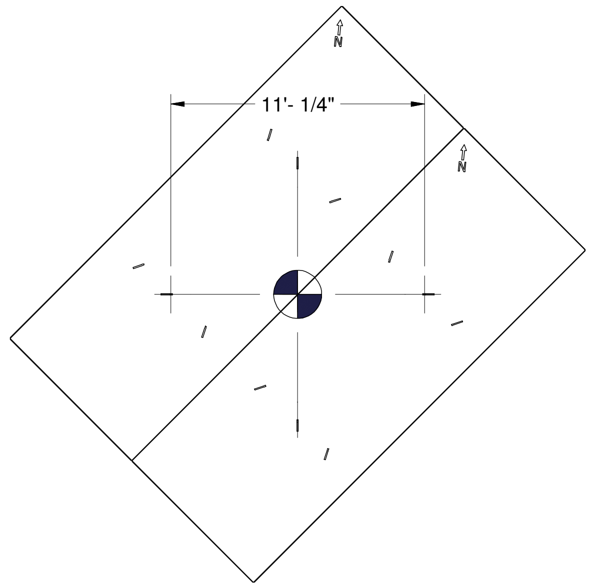
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

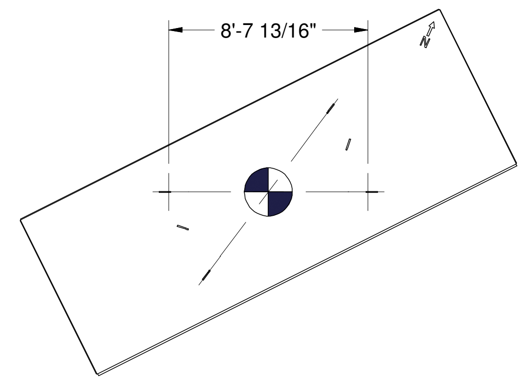
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING TOP COVER SECTIONS
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-09-4 (REV 2)
SHEET NO.: 4 OF 6

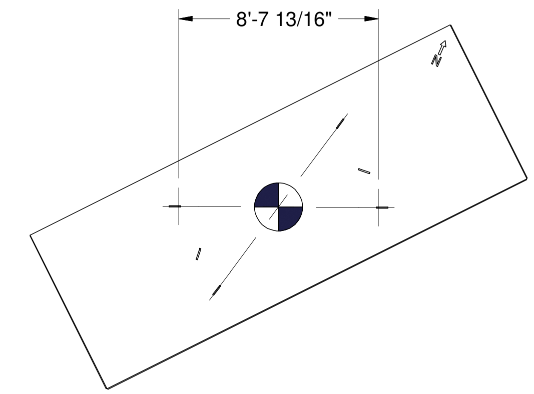
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



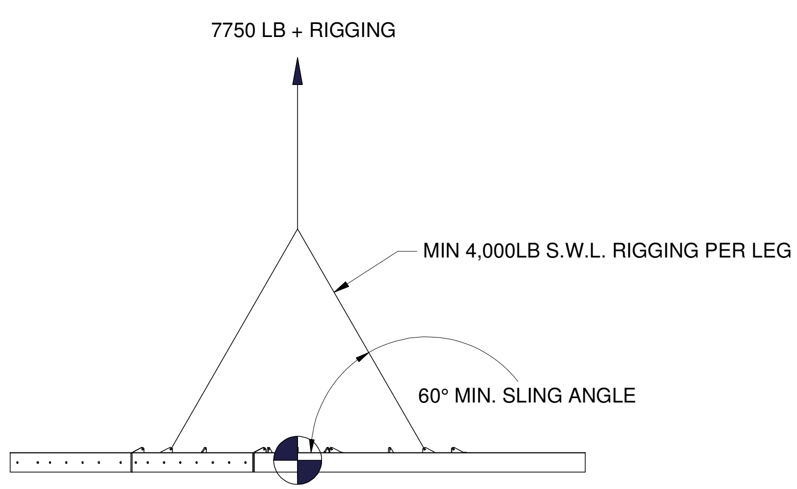

TOP COVER LIFTING DIAGRAM
S18678-A-901



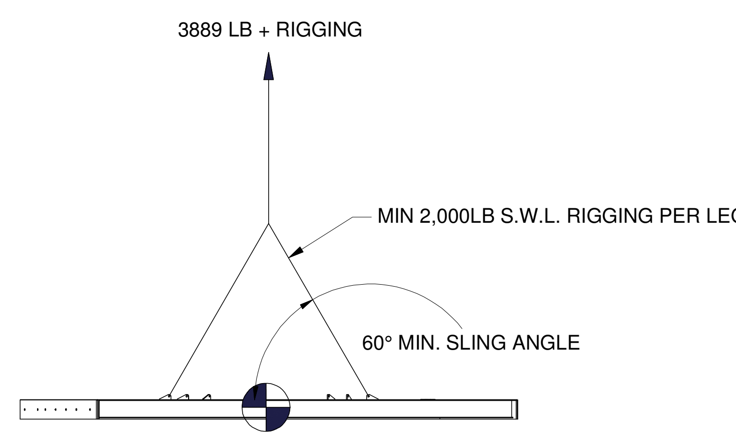

COVER SECTION 1 LIFTING DIAGRAM
S18678-A-902



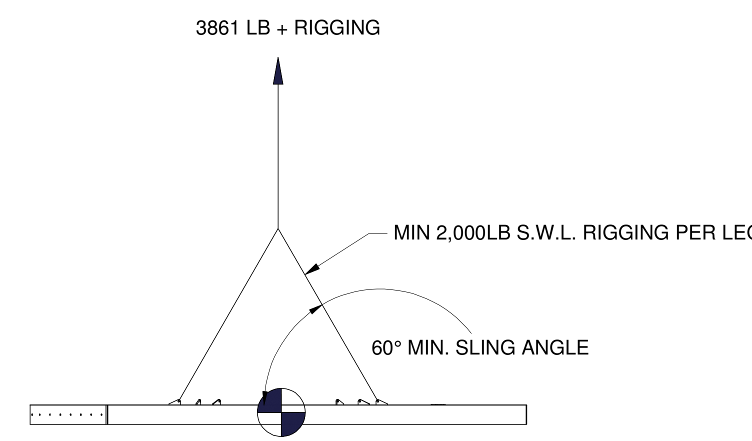

COVER SECTION 2 LIFTING DIAGRAM
S18678-A-903




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-901




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
S18678-A-902




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
S18678-A-903





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

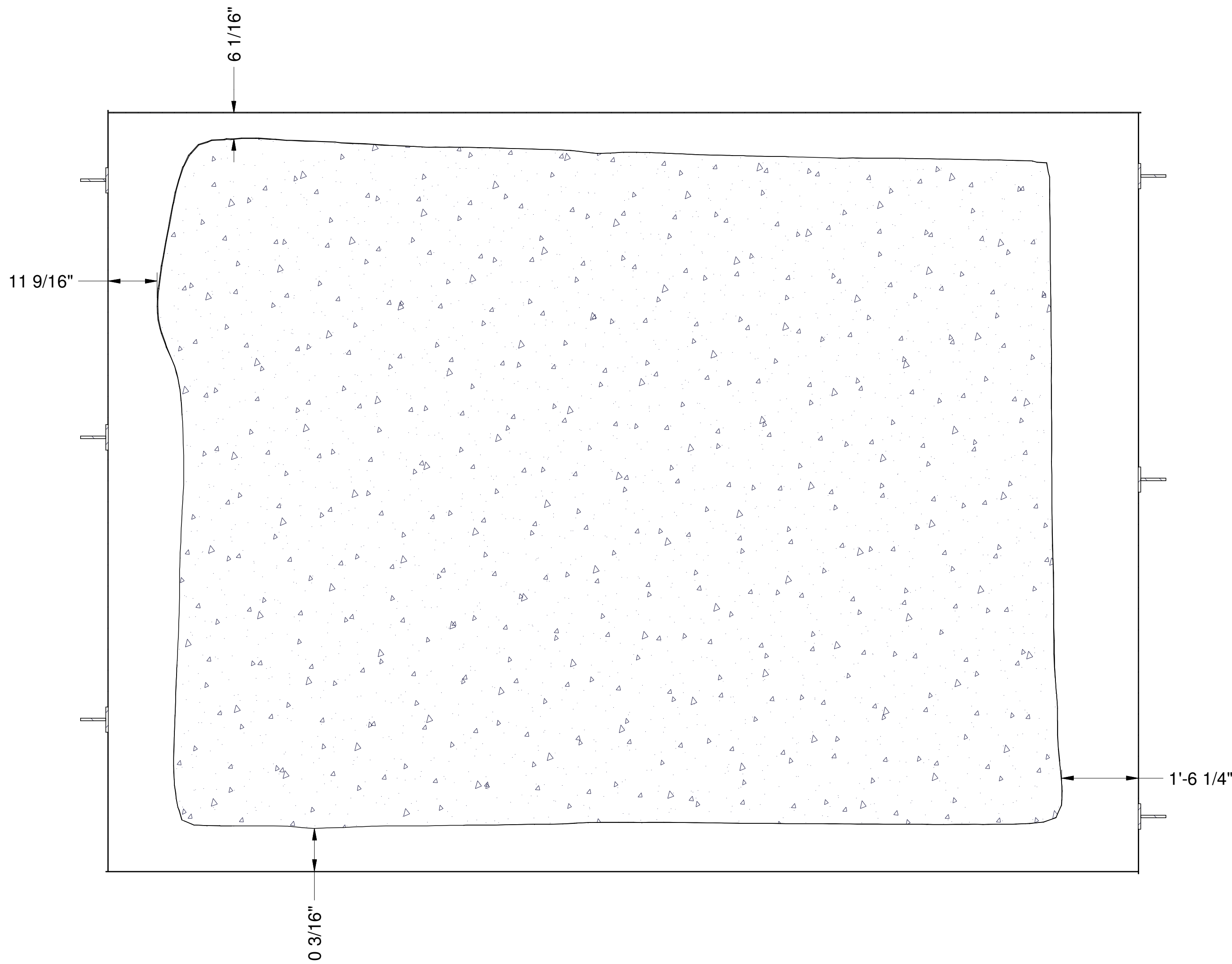
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

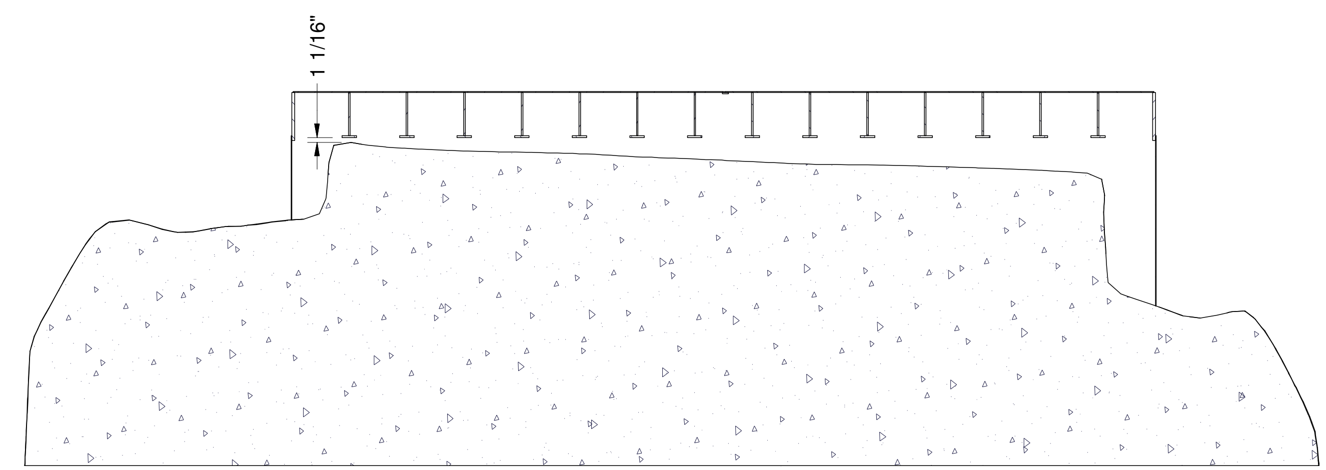
**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING LIFTING DETAILS
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: S18678-09-5
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE DUBYNA 2 OPENING CLEARANCES
LOCATION: 59°35'16.9"N 108°22'54.7"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: S18678-09-6 REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# FAY 10 Raise

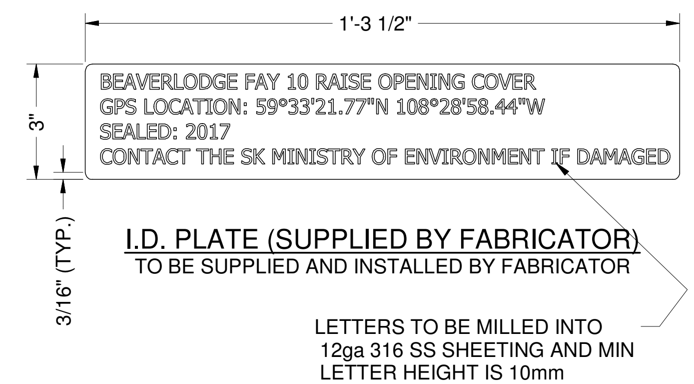
FAY 10 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. ALL ITEMS ARE EXISTING UNLESS NOTED OTHERWISE, (M) DENOTES MODIFIED ITEM, (N) DENOTES NEW ITEM.
15. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGS. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
16. (N) DENOTES ITEMS THAT ARE TO BE SUPPLIED BETWEEN DECEMBER 2016 AND SPRING OF 2017. (E) DENOTES ITEMS THAT WERE SUPPLIED DURING THE SPRING OF 2016.

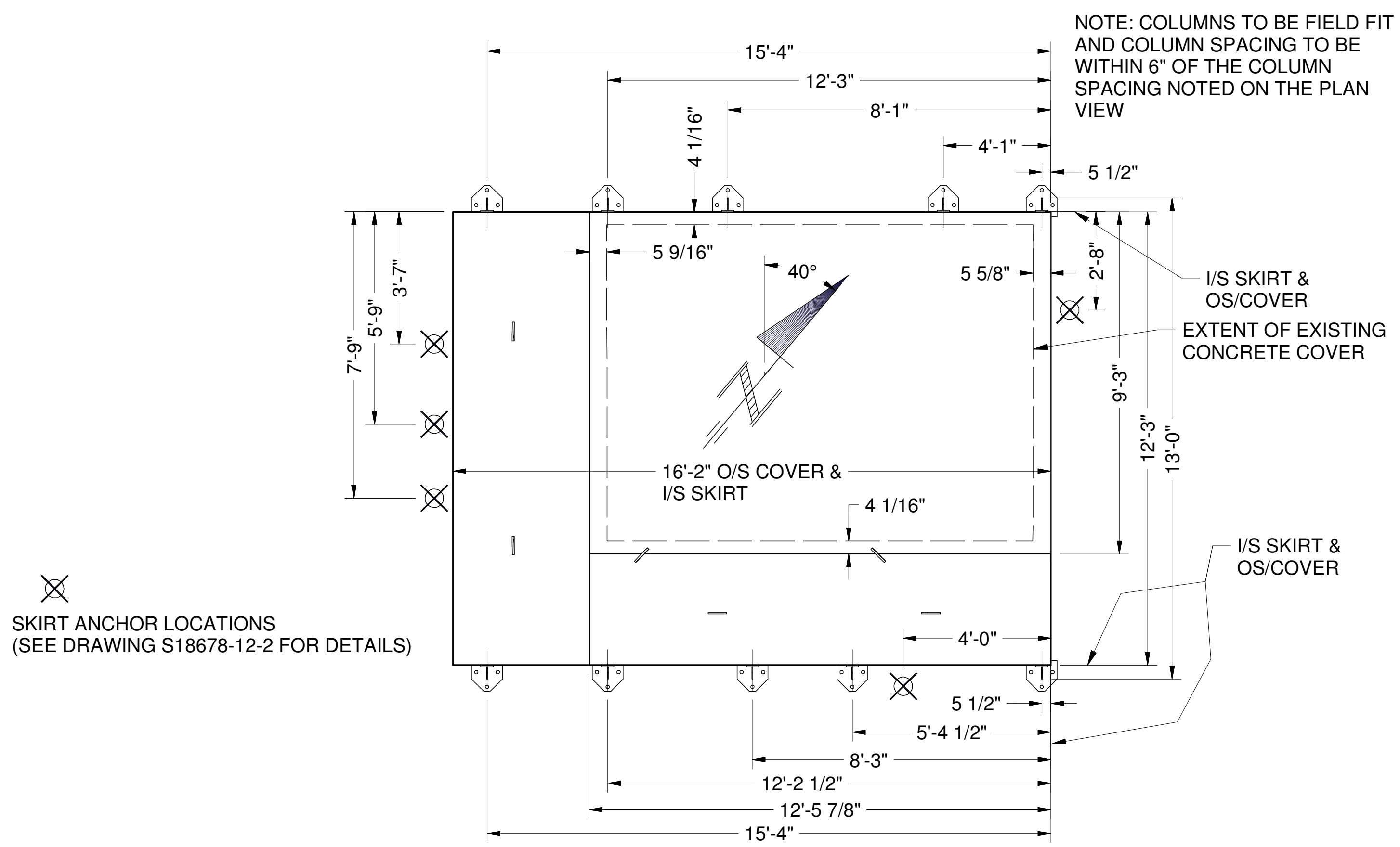
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD. COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL, WITHOUT DELIBERATE SABOTAGE. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 5,066 LBS
5. DO NOT BACK FILL WALLS OR TOP OF COVER 4

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | | (E) ROCK BED | | | |
| 2 | 1 | (M) EXTENDED TOP COVER | MK#S17550-A-101 | | 3 |
| 3 | | (E) 12 ga. SKIRT SHEETING | | ASTM A240-316L | |

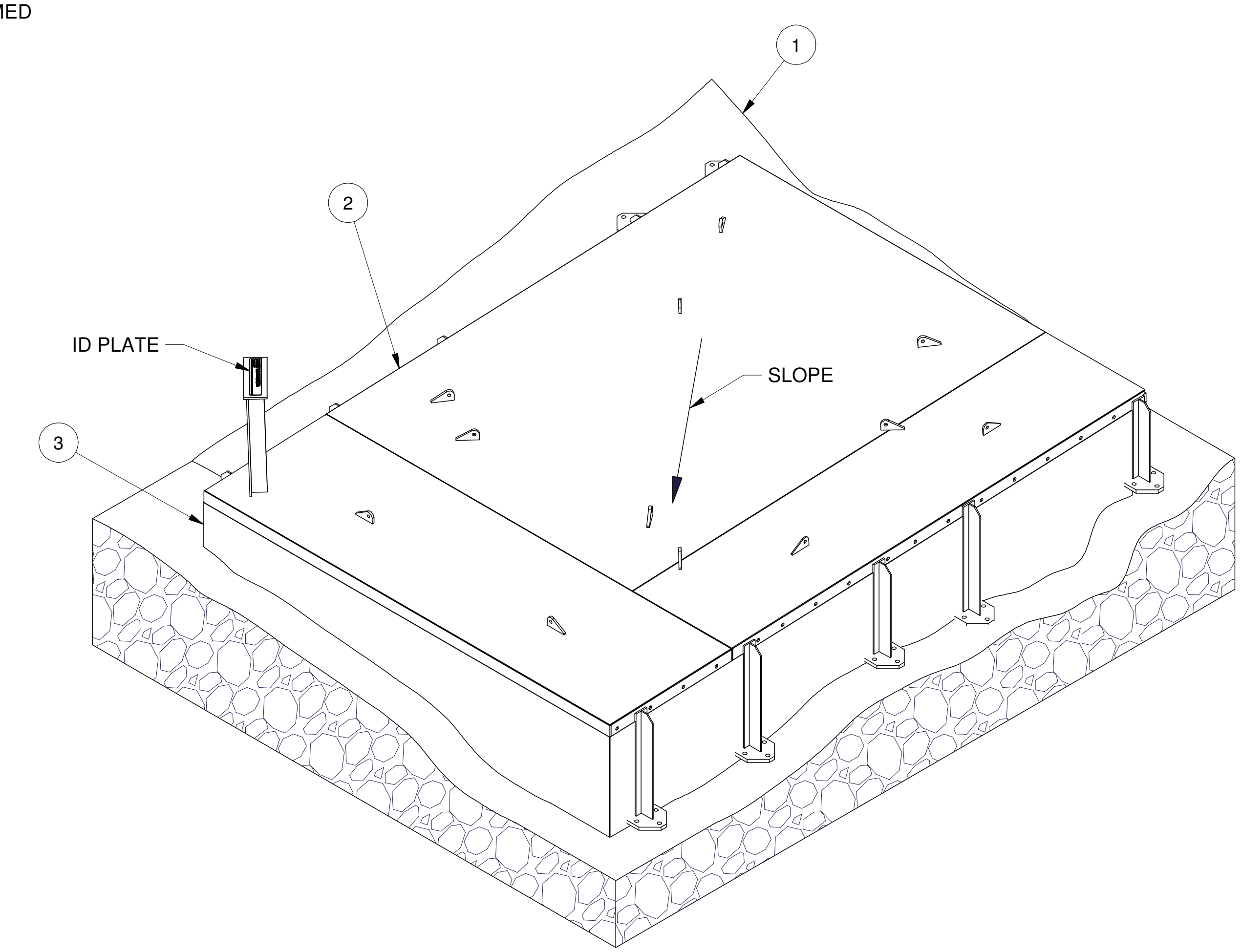
ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 4,072 LBS
AS INSTALLED: 5,066 LBS




I.D. PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR




PLAN VIEW - FAY 10 OPENING COVER




ISO VIEW - LOOKING NORTH



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN. DAY) — SASKATCHEWAN

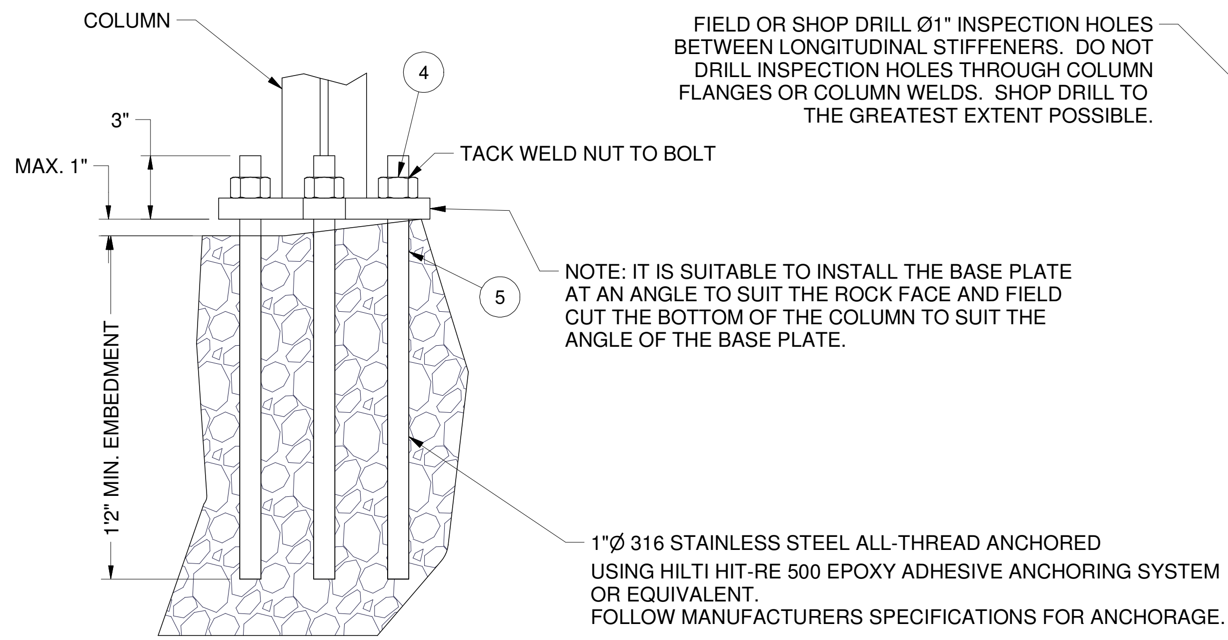
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

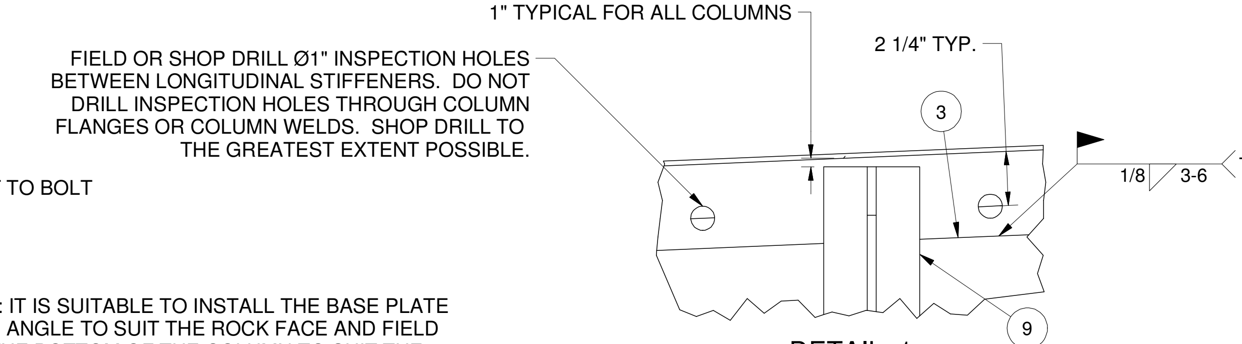
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 10
DWG. NO.: S17550-01-1
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



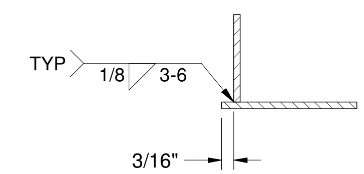

TYPICAL COLUMN ANCHOR BOLT DETAIL



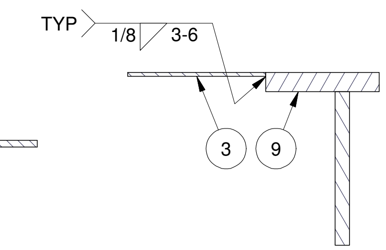

DETAIL 1

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | | (E) ROCK BED | | | |
| 2 | 1 | (M) EXTENDED TOP COVER | MK#S17550-A-101 | | 3 |
| 3 | | (E) 12 ga. SKIRT SHEETING | | ASTM A240-316L | |
| 4 | 48 | (E) Ø1" HEAVY HEX NUT | | ASTM A194 GR. B8M | |
| 5 | 24 | (E) Ø1" ALL THREAD | | ASTM A193 GR. B8M | |
| 6 | ~24 | (E) 3/8" SKIRT TAB | | ASTM A240-316L | |
| 7 | ~24 | (E) Ø5/8" NUT | | ASTM A194 GR. B8M | |
| 8 | ~24 | (E) Ø5/8" ALL THREAD | | ASTM A193 GR. B8M | |
| 9 | 8 | (E) COLUMN ASSEMBLY | MK#S17550-A-104 | | 6 |

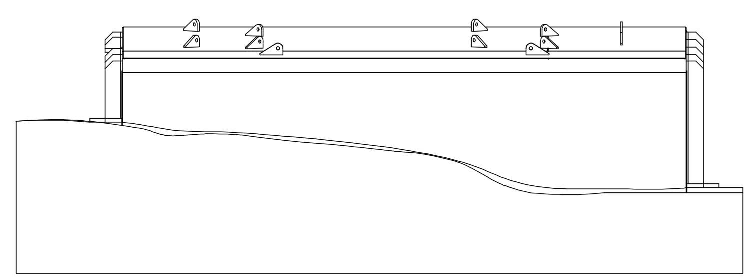
ESTIMATED TOTAL COLUMN LENGTH 13'-9 3/4" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH BE SUPPLIED PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.



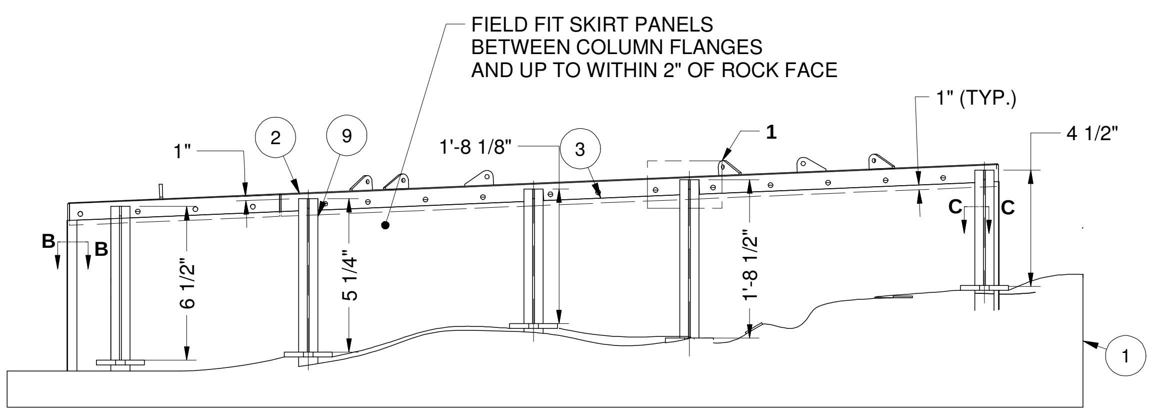

SECTION B-B

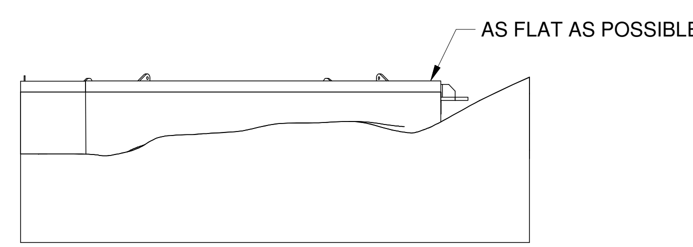



SECTION C-C

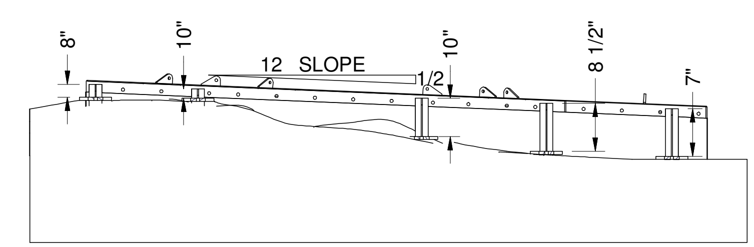


OPENING COVER - LOOKING NORTHEAST




OPENING COVER - LOOKING SOUTHWEST




OPENING COVER - LOOKING SOUTHEAST

OPENING COVER - MK#S17550-A-101 - LOOKING NORTHWEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

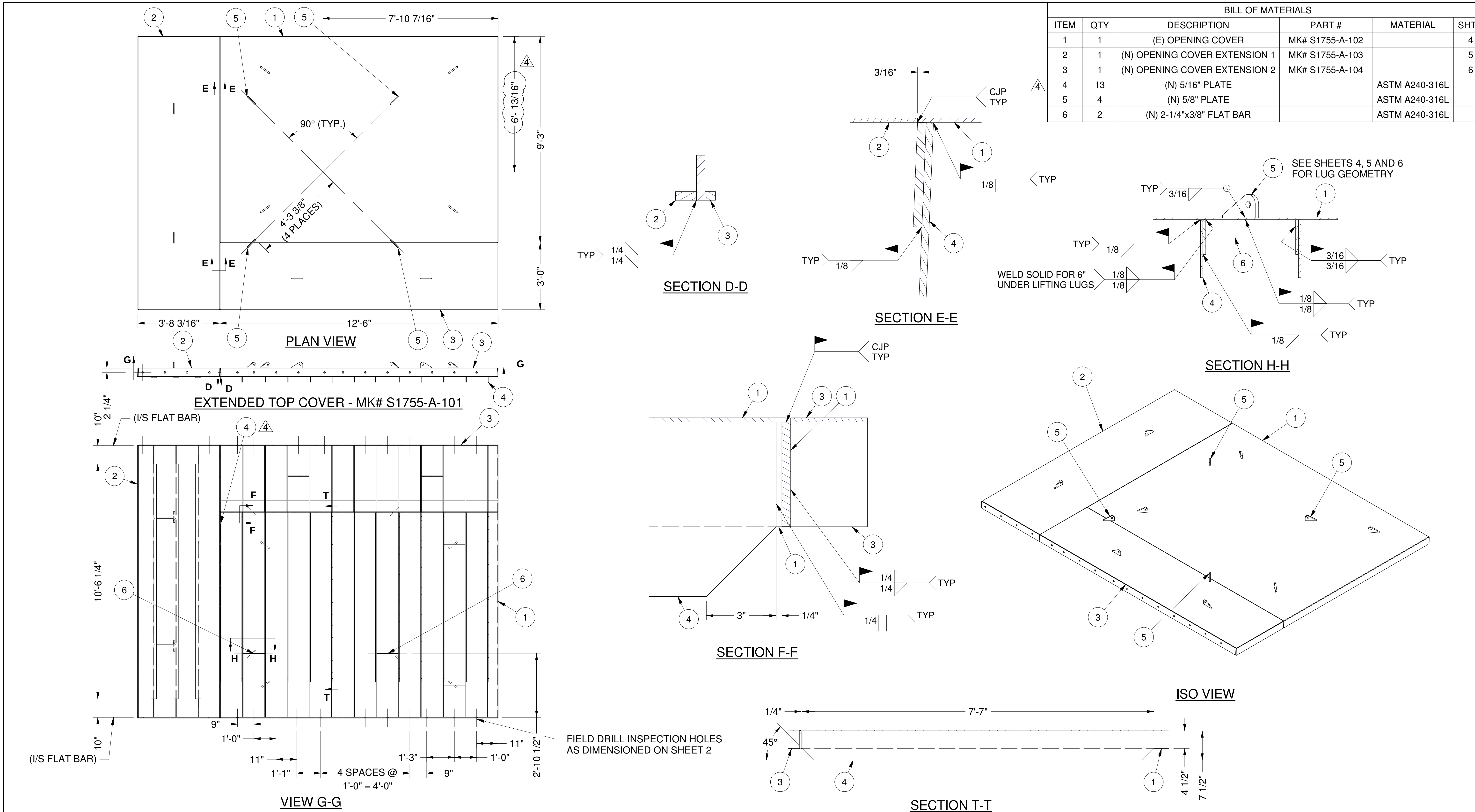
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING INSTALLATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 10
DWG. NO.: S17550-01-2
REV: 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (E) OPENING COVER | MK# S1755-A-102 | | 4 |
| 2 | 1 | (N) OPENING COVER EXTENSION 1 | MK# S1755-A-103 | | 5 |
| 3 | 1 | (N) OPENING COVER EXTENSION 2 | MK# S1755-A-104 | | 6 |
| 4 | 13 | (N) 5/16" PLATE | | ASTM A240-316L | |
| 5 | 4 | (N) 5/8" PLATE | | ASTM A240-316L | |
| 6 | 2 | (N) 2-1/4"x3/8" FLAT BAR | | ASTM A240-316L | |

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
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| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER E.B. CAUGHLIN MEMBER 14318 17 10 31 SASKATCHEWAN

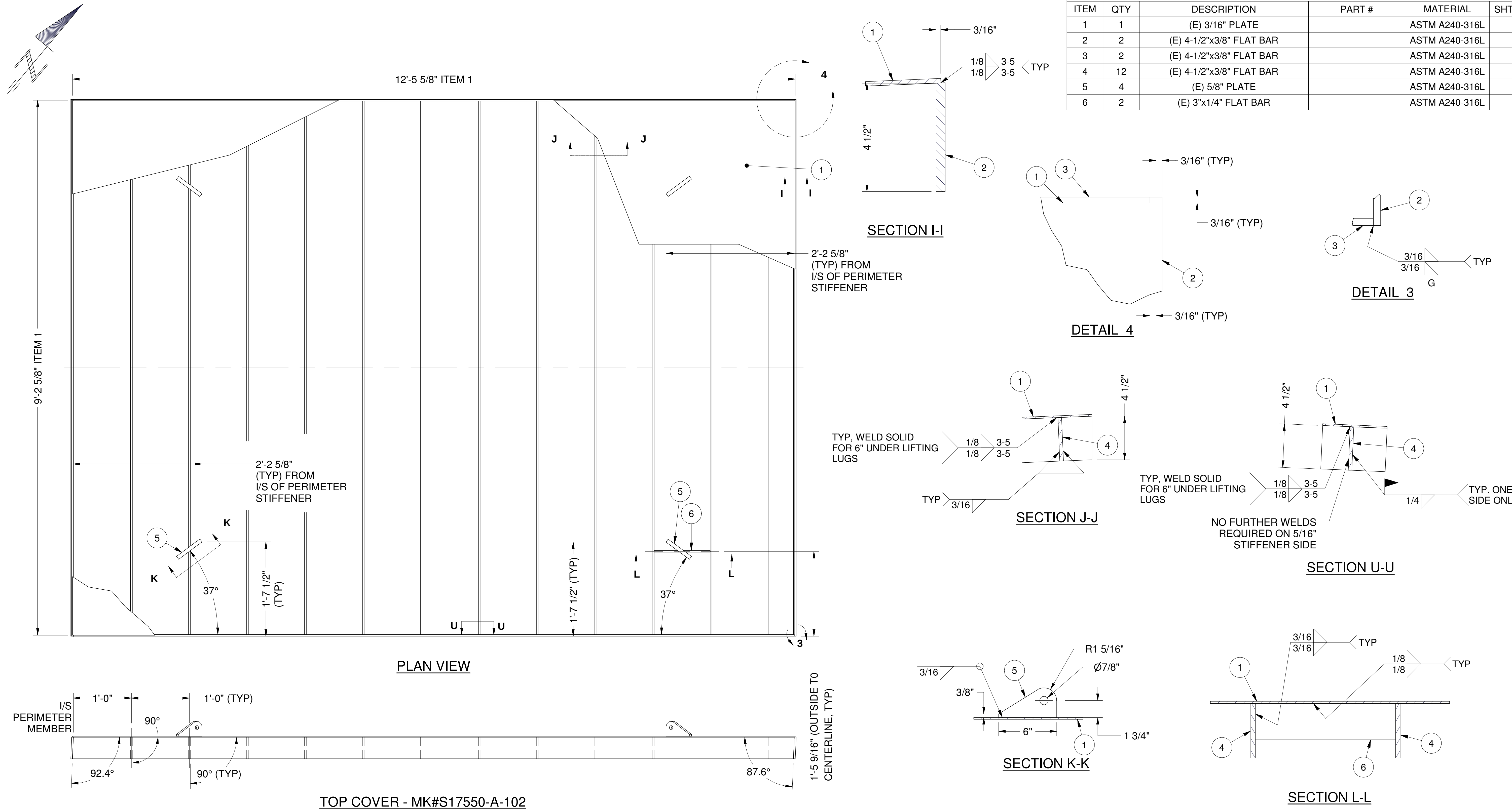
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: Structural — Sk. Reg. No.: 14318 — Signature

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
EXTENDED TOP COVER FABRICATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 10
DWG. NO.: S17550-01-3 REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (E) 3/16" PLATE | | ASTM A240-316L | |
| 2 | 2 | (E) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 3 | 2 | (E) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 4 | 12 | (E) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 5 | 4 | (E) 5/8" PLATE | | ASTM A240-316L | |
| 6 | 2 | (E) 3"x1/4" FLAT BAR | | ASTM A240-316L | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER — E.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY) — SASKATCHEWAN

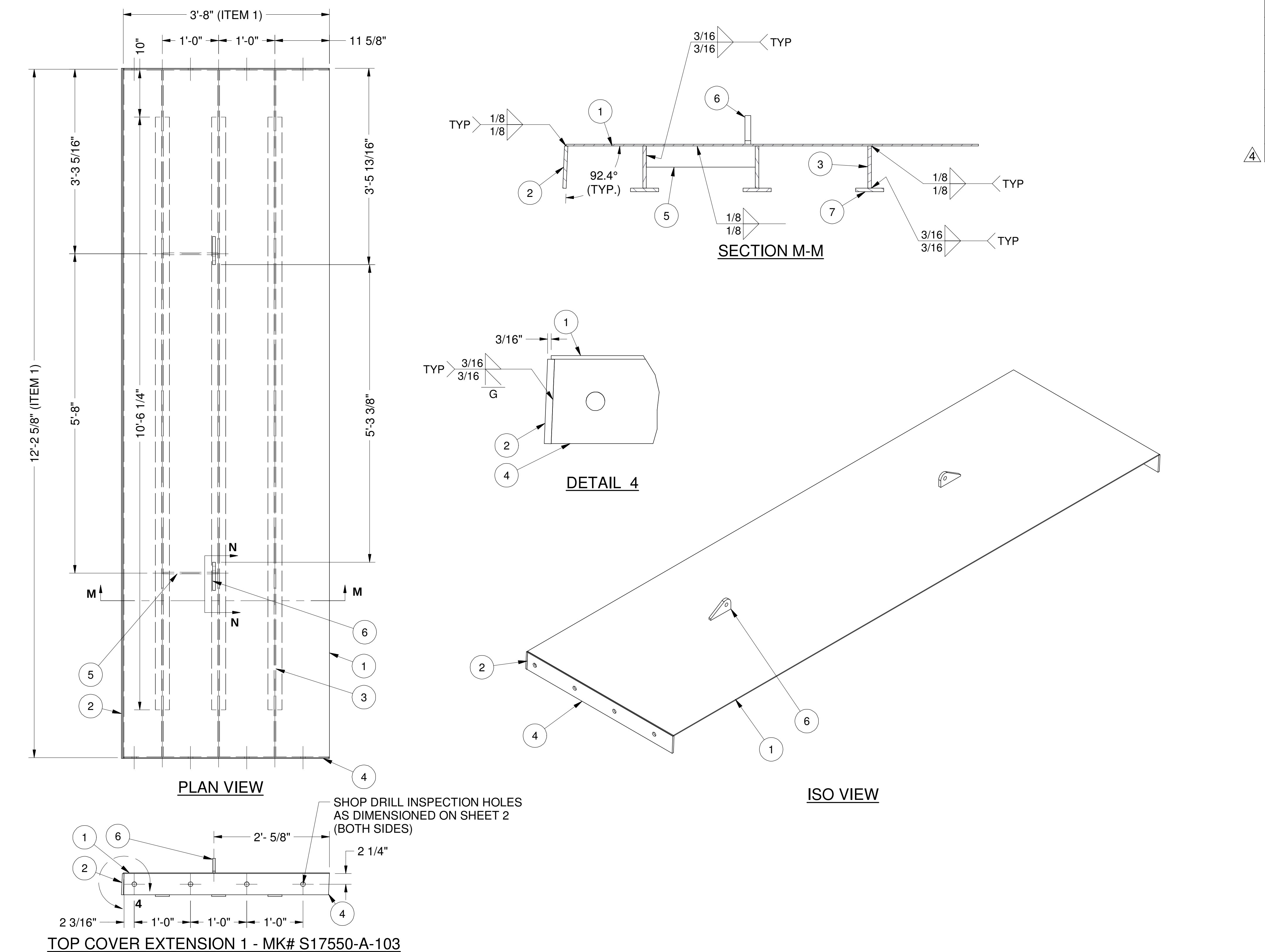
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

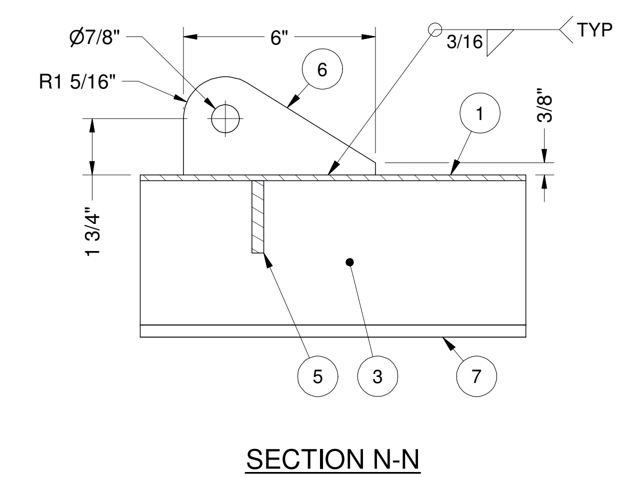
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
TOP COVER FABRICATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 10
DWG. NO.: S17550-01-4
REV: 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (N) 3/16" PLATE | | ASTM A240-316L | |
| 2 | 1 | (N) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 3 | 3 | (N) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 4 | 2 | (N) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 5 | 2 | (N) 2-1/4"x3/8" PLATE | | ASTM A240-316L | |
| 6 | 2 | (N) 5/8" PLATE | | ASTM A240-316L | |
| 7 | 3 | (N) 3/8" x 3" PLATE | | ASTM A240-316L | |




SECTION N-N

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

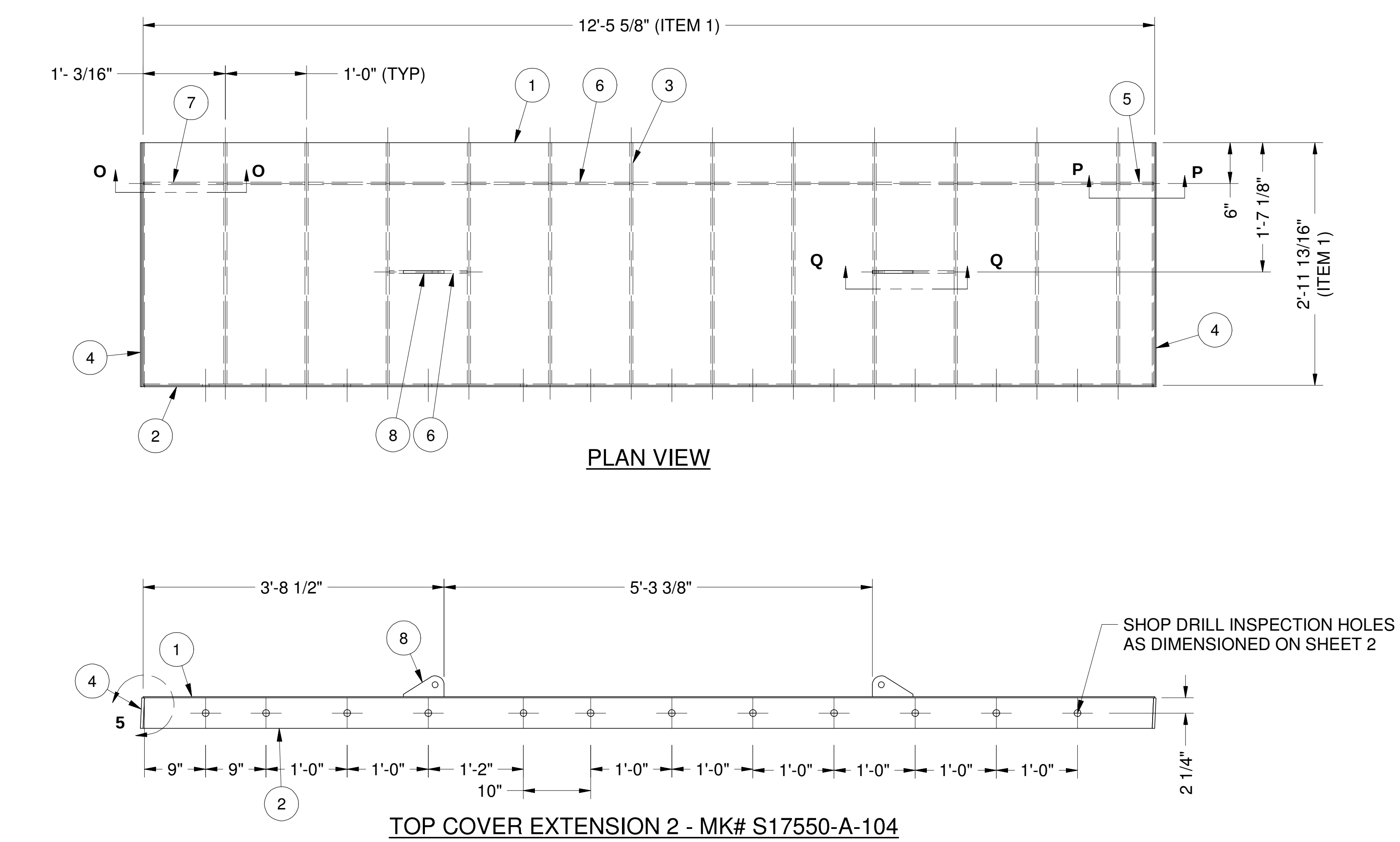
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

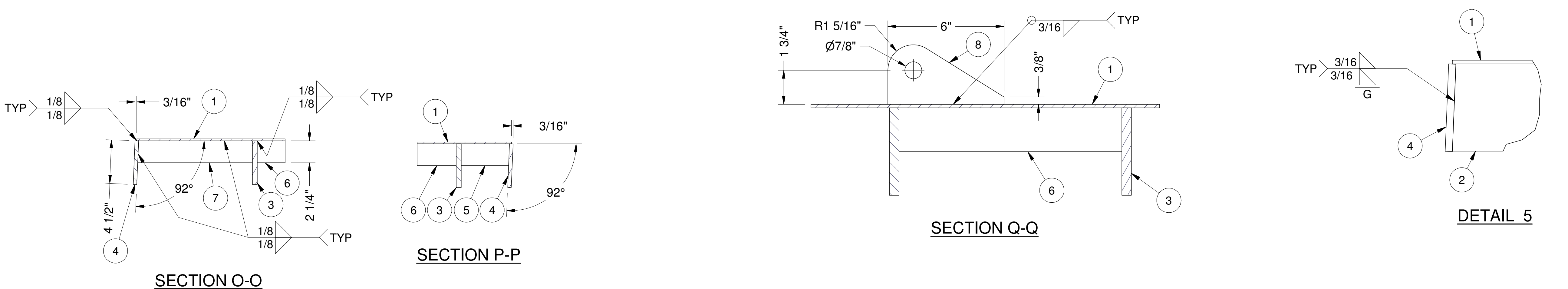
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
TOP COVER EXTENSION 1 FABRICATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S17550-01-5
4
SHEET NO.: 5 OF 10

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




BILL OF MATERIALS

| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
|---|---|---|---|---|---|
| 1 | 1 | (N) 3/16" PLATE | | ASTM A240-316L | |
| 2 | 1 | (N) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 3 | 12 | (N) 4-1/2"x1/2" FLAT BAR | | ASTM A240-316L | |
| 4 | 2 | (N) 4-1/2"x3/8" FLAT BAR | | ASTM A240-316L | |
| 5 | 1 | (N) 2-1/4"x3/8" FLAT BAR | | ASTM A240-316L | |
| 6 | 13 | (N) 2-1/4"x3/8" FLAT BAR | | ASTM A240-316L | |
| 7 | 1 | (N) 2-1/4"x3/8" FLAT BAR | | ASTM A240-316L | |
| 8 | 2 | (N) 5/8" PLATE | | ASTM A240-316L | |



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER — C.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

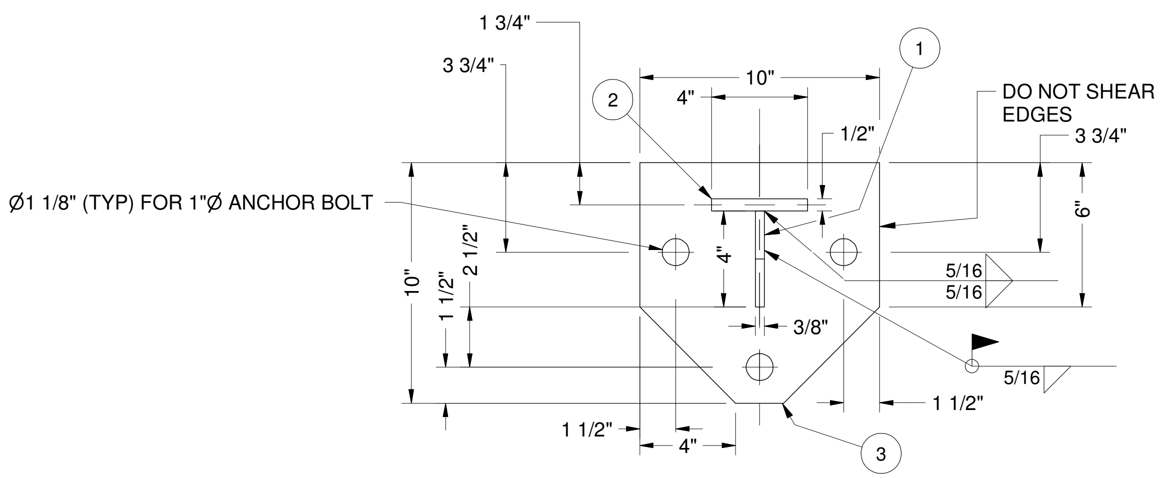
**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
TOP COVER EXTENSION 2 FABRICATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 10
DWG. NO.: S17550-01-6
REV: 4

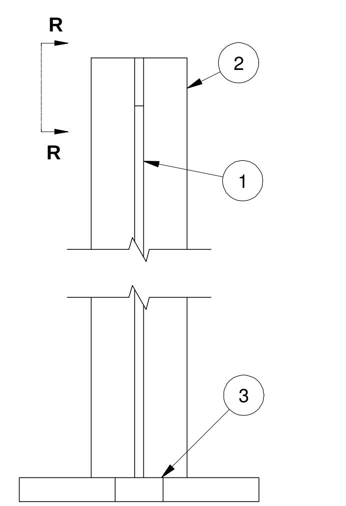
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

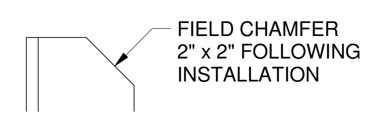
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT # |
| 1 | 1 | (E) 4x3/8" FLAT BAR | | ASTM A240-316L | |
| 2 | 1 | (E) 4x1/2" FLAT BAR | | ASTM A240-316L | |
| 3 | 1 | (E) 1" PLATE | | ASTM A240-316L | |

NOTE: QUANTITIES IN BOM ARE FOR ONE OF EACH ASSEMBLY ONLY. EIGHT (8) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.




TYPICAL COLUMN PLAN




SECTION R-R

TYPICAL COLUMN ELEVATION
MK#S17550-A-105



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | JG |
| DATE: | 11/13/2015 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

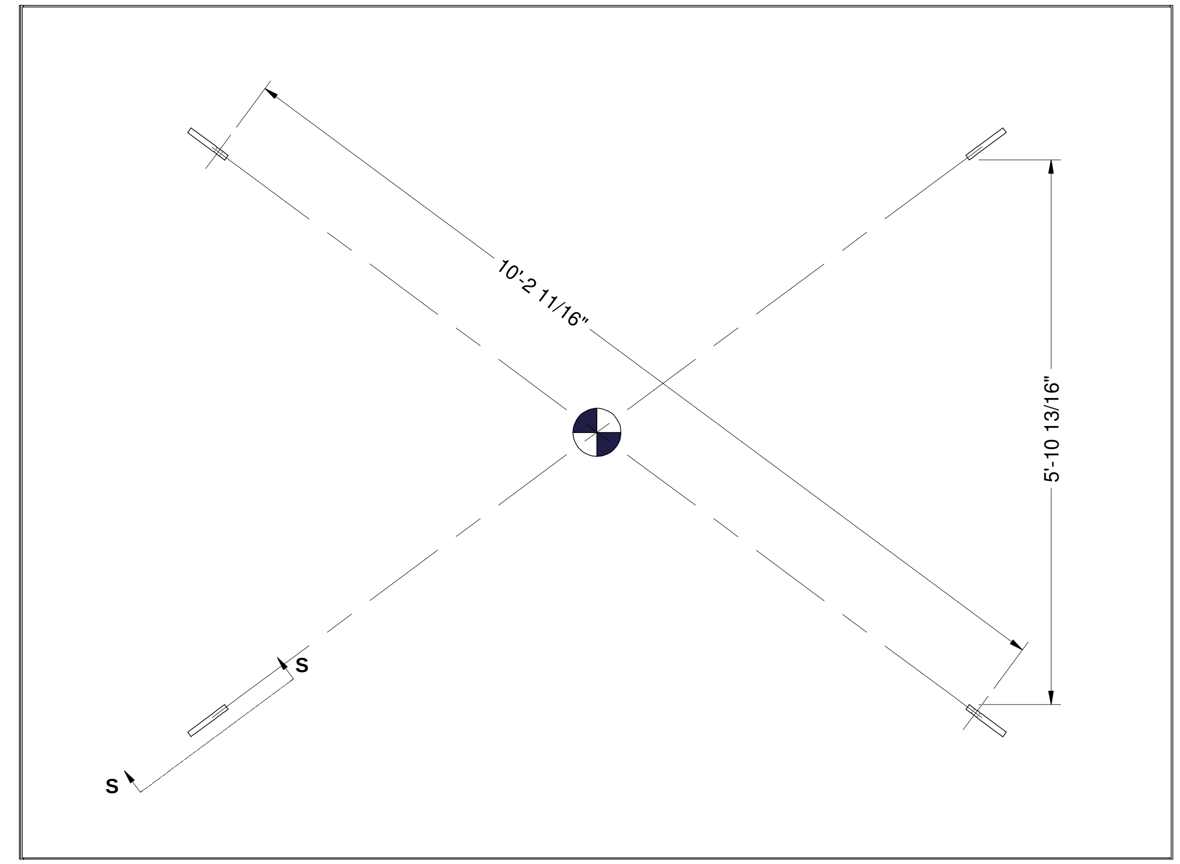
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

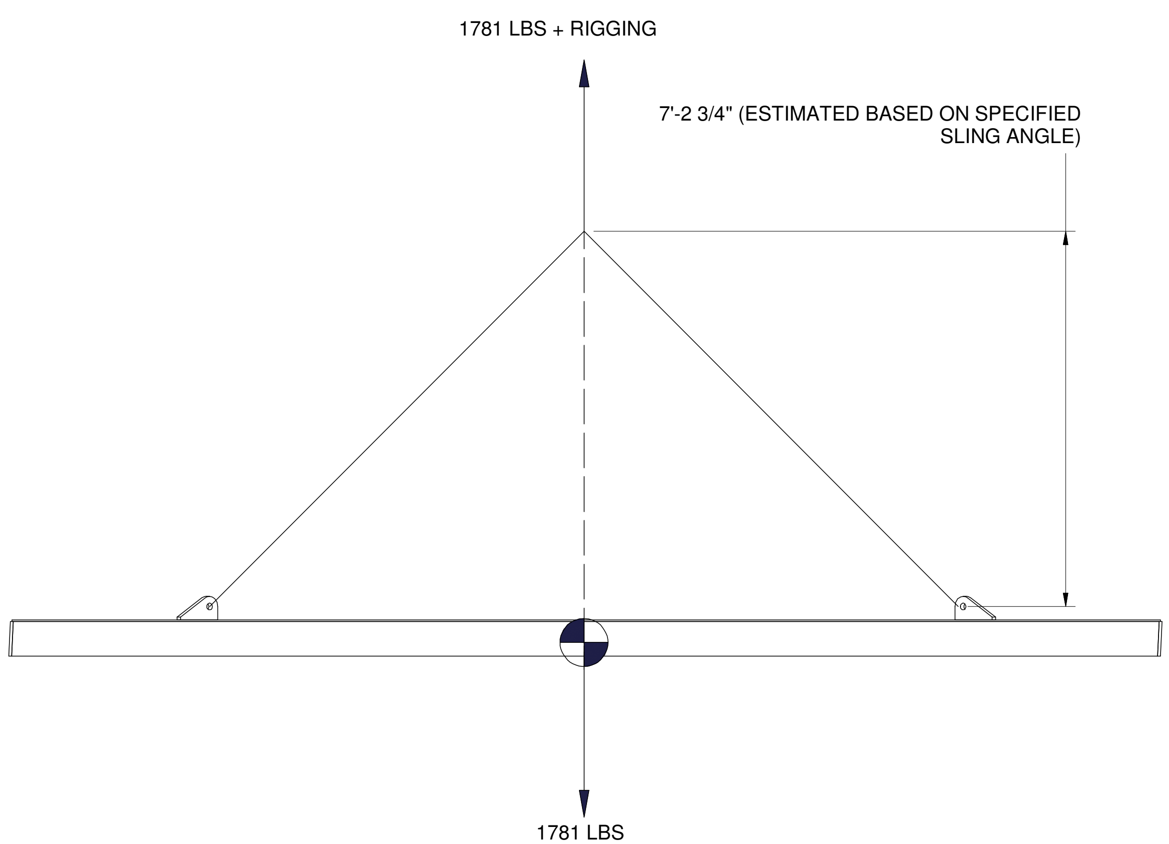
PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
COLUMN ASSEMBLY FABRICATION DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 10
DWG. NO.: S17550-01-7
4

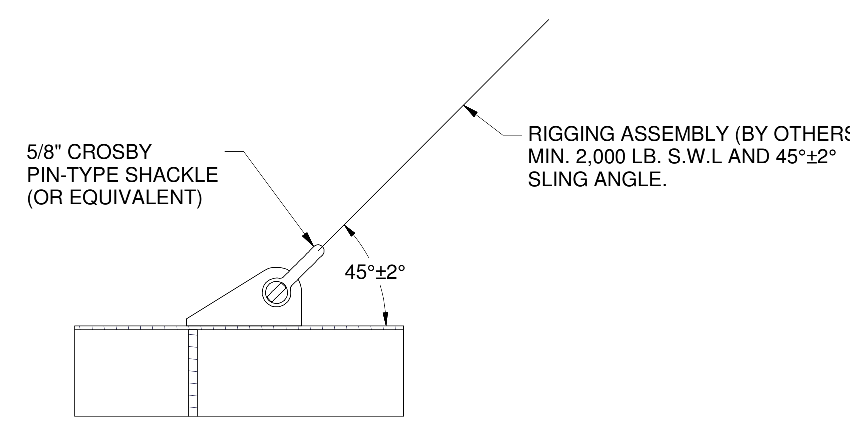
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - PLAN VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW




SECTION S-S





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | JG |
| DATE: | 11/13/2015 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

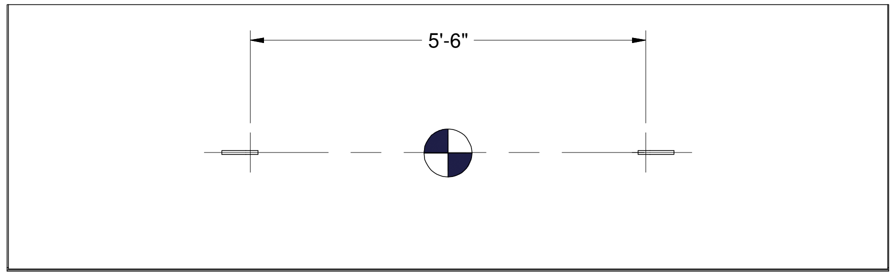
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

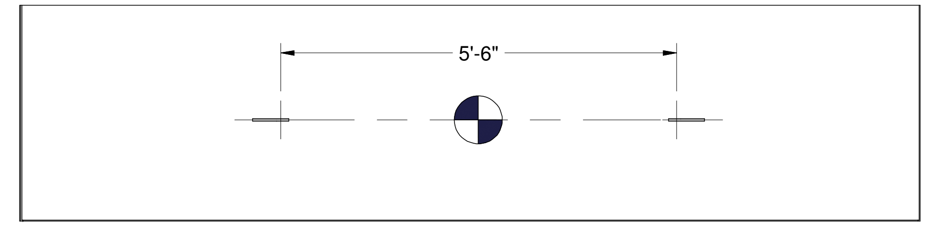
PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
COVER LIFTING DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 8 OF 10
DWG. NO.: S17550-01-8
4

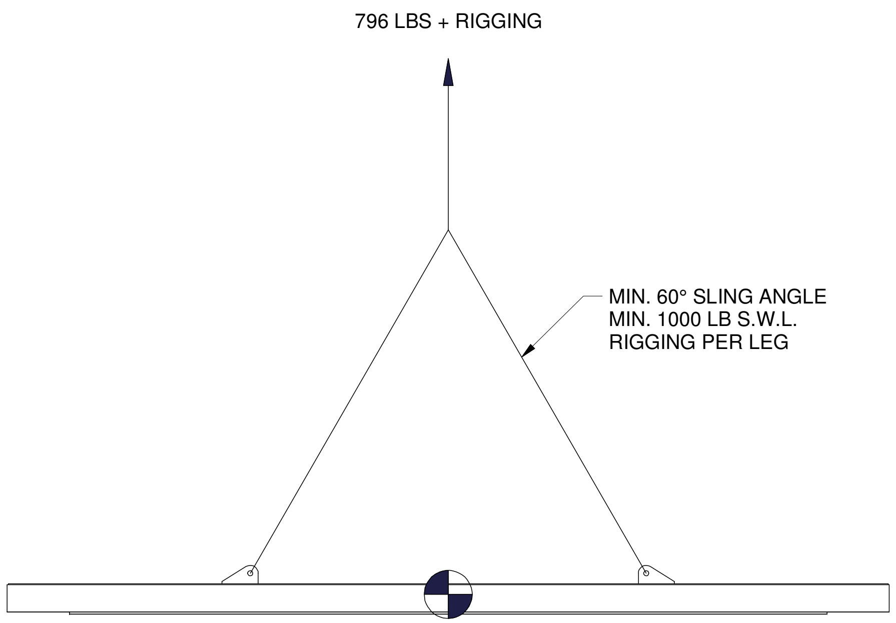
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



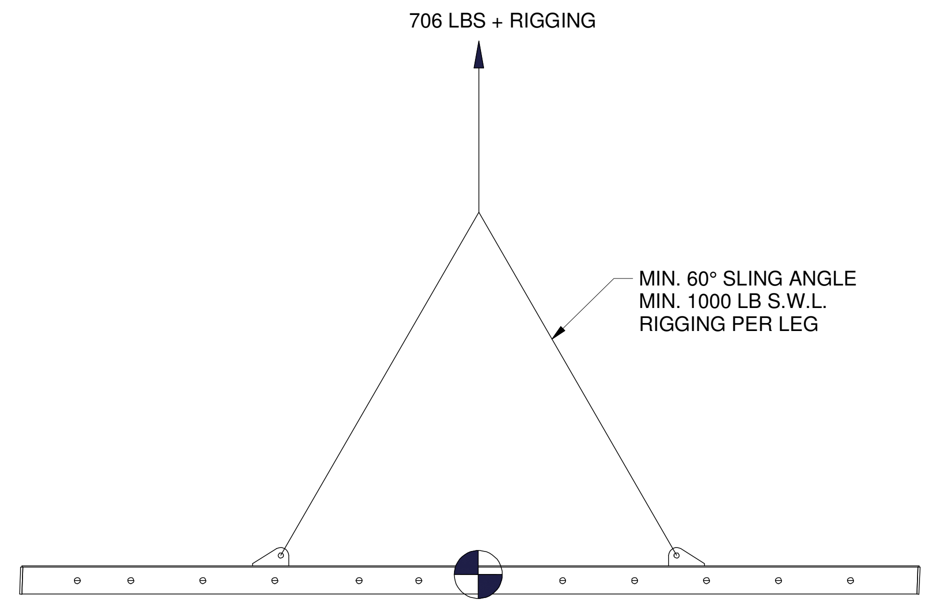

TOP COVER EXTENSION 1 LIFTING DIAGRAM - PLAN VIEW




TOP COVER EXTENSION 2 LIFTING DIAGRAM - PLAN VIEW




TOP COVER EXTENSION 1 LIFTING DIAGRAM - SIDE VIEW




TOP COVER EXTENSION 2 LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | JG |
| DATE: | 11/13/2015 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

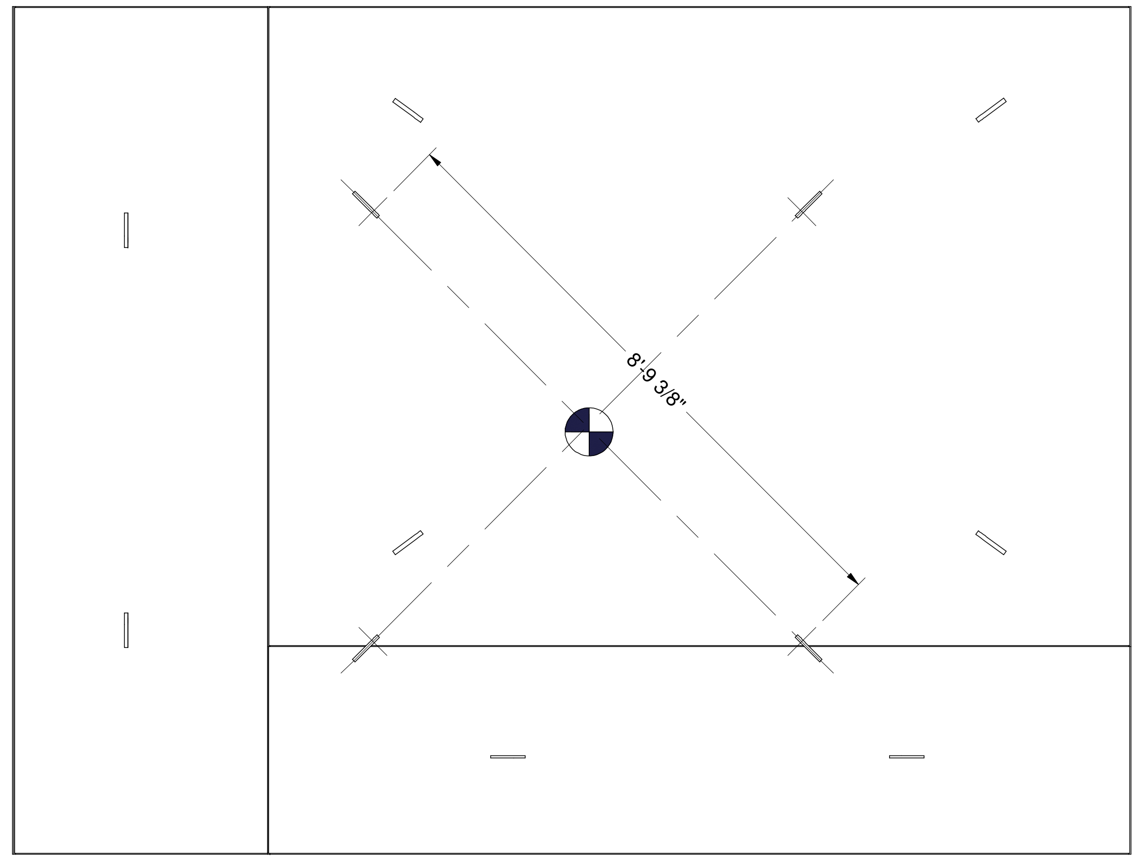
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

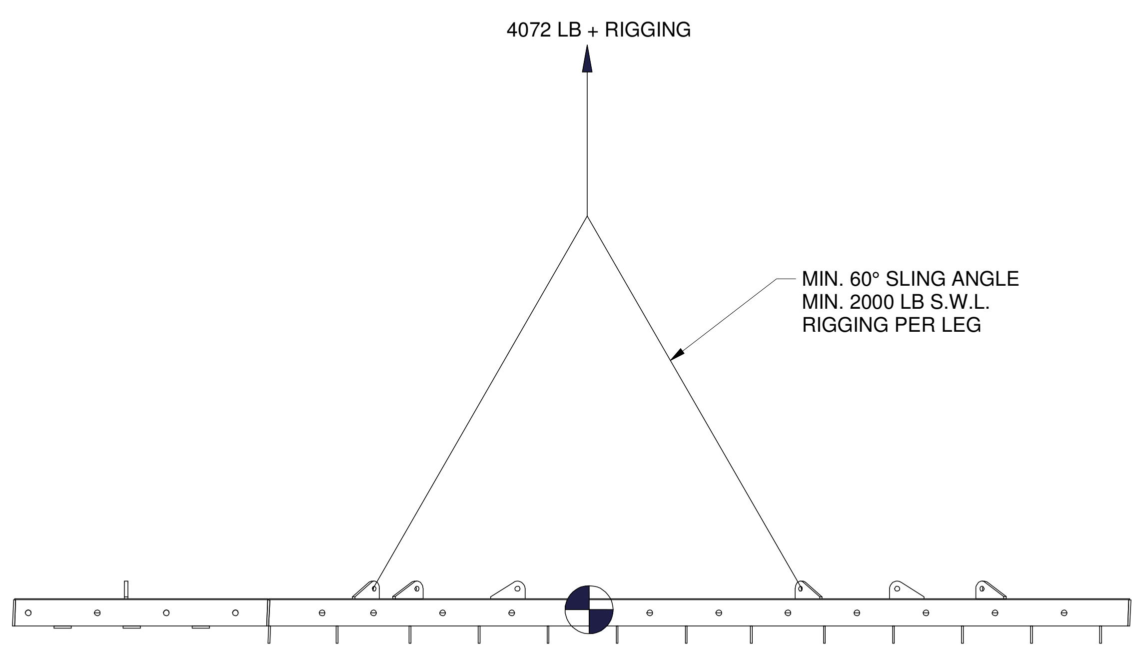
PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
COVER EXTENSION ASSEMBLY LIFTING DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 9 OF 10
DWG. NO.: S17550-01-9
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




EXTENDED TOP COVER LIFTING DETAIL - PLAN VIEW




EXTENDED TOP COVER LIFTING DETAIL - SIDE VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 3 | REVISED FOLLOWING FABRICATOR INPUT | 11/18/2016 | N.R. |
| | | 2 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | 1 | ADDED EXTENSIONS, AND REVISED INSPECTION HOLES AND SKIRT | 10/25/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: JG
DATE: 11/13/2015
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT STAINLESS STEEL COVER FOR BEAVERLODGE FAY 10 OPENING
EXTENDED TOP COVER ASSEMBLY LIFTING DETAILS
LOCATION: 59°33'21.77N, 108°28'58.44W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 10 OF 10
DWG. NO.: S17550-01-10
4

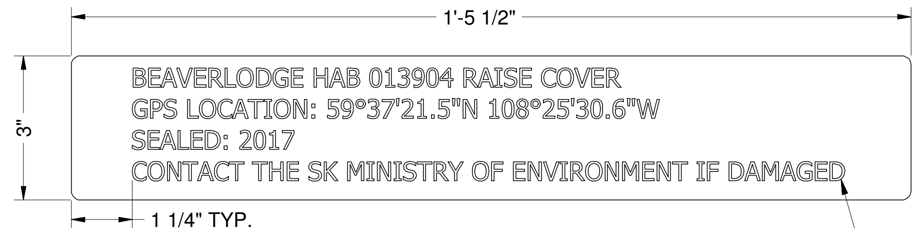
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## HAB 2 - 013904 Raise

HAB 2 - 013904 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

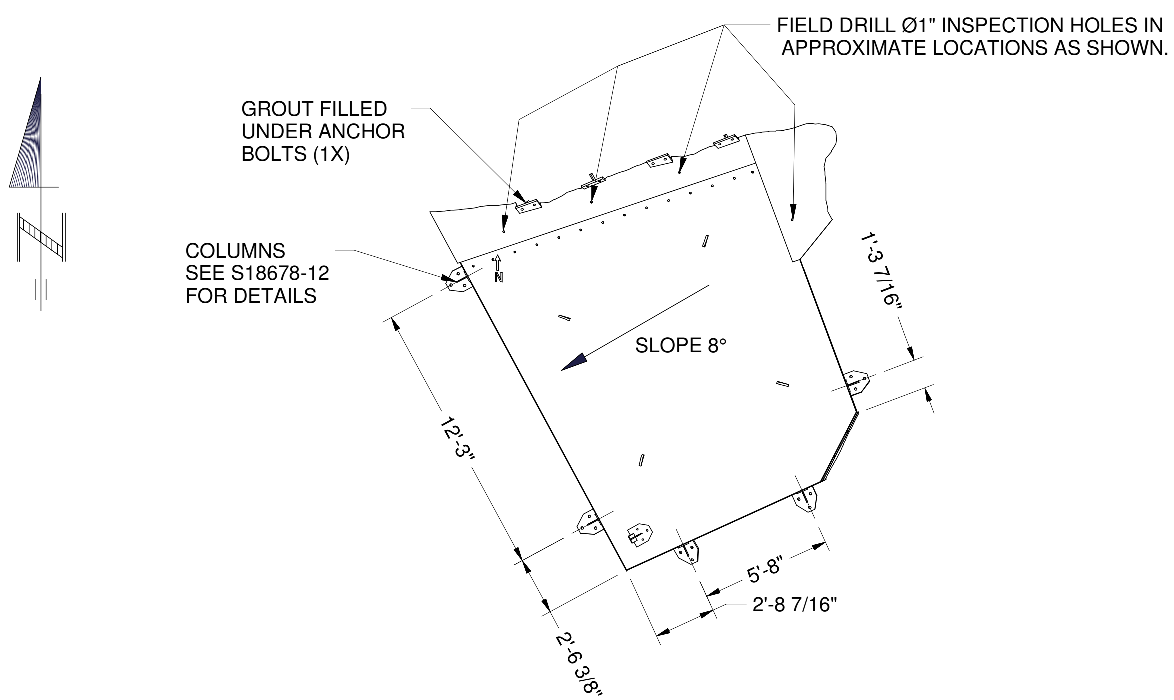
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 5732 LB
5. DO NOT BACK FILL WALLS OF COVER.



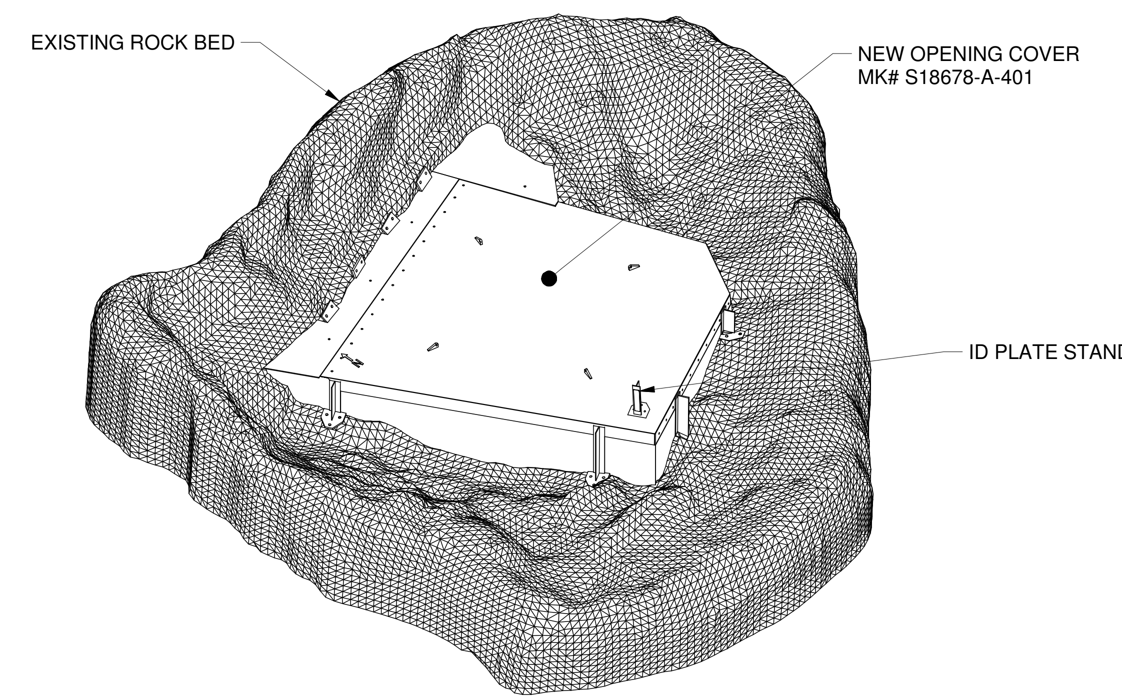

ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 4242 LB
AS INSTALLED: 5732 LB




PLAN VIEW - HAB 2 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

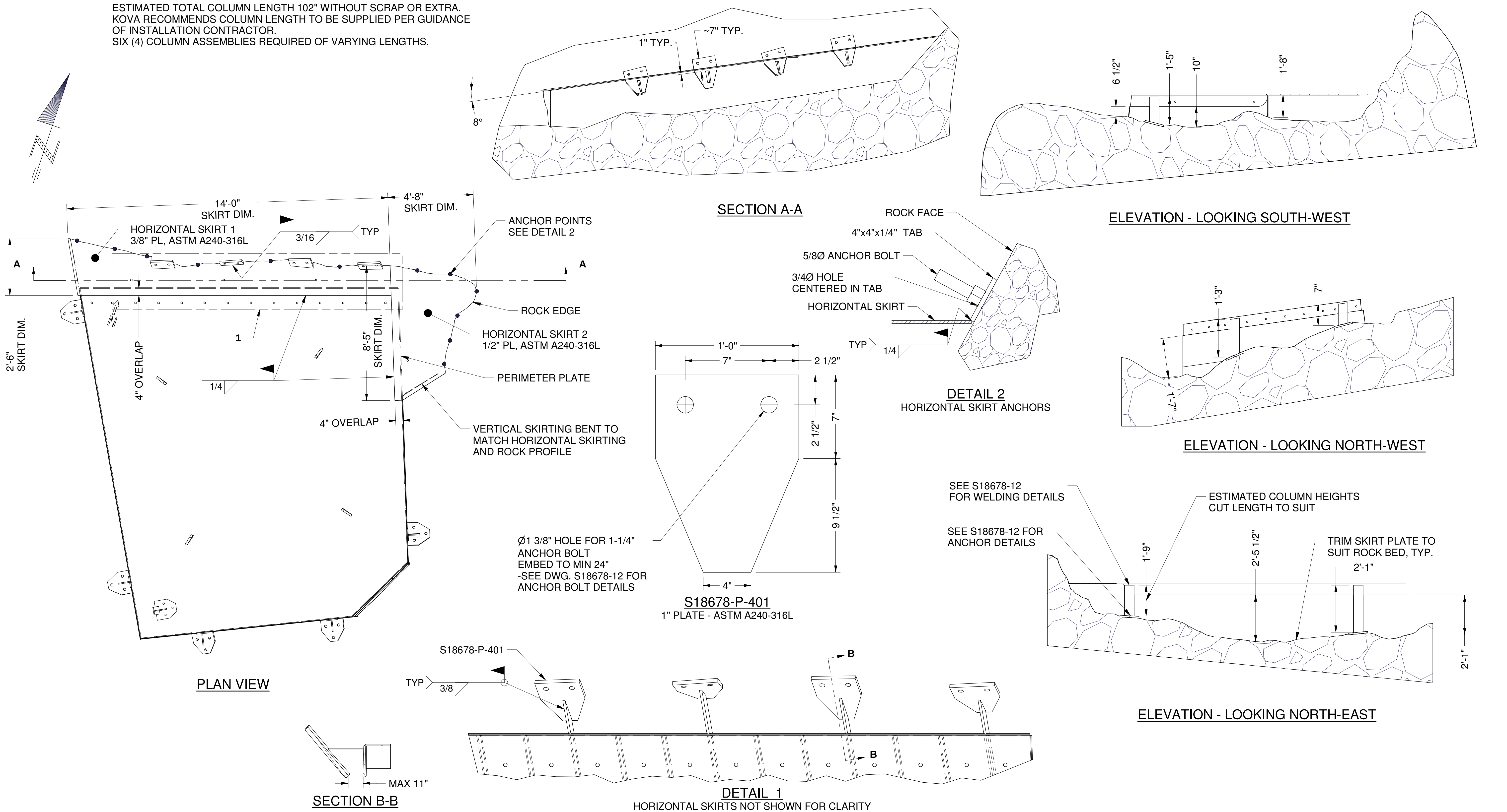
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: S18678-04-1
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

ESTIMATED TOTAL COLUMN LENGTH 102" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (4) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN. DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

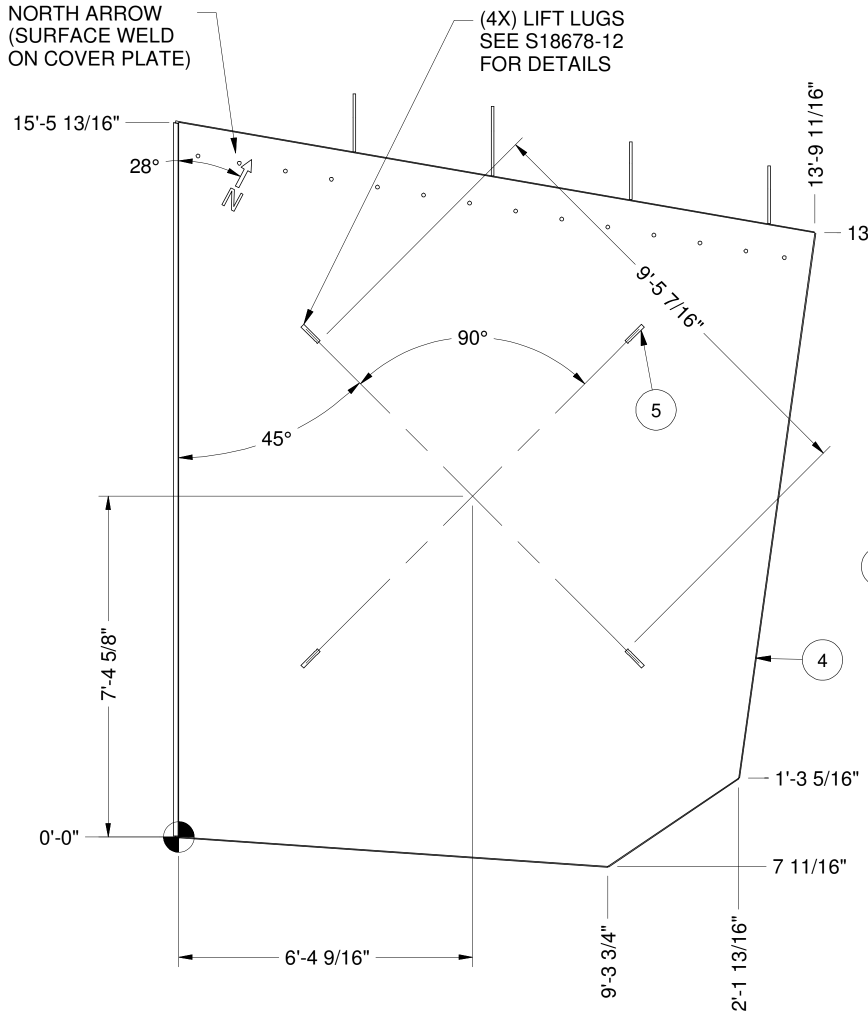
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

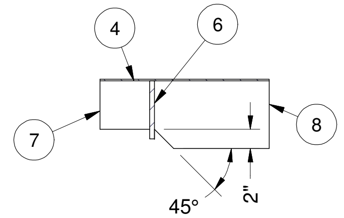
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING
INSTALLATION DETAILS
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: S18678-04-2
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

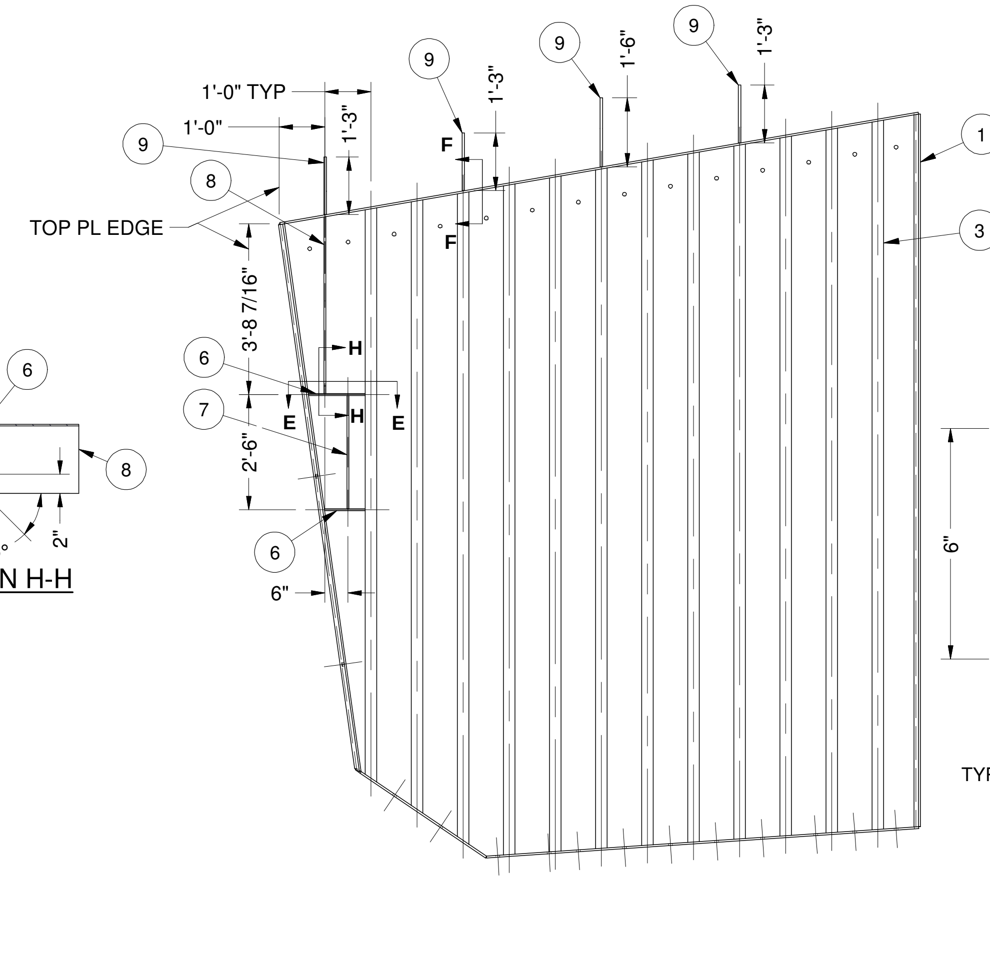
| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | | 8"x1/2" FB | ASTM A240-316L |
| 2 | | 7" x 5/16" FB | ASTM A240-316L |
| 3 | | 3"x3/8" FB | ASTM A240-316L |
| 4 | 1 | 3/16" PL | ASTM A240-316L |
| 5 | 4 | 5/8" PL | ASTM A240-316L |
| 6 | 2 | 6" X 1/2" FB | ASTM A240-316L |
| 7 | 1 | 5" x 1/2" FB | ASTM A240-316L |
| 8 | 1 | 7" x 1/2" FB | ASTM A240-316L |
| 9 | 4 | 6" x 5/8" F.B. | ASTM A240-316L |



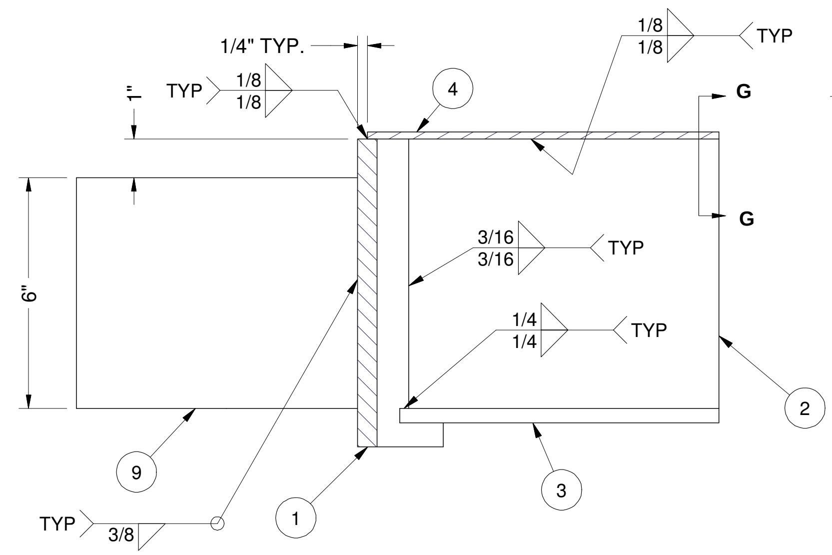

S18678-A-401 - TOP VIEW
TOP PLATE DIMENSIONS



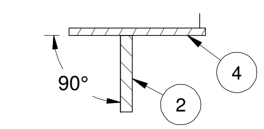

SECTION H-H



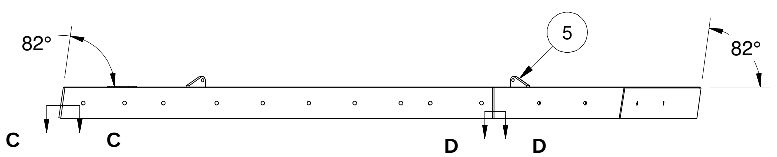

S18678-A-401 - BOTTOM VIEW
STIFFENER LAYOUT



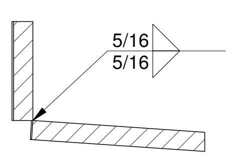

SECTION F-F



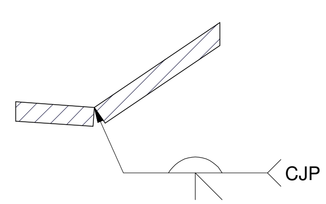

SECTION G-G



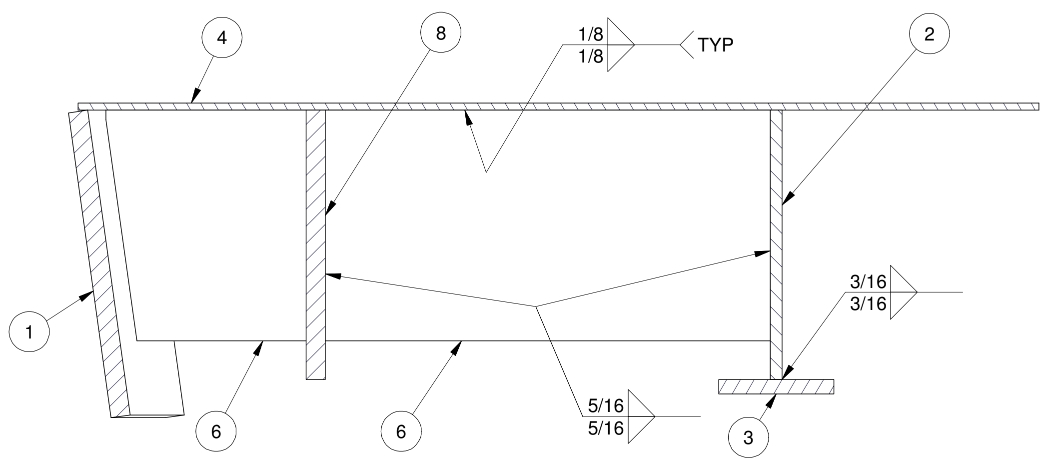

SIDE VIEW



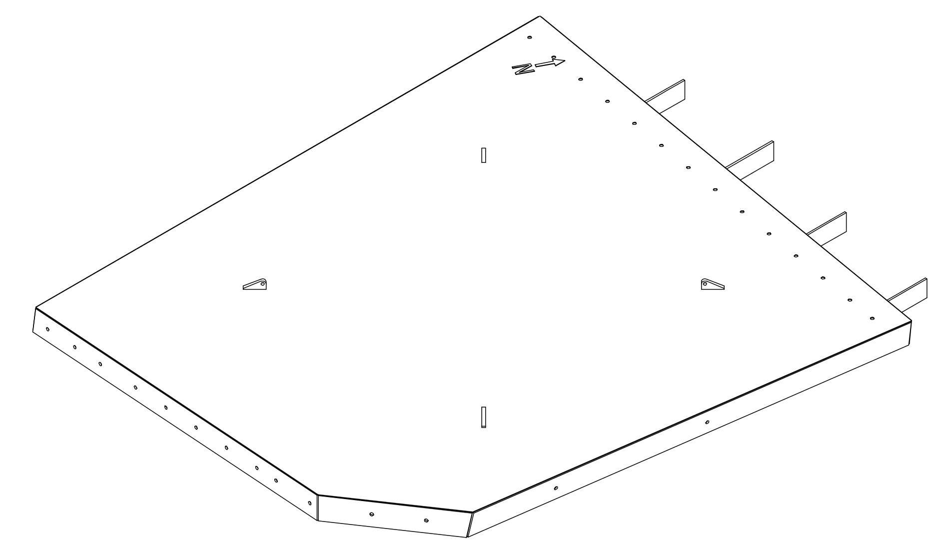

SECTION C-C




SECTION D-D




SECTION E-E



S18678-A-401 - ISO VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR MN DAY
SASKATCHEWAN

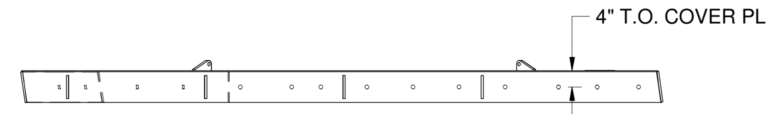
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

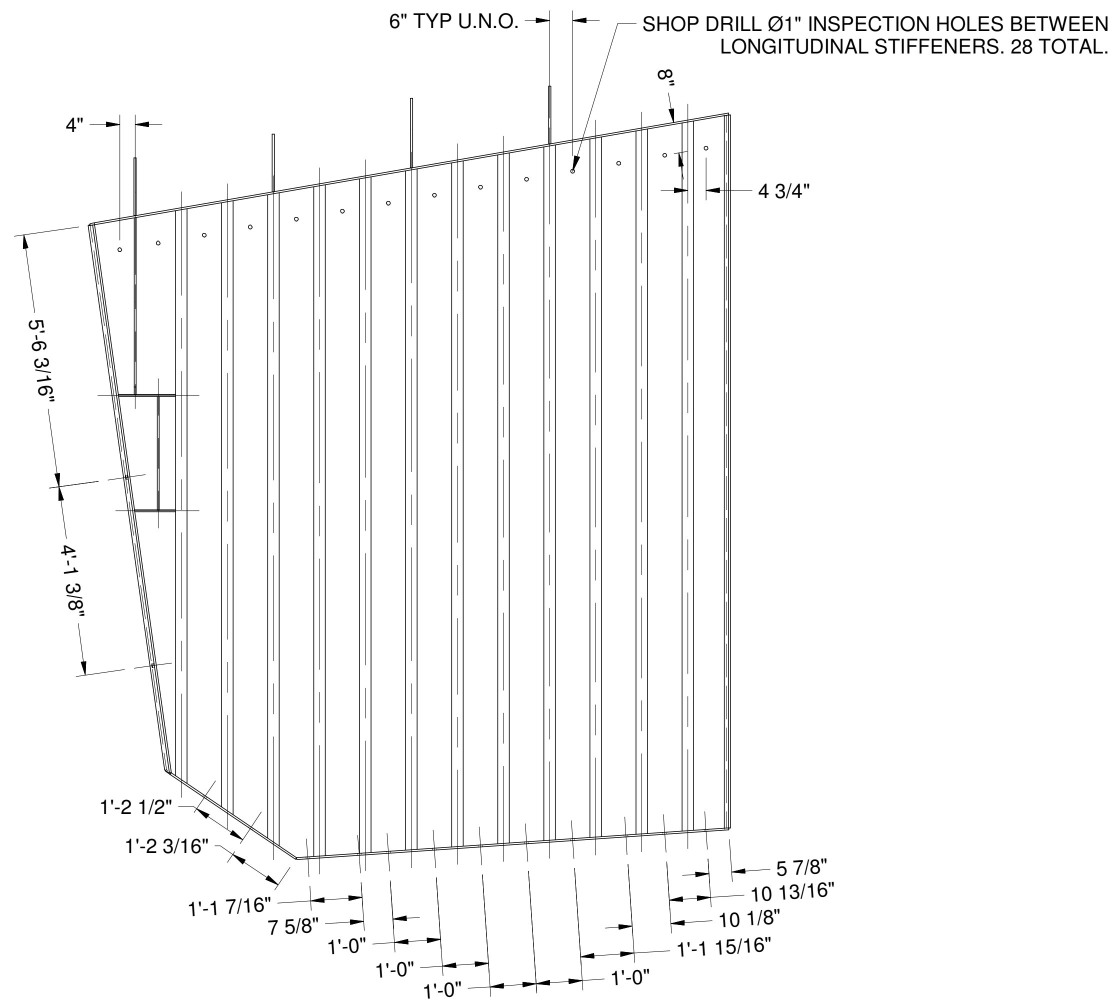
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING
TOP COVER SECTIONS
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: S18678-04-3 REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




SIDE VIEW




S18678-A-401 - BOTTOM VIEW
INSPECTION HOLE LAYOUT





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

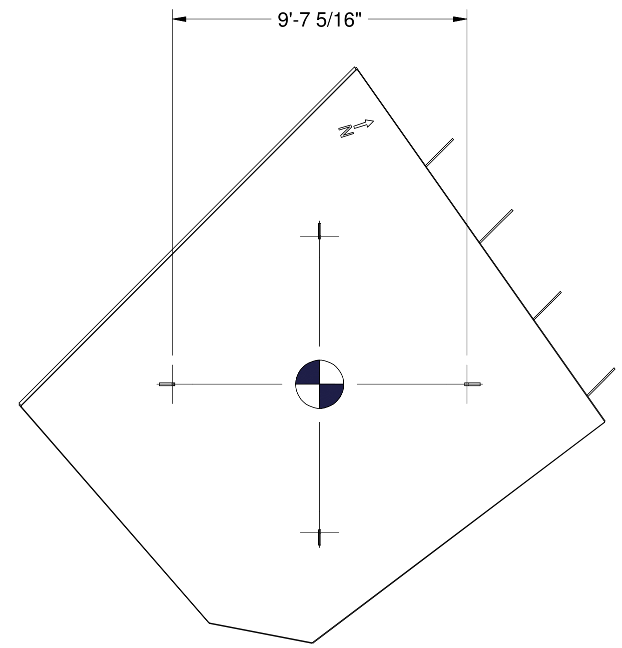
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

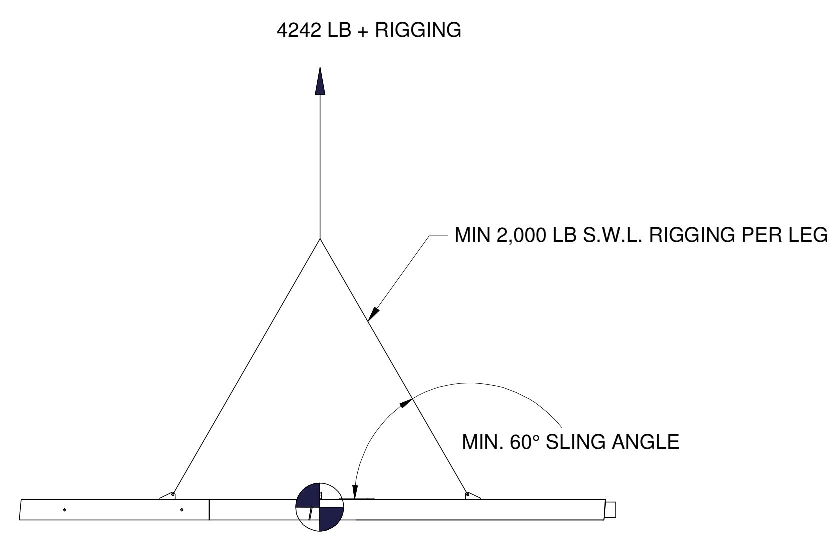
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING INSPECTION HOLE LOCATIONS
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 6
DWG. NO.: S18678-04-4
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM
S18678-A-401




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-401

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

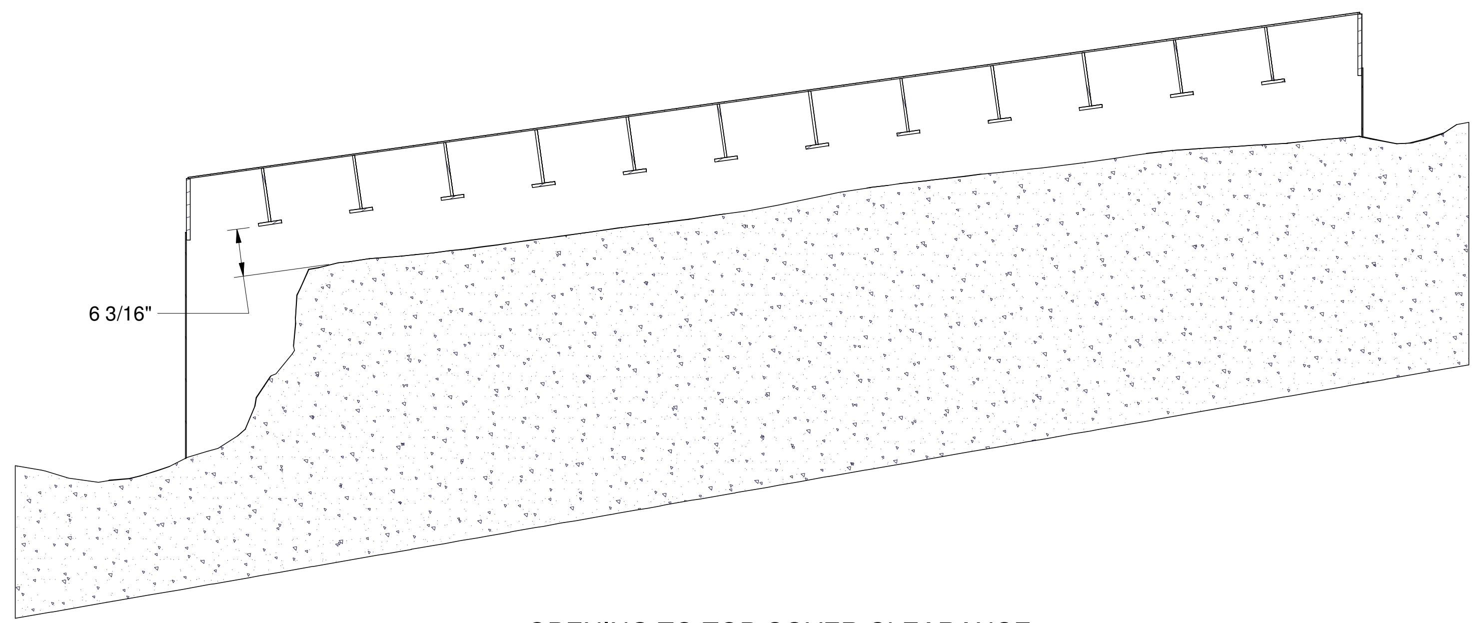
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING
LIFTING DETAILS
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: S18678-04-5
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO TOP COVER CLEARANCE





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATED | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | A.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 2 OPENING CLEARANCES
LOCATION: 59°37'21.5"N 108°25'30.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-04-6 REV 2
SHEET NO.: 6 OF 6

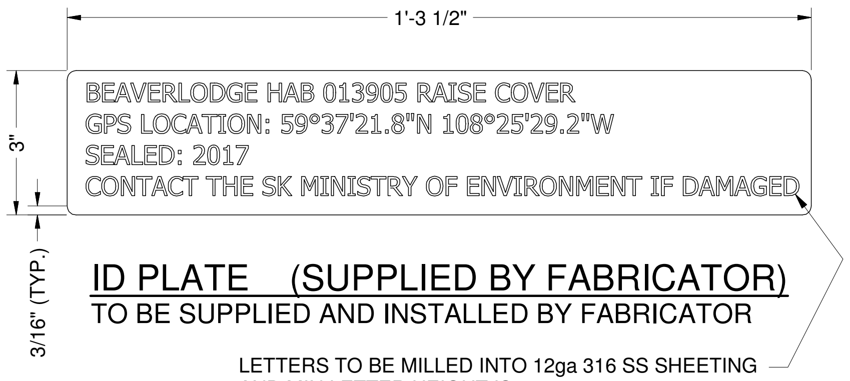
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# HAB 3 - 013905 Raise

HAB 3 - 013905 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

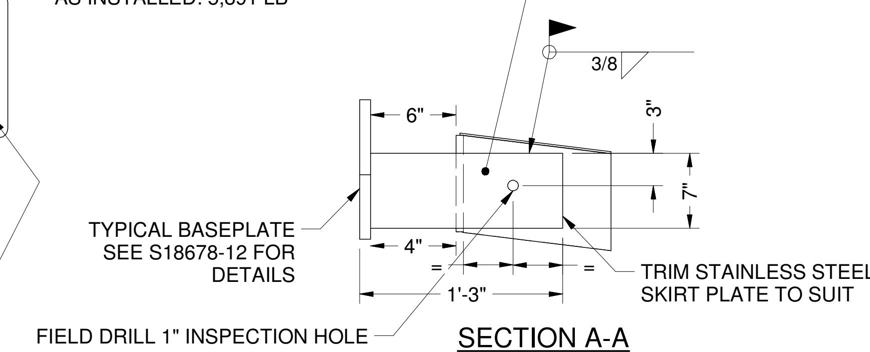
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 5,891 LB
5. DO NOT BACK FILL WALLS OF COVER.




ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

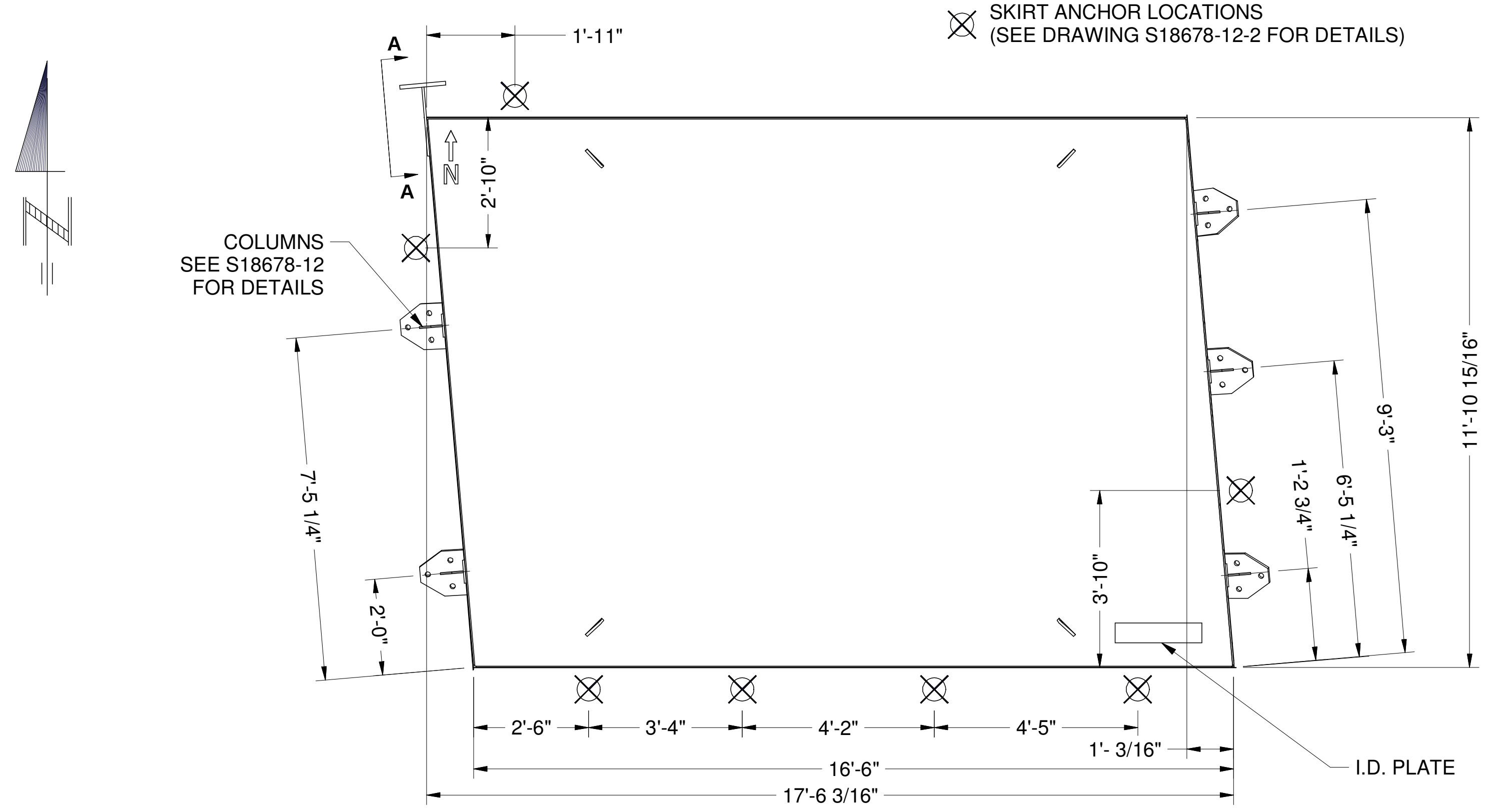
LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 4,860 LB
AS INSTALLED: 5,891 LB

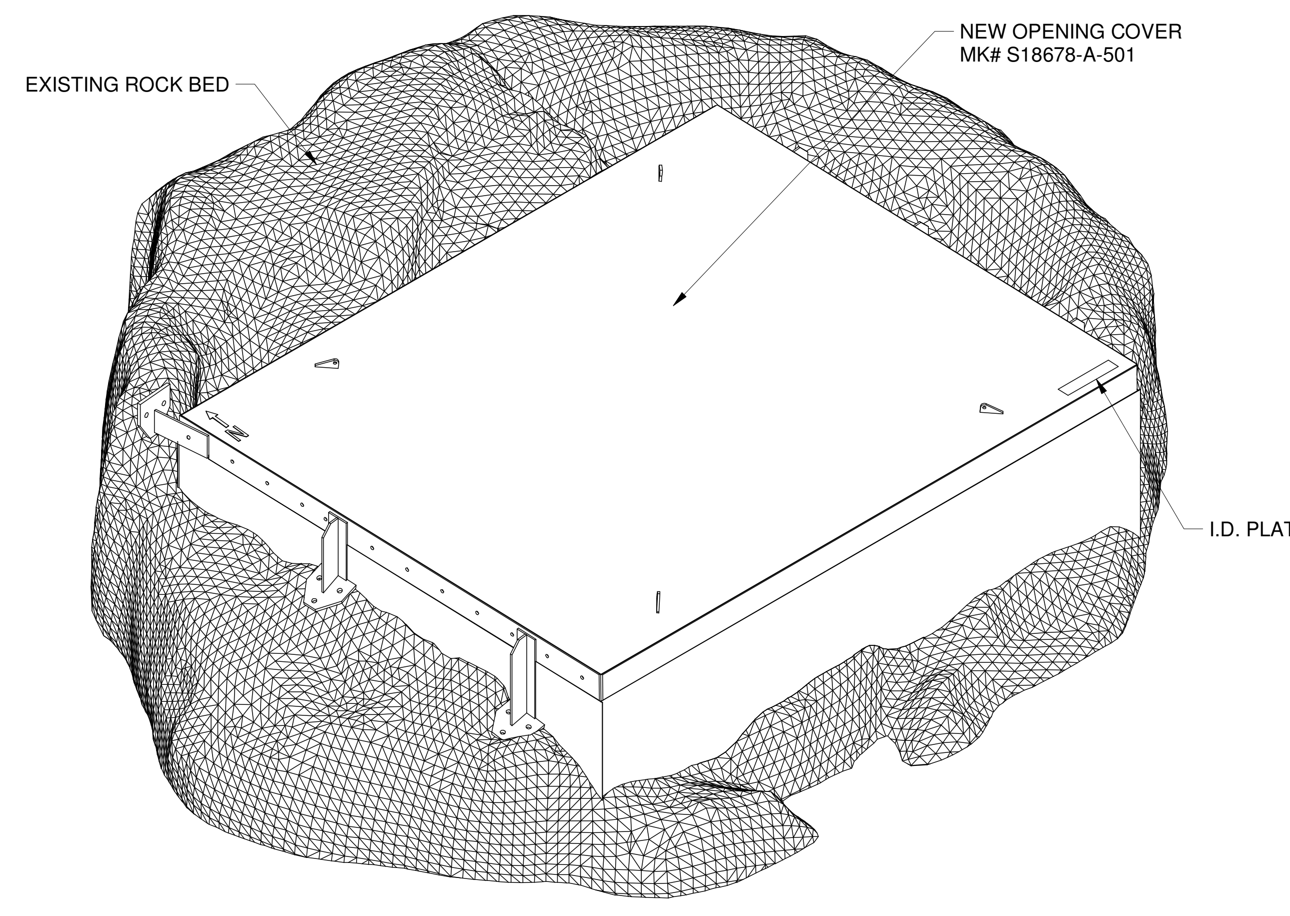



SECTION A-A
STAINLESS STEEL SKIRT PLATE NOT SHOWN FOR CLARITY

SKIRT ANCHOR LOCATIONS (SEE DRAWING S18678-12-2 FOR DETAILS)




PLAN VIEW - HAB 3 OPENING COVER
(HORIZONTAL PROJECTED DIMENSIONS SHOWN)




ISO VIEW
LOOKING NORTH EAST

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVEW | 10/14/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

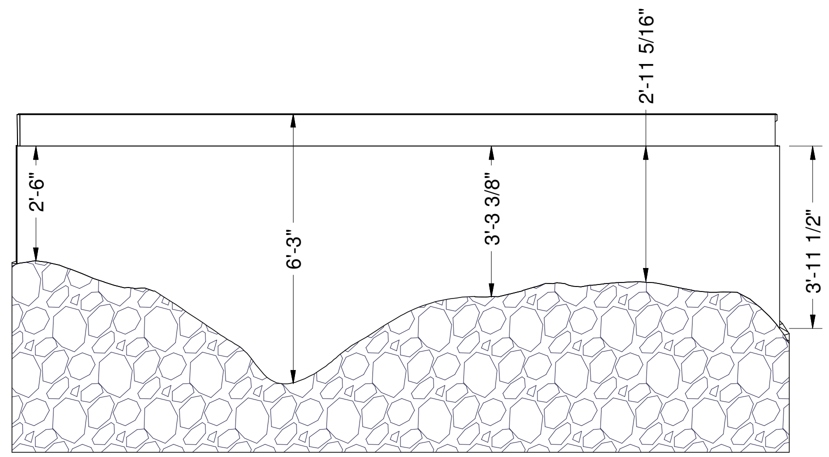
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

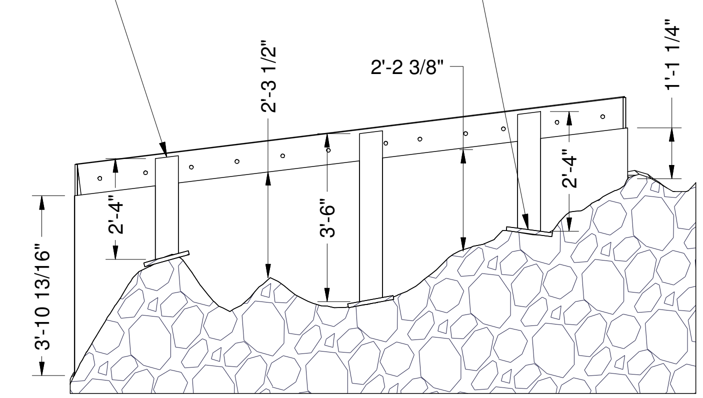
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 3 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°37'21.8"N 108°25'29.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 5
DWG. NO.: S18678-05-1
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

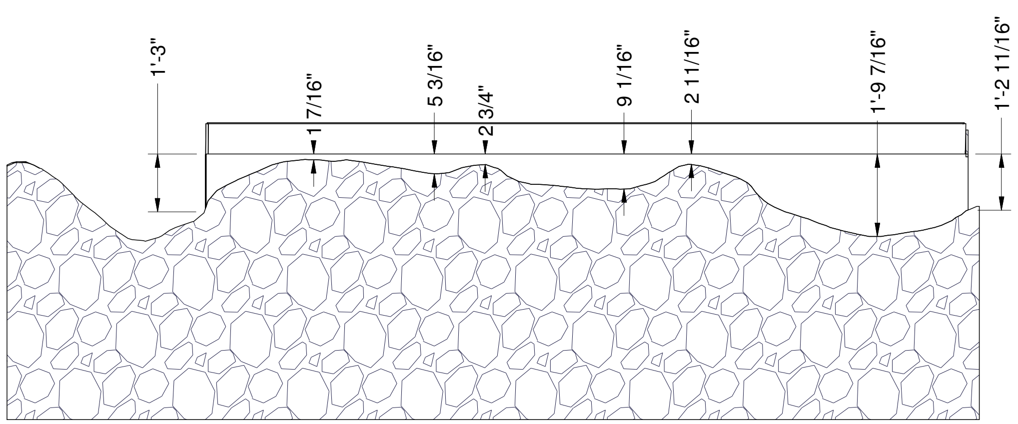
ESTIMATED TOTAL COLUMN LENGTH 145" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
FIVE (5) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



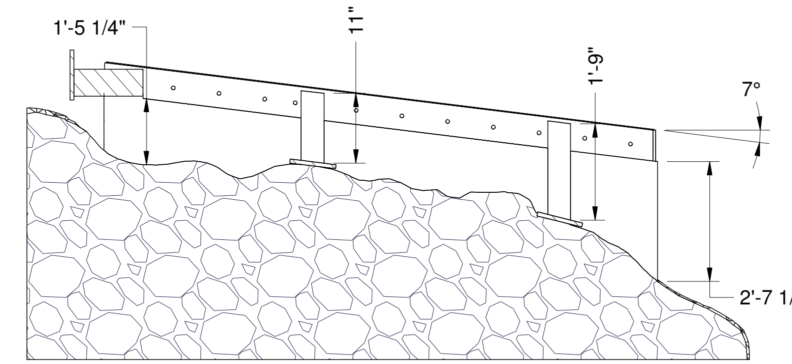

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVEW | 10/14/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
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SASKATCHEWAN

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| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

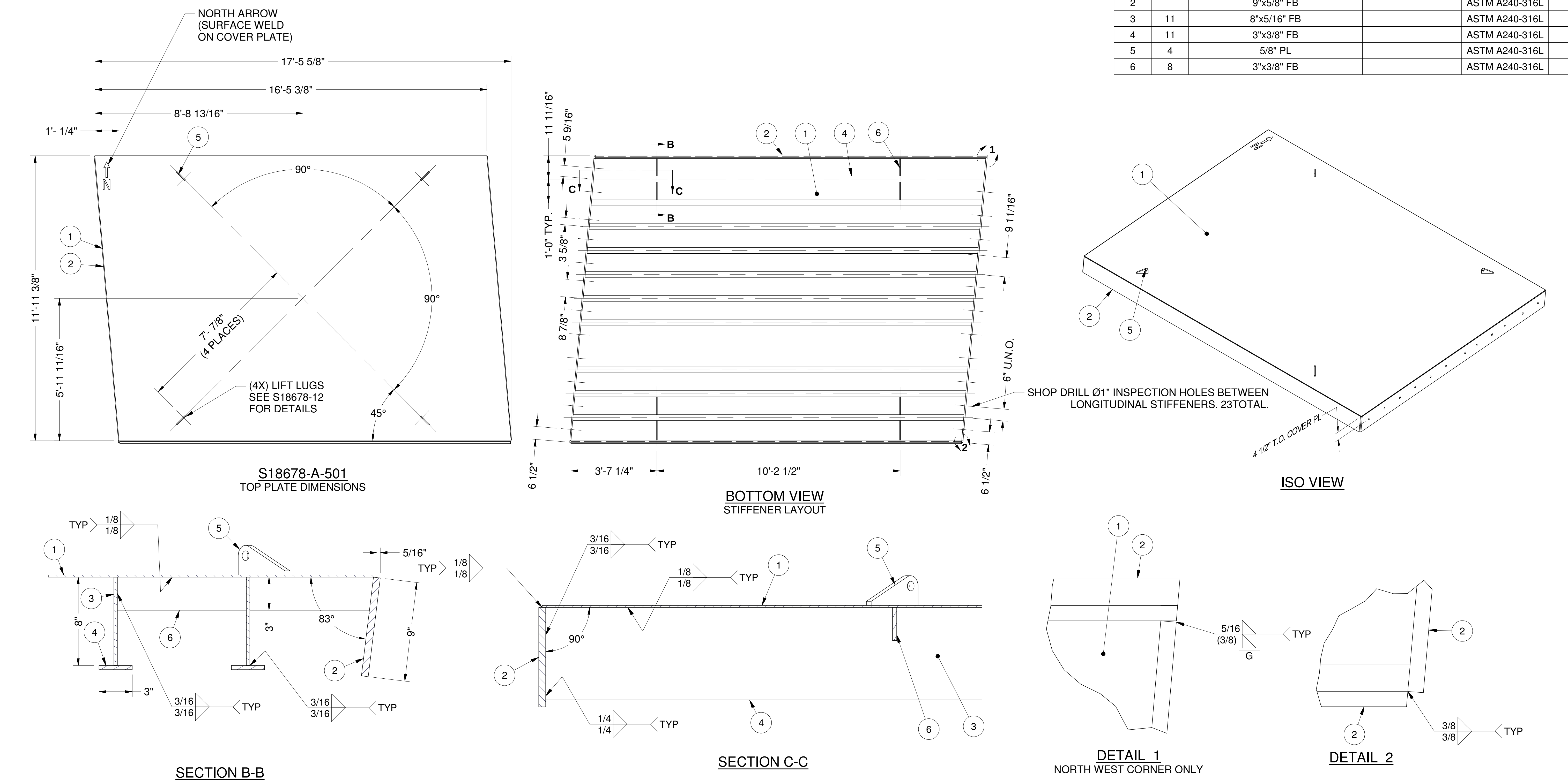
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 3 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°37'21.8"N 108°25'29.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 5
DWG. NO.: S18678-05-2
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | 3/16" PL | | ASTM A240-316L | |
| 2 | | 9"x5/8" FB | | ASTM A240-316L | |
| 3 | 11 | 8"x5/16" FB | | ASTM A240-316L | |
| 4 | 11 | 3"x3/8" FB | | ASTM A240-316L | |
| 5 | 4 | 5/8" PL | | ASTM A240-316L | |
| 6 | 8 | 3"x3/8" FB | | ASTM A240-316L | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVEW | 10/14/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN. DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

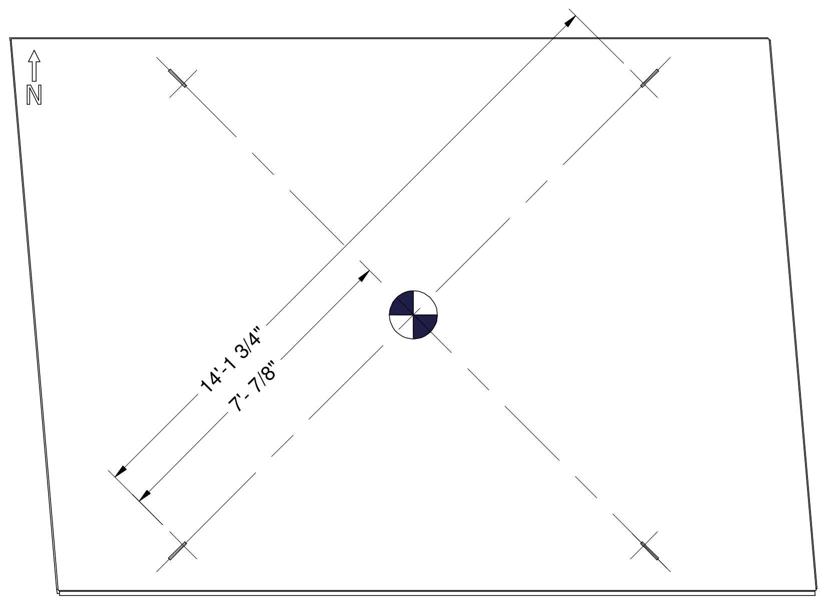
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

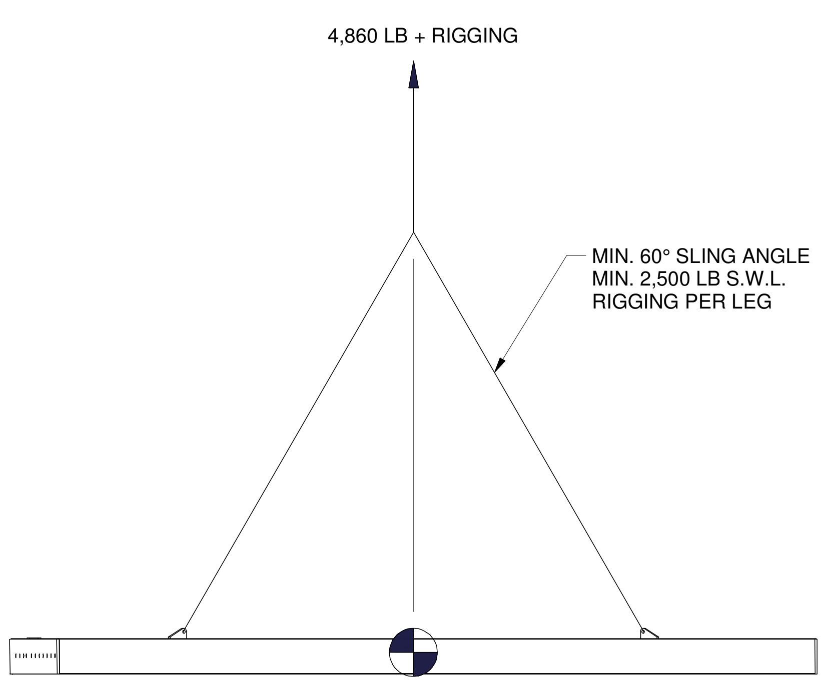
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 3 OPENING
TOP COVER DETAILS
LOCATION: 59°37'21.8"N 108°25'29.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 5
DWG. NO.: S18678-05-3 — REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVEW | 10/14/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 10/6/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

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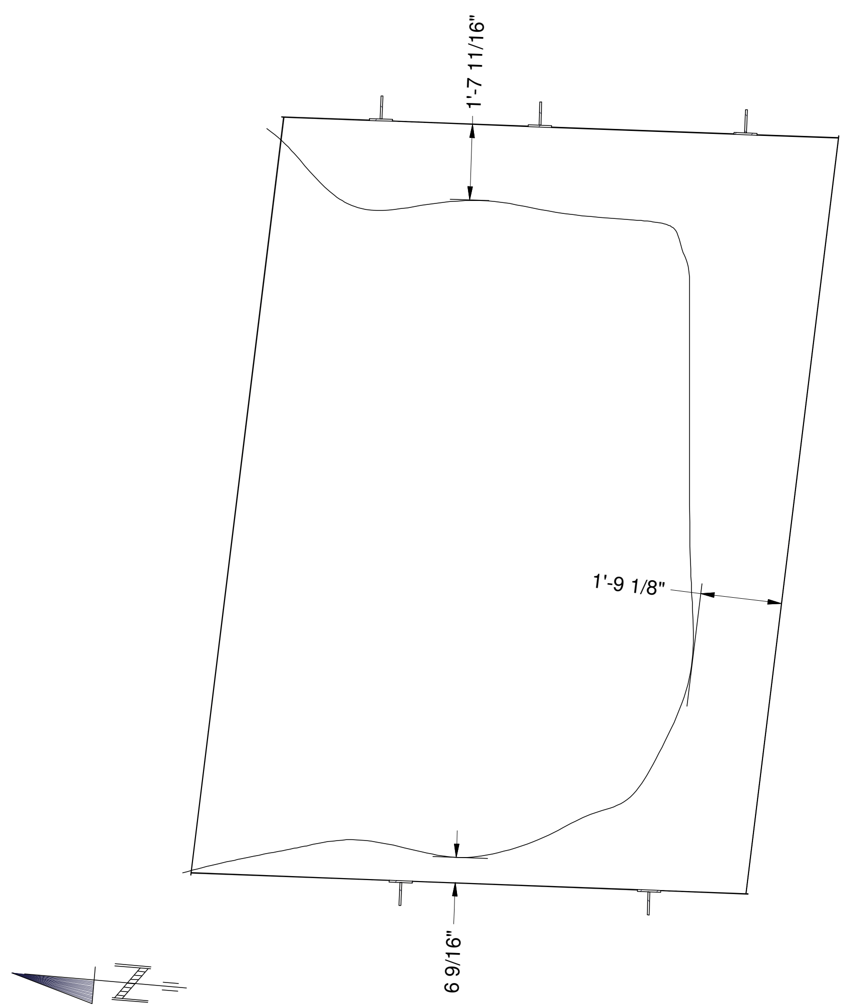
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

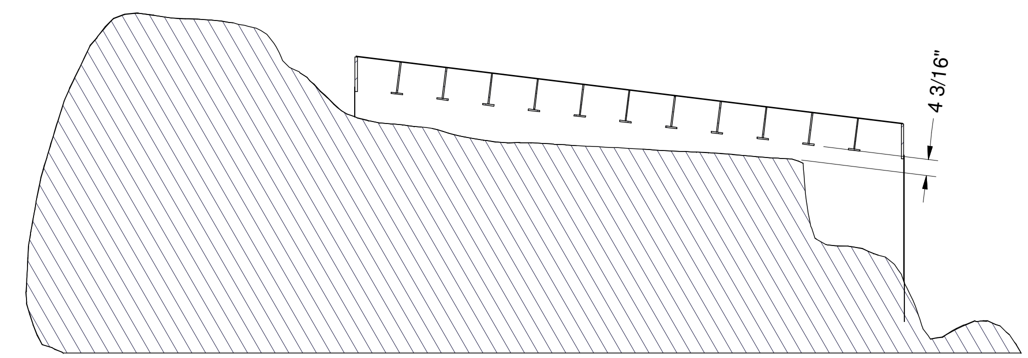
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 3 OPENING
LIFTING DETAILS
LOCATION: 59°37'21.8"N 108°25'29.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 5
DWG. NO.: S18678-05-4
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVEW | 10/14/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering Saskatchewan Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 3 OPENING CLEARANCES
LOCATION: 59°37'21.8"N 108°25'29.2"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 5
DWG. NO.: S18678-05-5
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## HAB 5 - 013927 Raise

HAB 5 - 013927 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

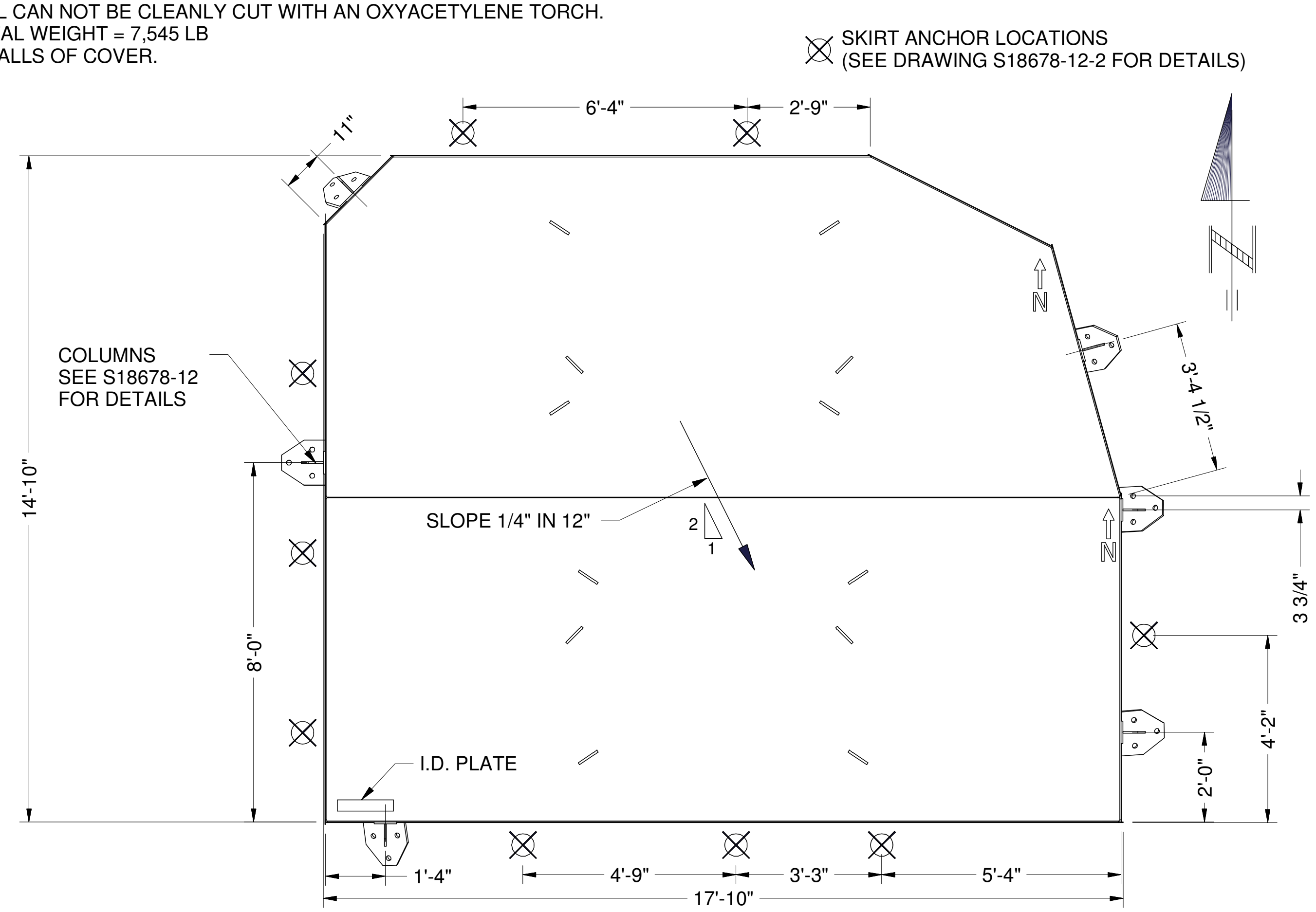
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 7,545 LB
5. DO NOT BACK FILL WALLS OF COVER.


ID PLATE (SUPPLIED BY FABRICATOR)

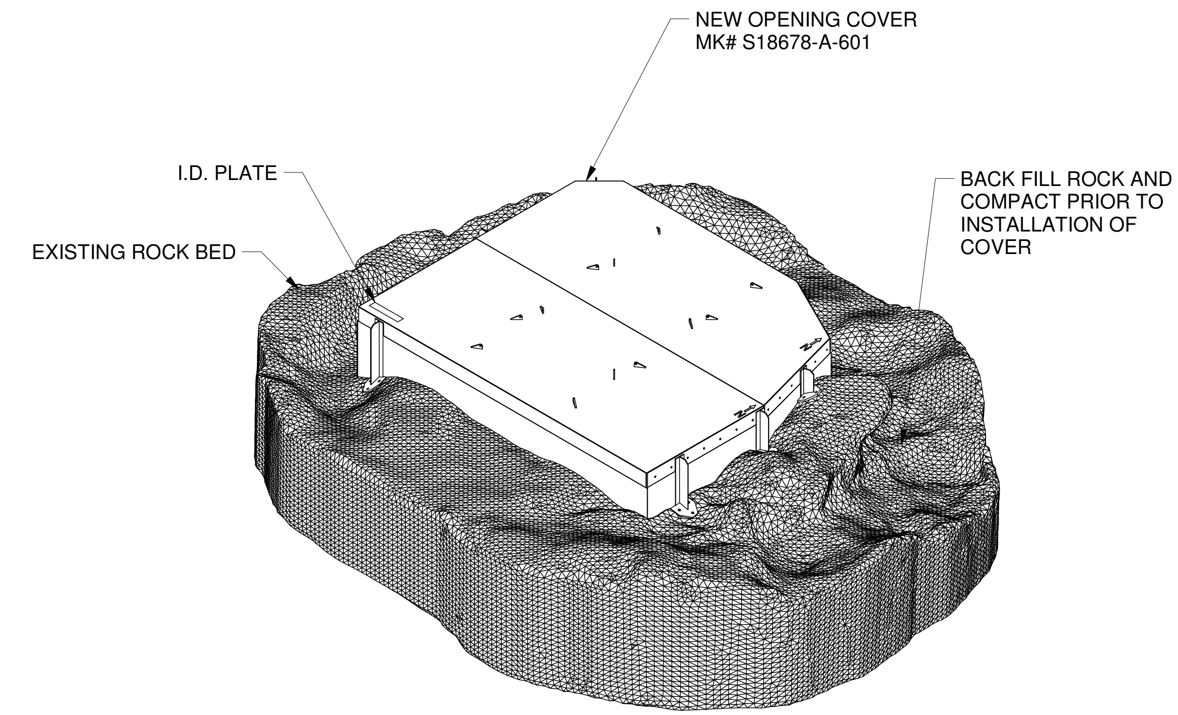
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 6,505 LB
AS INSTALLED: 7,545 LB




PLAN VIEW - HAB 5 OPENING COVER




ISO VIEW

LOOKING NORTH WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/6/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

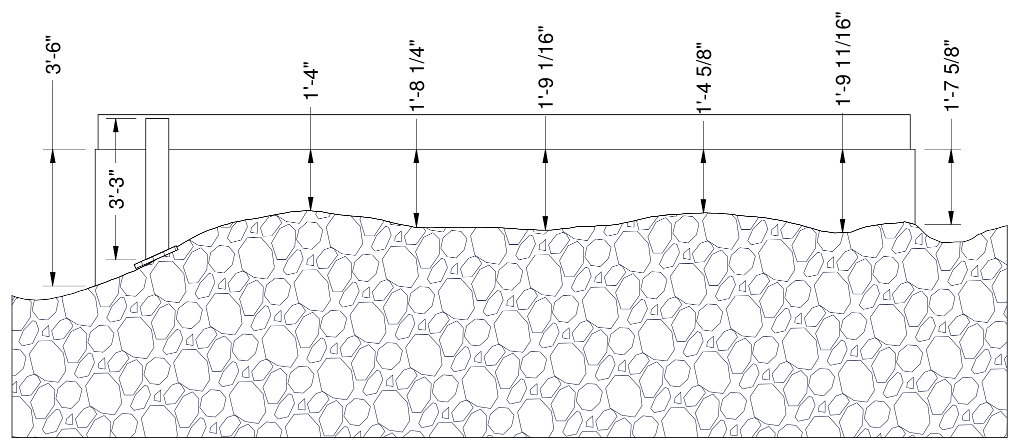
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

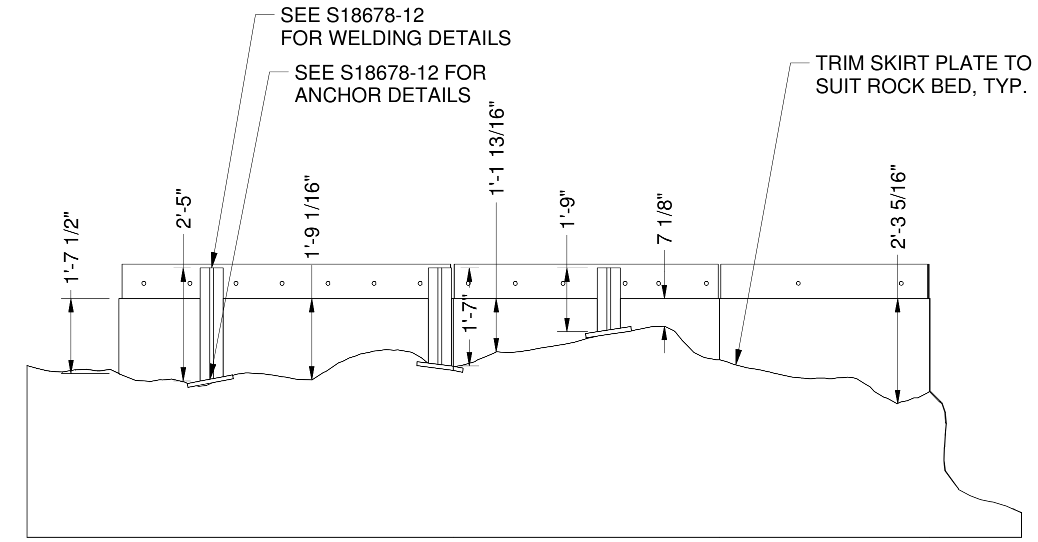
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: S18678-06-1
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

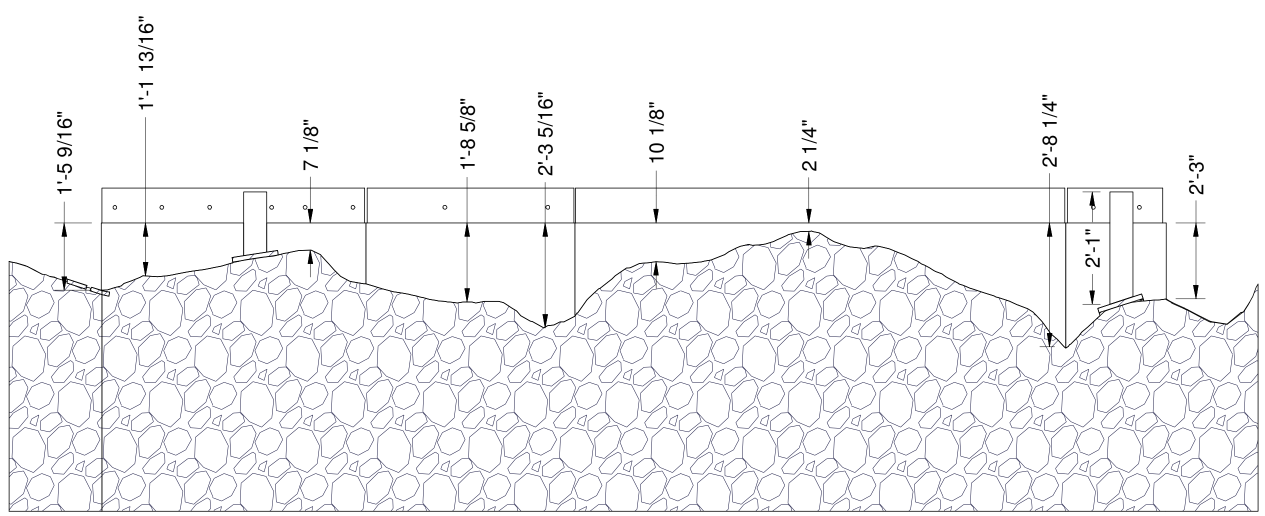
ESTIMATED TOTAL COLUMN LENGTH 171" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE
OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



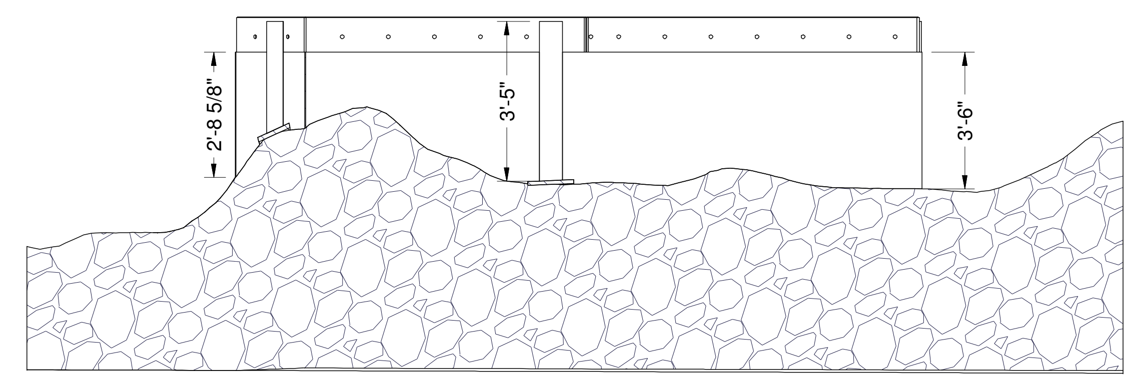

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
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TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
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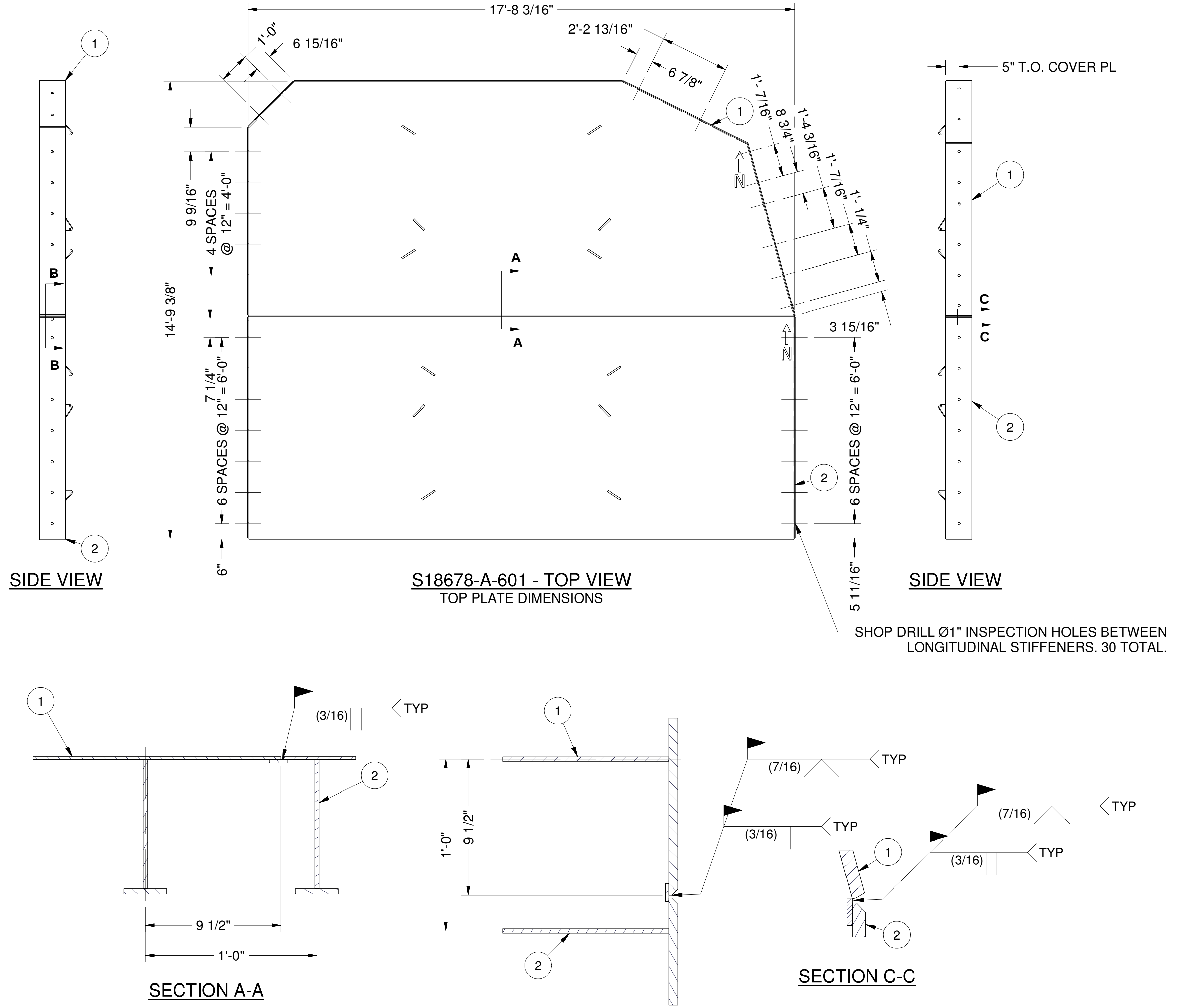
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-06-2
REV: 2
SHEET NO.: 2 OF 7

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | TOP COVER SECTION 1 | S18678-A-602 | | 4 |
| 2 | 1 | TOP COVER SECTION 2 | S18678-A-603 | | 5 |




SIDE VIEW

S18678-A-601 - TOP VIEW

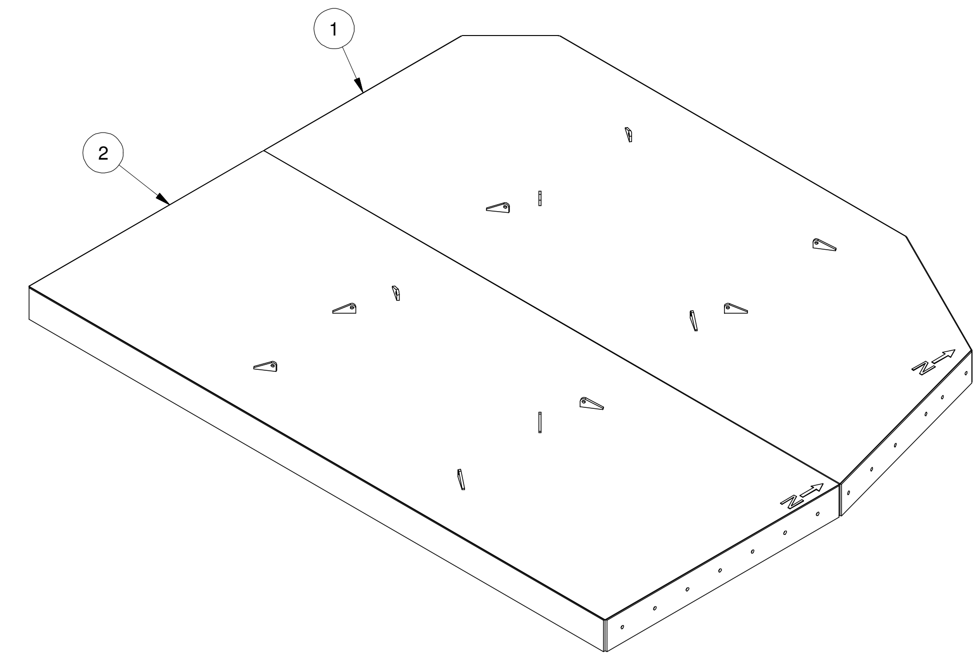
TOP PLATE DIMENSIONS

SIDE VIEW

SECTION A-A

SECTION B-B

SECTION C-C



ISO VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER P.B. CAUGHLIN MEMBER 14318 17 10 31 YR MN DAY SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
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Permission to Consult held by:

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| Structural | 14318 | |

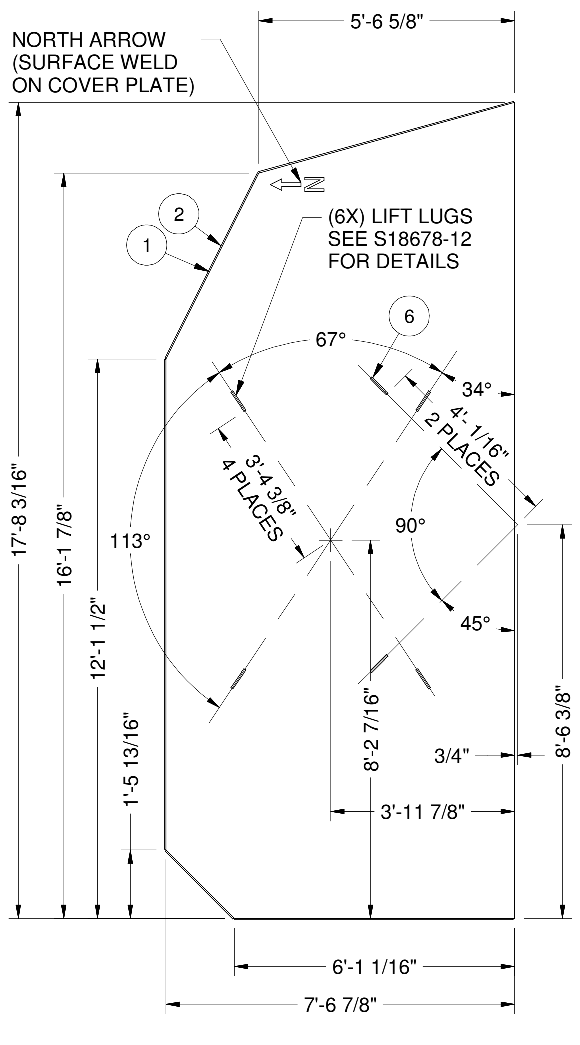
## Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING
TOP COVER DETAILS
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

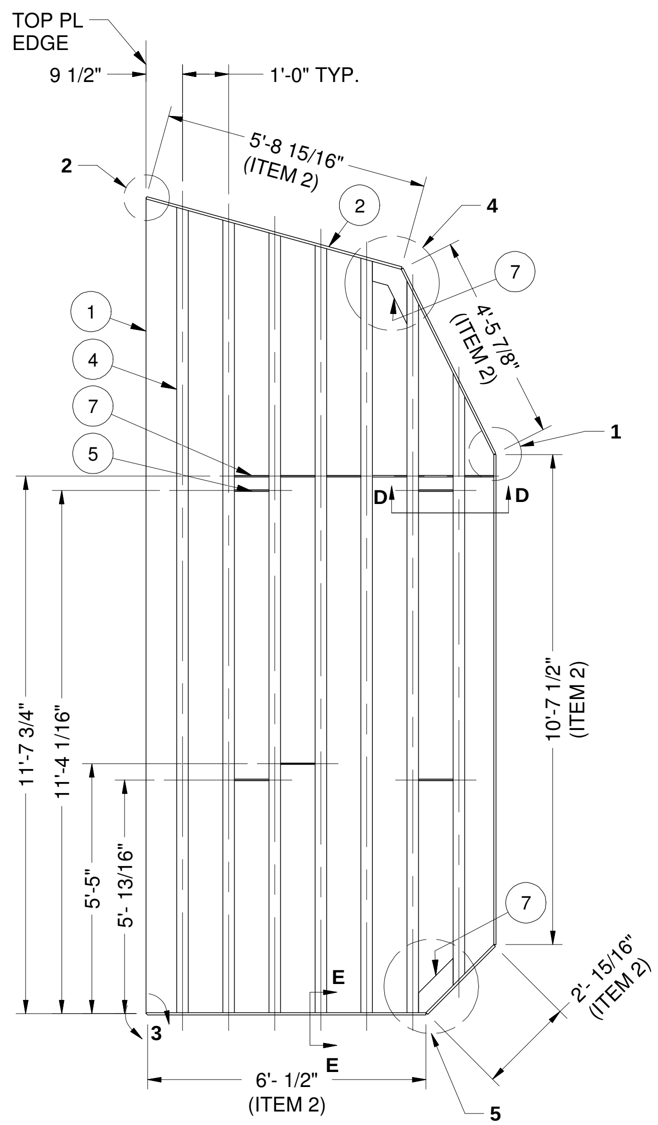
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: S18678-06-3
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

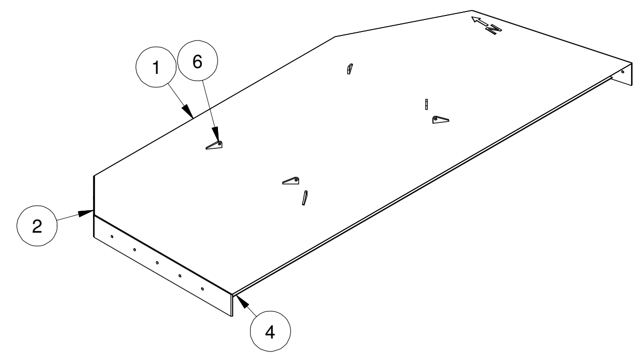
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL | SHT# |
| 1 | 1 | 3/16" PL | ASTM A240-316L | |
| 2 | | 10"x5/8" FB | ASTM A240-316L | |
| 3 | | 9"x5/16" FB | ASTM A240-316L | |
| 4 | | 3"x3/8" FB | ASTM A240-316L | |
| 5 | 5 | 3"x3/8" FB | ASTM A240-316L | |
| 6 | 6 | 5/8" PL | ASTM A240-316L | |
| 7 | | 5"x3/8" FB | ASTM A240-316L | |



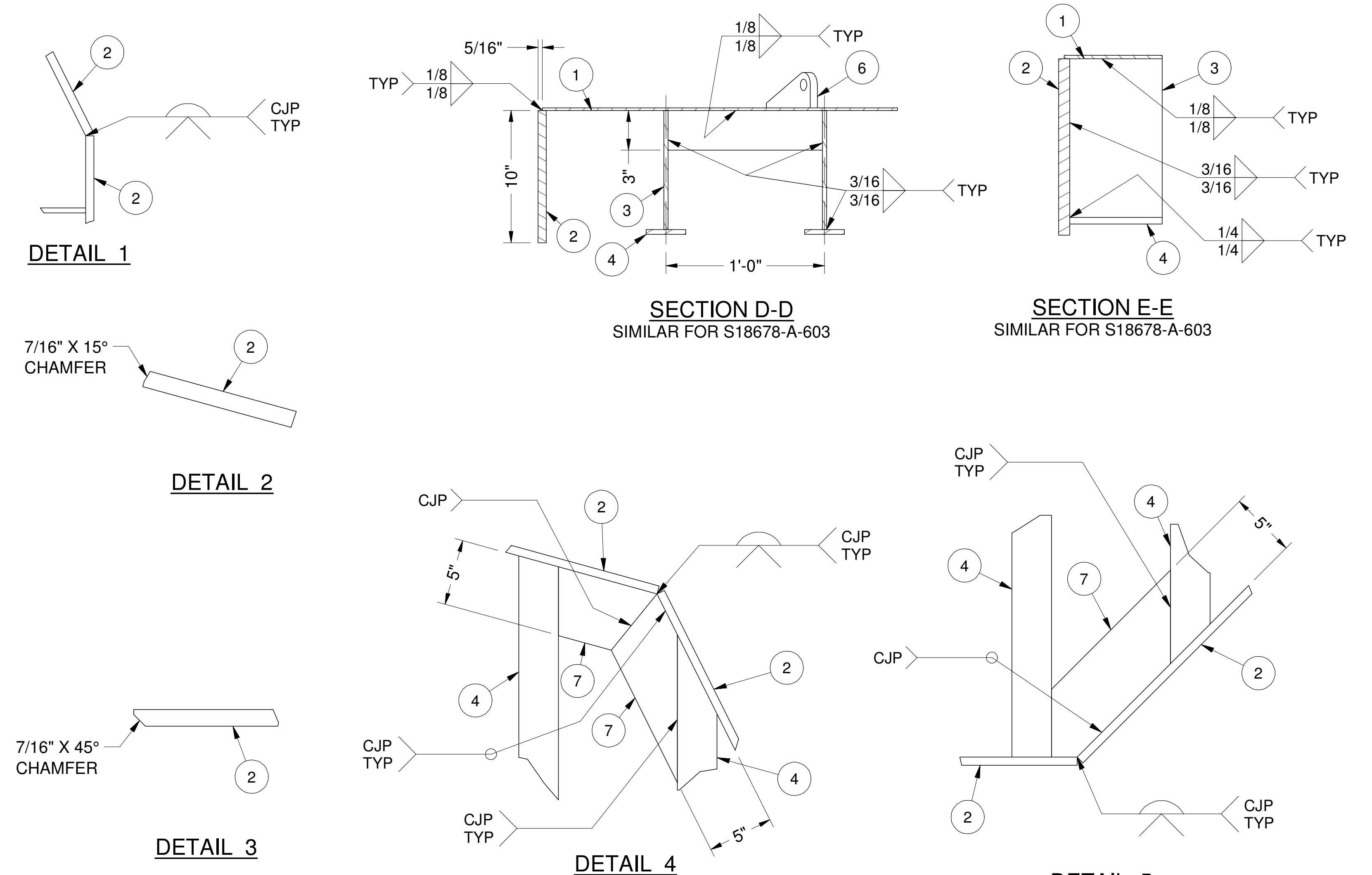

## S18678-A-602 - TOP VIEW
TOP PLATE DIMENSIONS




## S18678-A-602 - BOTTOM VIEW
STIFFENER LAYOUT



## S18678-A-602 - ISO VIEW




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

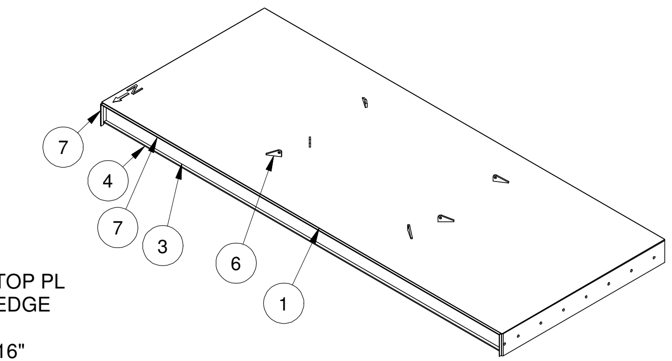
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

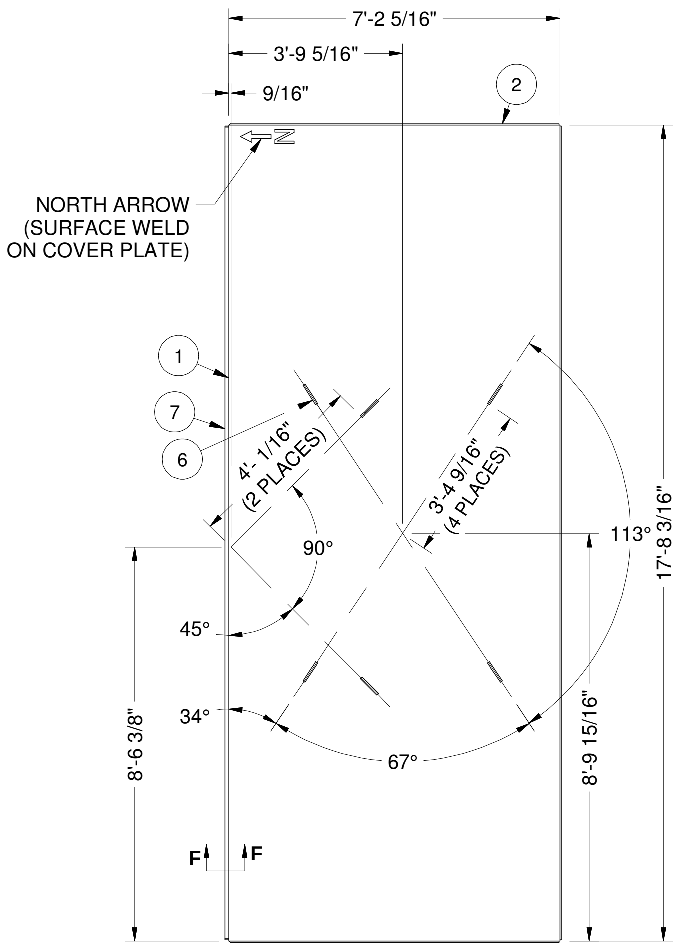
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING TOP COVER SECTIONS
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 7
DWG. NO.: S18678-06-4
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

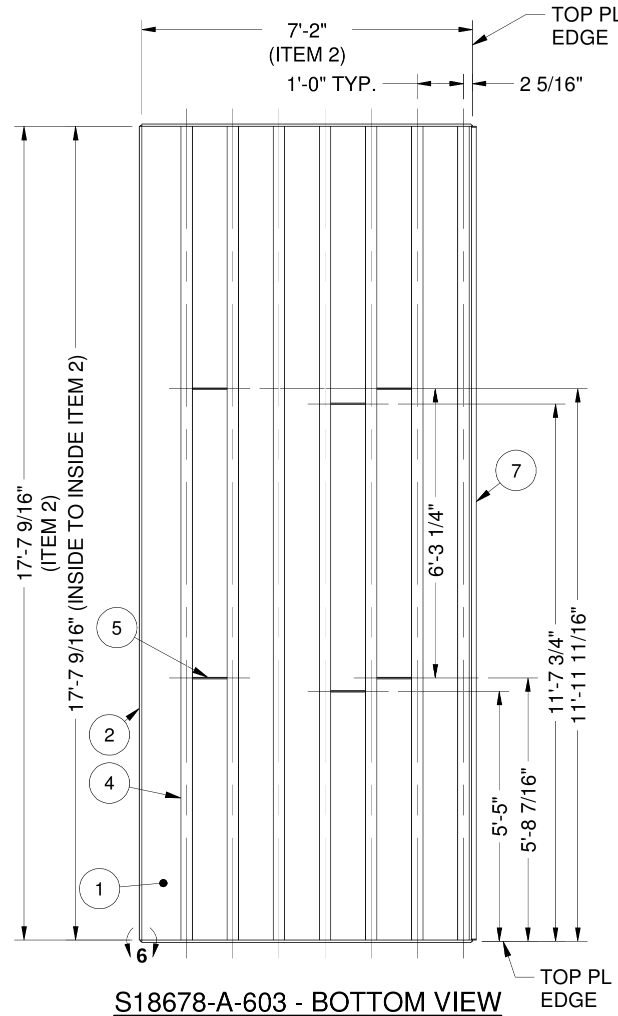
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL | SHT# |
| 1 | 1 | 3/16" PL | ASTM A240-316L | |
| 2 | | 10"x5/8" FB | ASTM A240-316L | |
| 3 | | 9"x5/16" FB | ASTM A240-316L | |
| 4 | | 3"x3/8" FB | ASTM A240-316L | |
| 5 | 6 | 3"x3/8" FB | ASTM A240-316L | |
| 6 | 6 | 5/8" PL | ASTM A240-316L | |
| 7 | | 1 1/4"x1/4" FB | ASTM A240-316L | |



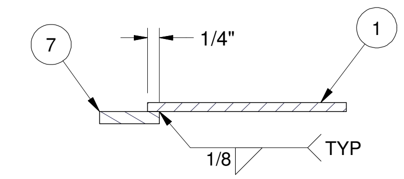

S18678-A-603 - ISO VIEW



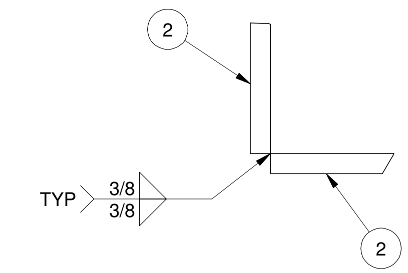

S18678-A-603 - TOP VIEW
TOP PLATE DIMENSIONS



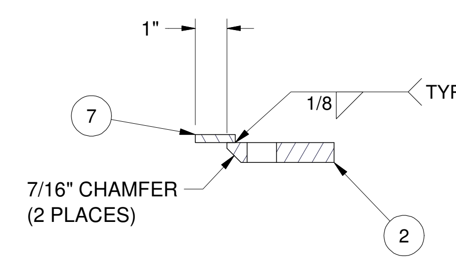

S18678-A-603 - BOTTOM VIEW
STIFFENER LAYOUT



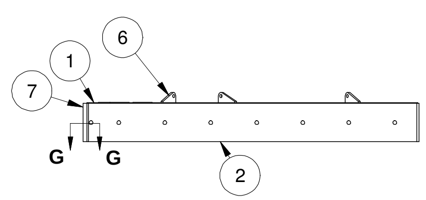

SECTION F-F




DETAIL 6




SECTION G-G




S18678-A-603 - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 10/6/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

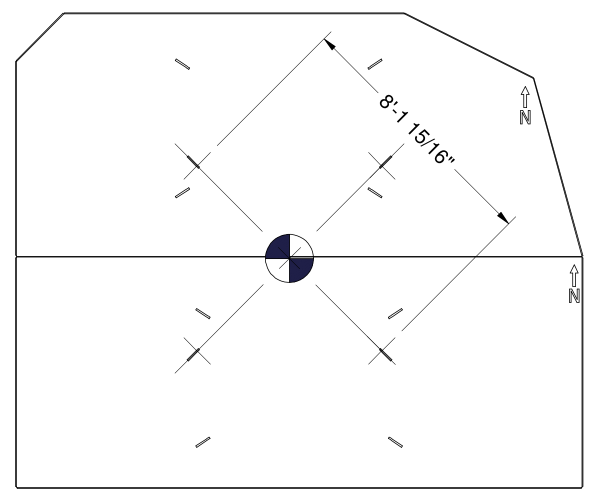
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

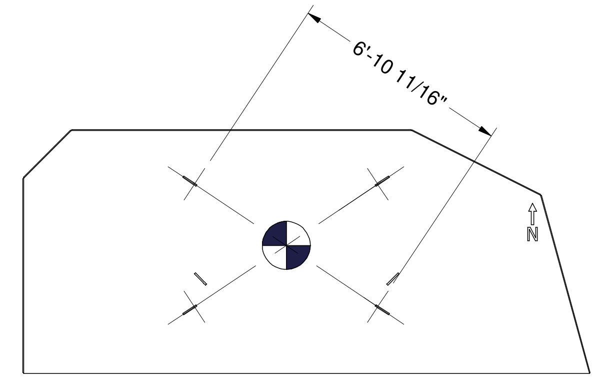
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING
TOP COVER SECTION 2
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
DWG. NO.: S18678-06-5 REV 2
SHEET NO.: 5 OF 7

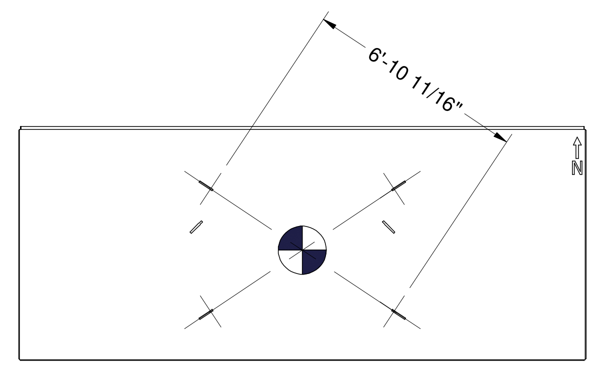
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



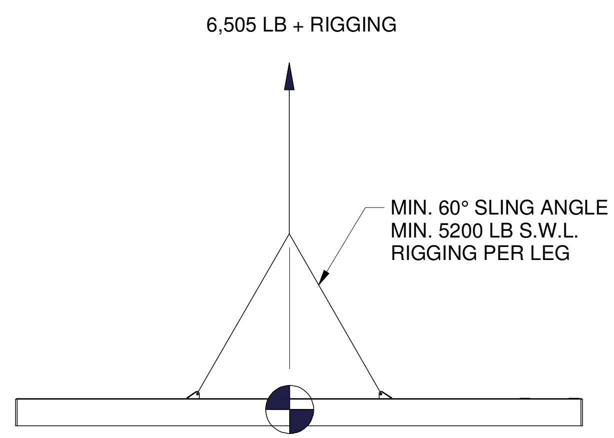

TOP COVER LIFTING DIAGRAM - TOP VIEW



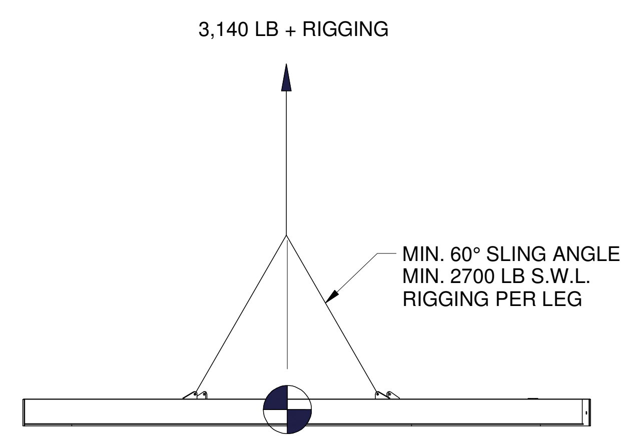

S18678-A-602 LIFTING DIAGRAM - TOP VIEW



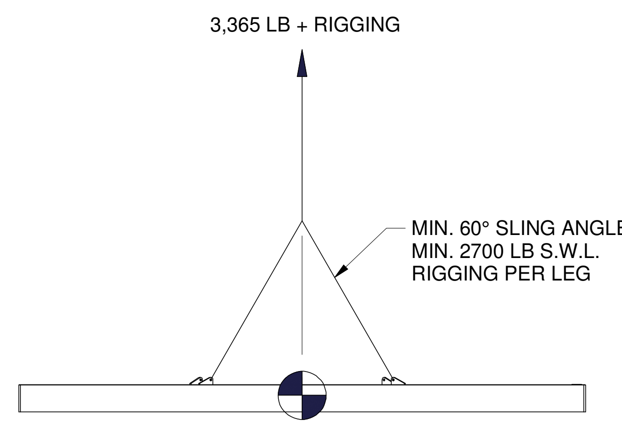

S18678-A-603 LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW




S18678-A-602 LIFTING DIAGRAM - SIDE VIEW




S18678-A-603 LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/6/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

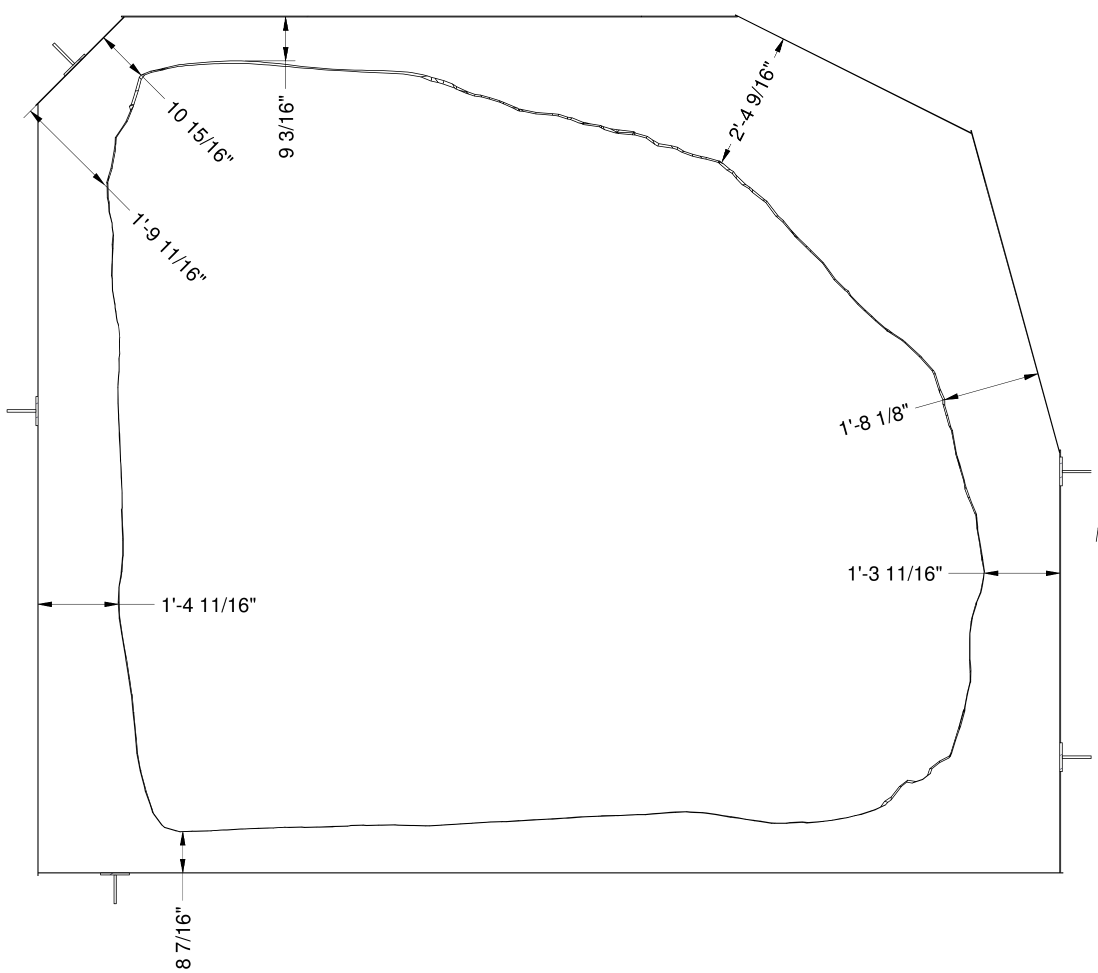
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

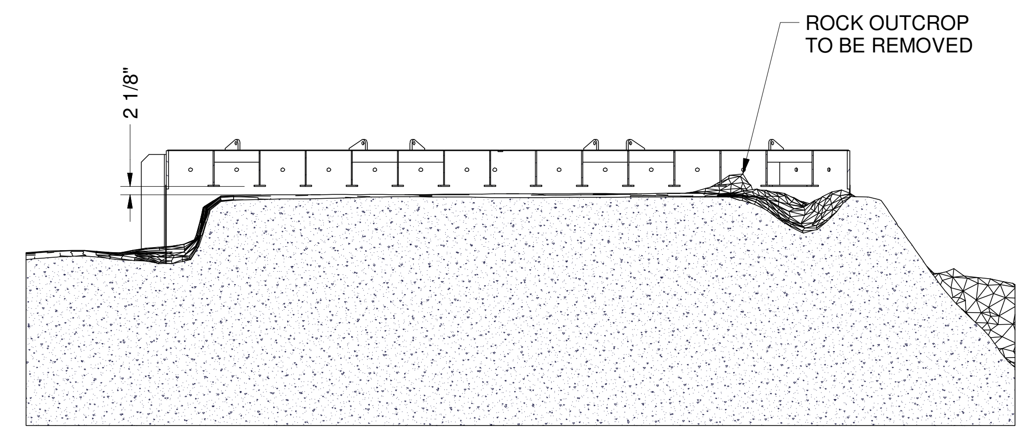
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING
LIFTING DETAILS
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: S18678-06-6
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | ID PLATE UPDATE | 10/26/2016 | A.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | A.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/17/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 10/6/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 5 OPENING CLEARANCES
LOCATION: 59°37'22.2"N 108°25'26.1"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: S18678-06-7
REV: 2

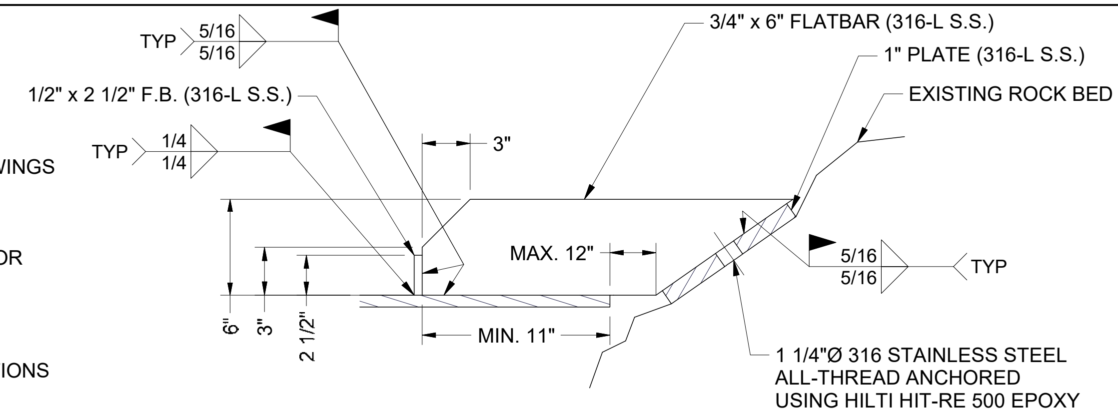
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## HAB 8 - 013810 Raise

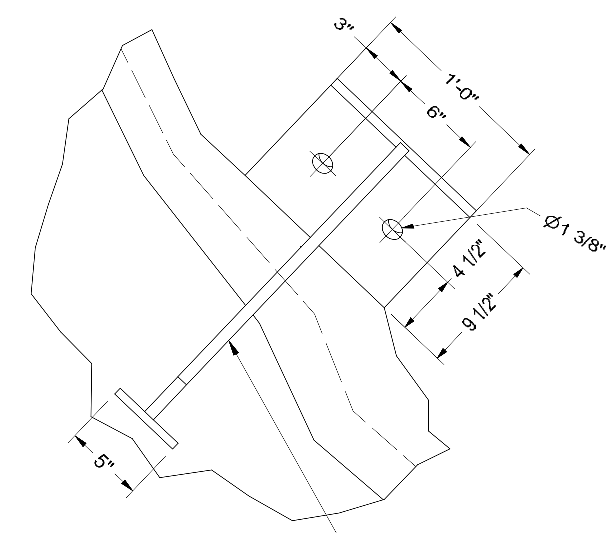
HAB 8 - 013810 Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.

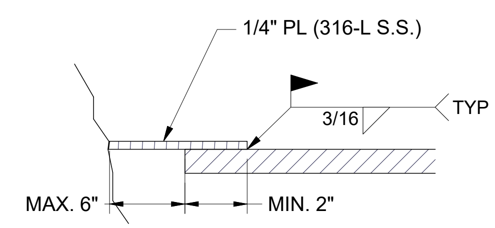
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN ONE VERTICAL WHEEL LOAD OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 3,060 LB
5. DO NOT BACK FILL WALLS OF COVER.



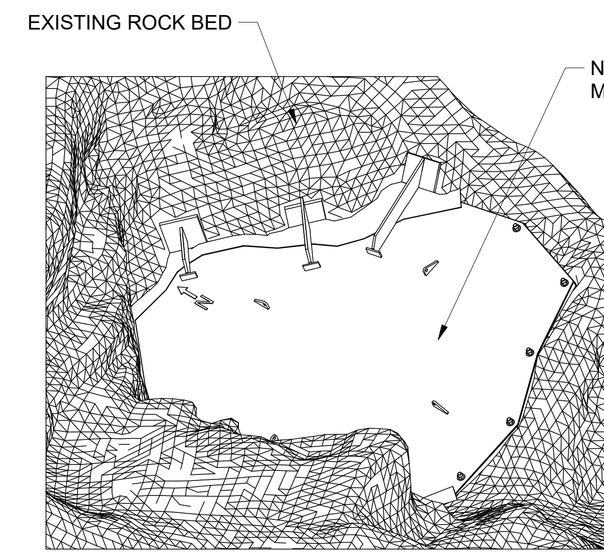

SECTION A-A
(EXAMPLE)




DETAIL 1

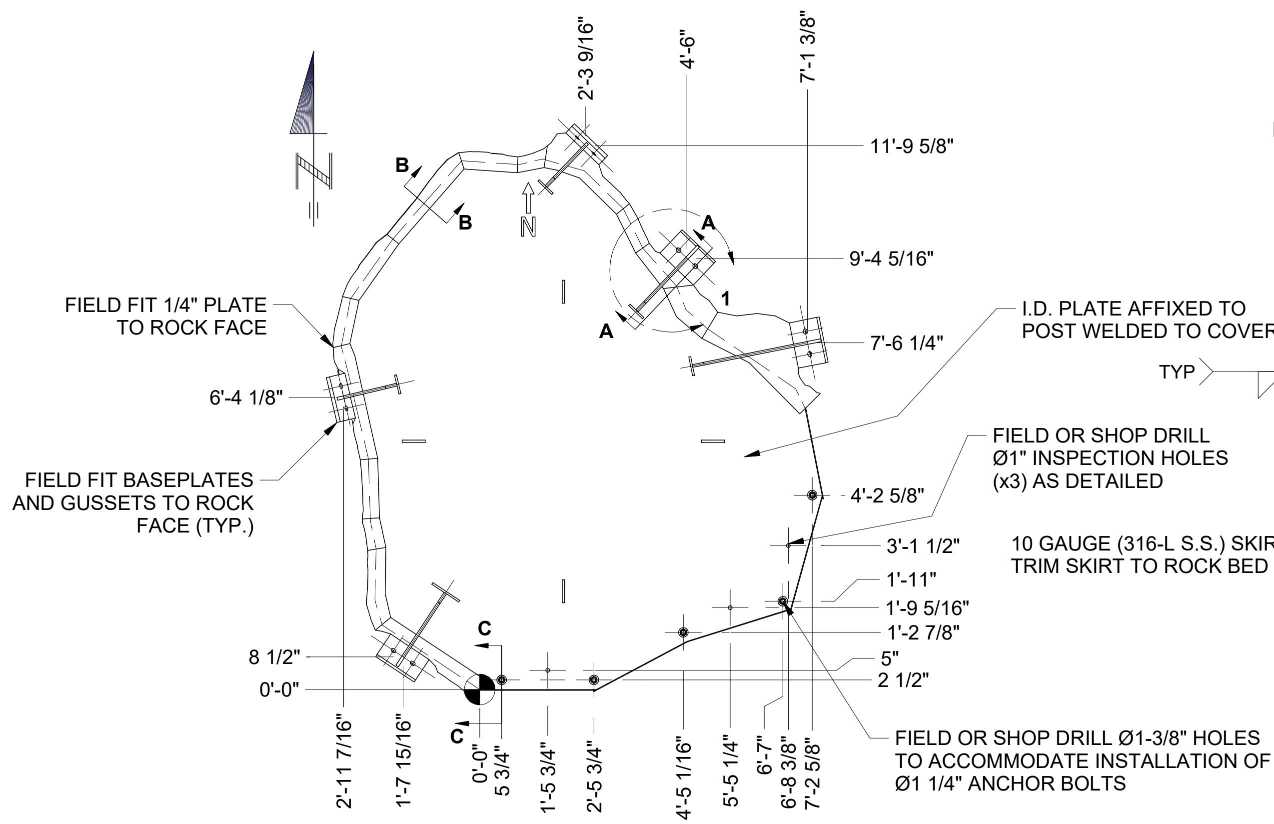



SECTION B-B

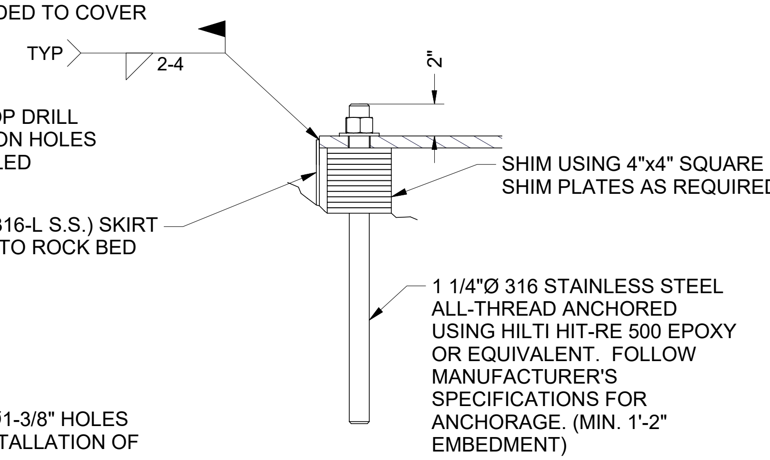



ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 2,664 LB
AS INSTALLED: 3,060 LB

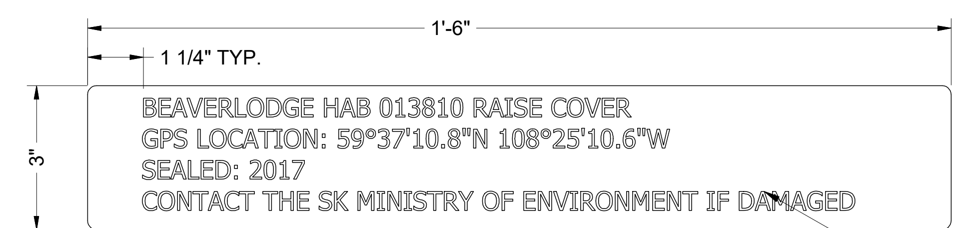
ISO VIEW
LOOKING NORTH WEST




PLAN VIEW - HAB 8 OPENING COVER




SECTION C-C




ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR
LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT REVISIONS | 31/Oct/17 | N.R. |
| | | 1 | I.D. PLATE UPDATED | 26/Oct/16 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 25/Oct/15 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 18/Oct/16 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 06/Oct/16
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

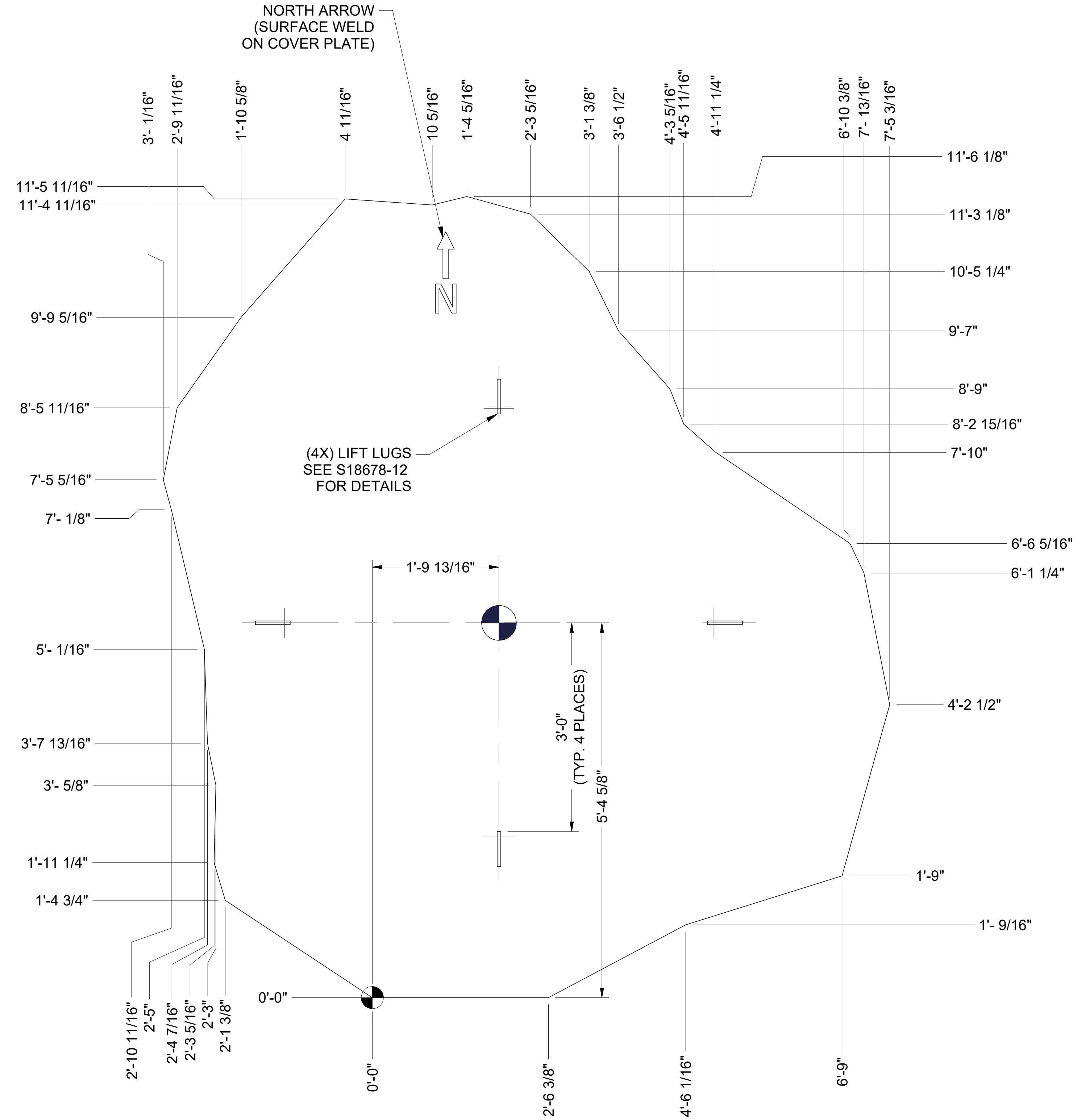
# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 8 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°37'10.8"N 108°25'10.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

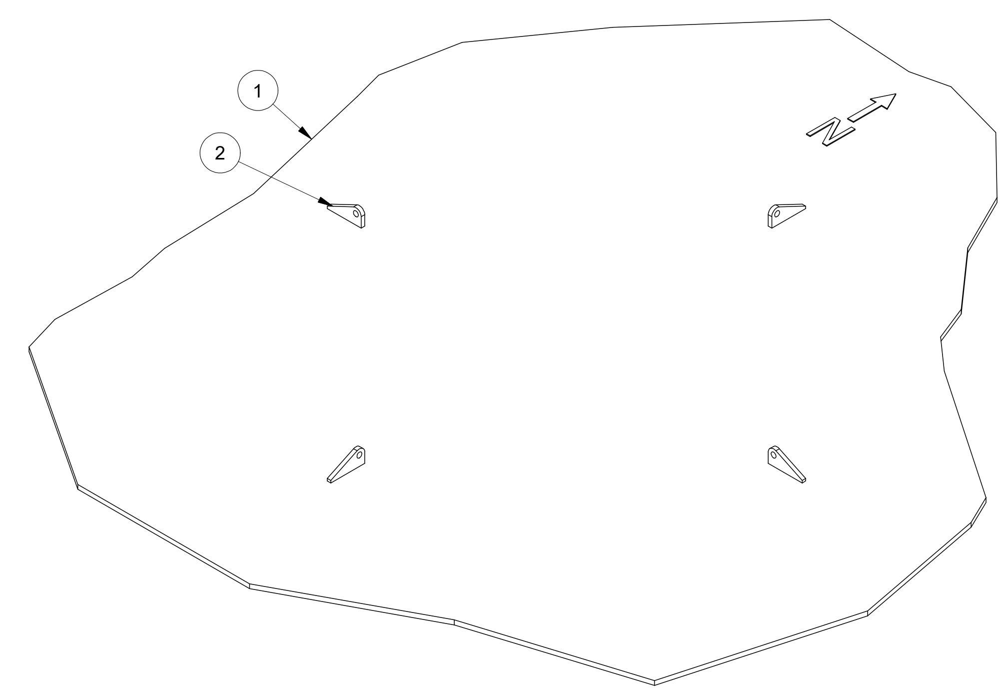
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 4
DWG. NO.: S18678-07-1
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | 3/4" PL | | ASTM A240-316L | |
| 2 | 4 | 5/8" PL | | ASTM A240-316L | |




S18678-A-701




ISO VIEW

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT REVISIONS | 31/Oct/17 | N.R. |
| | | 1 | I.D. PLATE UPDATED | 26/Oct/16 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 25/Oct/15 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 18/Oct/16 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 06/Oct/16 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 17 10 31 (YR MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

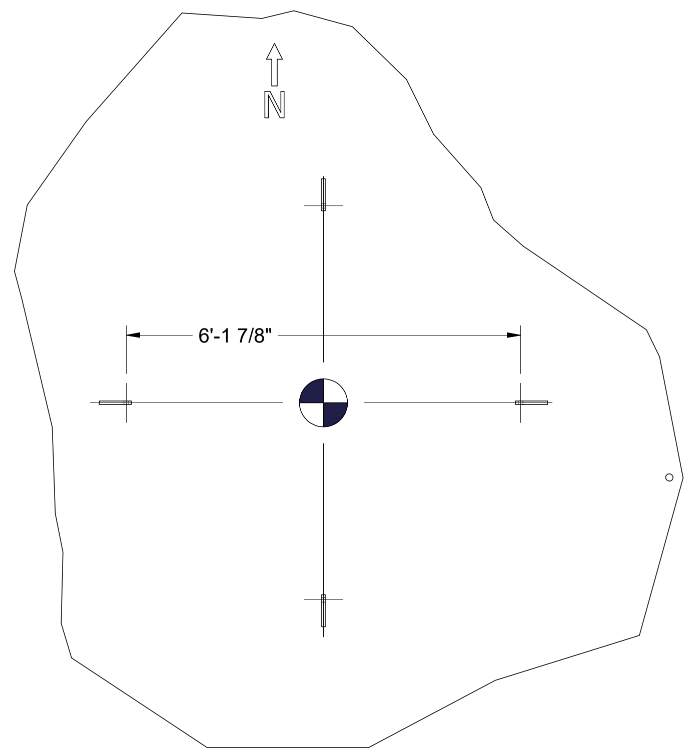
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

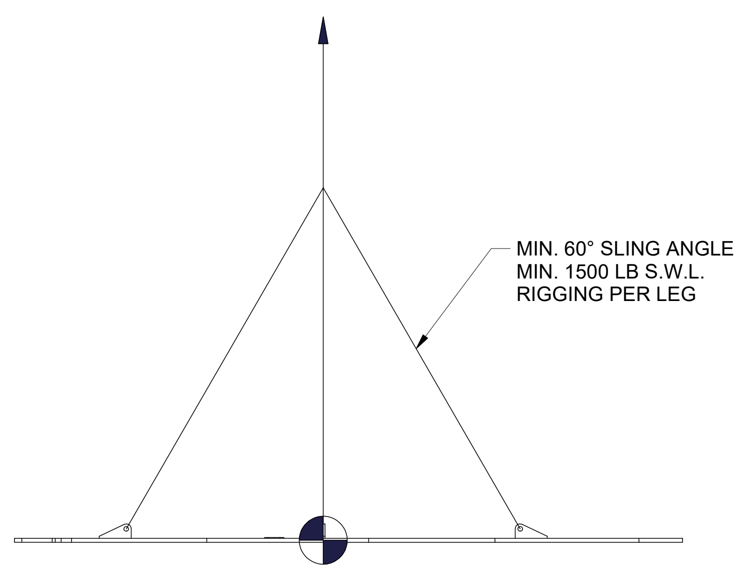
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 8 OPENING TOP COVER DETAILS
LOCATION: 59°37'10.8"N 108°25'10.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 4
DWG. NO.: S18678-07-2
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM - TOP VIEW




TOP COVER LIFTING DIAGRAM - SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT REVISIONS | 31/Oct/17 | N.R. |
| | | 1 | I.D. PLATE UPDATED | 26/Oct/16 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 25/Oct/15 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 18/Oct/16 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 06/Oct/16 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

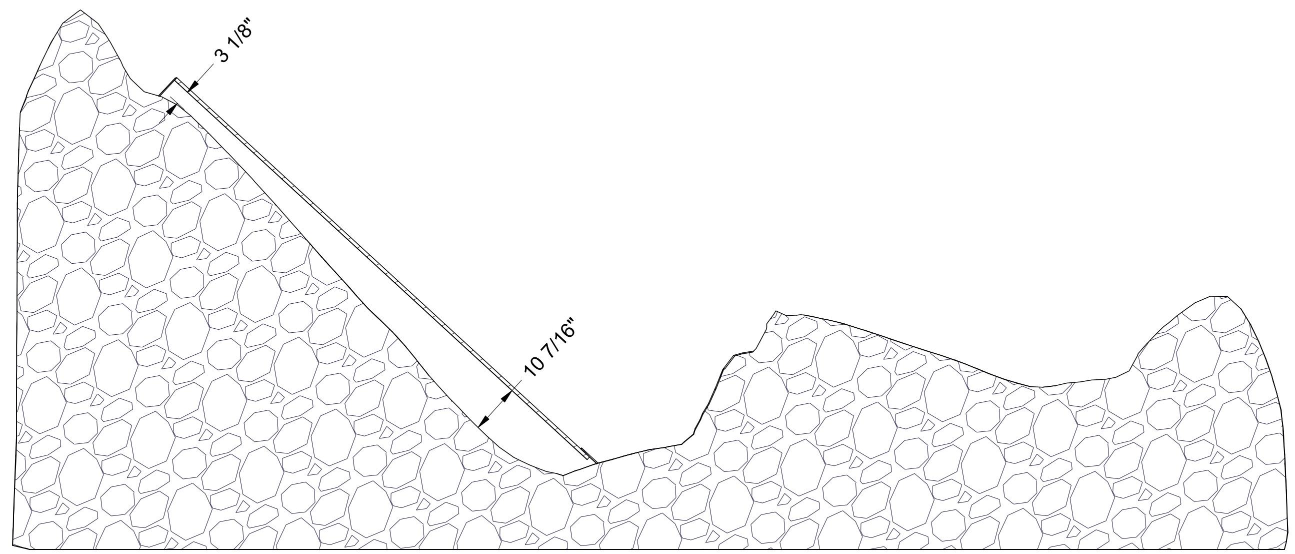
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 8 OPENING
LIFTING DETAILS
LOCATION: 59°37'10.8"N 108°25'10.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 4
DWG. NO.: S18678-07-3
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO TOP COVER CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT REVISIONS | 31/Oct/17 | N.R. |
| | | 1 | I.D. PLATE UPDATED | 26/Oct/16 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 25/Oct/15 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 18/Oct/16 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 06/Oct/16 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
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| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 8 OPENING CLEARANCES
LOCATION: 59°37'10.8"N 108°25'10.6"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

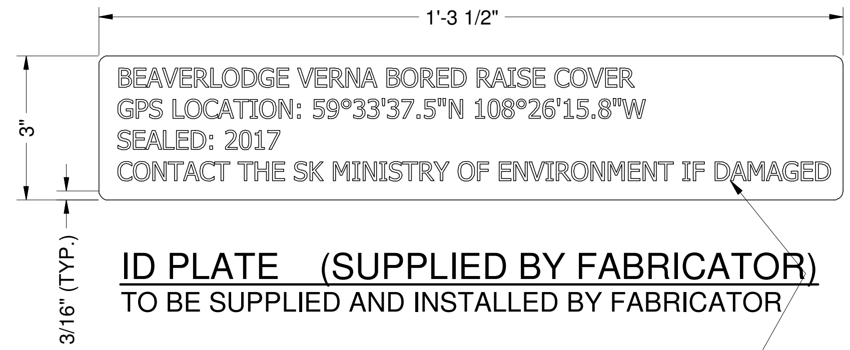
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 4
DWG. NO.: S18678-07-4
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# VERNA 4 - Bored Raise

VERNA 4 - Bored Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.

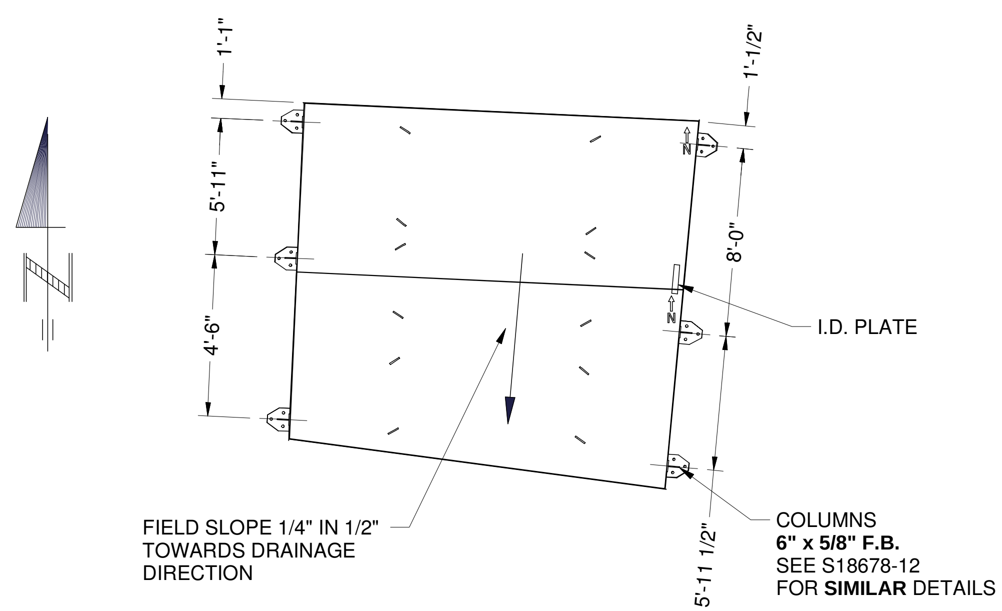



ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

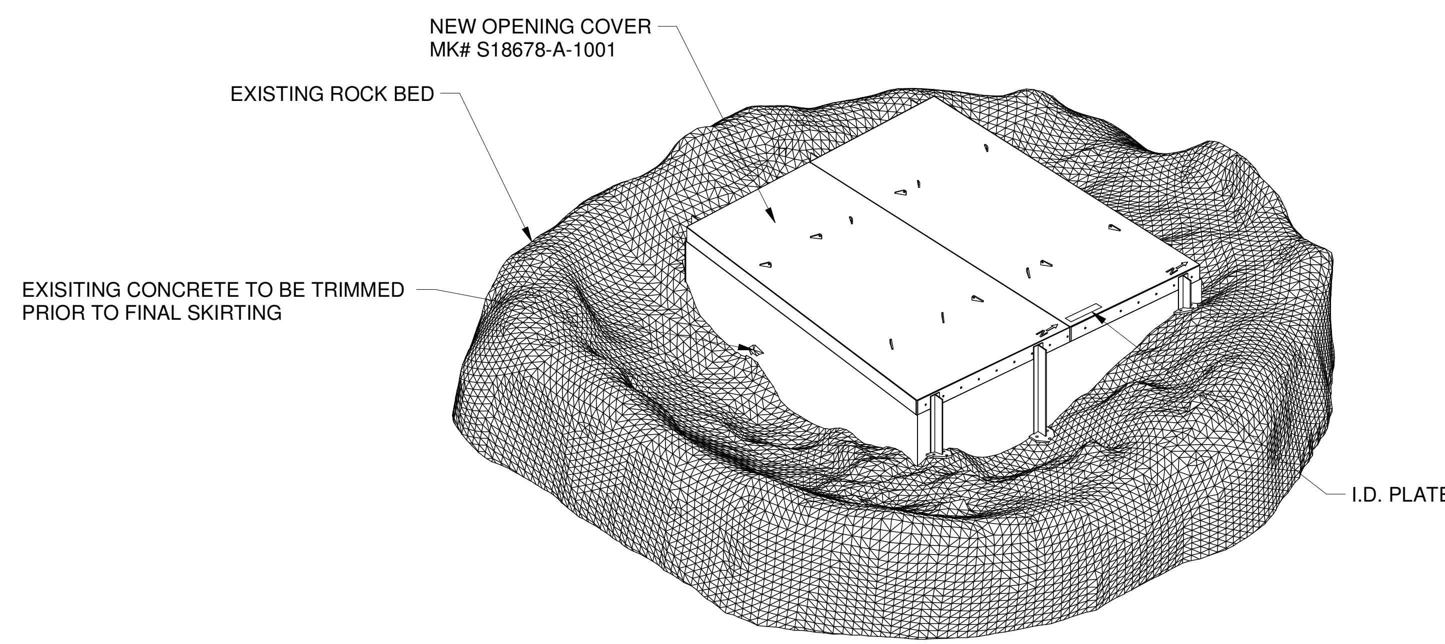
LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 6,660 LB
AS INSTALLED: 8,436 LB

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 8,436LB
5. DO NOT BACK FILL WALLS OF COVER.




PLAN VIEW - VERNA 4 OPENING COVER




ISO VIEW
LOOKING NORTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
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| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
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Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

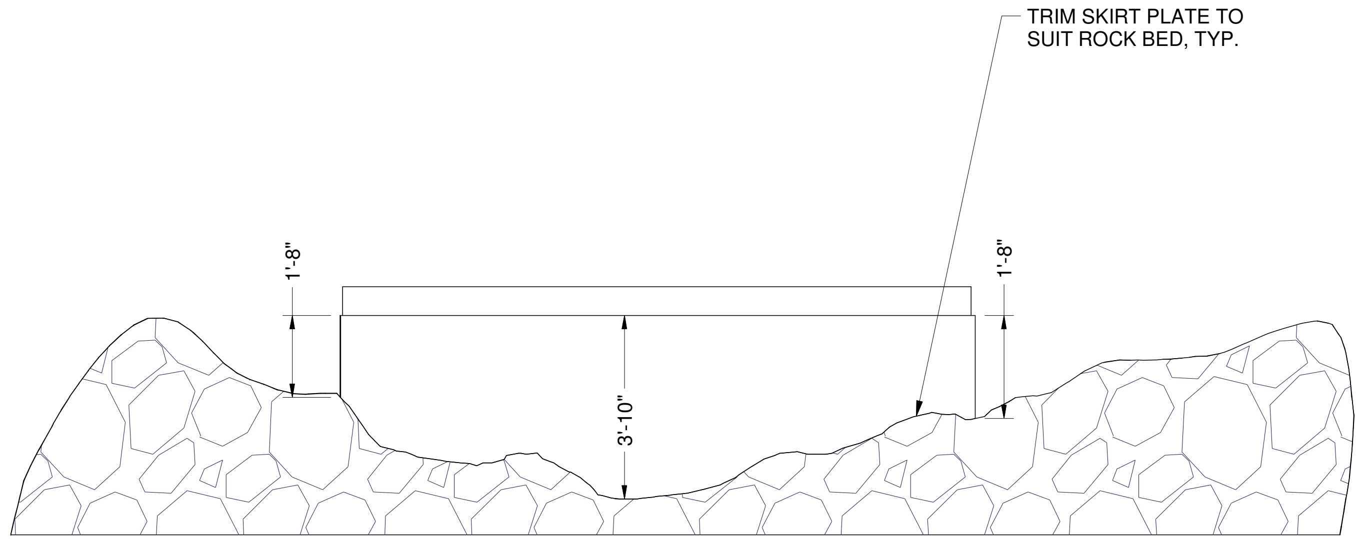
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

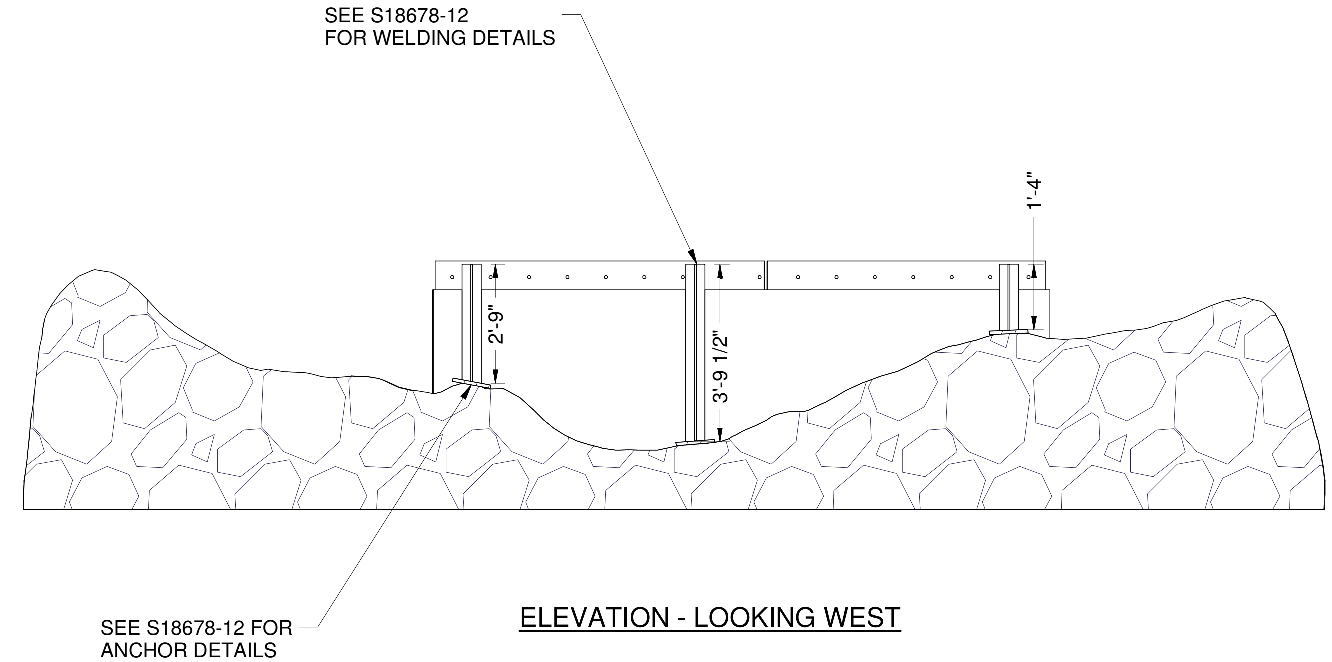
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING GENERAL ARRANGEMENT AND NOTES
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: S18678-10-1
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

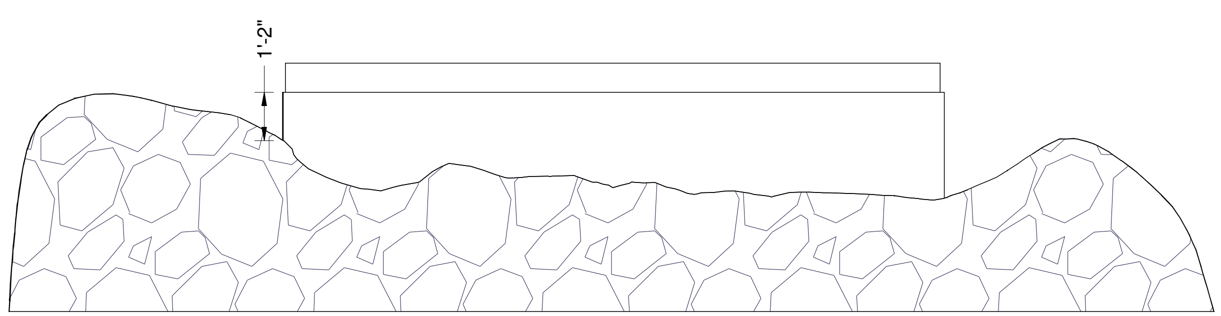
ESTIMATED TOTAL COLUMN LENGTH 220" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



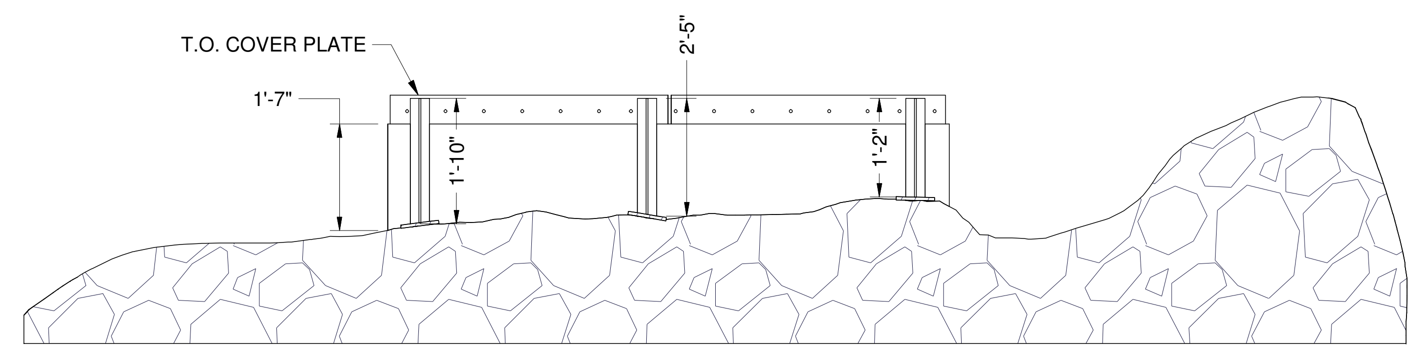

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.G. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

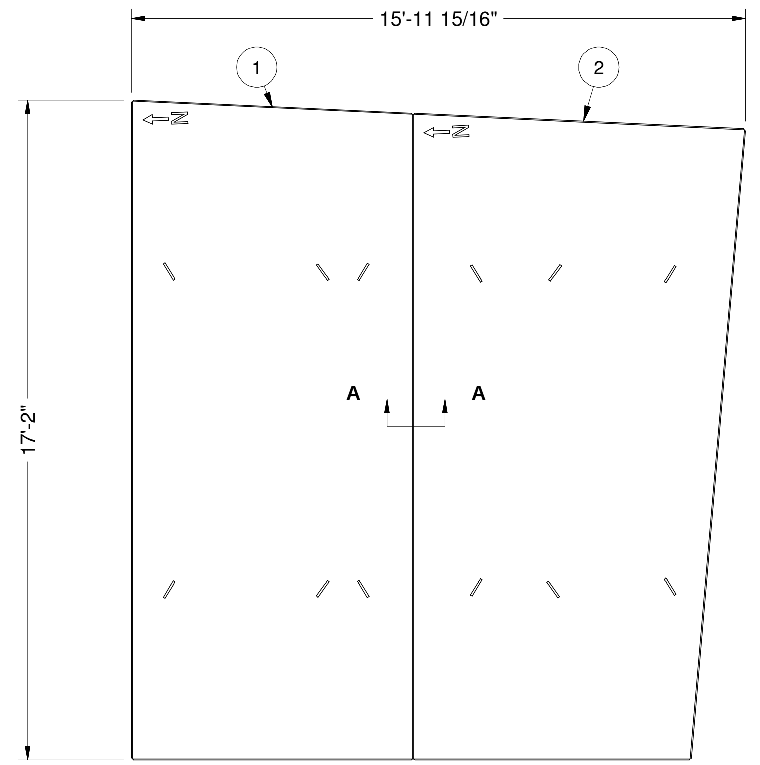
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: S18678-10-2
2

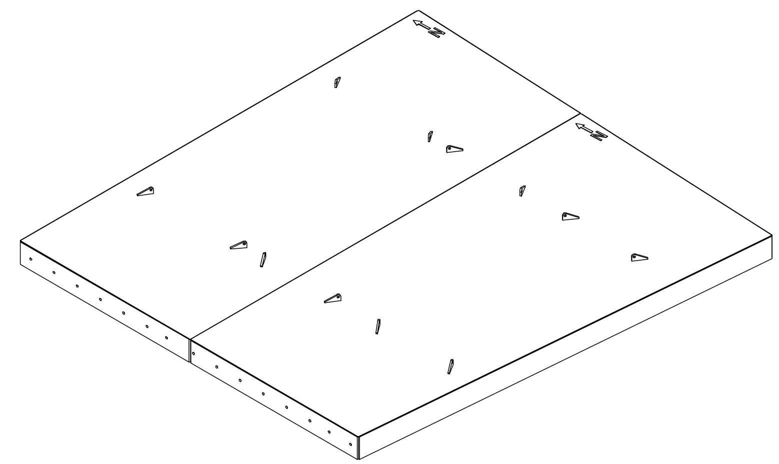
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

BILL OF MATERIALS

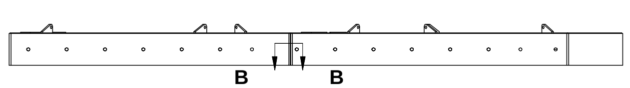
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
|---|---|---|---|---|---|
| 1 | 1 | COVER SECTION 1 | S18678-A-1002 | | 4 |
| 2 | 1 | COVER SECTION 2 | S18678-A-1003 | | 4 |



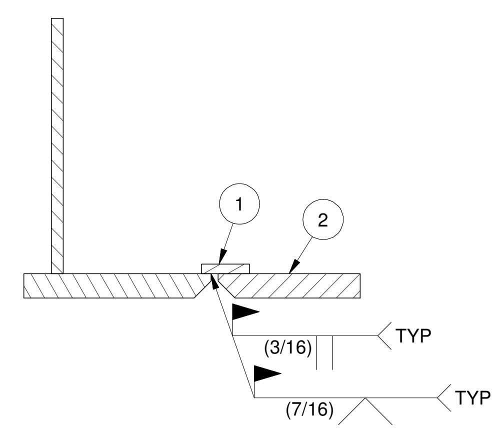

S18678-A-1001 - TOP VIEW
WELDED ASSEMBLY



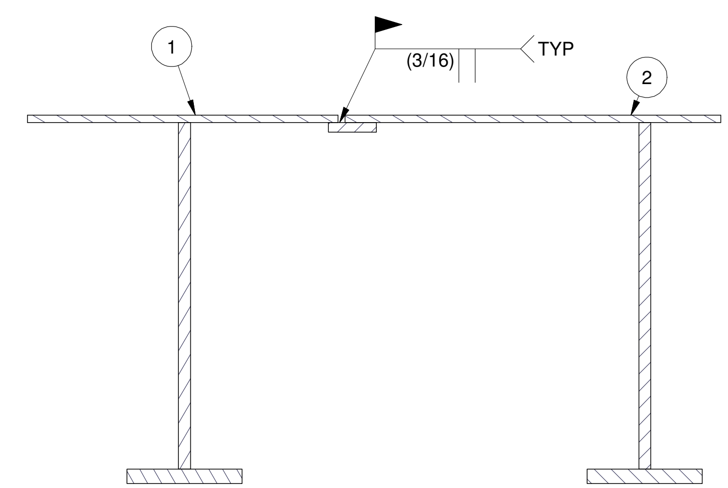
S18678-A-1001 - ISO VIEW




S18678-A-1001 - SIDE VIEW




SECTION B-B




SECTION A-A

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
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| Structural | 14318 | |

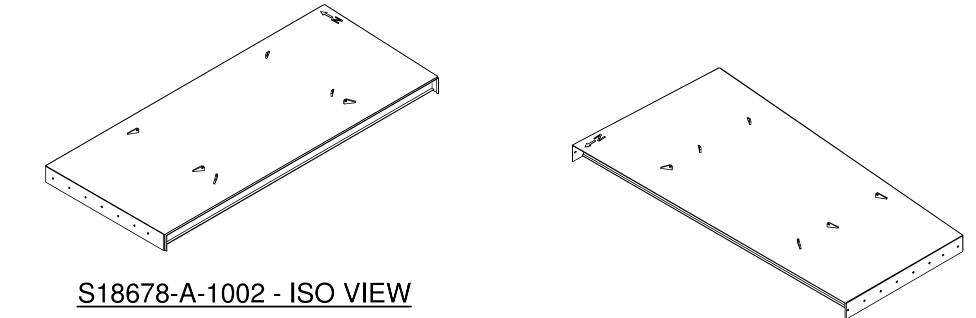
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING
TOP COVER DETAILS
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

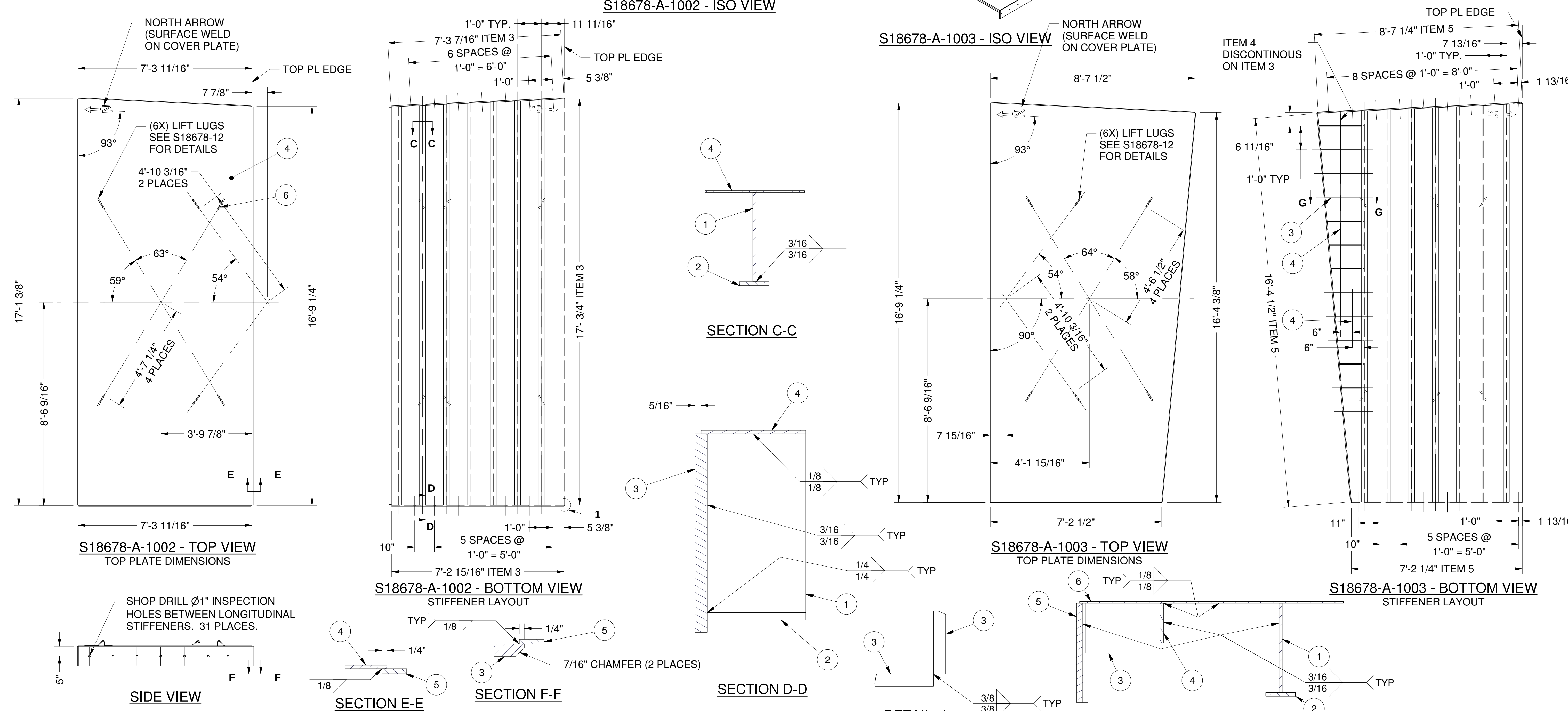
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: S18678-10-3
REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | | 9"x5/16" FB | ASTM A240-316L |
| 2 | | 3"x3/8" FB | ASTM A240-316L |
| 3 | | 10x5/8" FB | ASTM A240-316L |
| 4 | 1 | 3/16" PL | ASTM A240-316L |
| 5 | | 1 1/4"x1/4" FB | ASTM A240-316L |
| 6 | 6 | 5/8" PL | ASTM A240-316L |




| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | | 9"x5/16" FB | ASTM A240-316L |
| 2 | | 3"x3/8" FB | ASTM A240-316L |
| 3 | | 5"x3/8" FB | ASTM A240-316L |
| 4 | | 4"x3/8" FB | ASTM A240-316L |
| 5 | | 10"x5/8" FB | ASTM A240-316L |
| 6 | 1 | 3/16" FB | ASTM A240-316L |
| 7 | 6 | 5/8" PL | ASTM A240-316L |

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| | | 1 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
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| S18678-12 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
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DRWN BY: A.R.
DATE: 8/29/2016
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
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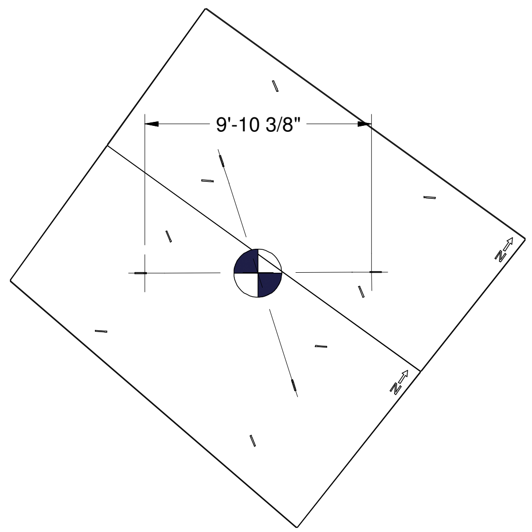
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

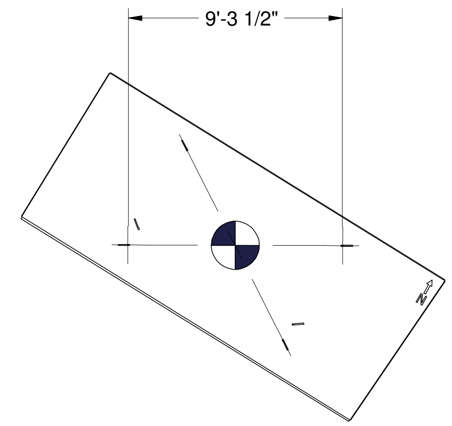
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING
TOP COVER SECTIONS
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 6
DWG. NO.: S18678-10-4
REV 2

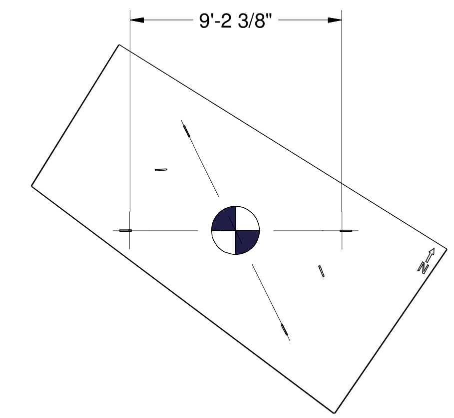
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



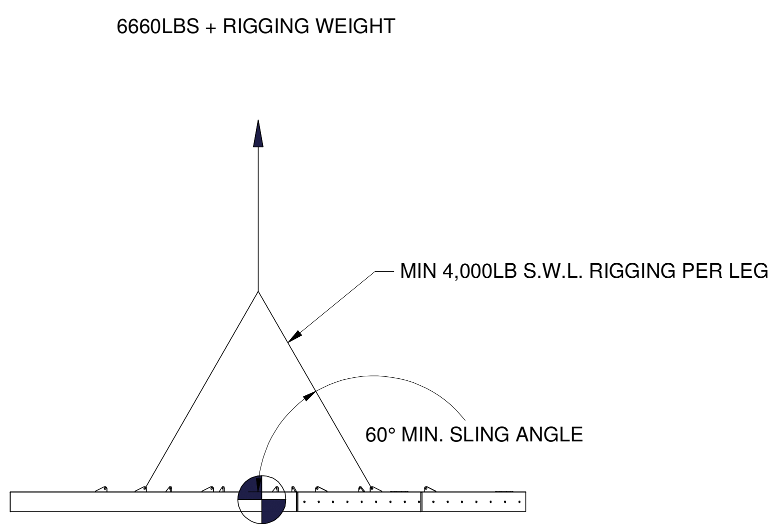

TOP COVER LIFTING DIAGRAM
S18678-A-1001



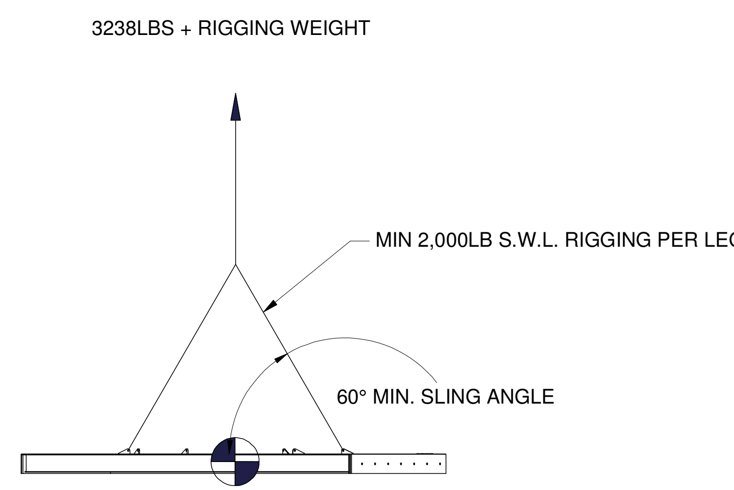

TOP COVER LIFTING DIAGRAM
S18678-A-1002



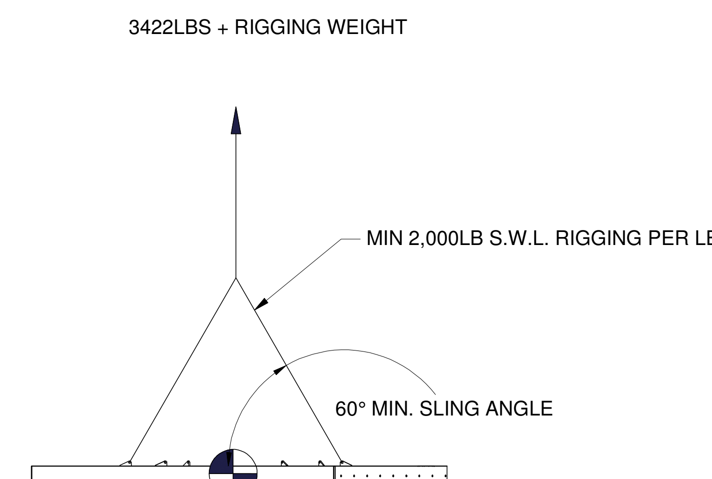

TOP COVER LIFTING DIAGRAM
S18678-A-1003




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-1001




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-1002




TOP COVER LIFTING DIAGRAM - SIDE VIEW
S18678-A-1003



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
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ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

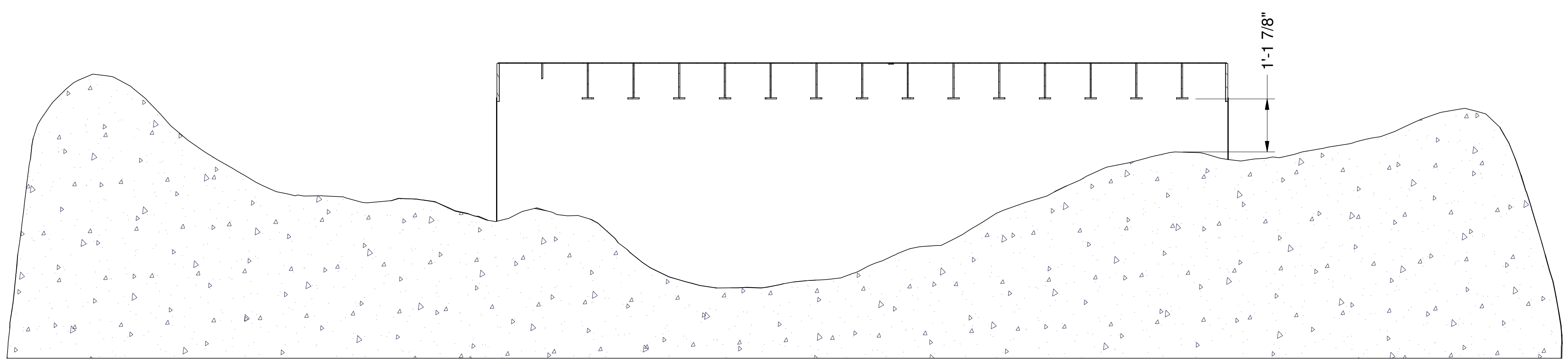
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING LIFTING DETAILS
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: S18678-10-5
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO TOP COVER CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS-BUILT REVISIONS | 10/31/2017 | A.R. |
| | | 1 | I.D. PLATE UPDATED | 10/26/2016 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 10/25/2016 | N.R. |
| S18678-12 | KOVA DWG. - STANDARD DETAILS | B | ISSUED FOR REVIEW | 10/18/2016 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 8/29/2016 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
17 10 31
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 4 OPENING CLEARANCES
LOCATION: 59°33'37.5"N 108°26'15.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: S18678-10-6
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

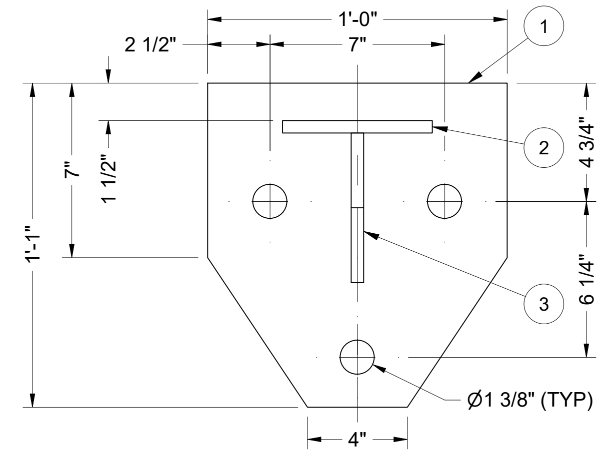
# 2018 Cover Installations

**2018 Stainless Steel Cover Details**

- **Columns Details and Notes**
- **Bedrock Anchor Details**
- **Welding Details**
- **Lift Lug Design**

**2018 Stainless Steel Cover Details**

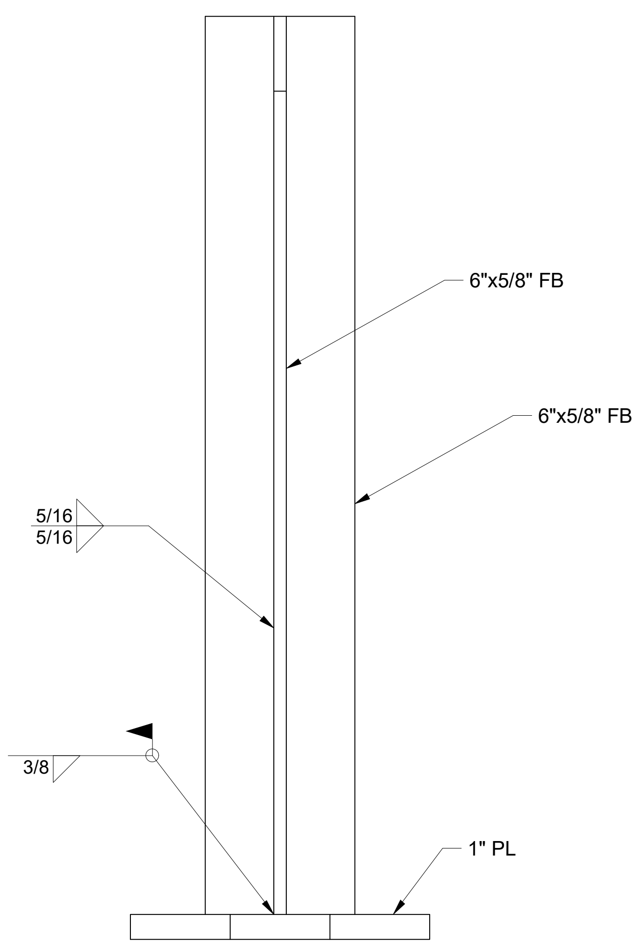
GENERAL NOTES:
1. ALL STRUCTURAL PLATE MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
5. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
6. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
7. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
8. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.



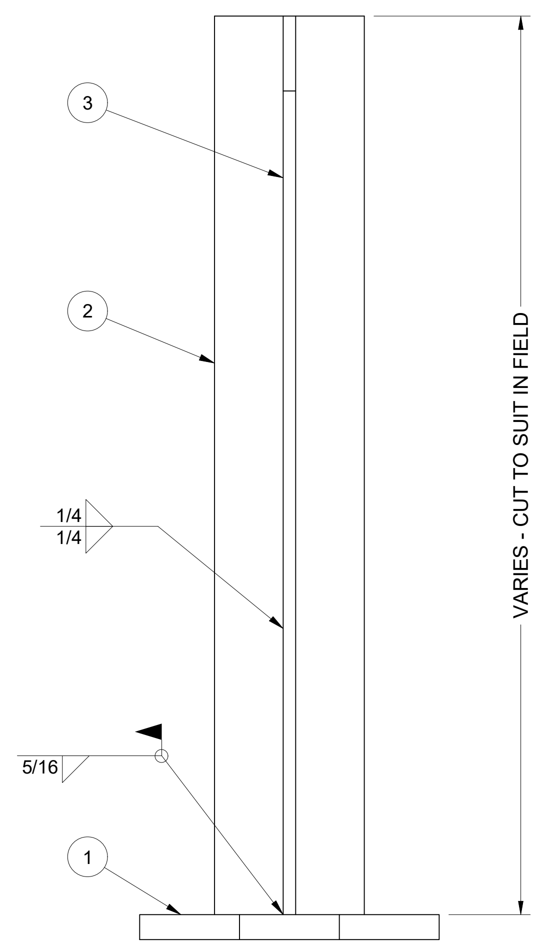

TOP VIEW

BILL OF MATERIALS

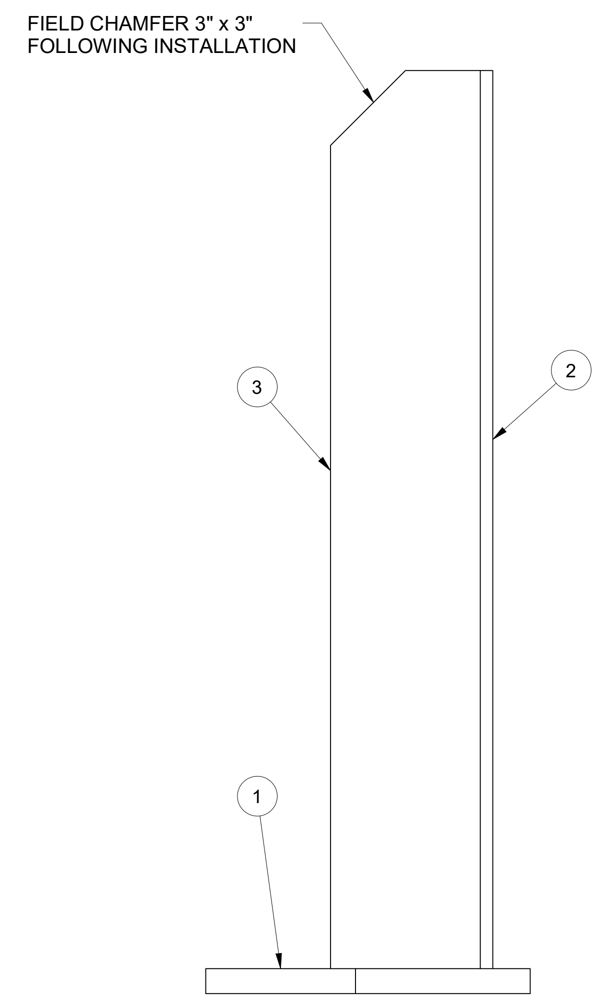
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
|---|---|---|---|---|---|
| 1 | 1 | 1" PL | | ASTM A240-316L | |
| 2 | 1 | 6" x 1/2" FB | | ASTM A240-316L | |
| 3 | 1 | 6" x 1/2' FB | | ASTM A240-316L | |



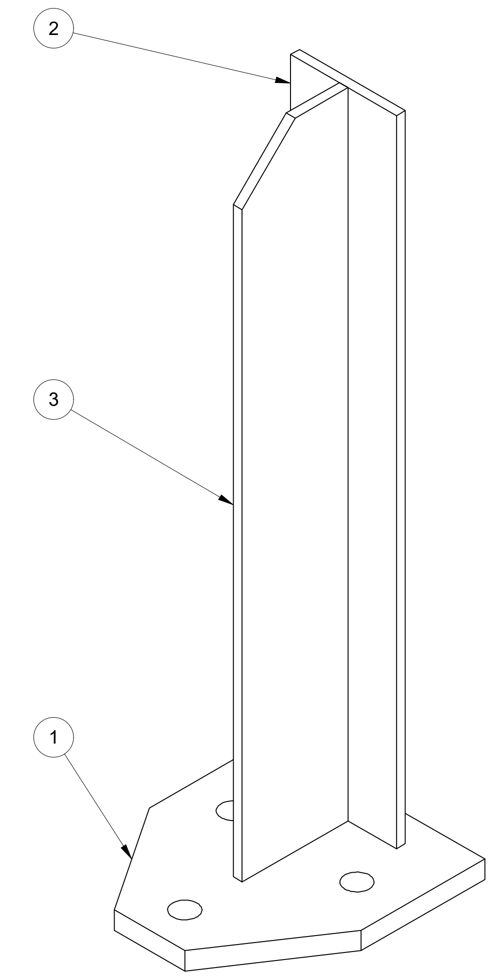

ALTERNATIVE COLUMN DETAIL
5/8" PLATE COLUMNS




COLUMN DETAIL




SIDE VIEW




ISO VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-01~6 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES
DRWN BY: A.R.
DATE: 13/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

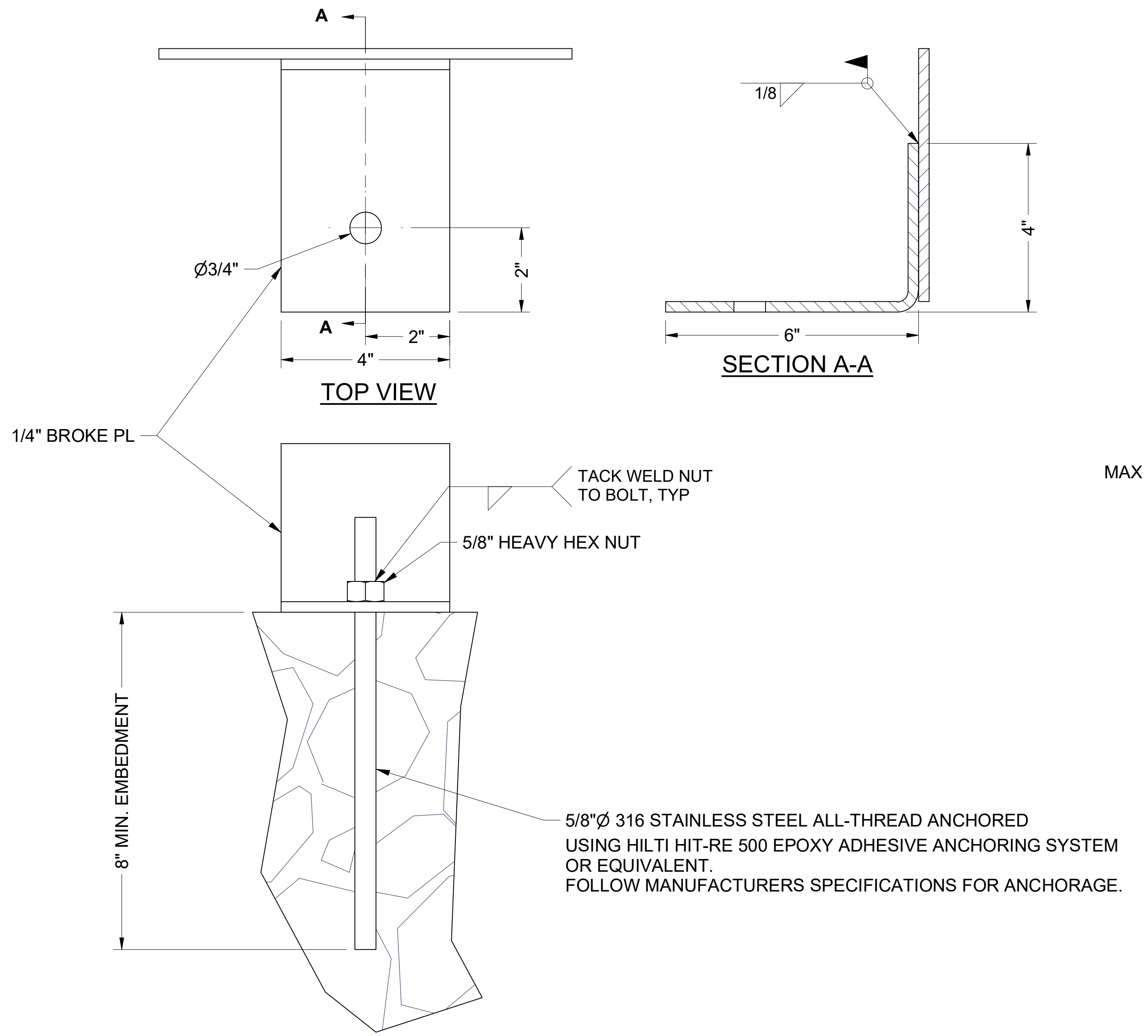
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

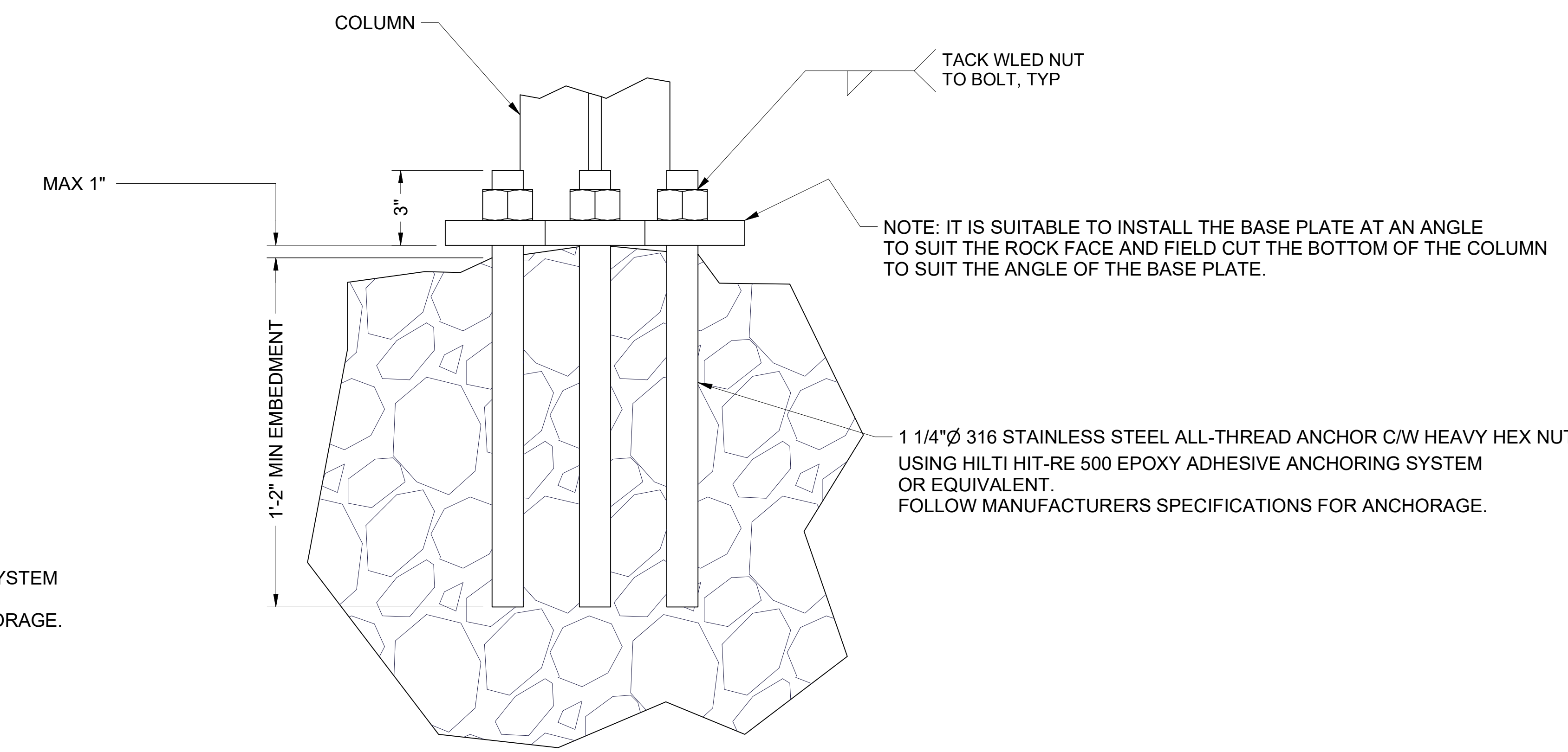
Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
COLUMN DETAILS & NOTES
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 4
DWG. NO.: P60236-07-1
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TYPICAL SKIRT ANCHOR DETAIL




TYPICAL COLUMN ANCHOR BOLT DETAIL





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-01~6 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 13/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Number C672
Permission to Consult held by:

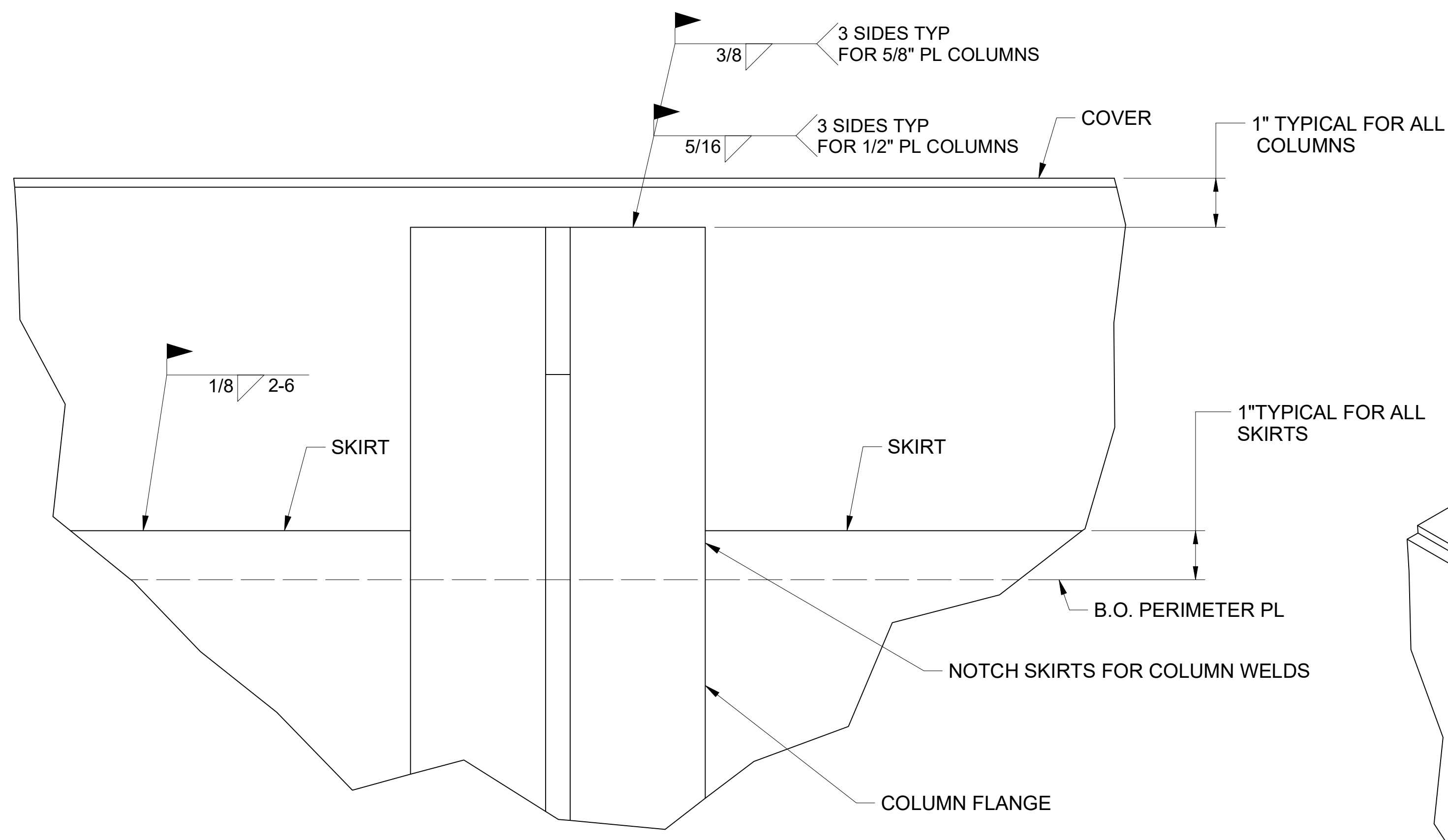
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

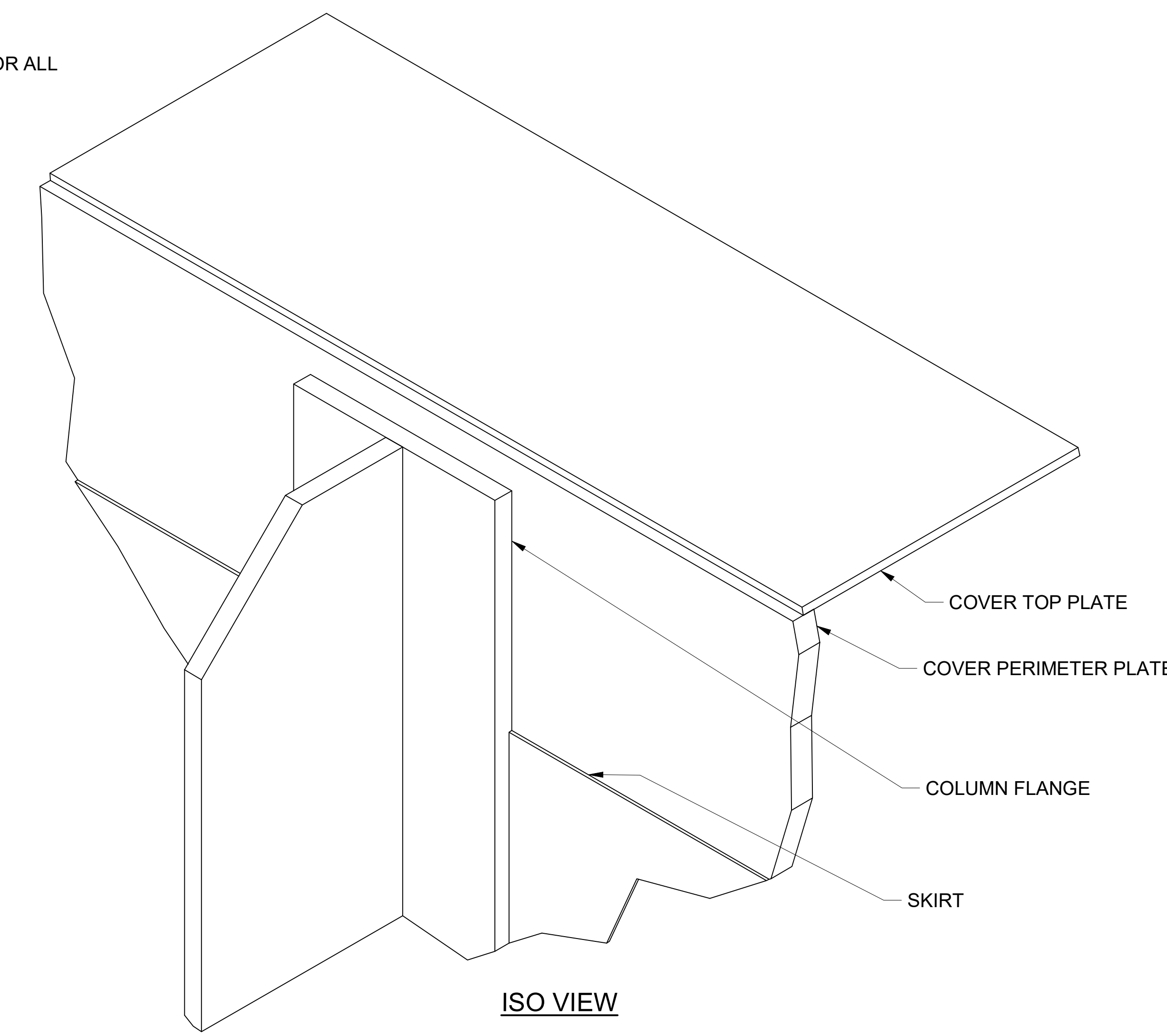
PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
ANCHOR DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 4
DWG. NO.: P60236-07-2
1

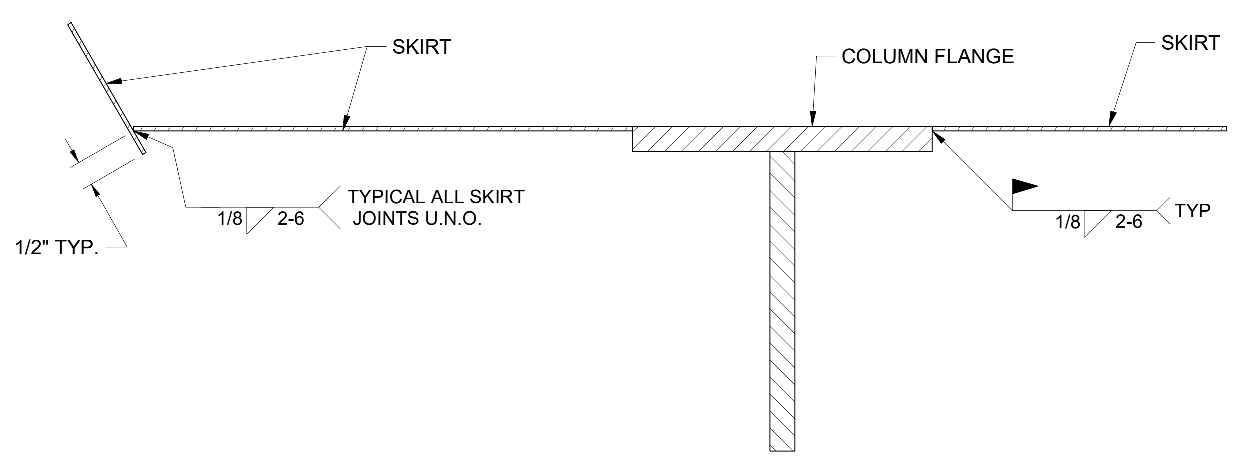
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




WELDING COLUMN
AND SKIRT TO COVER




ISO VIEW




SKIRT WELDING





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-01~6 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 13/Nov/17 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
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CERTIFICATE OF AUTHORIZATION
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Permission to Consult held by:

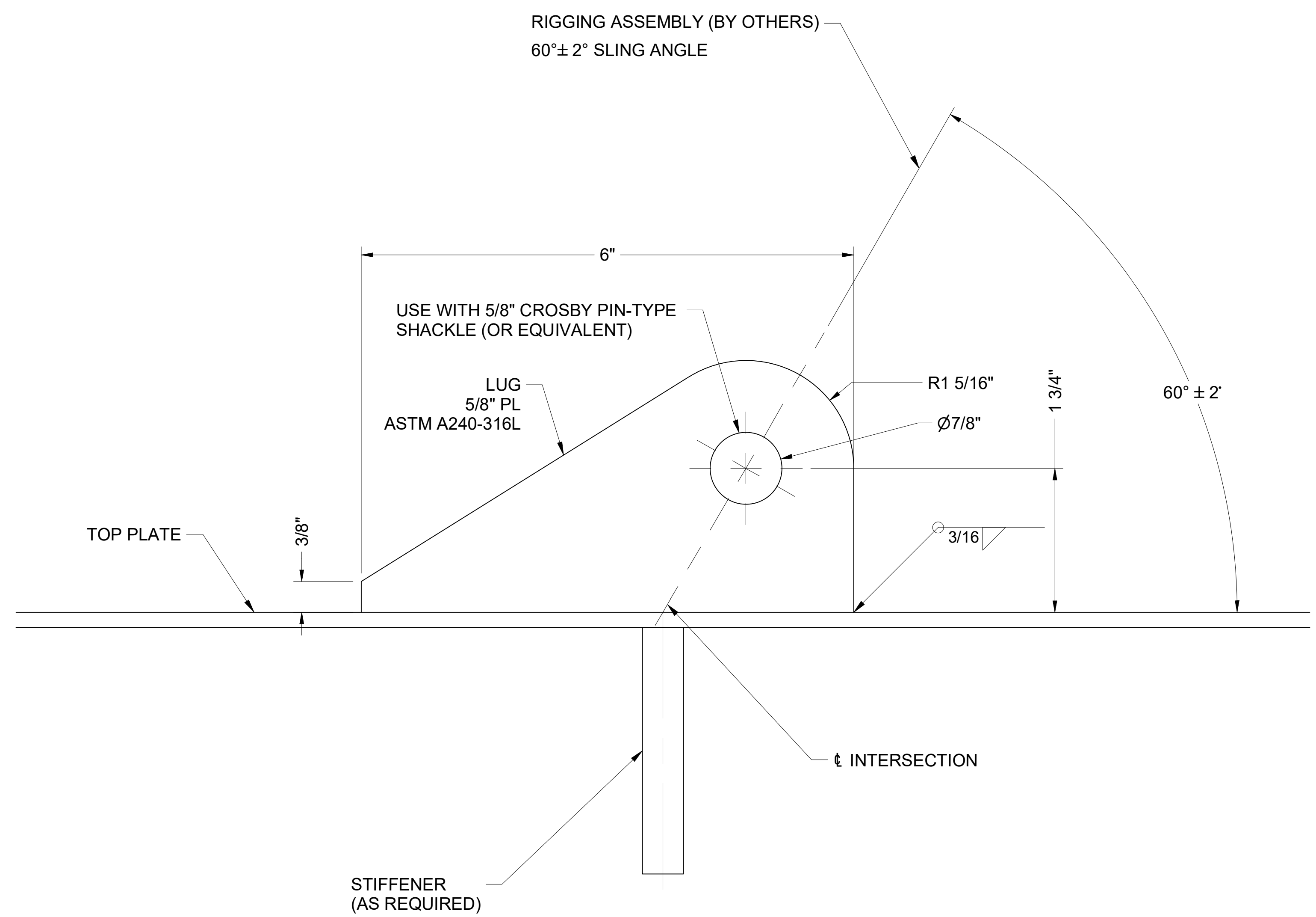
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
WELDING DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

| | | |
|---|---|---|
| DO NOT SCALE DRAWINGS | DWG. NO.: | P60236-07-3 |
| SHEET NO.: 3 OF 4 | | 1 |

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




LUG DETAIL

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 1 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-01~6 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 13/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

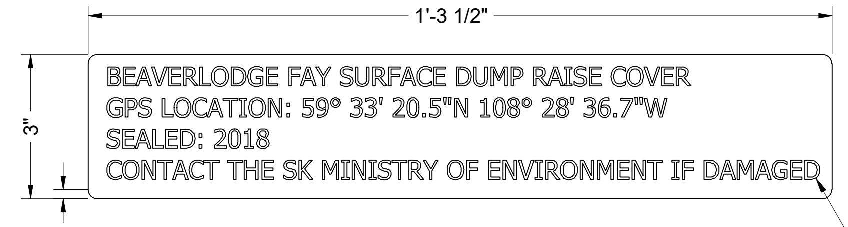
PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
LIFT LUG DESIGN
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 4
DWG. NO.: P60236-07-4
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

## FAY 5 – Surface Dump Raise

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
15. SEE DRAWING P60236-07 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

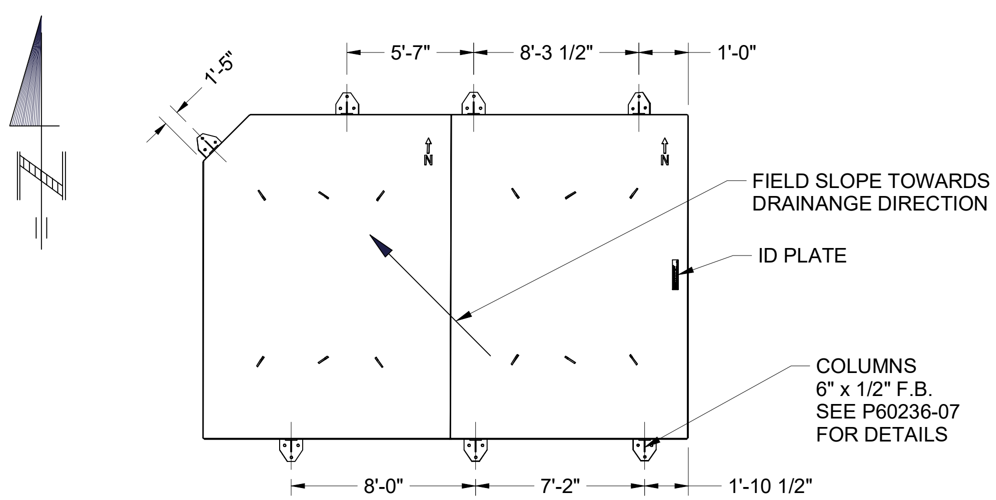
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 10,200 LB
5. DO NOT BACK FILL WALLS OF COVER.



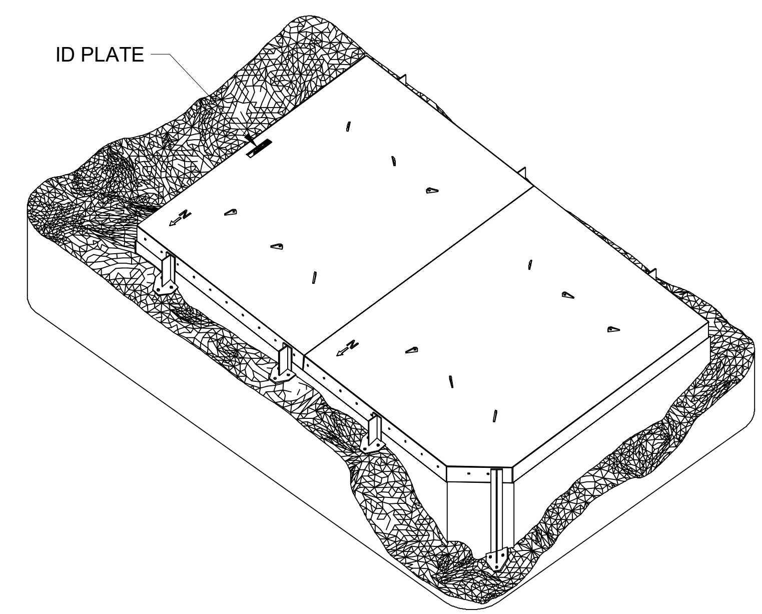

ID PLATE (SUPPLIED BY FABRICATOR)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER ASSEMBLY W/O RIGGING: 8,530 LB
AS INSTALLED: 10,200 LB




PLAN VIEW FAY 5 OPENING COVER




ISO VIEW
LOOKING SOUTH-EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | AR |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

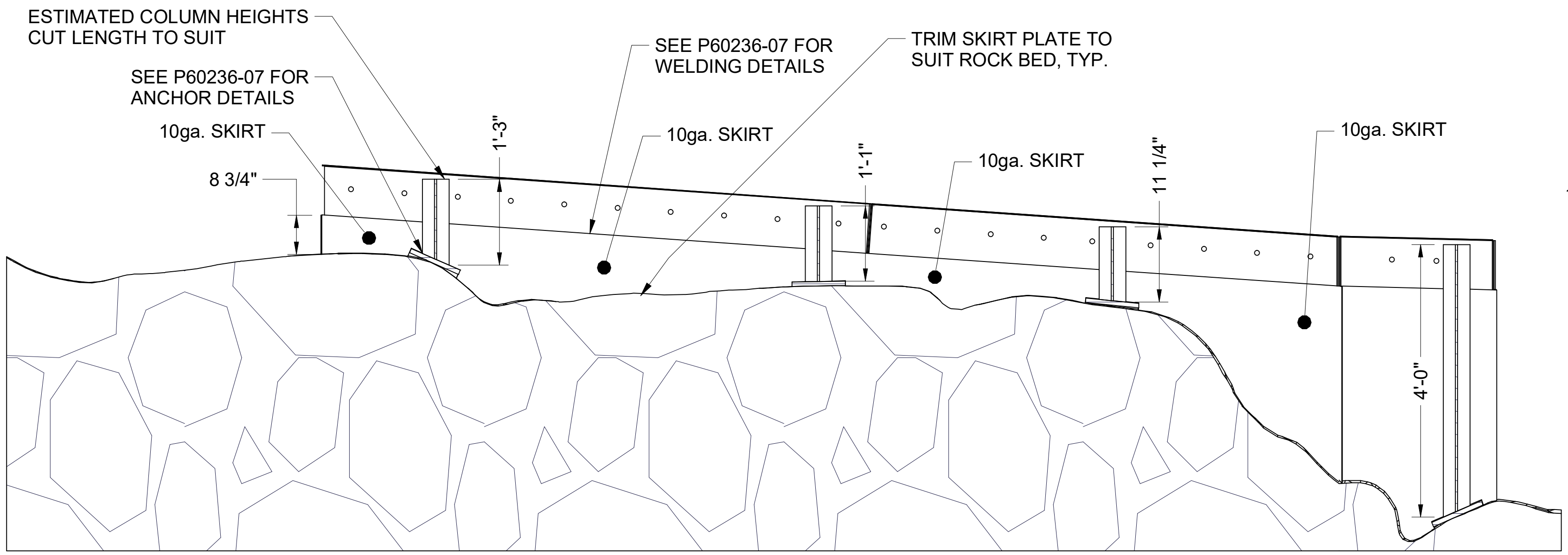
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 5 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 33' 20.5"N 108° 28' 36.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

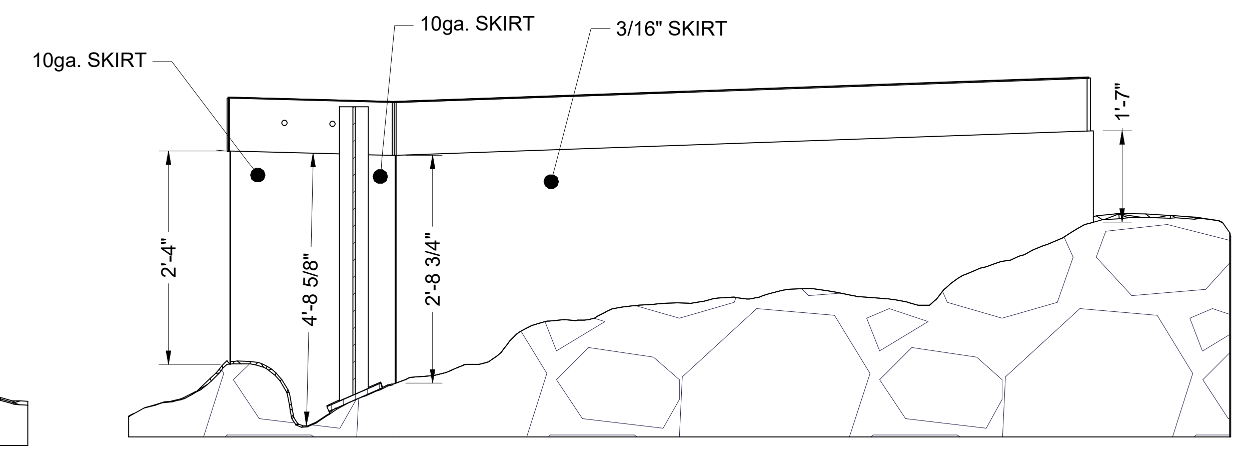
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 5
DWG. NO.: P60236-03-1
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

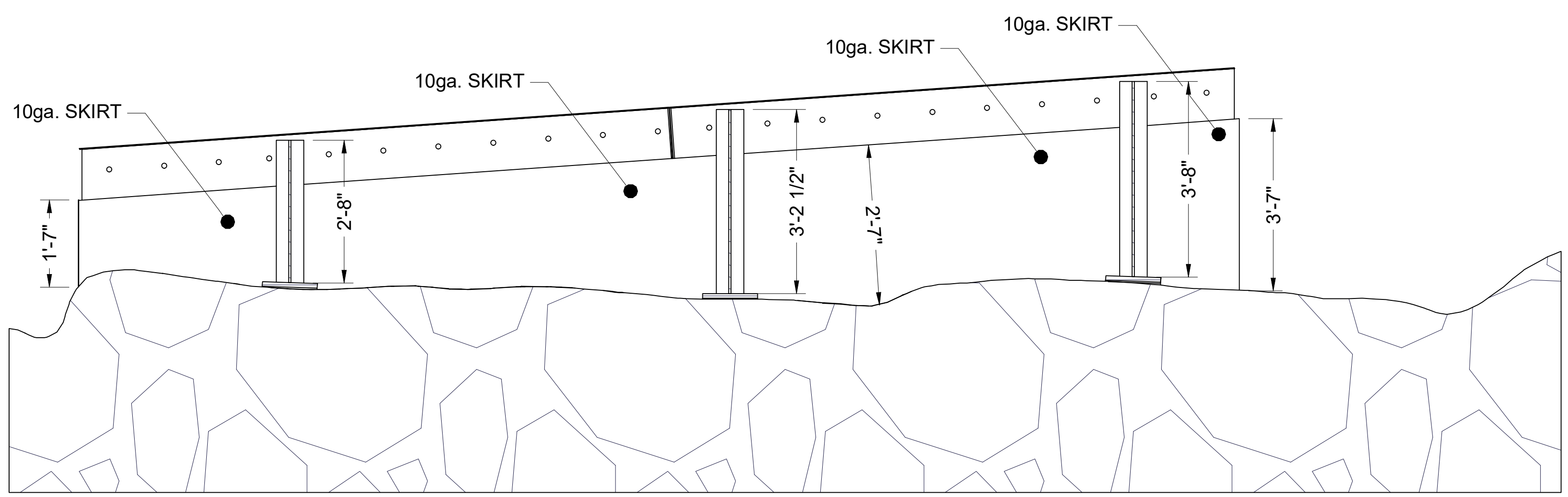
ESTIMATED TOTAL COLUMN LENGTH 220" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SEVEN (7) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



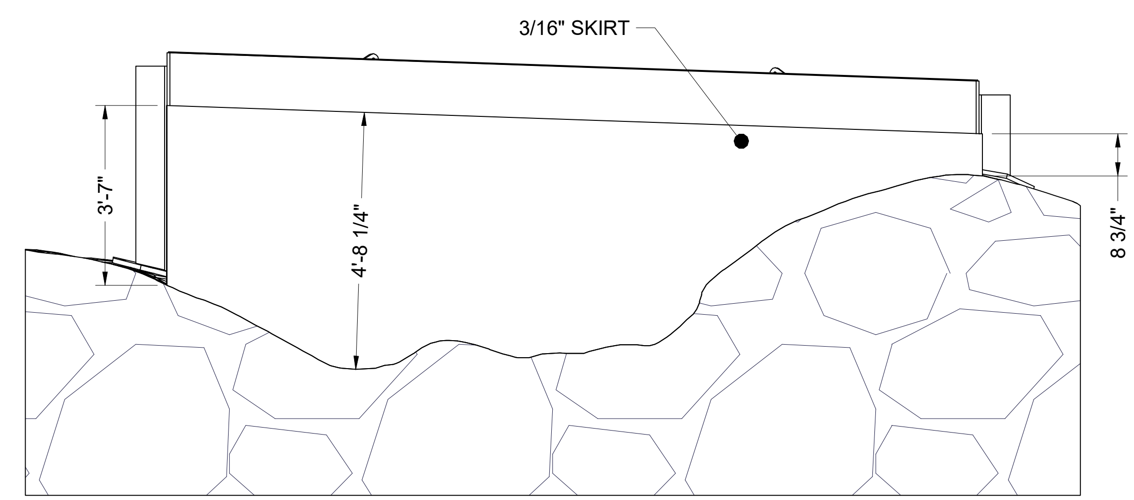

ELEVATION LOOKING SOUTH




ELEVATION LOOKING EAST




ELEVATION LOOKING NORTH




ELEVATION LOOKING WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △2 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | △1 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | AR |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

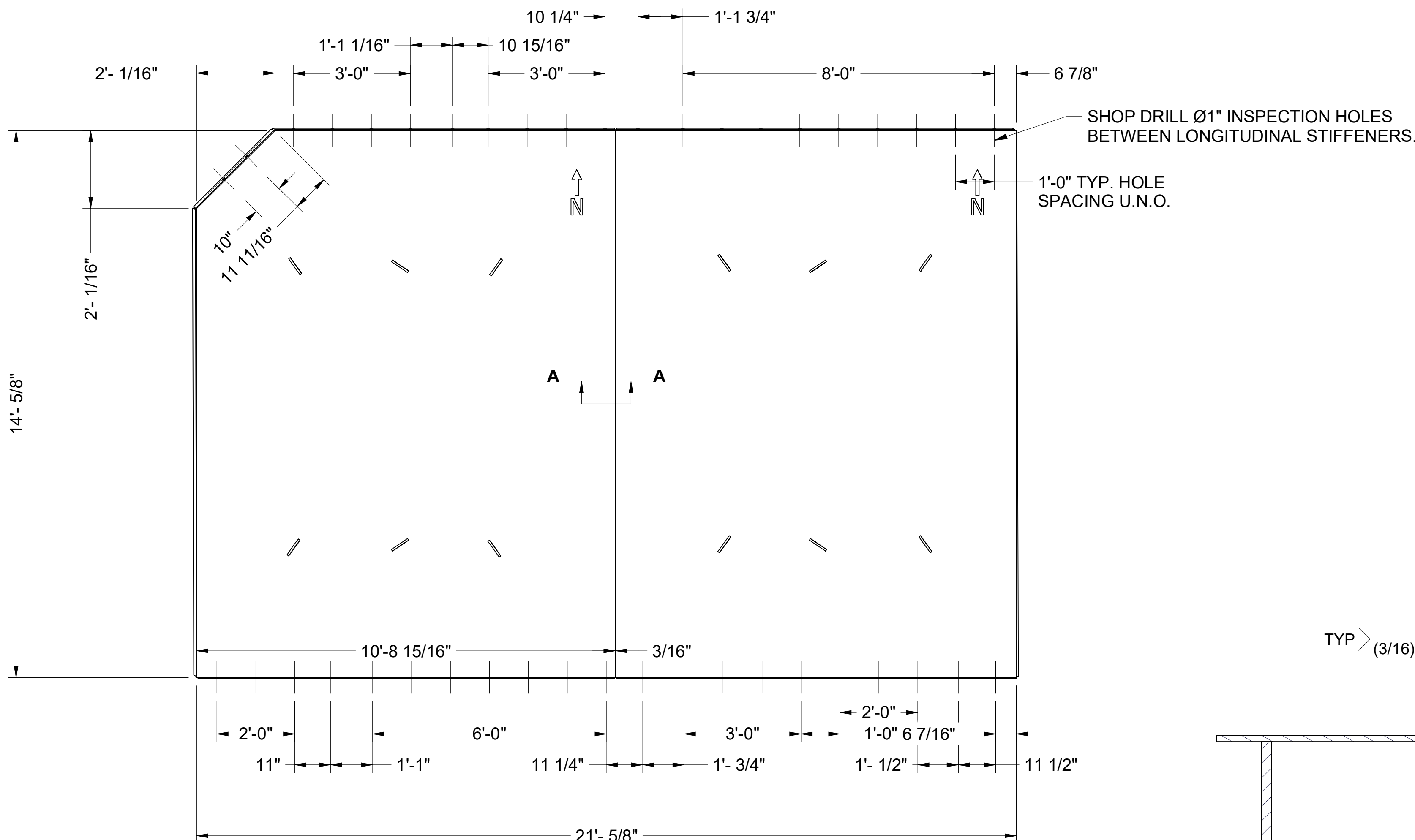
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 5 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 33' 20.5"N 108° 28' 36.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

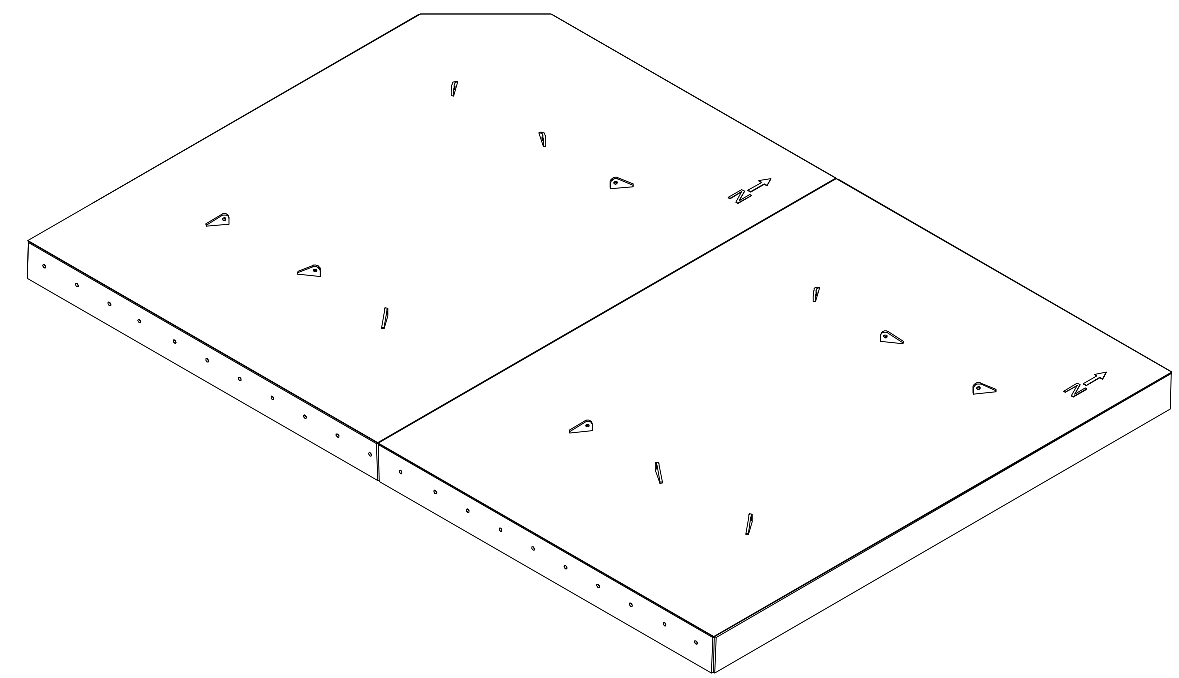
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 5
DWG. NO.: P60236-03-2
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

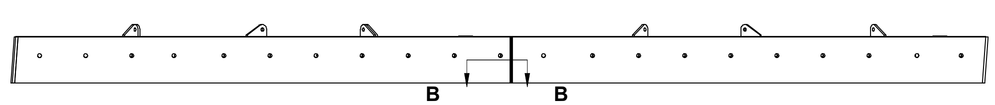
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 19 | 1 | TOP COVER SECTION 2 | P60236-A-303 | | |
| 27 | 1 | TOP COVER SECTION 1 | P60236-A-302 | | |



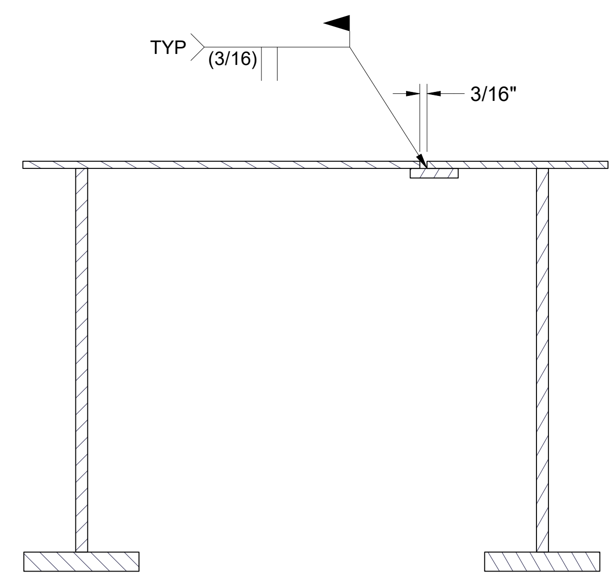

P60236-A-301
TOP PLATE DIMENSIONS



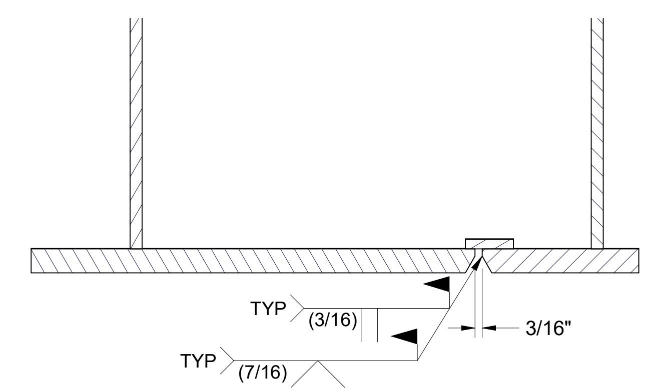

P60236-A-301 - ISO VIEW




SIDE VIEW




SECTION A-A




SECTION B-B





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: AR
DATE: 08/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

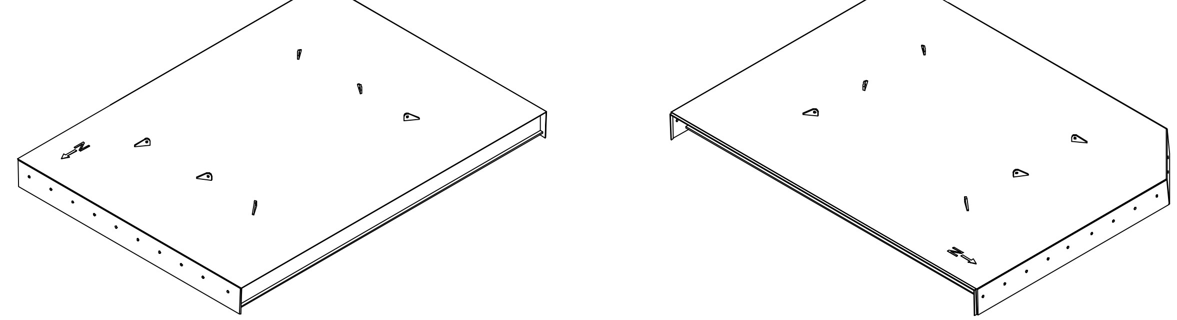
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 5 OPENING
TOP COVER DETAILS
LOCATION: 59° 33' 20.5"N 108° 28' 36.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 5
DWG. NO.: P60236-03-3
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

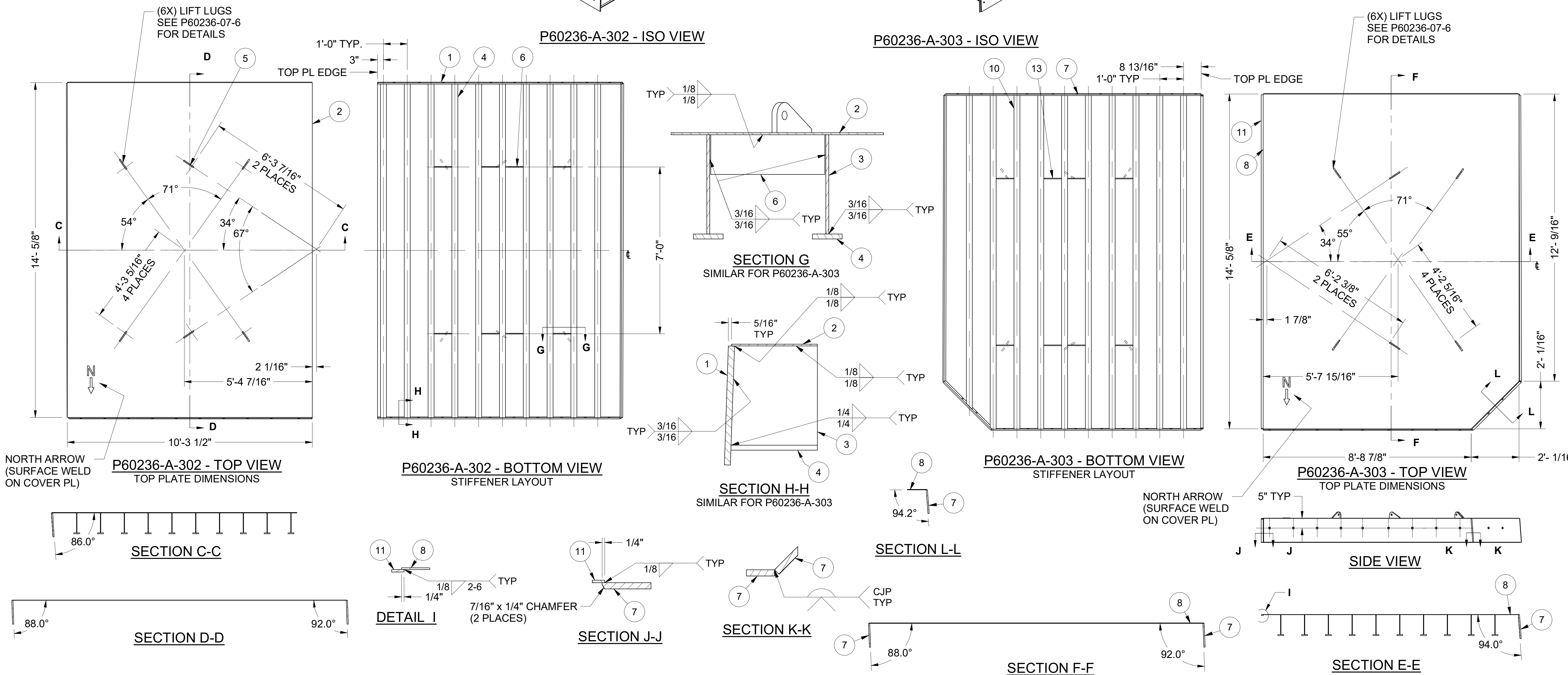
| BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 12"x5/8" FB | ASTM A-240 316 |
| 2 | 3/16" PL | ASTM A-240 316 |
| 3 | 10"x5/16" FB | ASTM A-240 316 |
| 4 | 3"x1/2" FB | ASTM A-240 316 |
| 5 | 5/8" PL | ASTM A-240 316 |
| 6 | 4"x3/8" FB | ASTM A-240 316 |

| BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 7 | 12"x5/8" FB | ASTM A-240 316 |
| 8 | 3/16" PL | ASTM A-240 316 |
| 9 | 10"x5/16" FB | ASTM A-240 316 |
| 10 | 3"x1/2" FB | ASTM A-240 316 |
| 11 | 1 1/4"x1/4" FB | ASTM A-240 316 |
| 12 | 5/8" PL | ASTM A-240 316 |
| 13 | 4"x3/8" FB | ASTM A-240 316 |



P60236-A-302 - ISO VIEW

P60236-A-303 - ISO VIEW




P60236-A-302 - TOP VIEW
TOP PLATE DIMENSIONS

P60236-A-302 - BOTTOM VIEW
STIFFENER LAYOUT

SECTION G
SIMILAR FOR P60236-A-303

SECTION H-H
SIMILAR FOR P60236-A-303

P60236-A-303 - BOTTOM VIEW
STIFFENER LAYOUT

P60236-A-303 - TOP VIEW
TOP PLATE DIMENSIONS

SECTION C-C

SECTION D-D

DETAIL I

SECTION J-J

SECTION K-K

SECTION L-L

SIDE VIEW

SECTION F-F

SECTION E-E



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: AR
DATE: 08/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.S. CAUGHLIN — MEMBER 14318 — 18 11 09 — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

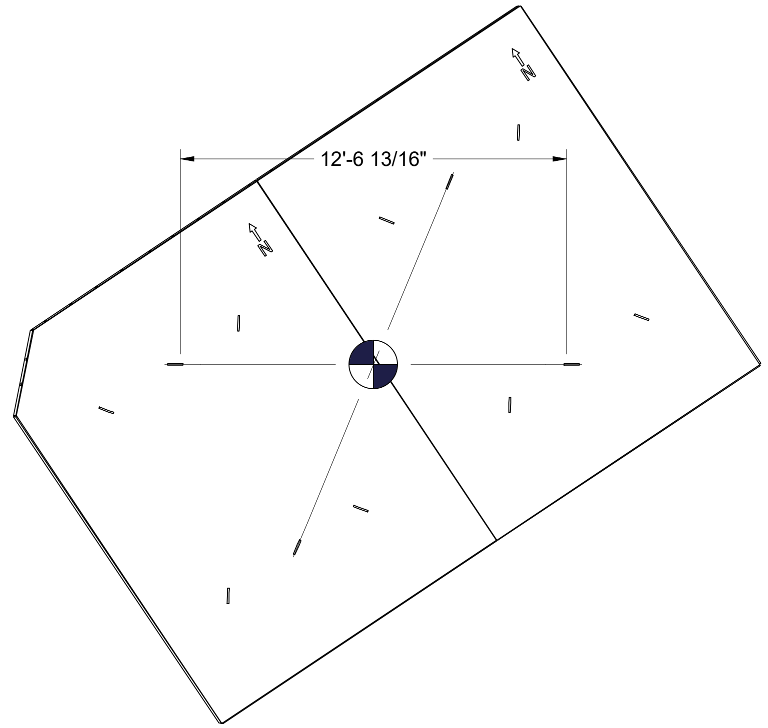
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

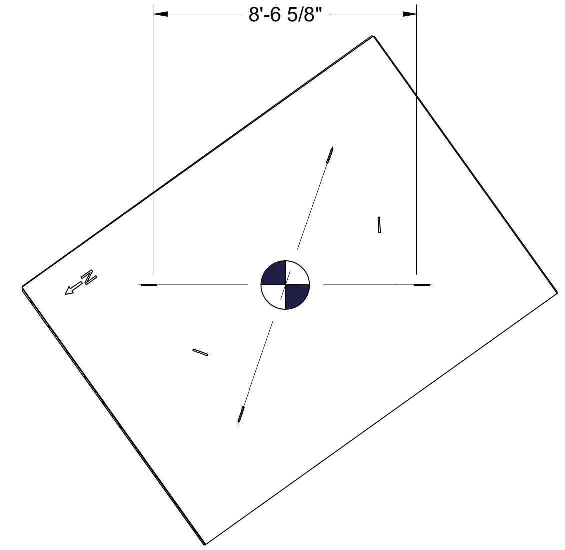
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 5 OPENING
TOP COVER SECTIONS
LOCATION: 59° 33' 20.5"N 108° 28' 36.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 5
DWG. NO.: P60236-03-4
1

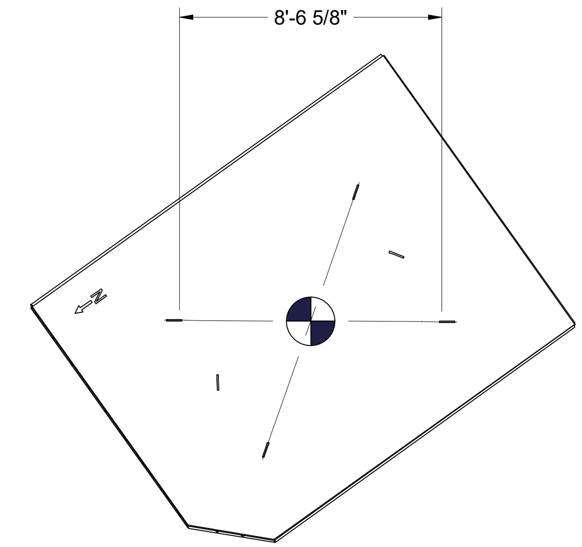
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



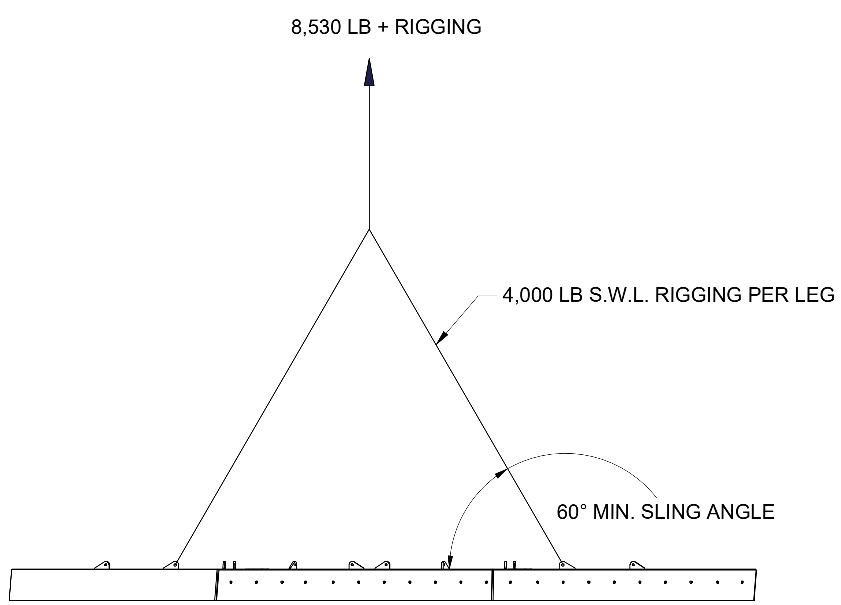

TOP COVER LIFTING DIAGRAM
P60236-A-301



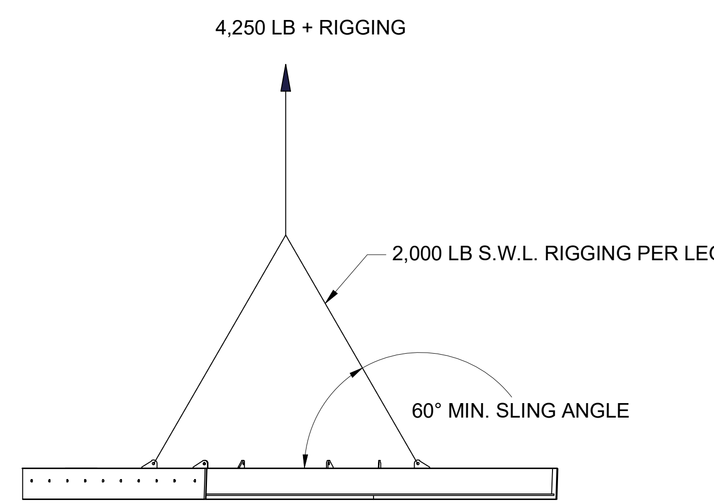

TOP COVER LIFTING DIAGRAM
P60236-A-302



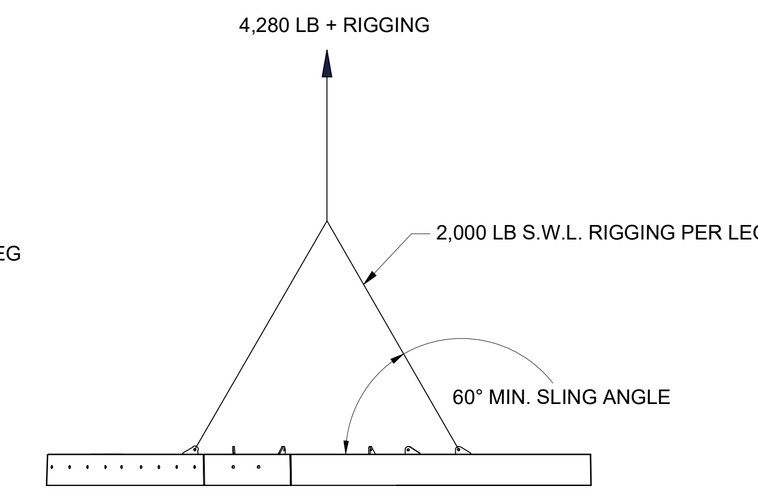

TOP COVER LIFTING DIAGRAM
P60236-A-303




TOP COVER LIFTING DIAGRAM - SIDE VIEW
P60236-A-301




TOP COVER LIFTING DIAGRAM - SIDE VIEW
P60236-A-302




TOP COVER LIFTING DIAGRAM - SIDE VIEW
P60236-A-303





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: AR
DATE: 08/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering**
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 5 OPENING LIFTING DETAILS
LOCATION: 59° 33' 20.5"N 108° 28' 36.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 5
DWG. NO.: P60236-03-5
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

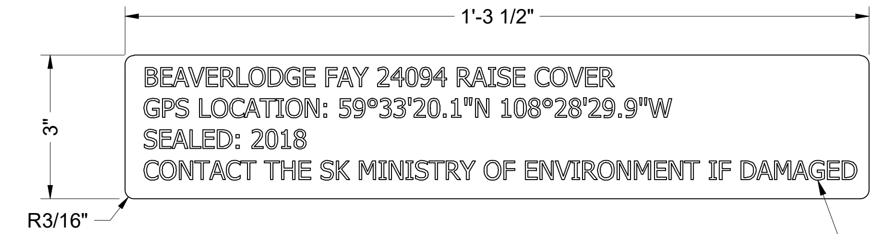
# FAY 11 – 24094 Ventilation Raise

# (Main Beaverlodge Ventilation Shaft)

FAY 11 – 24094 Raise

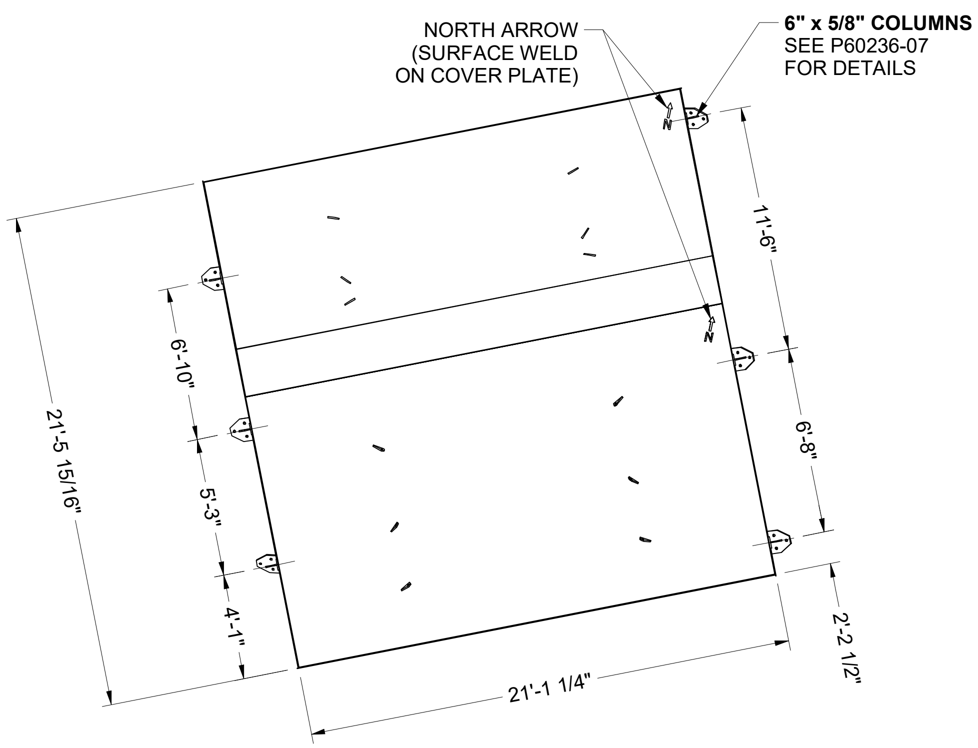
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
15. SEE DRAWING P60236-07 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 19,010 LB
5. DO NOT BACK FILL WALLS OF COVER.

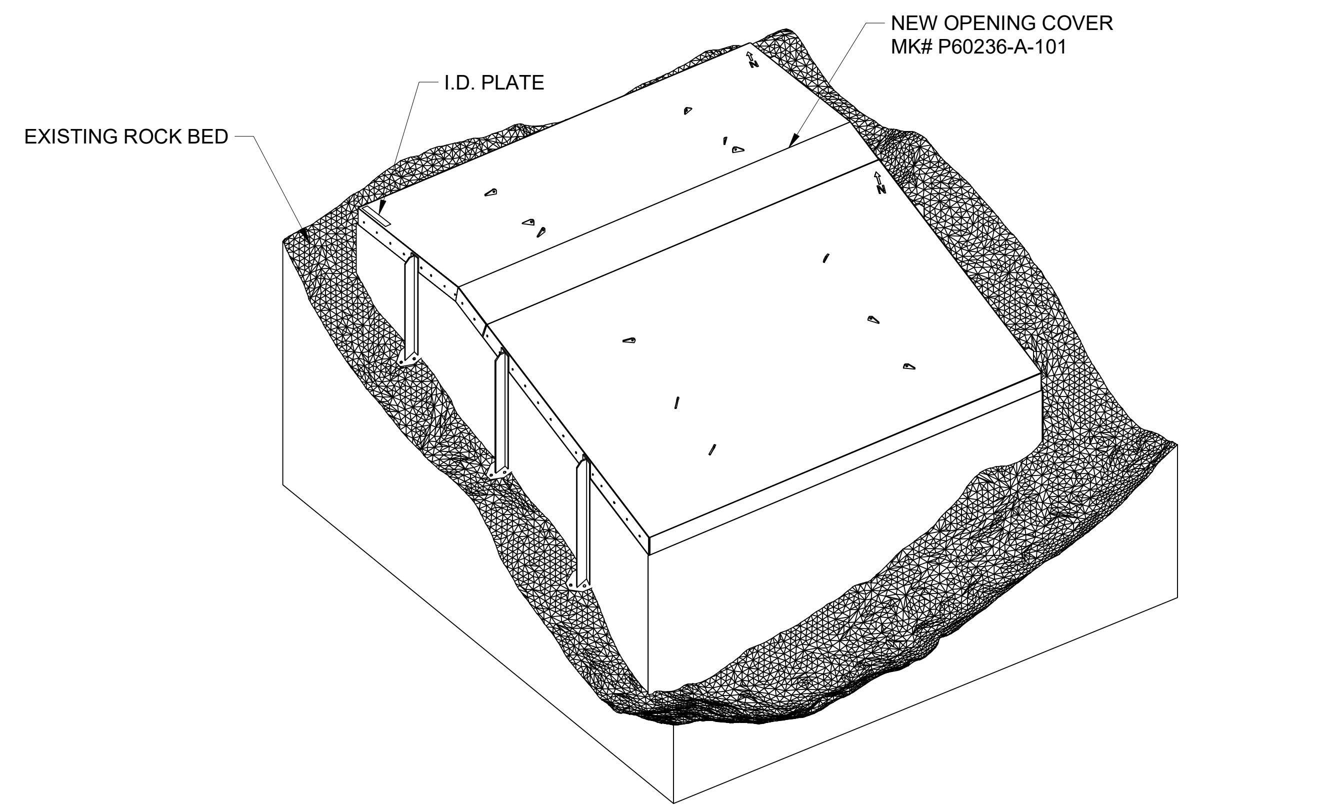



I.D. PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS
TOP COVER W/O RIGGING: 15,510 Lbs
AS INSTALLED: 19,010 Lbs




PLAN VIEW - FAY 11 OPENING COVER




ISO VIEW
(LOOKING NORTH)



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

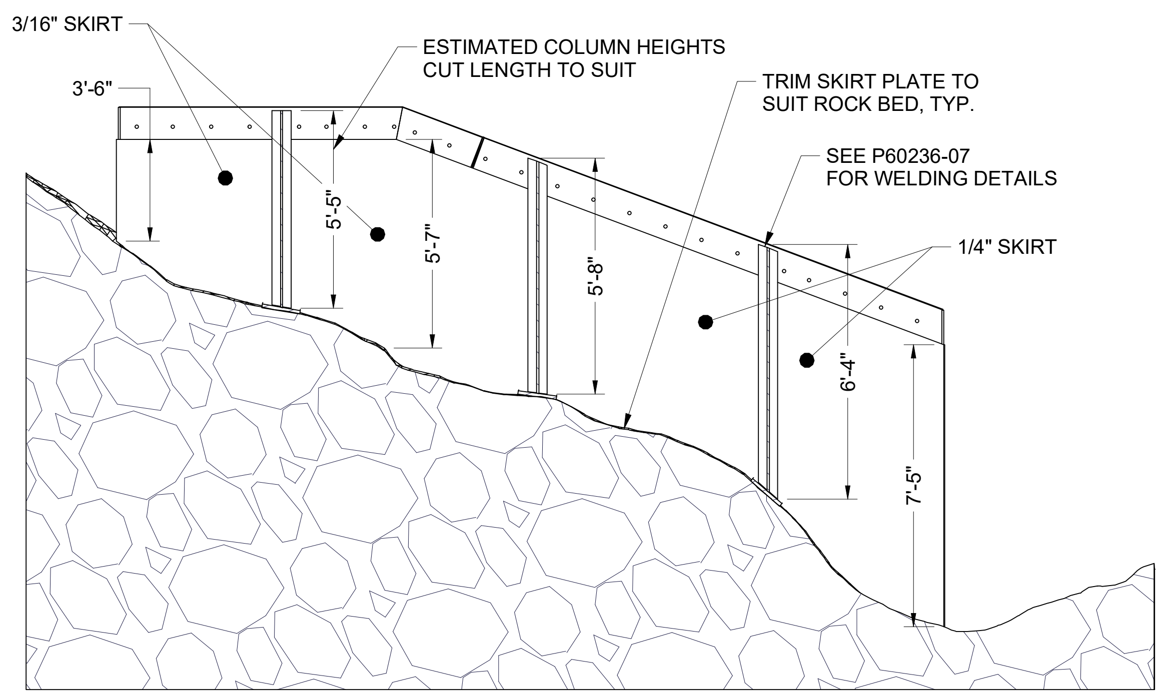
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

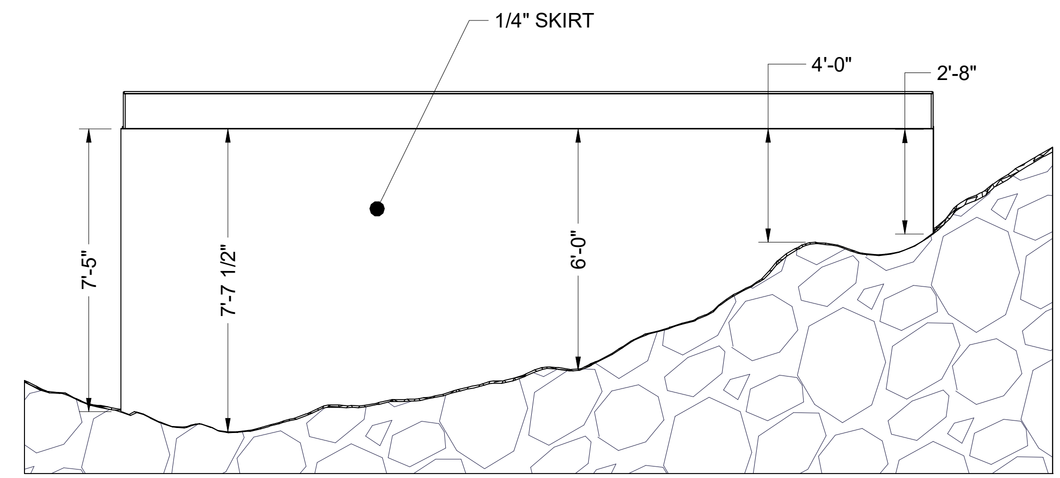
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-01-1 REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

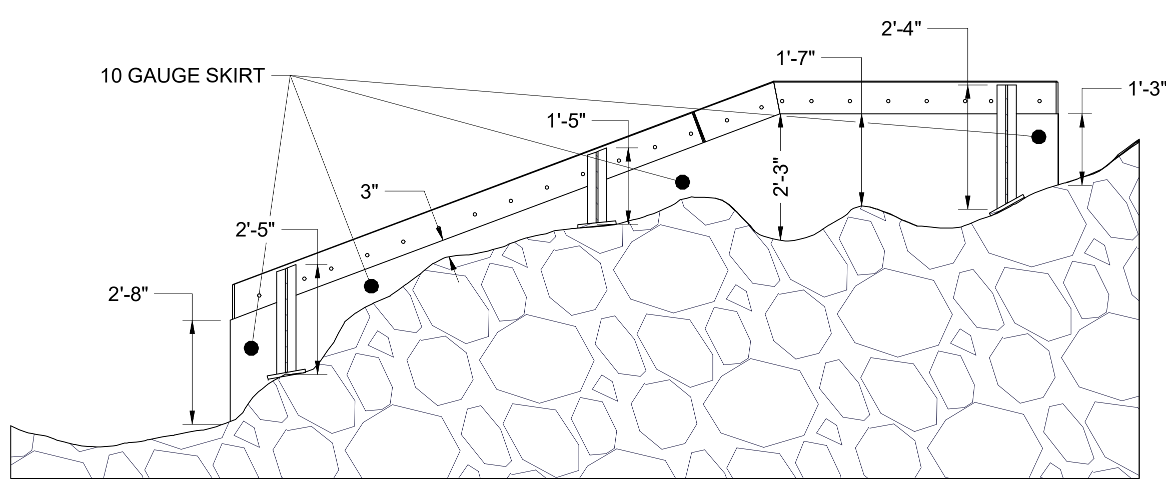
ESTIMATED TOTAL COLUMN LENGTH 313" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE
OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



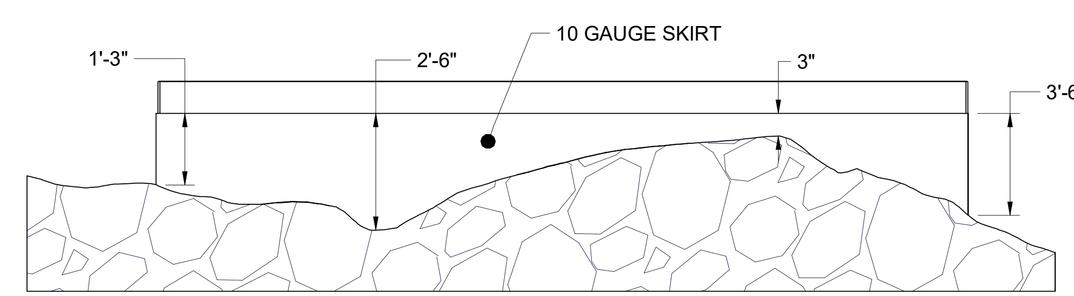

ELEVATION VIEW - LOOKING NORTH-EAST




ELEVATION VIEW - LOOKING NORTH-WEST




ELEVATION VIEW - LOOKING SOUTH-WEST




ELEVATION VIEW - LOOKING SOUTH-EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

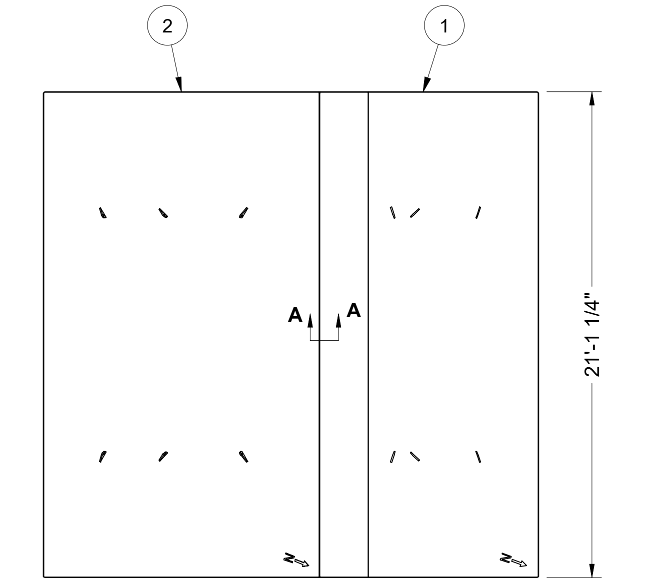
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

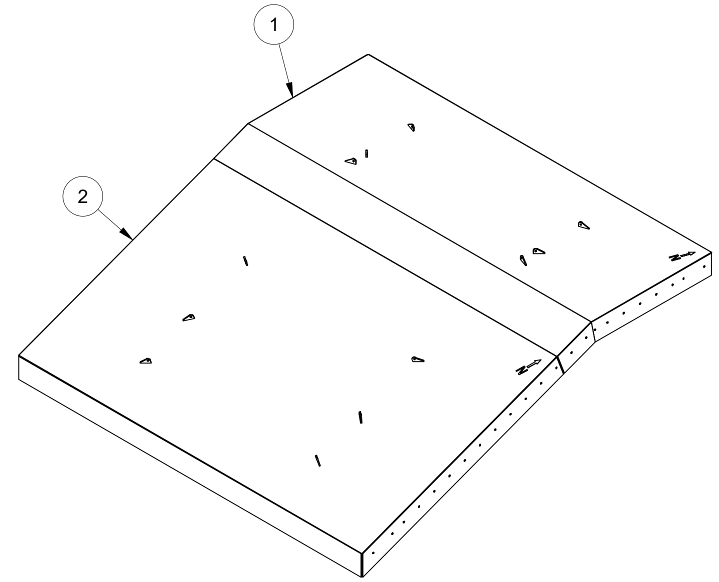
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-01-2
REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

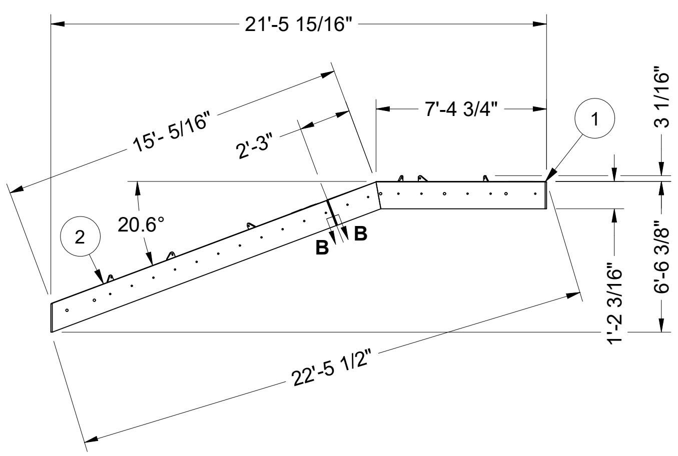
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | COVER SECTION 1 | MK# P60236-A-102 | | |
| 2 | COVER SECTION 2 | MK# P60236-A-103 | | |



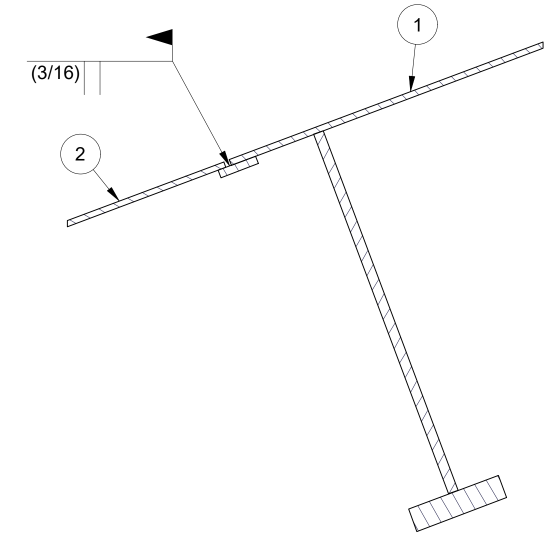

MK# P60236-A-101 - PLAN VIEW



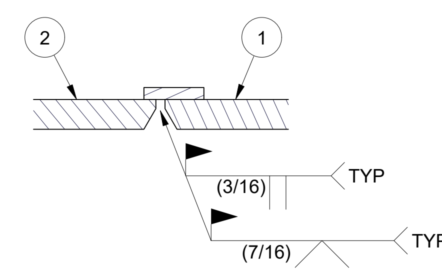

MK# P60236-A-101 - ISO VIEW




MK# P60236-A-101 - ELEVATION VIEW




SECTION A-A




SECTION B-B



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 3 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 2 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 14/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
E.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
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|---|---|---|
| Structural | 14318 | |

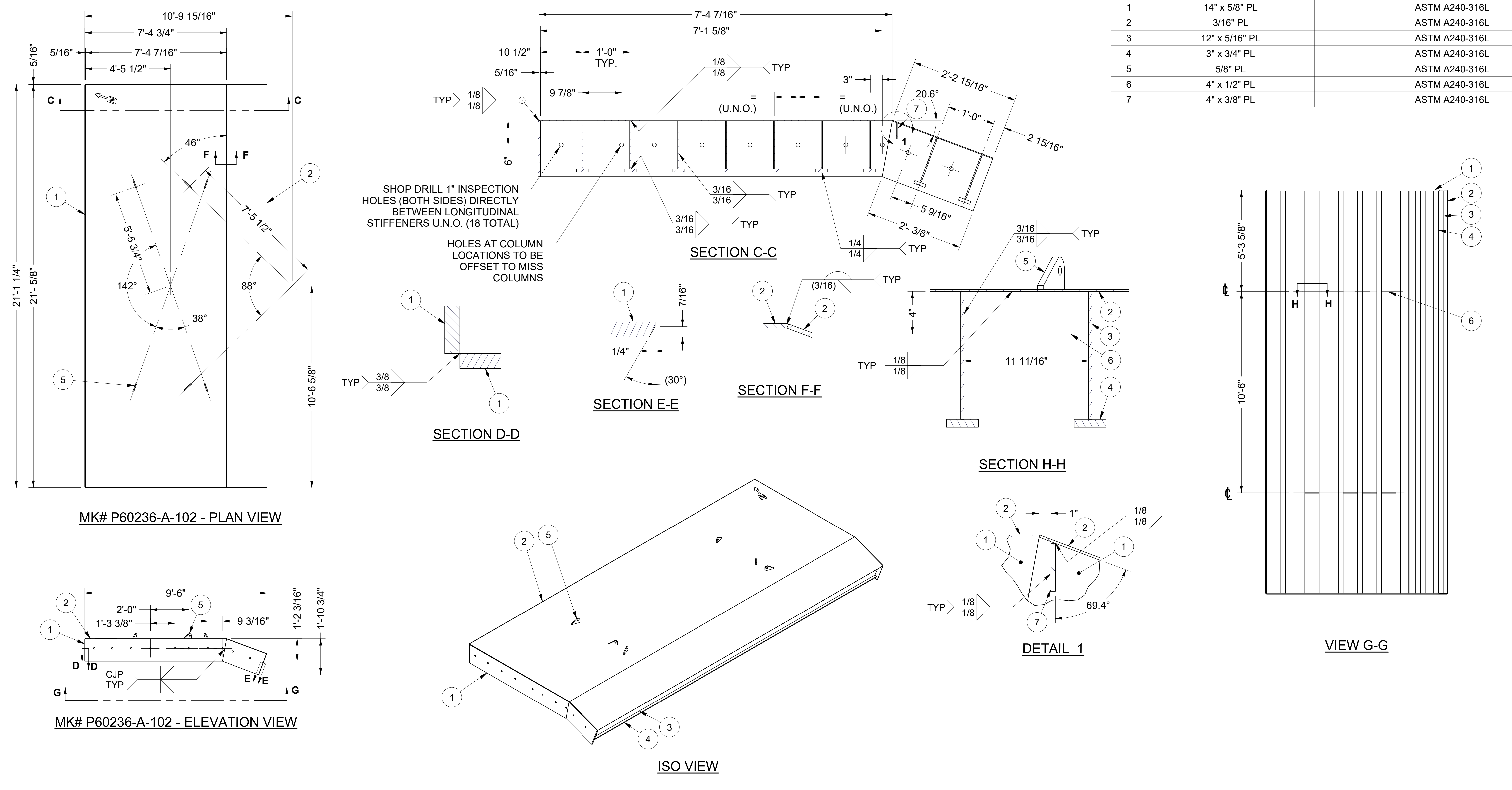
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
TOP COVER DETAILS
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-01-3
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 14" x 5/8" PL | | ASTM A240-316L | |
| 2 | 3/16" PL | | ASTM A240-316L | |
| 3 | 12" x 5/16" PL | | ASTM A240-316L | |
| 4 | 3" x 3/4" PL | | ASTM A240-316L | |
| 5 | 5/8" PL | | ASTM A240-316L | |
| 6 | 4" x 1/2" PL | | ASTM A240-316L | |
| 7 | 4" x 3/8" PL | | ASTM A240-316L | |






| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 3 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 2 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 14/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 18 11 09 — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: Structural — Sk. Reg. No.: 14318 — Signature

Kova Engineering Saskatchewan Ltd.

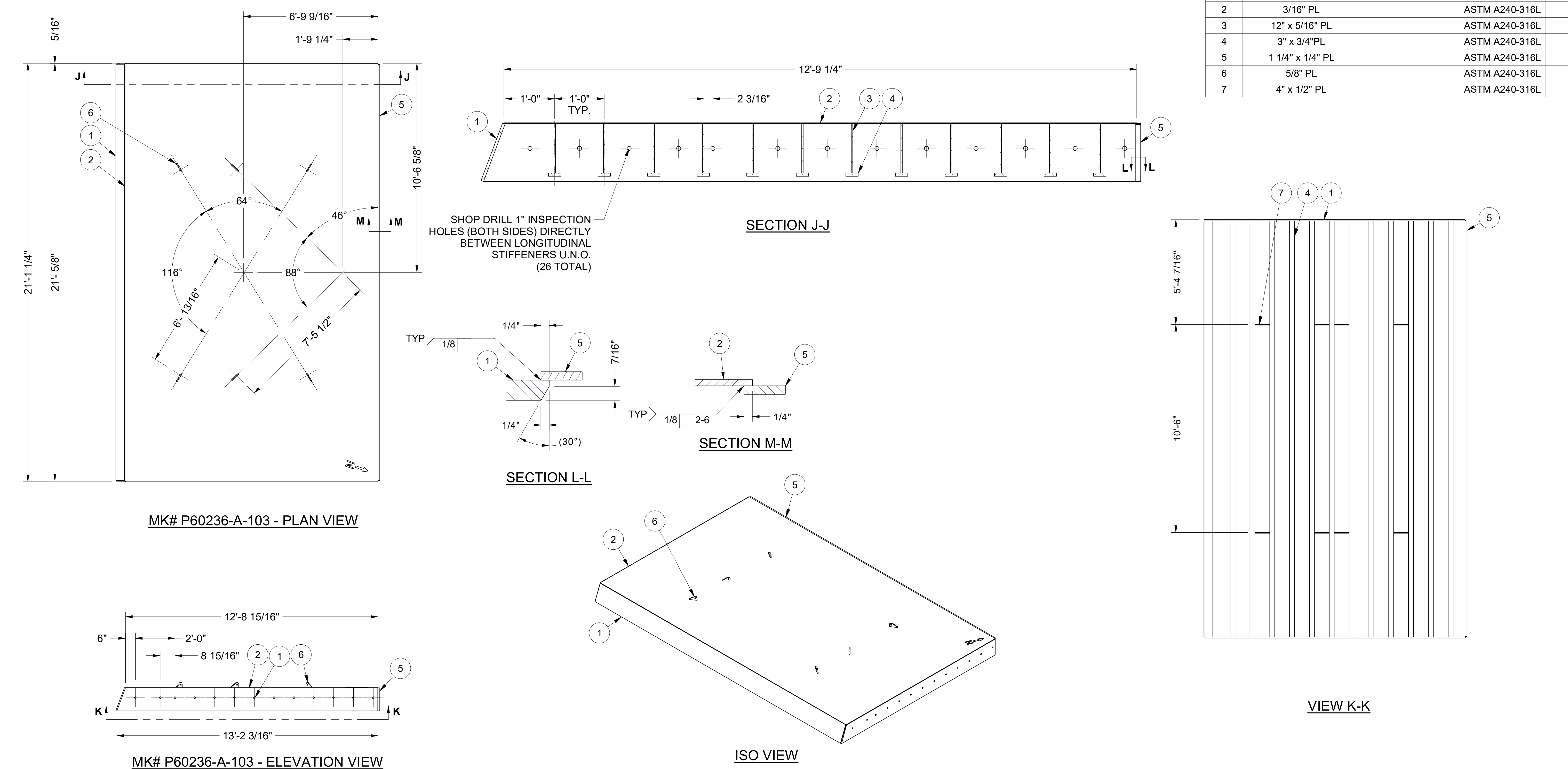
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
TOP COVER SECTION DETAILS
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 7
DWG. NO.: P60236-01-4 — REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

BILL OF MATERIALS

| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
|---|---|---|---|---|
| 1 | 14" x 5/8" PL | | ASTM A240-316L | |
| 2 | 3/16" PL | | ASTM A240-316L | |
| 3 | 12" x 5/16" PL | | ASTM A240-316L | |
| 4 | 3" x 3/4"PL | | ASTM A240-316L | |
| 5 | 1 1/4" x 1/4" PL | | ASTM A240-316L | |
| 6 | 5/8" PL | | ASTM A240-316L | |
| 7 | 4" x 1/2" PL | | ASTM A240-316L | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 3 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 2 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
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ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 14/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

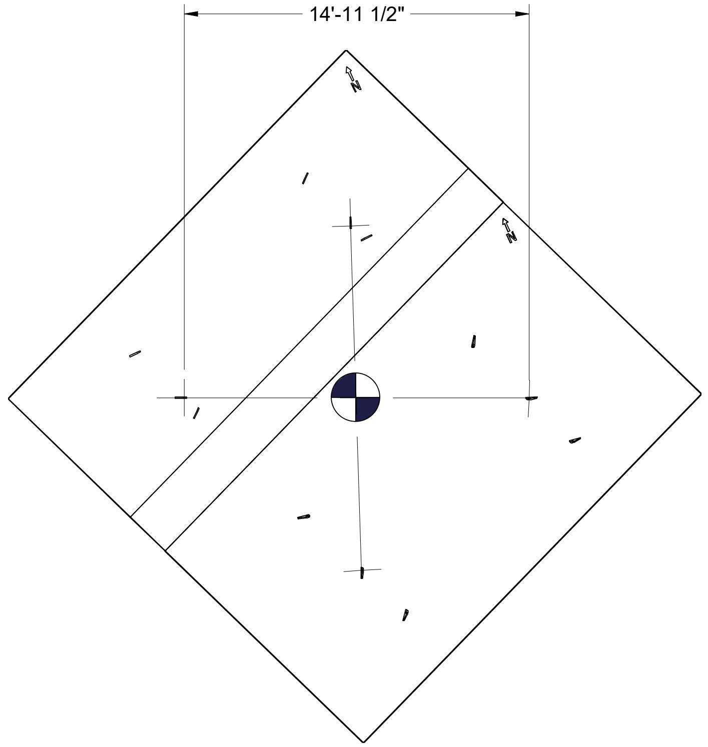
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

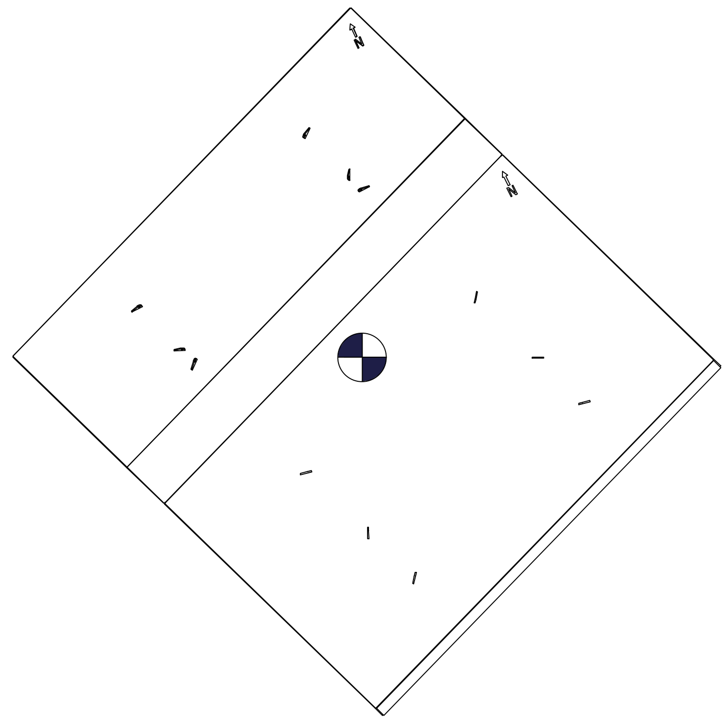
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
TOP COVER SECTION DETAILS
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-01-5
REV 1

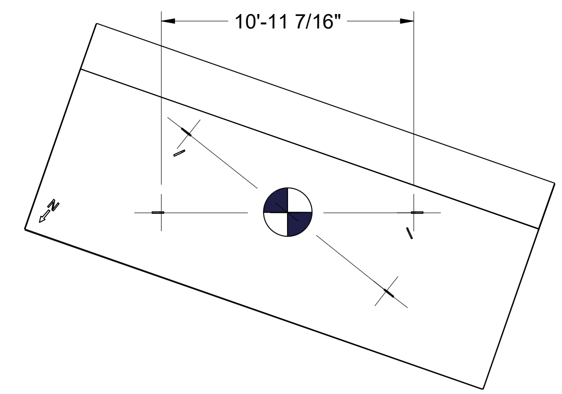
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



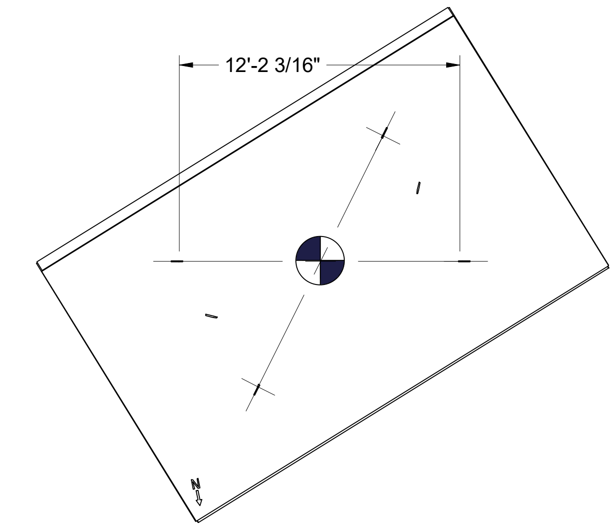

TOP COVER LIFTING DIAGRAM
(MK# P60236-A-102 HORIZONTAL)
(MK# P60236-A-101)



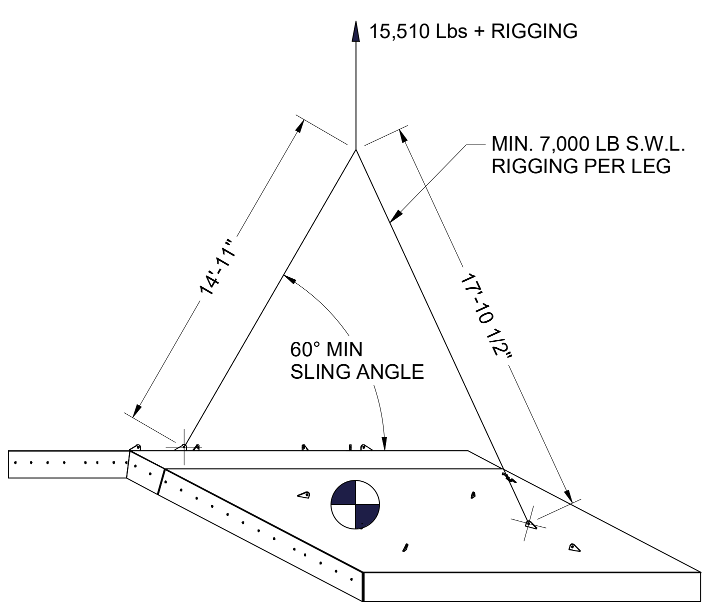
TOP COVER LIFTING DIAGRAM
(MK# P60236-A-103 HORIZONTAL)
(MK# P60236-A-101)



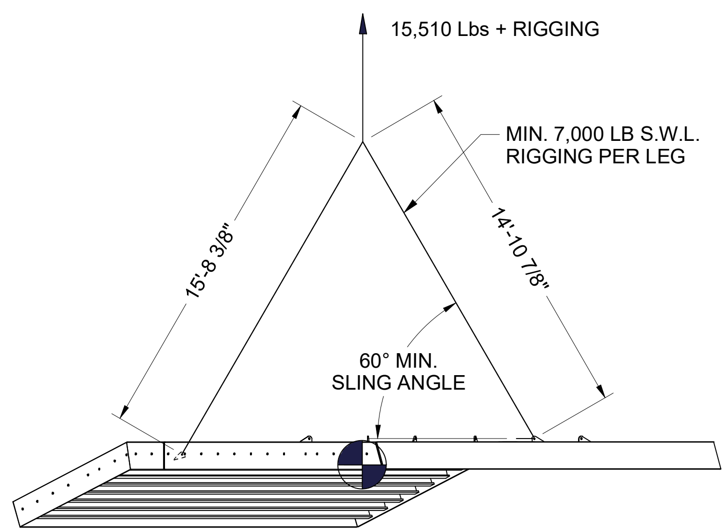

COVER SECTION 1 LIFTING DRAWING
(MK# P60236-A-102)



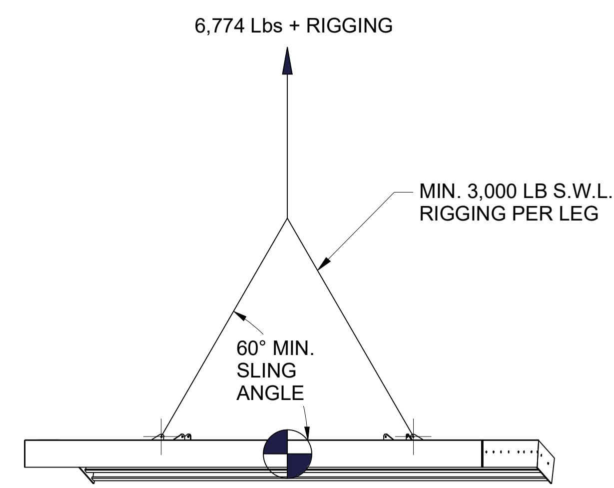

COVER SECTION 2 LIFTING DRAWING
(MK# P60236-A-103)



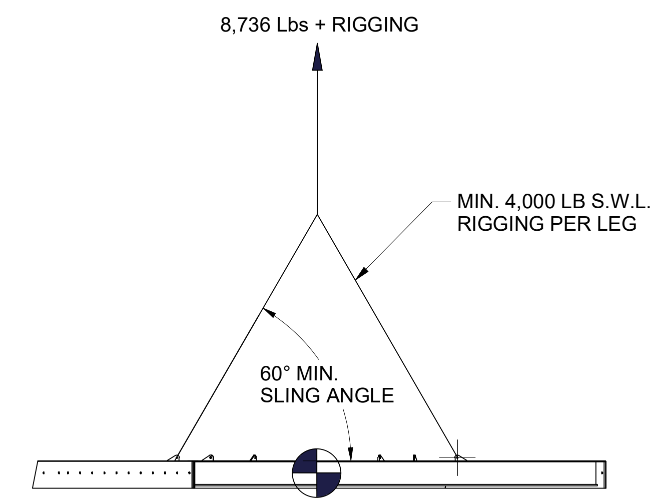

TOP COVER LIFTING DRAWING - SIDE VIEW
(MK# P60236-A-101)




TOP COVER LIFTING DRAWING - SIDE VIEW
(MK# P60236-A-101)




COVER SECTION 1 LIFTING DRAWING - SIDE VIEW
(MK# P60236-A-102)




COVER SECTION 2 LIFTING DRAWING - SIDE VIEW
(MK# P60236-A-103)





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: N.R.
DATE: 14/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
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Number C672
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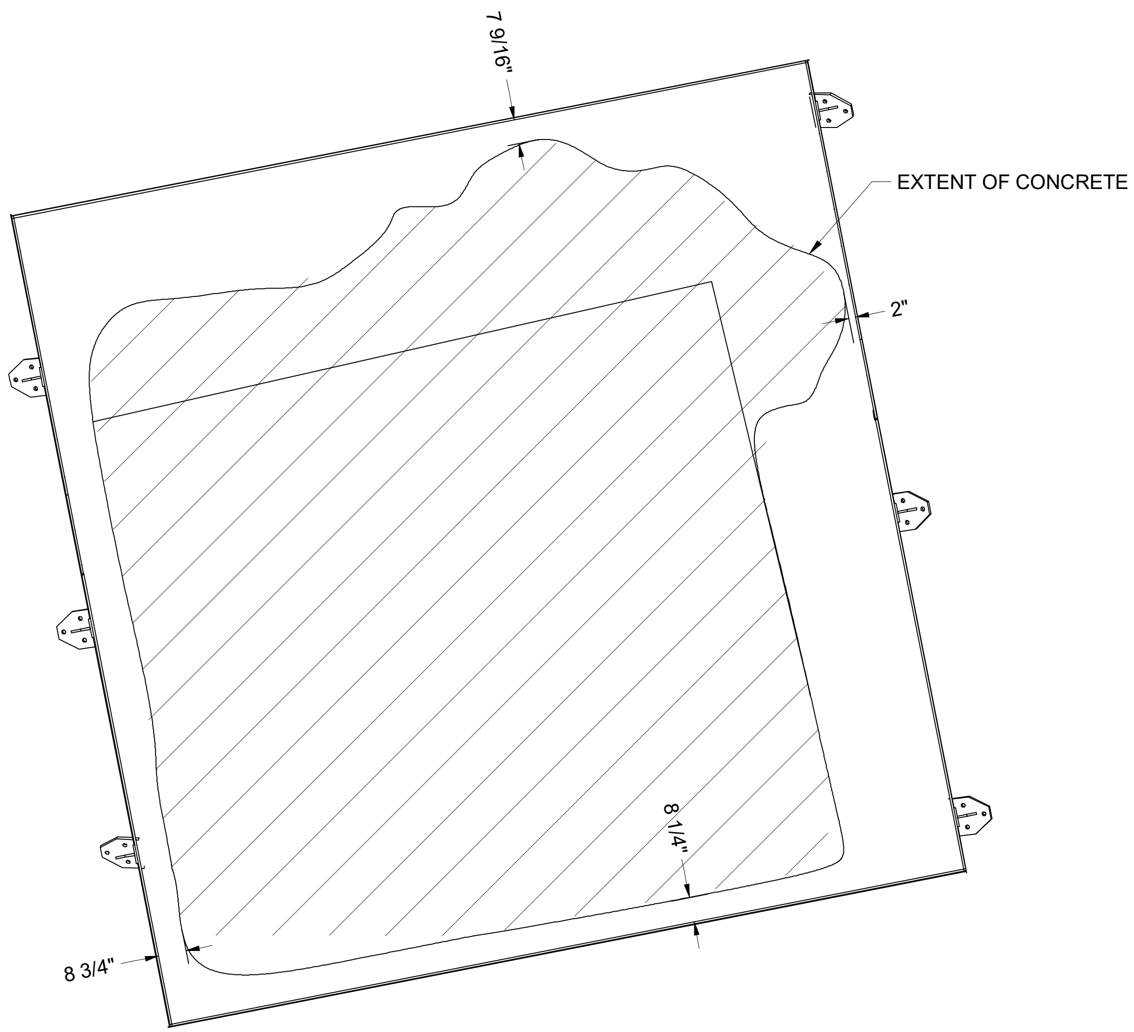
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

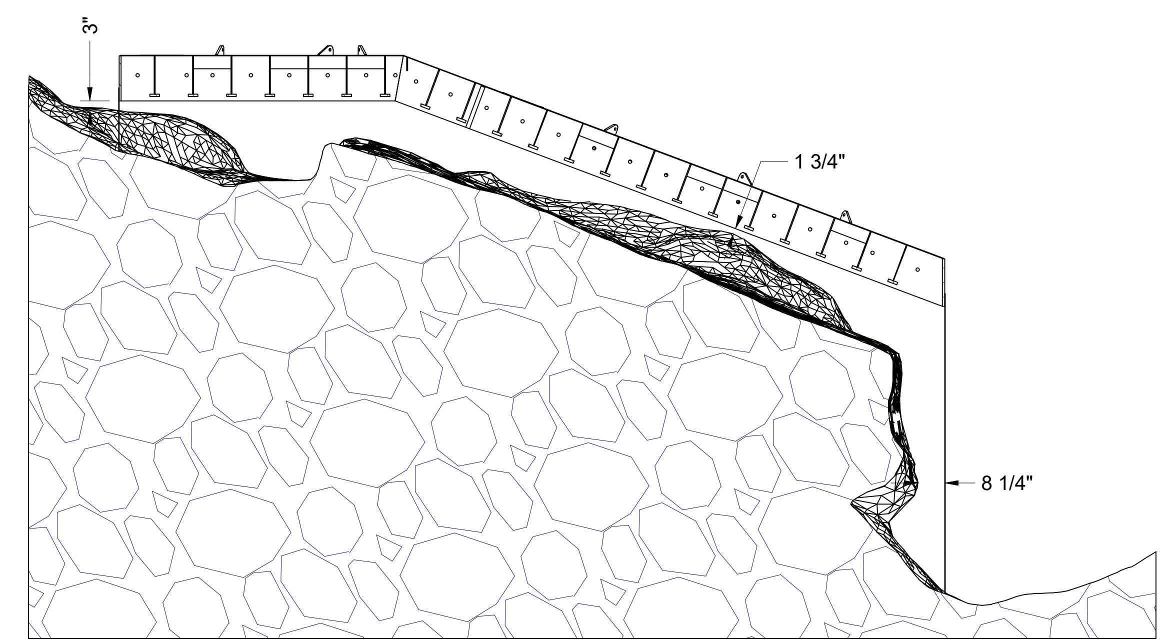
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING
LIFTING DETAILS
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
DWG. NO.: P60236-01-6 (REV 1)
SHEET NO.: 6 OF 7

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

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ALL DIMENSIONS IN INCHES

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| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
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| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY 11 OPENING CLEARANCES
LOCATION: 59° 33' 20.1" N, 108° 28' 29.9" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: P60236-01-7
1

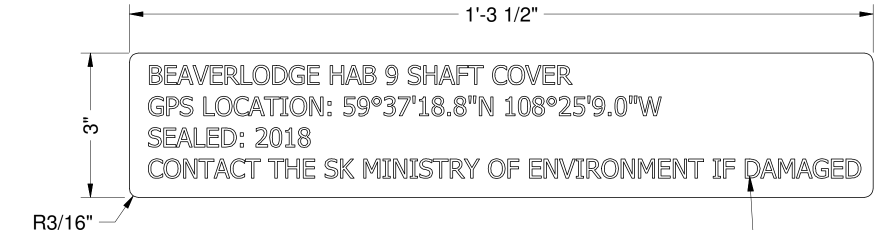
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# HAB 9 – Hab Shaft

HAB 9 – Hab Shaft

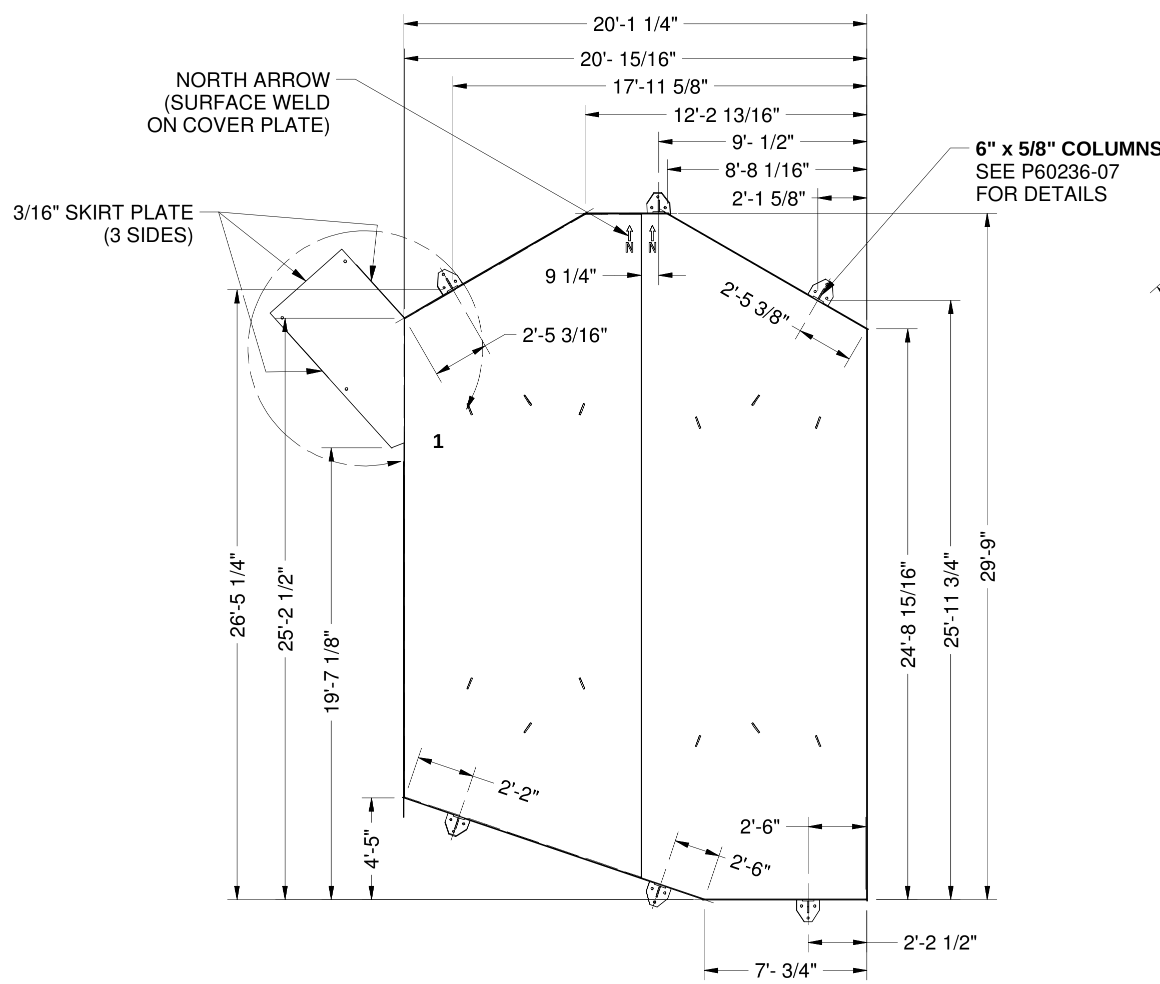
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 22,060 LB
5. DO NOT BACK FILL WALLS OF COVER.

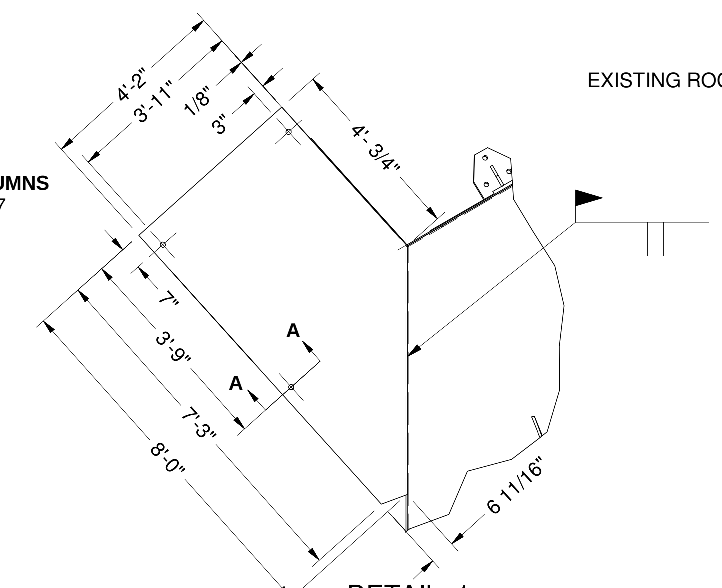



I.D. PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

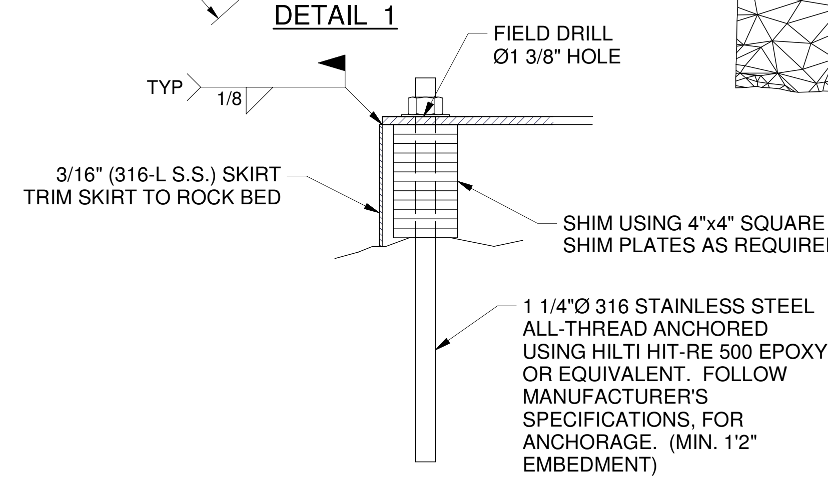
ESTIMATED WEIGHTS
TOP COVER W/O RIGGING: 18,470 Lbs
AS INSTALLED: 22,060 Lbs



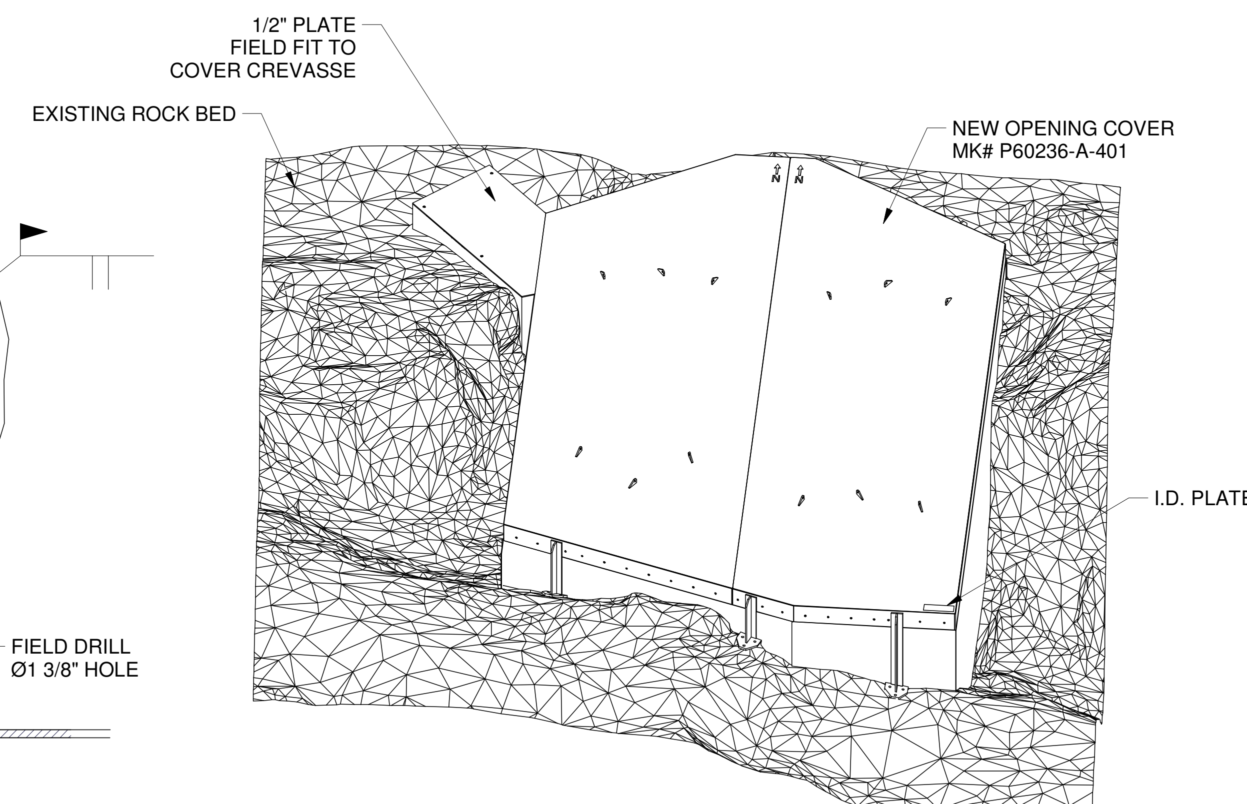

PLAN VIEW - HAB 9 OPENING COVER




DETAIL 1




SECTION A-A




ISO VIEW
(LOOKING NORTH)



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
B.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
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Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

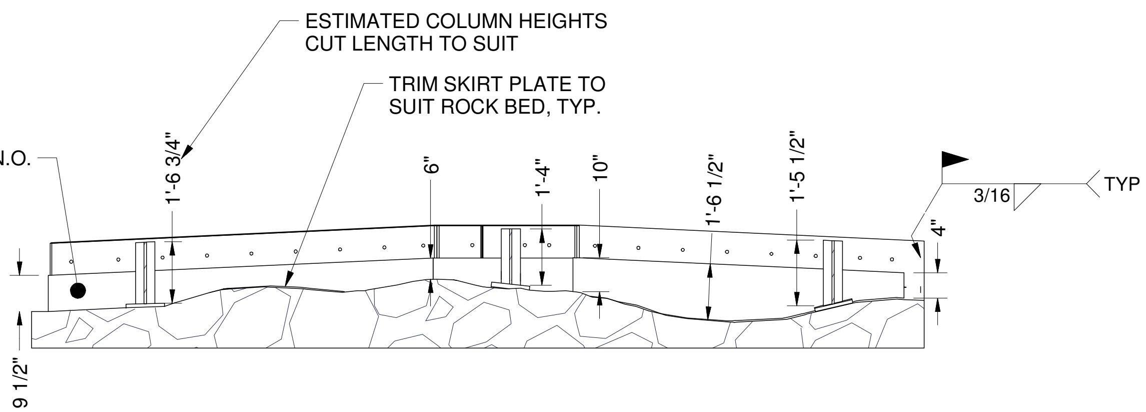
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

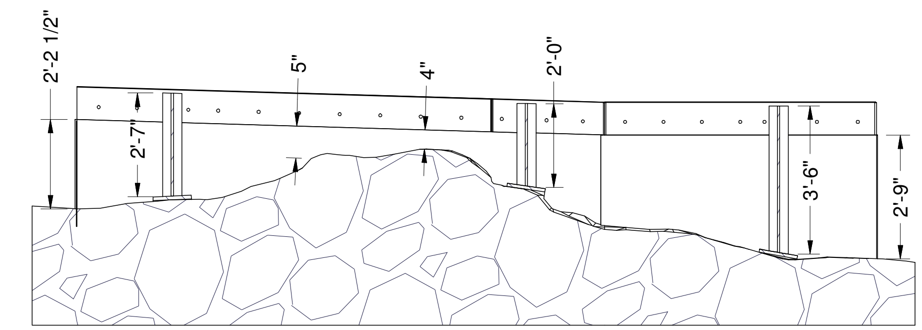
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-04-1
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

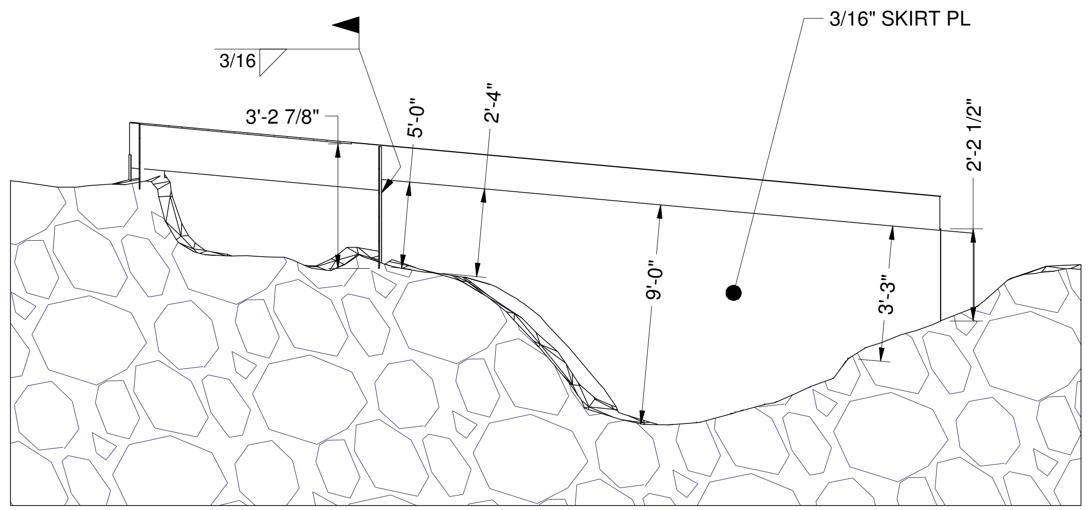
ESTIMATED TOTAL COLUMN LENGTH 154" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



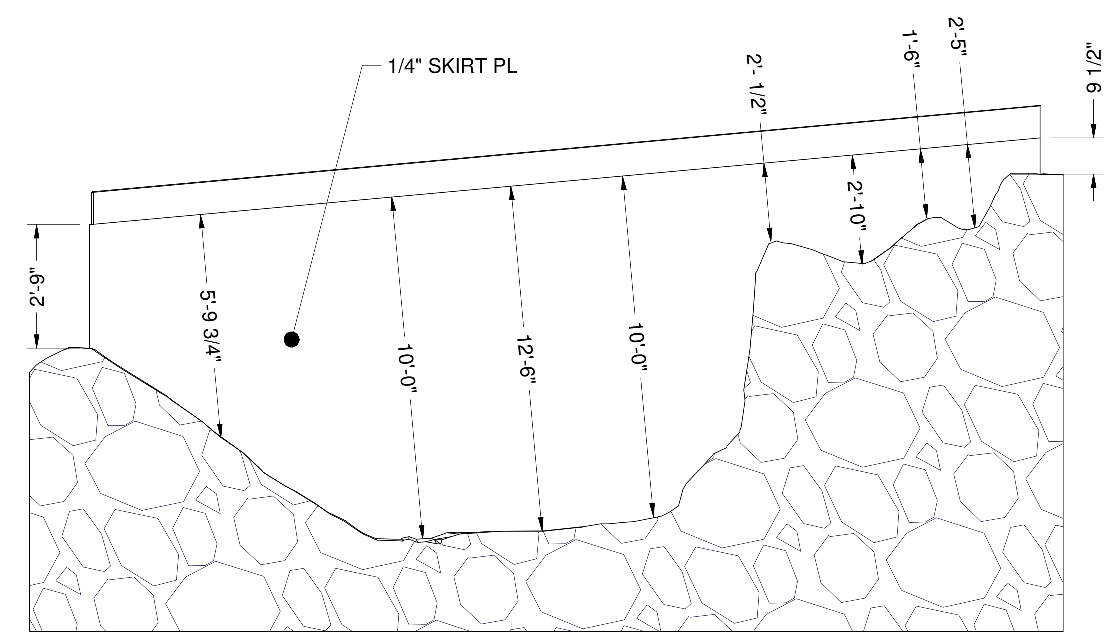

ELEVATION VIEW - LOOKING SOUTH




ELEVATION VIEW - LOOKING NORTH




ELEVATION VIEW - LOOKING EAST




ELEVATION VIEW - LOOKING WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
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CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER — E.B. CAUGHLIN — MEMBER 14318 — 18 11 09 (YR MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Kova Engineering (Saskatchewan) Ltd.
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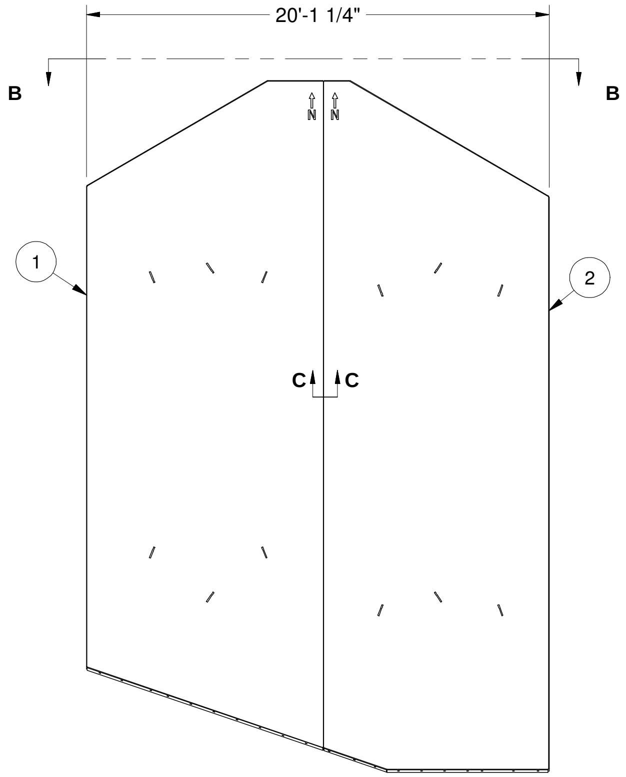
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

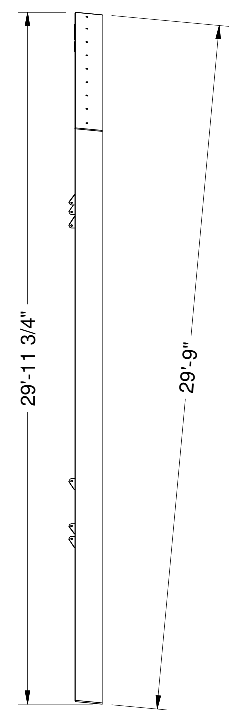
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-04-2
REV: 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

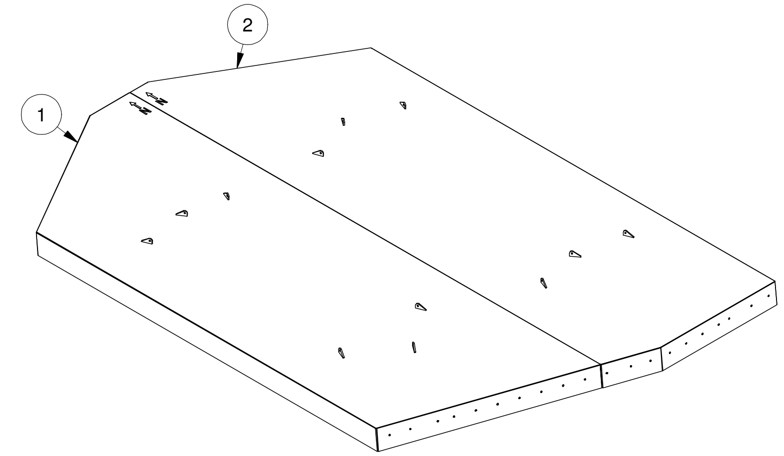
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | COVER SECTION 1 | MK# P60236-A-402 | | |
| 2 | COVER SECTION 2 | MK# P60236-A-403 | | |



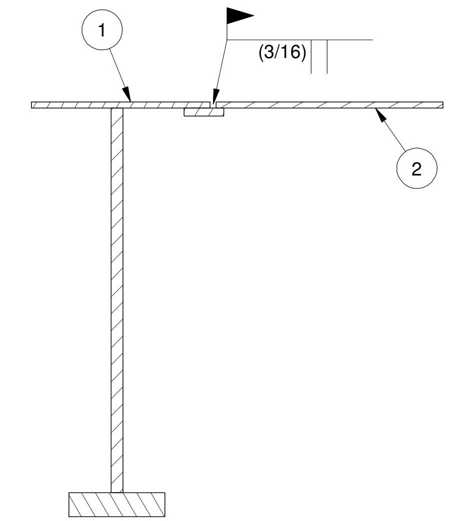

MK# P60236-A-401 - PLAN VIEW



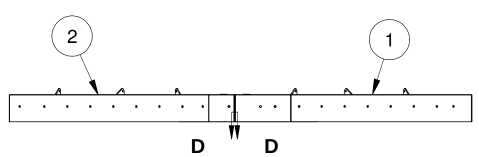

MK# P60236-A-401 - SIDE VIEW



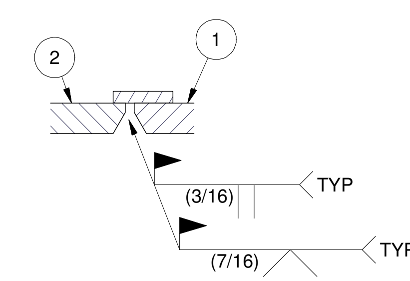

ISO VIEW




SECTION C-C




VIEW B-B




SECTION D-D



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

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ALL DIMENSIONS IN INCHES

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|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

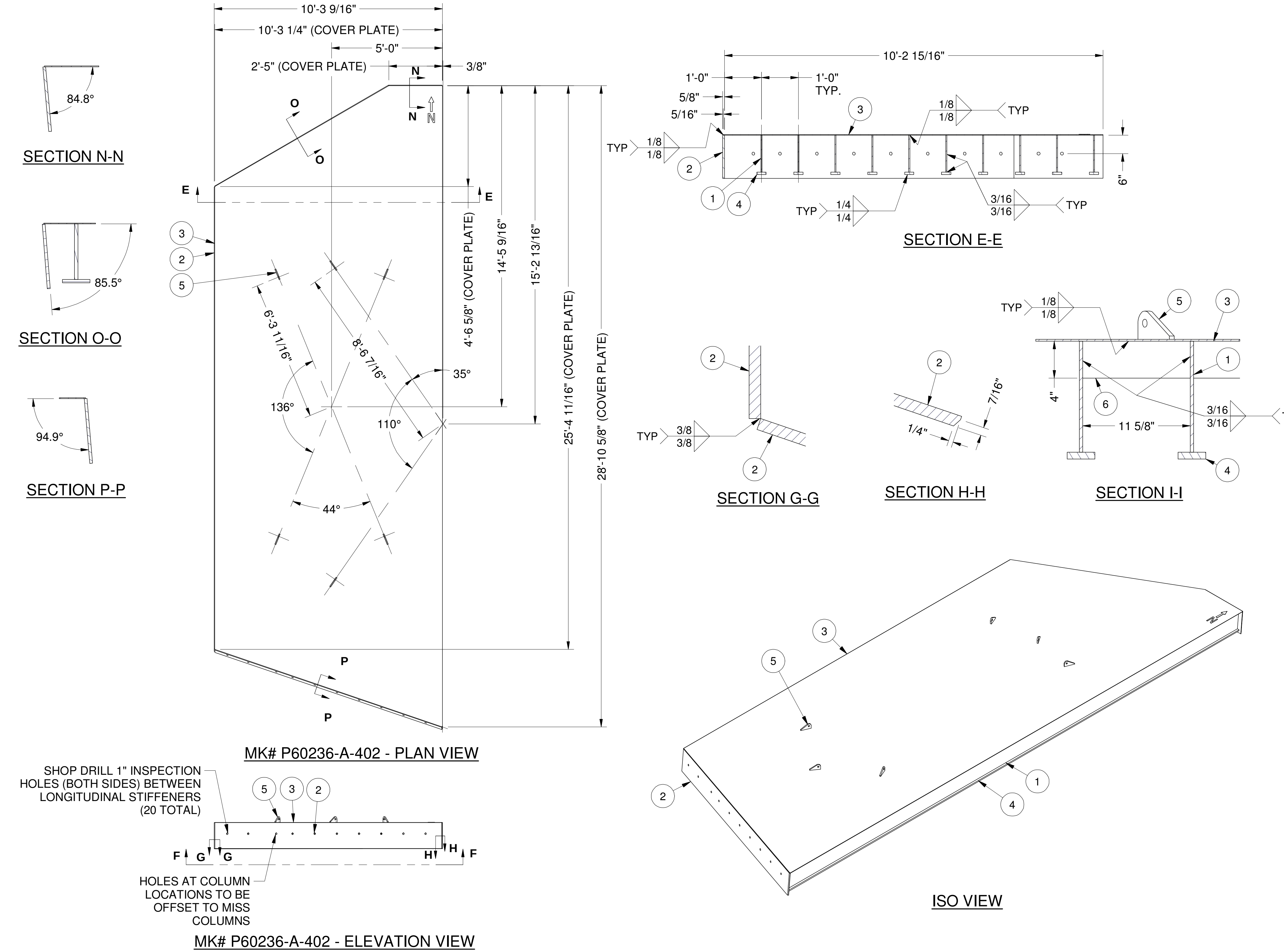
Kova Engineering Saskatchewan Ltd.

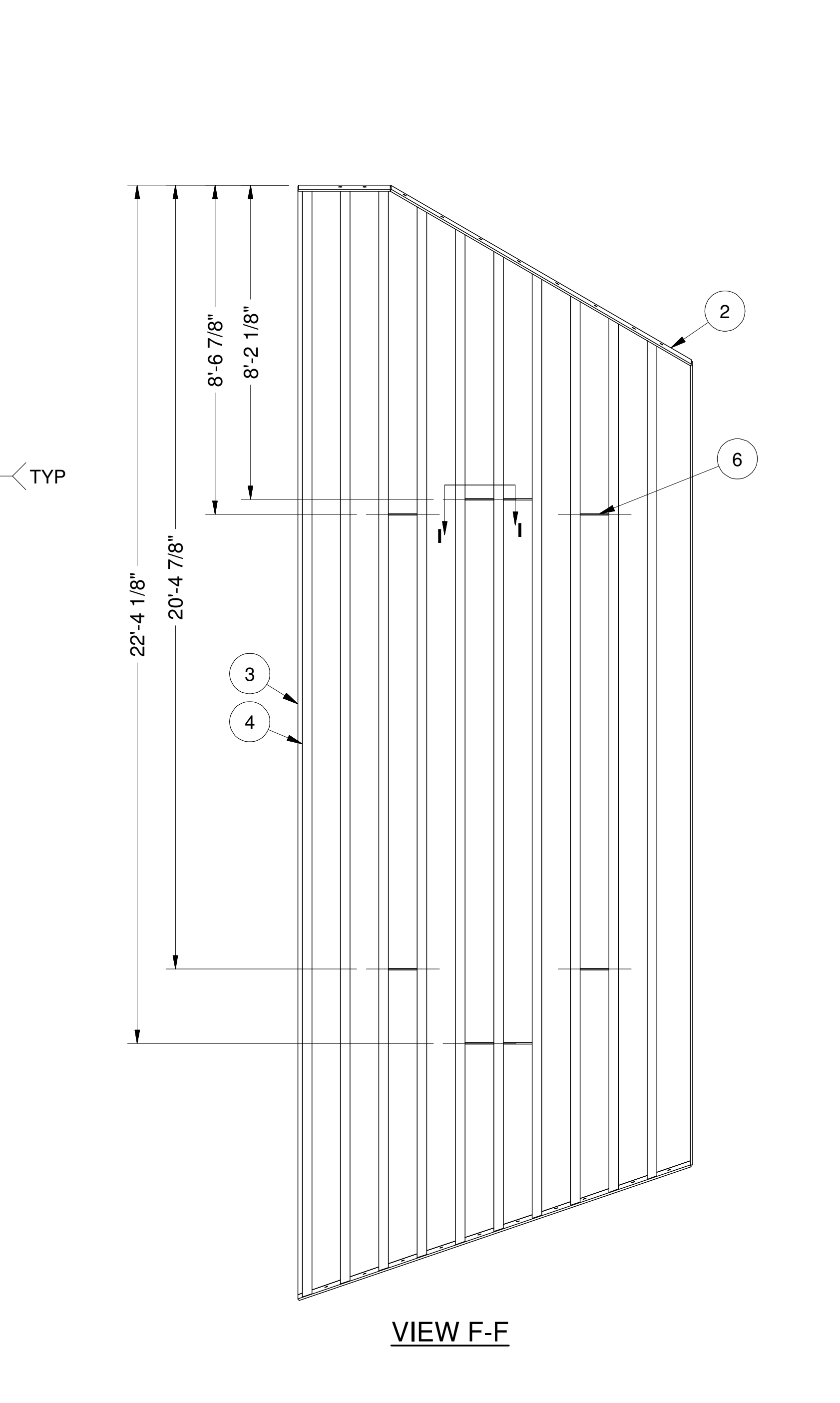
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING TOP COVER DETAIL
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-04-3 REV 2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 12" x 3/8" PL | | ASTM A240-316L | |
| 2 | 14" x 5/8" PL | | ASTM A240-316L | |
| 3 | 3/16" PL | | ASTM A240-316L | |
| 4 | 3" x 3/4" PL | | ASTM A240-316L | |
| 5 | 5/8" PL | | ASTM A240-316L | |
| 6 | 4" x 1/2" PL | | ASTM A240-316L | |






| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER — C.B. CAUGHLIN — MEMBER 14318 — SASKATCHEWAN — 18 11 09 (YR. MN. DAY)

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

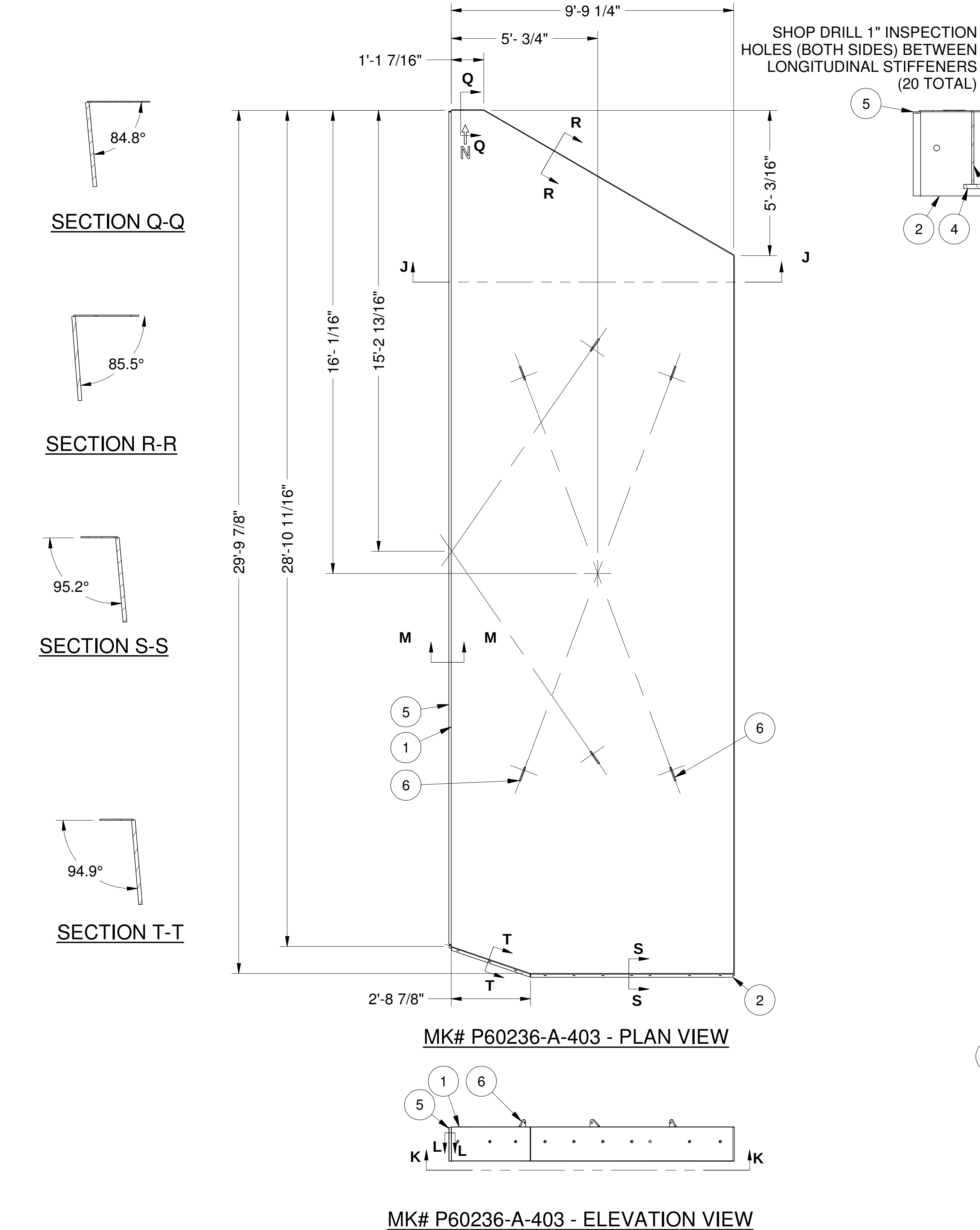
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING
TOP COVER SECTION DETAILS
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
DWG. NO.: P60236-04-4 — REV 2
SHEET NO.: 4 OF 7

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




SECTION Q-Q

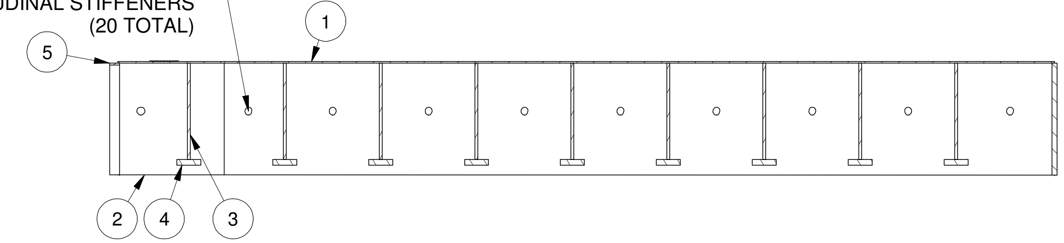
SECTION R-R

SECTION S-S

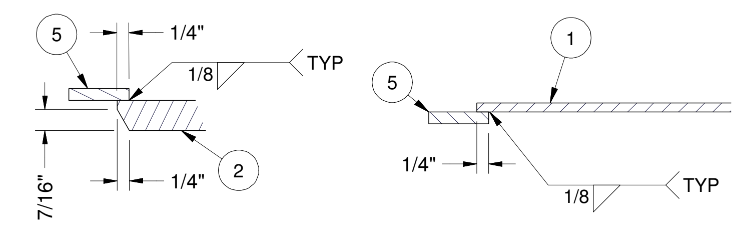
SECTION T-T

MK# P60236-A-403 - PLAN VIEW

MK# P60236-A-403 - ELEVATION VIEW

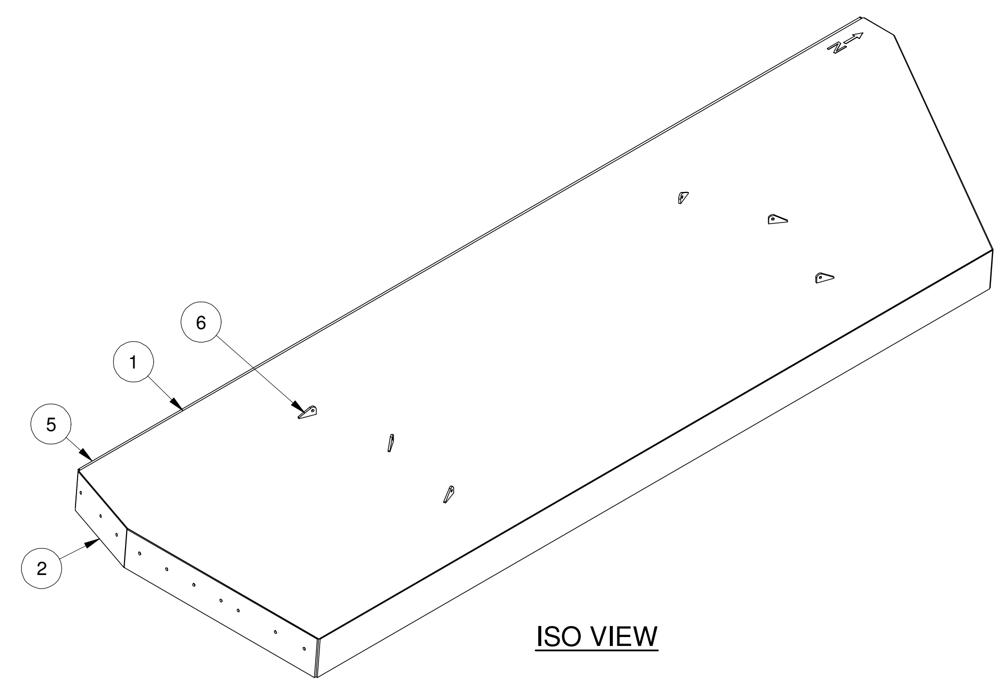



SECTION J-J

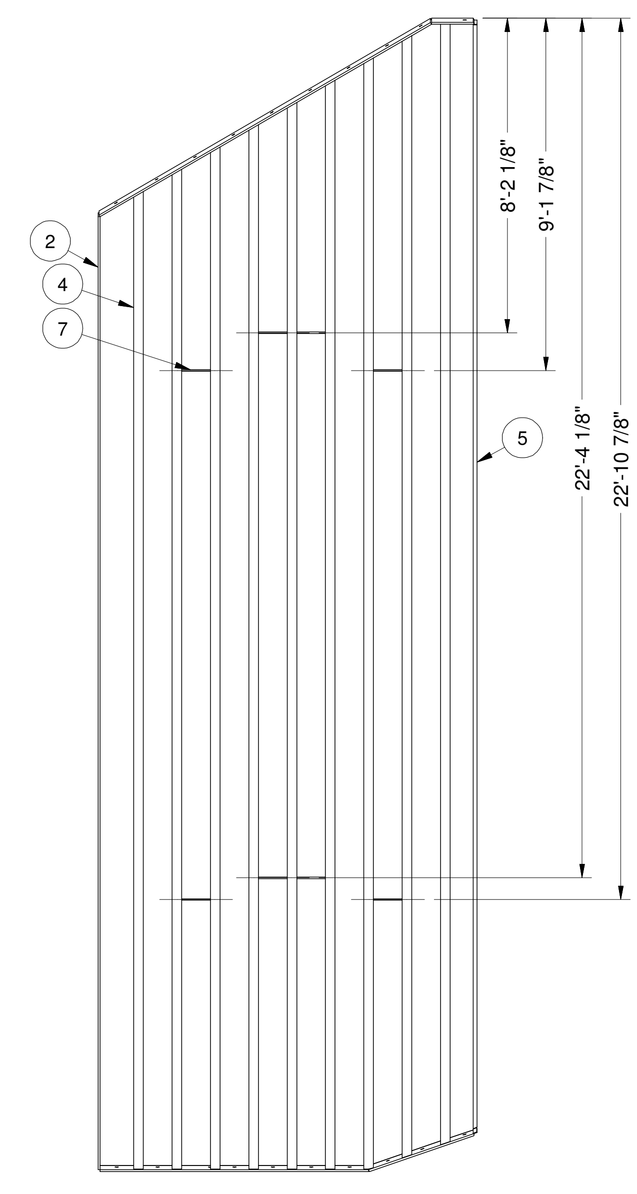



SECTION L-L

SECTION M-M



ISO VIEW




VIEW K-K

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 3/16" PL | | ASTM A240-316L | |
| 2 | 14" x 5/8" PL | | ASTM A240-316L | |
| 3 | 12" x 3/8" PL | | ASTM A240-316L | |
| 4 | 3" x 3/4" PL | | ASTM A240-316L | |
| 5 | 1 1/4" x 1/4" PL | | ASTM A240-316L | |
| 6 | 5/8" PL | | ASTM A240-316L | |
| 7 | 4" x 1/2" PL | | ASTM A240-316L | |

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER — E.B. CAUGHLIN — MEMBER 14318 — 18 11 09 — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

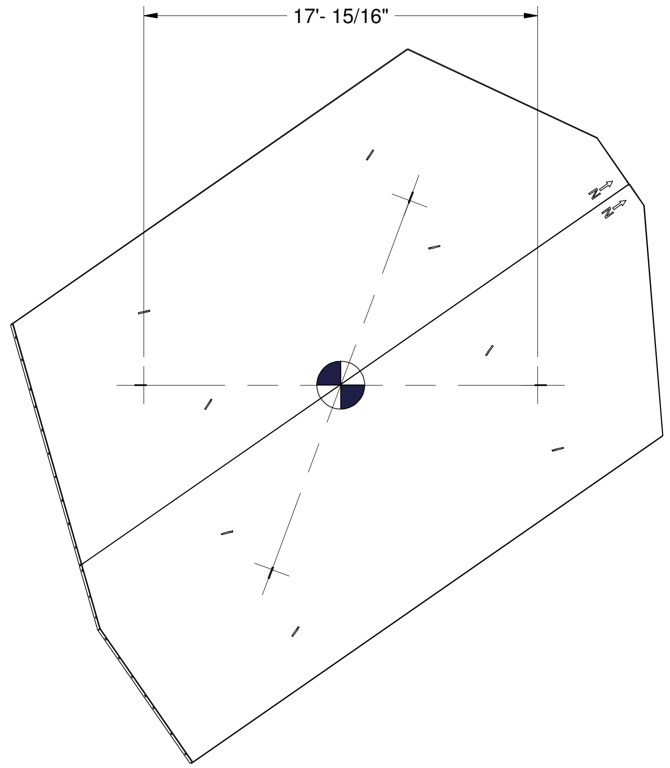
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

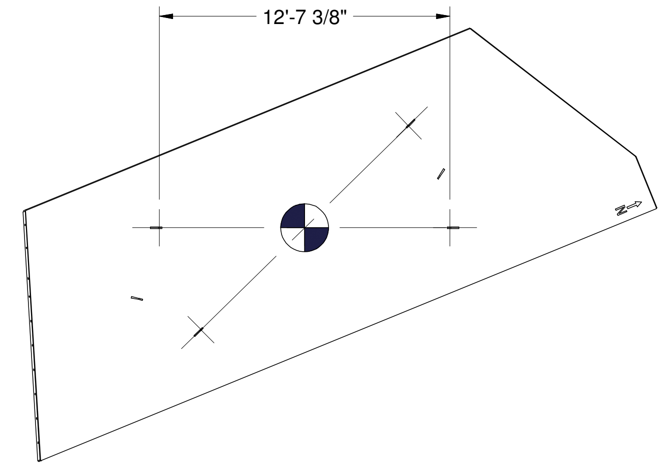
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING
TOP COVER SECTION DETAILS
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-04-5
2

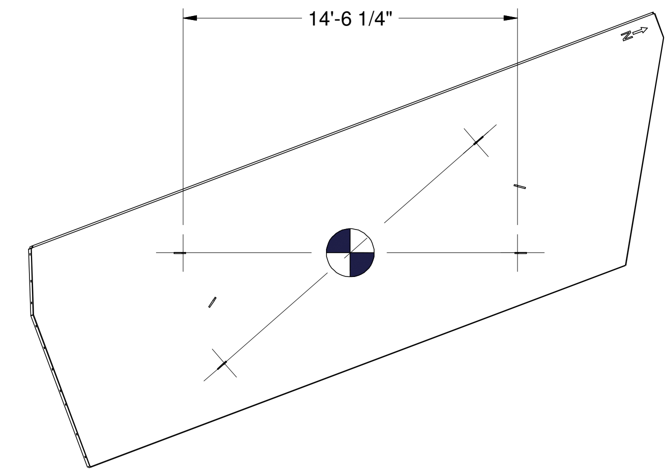
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



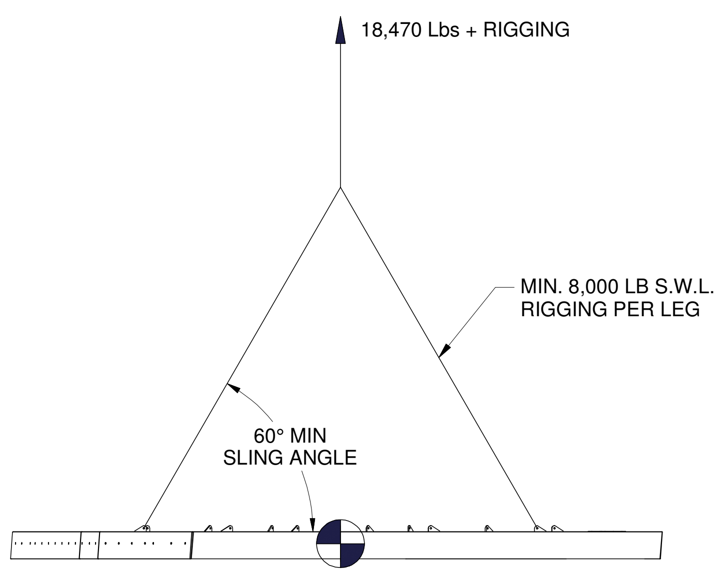

TOP COVER LIFTING DIAGRAM
(MK# P60236-A-401)



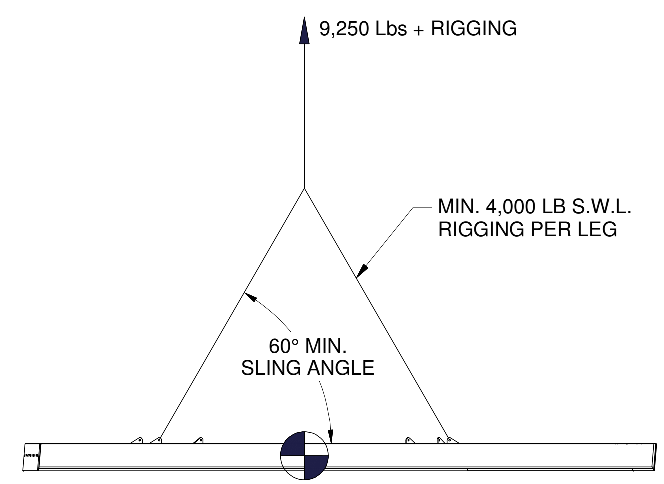

COVER SECTION 1 LIFTING DIAGRAM
(MK# P60236-A-402)



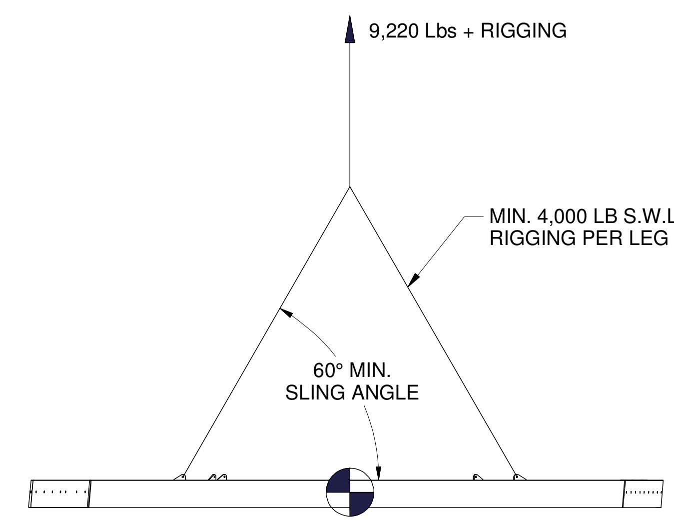

COVER SECTION 2 LIFTING DIAGRAM
(MK# P60236-A-403)




TOP COVER LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-401




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
(MK# P60236-A-402)




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
(MK# P60236-A-403)



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

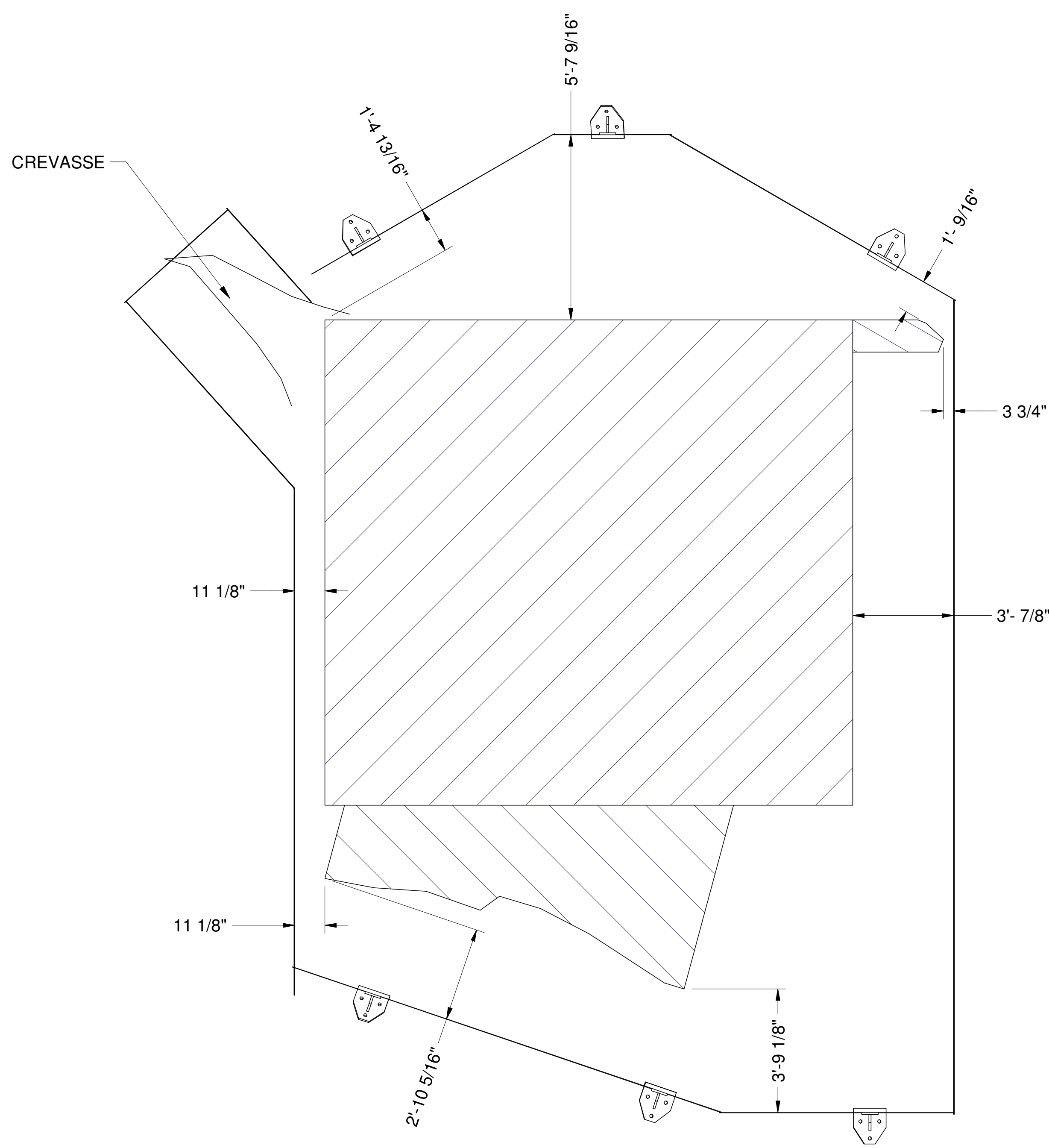
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

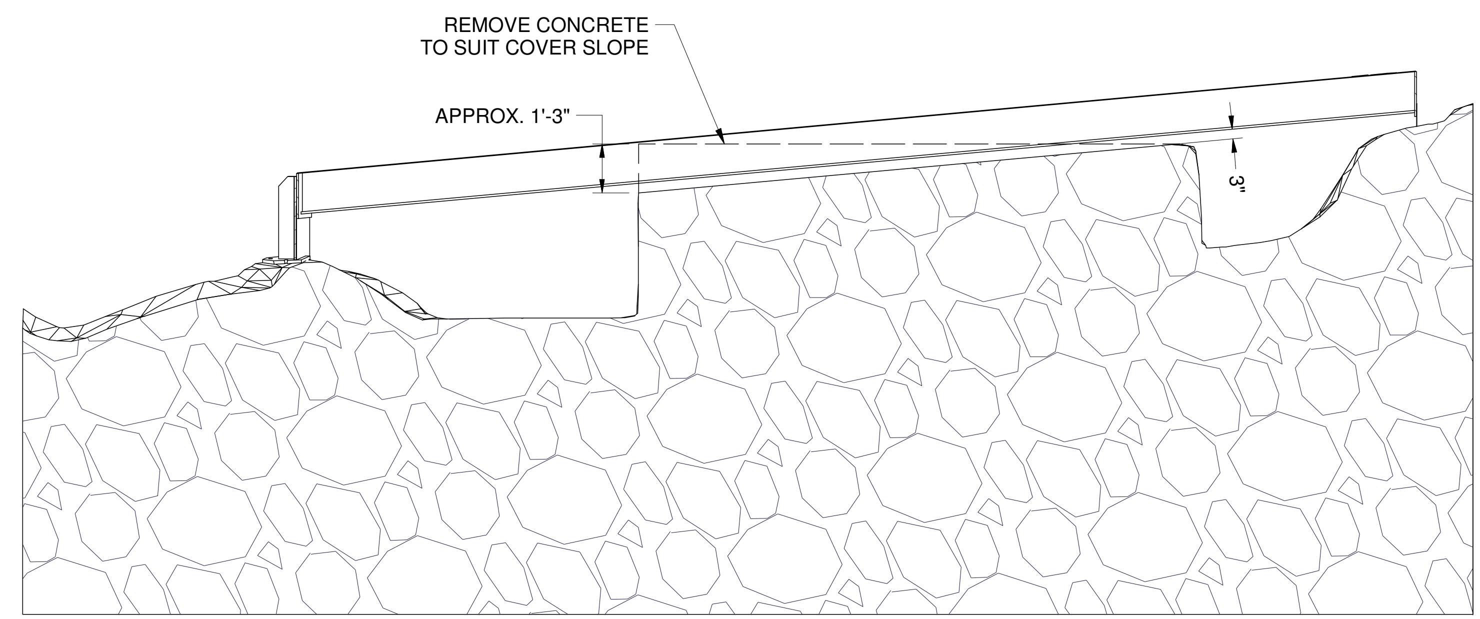
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING
LIFTING DETAILS
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: P60236-04-6
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | N.R. |
| | | 1 | ADDED SECTION VIEWS ON SHEETS 4 AND 5 | 11/Jan/18 | N.R. |
| | | 0 | ISSUED FOR CONSTRUCTION | 05/Jan/18 | N.R. |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | N.R. |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | N.R. |
| DATE: | 14/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 9 OPENING CLEARANCES
LOCATION: 59° 37' 18.8" N, 108° 25' 9.0" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: P60236-04-7
2

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

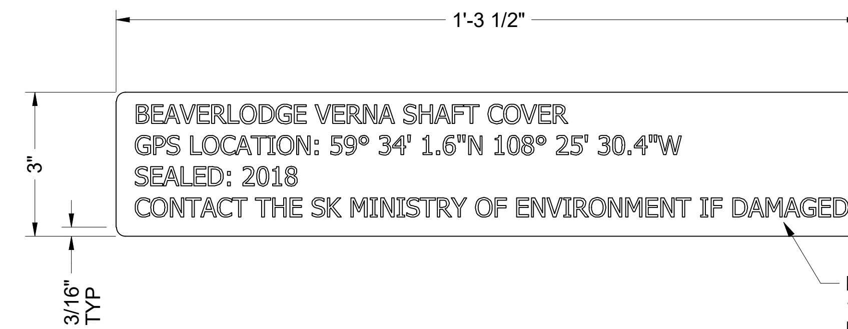
**VERNA 1**

**(Verna Shaft)**

VERNA 1 – Verna Shaft

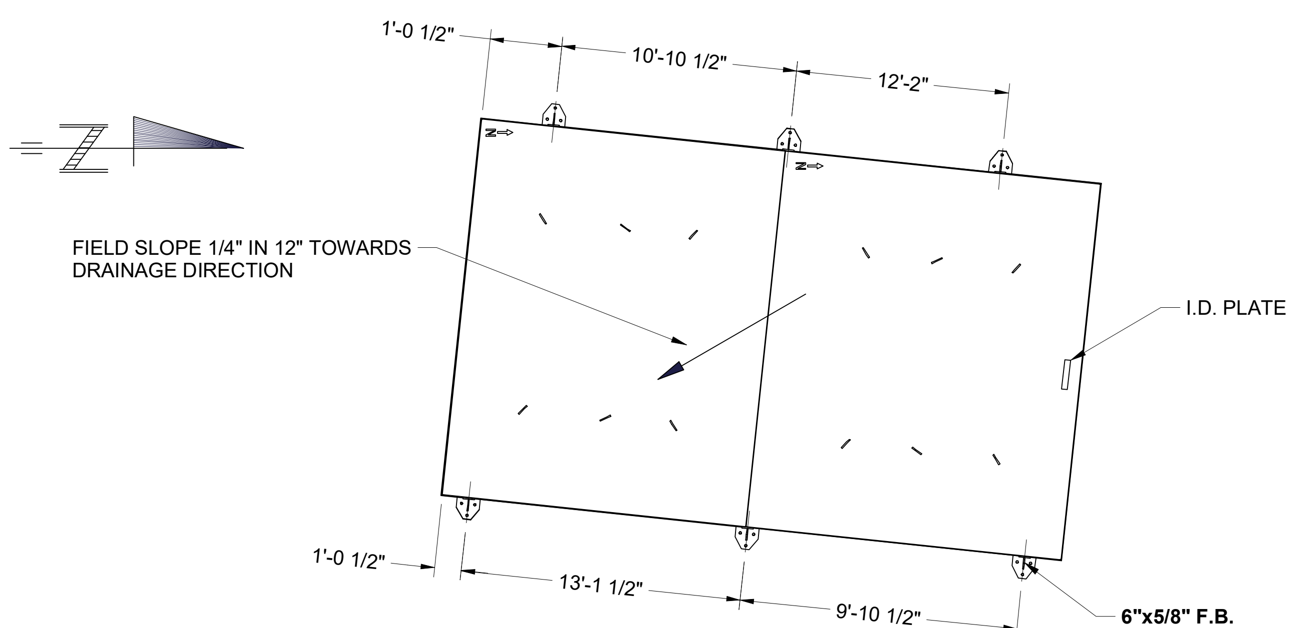
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KONDA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
15. SEE DRAWING P60236-07 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 15,572 LBS.
5. DO NOT BACK FILL WALLS OF COVER.

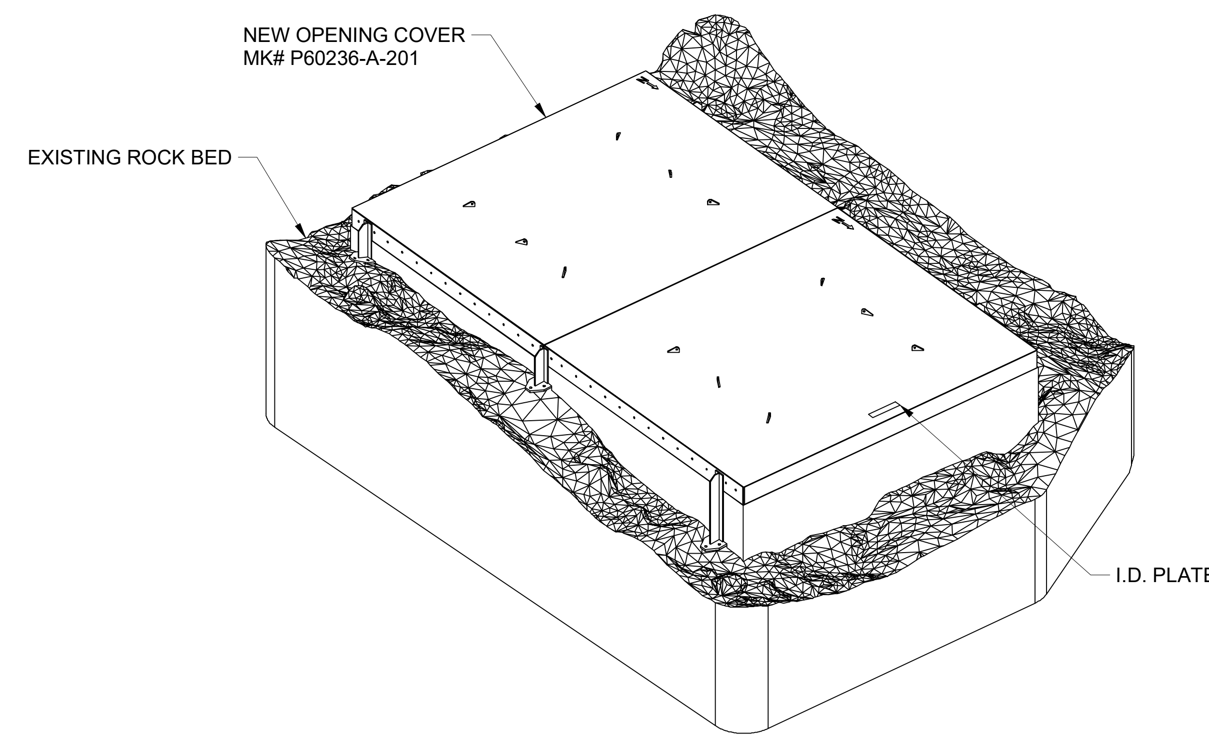



ID PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 13,967 LBS
AS INSTALLED: 15,572 LBS




PLAN VIEW - VERNA 1 OPENING COVER




ISO VIEW
LOOKING SOUTH-WEST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

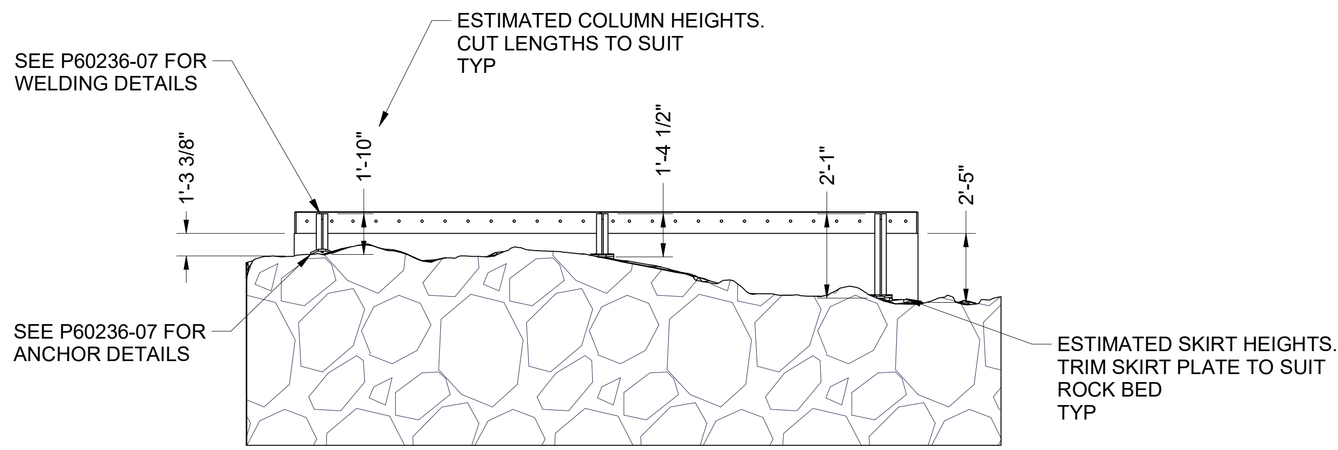
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

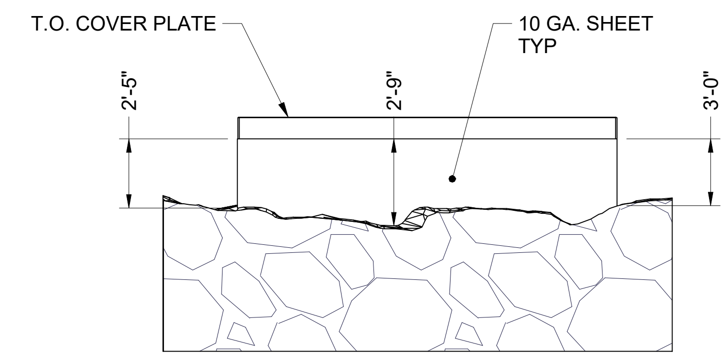
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-02-1
REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

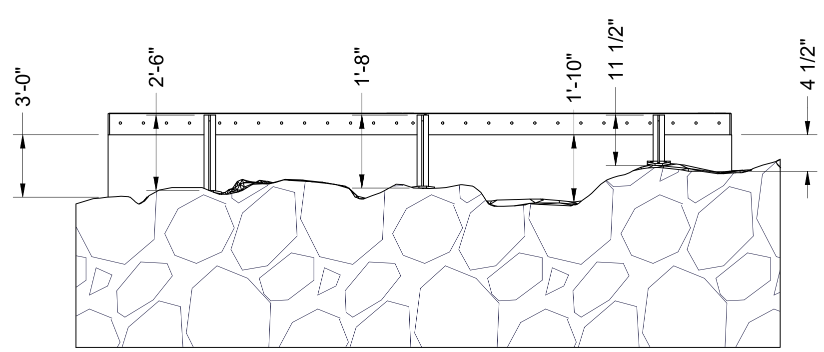
ESTIMATED TOTAL COLUMN LENTH 195" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER
GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



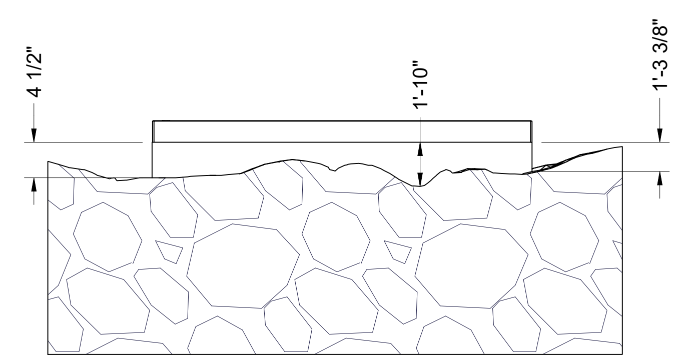

ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST




ELEVATION - LOOKING NORTH





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

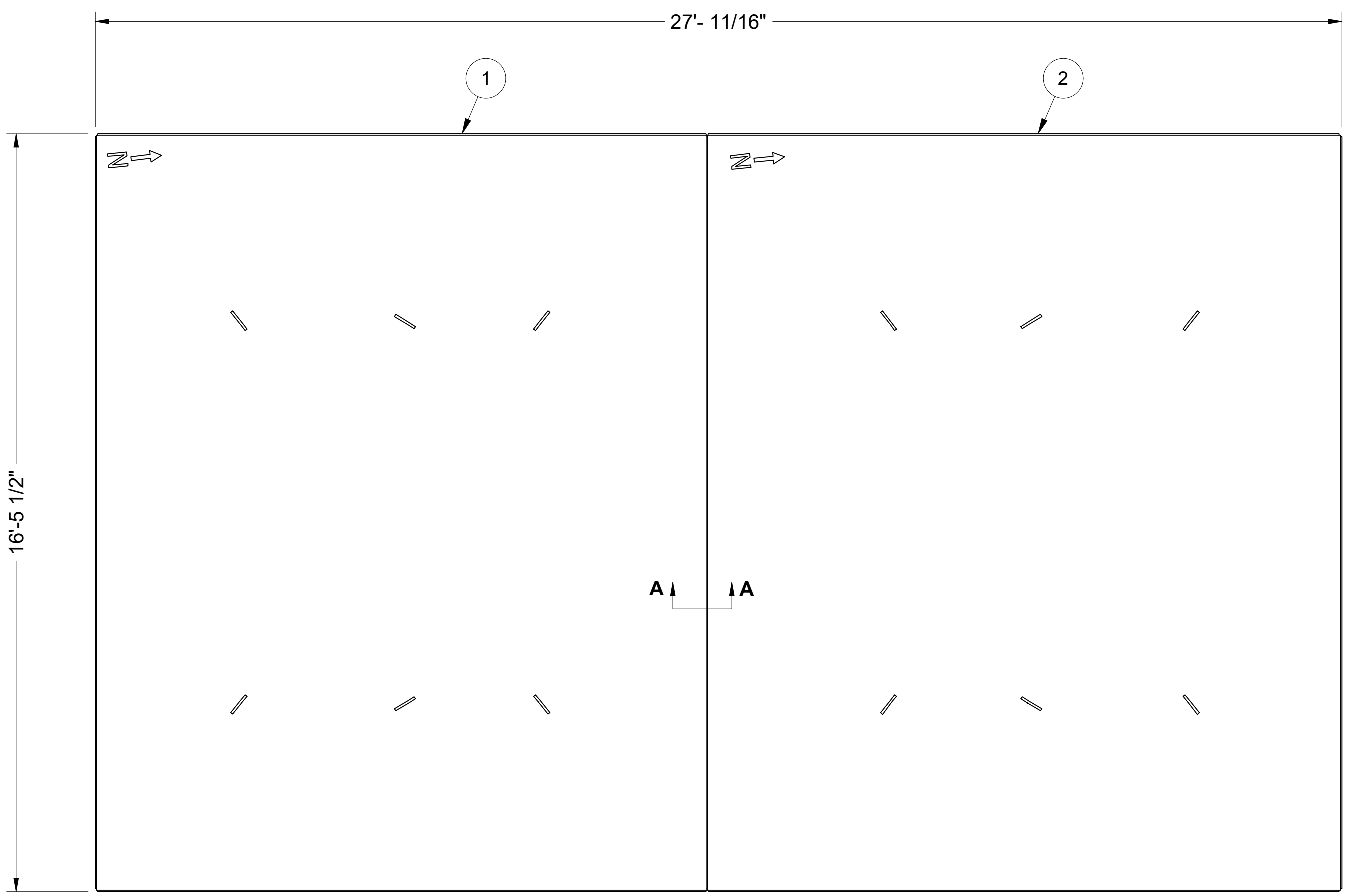
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

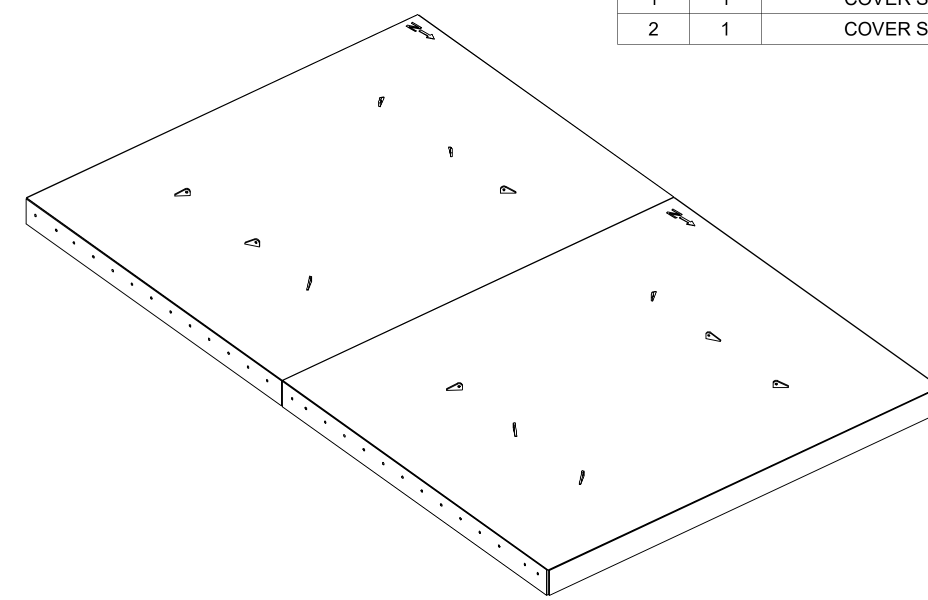
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-02-2
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

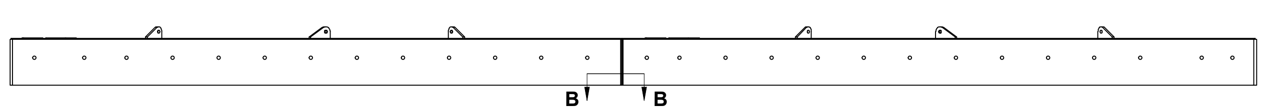
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | P60236-A-202 | | 4 |
| 2 | 1 | COVER SECTION 2 | P60236-A-203 | | 4 |



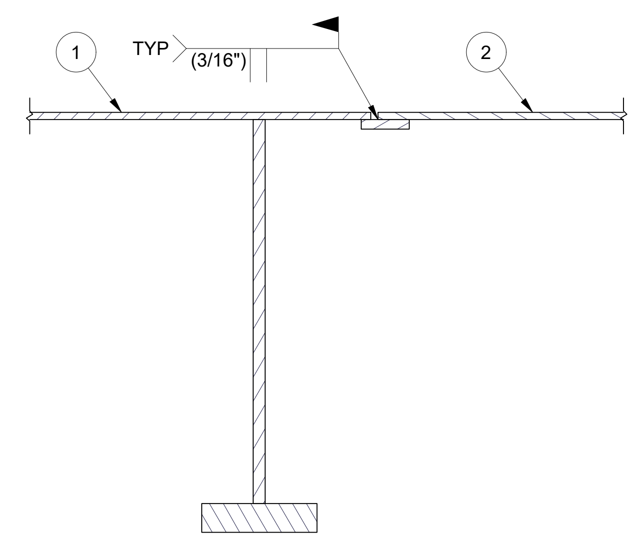

P60236-A-201 - TOP VIEW
TOP PLATE DIMENSIONS



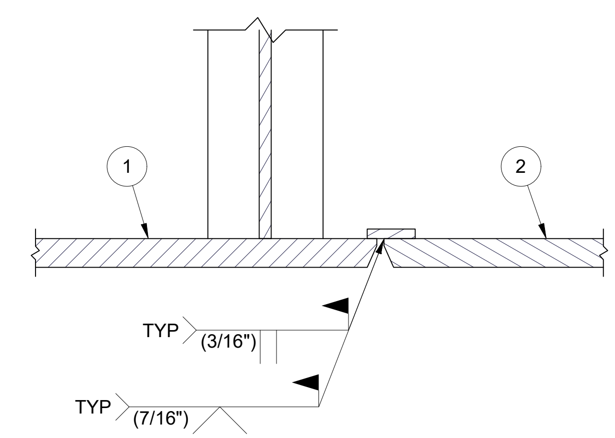
P60236-A-201 - ISO VIEW




P60236-A-201 - SIDE VIEW




SECTION A-A




SECTION B-B



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | △0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.R. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

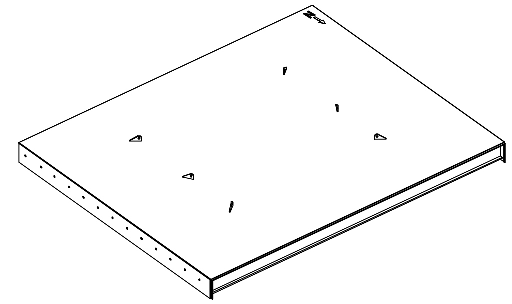
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING
TOP COVER DETAILS
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-02-3 △1

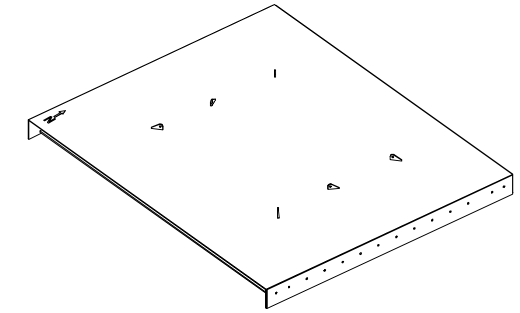
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| MK# P60236-A-202 BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 3/16" PLATE | ASTM A240-316-L |
| 2 | 12"x3/4" FB | ASTM A240-316-L |
| 3 | 10"x5/16" FB | ASTM A240-316-L |
| 4 | 3"x3/4" FB | ASTM A240-316-L |
| 5 | 5/8" PL | ASTM A240-316-L |
| 6 | 4"x1/2" FB | ASTM A240-316-L |
| 7 | 1 1/4"x1/4" FB | ASTM A240-316-L |

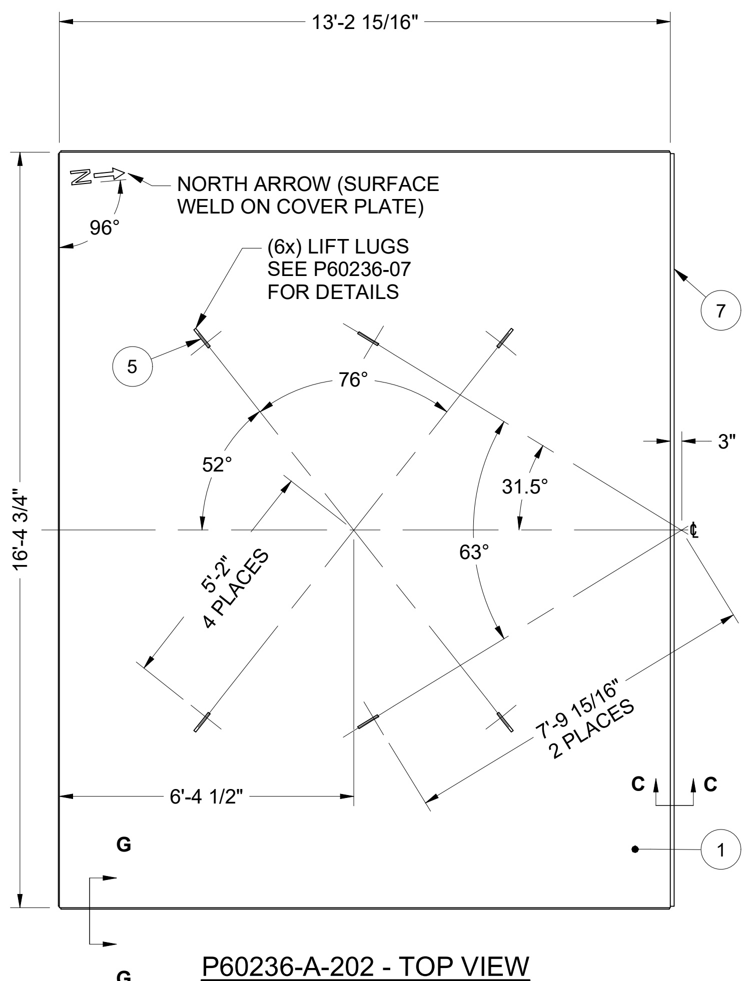


P60236-A-202 - ISO VIEW

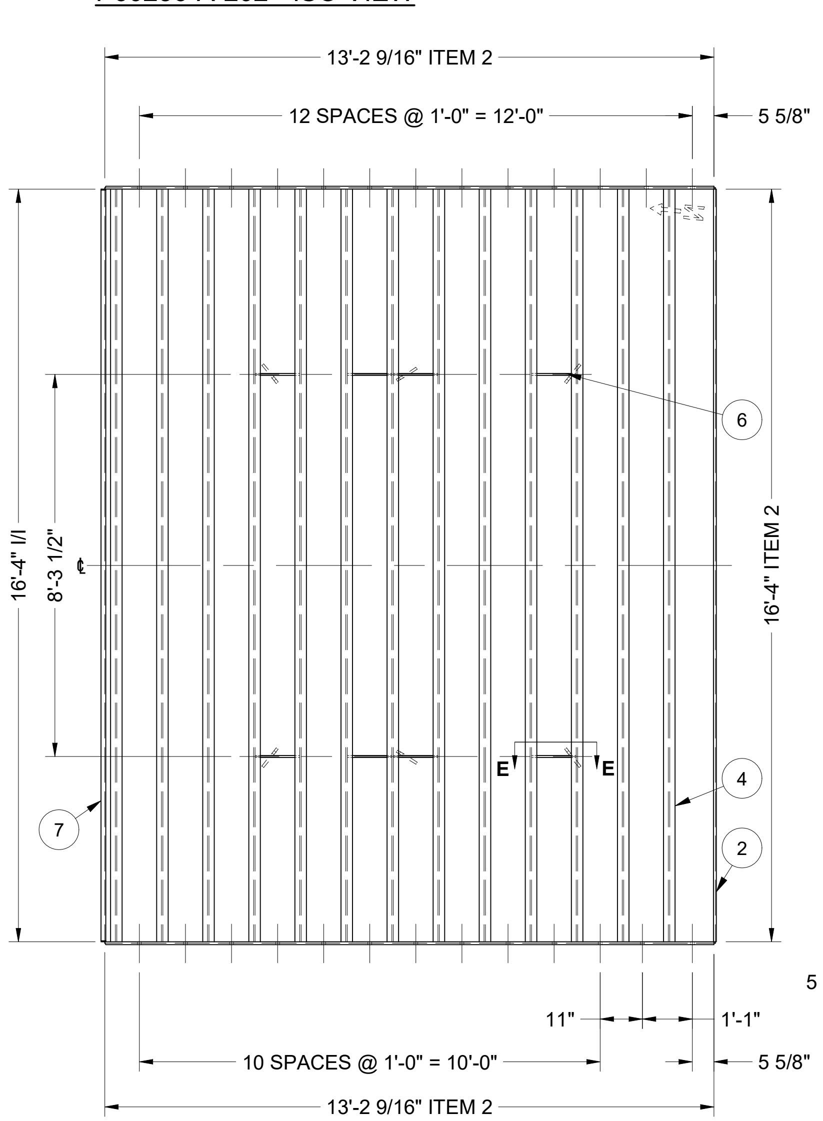
| MK# P60236-A-203 BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 3/16" PLATE | ASTM A240-316-L |
| 2 | 12"x3/4" FB | ASTM A240-316-L |
| 3 | 10"x5/16" FB | ASTM A240-316-L |
| 4 | 3"x3/4" FB | ASTM A240-316-L |
| 5 | 5/8" PL | ASTM A240-316-L |
| 6 | 4"x1/2" FB | ASTM A240-316-L |



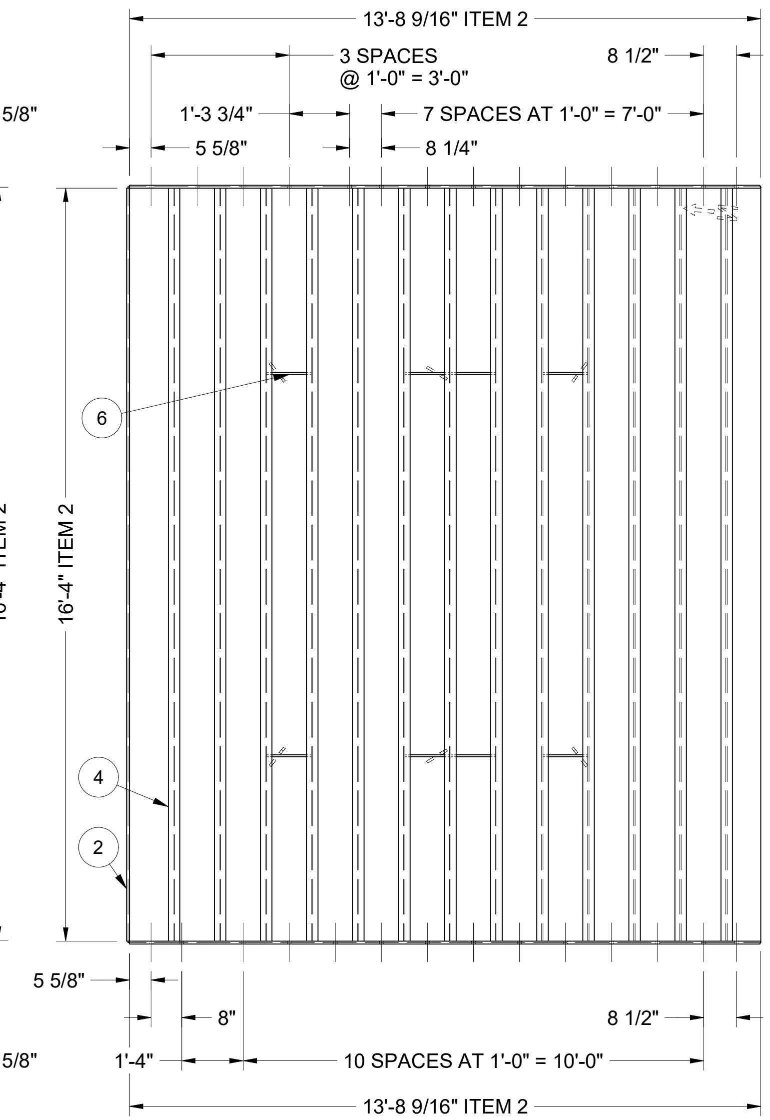
P60236-A-203 - ISO VIEW



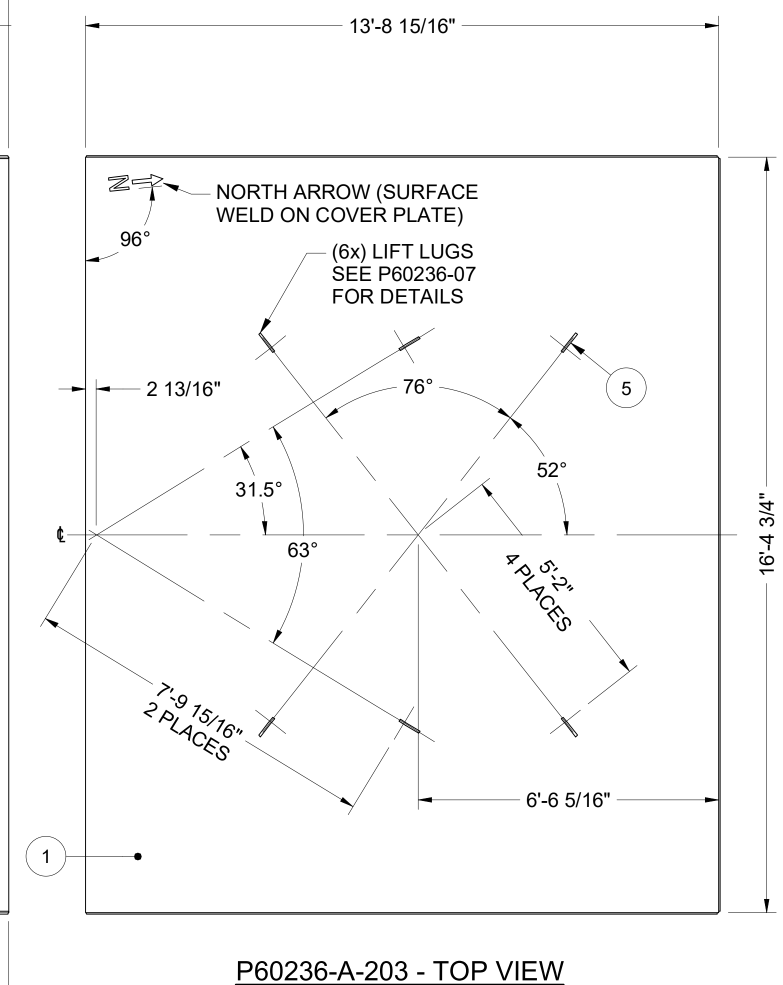

P60236-A-202 - TOP VIEW
TOP PLATE DIMENSIONS



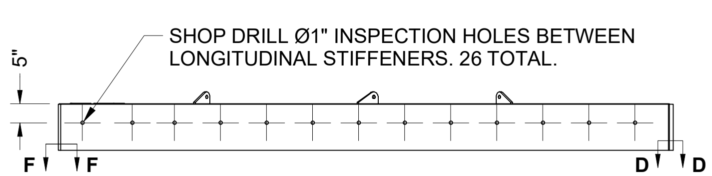

P60236-A-202 - BOTTOM VIEW
TOP PLATE DIMENSIONS



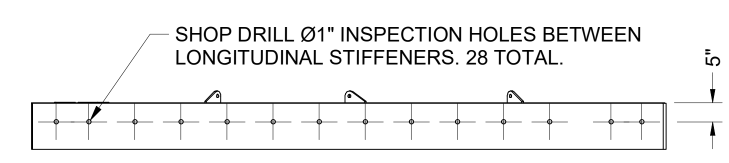

P60236-A-203 - BOTTOM VIEW
TOP PLATE DIMENSIONS




P60236-A-203 - TOP VIEW
TOP PLATE DIMENSIONS




SIDE VIEW




SIDE VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: CN
DATE: 07/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER P.B. CAUGHLIN MEMBER 14318 18 11 09 YR. MN DAY SASKATCHEWAN

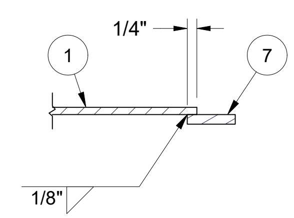
Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

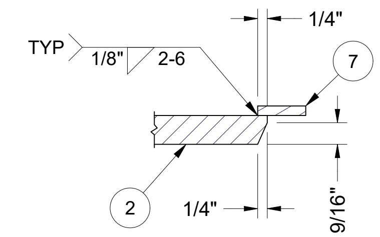
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING TOP COVER SECTIONS
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 7
DWG. NO.: P60236-02-4 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




SECTION C-C
FROM SHEET 4

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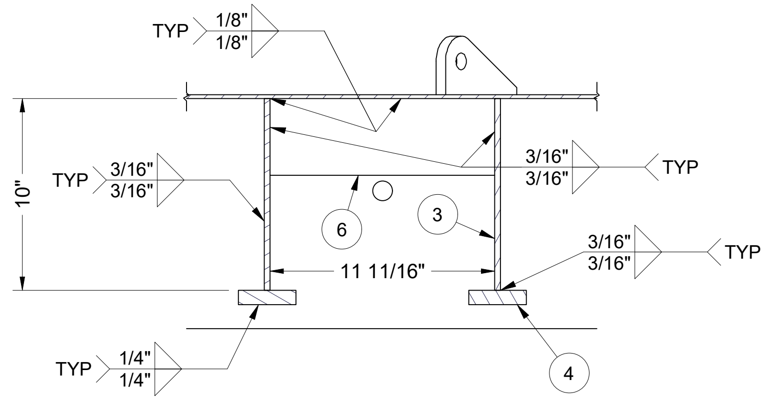
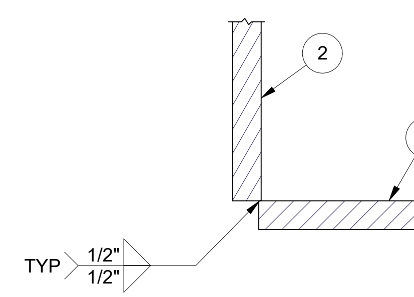
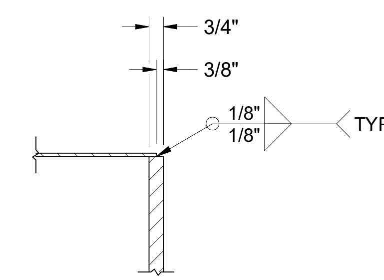
FROM SHEET 4




SECTION E-E
FROM SHEET 4




SECTION F-F
FROM SHEET 4




SECTION G-G
FROM SHEET 4



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | △0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

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CERTIFICATE OF AUTHORIZATION
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Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
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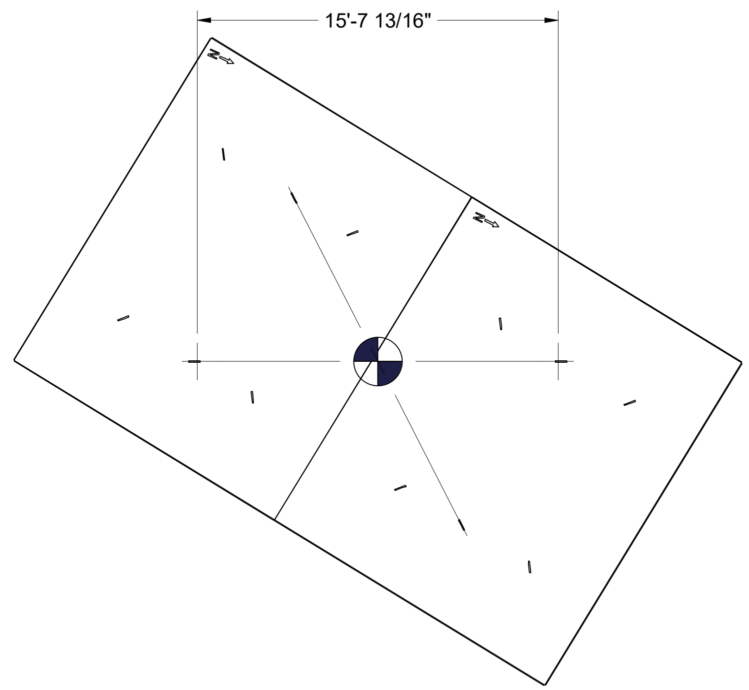
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

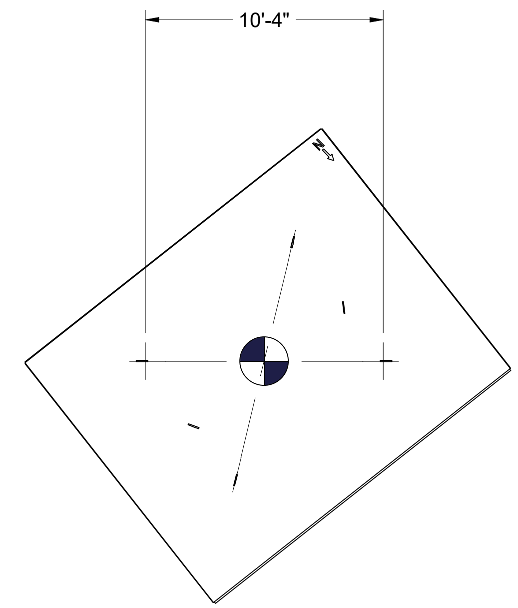
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING
SECTIONS
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-02-5 △1

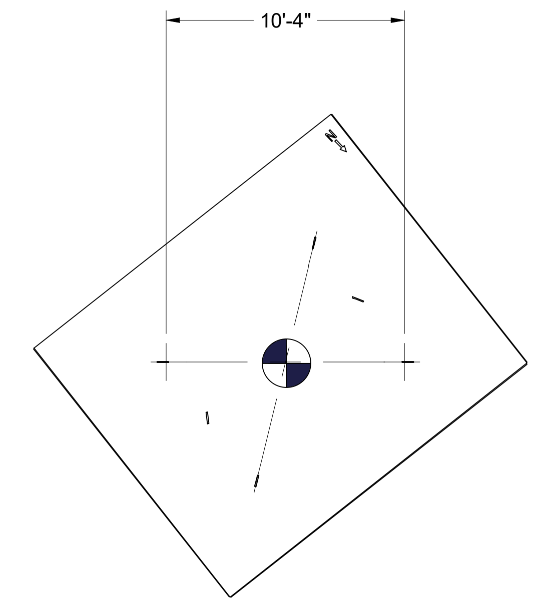
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



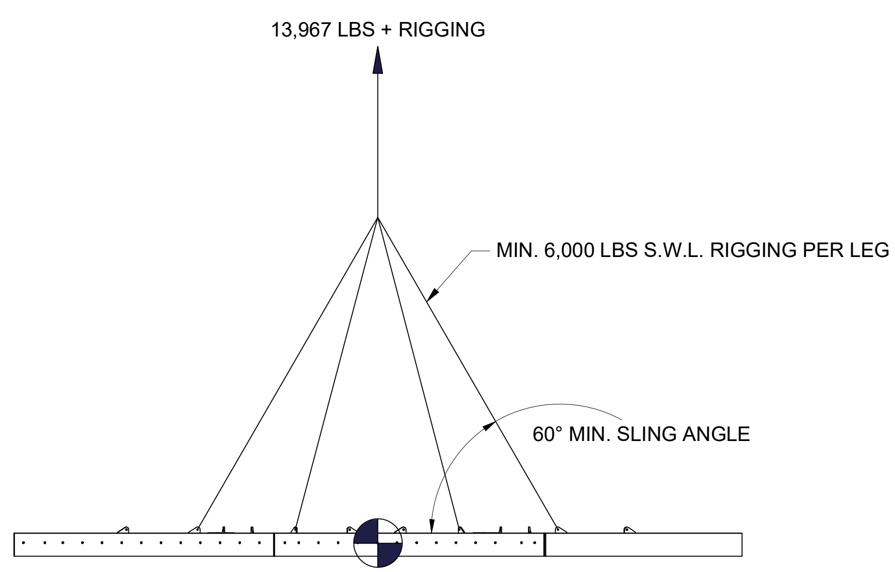

TOP COVER LIFTING DIAGRAM
P60236-A-201



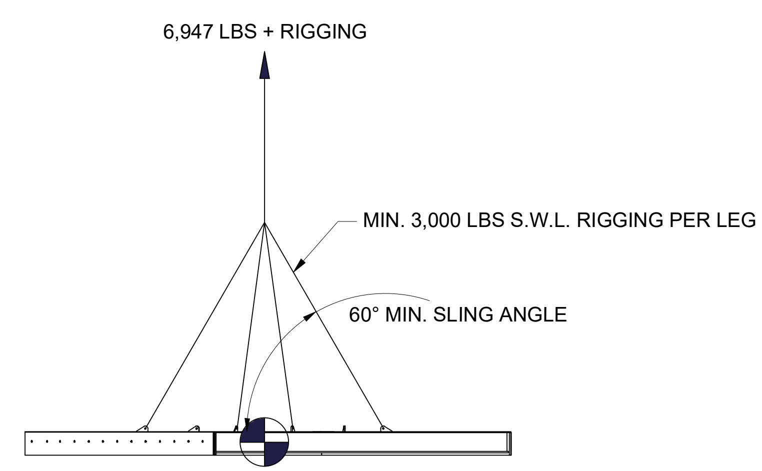

COVER SECTION 1 LIFTING DIAGRAM
P60236-A-202



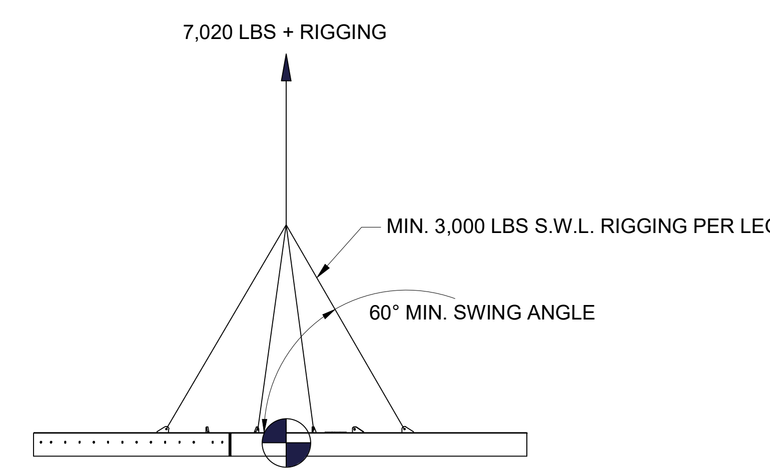

COVER SECTION 2 LIFTING DIAGRAM
P60236-A-203




TOP COVER LIFTING DIAGRAM - SIDE VIEW
P60236-A-201




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
P60236-A-202




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
P60236-A-203





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
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MEMBER 14318
18 11 09
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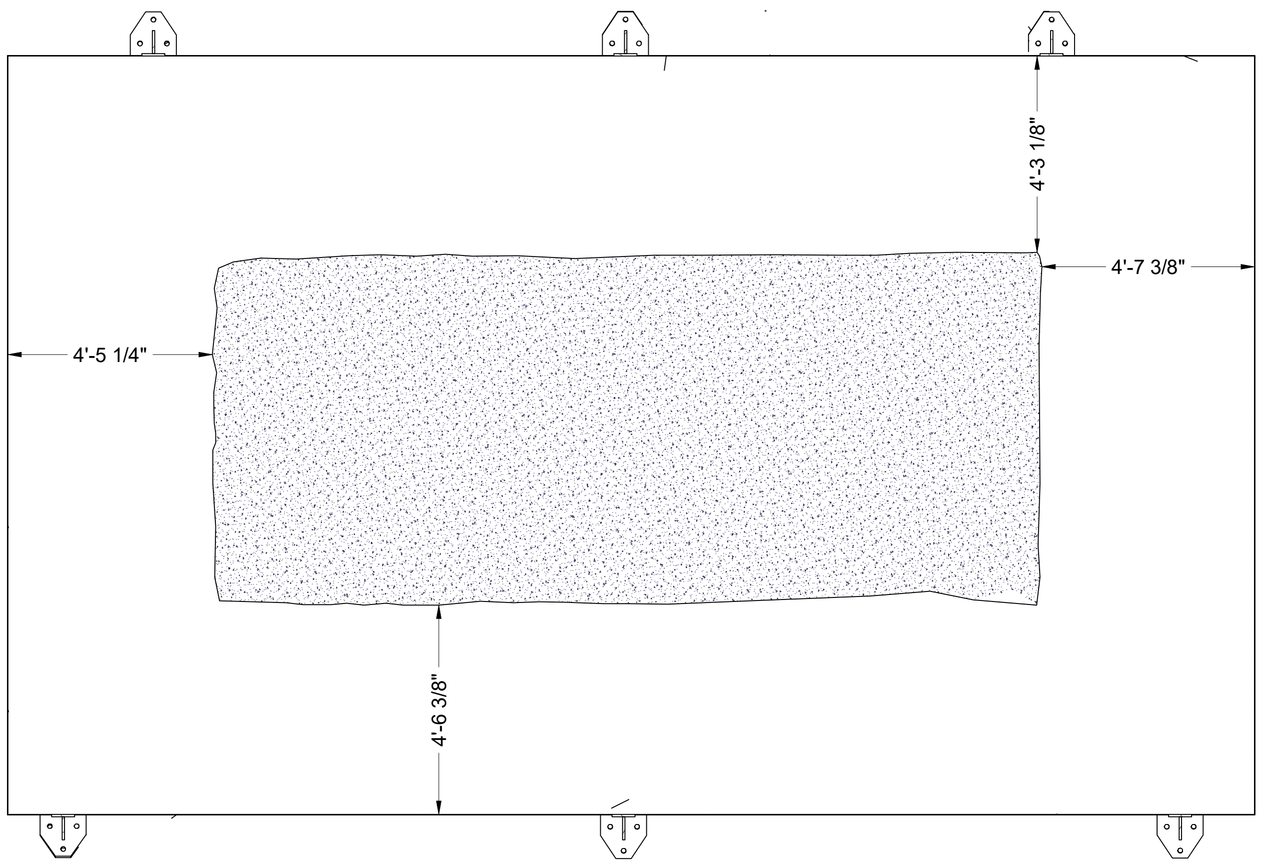
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

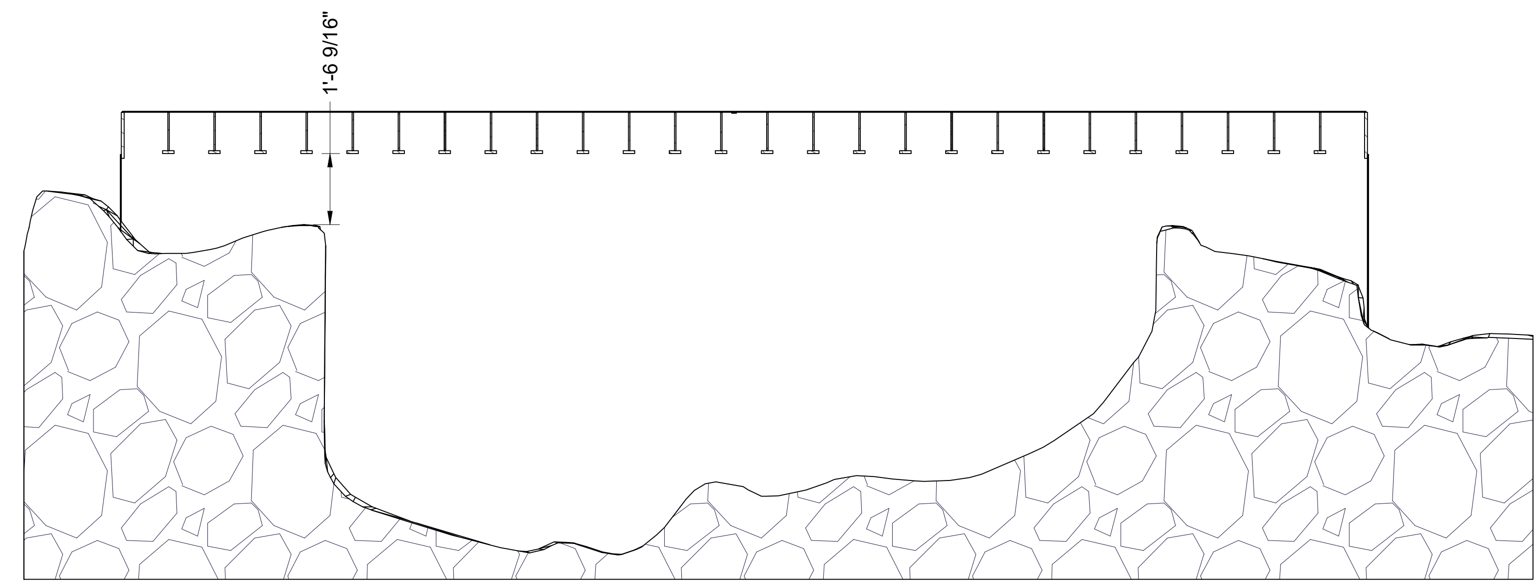
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING
LIFTING DETAILS
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: P60236-02-6
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
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TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
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CUT SURFACES: 250
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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

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|---|---|
| DRWN BY: | CN |
| DATE: | 07/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

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| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 1 OPENING CLEARANCES
LOCATION: 59° 34' 1.6"N 108° 25' 30.4"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: P60236-02-7
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

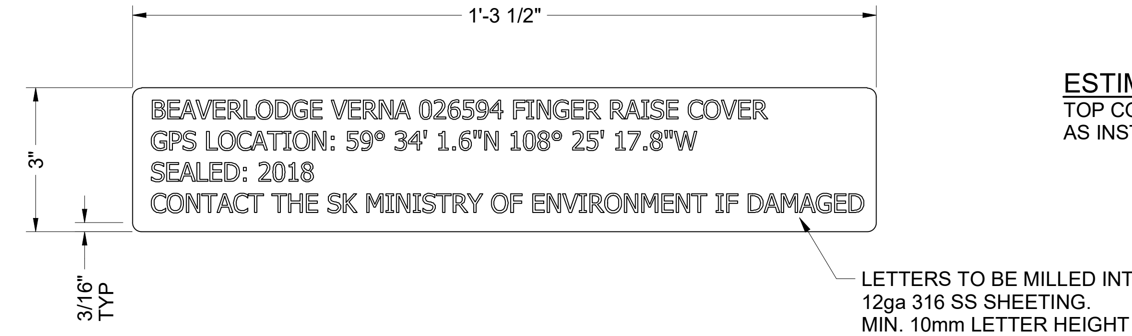
**VERNA 3 – 026594 Raise**

**(Verna Finger Raise)**

VERNA 3 – 026594 Raise

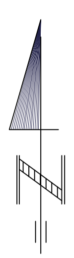
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KONDA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
15. SEE DRAWING P60236-07 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

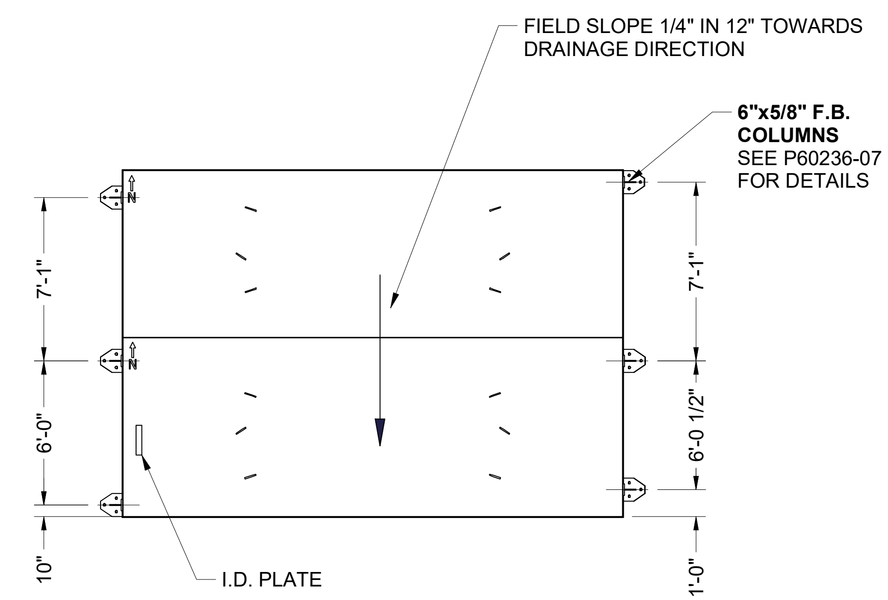
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 11,915 LBS.
5. DO NOT BACK FILL WALLS OF COVER.



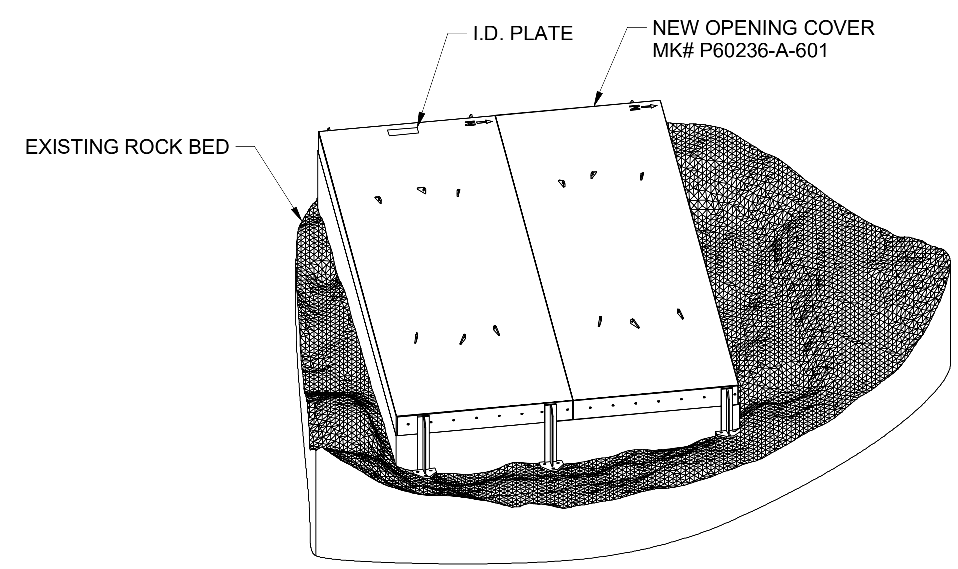

ID PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 10,485 LBS
AS INSTALLED: 11,915 LBS






PLAN VIEW - VERNA 3 OPENING COVER




ISO VIEW
LOOKING WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS BUILT DETAILS | 09/Nov/18 | NR |
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ALL DIMENSIONS IN INCHES

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|---|---|
| DRWN BY: | CN |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
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Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

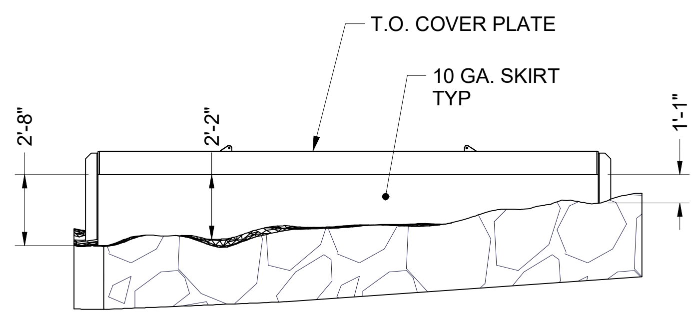
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

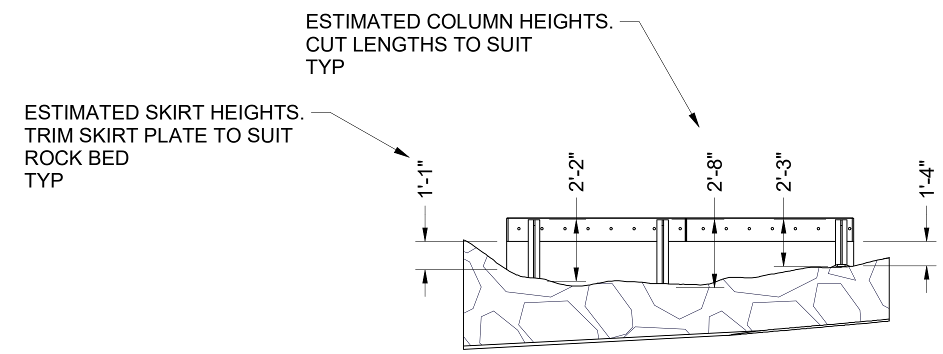
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: P60236-06-1 △1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

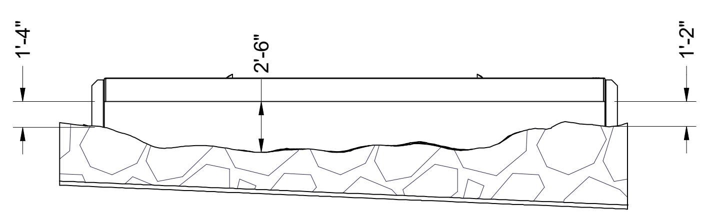
ESTIMATED TOTAL COLUMN LENTH 202" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.



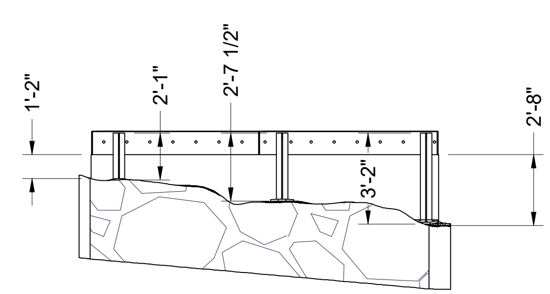

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

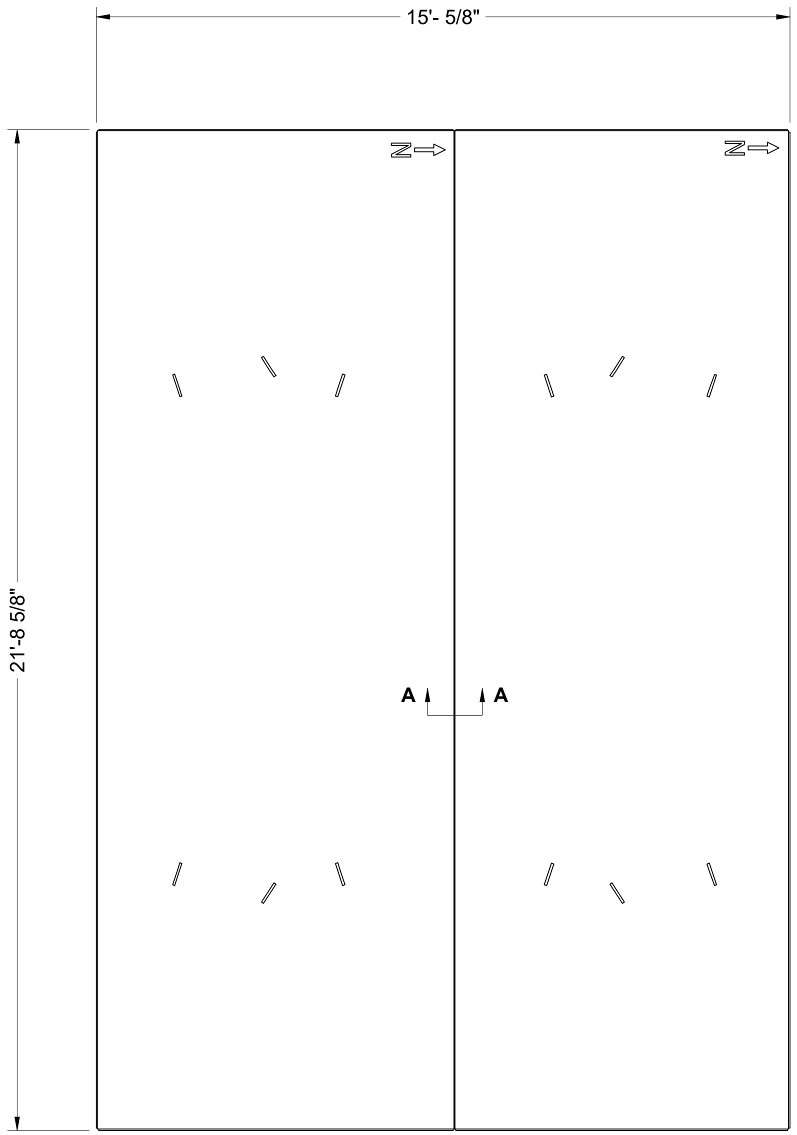
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

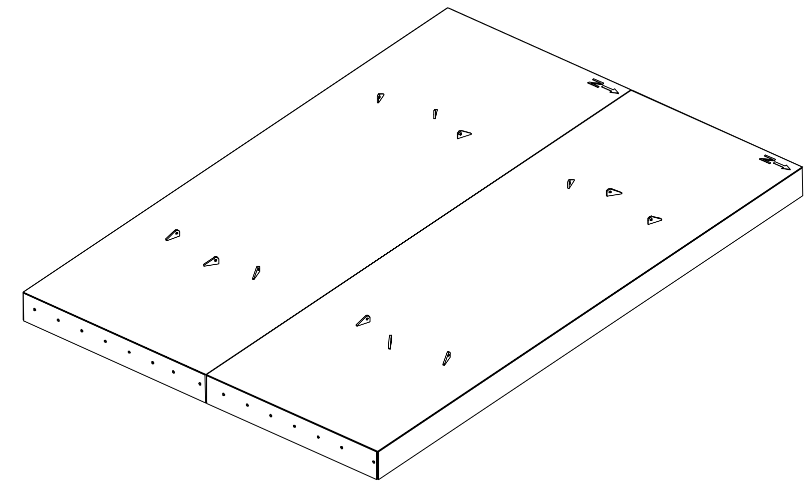
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: P60236-06-2
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

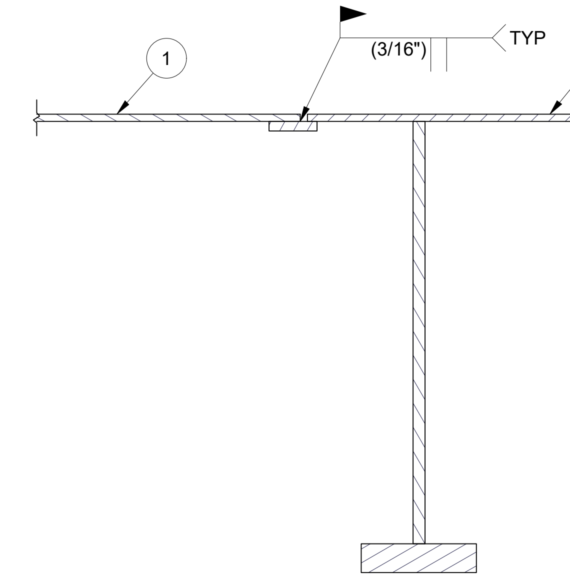
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | MK# P60236-A-602 | | 4 |
| 2 | 1 | COVER SECTION 2 | MK# P60236-A-603 | | 4 |



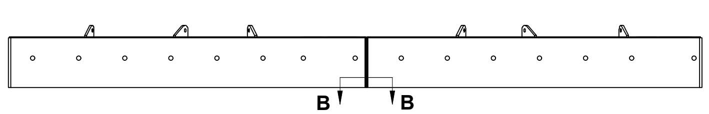

MK# P60236-A-601 - TOP VIEW
TOP PLATE DIMENSIONS



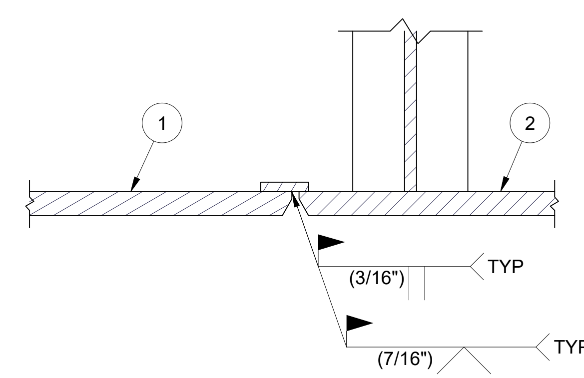
MK# P60236-A-601 - ISO VIEW




SECTION A-A




MK# P60236-A-601 - SIDE VIEW




SECTION B-B





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 2 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 1 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

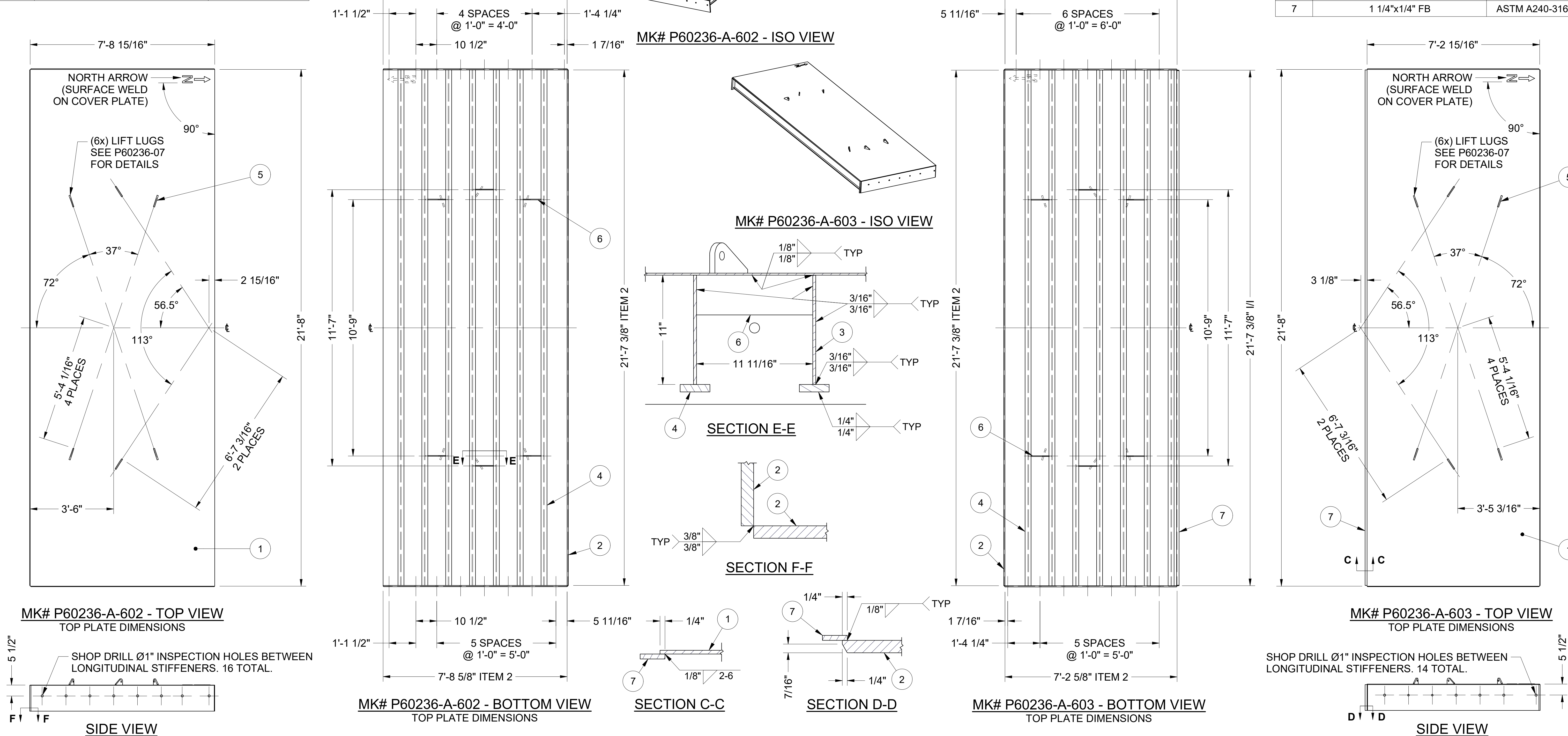
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING
TOP COVER DETAILS
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: P60236-06-3
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| MK# P60236-A-602 BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 3/16" PLATE | ASTM A240-316-L |
| 2 | 13"x5/8" FB | ASTM A240-316-L |
| 3 | 11"x5/16" FB | ASTM A240-316-L |
| 4 | 3"x3/4" FB | ASTM A240-316-L |
| 5 | 5/8" PL | ASTM A240-316-L |
| 6 | 4"x3/8" FB | ASTM A240-316-L |

| MK# P60236-A-603 BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 3/16" PLATE | ASTM A240-316-L |
| 2 | 13"x5/8" FB | ASTM A240-316-L |
| 3 | 11"x5/16" FB | ASTM A240-316-L |
| 4 | 3"x3/4" FB | ASTM A240-316-L |
| 5 | 5/8" PL | ASTM A240-316-L |
| 6 | 4"x3/8" FB | ASTM A240-316-L |
| 7 | 1 1/4"x1/4" FB | ASTM A240-316-L |

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: CN
DATE: 08/Nov/17
CHK'D BY:
ENG BY: PC

PROFESSIONAL ENGINEER – P.B. CAUGHLIN – MEMBER 14318 – 18 11 09 – SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

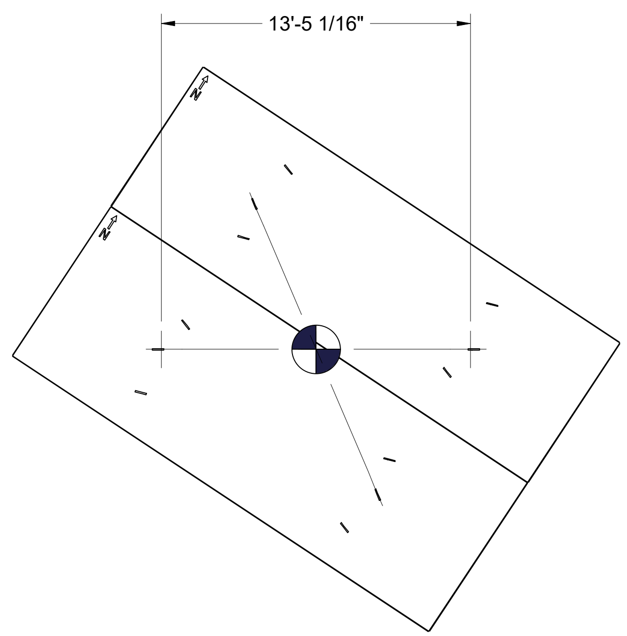
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

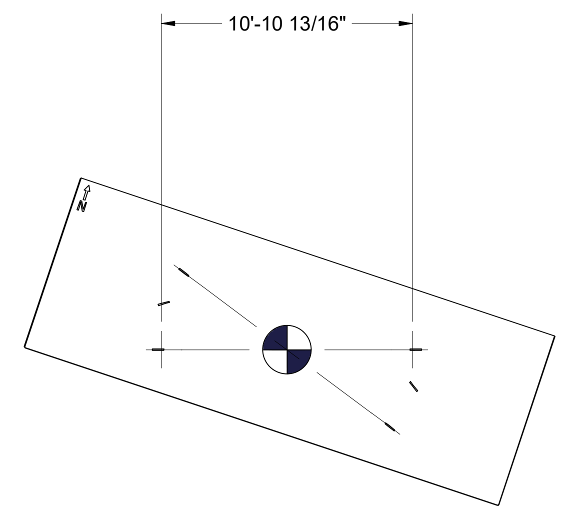
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING
TOP SECTION COVERS
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 6
DWG. NO.: P60236-06-4 (REV 1)

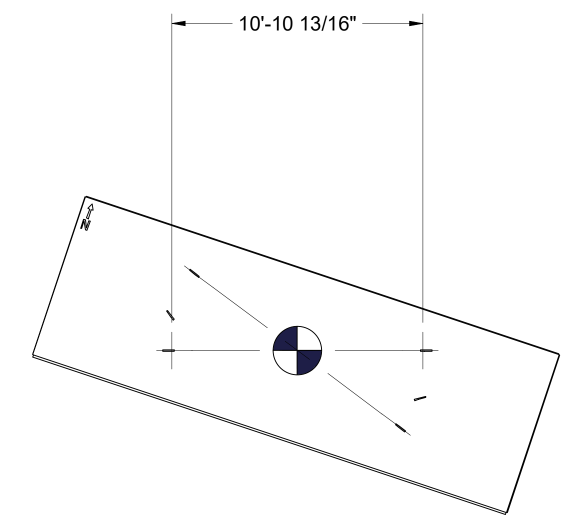
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



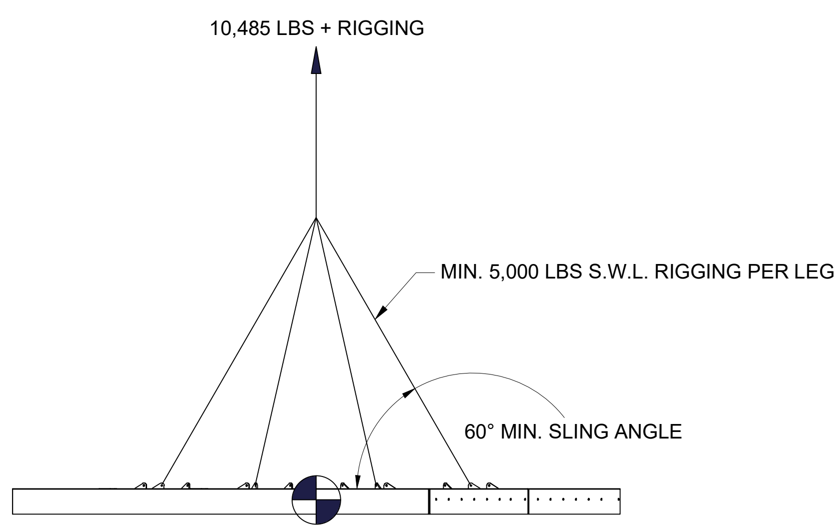

TOP COVER LIFTING DIAGRAM
MK# P60236-A-601



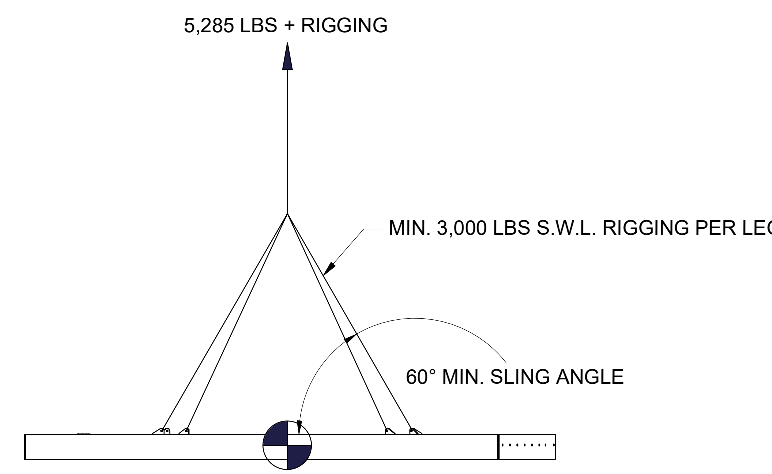

COVER SECTION 1 LIFTING DIAGRAM
MK# P60236-A-602



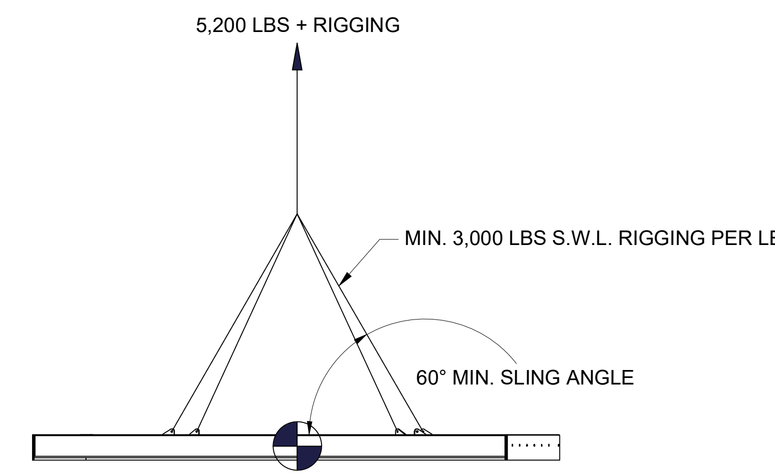

COVER SECTION 2 LIFTING DIAGRAM
MK# P60236-A-603




TOP COVER LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-601




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-602




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-603



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 0 | | | |
| | | 3 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 2 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

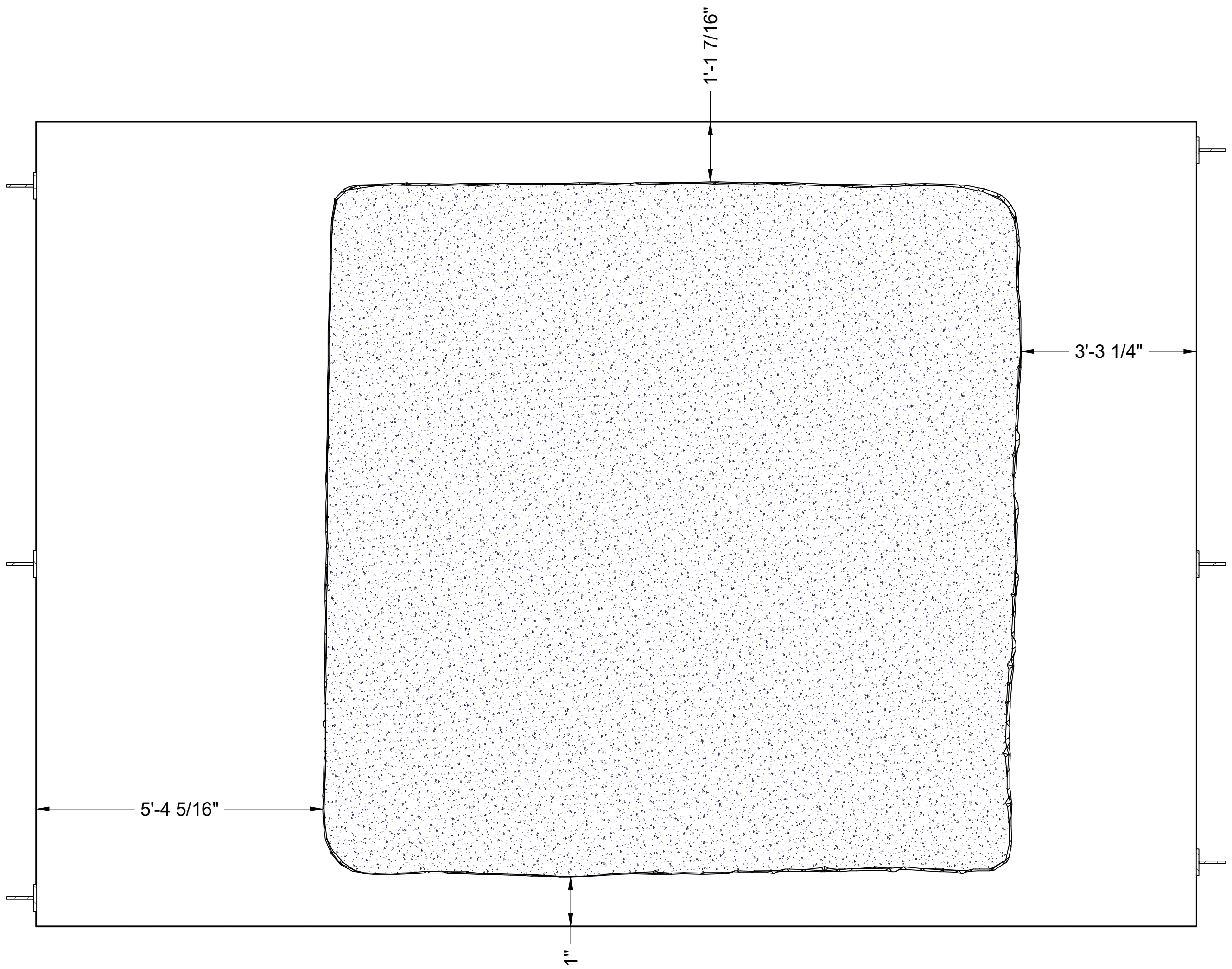
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

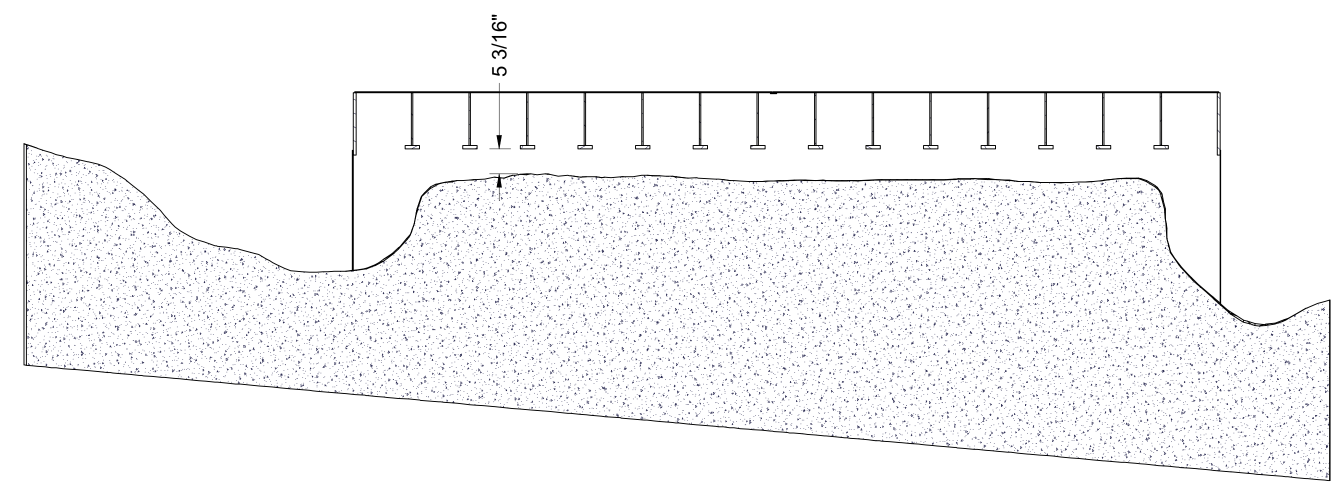
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING
LIFTING DETAILS
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: P60236-06-5
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | CN |
| P60236-07 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | CN |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | CN |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | PC |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 3 OPENING CLEARANCES
LOCATION: 59° 34' 1.6"N 108° 25' 17.8"W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: P60236-06-6
REV: 1

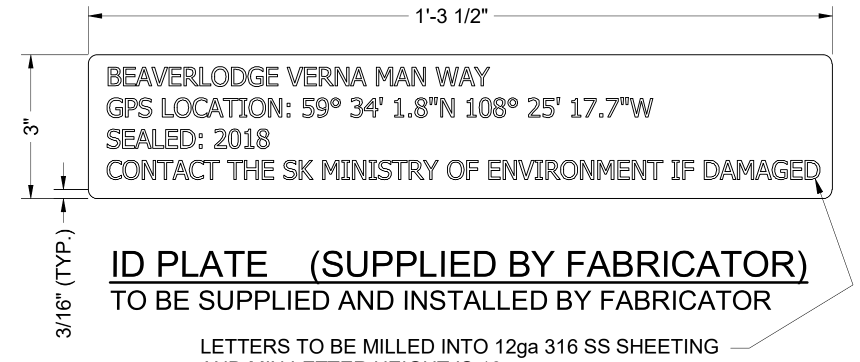
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# VERNA 8 – Verna Manway

VERNA 8 – Verna Manway

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. CERTIFICATION REQUIRES A NEW SERIAL NUMBER TO BE PROVIDED BY KOVA ENGINEERING (SASKATCHEWAN) LTD. FOR EACH NEW UNIT MADE.
10. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
11. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
12. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
13. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
14. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
15. SEE DRAWING P60236-07 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3kN (4,800 LB) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED STAINLESS STEEL. THEREFORE, KOVA HAS DESIGNED THE COVER CONSIDERING A 1mm CORROSION ALLOWANCE ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS AN INSPECTION BE PERFORMED BY A QUALIFIED ENGINEER AT LEAST ONCE EVERY 20 YEARS OR FOLLOWING NOTIFICATION OF VISUAL DAMAGE
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 3,445 LB
5. DO NOT BACK FILL WALLS OF COVER.

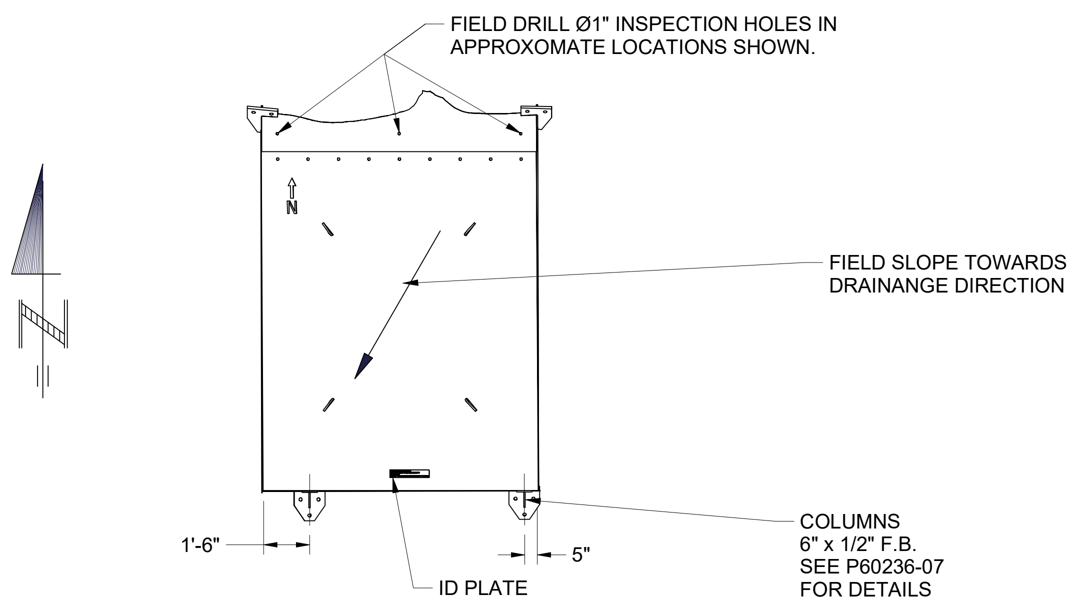



ID PLATE (SUPPLIED BY FABRICATOR)

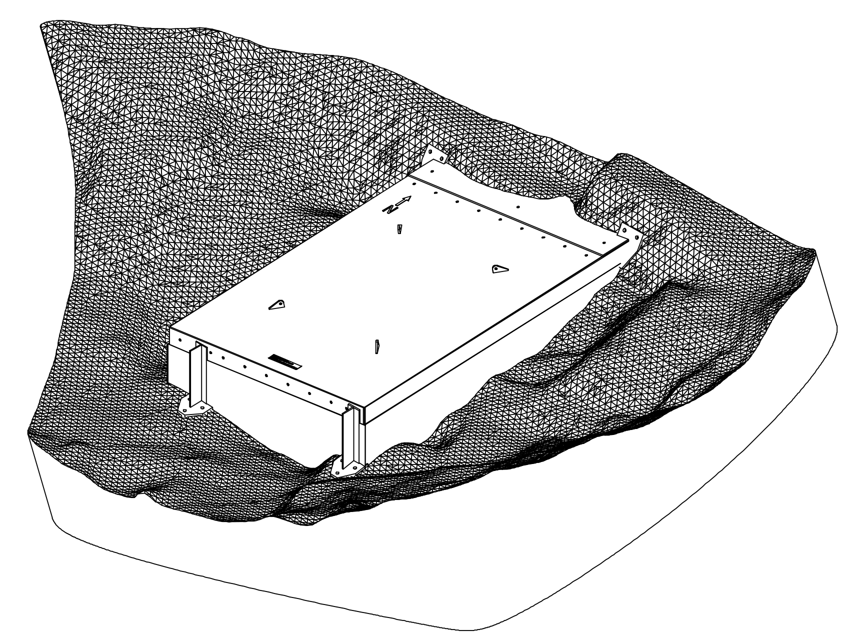
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

LETTERS TO BE MILLED INTO 12ga 316 SS SHEETING AND MIN LETTER HEIGHT IS 10mm

ESTIMATED WEIGHTS:
TOP COVER ASSEMBLY W/O RIGGING: 2,660 LB
AS INSTALLED: 3,445 LB




PLAN VIEW VERNA 8 MANWAY COVER



ISO VIEW
LOOKING NORTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | △0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | AR |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
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Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
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| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

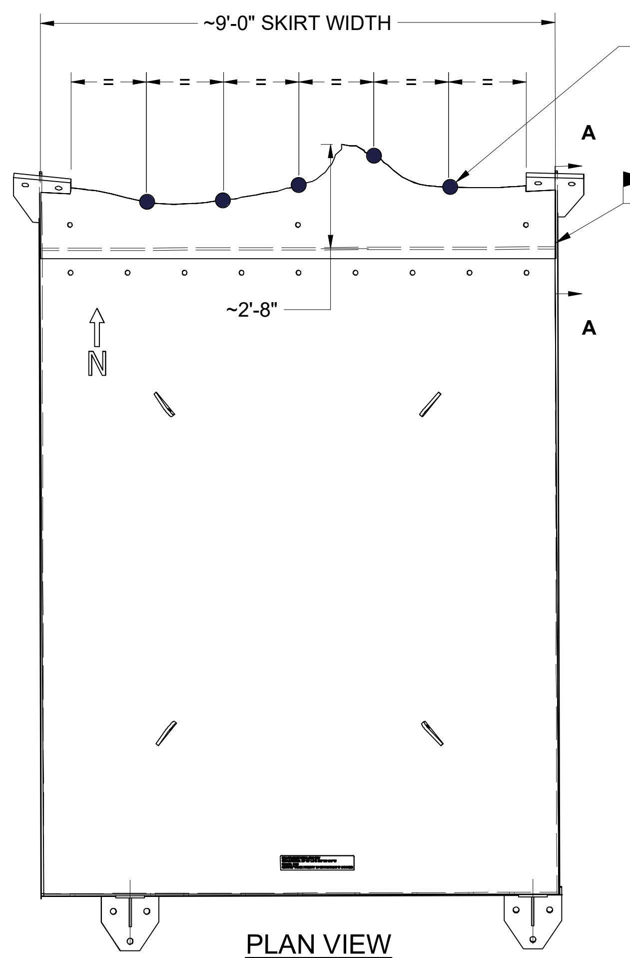
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 8 OPENING GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 34' 1.8"N 108° 25' 17.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

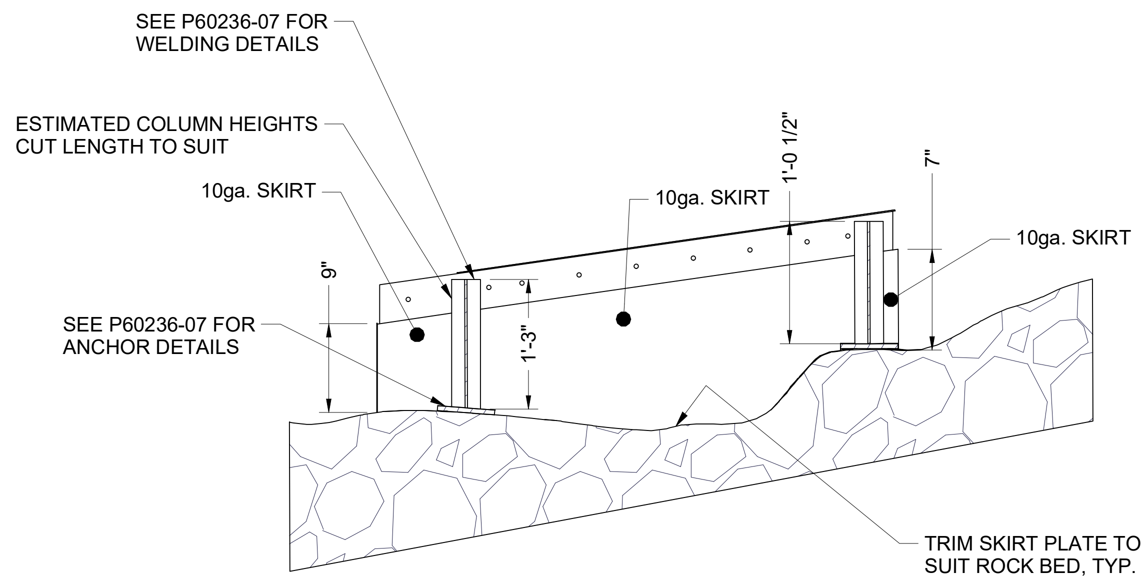
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 4
DWG. NO.: P60236-05-1 △1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

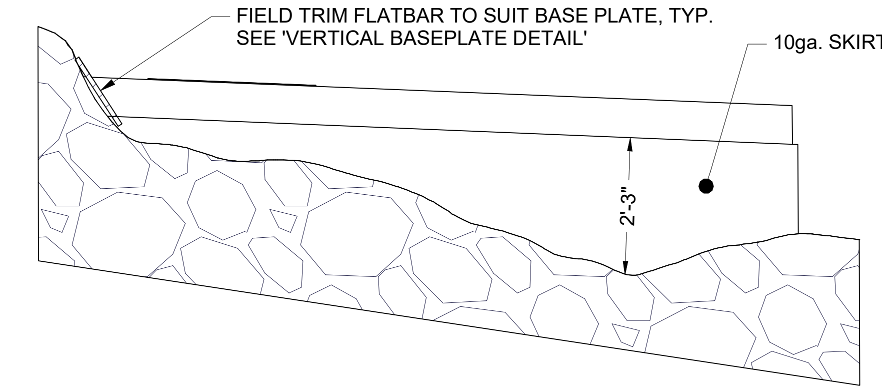
ESTIMATED TOTAL COLUMN LENGTH 52" WITHOUT SCRAP OR EXTRA.
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (2) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.




PLAN VIEW




ELEAVATION LOOKING NORTH

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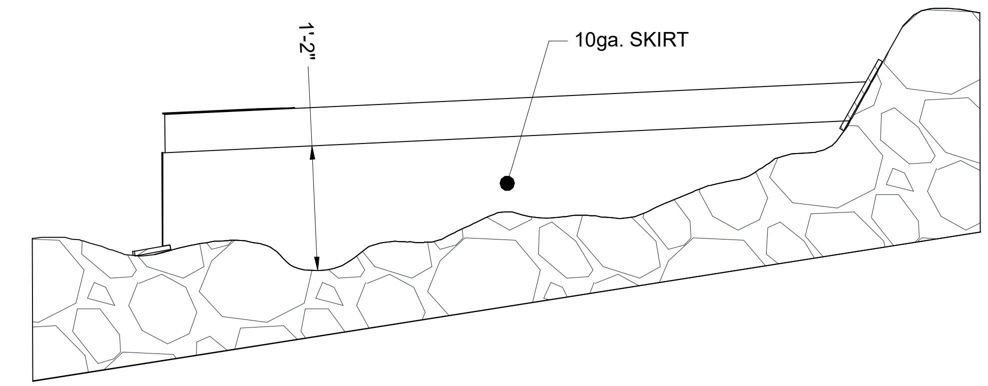


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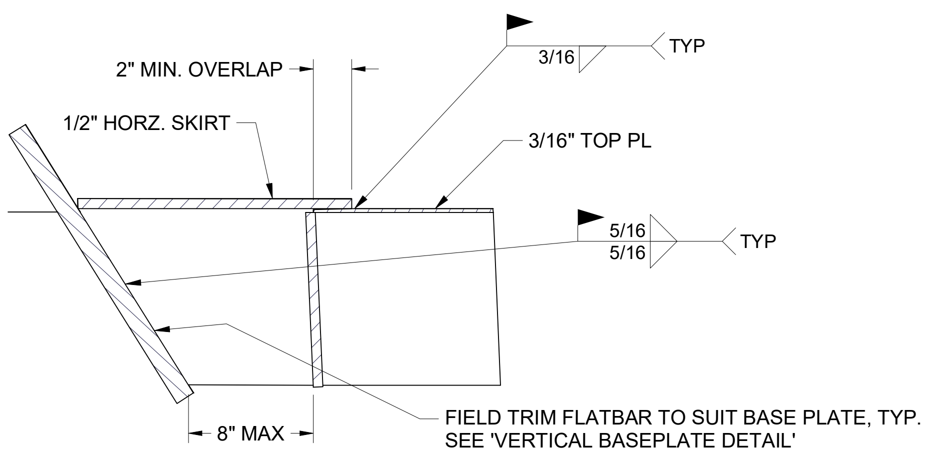
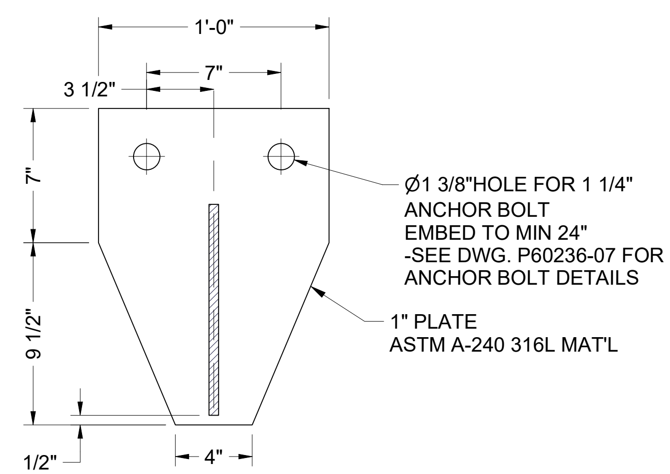
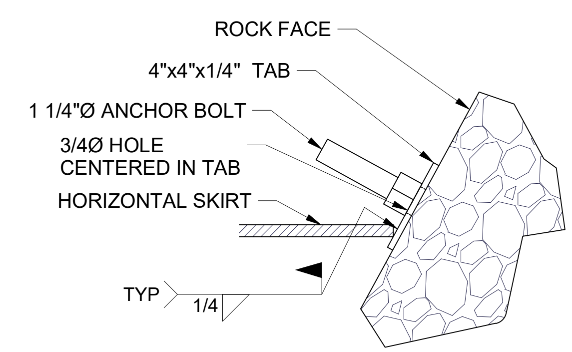



SECTION A-A




VERTICAL BASEPLATE DETAIL
2X REQUIRED




DETAIL 1
HORIZONTAL SKIRT ANCHORS





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: AR
DATE: 08/Nov/17
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

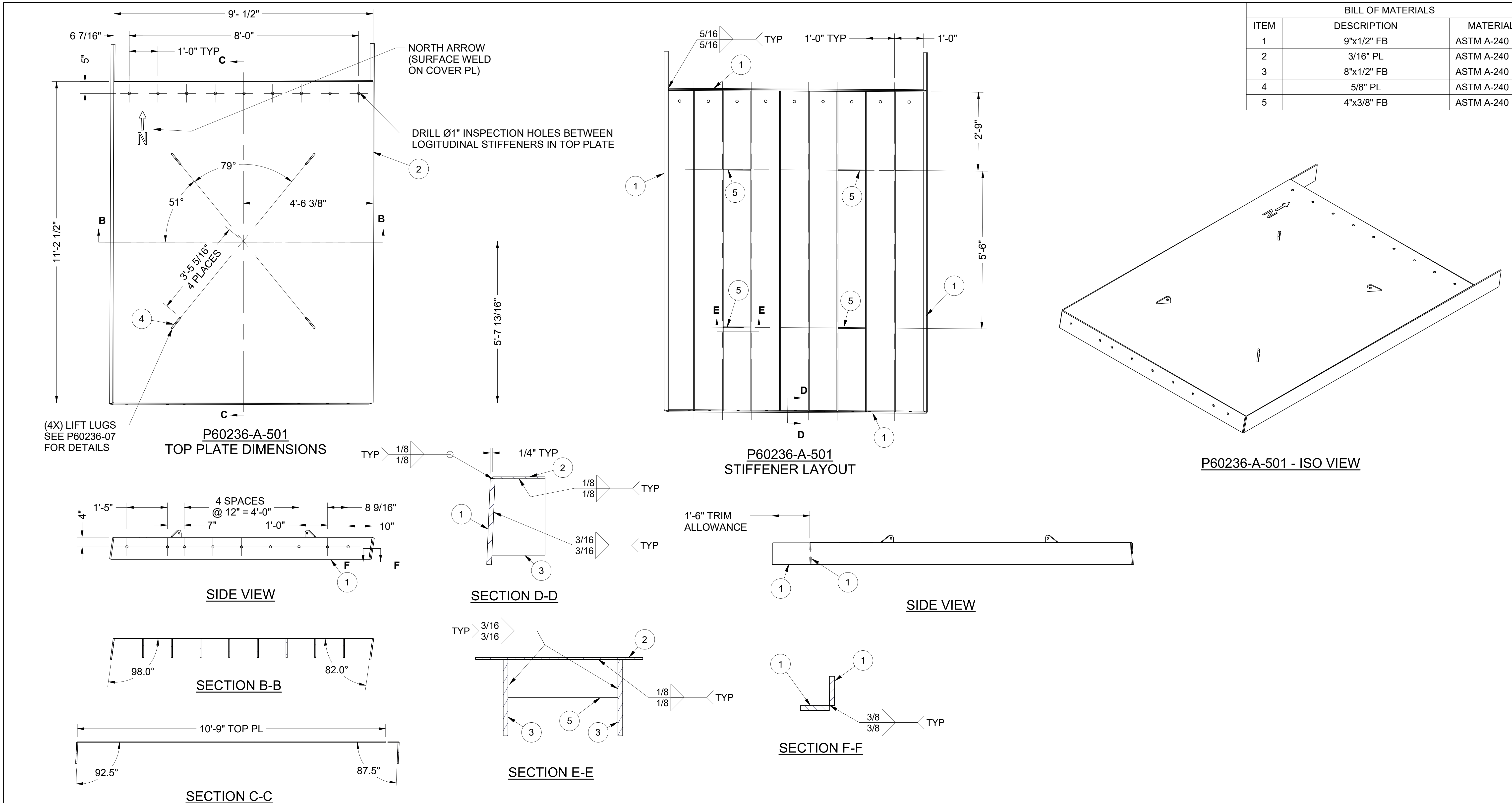
Kova Engineering
Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 8 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 34' 1.8"N 108° 25' 17.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 4
DWG. NO.: P60236-05-2
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | |
|---|---|---|
| ITEM | DESCRIPTION | MATERIAL |
| 1 | 9"x1/2" FB | ASTM A-240 316 |
| 2 | 3/16" PL | ASTM A-240 316 |
| 3 | 8"x1/2" FB | ASTM A-240 316 |
| 4 | 5/8" PL | ASTM A-240 316 |
| 5 | 4"x3/8" FB | ASTM A-240 316 |






| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 3 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | 2 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: AR
DATE: 08/Nov/17
CHK'D BY:
ENG BY: P.C.

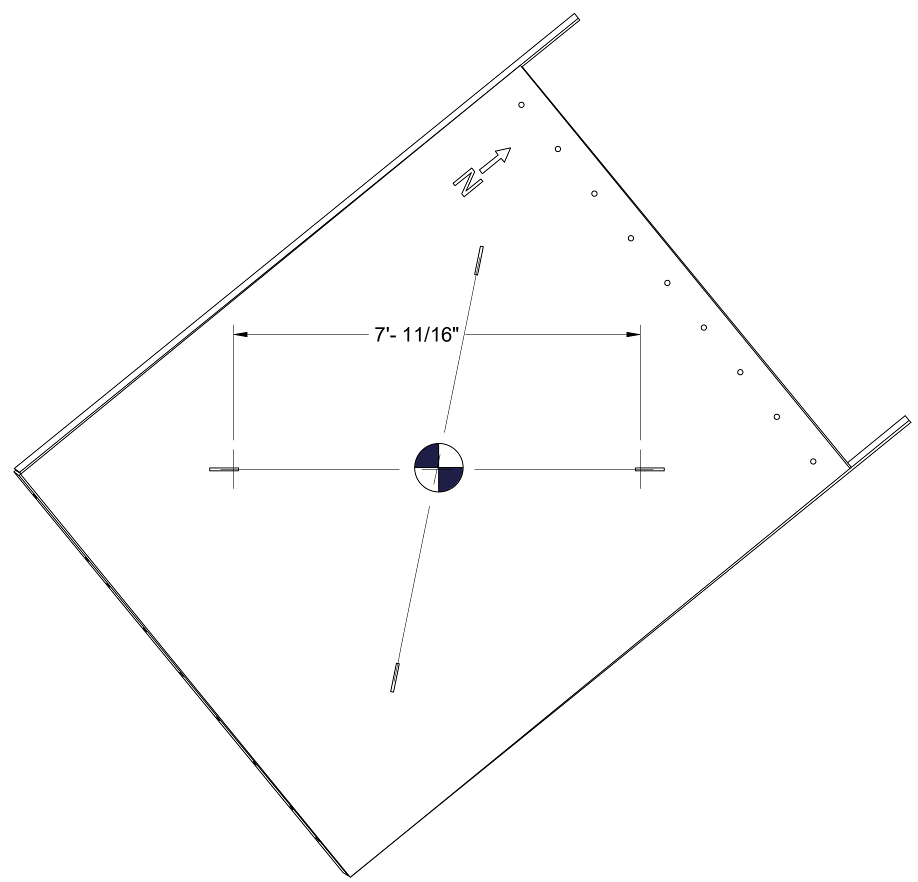
PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 18 11 09 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: Structural — Sk. Reg. No.: 14318 — Signature

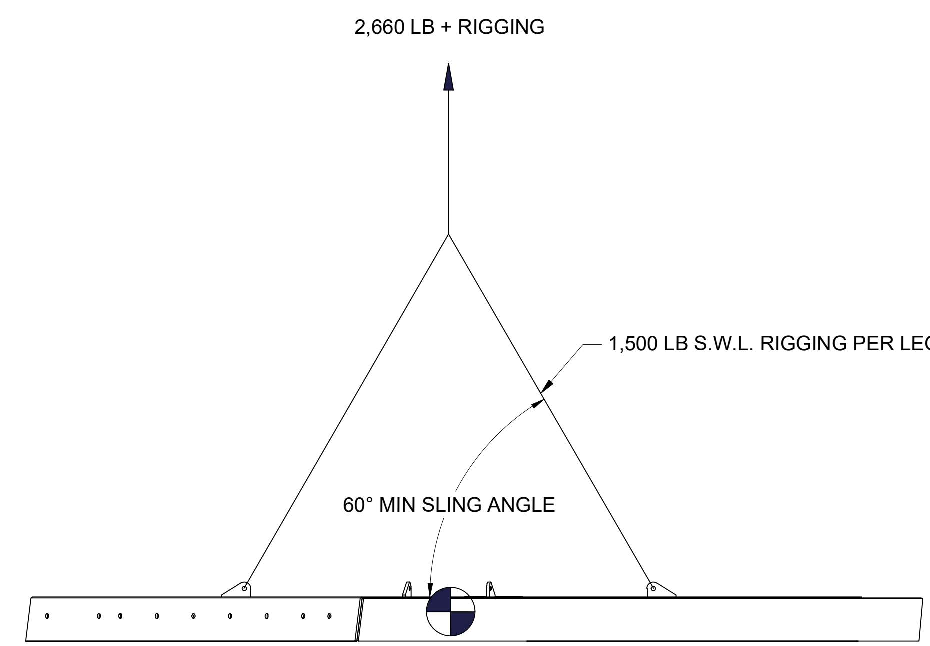
Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 8 OPENING
TOP COVER DETAILS
LOCATION: 59° 34' 1.8"N 108° 25' 17.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 4
DWG. NO.: P60236-05-3
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




TOP COVER LIFTING DIAGRAM
P60236-A-501




TOP COVER LIFTING DIAGRAM - SIDE VIEW
P60236-A-501



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
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| | | △1 | AS BUILT DETAILS | 09/Nov/18 | NR |
| | | △0 | ISSUED FOR CONSTRUCTION | 04/Jan/18 | AR |
| P60236-07 | KOVA DWG. - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/17 | AR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | AR |
| DATE: | 08/Nov/17 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
18 11 09
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 8 OPENING
LIFTING DETAILS
LOCATION: 59° 34' 1.8"N 108° 25' 17.7"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 4
DWG. NO.: P60236-05-4 △1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

Cameco

# Beaverlodge Ace Mine Property

## Ace Vent Raise 105 Closure Cap Design

| Active Drawing Status | Drawing Title | Rev | Date |
|---|---|---|---|
| ACE18-00 | Title Sheet | AB-1 | February 19, 2019 |
| ACE18-01 | Project Location Map | AB-1 | February 19, 2019 |
| ACE18-02 | As-Built General Arrangement Site Plan | AB-1 | February 19, 2019 |
| ACE18-03 | As-Built Plan and Sections | AB-1 | February 19, 2019 |
| ACE18-04 | Vent Raise CAP As-Built Construction Steps | AB-1 | February 19, 2019 |
| ACE18-05 | Completion of North Berm As-Built Construction Steps | AB-1 | February 19, 2019 |

srk consulting

Project Number: 2CC009.007
Date: February 19, 2019
Drawing Number: ACE18-00

1_SITES\Beaverlodge\!040_AutoCAD\Ace Vent Raise Closure Design\2CC009.007 – title.dwg



\\SSK-SVR0.SSK.NA.SRK.AD\Saskatoon Projects\01_SITES\Beaverlodge\020_Site-Wide_Data\GIS\Maps\Figure Maps\1CC007_062_ace_remed_fig_01_location_map_FOR_ACAD.mxd

P:\01_SITES\Beaverlodge\040_AutoCAD\Ace Vent Raise Closure Design\2CC009.007 - Site Plan.dwg

| DRAWING NO. | DRAWING TITLE | NO. | DESCRIPTION | CHK'D | APP'D | DATE | NO. | DESCRIPTION | CHK'D | APP'D | DATE |
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| | | | | | | | AB-1 | As-Built | TPP | MWL | 19/02/19 |
| | | | | | | | A | Issued for Review | TPP | BM | 18/01/29 |

REFERENCE DRAWINGS | REVISIONS

PROFESSIONAL ENGINEERS STAMP: PROFESSIONAL ENGINEER, T.P.G. ... MEMBER 20380, SASKATCHEWAN, 2019 02 19 (YR. MM. DAY)

srk consulting

| DESIGN: TPP | DRAWN: TAH | REVIEWED: TPP |
|---|---|---|
| CHECKED: TPP | APPROVED: MWL | DATE: 2019/02/19 |

FILE NAME: 2CC009.007 - Site Plan.dwg

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Beaverlodge

SRK JOB NO.: 2CC009.007

Ace Subsidence and Vent Raise 105 Remediation

DRAWING TITLE: Project Location Map

DRAWING NO.: ACE18-01 | SHEET: 2 OF 5 | REVISION NO.: AB-1


## LEGEND

- Flow Direction
- Vertical Projection of Stope Outline
- 105 Stope, Elev. 265.5m
- Interim As-Built of North and South Berms
- As-Built Extents of North Berm Extension and Ace 7 #105 Closure Cap

## NOTES

1. Interim as-built crests and toes of North and South berms are based on the August 31, 2016 survey. This survey was completed using a Leica Global Navigation Satellite System (GNSS/GPS) unit. The North Berm Extension as-built toes and crests are based on the August 24, 2018 survey, which was completed using a handheld GPS.
2. A vertical projection method from the Stope Back was used to locate the stopes. (SRK Memo, Beaverlodge Property Ace Mine - 2016 Subsidence Remediation - Optimization Study, August 2016).
3. 105 Stope Elev. 265.5m digitized from Eldorado Mining and Refining Ltd. Beaverlodge Operation. "105 #2 Raise", drawn by KAR, July 26.

## REFERENCE

NAD83 UTM Zone 12.
SRK Drone Imagery, 2016.

0m 10 20 30 40 50

| DRAWING NO. | DRAWING TITLE |
|---|---|
| REFERENCE DRAWINGS | |

| NO. | DESCRIPTION | CHK'D | APP'D | DATE |
|---|---|---|---|---|
| AB-1 | As-Built | TPP | MWL | 19/02/19 |
| A | Issued for Review | TPP | BM | 18/01/29 |

REVISIONS

PROFESSIONAL ENGINEER T.P.S. [illegible] MEMBER 20360 2019 02 19 YR. MM. DAY SASKATCHEWAN

PROFESSIONAL ENGINEERS STAMP

srk consulting

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| DESIGN: TPP | DRAWN: TAH | REVIEWED: TPP |
| CHECKED: TPP | APPROVED: MWL | DATE: 2019/02/19 |

FILE NAME: 2CC009.007 - OV.dwg

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Beaverlodge

SRK JOB NO.: 2CC009.007

Ace Subsidence and Vent Raise 105 Remediation

DRAWING TITLE:
As-Built General Arrangement
Site Plan

DRAWING NO.: ACE18-02 | SHEET: 3 OF 5 | REVISION NO.: AB-1

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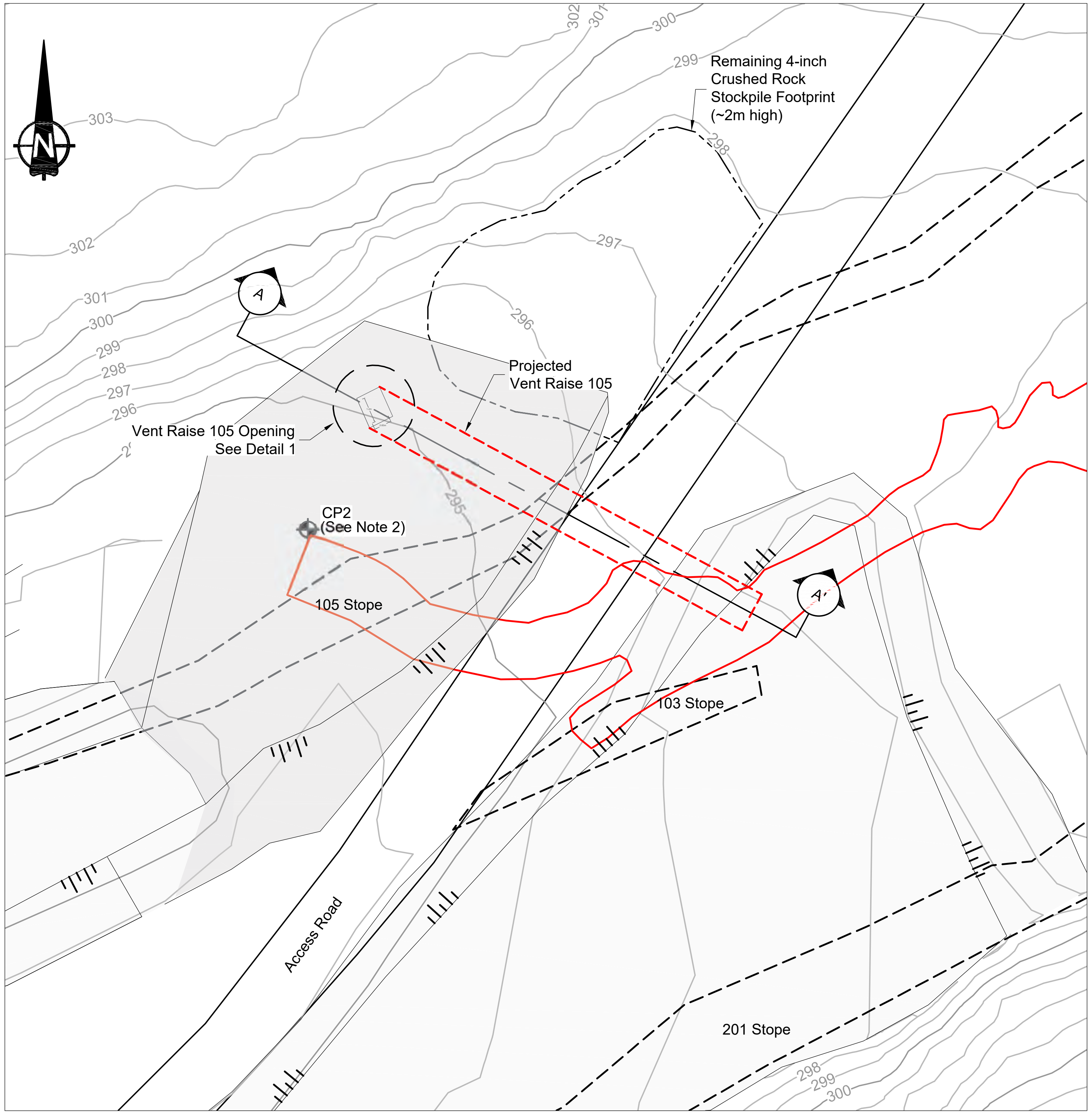
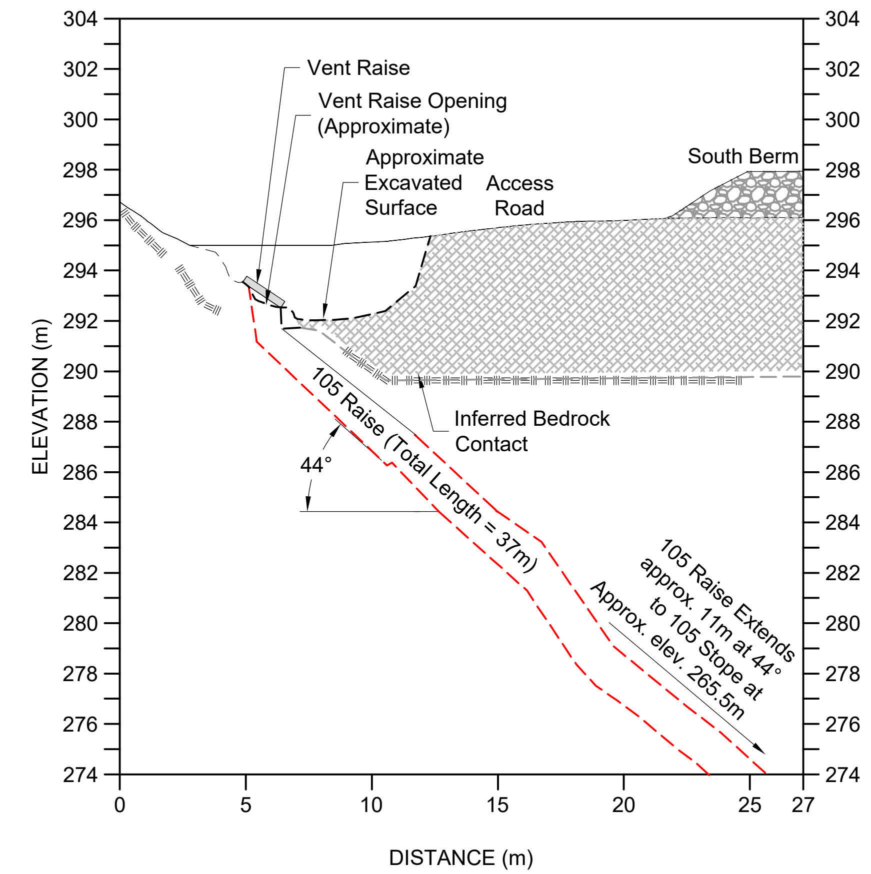


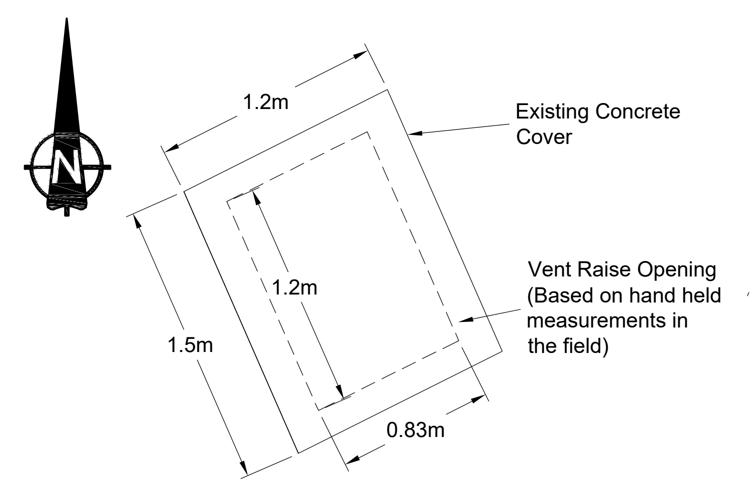

Vent Raise 105 Plan View

0m 3 6 9 12



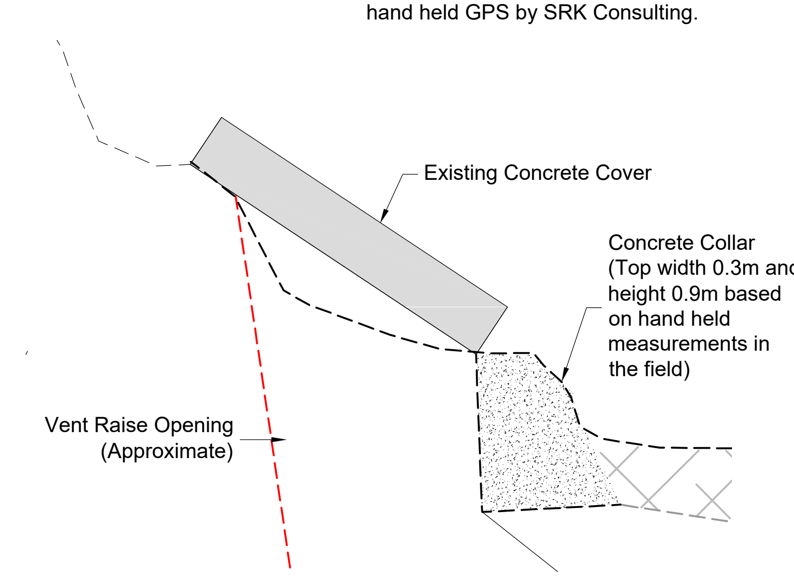

A Cross Section A-A'

0m 3 6 9 12




Vent Raise Opening Plan View

0m 0.5 1.0 1.5




Vent Raise Opening Looking North

0m 0.5 1.0 1.5

## LEGEND

- Overburden, Mine Waste Rock and Tailings
- Berm Backfill
- Stockpile Footprint
- 105 Stope, Elev. 265.5m
- Vertical Projection of Stope Outline
- Bedrock

## NOTES

1. Underground and 105 Raise extents were digitized using Cross Section 5+25W from the "Beaverlodge Property Ace Mine - 2016 Subsidence Remediation - Optimization Study" dated March 1, 2017
2. CP2 is a projected vertical drill hole that hit a void 8.3m below ground surface / drill hole collar (1983 Surface Pillar Investigation). It also denotes overburden thickness
3. Vent raise opening location surveyed by SRK Consulting, July 2016.
4. Bedrock surface in vicinity of Vent Raise 105 based on work completed by Kova Engineering Saskatchewan Ltd. (Drawing Number S17550-03-2, Rev. 0).
5. 105 Stope Elev. 265.5m digitized from Eldorado Mining and Refining Ltd. Beaverlodge Operation. "105 #2 Raise", drawn by KAR, July 26.

## REFERENCE

Contours shown at 1.0m intervals and are based on 2009-2010 LiDAR survey, 2016 As-built survey by SRK Consulting, and 2018 As-built survey completed using a hand held GPS by SRK Consulting.

| DRAWING NO. | DRAWING TITLE | NO. | DESCRIPTION | CHK'D | APP'D | DATE | NO. | DESCRIPTION | CHK'D | APP'D | DATE |
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| | | | | | | | AB-1 | As-Built | TPP | MWL | 19/02/19 |
| | | | | | | | A | Issued for Review | TPP | BM | 18/01/29 |
| REFERENCE DRAWINGS | | REVISIONS | | | | | | | | | |

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DESIGN: TPP DRAWN: TAH REVIEWED: TPP

CHECKED: TPP APPROVED: MWL DATE: 2019/02/19

FILE NAME: 2CC009.007 - PP.dwg

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Beaverlodge

SRK JOB NO.: 2CC009.007

Ace Subsidence and Vent Raise 105 Remediation

DRAWING TITLE: Vent Raise Opening Sections and Details

DRAWING NO. ACE18-03 SHEET 4 OF 5 REVISION NO. AB-1

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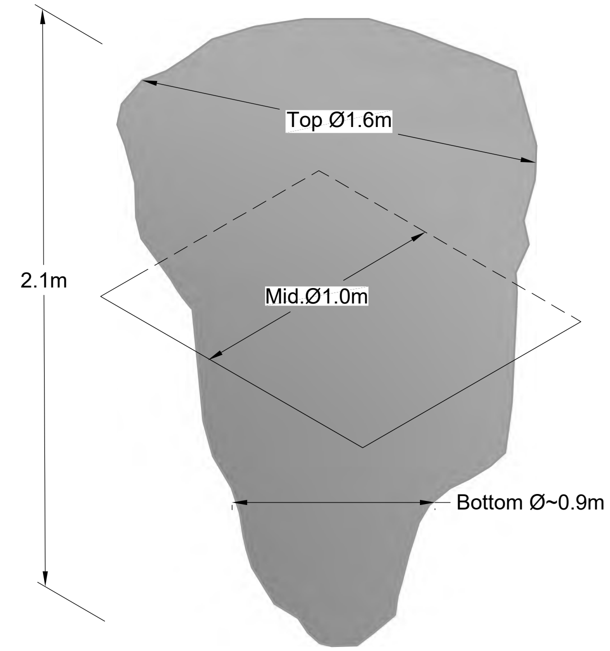
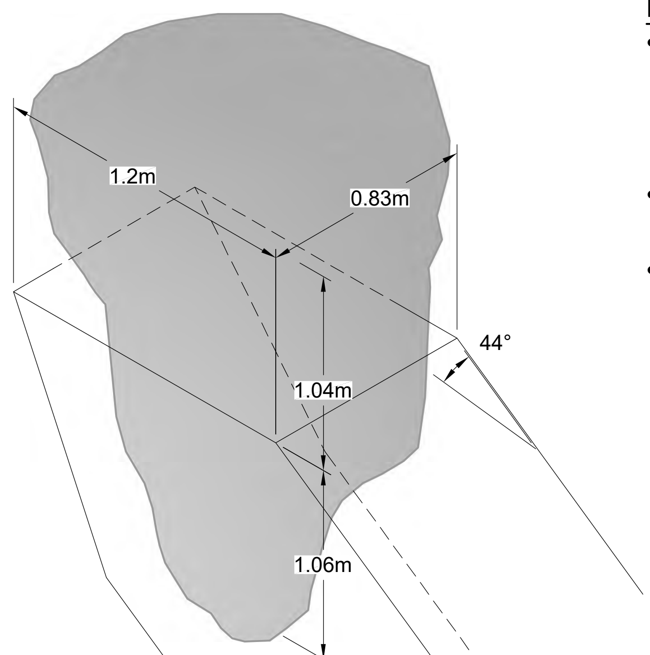



S□□□ □□S□□r□□ B□□□d□r□

0m 0.3 0.6 0.9 1.2

## NOTES

- Boulders were physically inspected by the Engineer to confirm they were competent and adequate for use.
- The boulder selected for placement / wedging in the vent raise opening met the top dimension and smaller bottom dimension as specified in the design (SRK 2018). Actual dimensions of this boulder are shown in Steps 1 and 2.
- The 3 additional boulders required for Step 4 had the following dimensions, which were approved by the Engineer:
  - Rectangular shape (1.8m long x 2.0m wide x 1.6m thick)
  - Cone shape (2m long x 1.6m diameter)
  - Cone shape (1.9m long x 1.3m diameter)

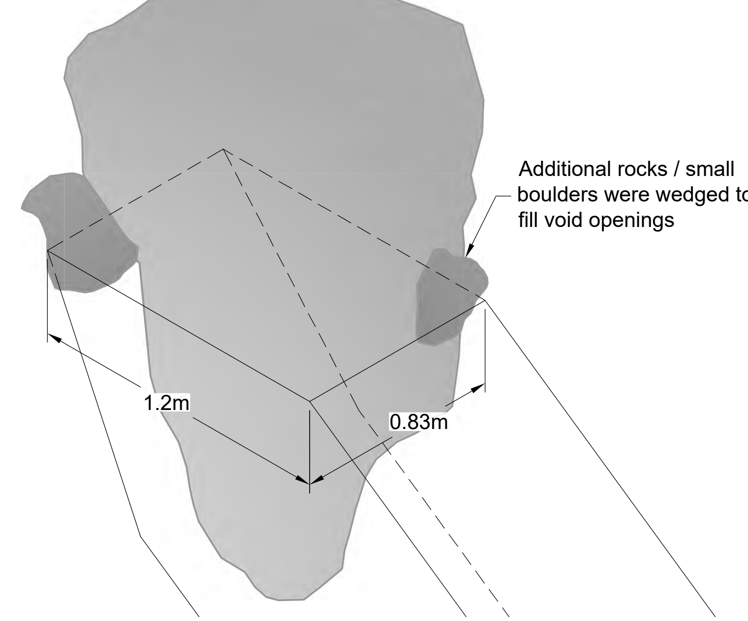



S□□□ □□W□d□□ B□□□d□r □□ O□□□□□□

0m 0.3 0.6 0.9 1.2

## NOTES

- Details of the boulder placed / wedged in the vent raise opening is shown in Step 2. The boulder extended 1.06m into the void and had a 1.04m stickup above the void which met the design requirements (SRK 2018).
- Light hydraulic pressure from the excavator bucket was used to wedge and secure the boulder in the opening.
- Final placement and wedging of the boulder was inspected and approved by the Engineer prior to Step 3.

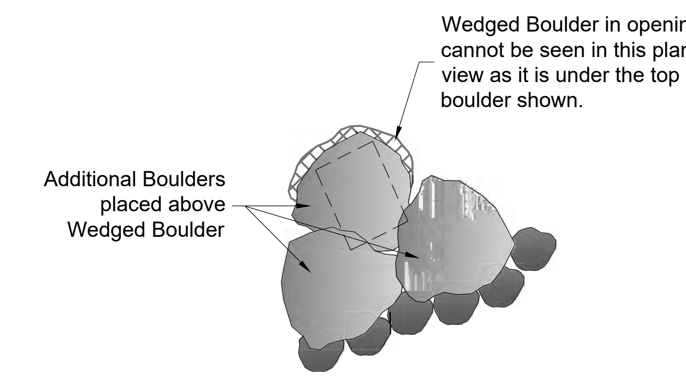



S□□□ □□W□d□□□ □□S□□□□□W□□□□ R□□□ □□
R□□ □□□□□ V□d□ (□ □□r□ R□□□□r□d)

0m 0.3 0.6 0.9 1.2

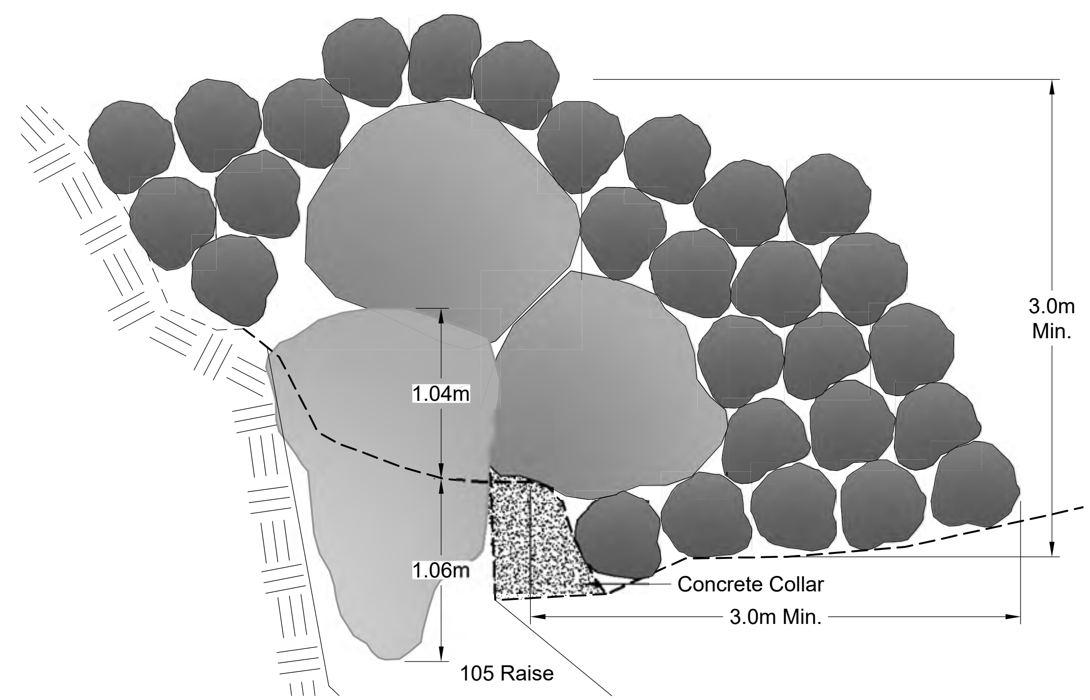
## NOTES

- Once the boulder is placed, there were some void spaces between the boulder and the opening. These voids were filled by wedging select rocks in a similar manner as described in Step 2.
- At times, manual effort was used with a small sledge hammer to wedge the select rock securely in the void.
- Final placement of the select rocks was inspected and approved by the Engineer prior to Step 4.




S□□□ □□P□□□ C□□□□□r□□□□ □□□□r□
P□□□□□ C□□r□□ W□□□□ R□□□ B□□□□□□

0m 1 2 3 4




S□□□ □□P□□□ Add□□□□□□B□□□d□r□ □□d
C□□r□□ W□□□□ R□□□ B□□□□□□

0m 0.5 1.0 1.5 2.0

## NOTES

- Coarse rocks / boulders with a minimum diameter of 0.6m were placed to a thickness of approximately 0.6m along the base of the excavation. This material extended to the perimeter extents of the excavation, which was approximately 3.0m laterally from the concrete Collar. Material was placed using an excavator.
- Subsequently, the three additional large boulders were placed as shown in Step 4. The top boulder was placed directly above the primary boulder placed in the vent raise opening.
- Final placement of the coarse rocks / boulders and the three additional boulders was inspected and approved by the Engineer.

## REFERENCE

Existing ground surface based on 2009-2010 LiDAR survey, and 2016 As-built survey by SRK Consulting.
SRK Consulting (Canada) Inc. (SRK 2018). Beaverlodge Property Ace Mine. Ace 7 105 #2 - Vent Raise Closure Design. Project Number 2CC009.007. Memorandum prepared for Cameco Corporation, January 29, 2018.

| NO. | DESCRIPTION | CHK'D | APP'D | DATE |
|---|---|---|---|---|
| AB-1 | As-Built | TPP | MWL | 19/02/19 |
| A | Issued for Review | TPP | BM | 18/01/29 |

REVISIONS

| DRAWING NO. | DRAWING TITLE |
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REFERENCE DRAWINGS

PROFESSIONAL ENGINEER T.P. PERERA MEMBER 20380 2019 02 19 SASKATCHEWAN
PROFESSIONAL ENGINEERS STAMP

srk consulting

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|---|---|---|
| DESIGN: TPP | DRAWN: TAH | REVIEWED: TPP |
| CHECKED: TPP | APPROVED: MWL | DATE: 2019/02/19 |

FILE NAME: 2CC009.007 - Cover Design.dwg

Cameco
Beaverlodge
SRK JOB NO.: 2CC009.007

Ace Subsidence and Vent Raise 105 Remediation
DRAWING TITLE: Vent Raise CAP As-Built Construction Steps
DRAWING NO.: ACE18-04
SHEET: 4 OF 5
REVISION NO.: AB-1

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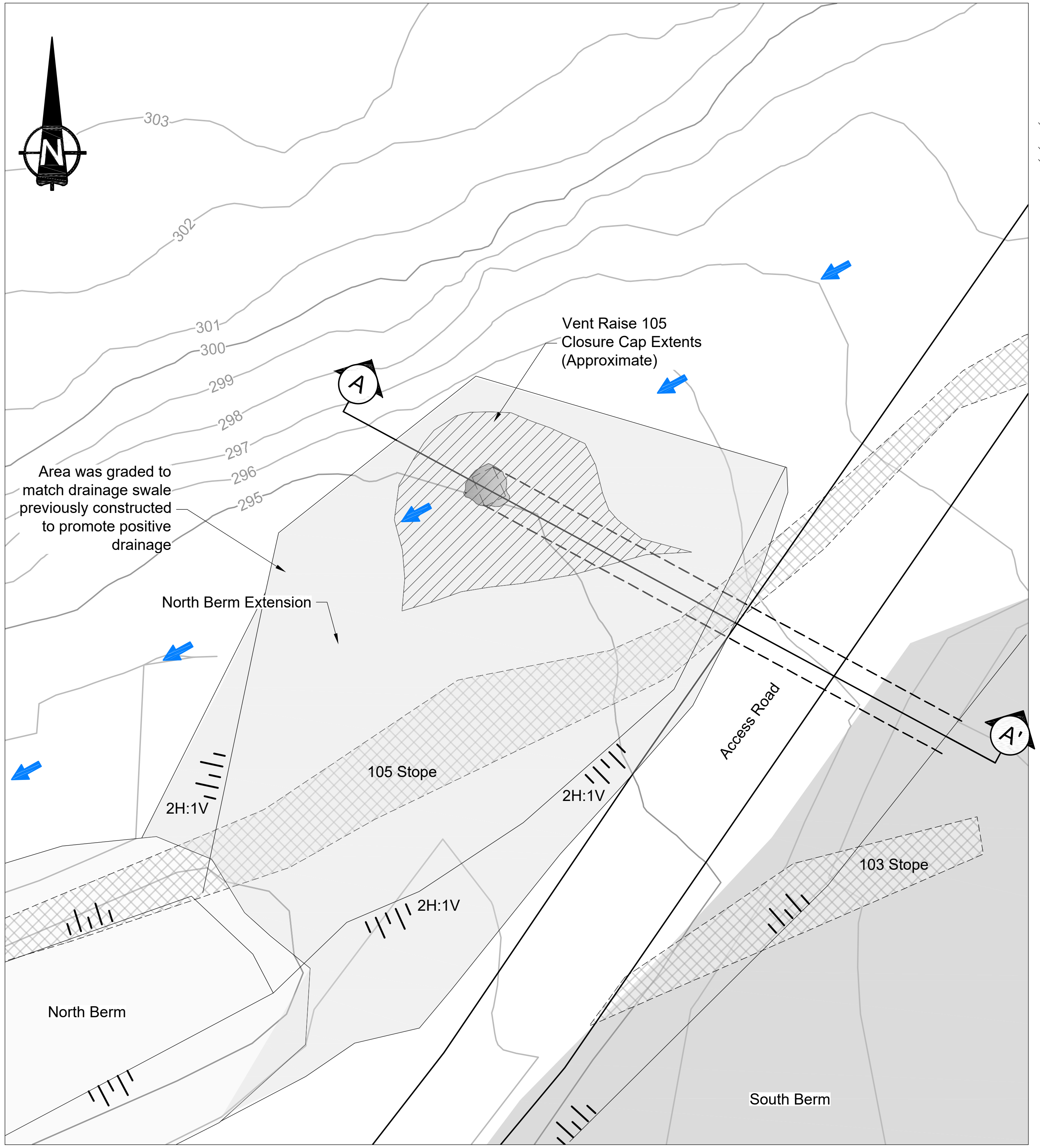
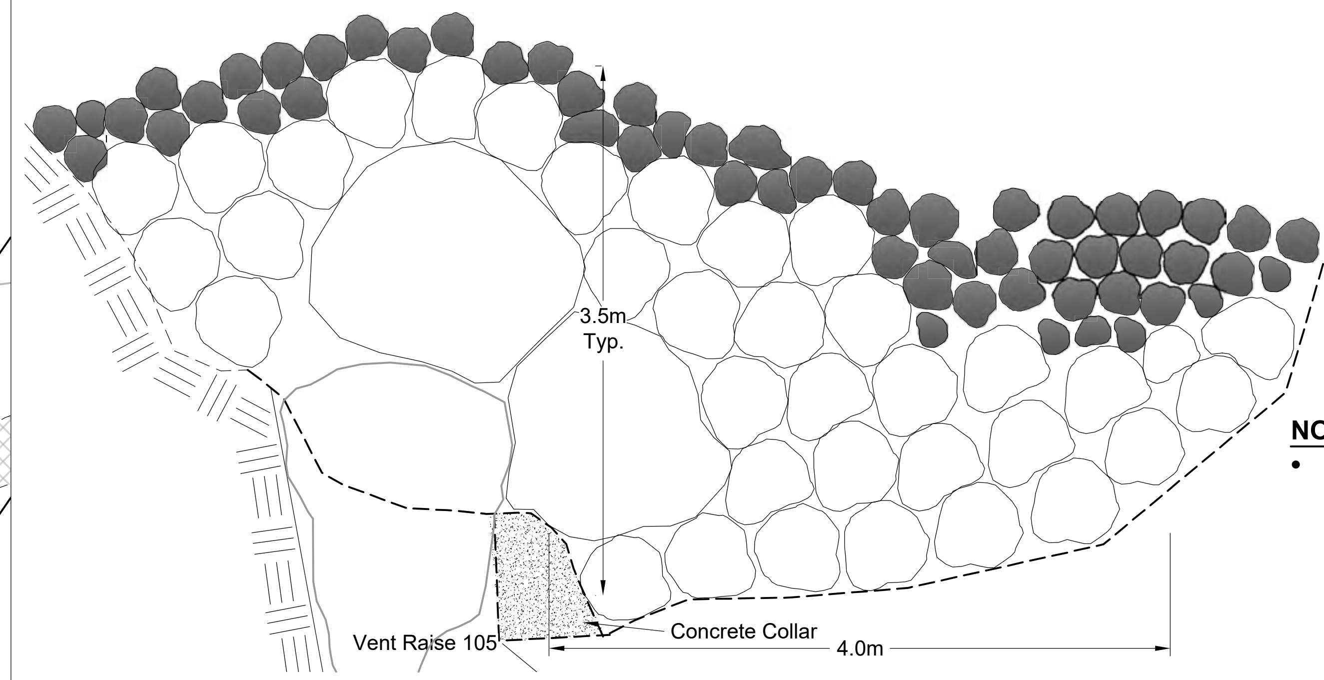



V[illegible] R[illegible] C[illegible] [illegible]d N[illegible]r[illegible] B[illegible]r[illegible] E[illegible]

0m 2 4 6 8

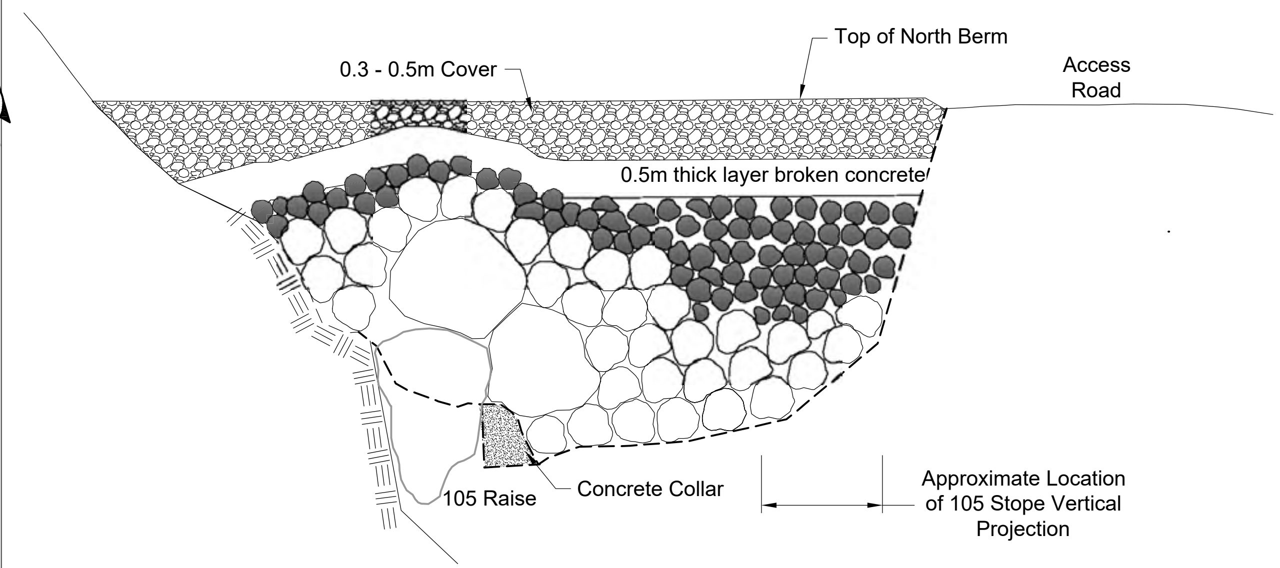



S[illegible] P[illegible] Tr[illegible] R[illegible] B[illegible]

0m 0.5 1.0 1.5 2.0

## NOTES

- Transition rock with a minimum diameter of 0.3m was placed until the coarse rock was fully encapsulated as shown in Step 5.

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0m 1 2 3 4

## NOTES

- The North Berm Extension was completed in accordance with SRK Memorandum "Beaverlodge Property Ace Mine - 2016 Subsidence Remediation - Optimization Study".
- The 4-inch minus crushed rock used as the final cover was already stockpiled on site, which was originally sourced from the Fay Mine Area. The final thickness ranged from 0.3m to 0.5m.

## LEGEND

Flow Direction

Cover

## REFERENCE

Existing ground surface based on 2009-2010 LiDAR survey, and 2016 As-built survey by SRK Consulting.

| DRAWING NO. | DRAWING TITLE | NO. | DESCRIPTION | CHK'D | APP'D | DATE | NO. | DESCRIPTION | CHK'D | APP'D | DATE |
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| | | | | | | | AB-1 | As-Built | TPP | MWL | 19/02/19 |
| | | | | | | | A | Issued for Review | TPP | BM | 18/01/29 |

REFERENCE DRAWINGS — REVISIONS

PROFESSIONAL ENGINEER T.P.P. MEMBER 20380 2019 02 19 SASKATCHEWAN

PROFESSIONAL ENGINEERS STAMP

srk consulting

DESIGN: TPP · DRAWN: TAH · REVIEWED: TPP
CHECKED: TPP · APPROVED: MWL · DATE: 2019/02/19
FILE NAME: 2CC009.007 - Cover Design.dwg

Cameco

Beaverlodge

SRK JOB NO.: 2CC009.007

Ace Subsidence and Vent Raise 105 Remediation

DRAWING TITLE: Completion of North Berm As-Built Construction Steps

DRAWING NO.: ACE18-05 · SHEET 5 OF 5 · REVISION NO. AB-1

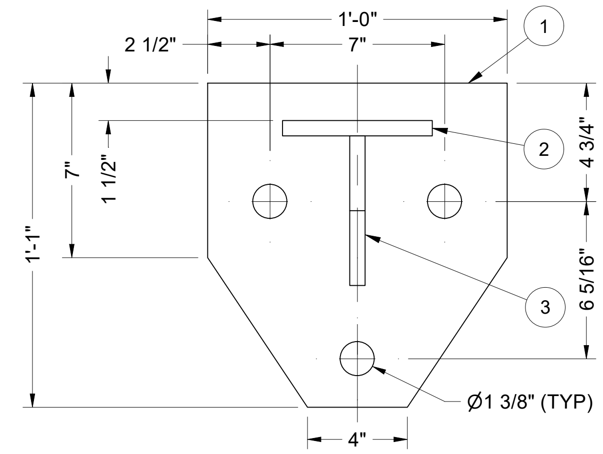
P:\01_SITES\Beaverlodge\1040_AutoCAD\Ace Vent Raise Closure Design\2CC009.007 - Cover Design.dwg

# 2019 Cover Installations

# 2019 Stainless Steel Cover Details

2019 Stainless Steel Cover Details

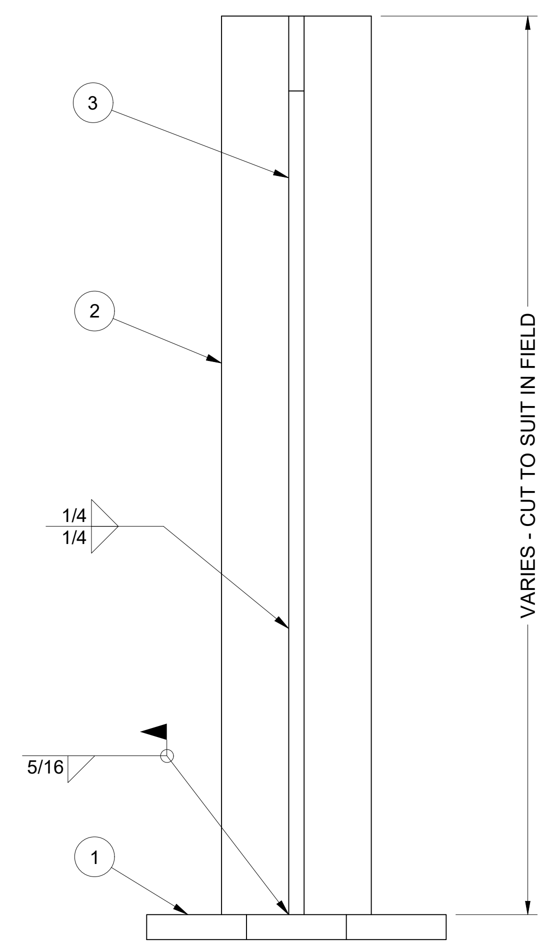
GENERAL NOTES:
1. ALL STRUCTURAL PLATE MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESS TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION
4. ALL WELD JOINTS TO BE FIELD PICKLED UNDER THE SUPERVISION OF KOVA PERSONNEL.
5. FINAL FABRICATION TO BE INSPECTED BY KOVA ENGINEERING PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
6. CONTRACTOR / FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
7. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
8. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.



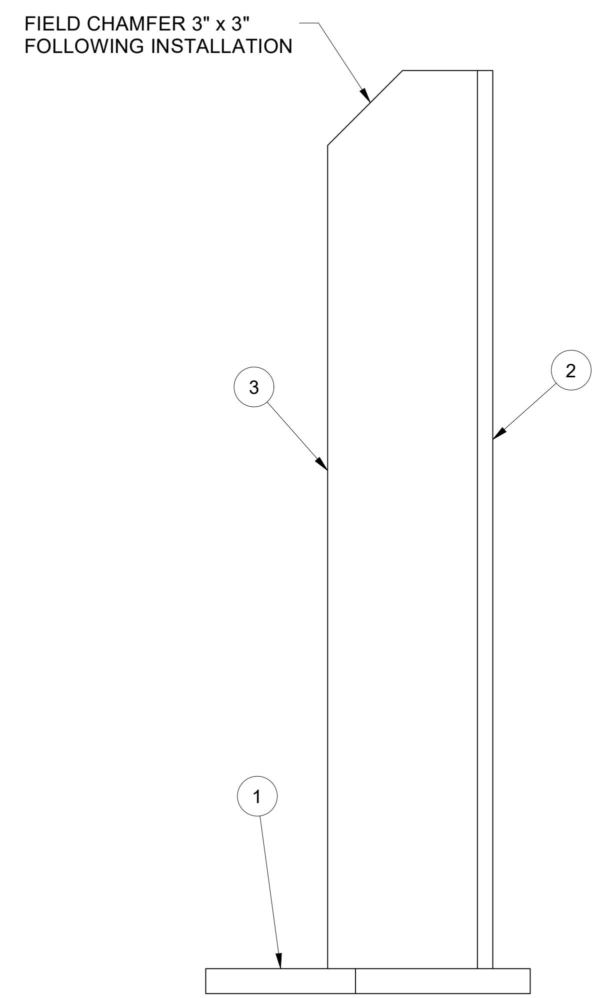

TOP VIEW

BILL OF MATERIALS

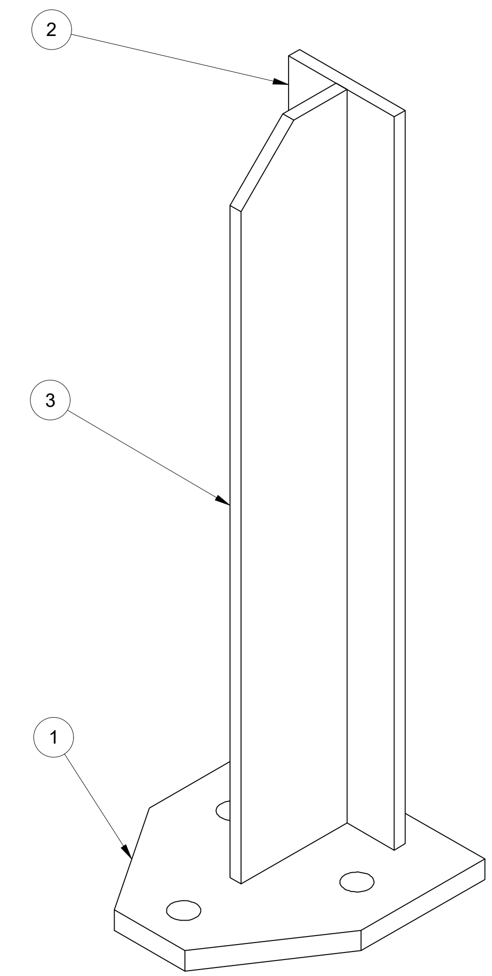
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
|---|---|---|---|---|---|
| 1 | 1 | 1" PL | | ASTM A240-316L | |
| 2 | 1 | 6" x 5/8" FB | | ASTM A240-316L | |
| 3 | 1 | 6" x 5/8" FB | | ASTM A240-316L | |




COLUMN DETAIL




SIDE VIEW




ISO VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 2 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 1 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-08 & 09 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: A.R.
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
C. COUGHLIN
MEMBER 14318
20 02 04
YR. MN. DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

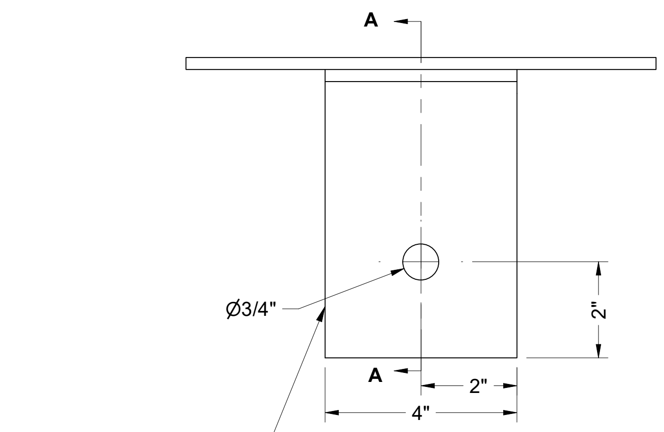
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

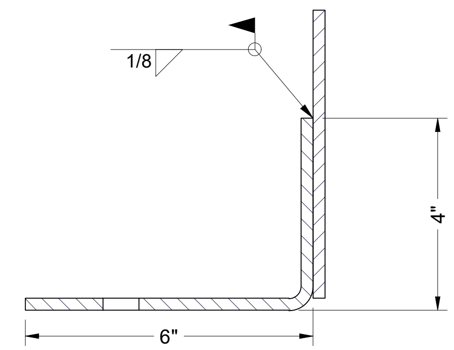
PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
COLUMN DETAILS & NOTES
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 4
DWG. NO.: P60236-10-1
REV: 1

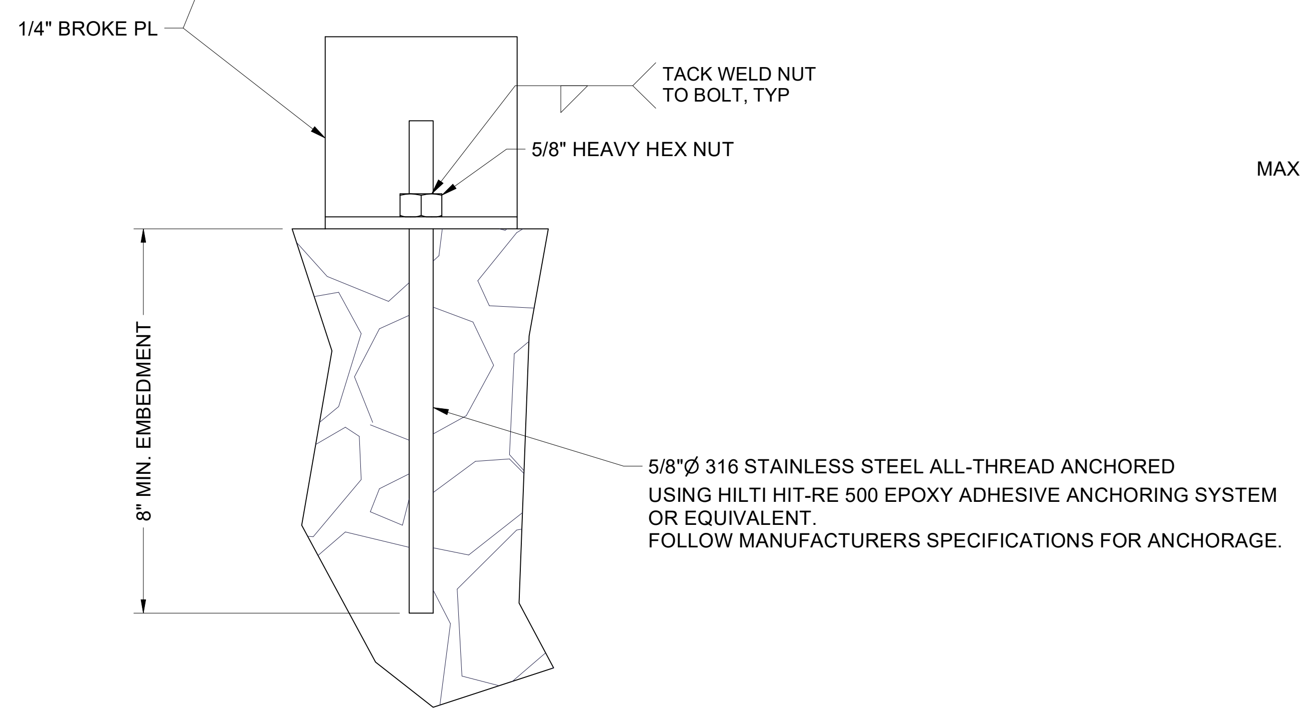
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



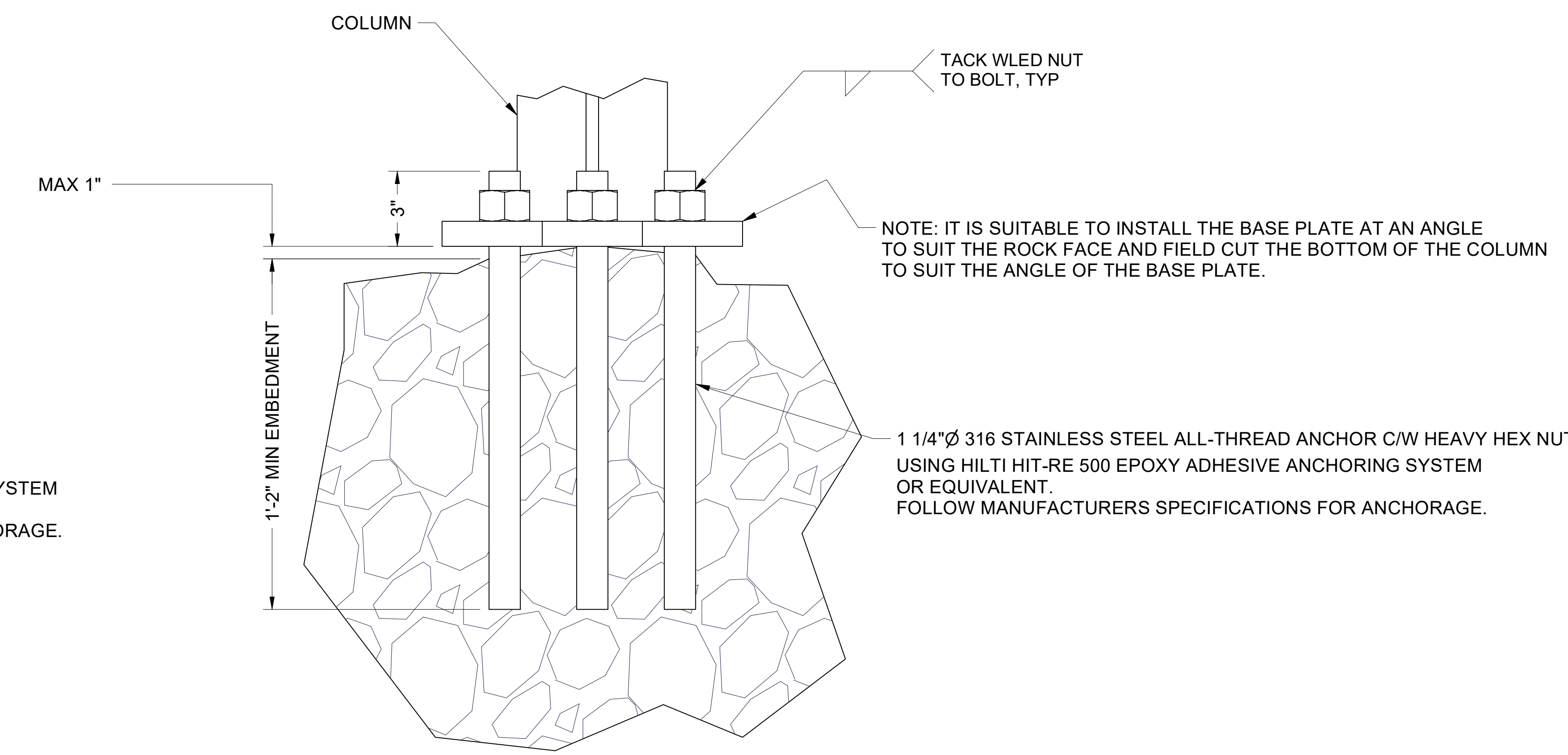

TOP VIEW




SECTION A-A




TYPICAL SKIRT ANCHOR DETAIL




TYPICAL COLUMN ANCHOR BOLT DETAIL



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-08 & 09 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
MEMBER 14318
20 02 04
YR. MN. DAY
SASKATCHEWAN

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Kova Engineering (Saskatchewan) Ltd.
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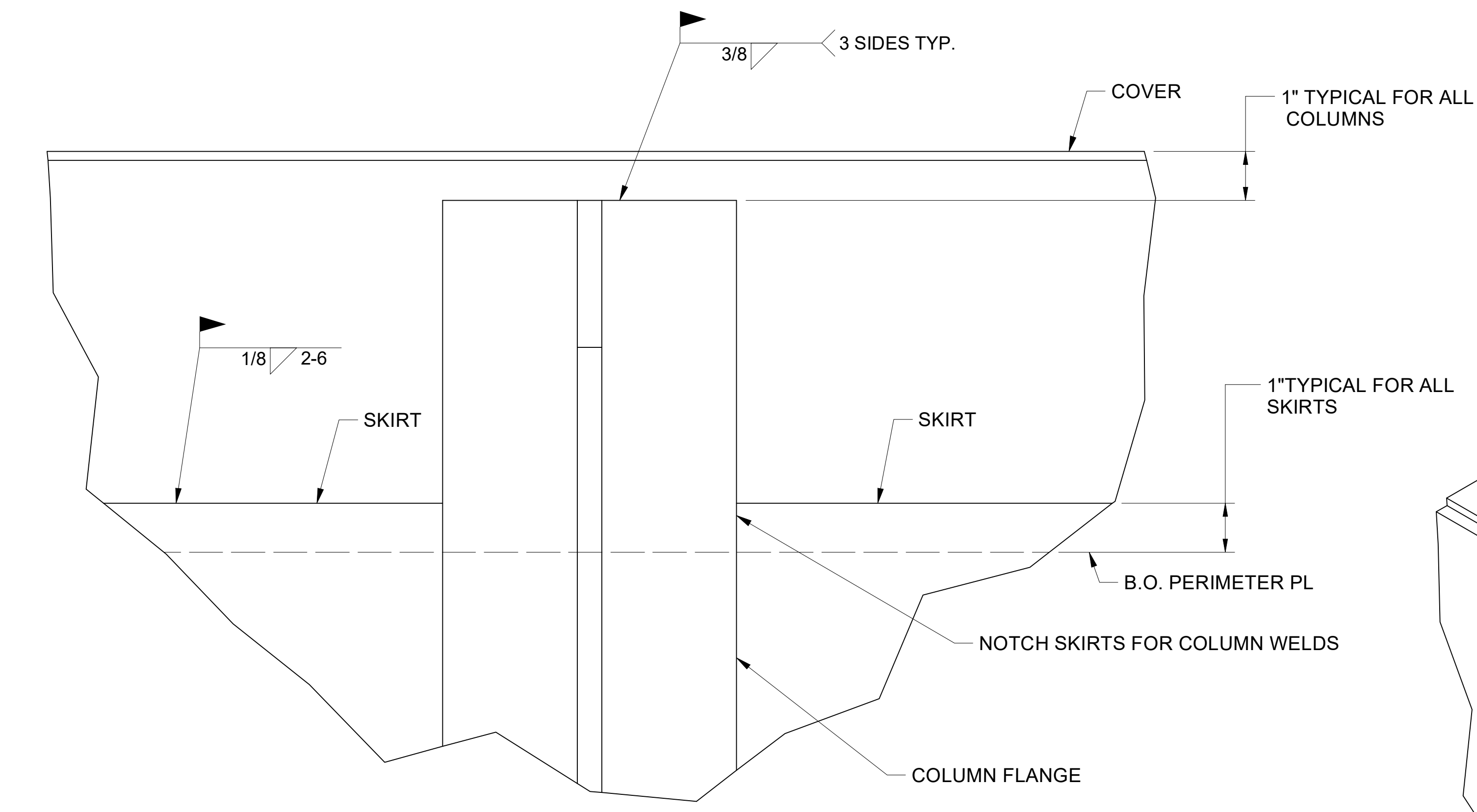
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

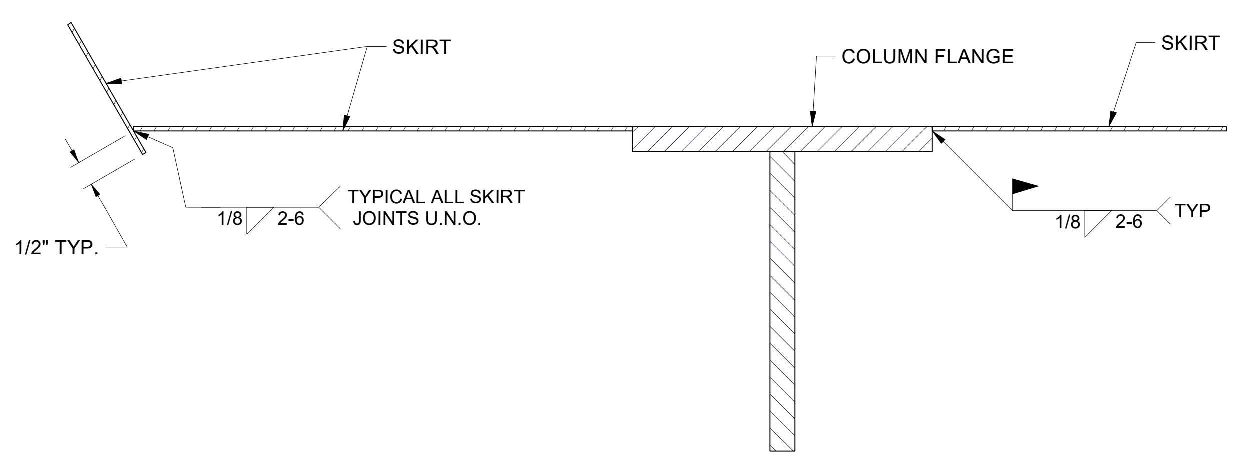
PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
ANCHOR DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 4
DWG. NO.: P60236-10-2
REV 1

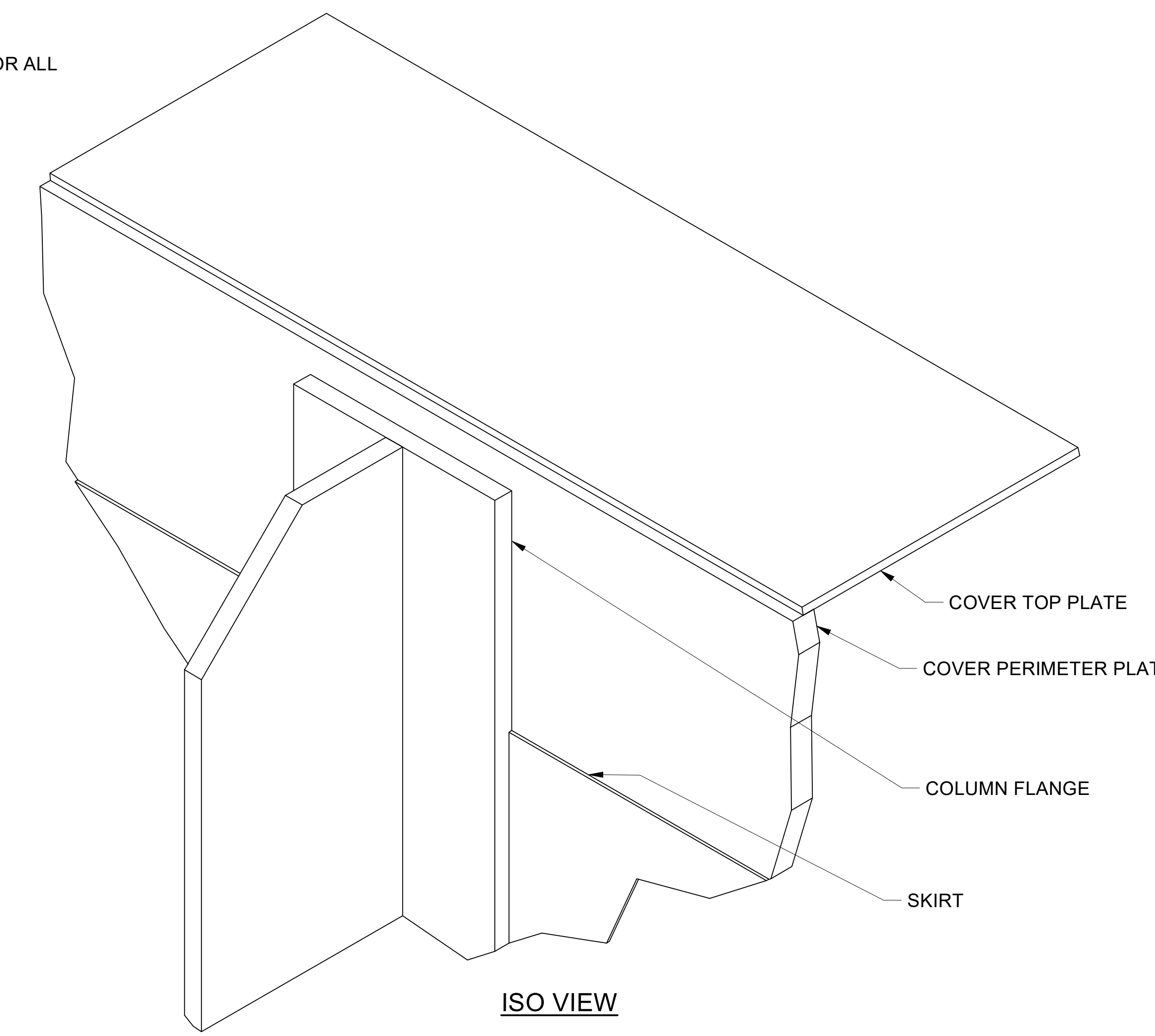
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




WELDING COLUMN AND SKIRT TO COVER




SKIRT WELDING




ISO VIEW



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-08 & 09 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

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ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Number C672
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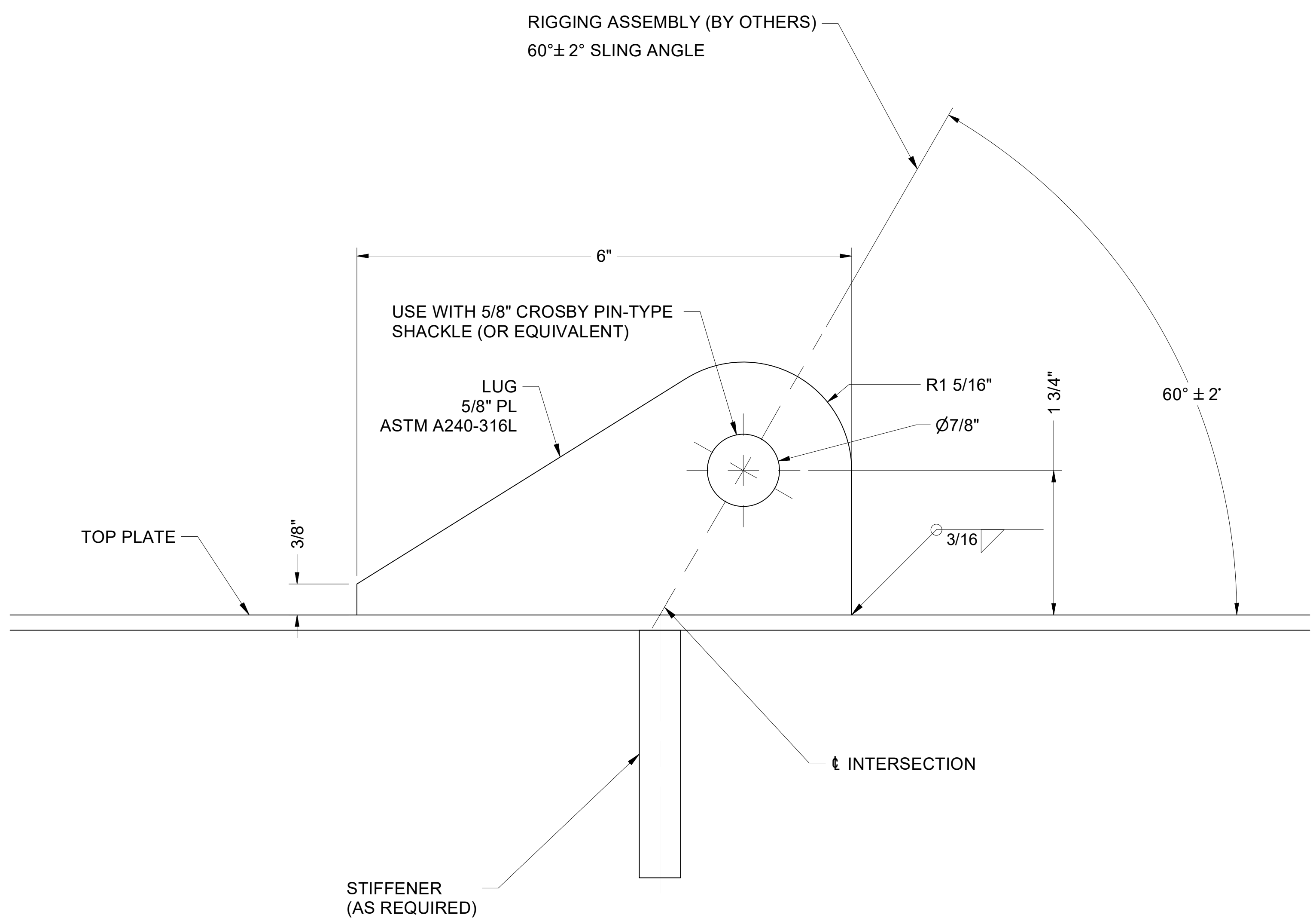
| Structural | 14318 | |

Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
WELDING DETAILS
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 4
DWG. NO.: P60236-10-3
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




LUG DETAIL





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-08 & 09 | KOVA DWGS - COVERS FOR OPENINGS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | A.R. |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
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|---|---|---|
| Structural | 14318 | |

# Kova Engineering Saskatchewan Ltd.

PROJECT: BEAVERLODGE PERMANENT COVERS FOR OPENINGS - STANDARD DETAILS
LIFT LUG DESIGN
LOCATION: NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 4
DWG. NO.: P60236-10-4
1

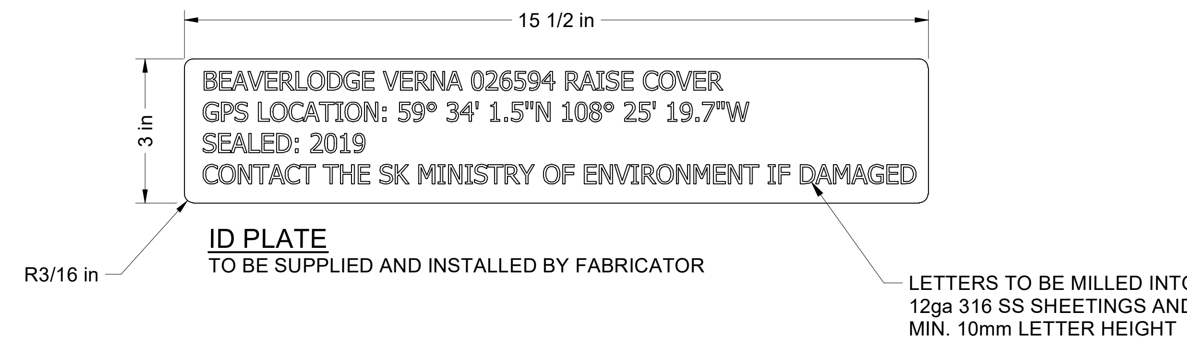
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# VERNA 2 – 026594 Raise Cover

VERNA 2 – 026594 Raise Cover

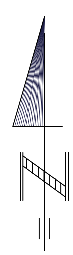
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED AND PASSIVATED IN ACCORDANCE WITH THE QA/QC PROTOCOL. KOVA PERSONNEL TO REVIEW SURFACES FOLLOWING PICKLING AND PASSIVATING.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
13. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
14. SEE DRAWING P60236-10 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

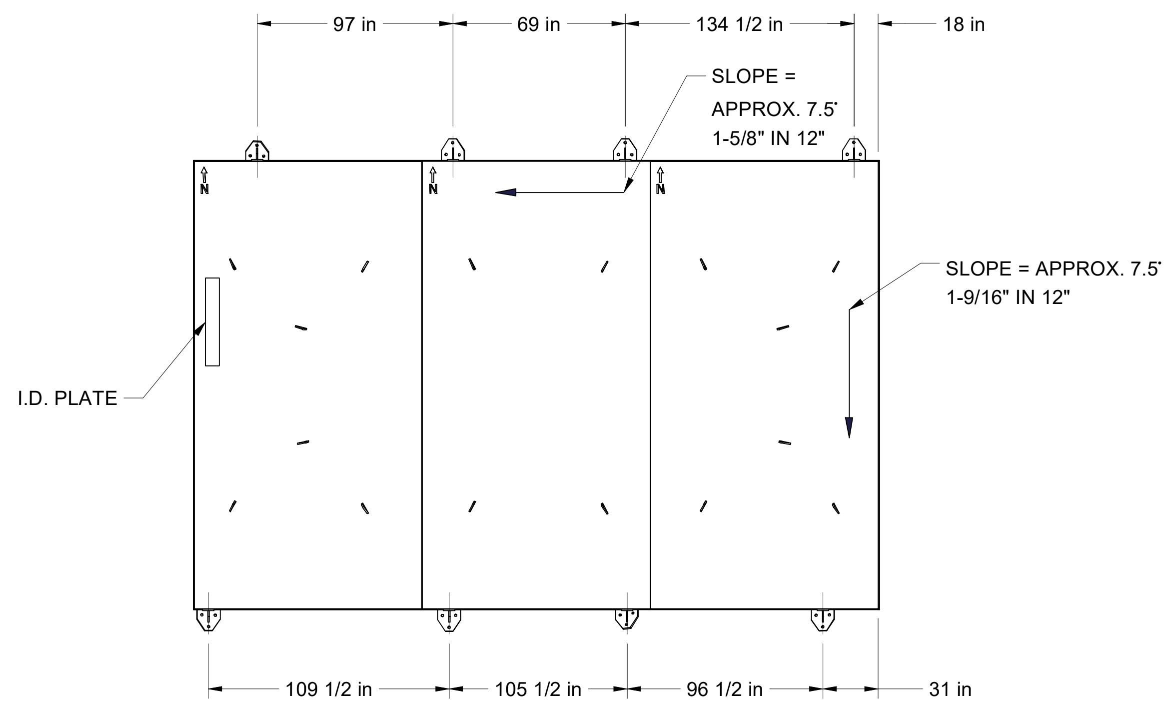
COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED SURFACES, CONSIDERING THE RESULTS OF THIS RESEARCH AND A CORROSION ALLOWANCE OF 1mm ON ANY SURFACE, THE COVER DEPICTED HAS AN ESTIMATED USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS PERIODIC INSPECTIONS BE PERFORMED AS RECOMMENDED IN THE QA/QC PROTOCOL.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 20,460 LBS.
5. DO NOT BACK FILL WALLS OF COVER.



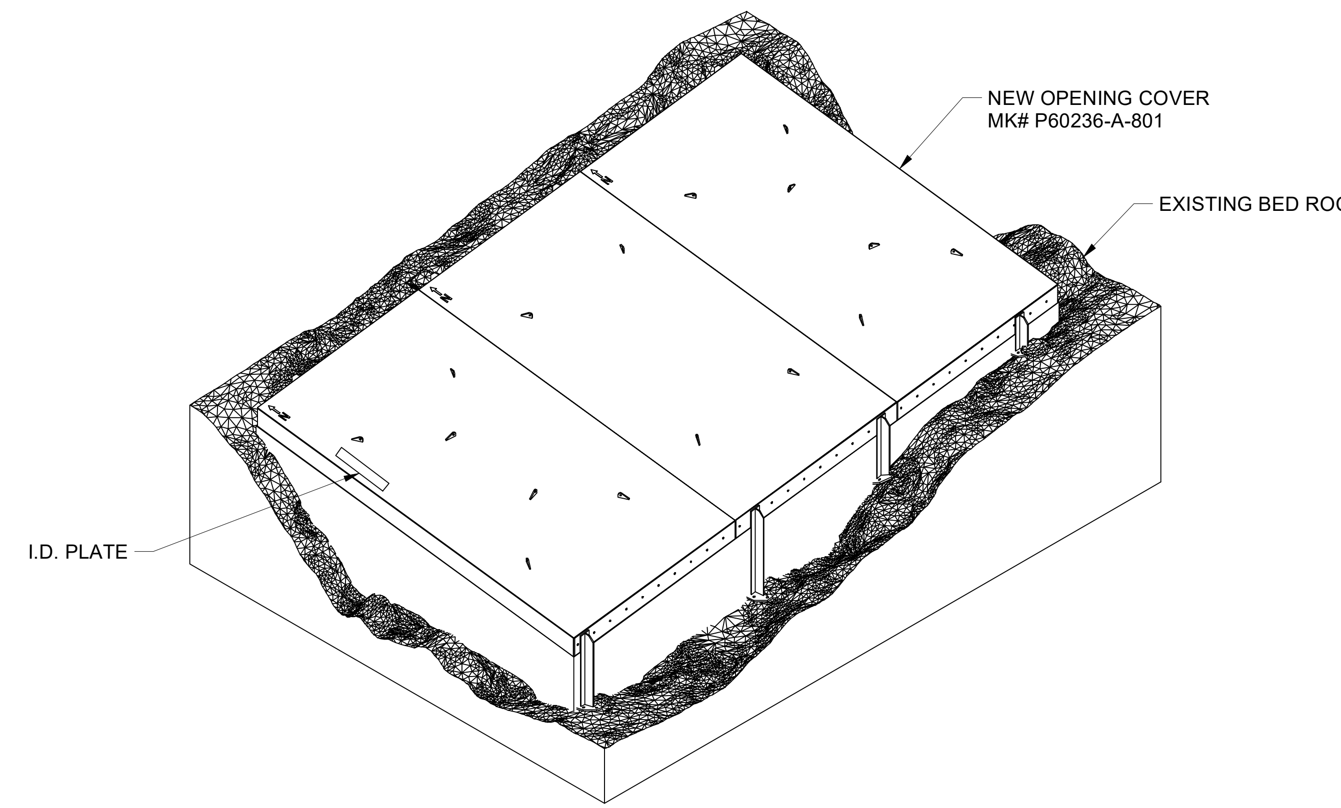

ID PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHS
TOP COVER W/O RIGGING: 17,780 LBS
AS INSTALLED: 20,460 LBS






PLAN VIEW - VERNA RAISE OPENING COVER




ISO VIEW
LOOKING NORTHEAST

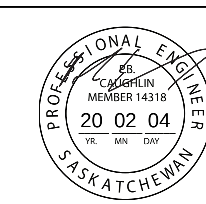




| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |




Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
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Number C672
Permission to Consult held by:

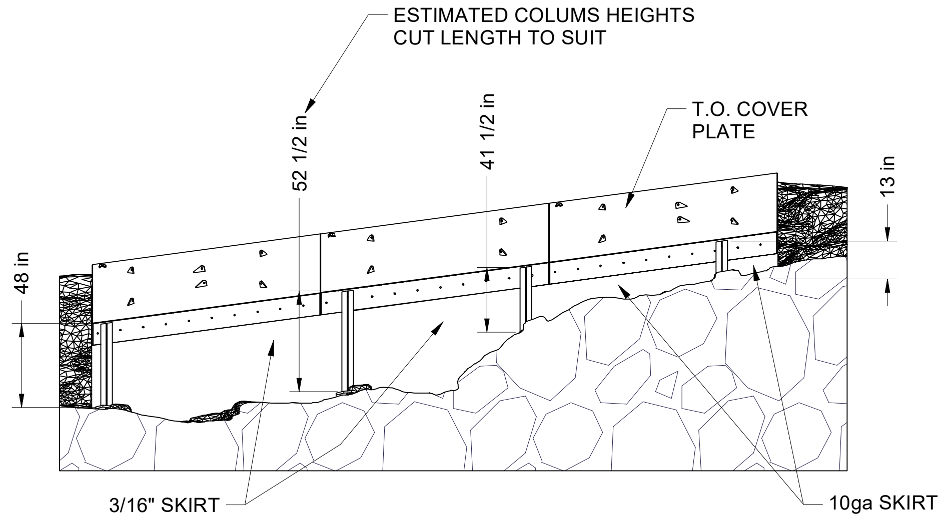
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

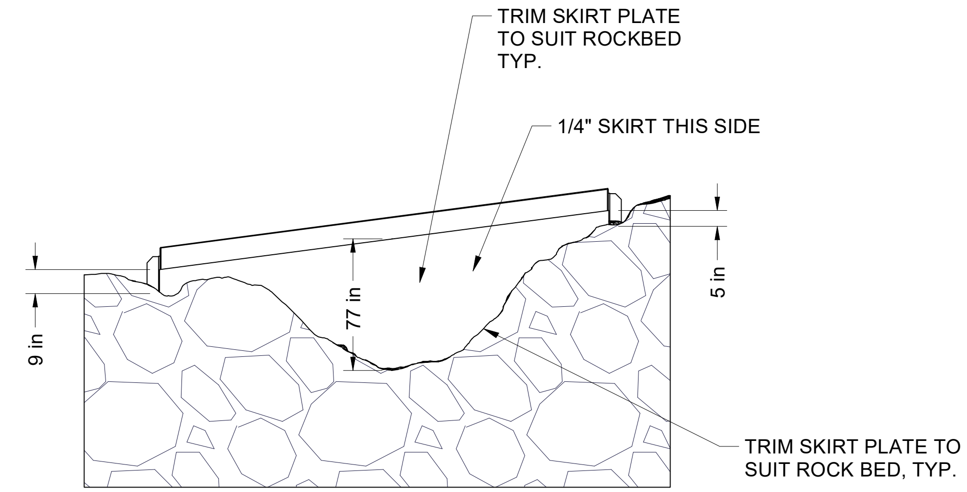
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-08-1 REV 1

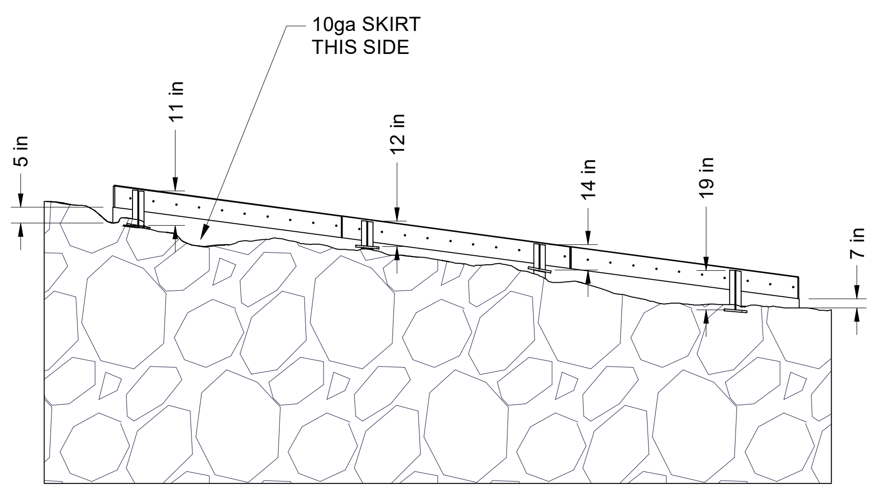
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



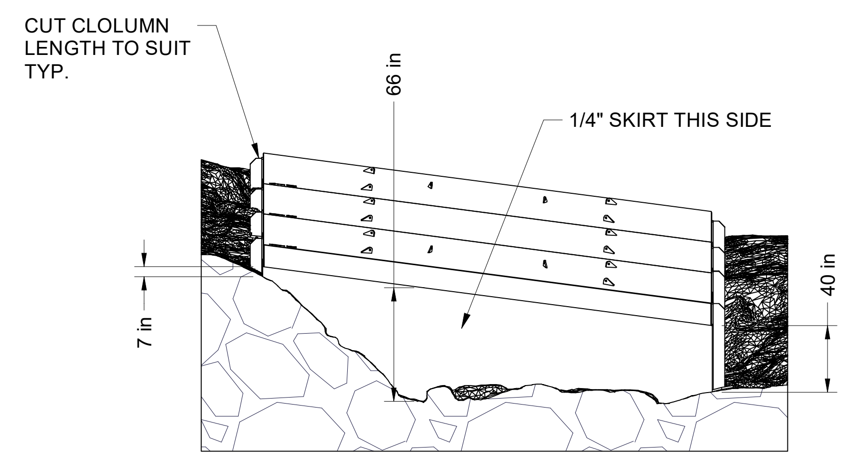

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 3 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 2 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | 1 | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
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MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
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Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

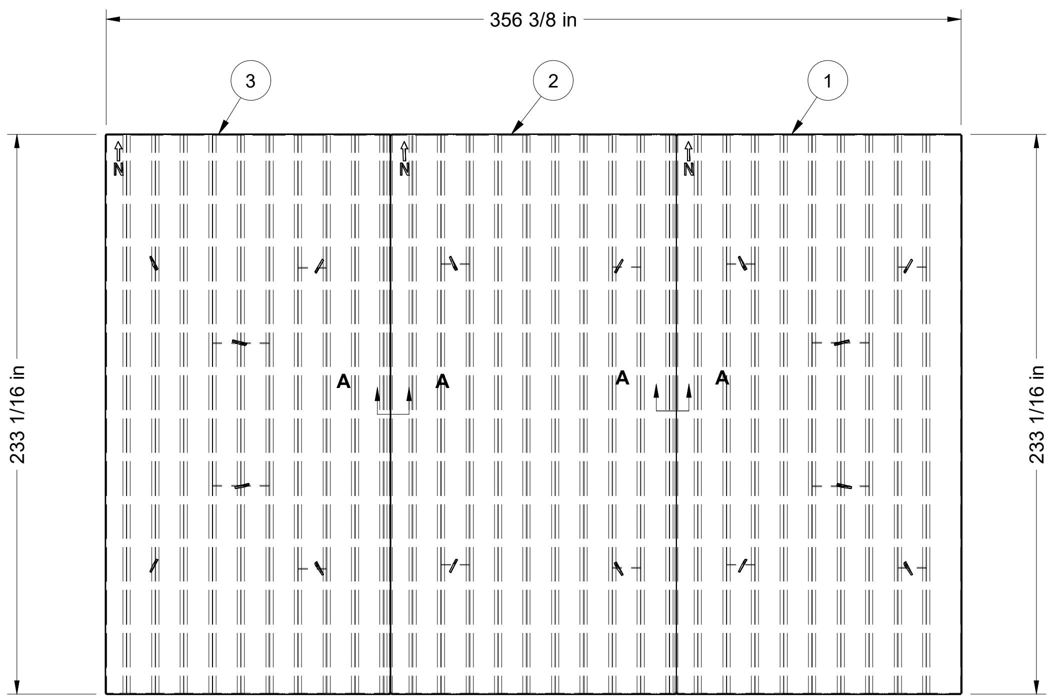
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

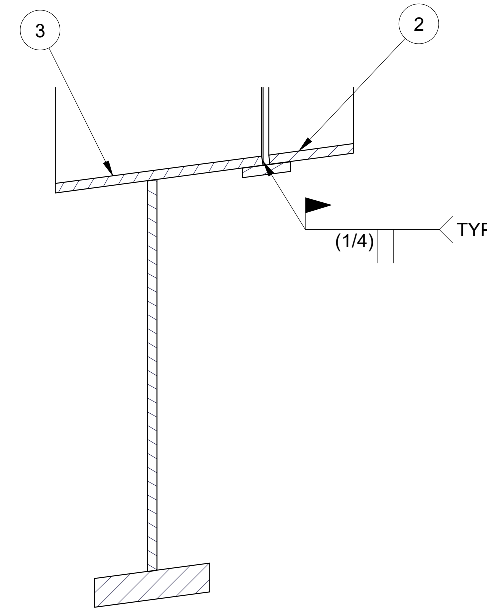
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-08-2
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

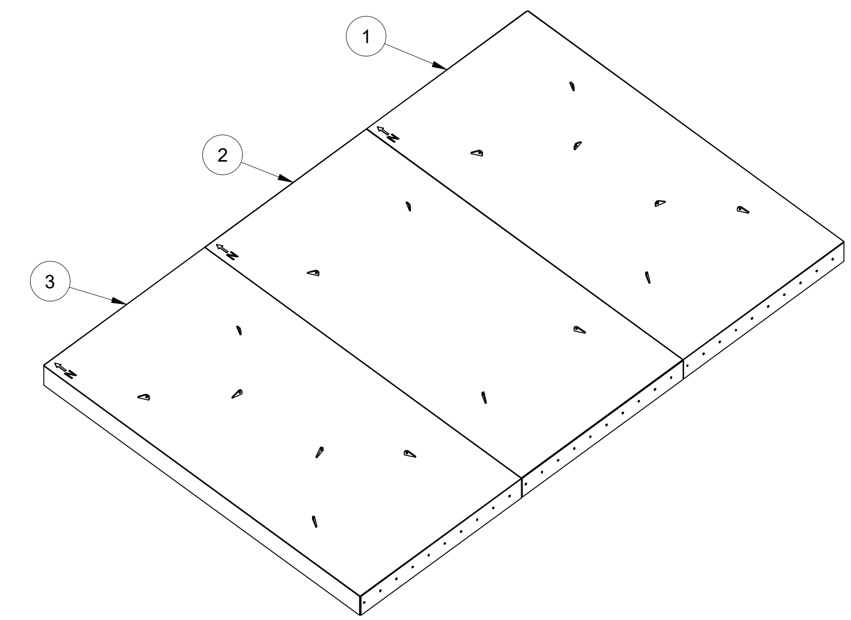
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | MK# P60236-A-802 | | 4 |
| 2 | 1 | COVER SECTION 3 | MK# P60236-A-803 | | 5 |
| 3 | 1 | COVER SECTION 2 | MK# P60236-A-804 | | 5 |



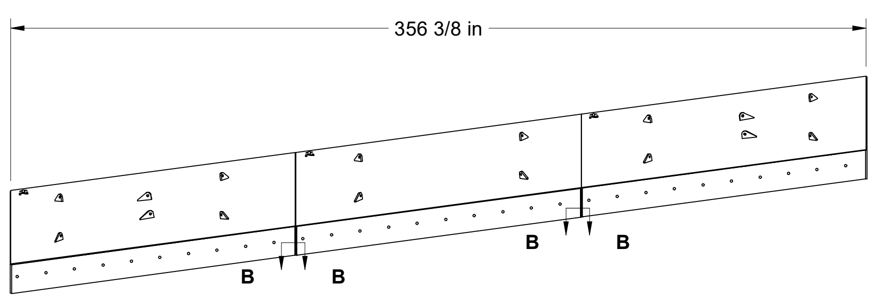

MK# P60236-A-801 - PLAN VIEW



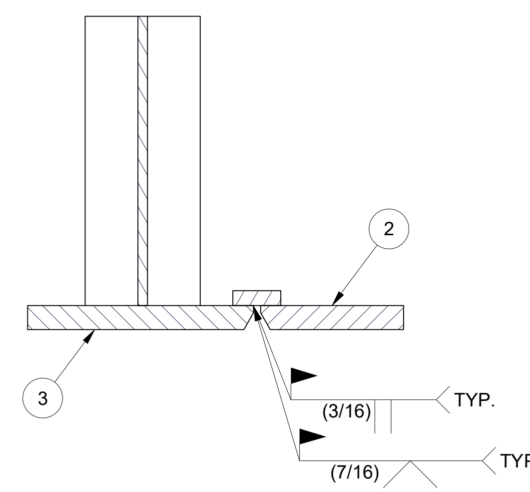

SECTION A-A




MK# P60236-A-801 - ISO VIEW




MK# P60236-A-801 - SIDE VIEW




SECTION B-B



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 3 | | | |
| | | 2 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 1 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | 0 | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 20 02 04 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

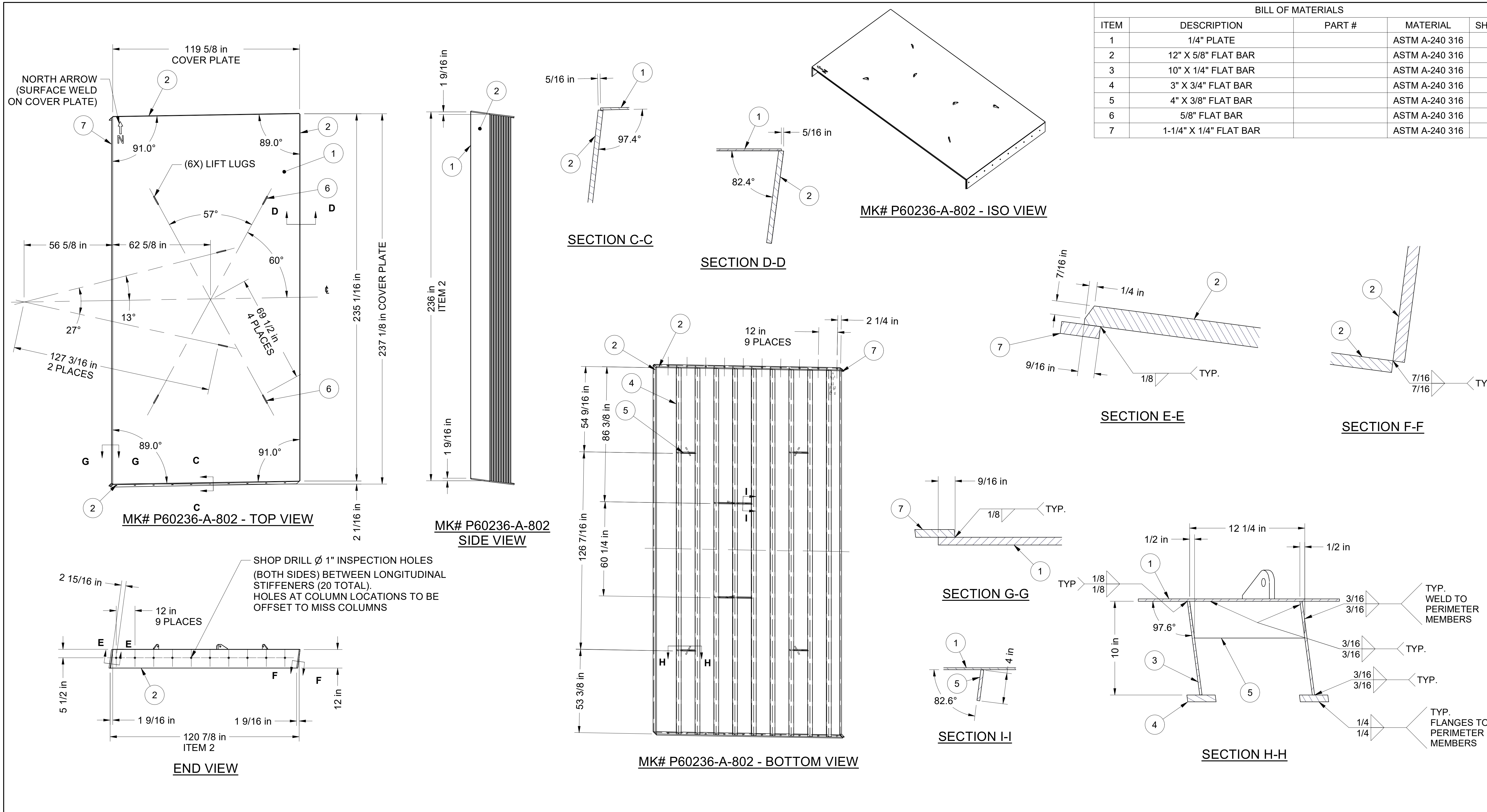
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING TOP COVER DETAILS
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-08-3
REV: 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PLATE | | ASTM A-240 316 | |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 | |
| 3 | 10" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 4 | 3" X 3/4" FLAT BAR | | ASTM A-240 316 | |
| 5 | 4" X 3/8" FLAT BAR | | ASTM A-240 316 | |
| 6 | 5/8" FLAT BAR | | ASTM A-240 316 | |
| 7 | 1-1/4" X 1/4" FLAT BAR | | ASTM A-240 316 | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 3 | | | |
| | | 2 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 1 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — MEMBER 14318 — SASKATCHEWAN — 20 02 04

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: Structural — Sk. Reg. No.: 14318 — Signature

**Kova Engineering (Saskatchewan) Ltd.**

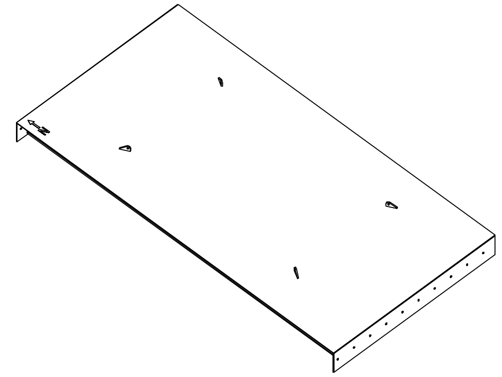
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING
TOP COVER SECTION -1 DETAIL
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 7
DWG. NO.: P60236-08-4 — REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

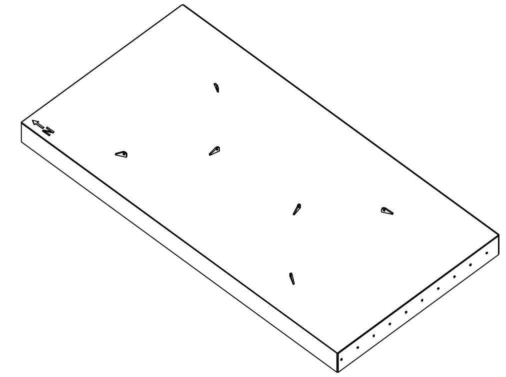
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PLATE | | ASTM A-240 316 | |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 | |
| 3 | 10" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 4 | 3" X 3/4" FLAT BAR | | ASTM A-240 316 | |
| 5 | 4" X 3/8" FLAT BAR | | ASTM A-240 316 | |
| 6 | 5/8" FLAT BAR | | ASTM A-240 316 | |

NOTE: SOME DETAILS AND VIEWS ARE ON PREVIOUS SHEET.

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PLATE | | ASTM A-240 316 | |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 | |
| 3 | 10" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 4 | 3" X 3/4" FLAT BAR | | ASTM A-240 316 | |
| 5 | 4" X 3/8" FLAT BAR | | ASTM A-240 316 | |
| 6 | 5/8" FLAT BAR | | ASTM A-240 316 | |
| 7 | 1-1/4" X 1/4" FLAT BAR | | ASTM A-240 316 | |



MK# P60236-A-803 - ISO VIEW



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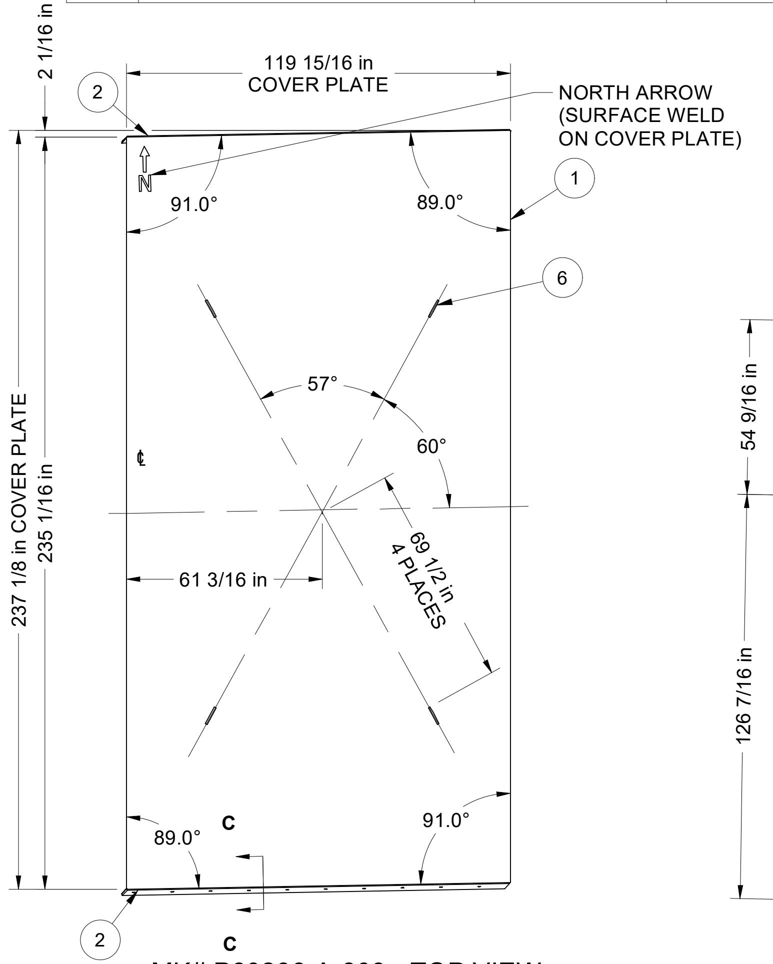


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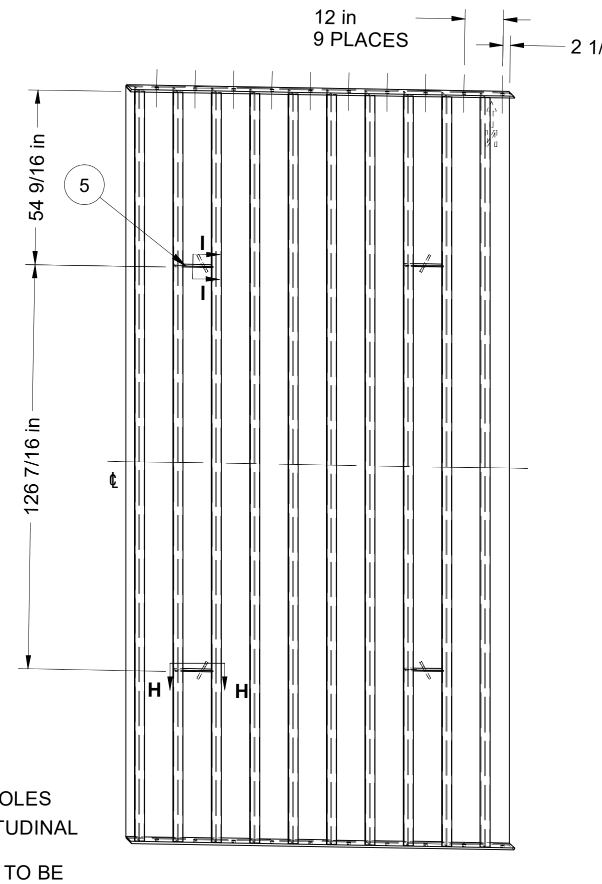
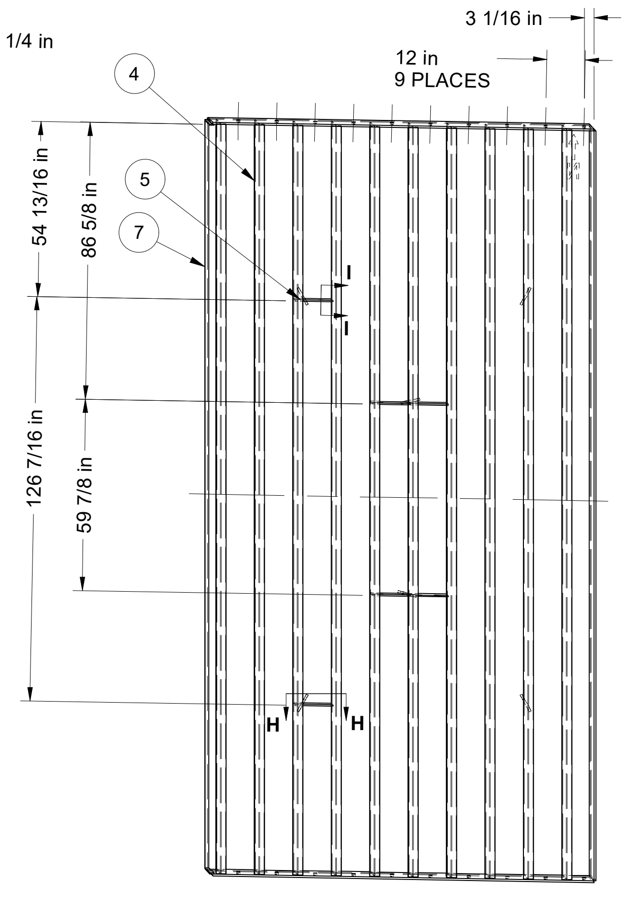
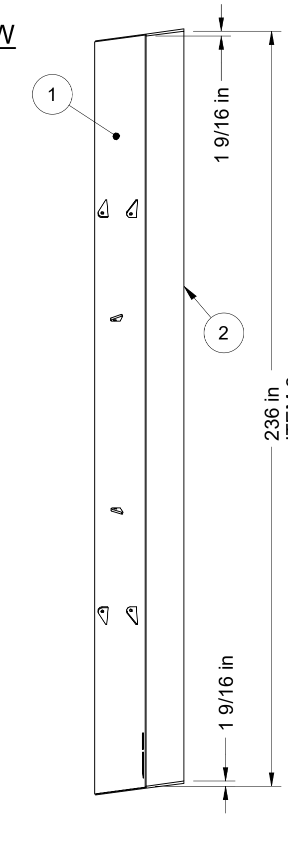


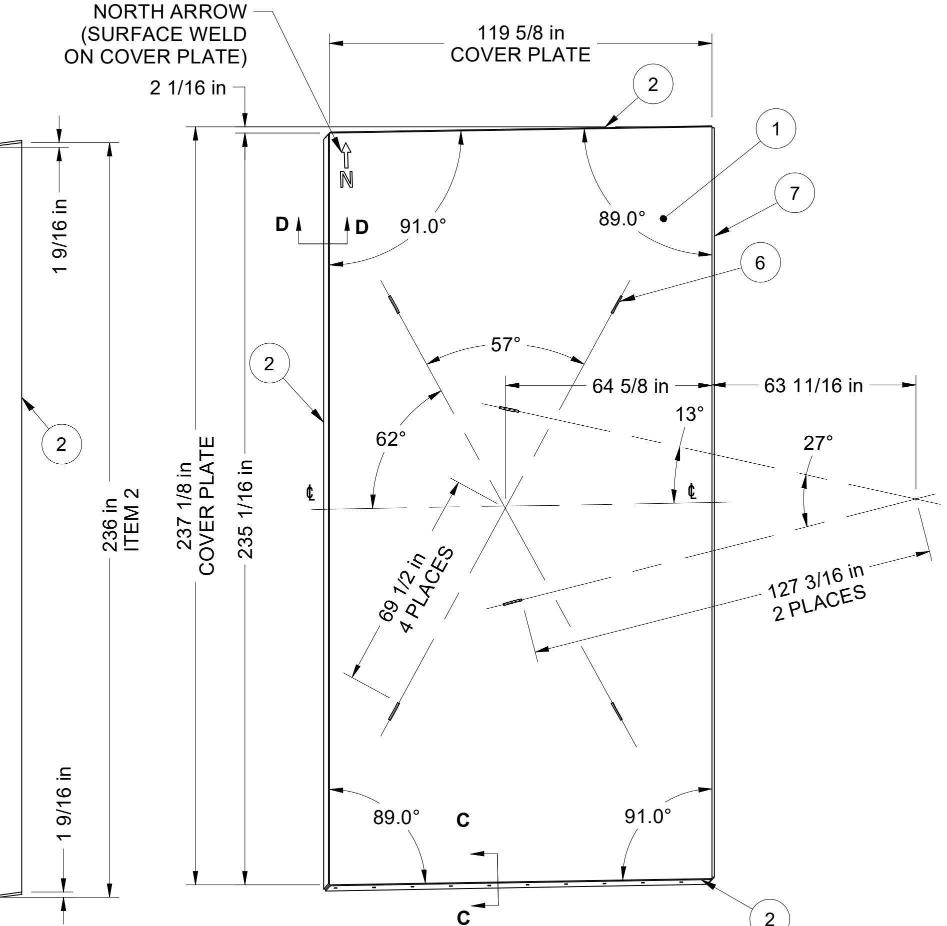

MK# P60236-A-803 - BOTTOM VIEW



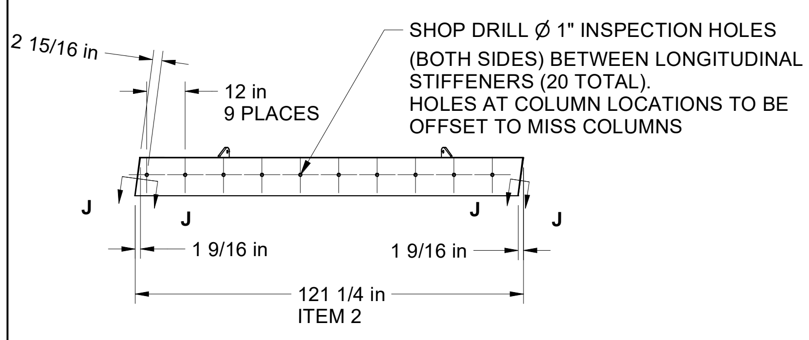

MK# P60236-A-804 - BOTTOM VIEW



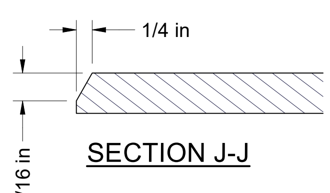

MK# P60236-A-804
SIDE VIEW



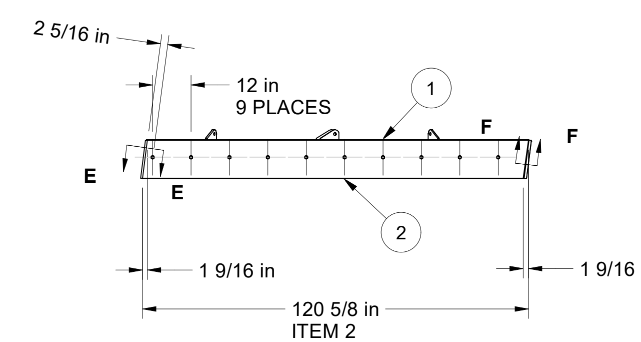

MK# P60236-A-804 - TOP VIEW
TOP PLATE DIMENSIONS




MK# P60236-A-803 - END VIEW




SECTION J-J




MK# P60236-A-804 - END VIEW





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — SASKATCHEWAN — MEMBER 14318 — 20 02 04

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

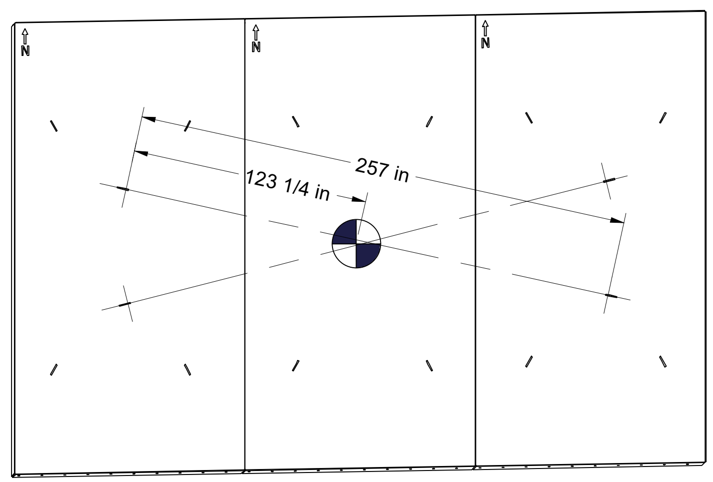
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

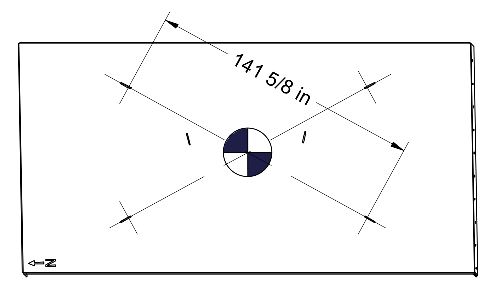
PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING
TOP COVER SECTION 2 & 3 DETAILS
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-08-5
REV: 1

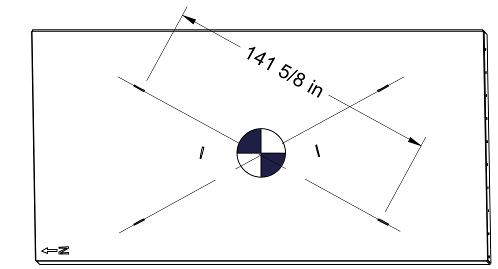
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



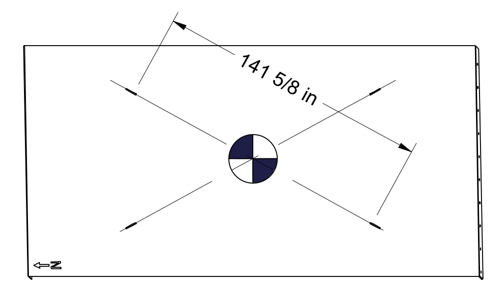

TOP COVER LIFTING DIAGRAM
MK# P60236-A-801



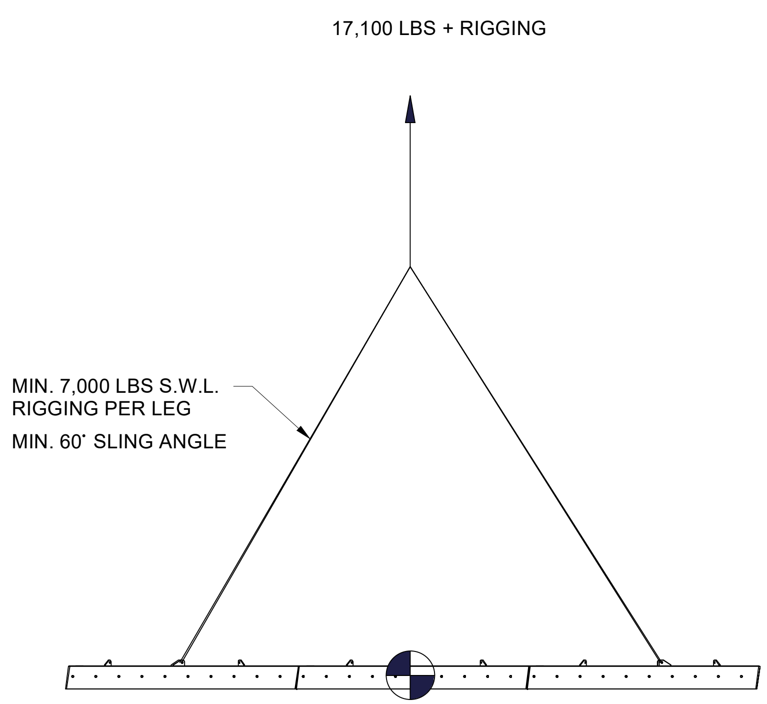

COVER SECTION 1 LIFTING DIAGRAM
MK# P60236-A-802



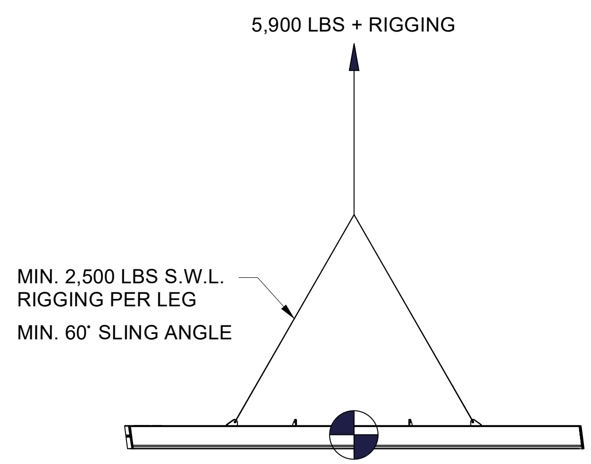

COVER SECTION 3 LIFTING DIAGRAM
MK# P60236-A-804



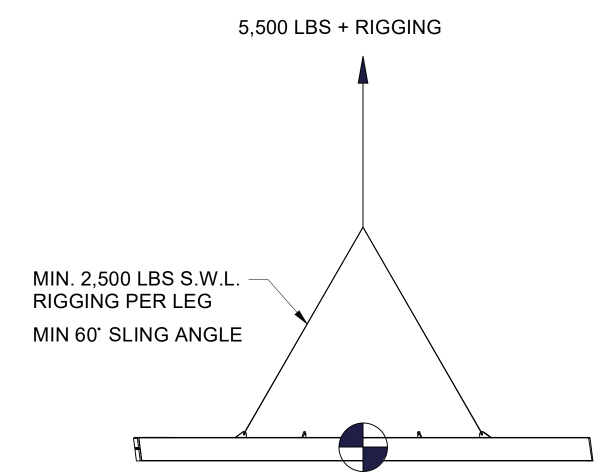

COVER SECTION 2 LIFTING DIAGRAM
MK# P60236-A-803



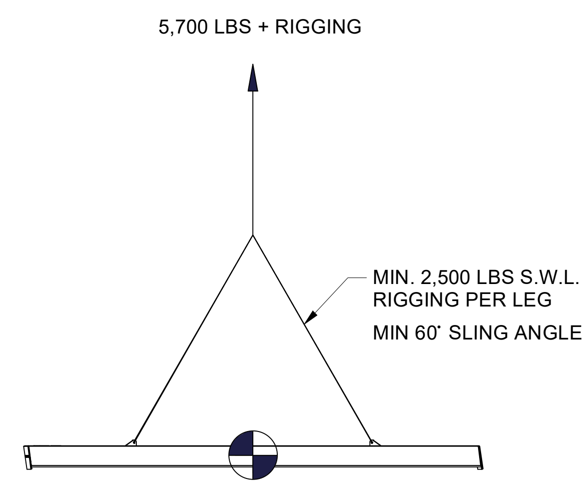

TOP COVER LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-801




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-802




COVER SECTION 3 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-804




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-803





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

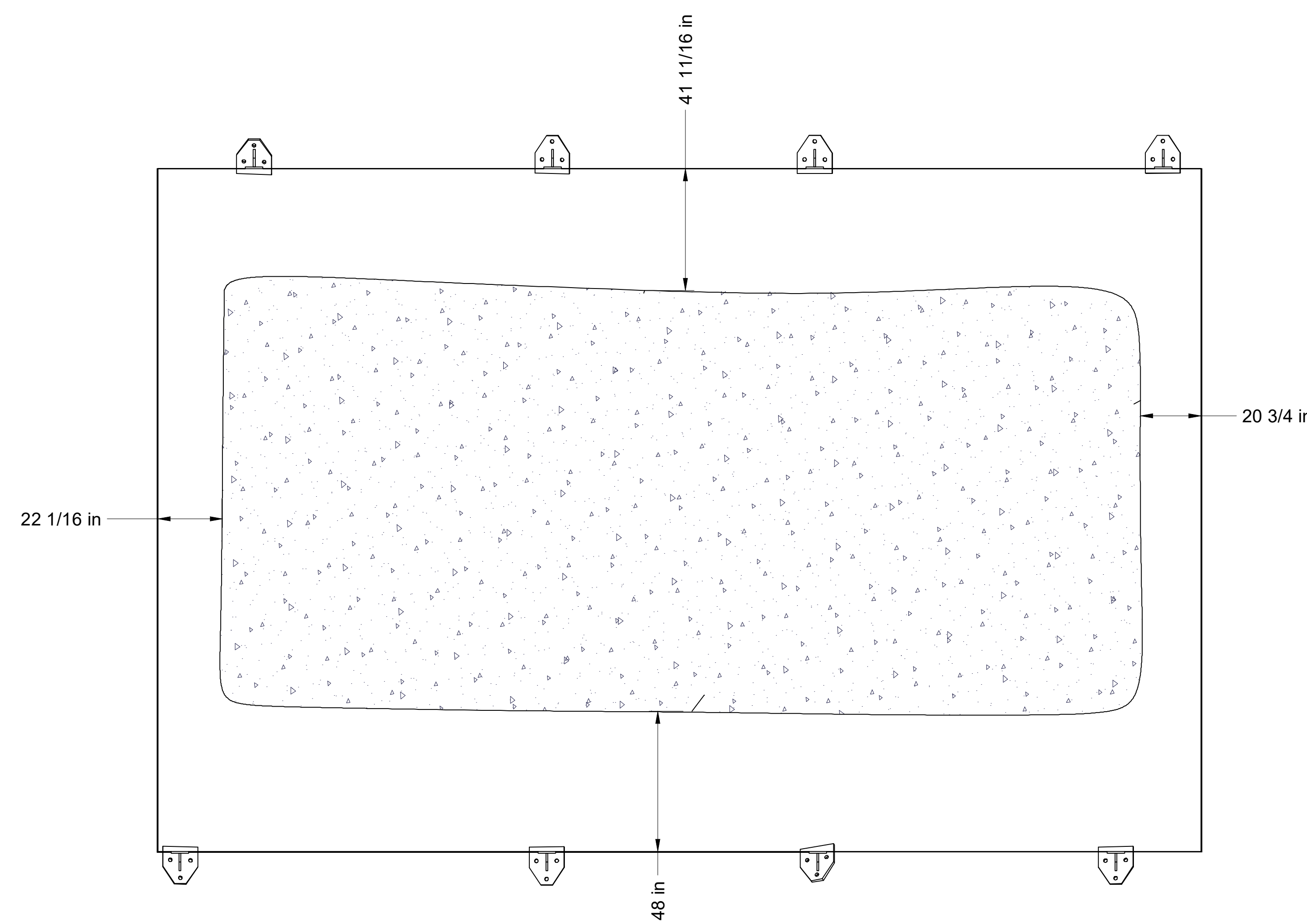
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING
LIFTING DETAILS
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: P60236-08-6
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | △0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 14/Nov/18 | ANP |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — P. CAUGHLIN — MEMBER 14318 — 20 02 04 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE VERNA 2 OPENING CLEARANCES
LOCATION: 59° 34' 1.5" N 108° 25' 19.7" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
DWG. NO.: P60236-08-7 △1
SHEET NO.: 7 OF 7

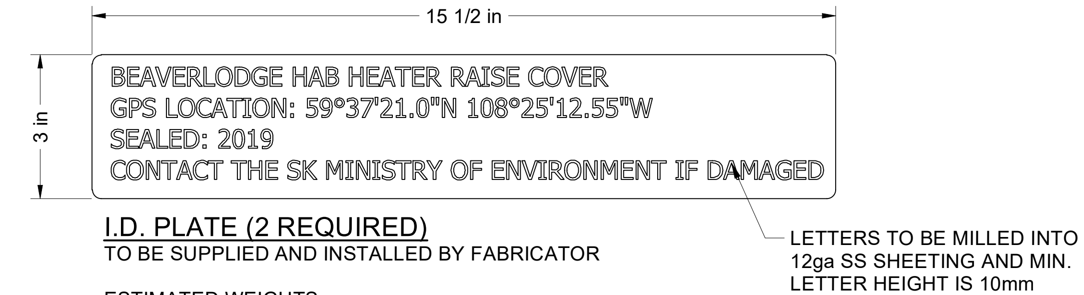
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# HAB 10 – Heater Raise Cover

HAB 10 – Heater Raise Cover

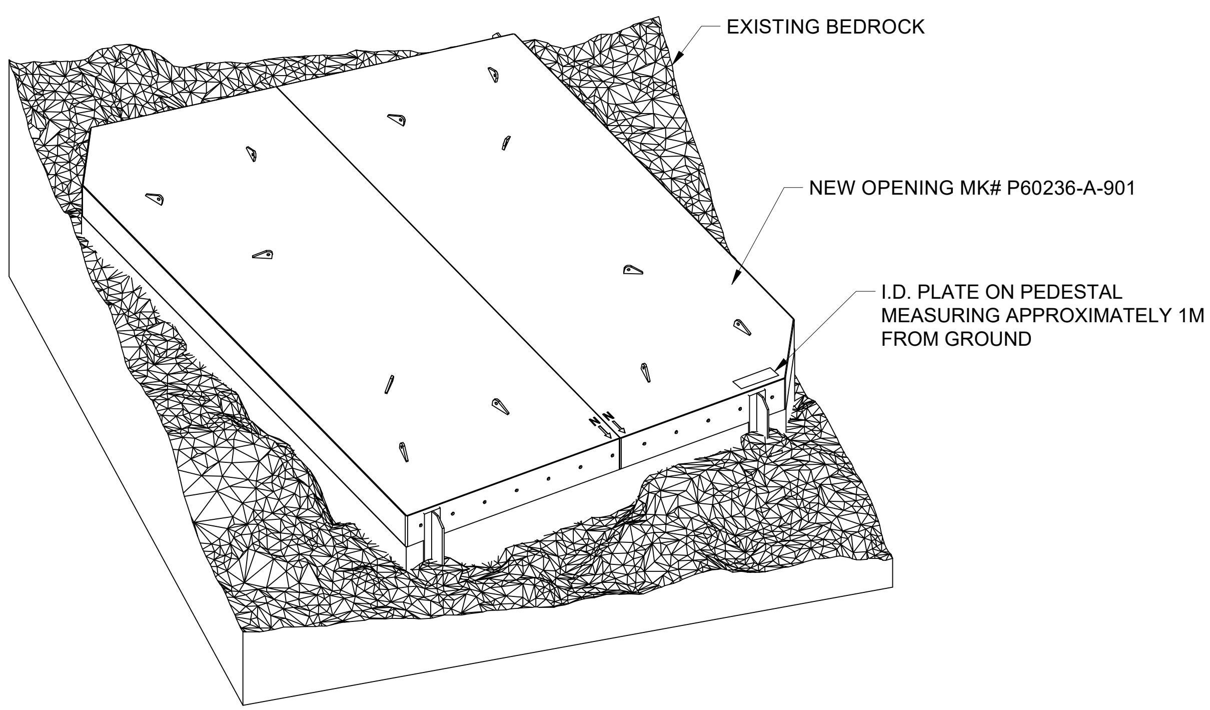
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL WELD JOINTS TO BE FIELD PICKLED AND PASSIVATED IN ACCORDANCE WITH QA/QC PROTOCOL. KOVA PERSONNEL TO REVIEW SURFACES FOLLOWING PICKLING AND PASSIVATING.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
13. SHOP DRILLED INSPECTION HOLES HAVE BEEN PLACED IN LOCATIONS THAT ENSURE THEY ARE NOT PLACED UNDER COLUMN FLANGES. IN THE CASE THAT A COLUMN IS FIELD LOCATED OVER AN INSPECTION HOLE THEN A NEW INSPECTION HOLE IS TO BE DRILLED IN A SIMILAR LOCATION SUCH THAT THE SAME BAY OF COVER STIFFENERS MAY BE EXAMINED.
14. SEE DRAWING P60236-10 FOR TYPICAL DETAILS OMITTED FROM THIS DRAWING SET.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED SURFACES. CONSIDERING THE RESULTS OF THIS RESEARCH AND A CORROSION ALLOWANCE OF 1mm ON ANY SURFACE, THE COVER DEPICTED HAS AN ESTIMATED USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS PERIODIC INSPECTIONS BE PERFORMED AS RECOMMENDED IN THE QA/QC PROTOCOL.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 6,320 LBS.
5. DO NOT BACK FILL WALLS OF COVER.

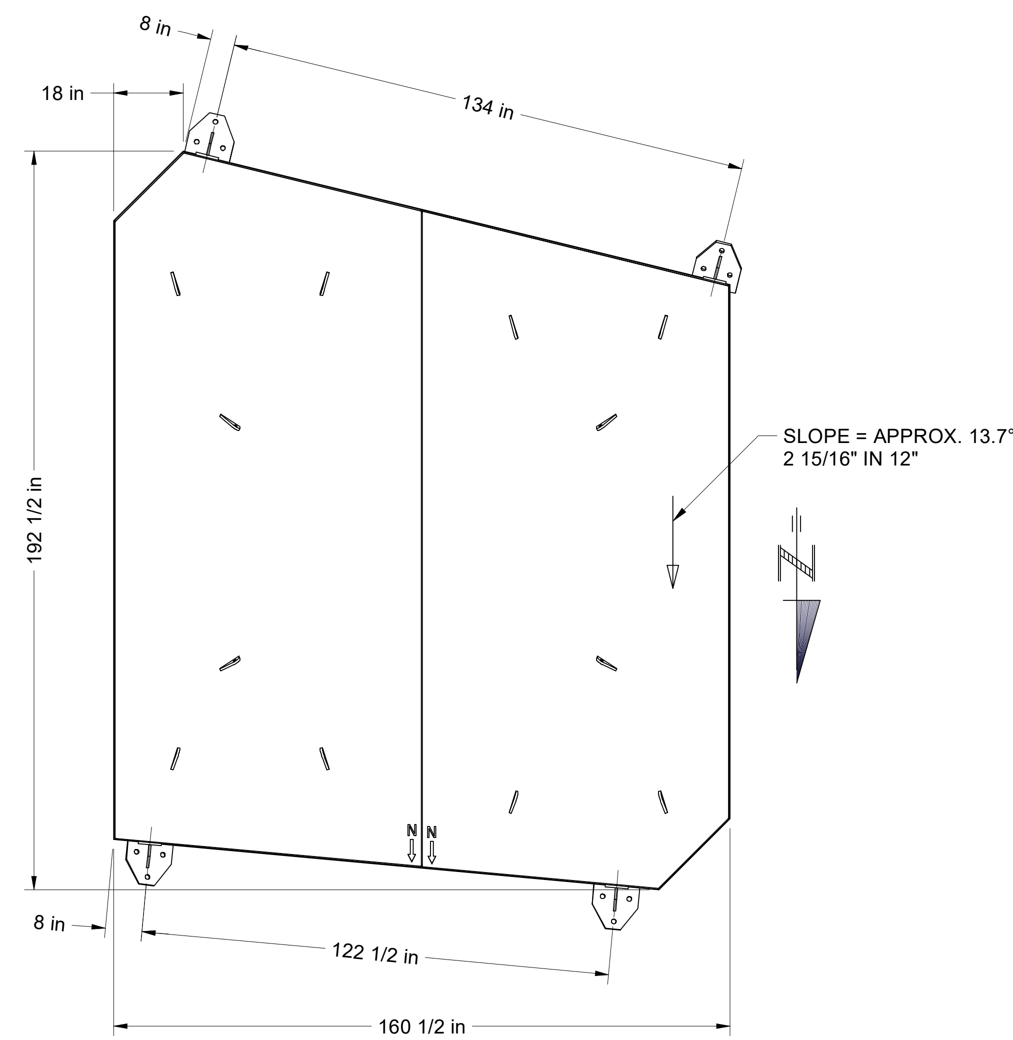



I.D. PLATE (2 REQUIRED)
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS
TOP COVER W/O RIGGING: 5,635 Lbs
AS INSTALLED: 6,320 Lbs




ISO VIEW
LOOKING SOUTHWEST




PLAN VIEW - NEW HAB OPENING COVER

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

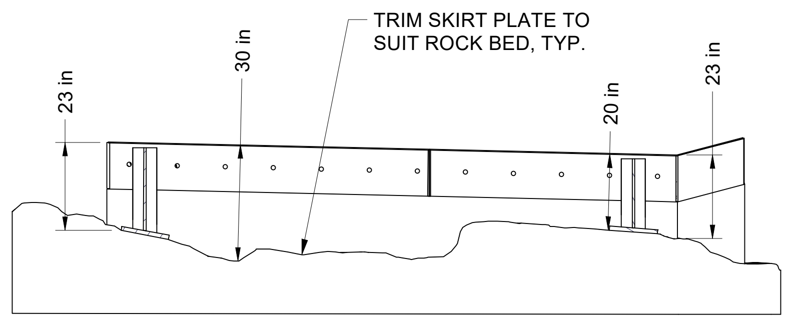
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering (Saskatchewan) Ltd.

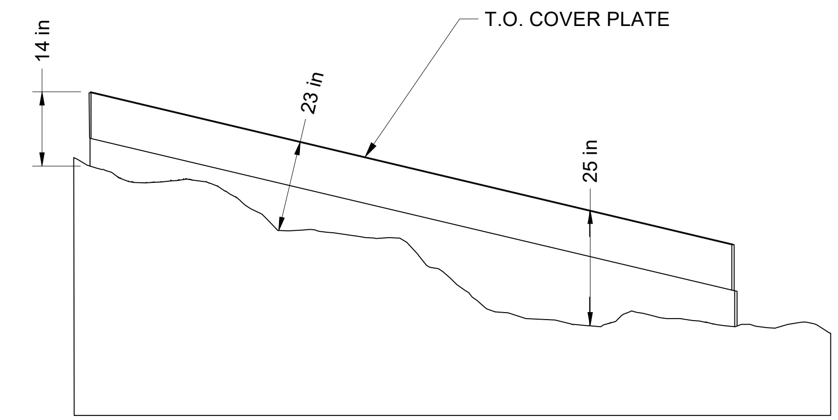
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-09-1
REV: 1

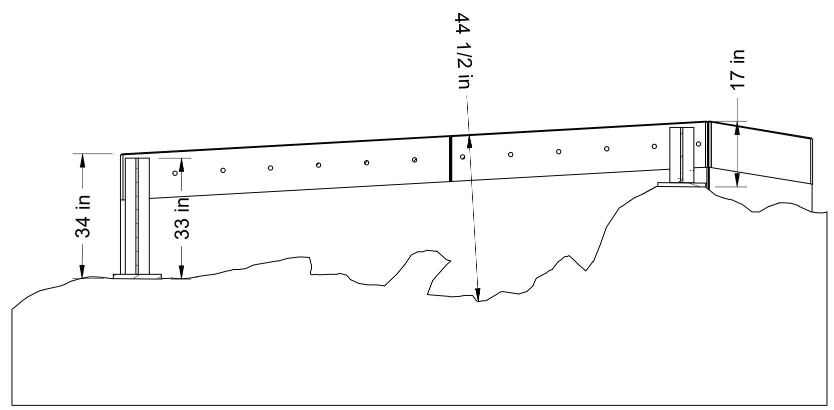
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



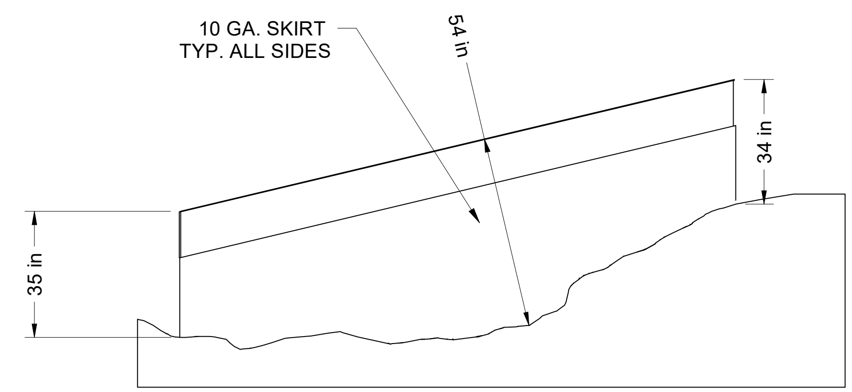

ELEVATION VIEW - LOOKING SOUTH




ELEVATION VIEW - LOOKING WEST




ELEVATION VIEW - LOOKING NORTH




ELEVATION VIEW - LOOKING EAST





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | C | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P. C. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

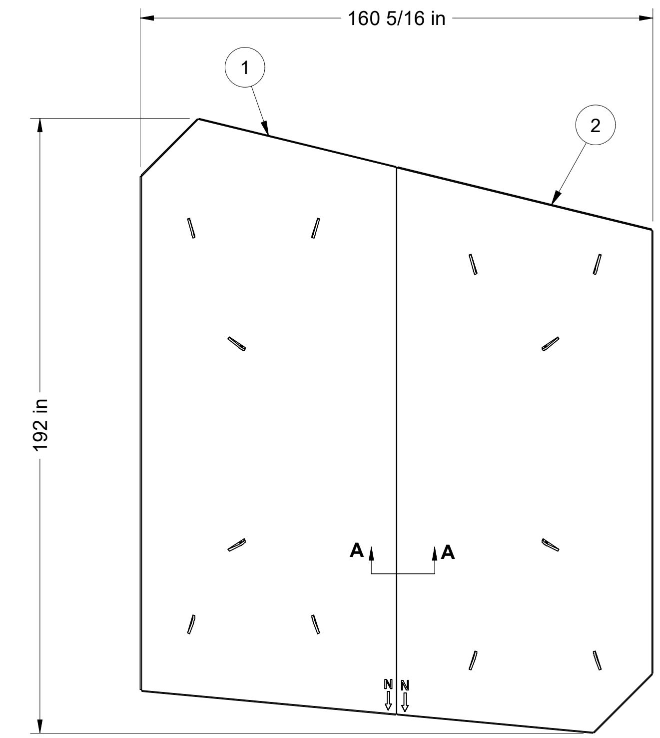
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

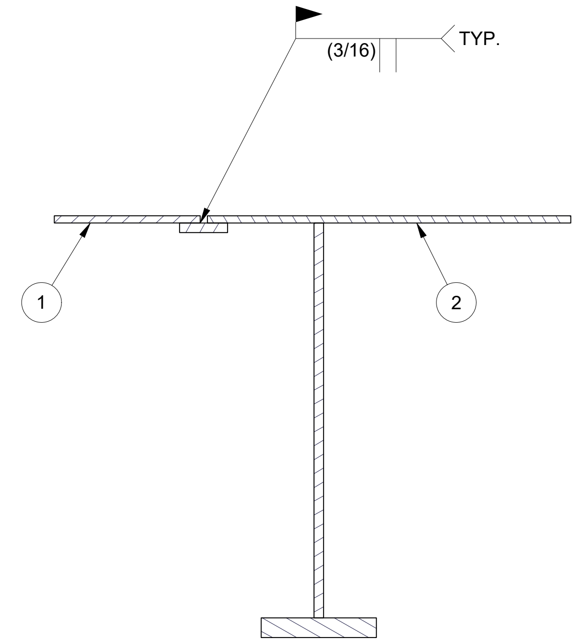
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-09-2 REV 1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

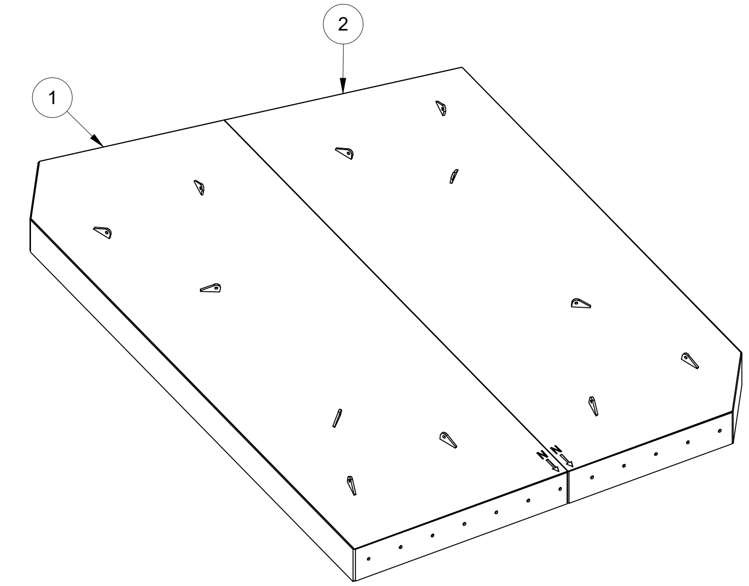
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | MK# P60236-A-902 | | 4 |
| 2 | 1 | COVER SECTION 2 | MK# P60236-A-903 | | 5 |



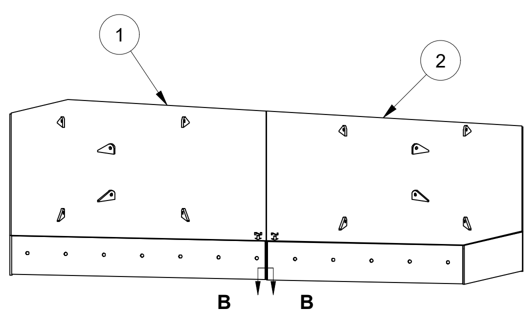

MK# P60236-A-901 - PLAN VIEW



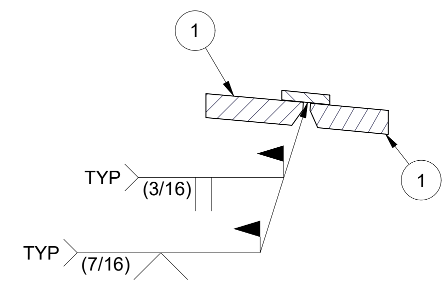

SECTION A-A




MK# P60236-A-901 - ISO VIEW




MK# P60236-A-901 - SIDE VIEW




SECTION B-B

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | △0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | △A | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

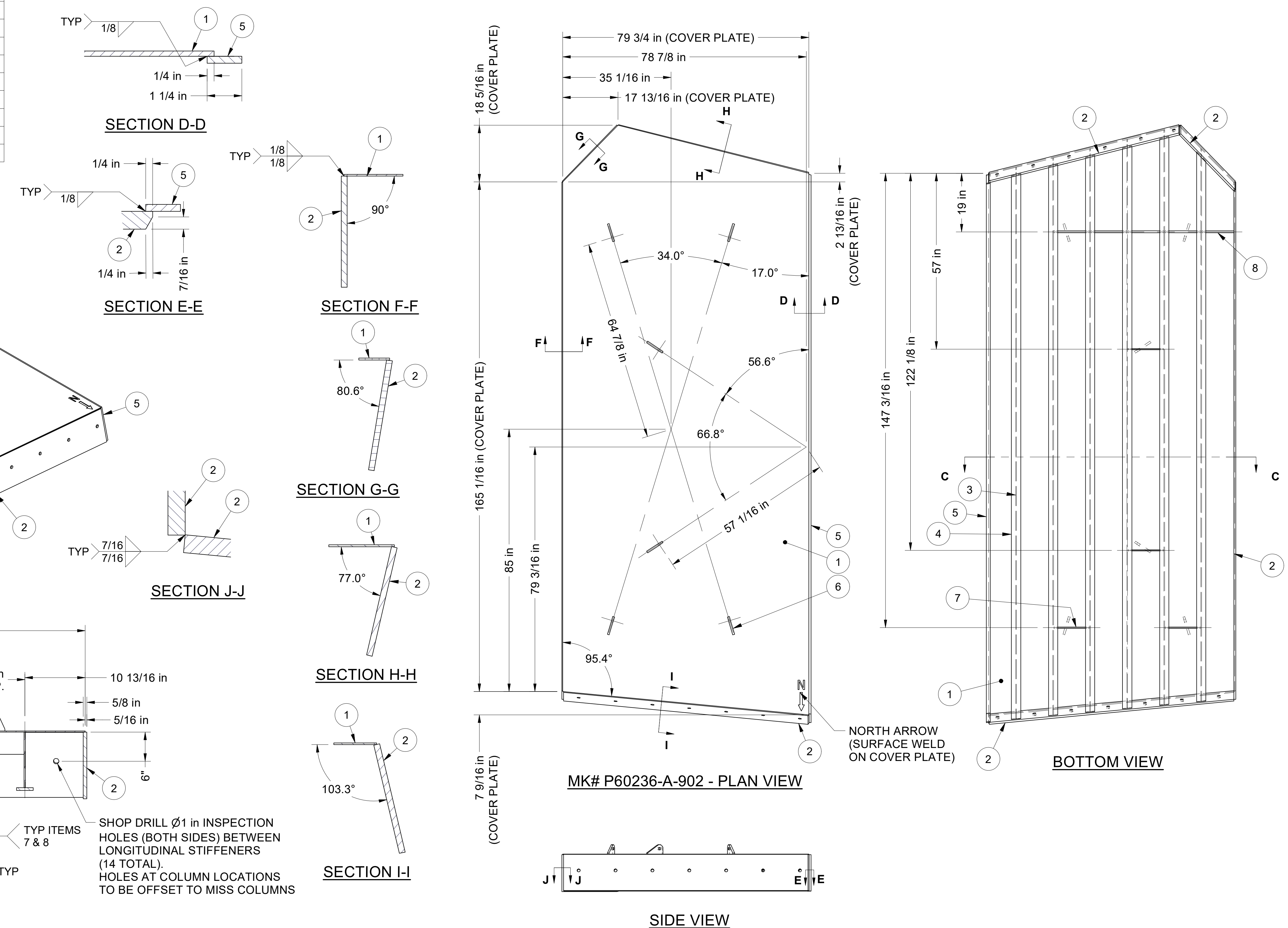
**Kova Engineering (Saskatchewan) Ltd.**

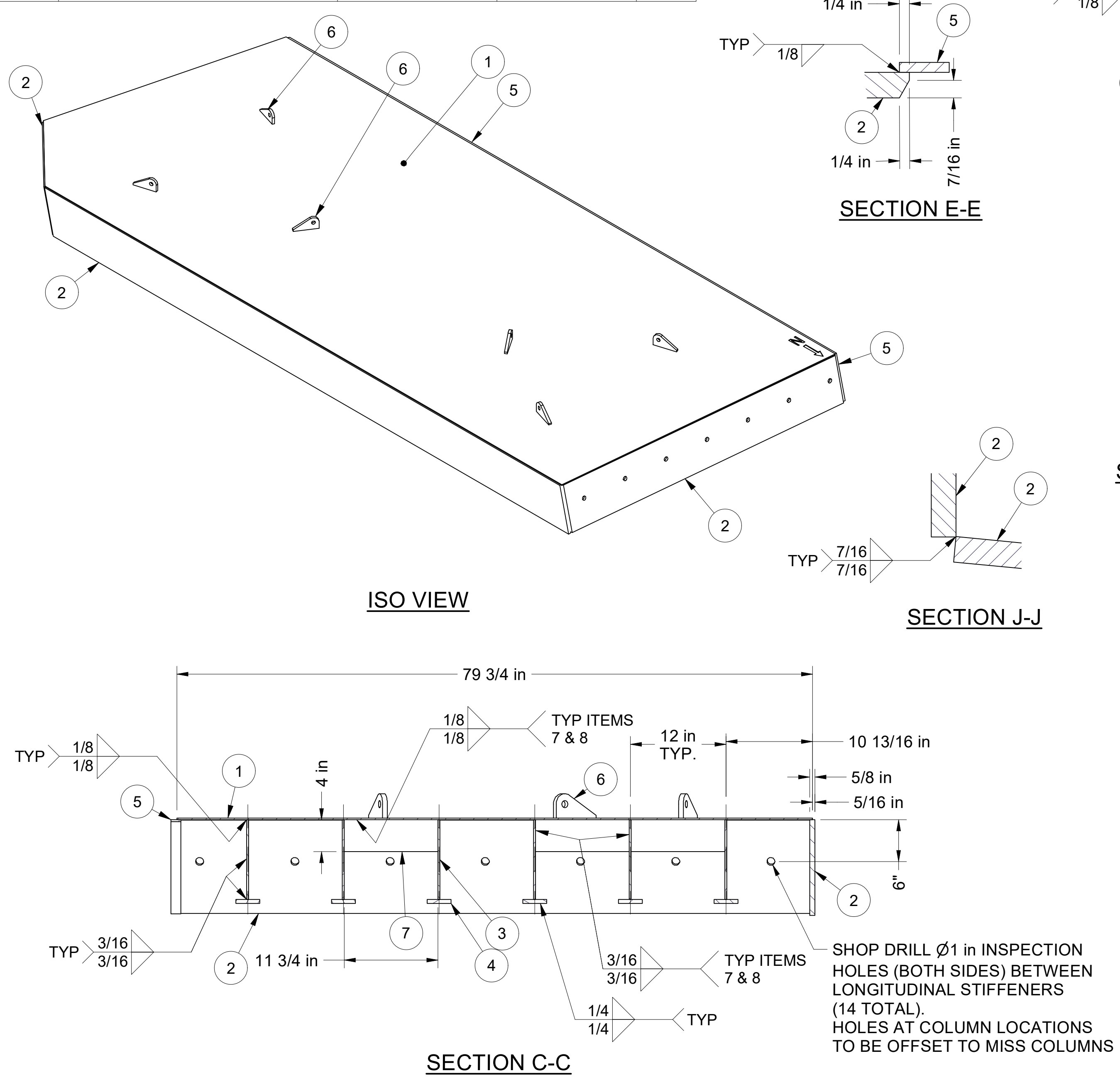
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING
TOP COVER DETAILS
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-09-3 △1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 3/16" PLATE | | ASTM A-240 316 | |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 | |
| 3 | 10" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 4 | 3" X 1/2" FLAT BAR | | ASTM A-240 316 | |
| 5 | 1-1/4" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 6 | 5/8" PLATE | | ASTM A-240 316 | |
| 7 | 4" X 3/8" FLAT BAR | | ASTM A-240 316 | |
| 8 | 8" X 5/8" FLAT BAR | | ASTM A-240 316 | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — E.B. CAUGHLIN — MEMBER 14318 — 20 02 04 — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:
Discipline: Structural — Sk. Reg. No.: 14318 — Signature

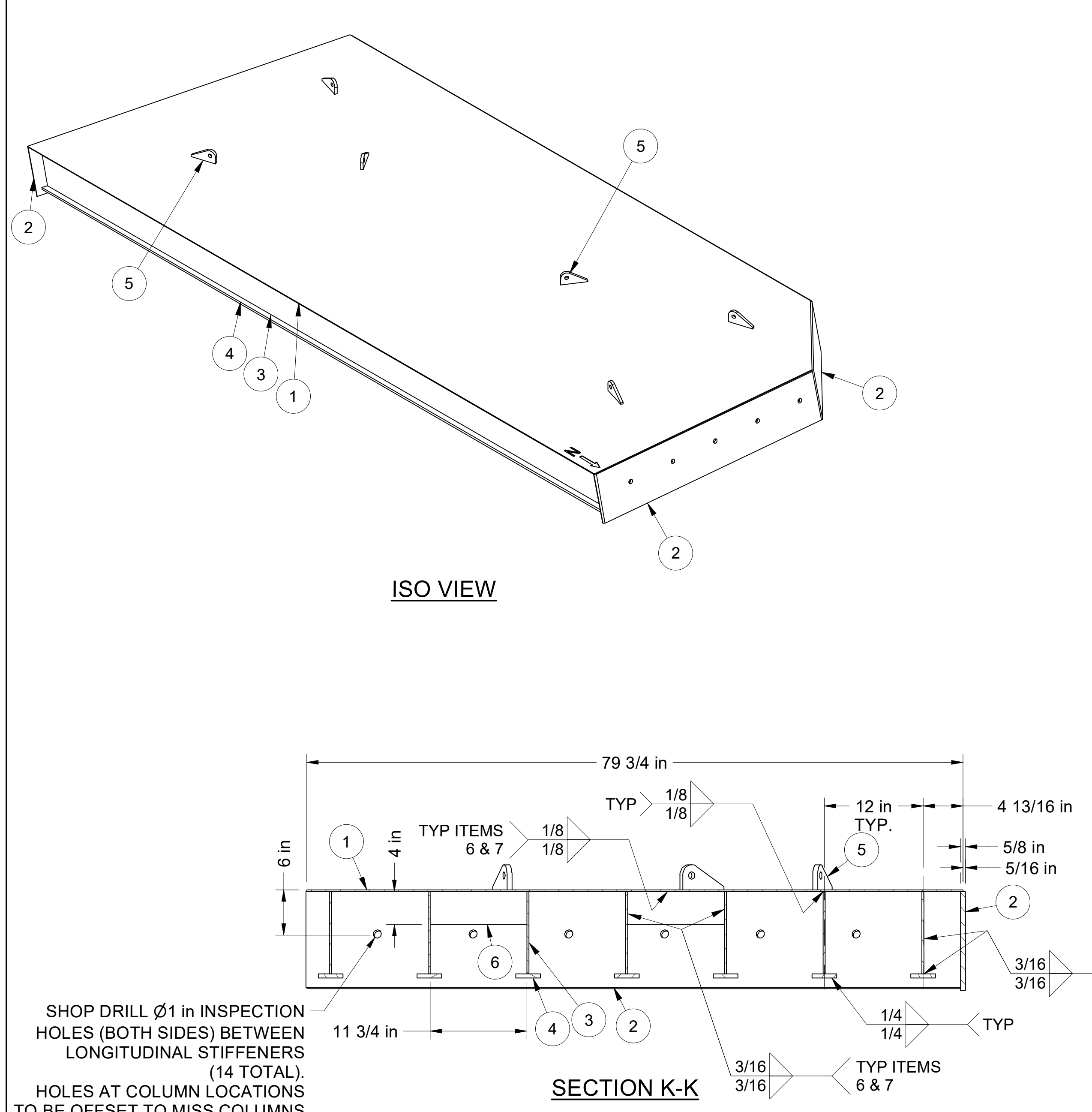
**Kova Engineering (Saskatchewan) Ltd.**

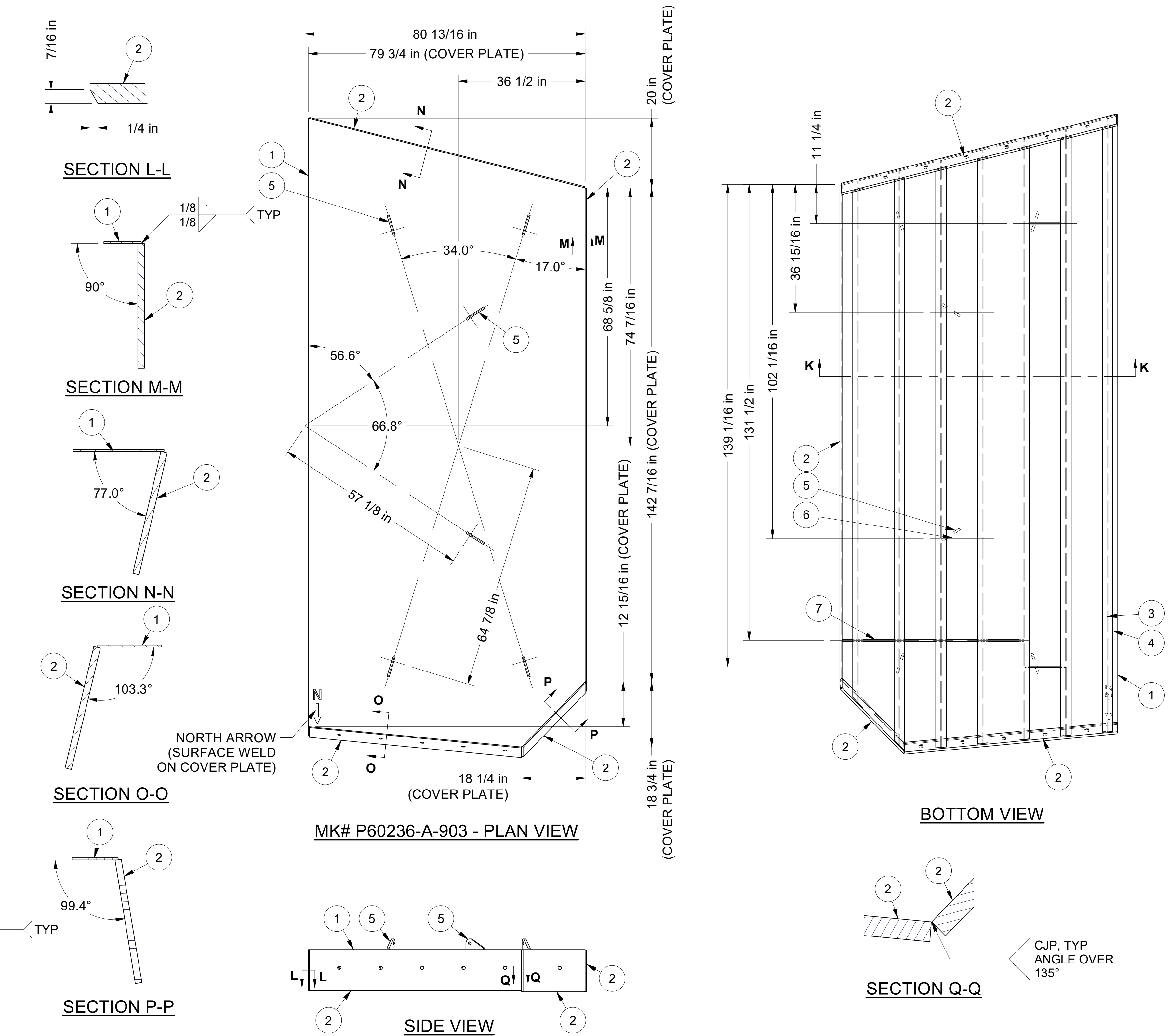
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING
TOP COVER SECTION 1 DETAILS
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS — DWG. NO.: P60236-09-4 — REV 1
SHEET NO.: 4 OF 7

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 3/16" PLATE | | ASTM A-240 316 | |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 | |
| 3 | 10" X 1/4" FLAT BAR | | ASTM A-240 316 | |
| 4 | 3" X 1/2" FLAT BAR | | ASTM A-240 316 | |
| 5 | 5/8" PLATE | | ASTM A-240 316 | |
| 6 | 4" X 3/8" FLAT BAR | | ASTM A-240 316 | |
| 7 | 8" X 5/8" FLAT BAR | | ASTM A-240 316 | |




THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 14/Nov/18
CHK'D BY:
ENG BY: P.C.

PROFESSIONAL ENGINEER — MEMBER 14318 — 20 02 04 (YR. MN. DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

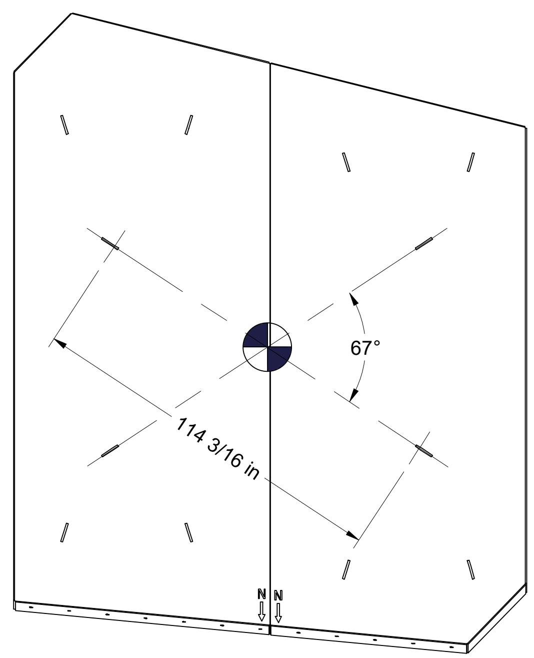
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

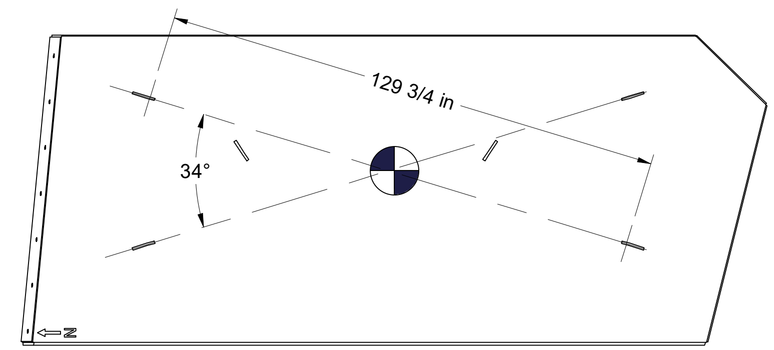
PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING TOP COVER SECTION 2 DETAILS
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-09-5 (REV 1)

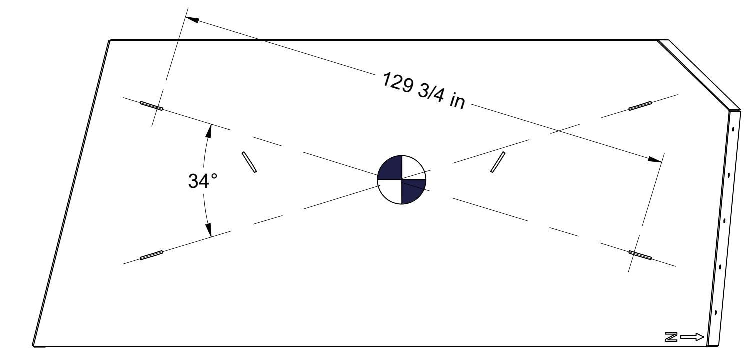
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



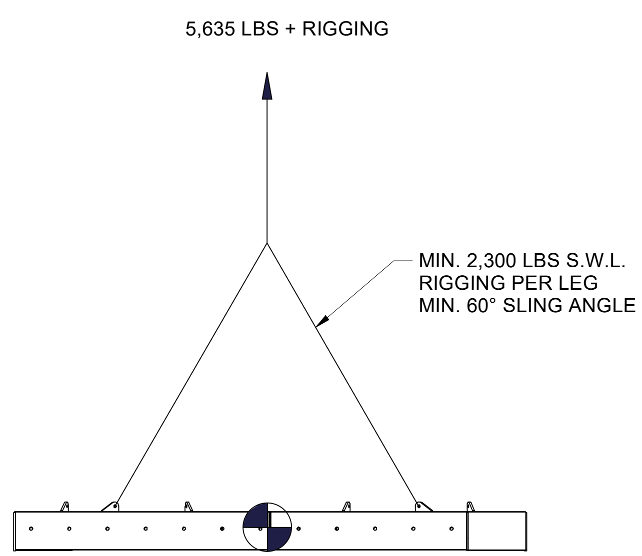

TOP COVER LIFTING DIAGRAM - TOP VIEW
MK# P60236-A-901



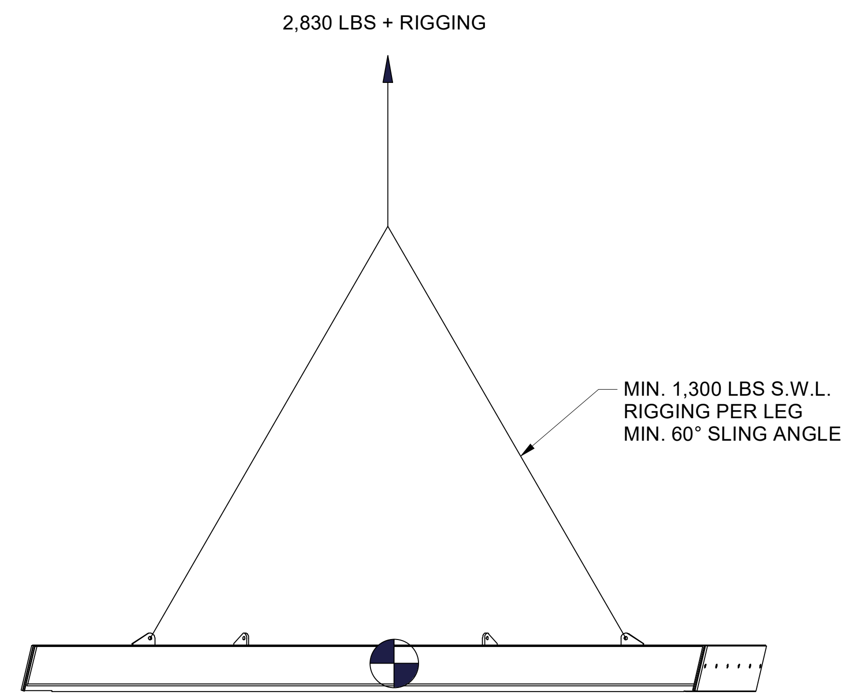

COVER SECTION 1 LIFTING DIAGRAM - TOP VIEW
MK# P60236-A-902



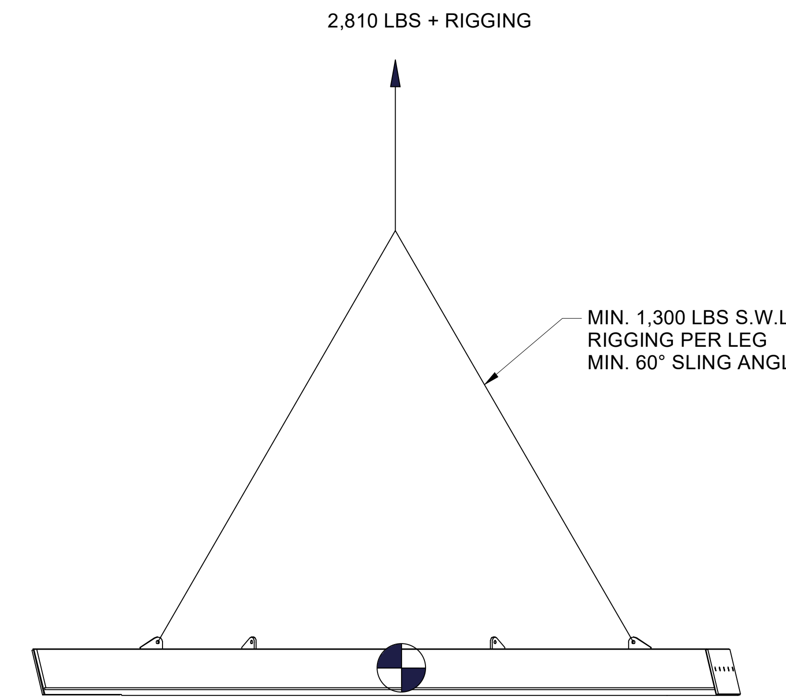

COVER SECTION 2 LIFTING DIAGRAM - TOP VIEW
MK# P60236-A-903




TOP COVER LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-901




COVER SECTION 1 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-902




COVER SECTION 2 LIFTING DIAGRAM - SIDE VIEW
MK# P60236-A-903



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | △ | | | |
| | | △3 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | △2 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | △1 | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

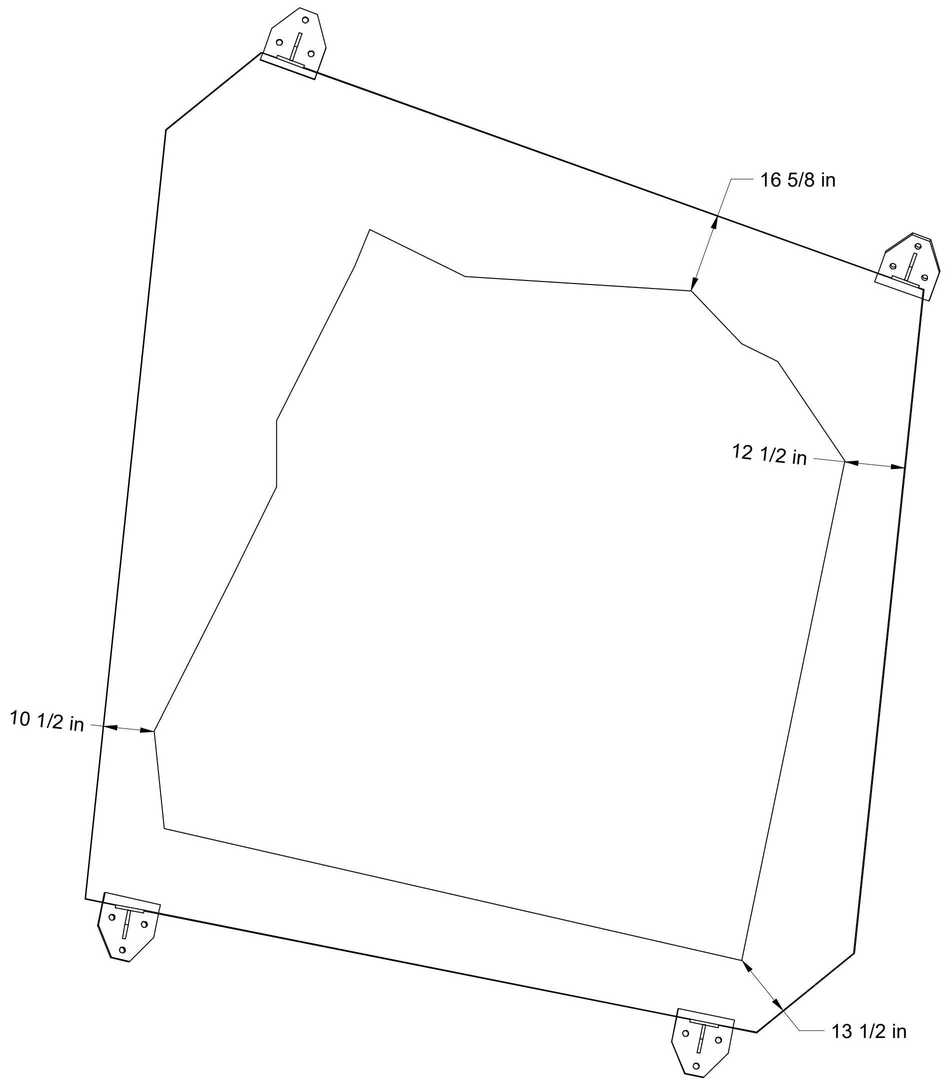
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING
LIFTING DETAILS
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: P60236-09-6
△1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




OPENING TO SKIRT CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | | | | |
| | | 1 | AS-BUILT DRAWING | 04/Feb/20 | CEG |
| | | 0 | ISSUED FOR CONSTRUCTION | 07/Jan/19 | ANP |
| P60236-10 | KOVA DWG - STANDARD DETAILS | A | ISSUED FOR REVIEW | 19/Nov/18 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 14/Nov/18 |
| CHK'D BY: | |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 02 04
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE HAB 10 OPENING CLEARANCES
LOCATION: 59° 37' 21.0" N, 108° 25' 12.55" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: P60236-09-7
1

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

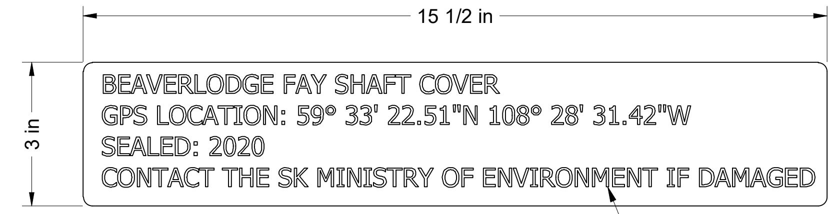
# 2020 Cover Installations

# FAY 1 - Shaft

FAY 1 - Shaft

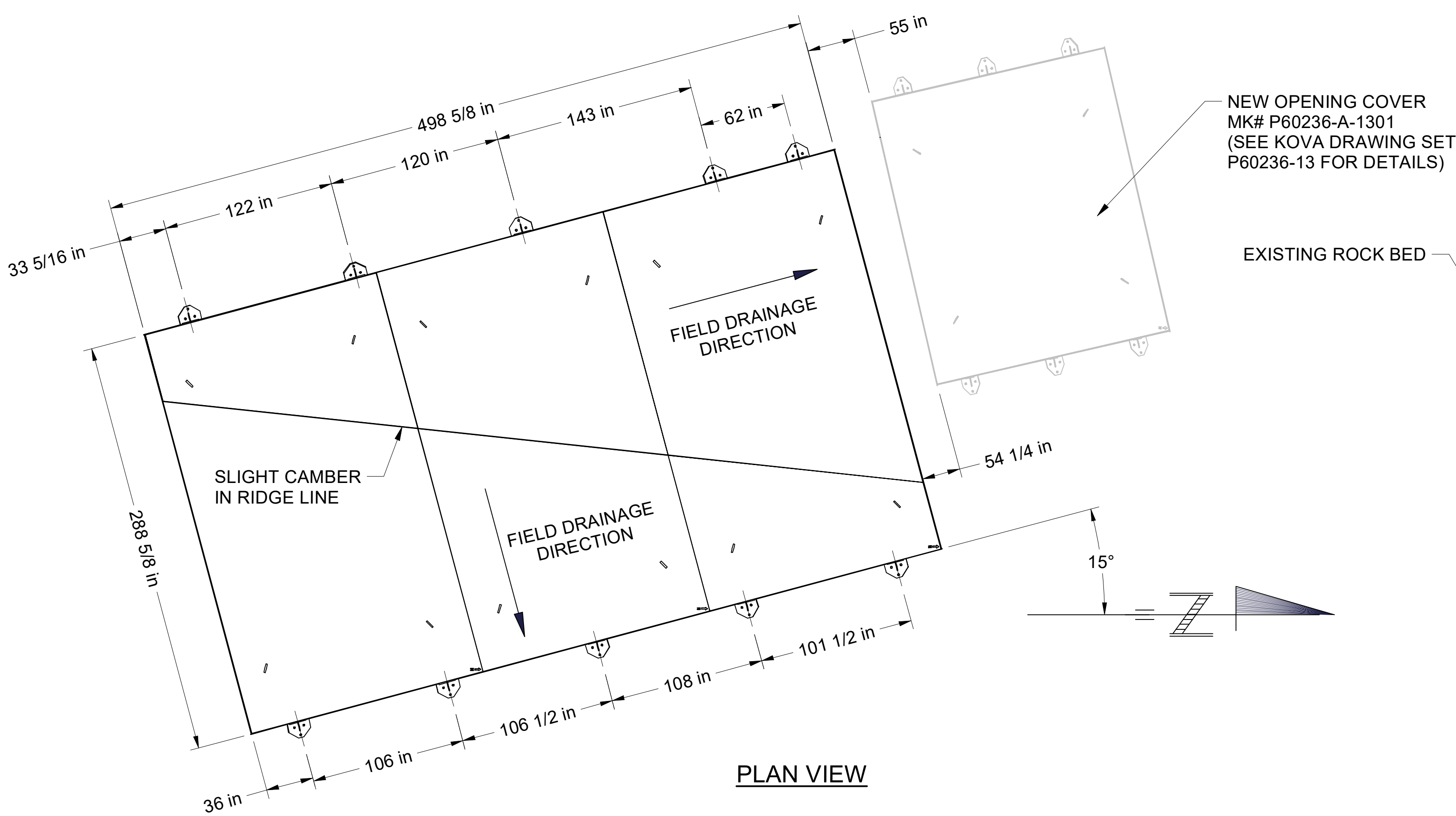
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL SURFACES TO BE FIELD PICKLED AND PASSIVATED FOLLOWING FIELD WELDING IN ACCORDANCE WITH QA/QC PROTOCOL. KOVA PERSONNEL TO REVIEW VISIBLE SURFACES FOLLOWING PICKLING AND PASSIVATING DURING FINAL FIELD INSPECTION.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.
13. SHOP DRAWINGS FOR PARTS USED IN FABRICATION SHALL BE REVIEWED BY KOVA PERSONNEL. KOVA TO PROVIDED CAD MODEL TO FABRICATION FOR REFERENCE IN MAKING PART DRAWINGS.
14. A TEST FIT OF THE TOP COVER COMPONENTS IN THE FABRICATION SHOP IS REQUIRED. KOVA PERSONNEL TO WITNESS THE COMPLETED TEST FIT ASSEMBLY.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED SURFACES. CONSIDERING THE RESULTS OF THIS RESEARCH AND A CORROSION ALLOWANCE OF 1mm ON ANY SURFACE, THE COVER DEPICTED HAS AN ESTIMATED USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS PERIODIC INSPECTIONS BE PERFORMED AS RECOMMENDED IN THE QA/QC PROTOCOL.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 44,200 LBS.
5. DO NOT BACK FILL WALLS OF COVER.

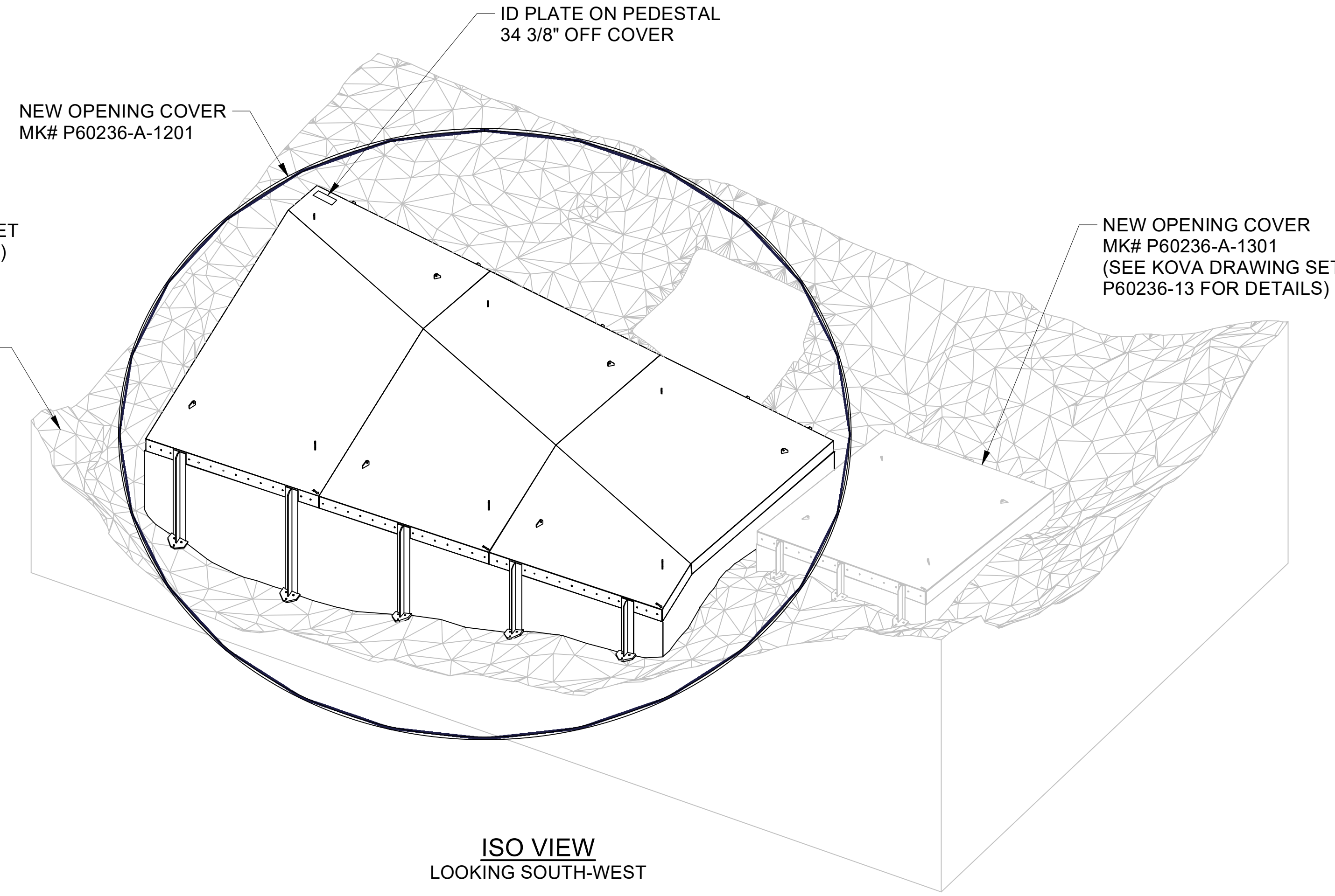



ID PLATE
TO BE SUPPLIED AND INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 36,760 LBS
AS INSTALLED: 44,200 LBS




PLAN VIEW




ISO VIEW
LOOKING SOUTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

Kova Engineering (Saskatchewan) Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

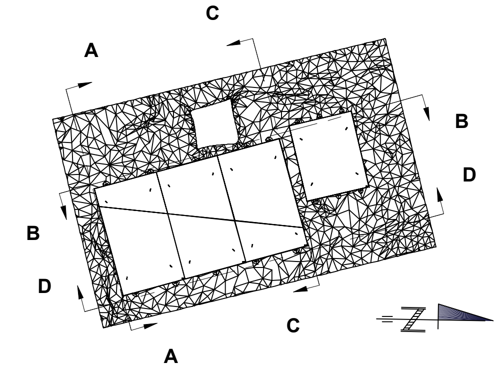
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 13
DWG. NO.: P60236-12-1
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

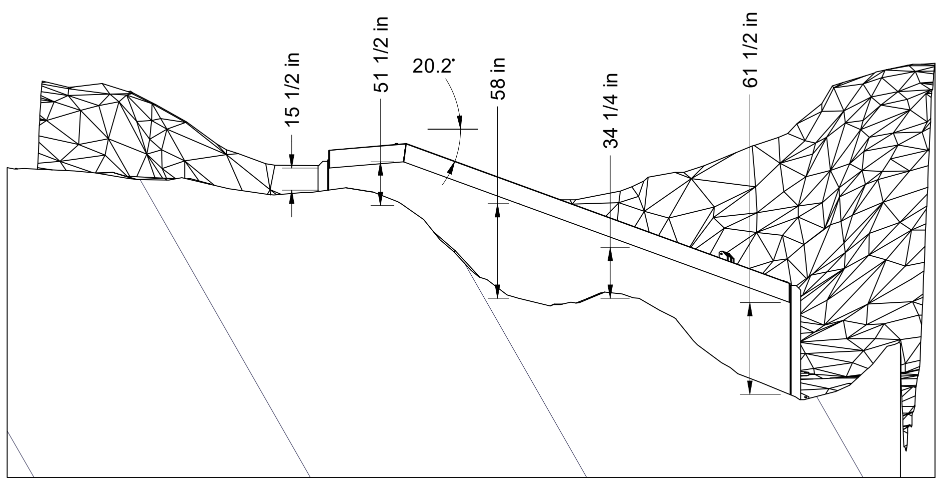
KOVA RECOMMENDED COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.

| BILL OF MATERIAL FOR SKIRT AND COLUMNS | |
|---|---|
| DISCRIPTION | QTY |
| COLUMN SECTIONS - 20' LENGTHS (SHIPPED LOOSE) | 6 |
| 1/4" SKIRT - 5' X 10' SHEETS (SHIPPED LOOSE) | 17 |

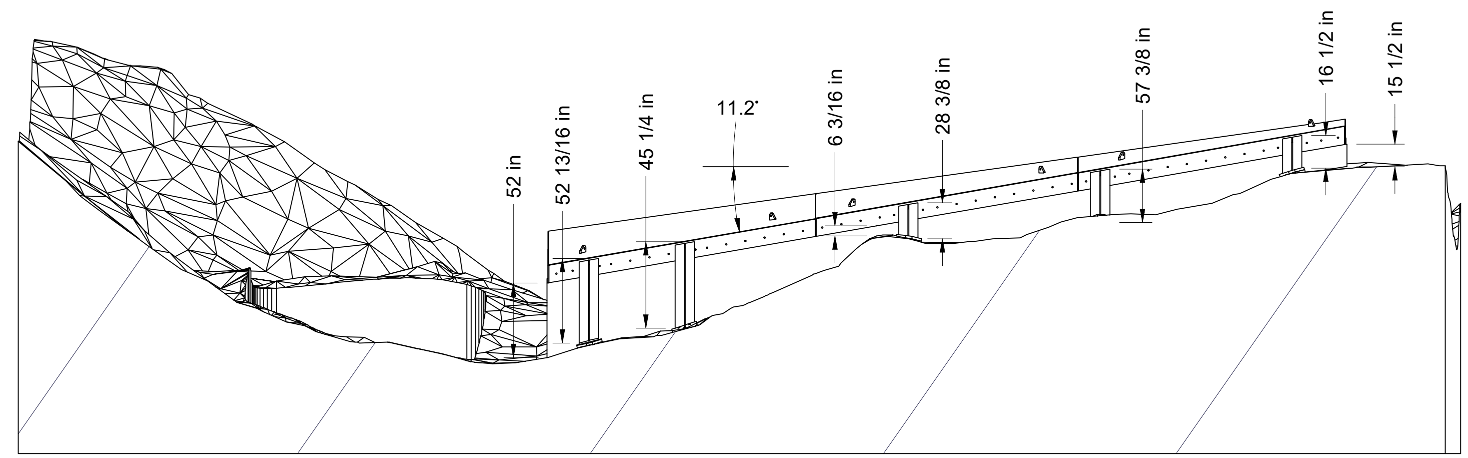
NOTE: QUANTITIES IN BILL OF MATERIALS ARE FOR BIDDING PURPOSES ONLY. SUBJECT TO CHANGE FOLLOWING AWARD.



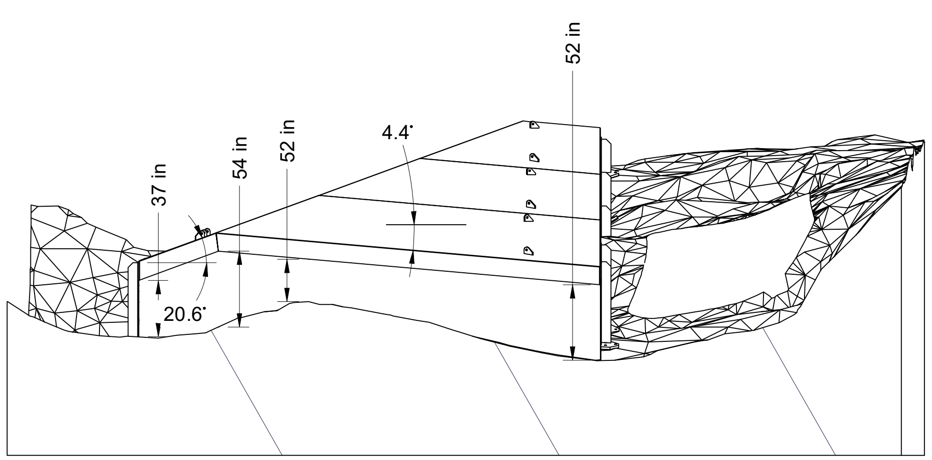

TOP VIEW



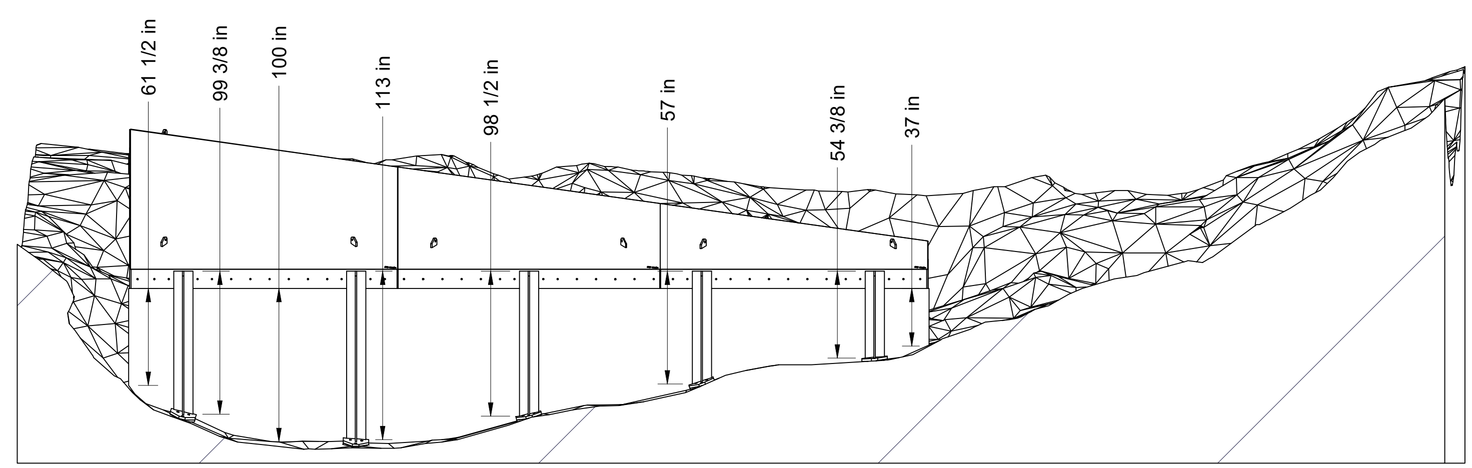

SECTION A-A




SECTION B-B




SECTION C-C




SECTION D-D





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

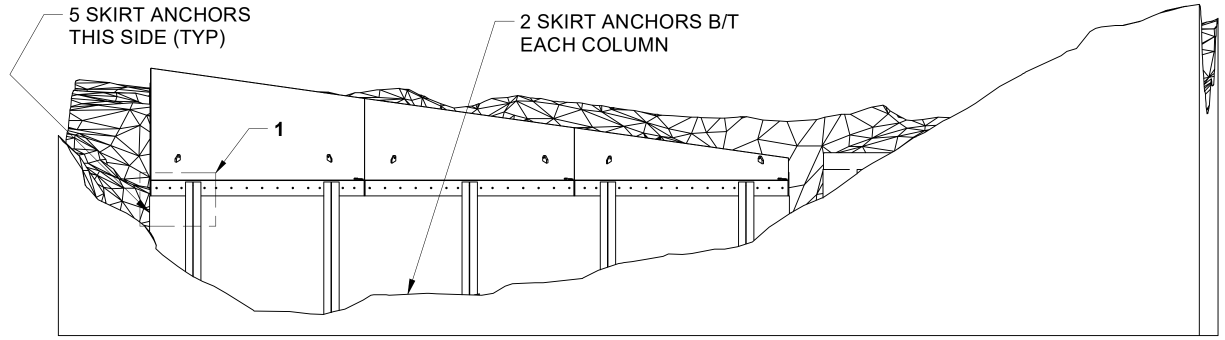
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

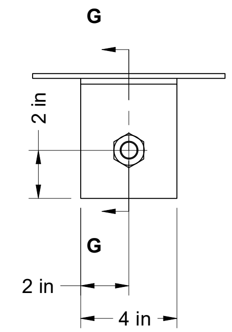
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 13
DWG. NO.: P60236-12-2
4

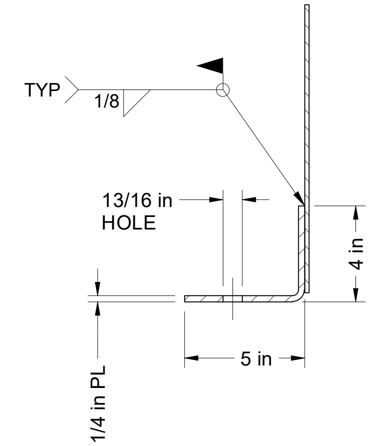
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




SIDE VIEW

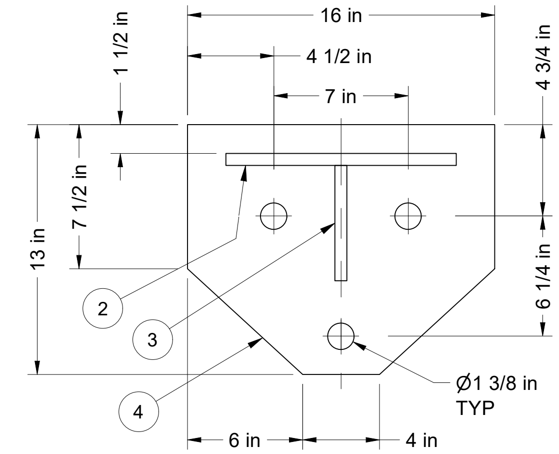



TOP VIEW

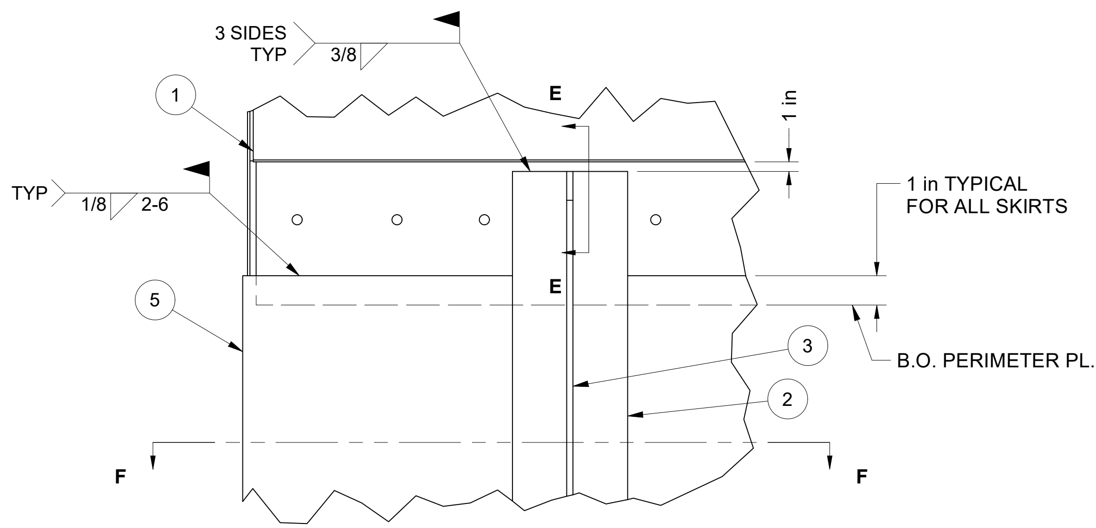



SECTION G-G

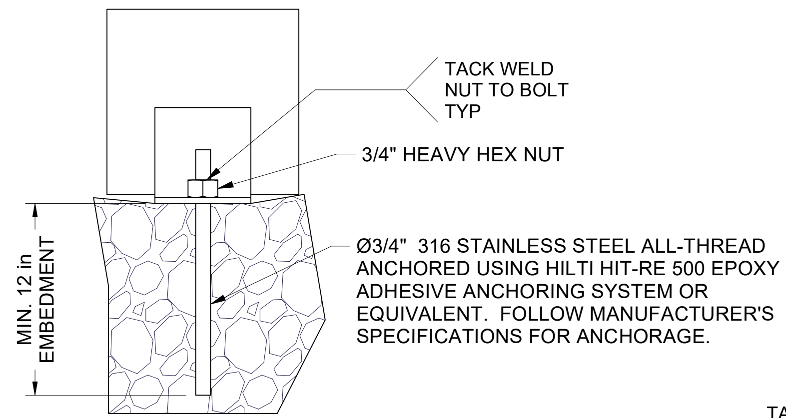
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | TOP COVER AASSEMBLY | MK# P60236-A-1201 | | 4 |
| 2 | 12" X 5/8" FLAT BAR | | ASTM A-240 316 L | |
| 3 | 6" X 5/8" FLAT BAR | | ASTM A-240 316 L | |
| 4 | 1-1/2" PL | | ASTM A-240 316 L | |
| 5 | 1/4" PL | | ASTM A-240 316 L | |



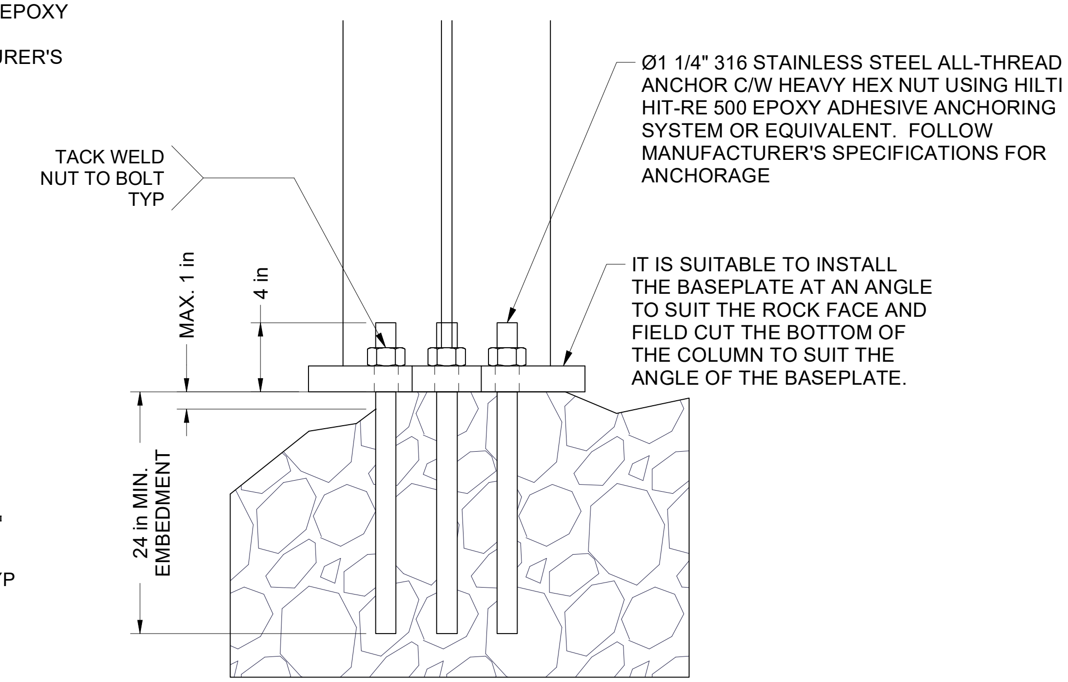

TYPICAL BASEPLATE DETAIL



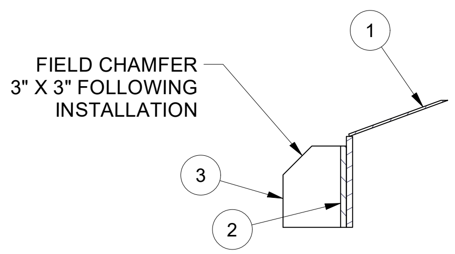

DETAIL 1



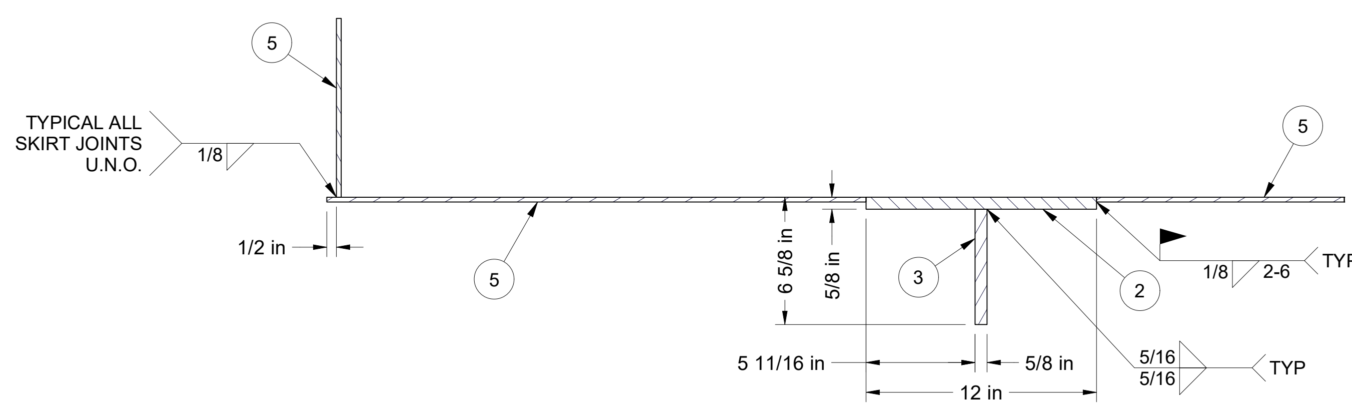

TYPICAL SKIRT ANCHOR DETAIL




TYPICAL COLUMN ANCHOR BOLT DETAIL




SECTION E-E




SECTION F-F



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

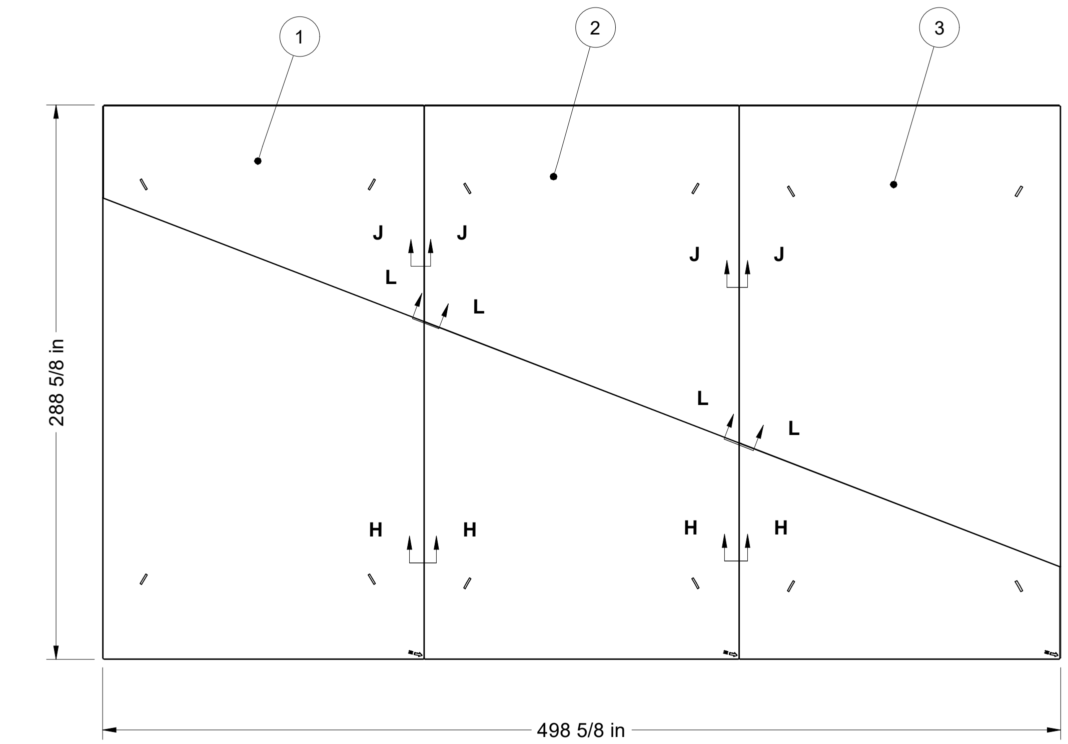
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
SKIRT AND COLUMN DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

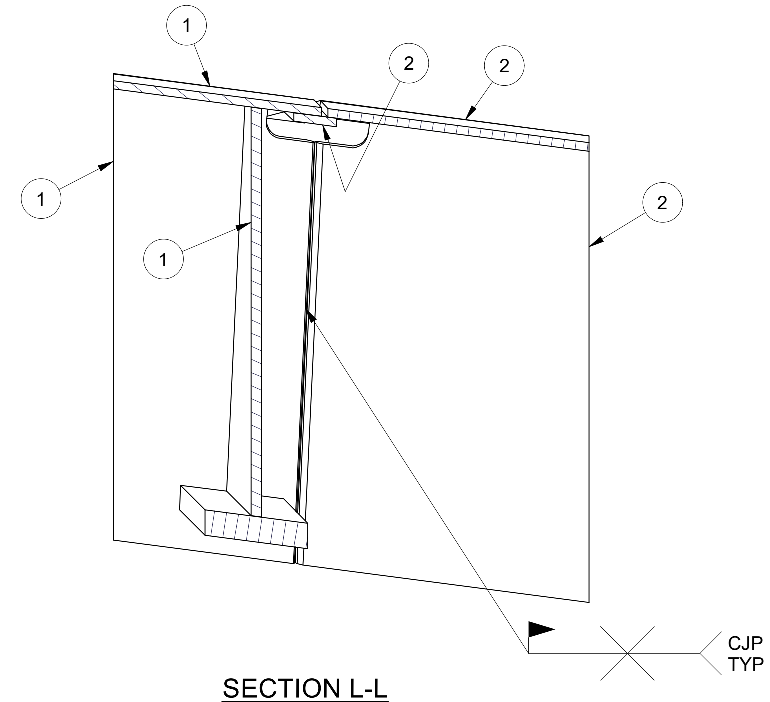
DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 13
DWG. NO.: P60236-12-3
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

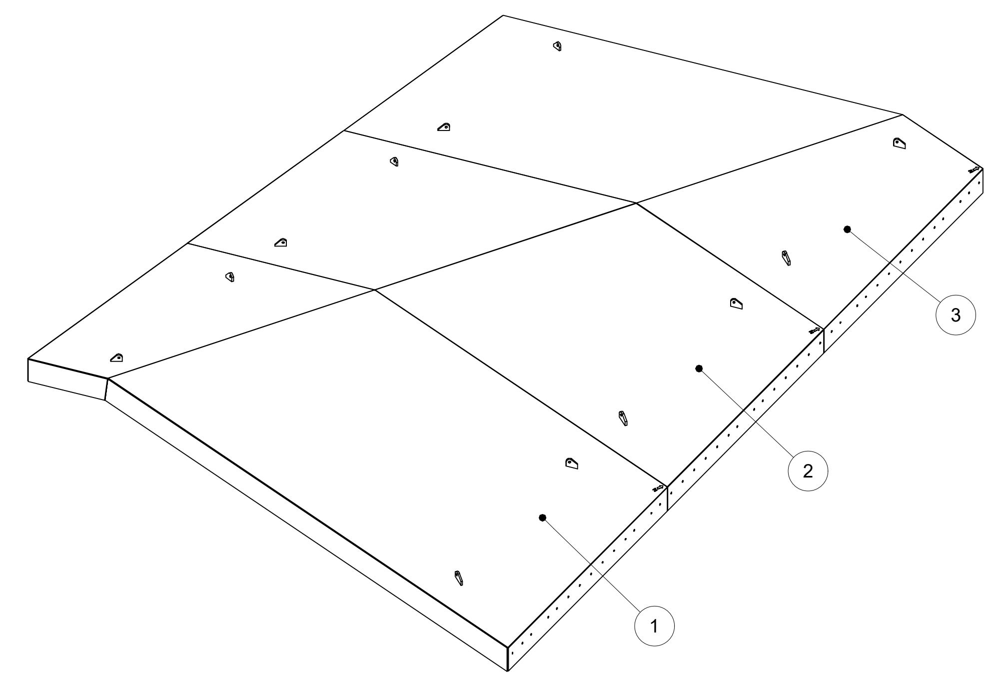
| BILL OF MATERIALS | | | | | |
|---|---|---|---|---|---|
| ITEM | QTY | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1 | COVER SECTION 1 | MK# P60236-A-1202 | | |
| 2 | 1 | COVER SECTION 2 | MK# P60236-A-1203 | | |
| 3 | 1 | COVER SECTION 3 | MK# P60236-A-1204 | | |



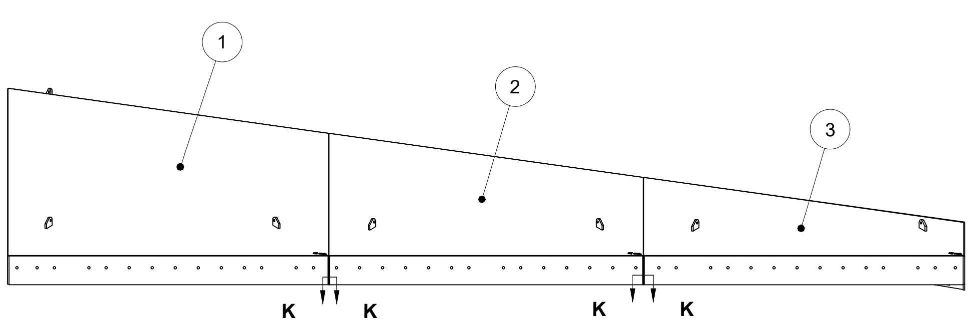

MK# P60236-A-1201 - PLAN VIEW



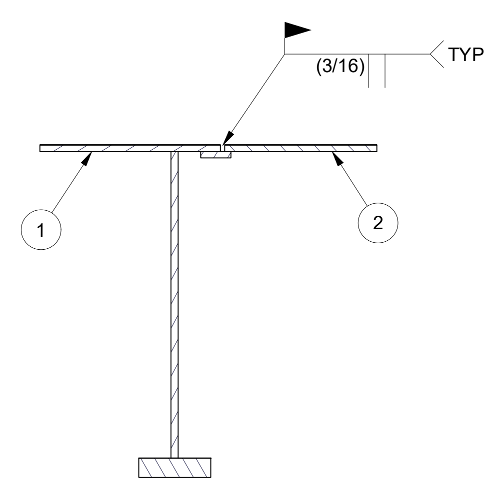

SECTION L-L



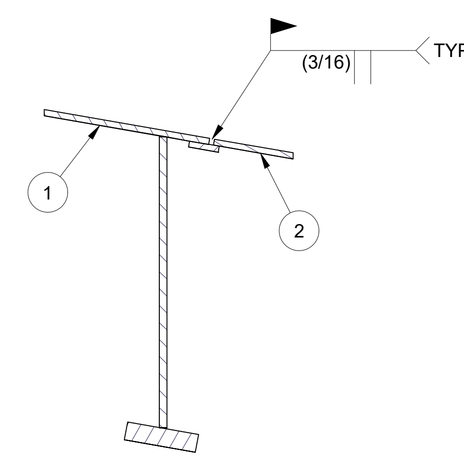

MK# P60236-A-1201 - ISO VIEW



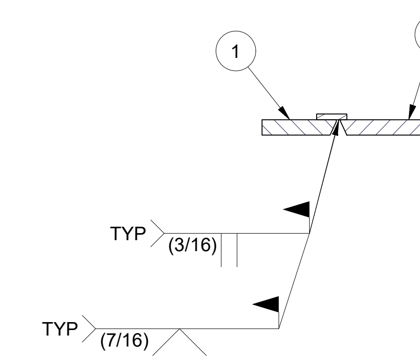

MK# P60236-A-1201 - SIDE VIEW




SECTION H-H




SECTION J-J




SECTION K-K





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: NathanR
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 20 12 18 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

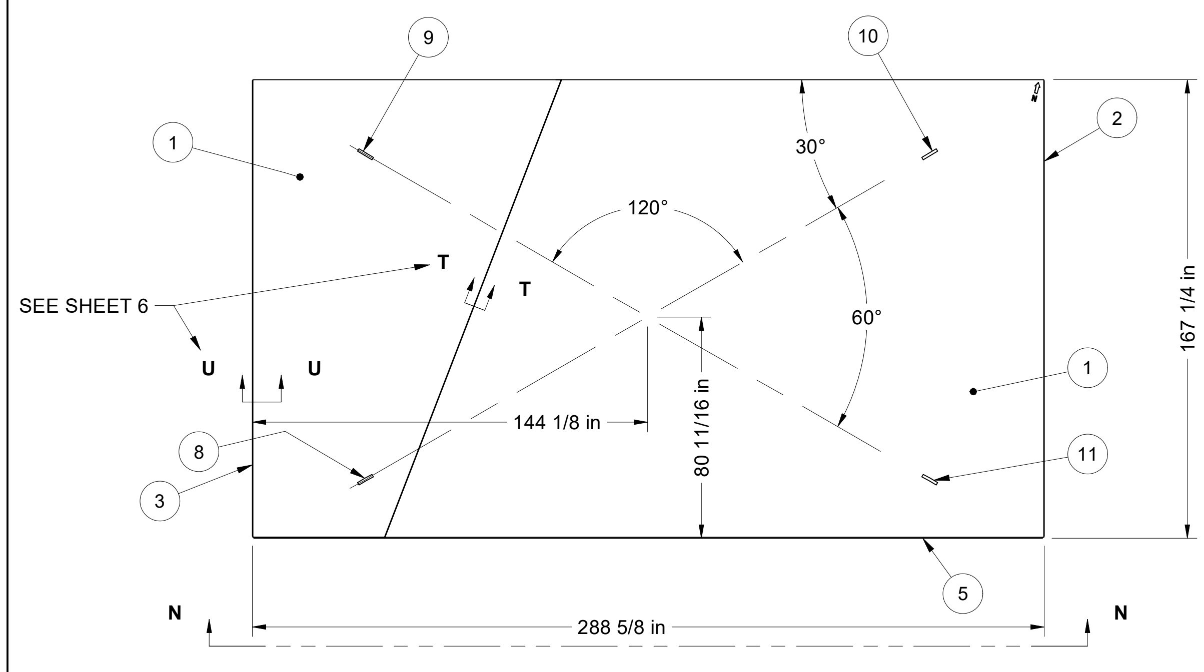
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER FIELD ASSEMBLY DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

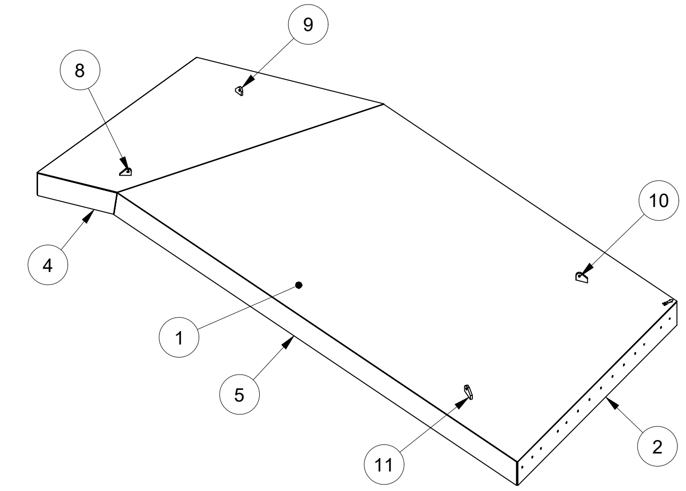
DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 13
DWG. NO.: P60236-12-4
REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

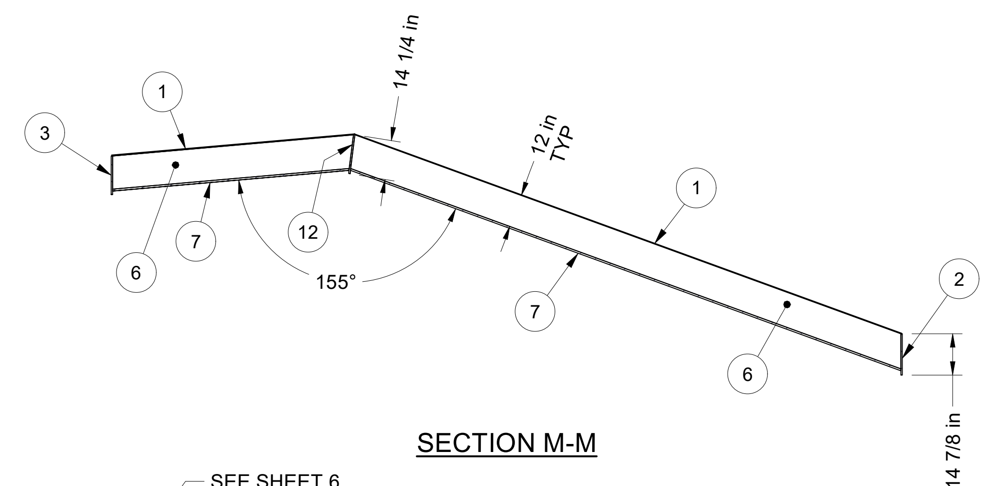
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 5/8" PL | | ASTM A-240 316L | |
| 5 | 5/8" PL | | ASTM A-240 316L | |
| 6 | 5/16" PL | | ASTM A-240 316L | |
| 7 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 1/2" PL | | ASTM A-240 316L | |
| 13 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |



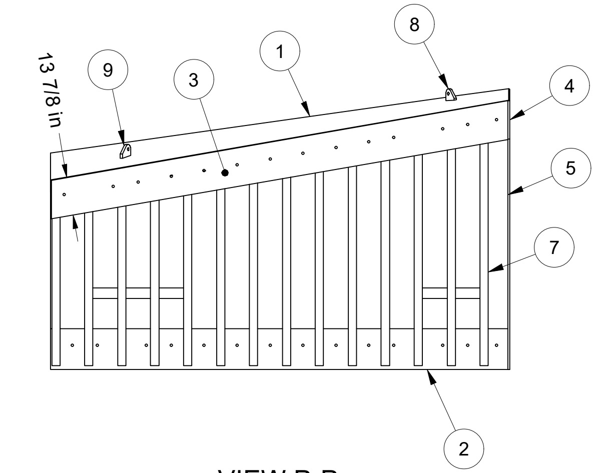

MK# P60236-A-1202 - TOP VIEW



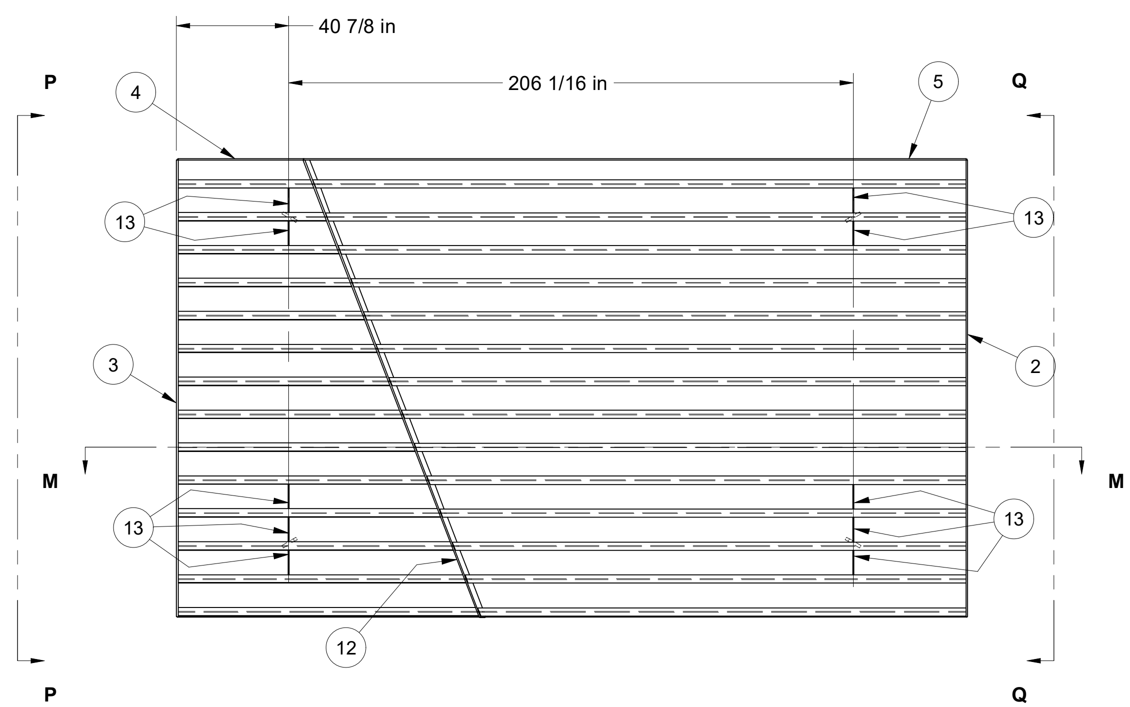
MK# P60236-A-1202 - ISO VIEW



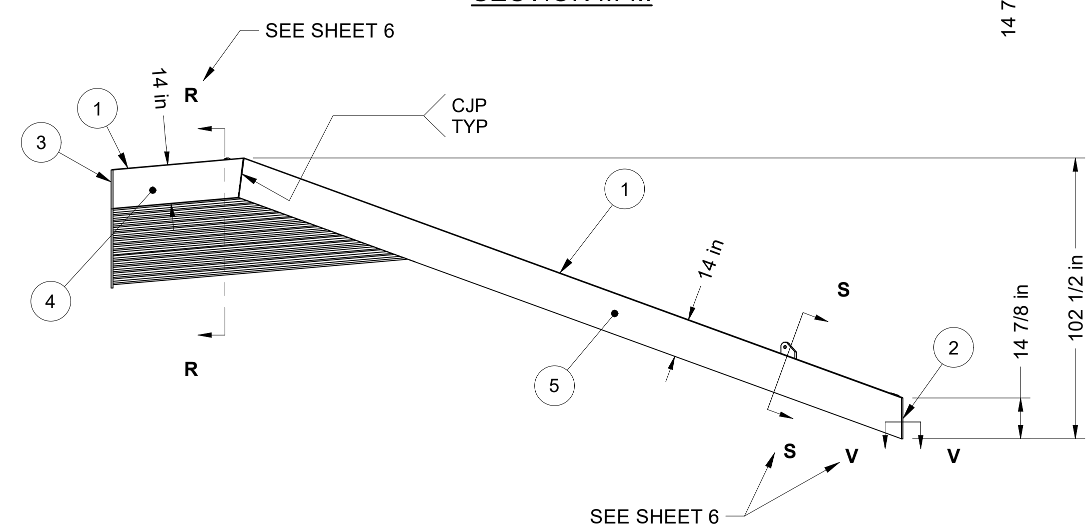

SECTION M-M



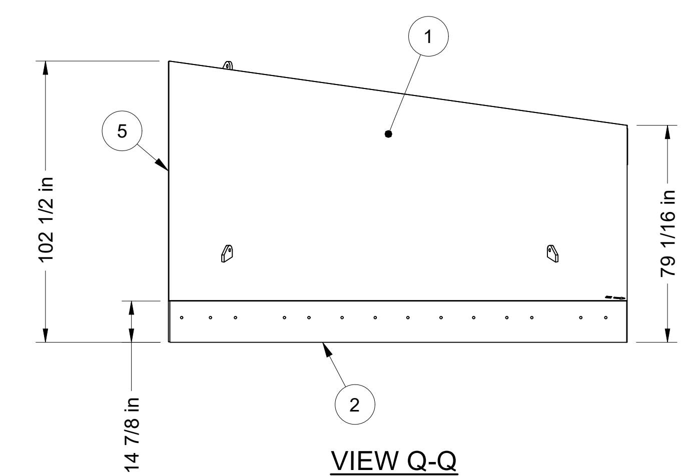

VIEW P-P




MK# P60236-A-1202 - BOTTOM VIEW




VIEW N-N




VIEW Q-Q





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: NathanR
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

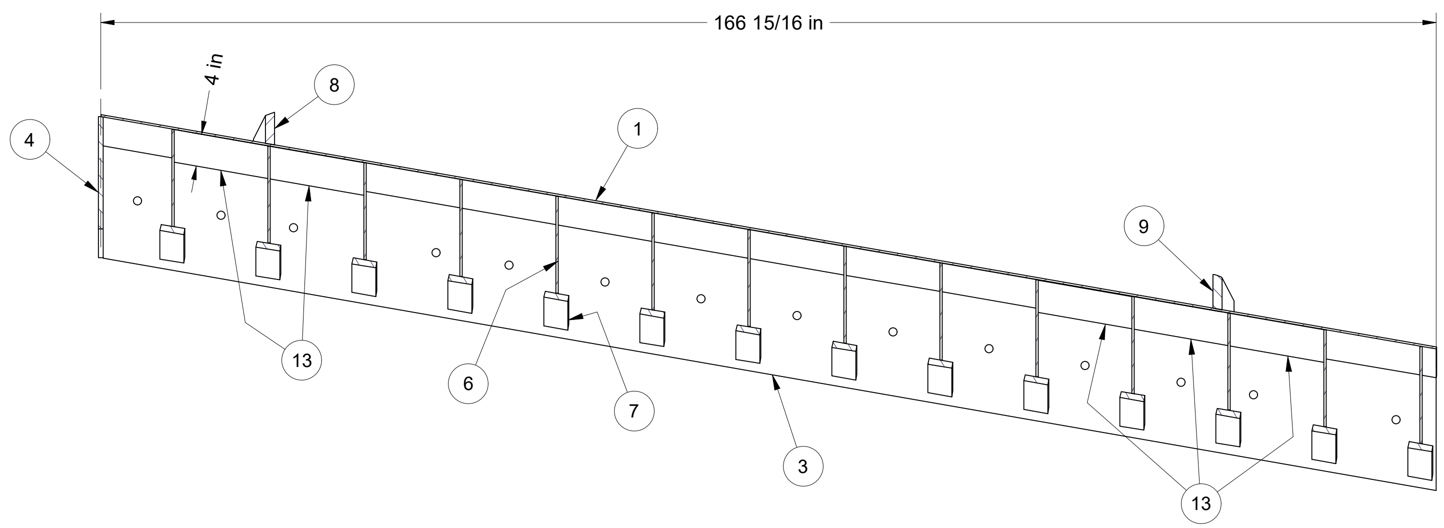
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 1 - ASSEMBLY DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

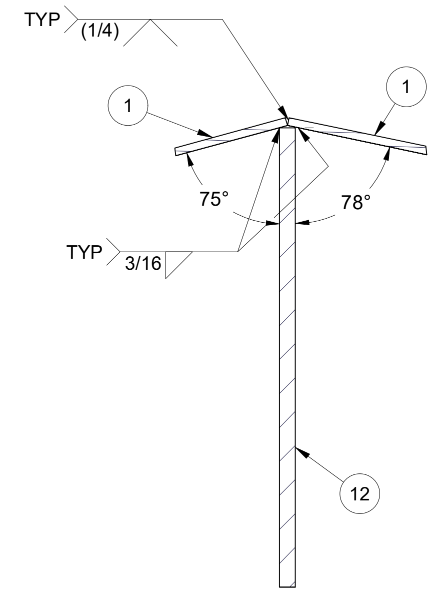
DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 13
DWG. NO.: P60236-12-5
REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

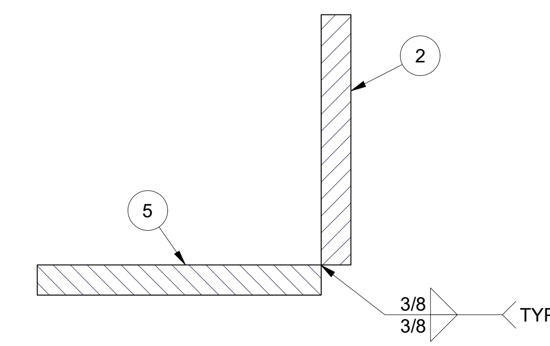
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 5/8" PL | | ASTM A-240 316L | |
| 5 | 5/8" PL | | ASTM A-240 316L | |
| 6 | 5/16" PL | | ASTM A-240 316L | |
| 7 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 1/2" PL | | ASTM A-240 316L | |
| 13 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |



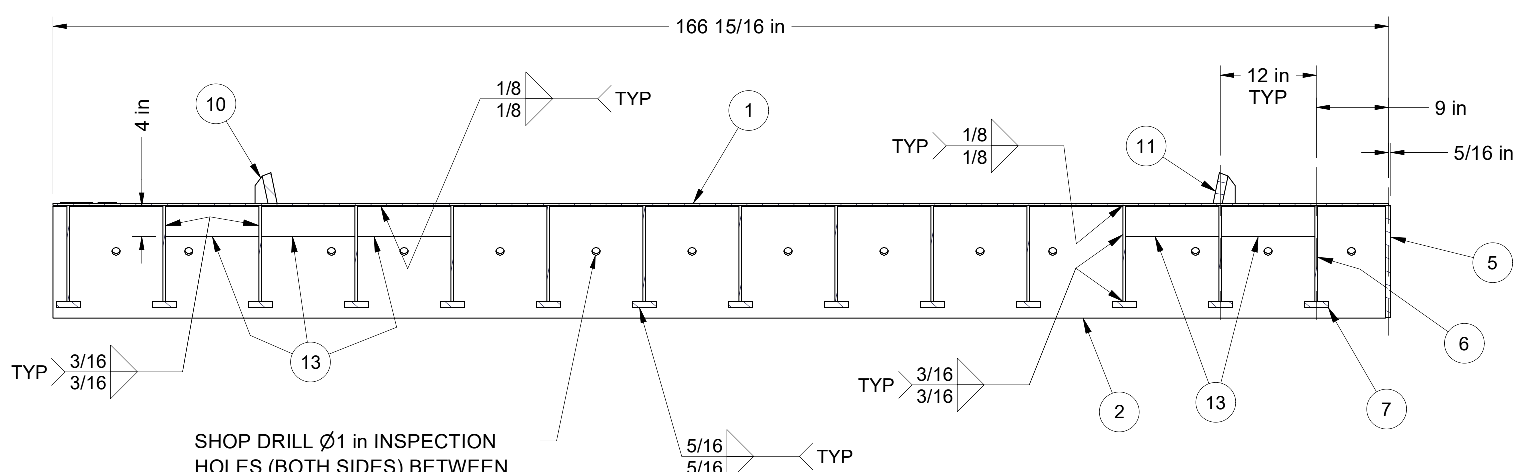

SECTION R-R




SECTION T-T

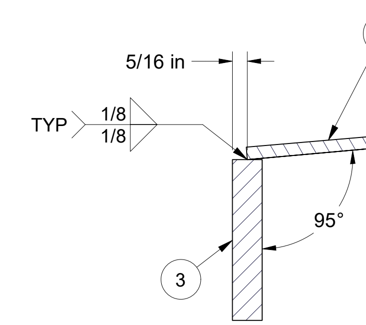



SECTION V-V




SHOP DRILL Ø1 in INSPECTION
HOLES (BOTH SIDES) BETWEEN
LONGITUDINAL STIFFENERS
(14 TOTAL)
HOLES AT COLUMN LOCATIONS
TO BE OFFSET TO MISS COLUMNS

SECTION S-S




SECTION U-U

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

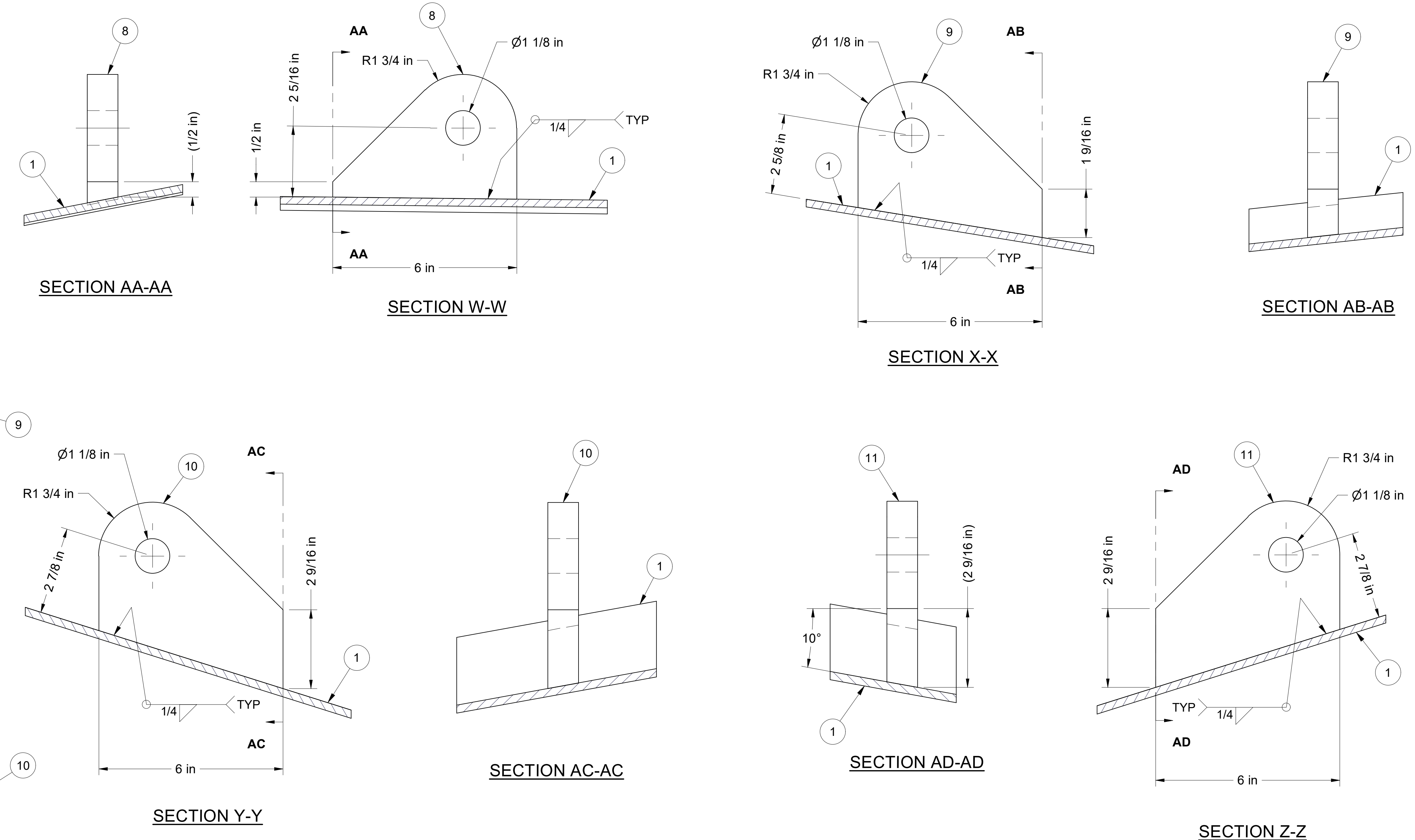
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 1 - PART DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

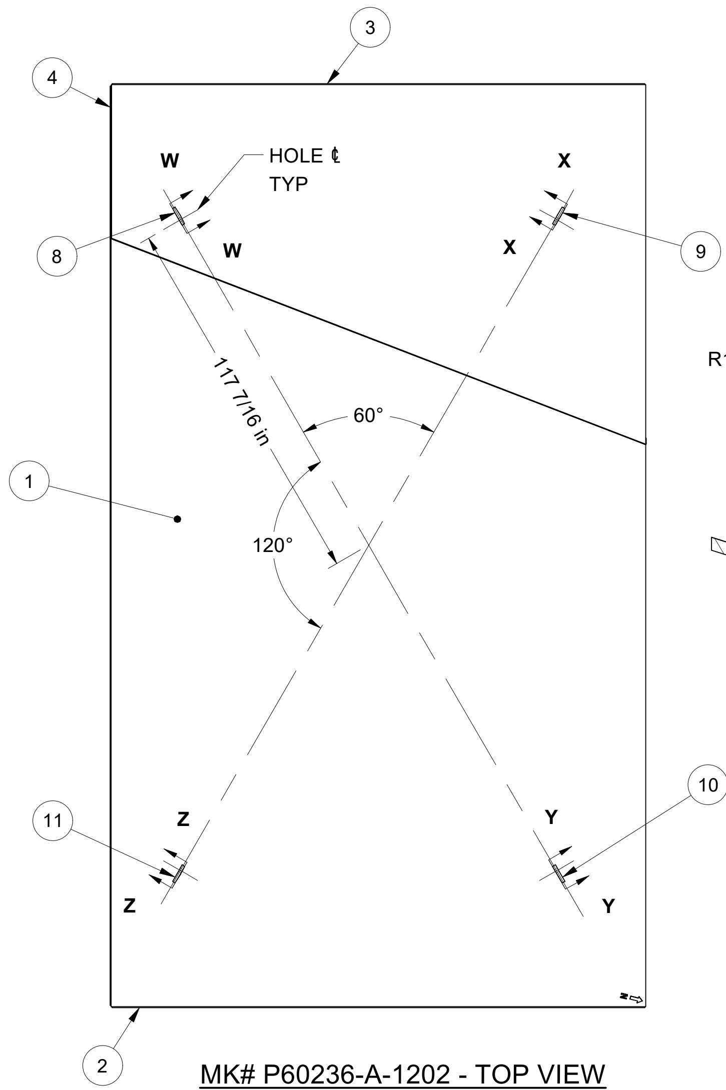
DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 13
DWG. NO.: P60236-12-6
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 5/8" PL | | ASTM A-240 316L | |
| 5 | 5/8" PL | | ASTM A-240 316L | |
| 6 | 5/16" PL | | ASTM A-240 316L | |
| 7 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 12 | 1/2" PL | | ASTM A-240 316L | |
| 13 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |

**NOTE: TYPICAL LUG DETAILS FOR ALL TOP COVERS.**




MK# P60236-A-1202 - TOP VIEW

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: NathanR
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER P.B. CAUGHLIN MEMBER 14318 20 12 18 YR. MN DAY SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

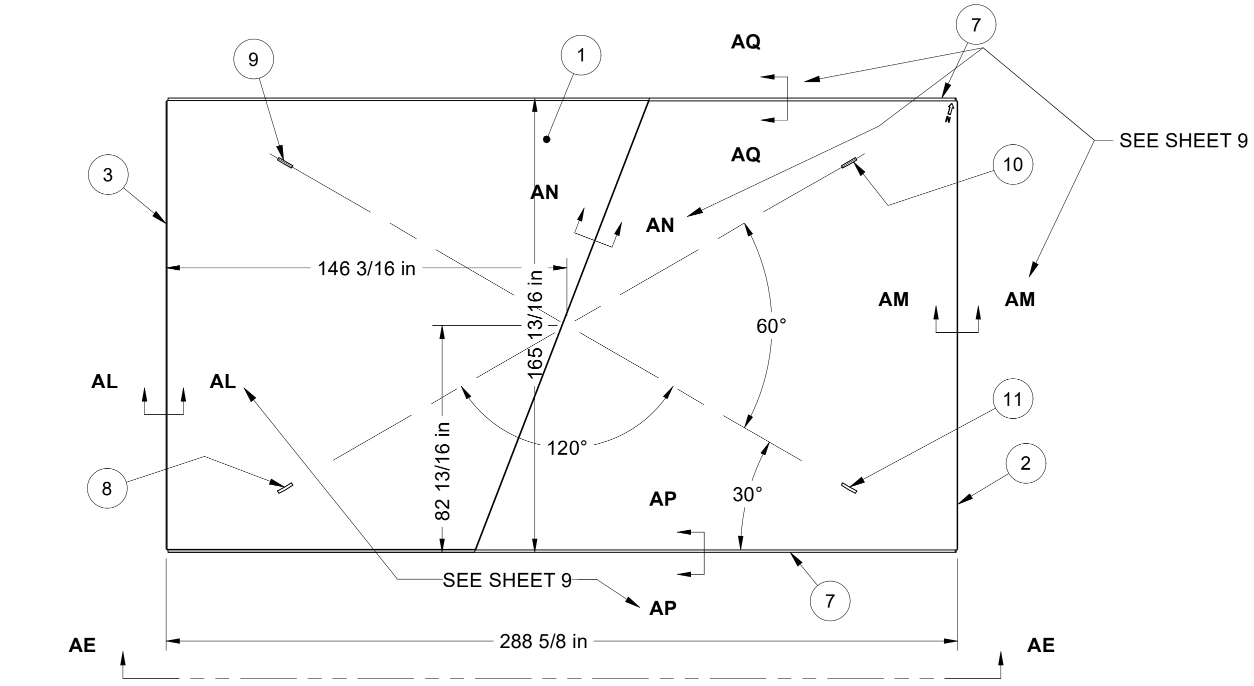
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

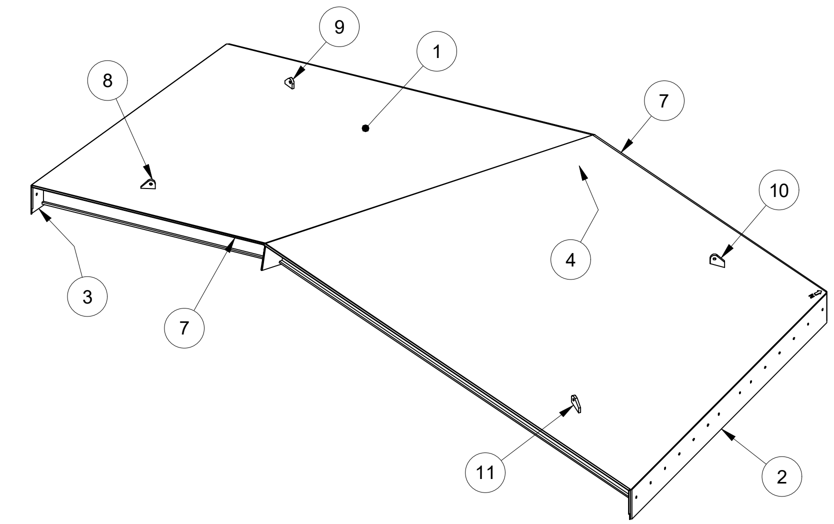
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVERS - LUG DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 13
DWG. NO.: P60236-12-7 REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

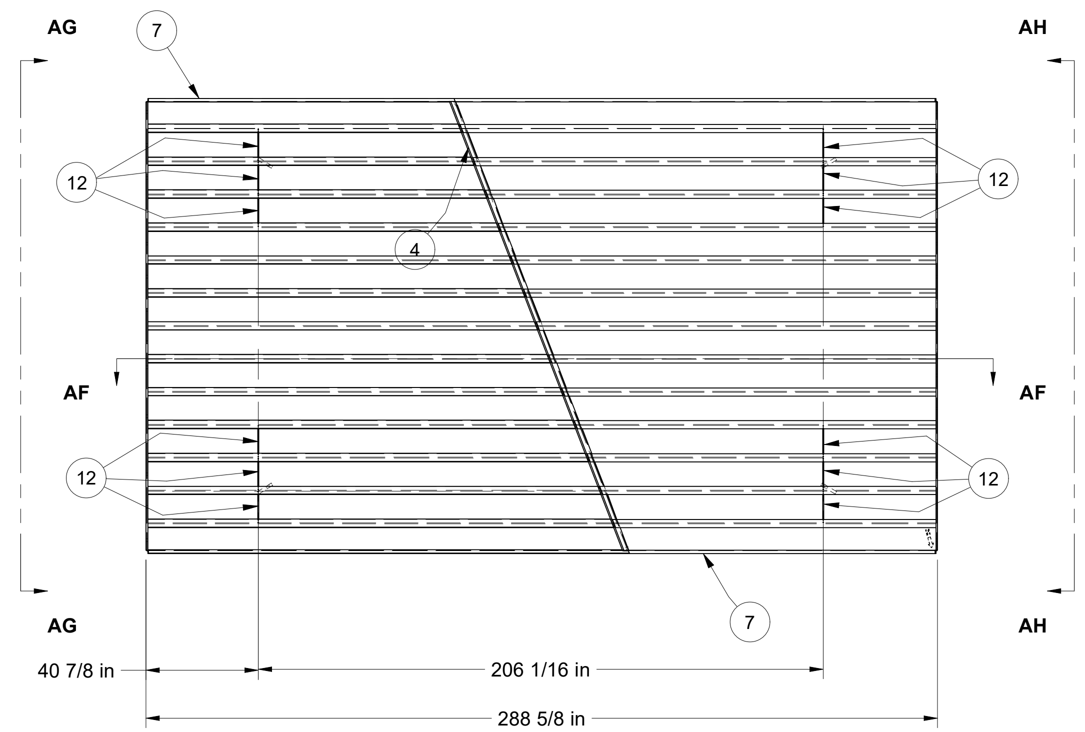



MK# P60236-A-1203 - TOP VIEW

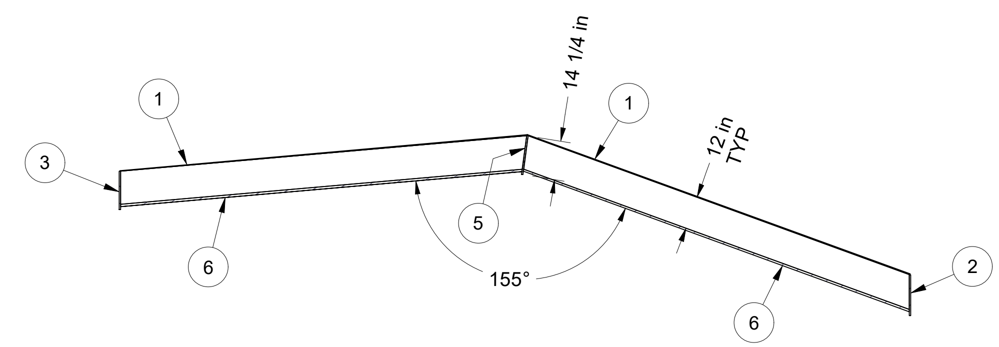



MK# P60236-A-1203

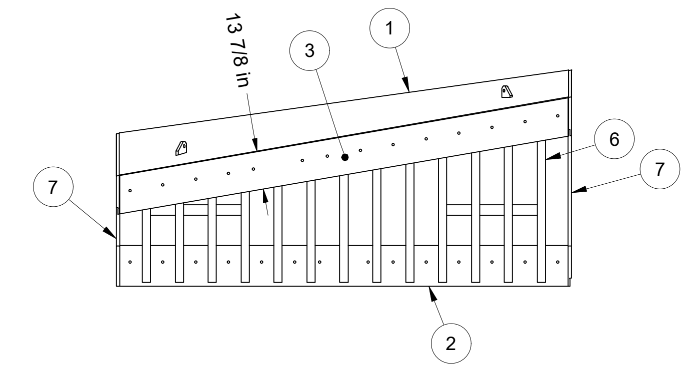
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 1/2" PL | | ASTM A-240 316L | |
| 5 | 5/16" PL | | ASTM A-240 316L | |
| 6 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 7 | 1-1/4" X 1/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |



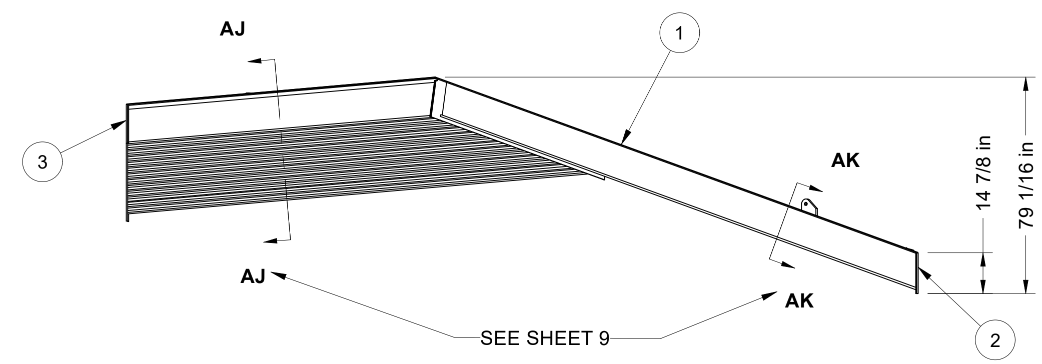

MK# P60236-A-1203 - BOTTOM VIEW



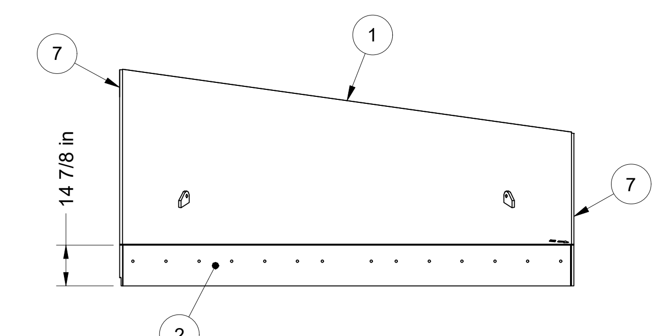

SECTION AF-AF




VIEW AG-AG




VIEW AE-AE




VIEW AH-AH





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: NathanR
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

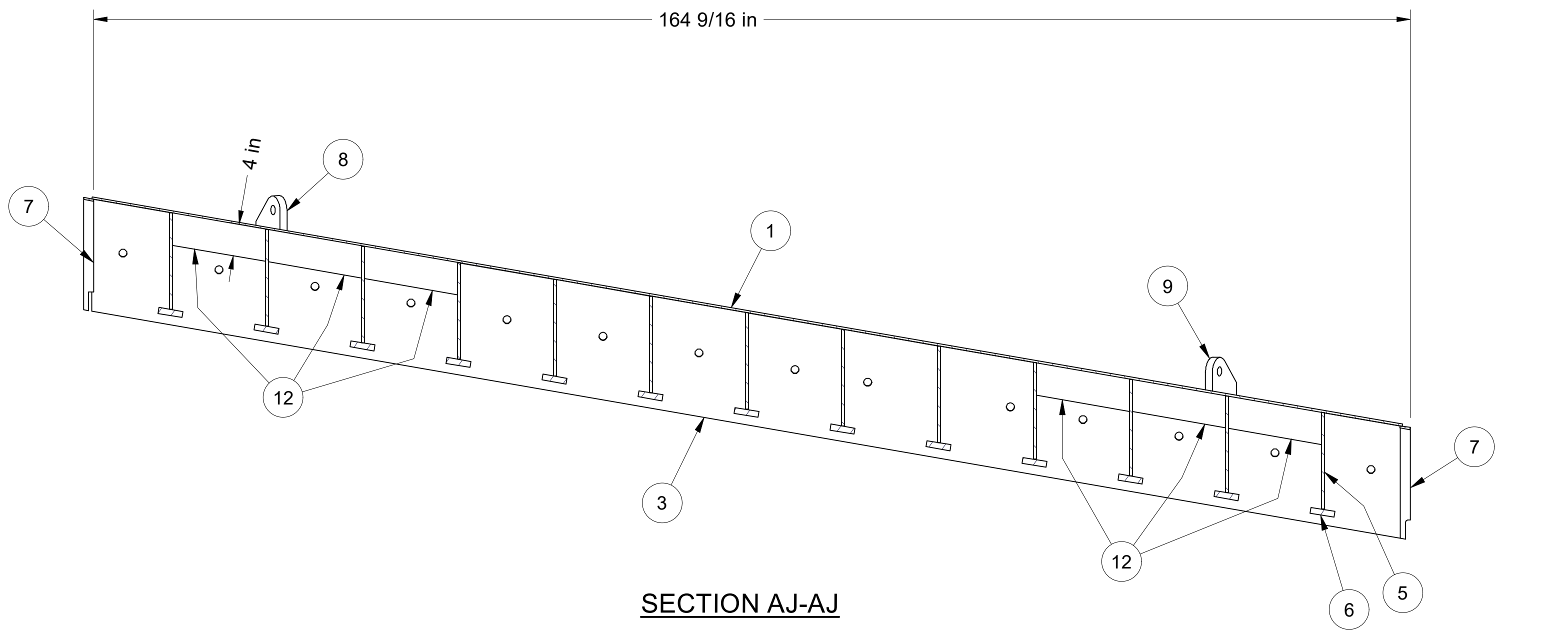
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

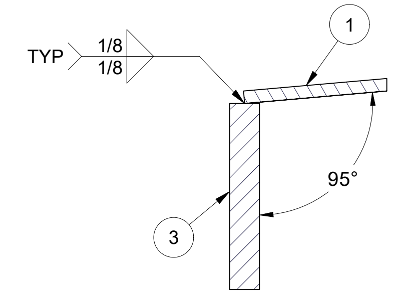
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 2 - ASSEMBLY DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 8 OF 13
DWG. NO.: P60236-12-8
REV: 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

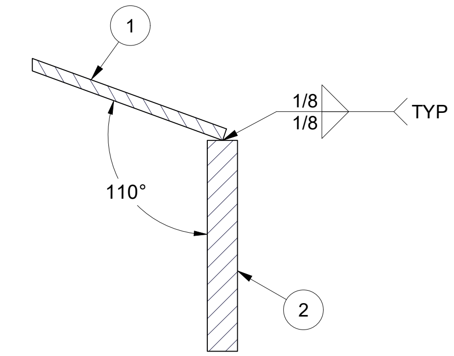



SECTION AJ-AJ

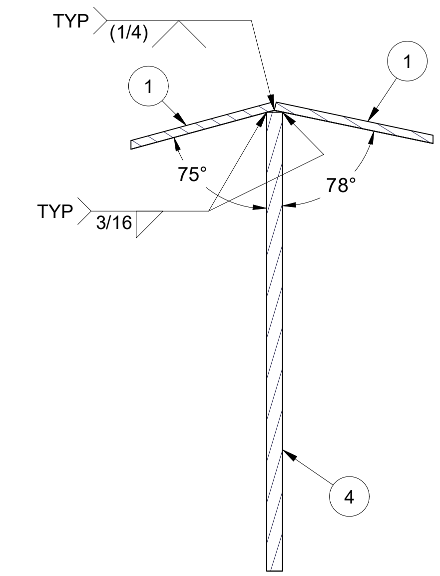



SECTION AL-AL

| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 1/2" PL | | ASTM A-240 316L | |
| 5 | 5/16" PL | | ASTM A-240 316L | |
| 6 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 7 | 1-1/4" X 1/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |




SECTION AM-AM

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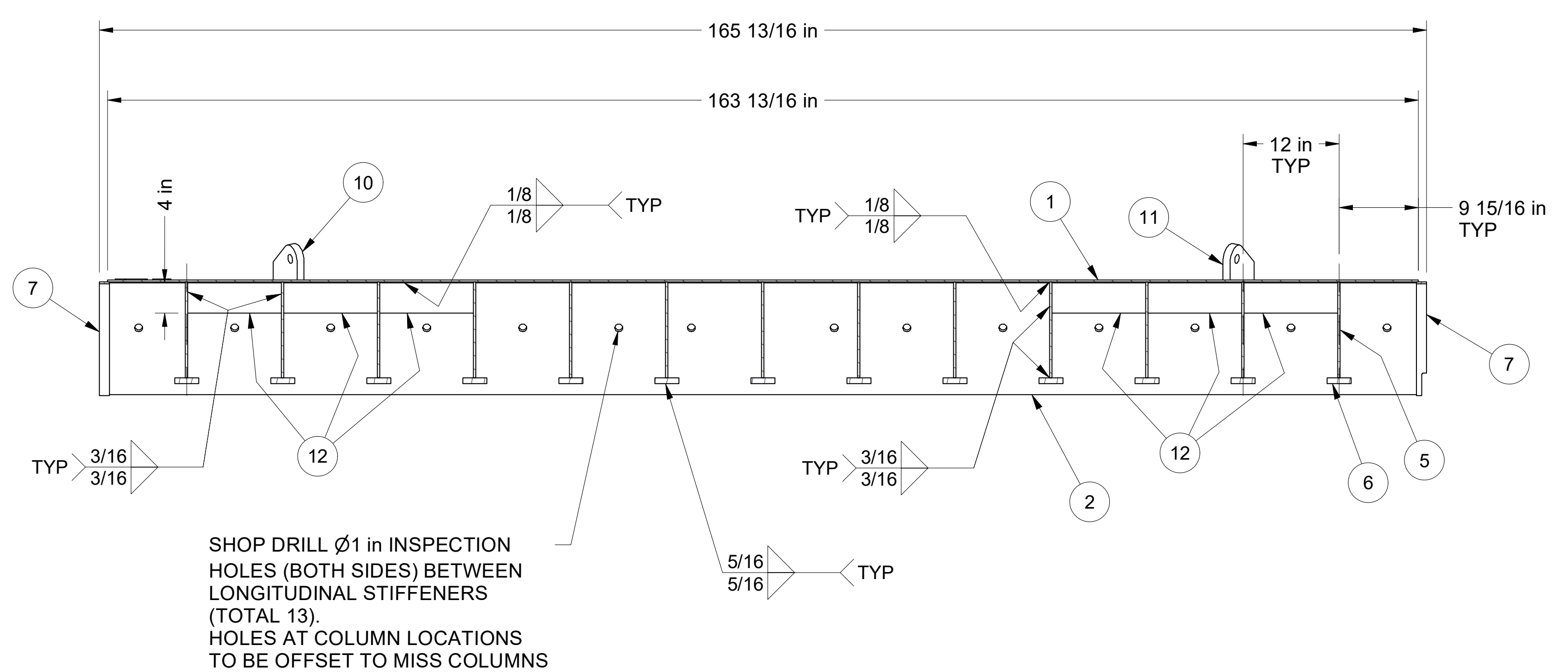
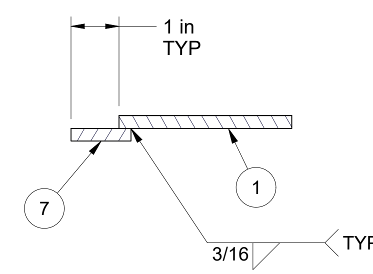



SECTION AK-AK

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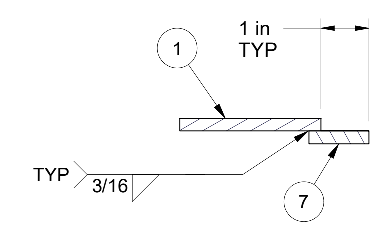


SECTION AQ-AQ

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|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — E.B. CAUGHLIN — MEMBER 14318 — 20 12 18 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

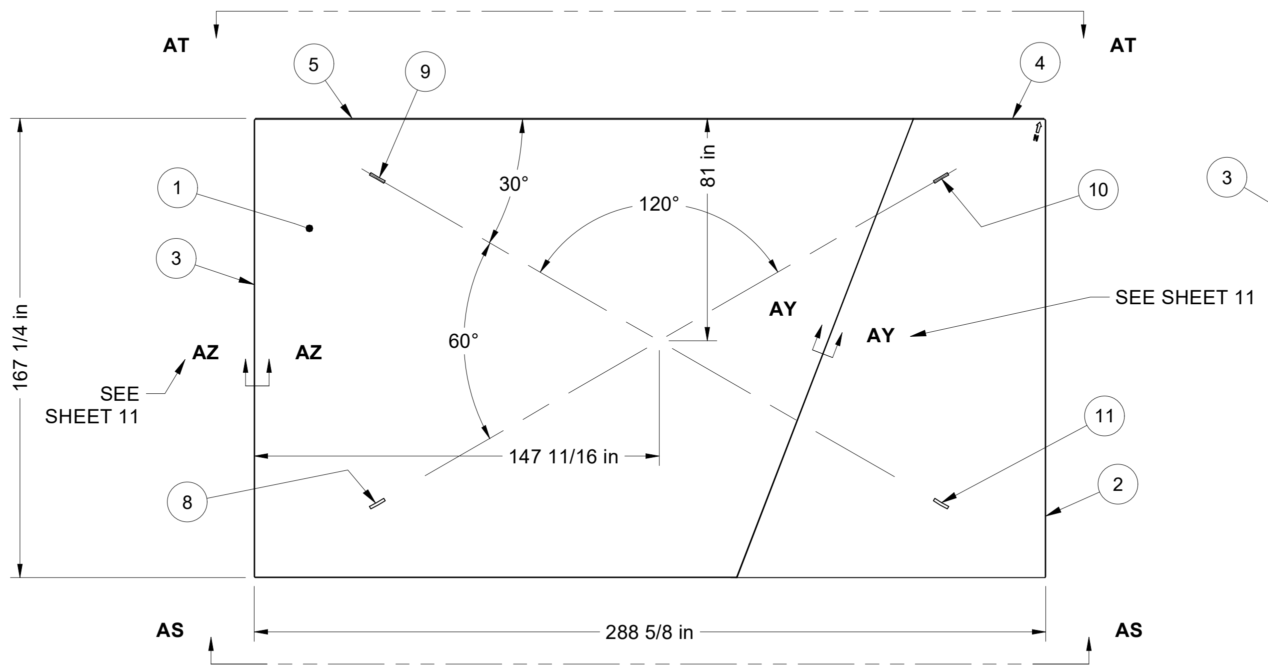
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

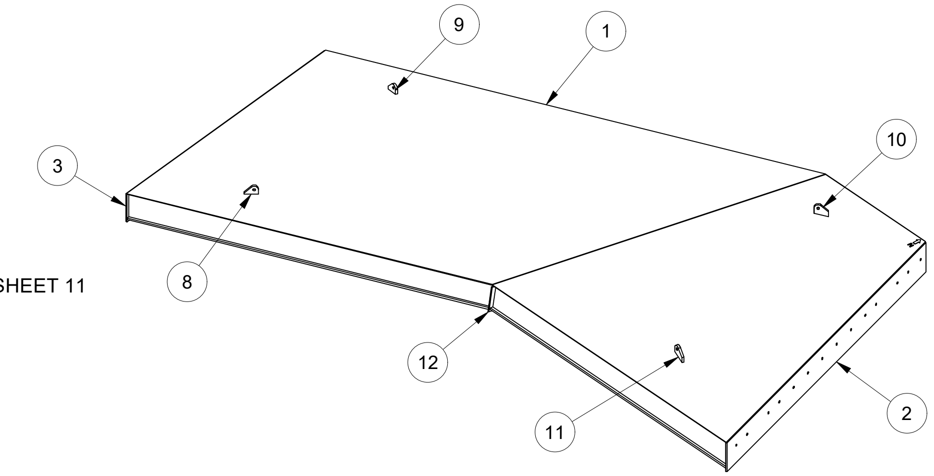
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 2 - PART DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 9 OF 13
DWG. NO.: P60236-12-9 — 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

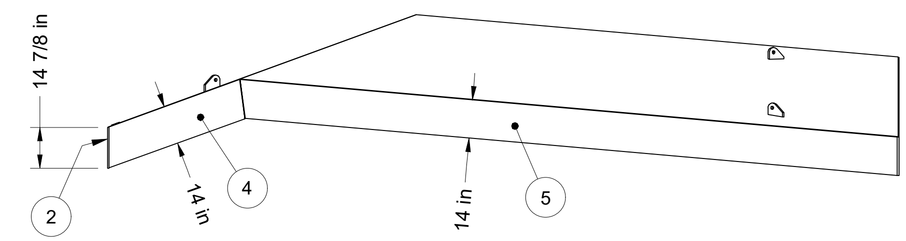



MK# P60236-A-1204 - TOP VIEW

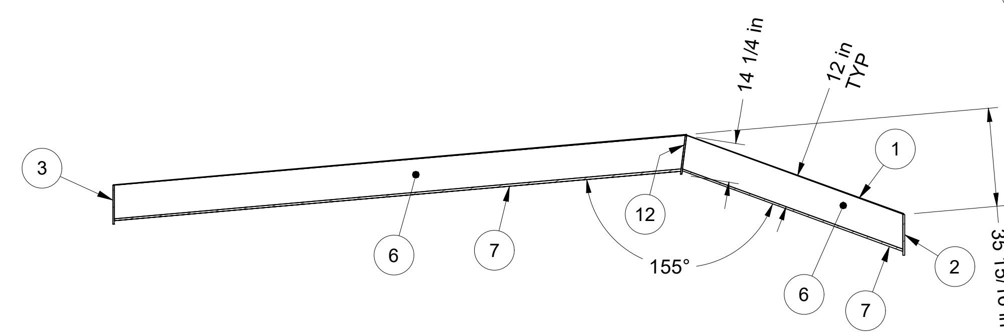



MK# P60236-A-1204 - ISO VIEW

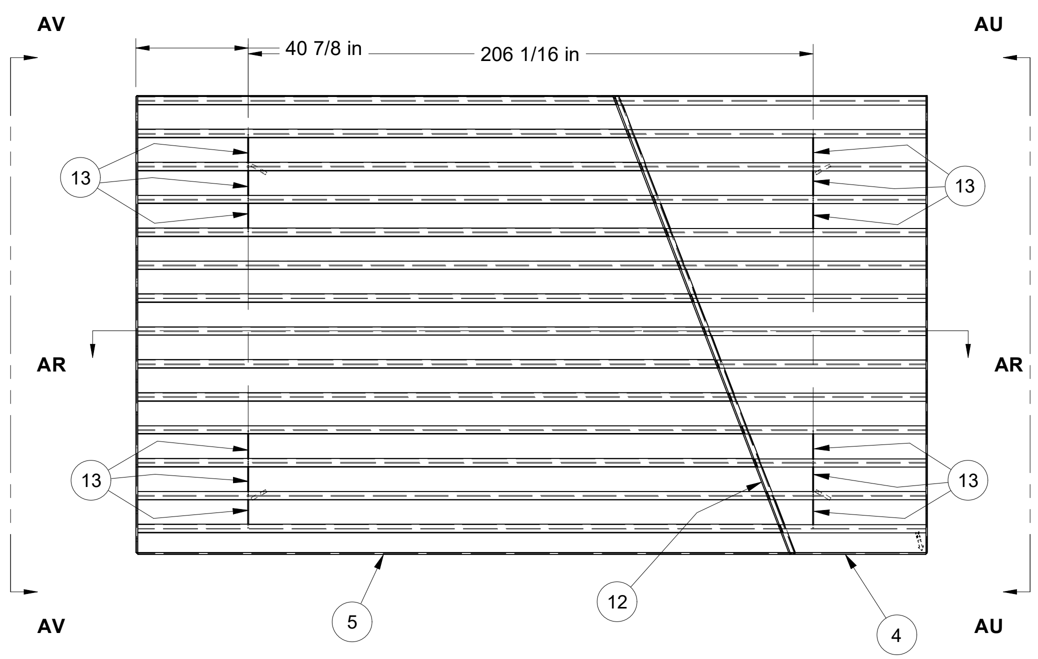
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 5/8" PL | | ASTM A-240 316L | |
| 5 | 5/8" PL | | ASTM A-240 316L | |
| 6 | 5/16" PL | | ASTM A-240 316L | |
| 7 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 1/2" PL | | ASTM A-240 316L | |
| 13 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |



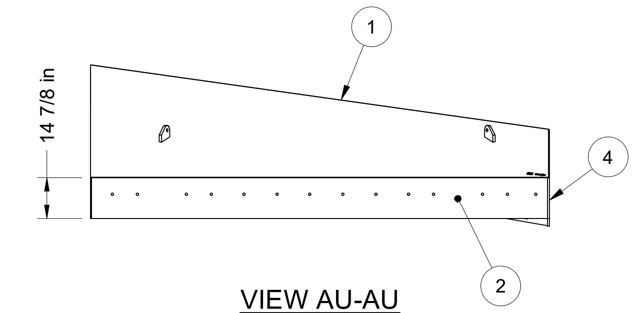

VIEW AT-AT



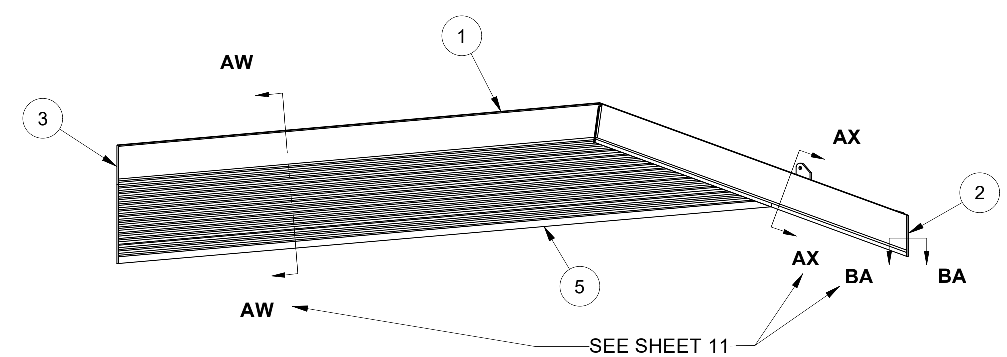

SECTION AR-AR



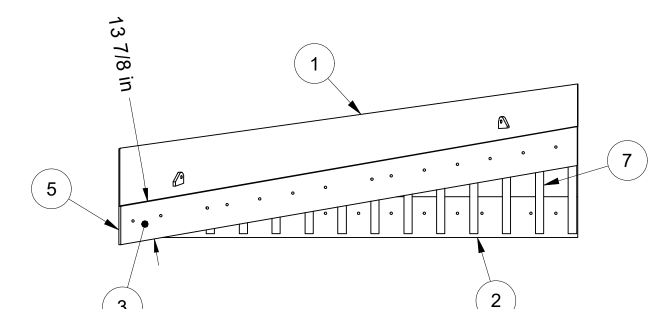

MK# P60236-A-1204 - BOTTOM VIEW




VIEW AU-AU




VIEW AS-AS




VIEW AV-AV

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

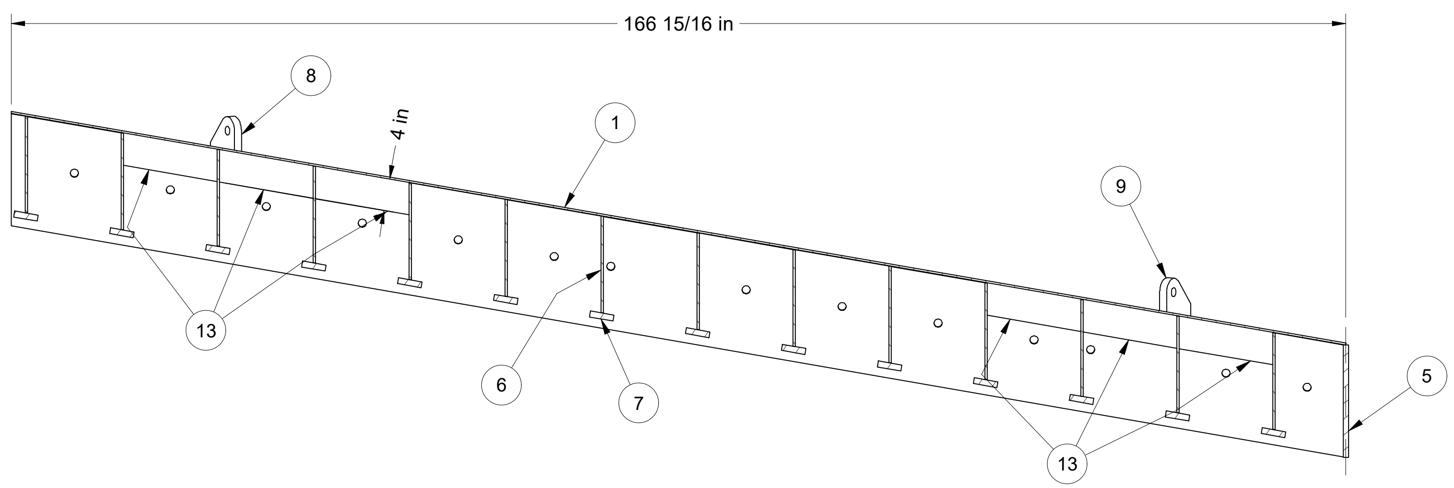
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 3 - ASSEMBLY DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

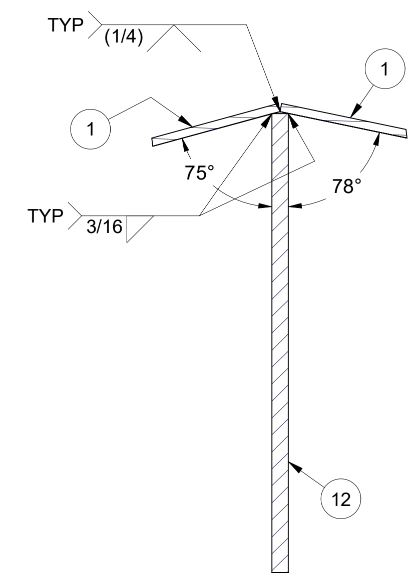
DO NOT SCALE DRAWINGS
SHEET NO.: 10 OF 13
DWG. NO.: P60236-12-10
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

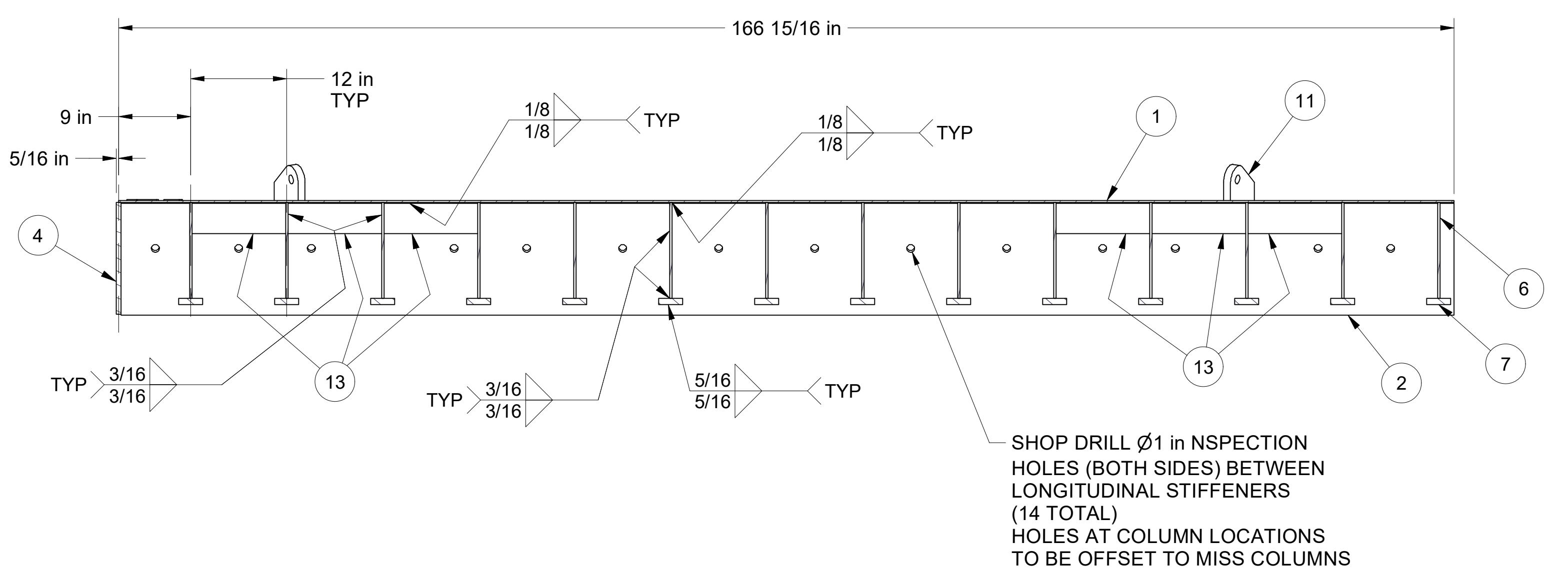
| BILL OF MATERIALS | | | | |
|---|---|---|---|---|
| ITEM | DESCRIPTION | PART # | MATERIAL | SHT# |
| 1 | 1/4" PL | | ASTM A-240 316L | |
| 2 | 5/8" PL | | ASTM A-240 316L | |
| 3 | 5/8" PL | | ASTM A-240 316L | |
| 4 | 5/8" PL | | ASTM A-240 316L | |
| 5 | 5/8" PL | | ASTM A-240 316L | |
| 6 | 5/16" PL | | ASTM A-240 316L | |
| 7 | 3" X 3/4" FLAT BAR | | ASTM A-240 316L | |
| 8 | 1" PL | | ASTM A-240 316L | |
| 9 | 1" PL | | ASTM A-240 316L | |
| 10 | 1" PL | | ASTM A-240 316L | |
| 11 | 1" PL | | ASTM A-240 316L | |
| 12 | 1/2" PL | | ASTM A-240 316L | |
| 13 | 4" X 3/8" FLAT BAR | | ASTM A-240 316L | |



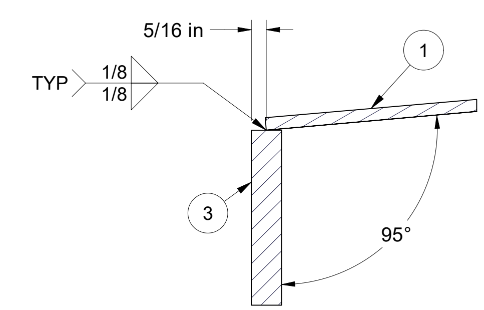

SECTION AW-AW



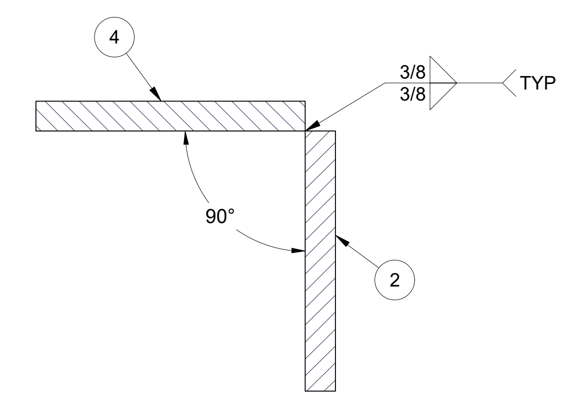

SECTION AY-AY




SECTION AX-AX




SECTION AZ-AZ




SECTION BA-BA



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

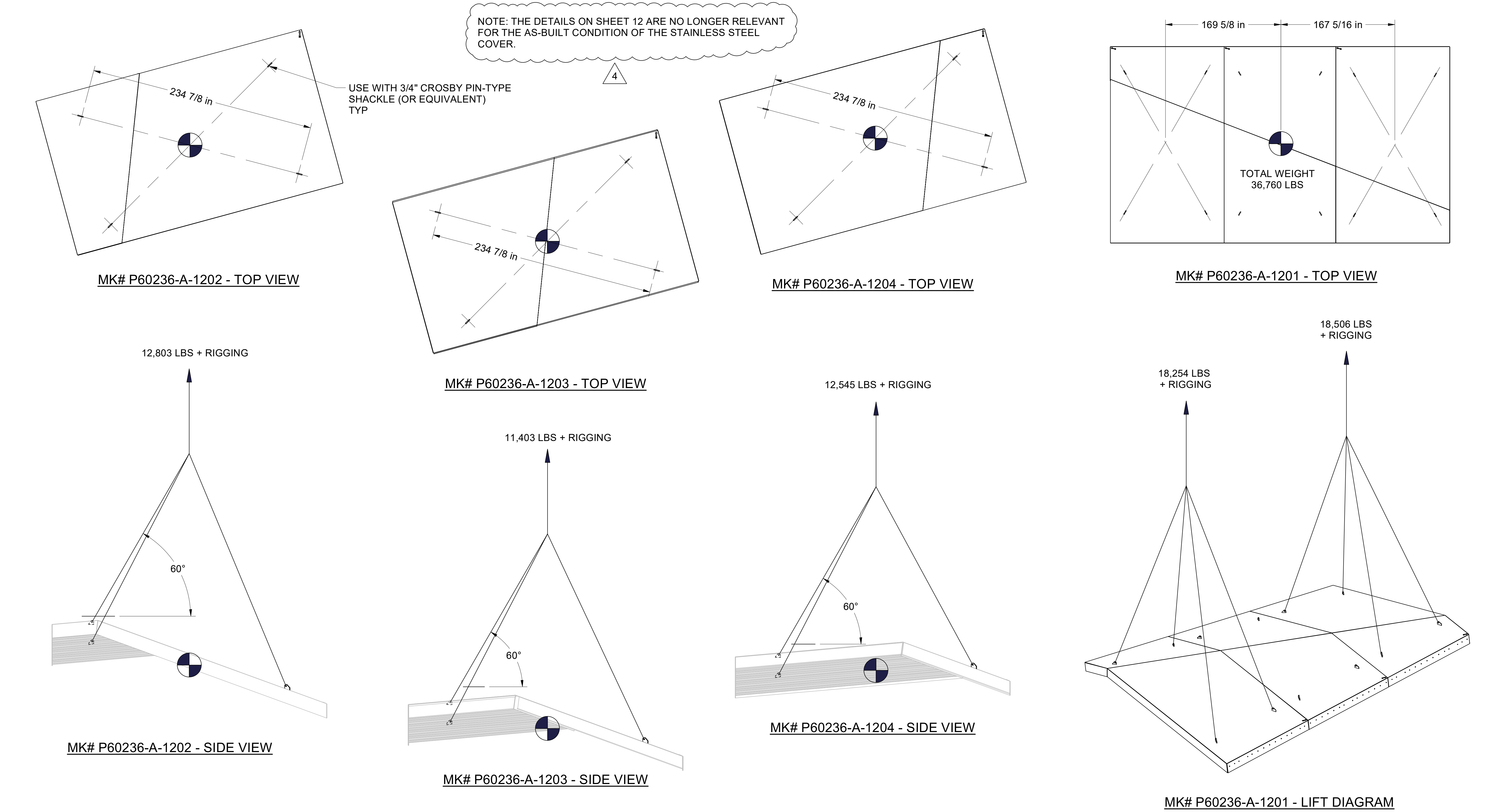
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVER 3 - PART DETAILS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 11 OF 13
DWG. NO.: P60236-12-11
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059








| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
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TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
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ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
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CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING
TOP COVERS - LIFTING DIAGRAMS
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 12 OF 13
DWG. NO.: P60236-12-12
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

NOTE: THE DETAILS ON THE SHEET 13 ARE THE RECOMMENDATION FOR PLACEMENT OF THE STAINLESS STEEL COVER PROVIDED PRIOR TO INSTALLATION OF THE COVER RATHER THAN AS-BUILT DETAILS. KOVA PERSONNEL DID NOT FIELD-VERIFY THE DETAILS SHOWN PRIOR TO REMOVAL; HOWEVER, THE STAINLESS STEEL COVER COULD NOT HAVE FIT AS SHOWN IN THE AS-BUILT DETAILS WITHOUT COVER PLACEMENT SIMILAR TO THAT SHOWN.

4


OPENING TO SKIRT CLEARANCE



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NathanR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY SHAFT OPENING INSTALLATION CLEARANCES
LOCATION: 59° 33' 22.51"N 108° 28' 31.42"W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 13 OF 13
DWG. NO.: P60236-12-13
4

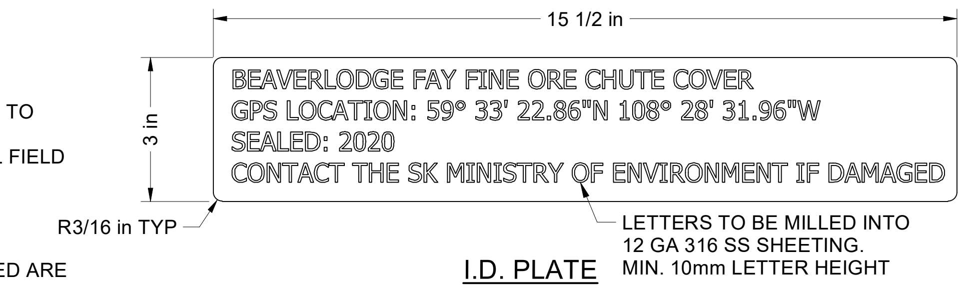
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# FAY 8 - Fine Ore Dump

FAY 8 - Fine Ore Dump

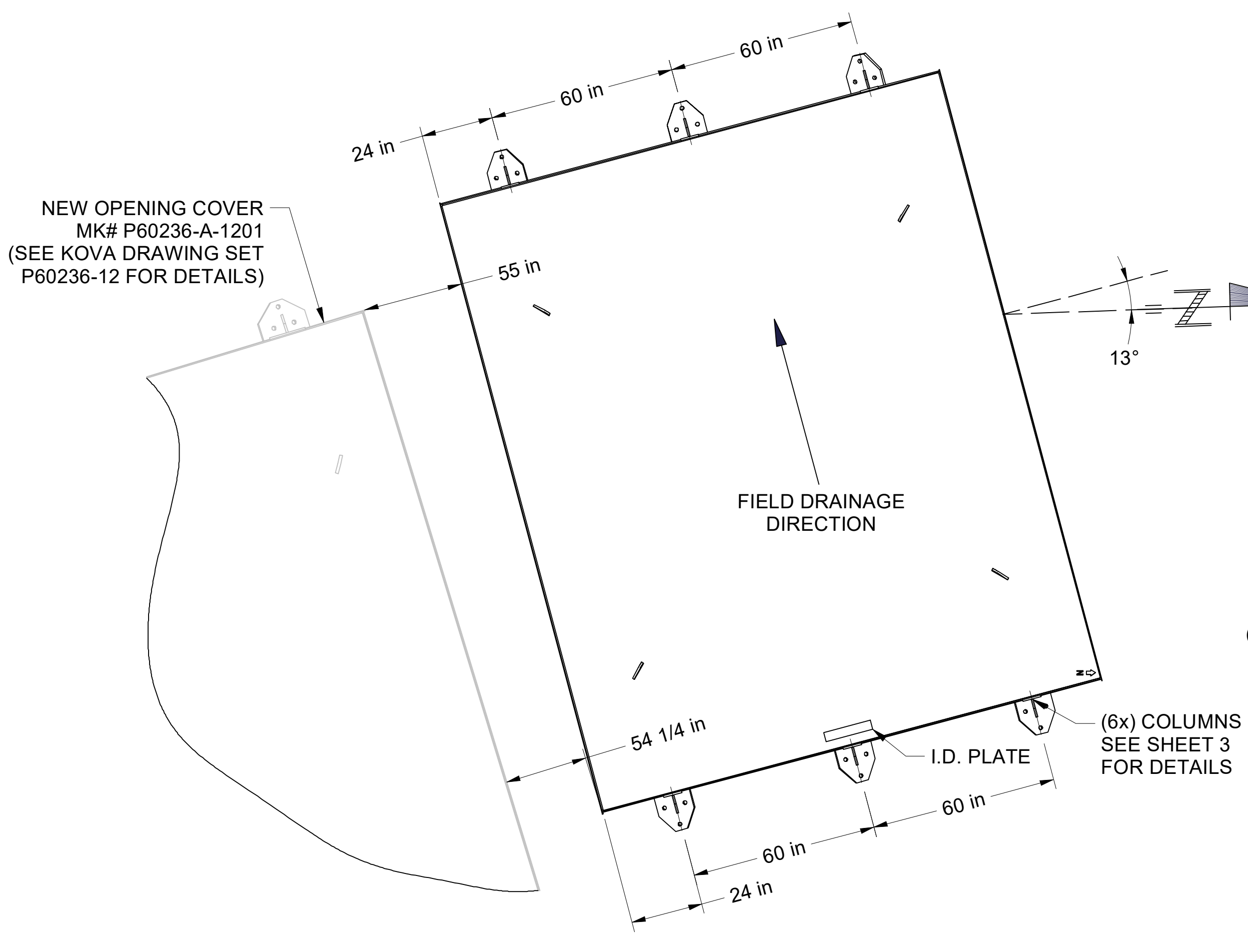
GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL SURFACES TO BE FIELD PICKLED AND PASSIVATED FOLLOWING FIELD WELDING IN ACCORDANCE WITH QA/QC PROTOCOL. KOVA PERSONNEL TO REVIEW VISIBLE SURFACES FOLLOWING PICKLING AND PASSIVATING DURING FINAL FIELD INSPECTION.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL ON ANY SURFACE AND A USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS PERIODIC INSPECTIONS BE PERFORMED AS RECOMMENDED IN THE QA/QC PROTOCOL.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 9,850 LBS.
5. DO NOT BACK FILL WALLS OF COVER.

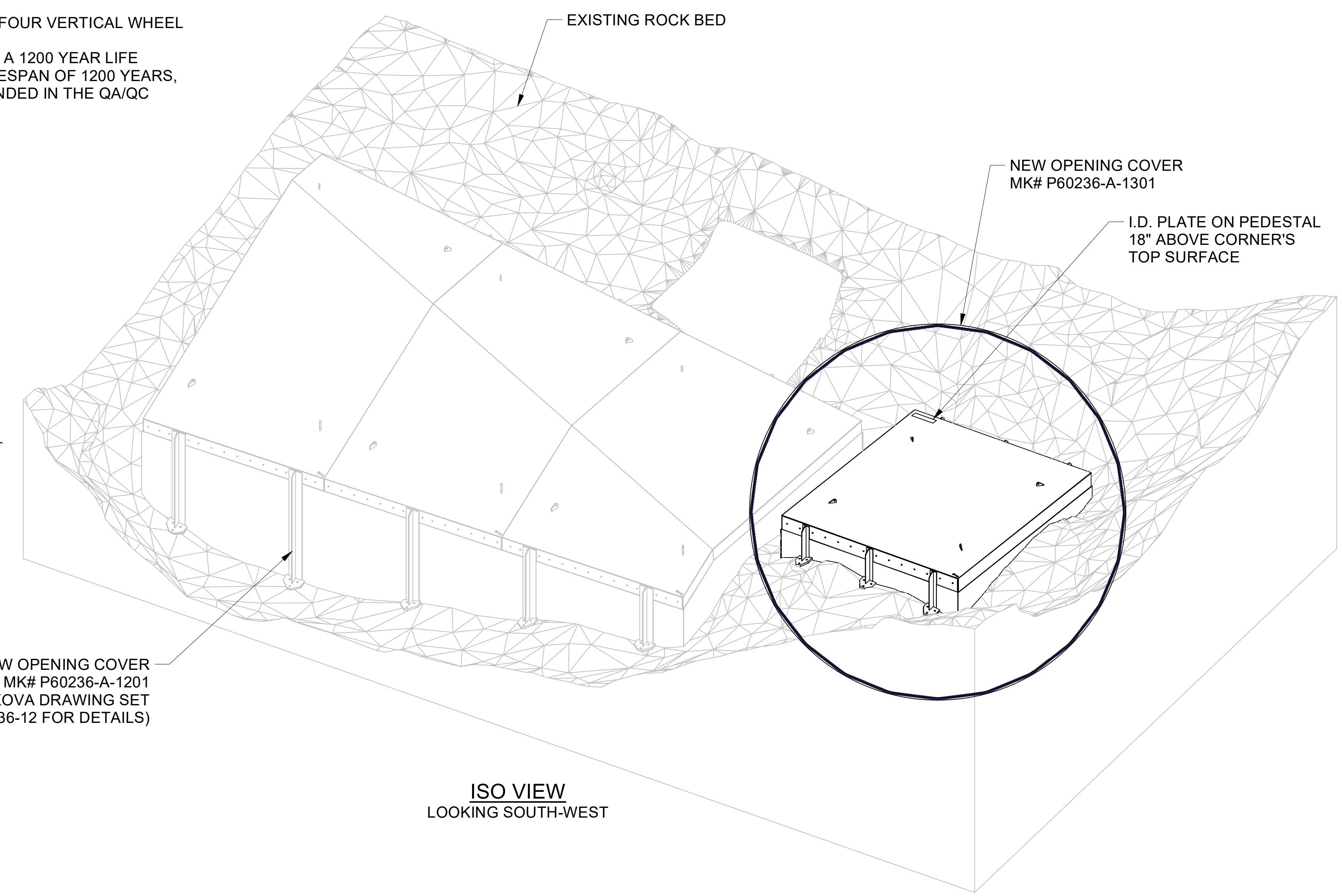



I.D. PLATE
TO BE SUPPLIED AND
INSTALLED BY FABRICATOR

ESTIMATED WEIGHTS:
TOP COVER W/O RIGGING: 7,620 LBS
AS INSTALLED: 9,850 LBS




PLAN VIEW - FAY SHAFT OPENING COVER




ISO VIEW
LOOKING SOUTH-WEST



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

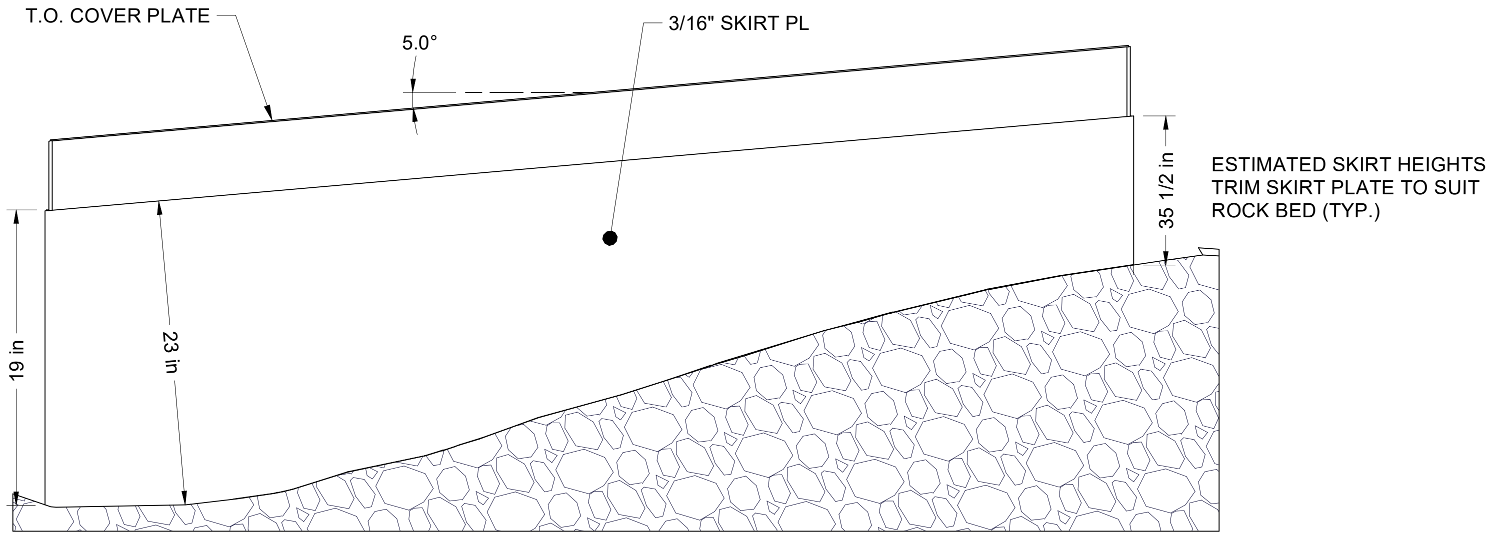
DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 6
DWG. NO.: P60236-13-1
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

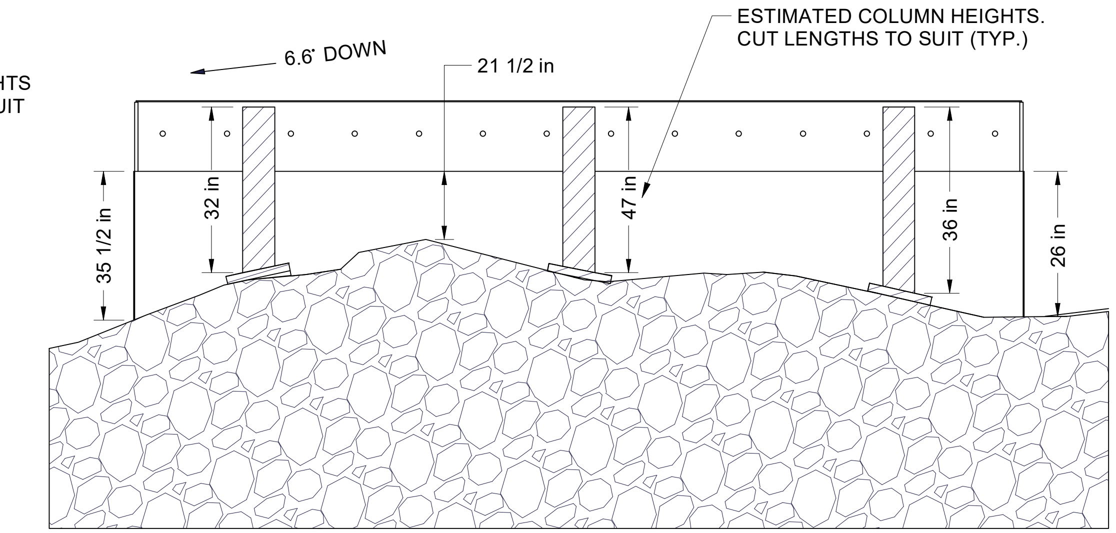
KOVA RECOMMENDS COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE
OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.

| BILL OF MATERIAL FOR SKIRT AND COLUMNS | |
|---|---|
| DISCRIPTION | QTY |
| COLUMN SECTIONS - 20' LENGTHS (SHIPPED LOOSE) | 3 |
| 3/16" SKIRT - 5' X 10' SHEETS (SHIPPED LOOSE) | 5 |

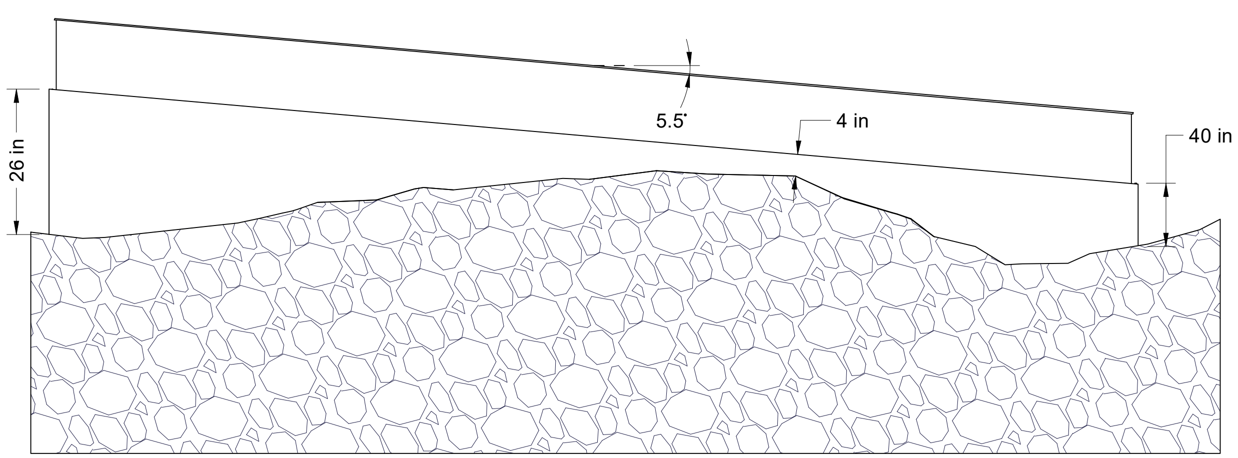
NOTE: QUANTITIES IN BILL OF MATERIALS ARE FOR BIDDING PURPOSES ONLY. SUBJECT TO CHANGE FOLLOWING AWARD.



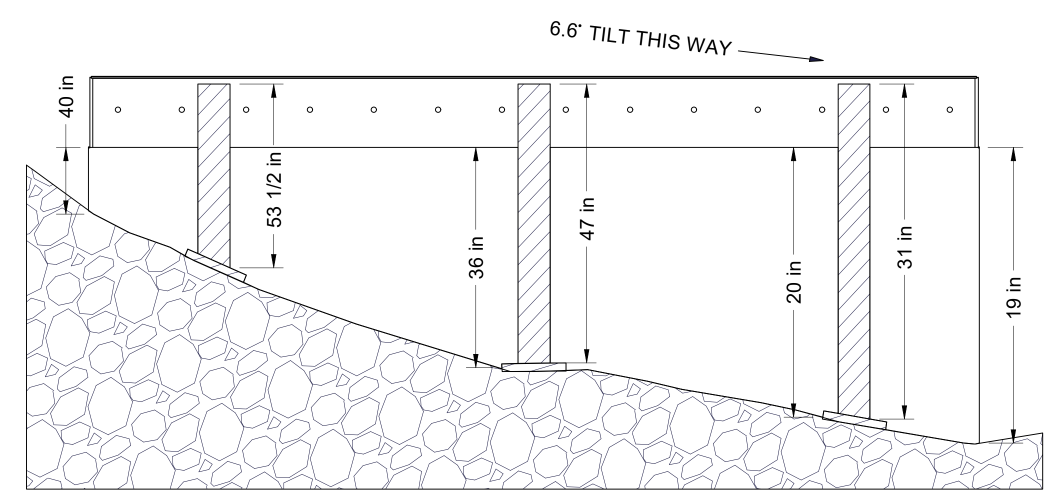

ELEVATION - LOOKING NORTH




ELEVATION - LOOKING WEST




ELEVATION - LOOKING SOUTH




ELEVATION - LOOKING EAST

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

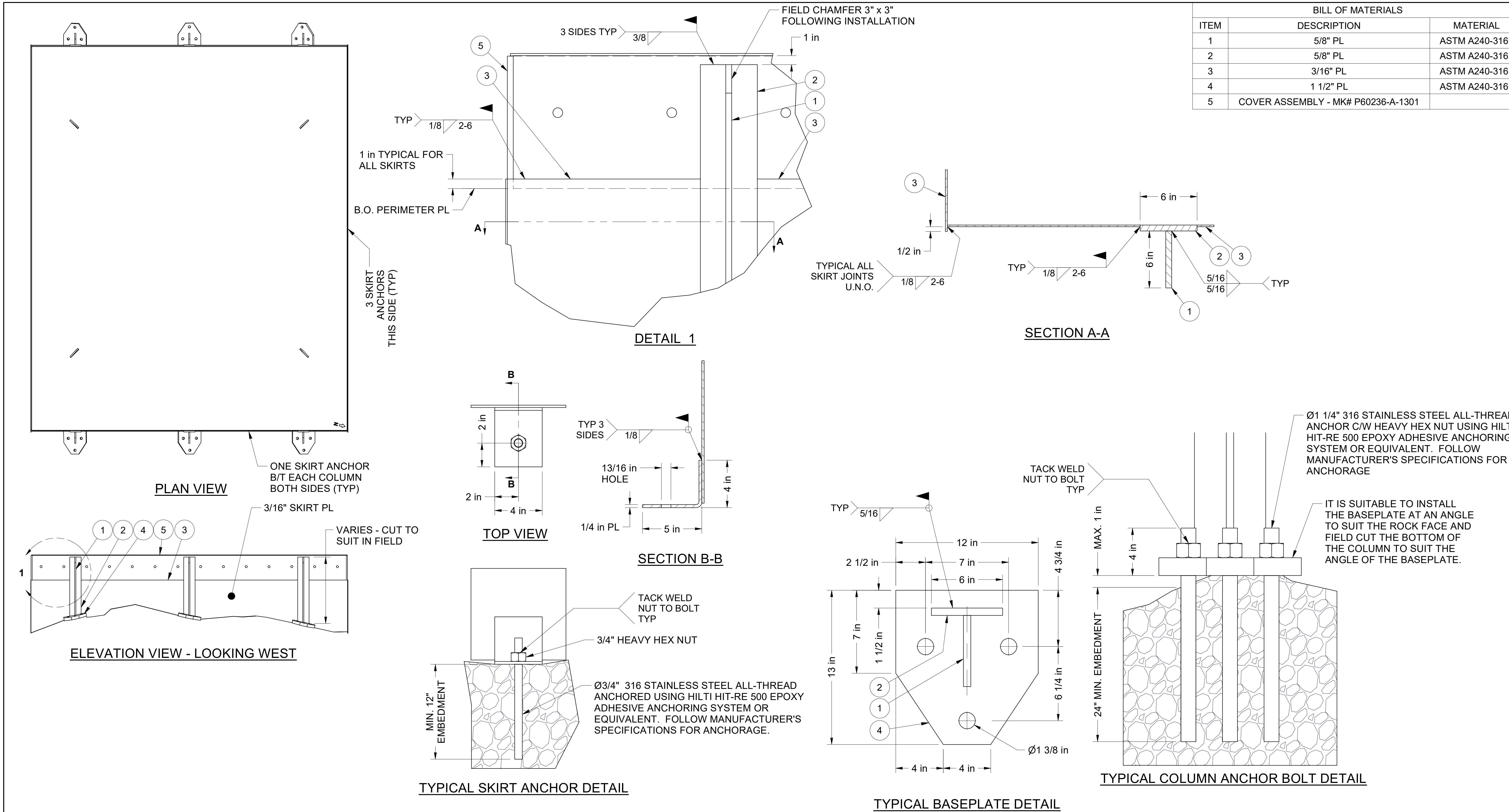
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
ELEVATIONS - ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 6
DWG. NO.: P60236-13-2 | REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




BILL OF MATERIALS

| ITEM | DESCRIPTION | MATERIAL |
|---|---|---|
| 1 | 5/8" PL | ASTM A240-316L |
| 2 | 5/8" PL | ASTM A240-316L |
| 3 | 3/16" PL | ASTM A240-316L |
| 4 | 1 1/2" PL | ASTM A240-316L |
| 5 | COVER ASSEMBLY - MK# P60236-A-1301 | |



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: NR
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

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Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

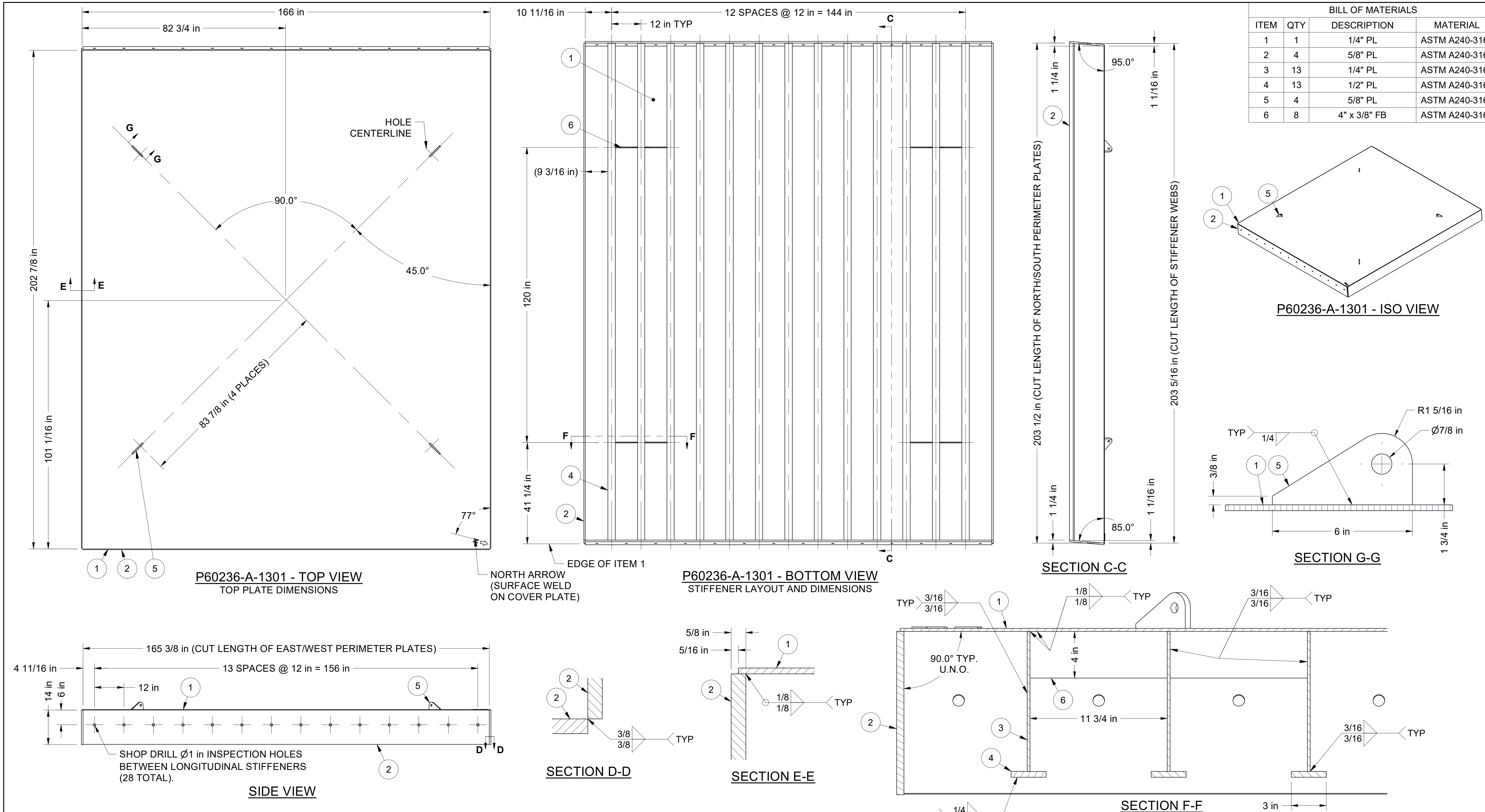
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
SKIRT AND COLUMN DETAILS
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 6
DWG. NO.: P60236-13-3
REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 1/4" PL | ASTM A240-316L |
| 2 | 4 | 5/8" PL | ASTM A240-316L |
| 3 | 13 | 1/4" PL | ASTM A240-316L |
| 4 | 13 | 1/2" PL | ASTM A240-316L |
| 5 | 4 | 5/8" PL | ASTM A240-316L |
| 6 | 8 | 4" x 3/8" FB | ASTM A240-316L |





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

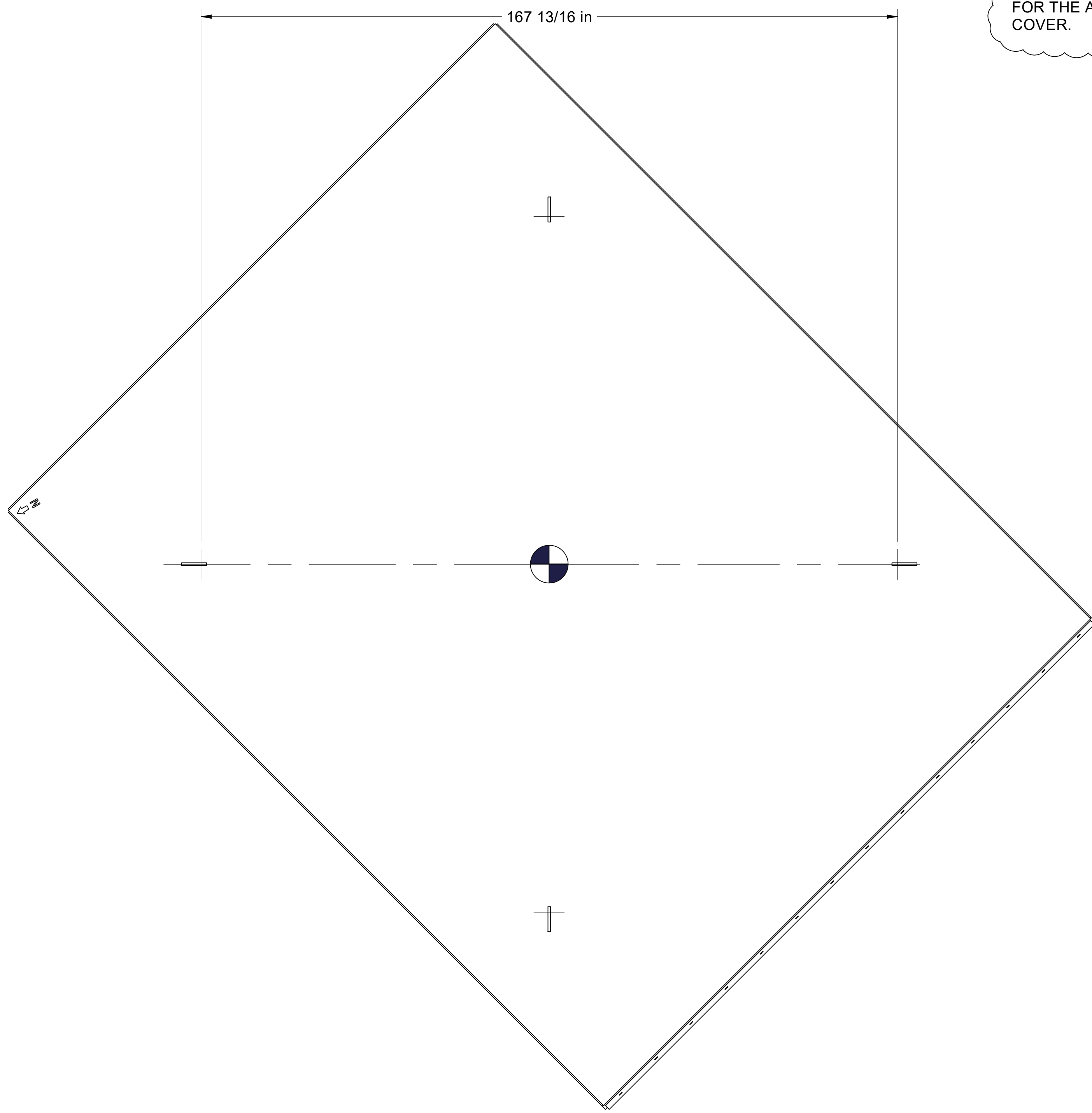
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
COVER ASSEMBLY DETAILS
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 6
DWG. NO.: P60236-13-4
4

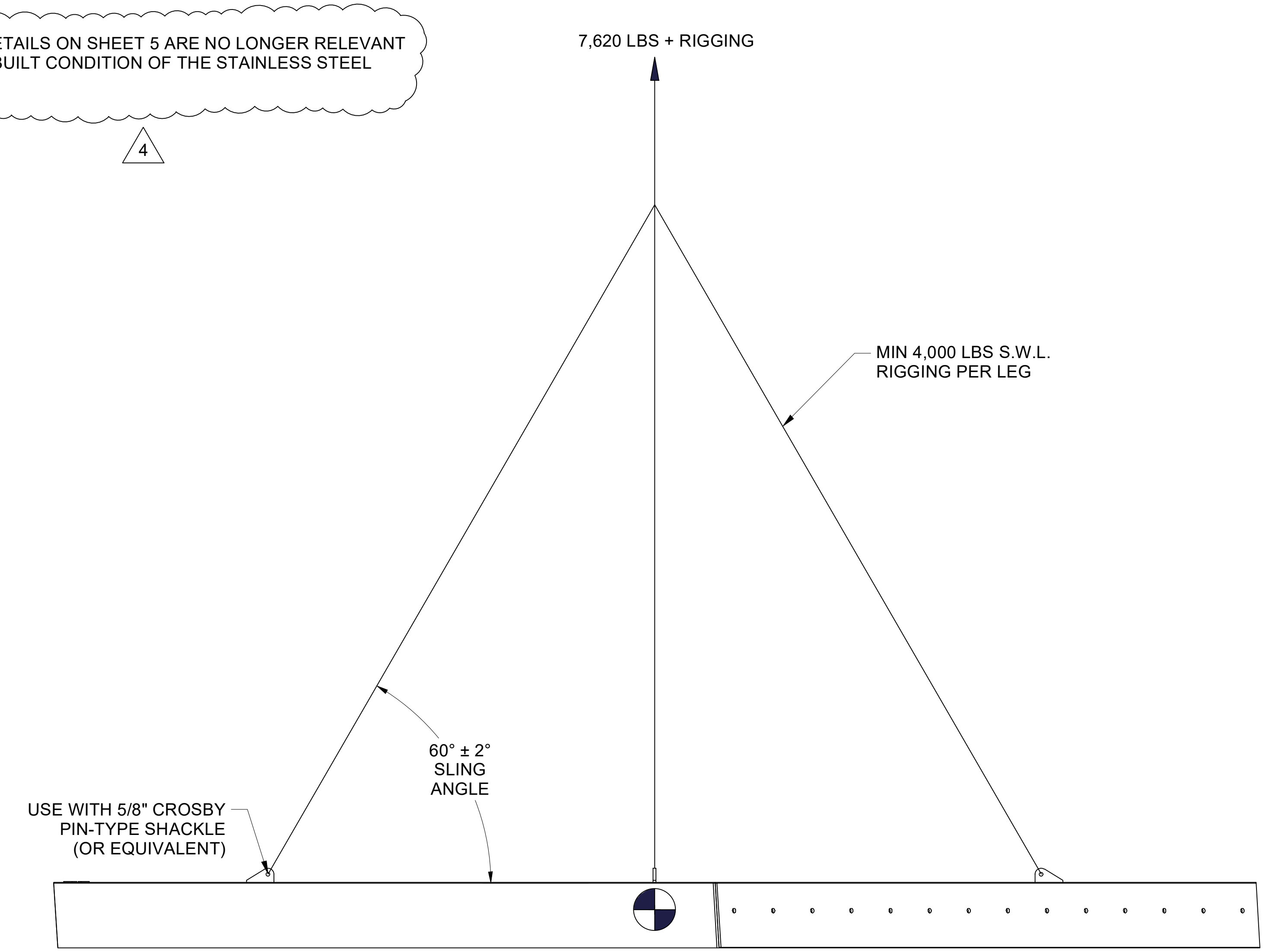
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

NOTE: THE DETAILS ON SHEET 5 ARE NO LONGER RELEVANT FOR THE AS-BUILT CONDITION OF THE STAINLESS STEEL COVER.

4




COVER ASSEMBLY LIFTING DIAGRAM




COVER ASSEMBLY LIFTING DIAGRAM - SIDE VIEW

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

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Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

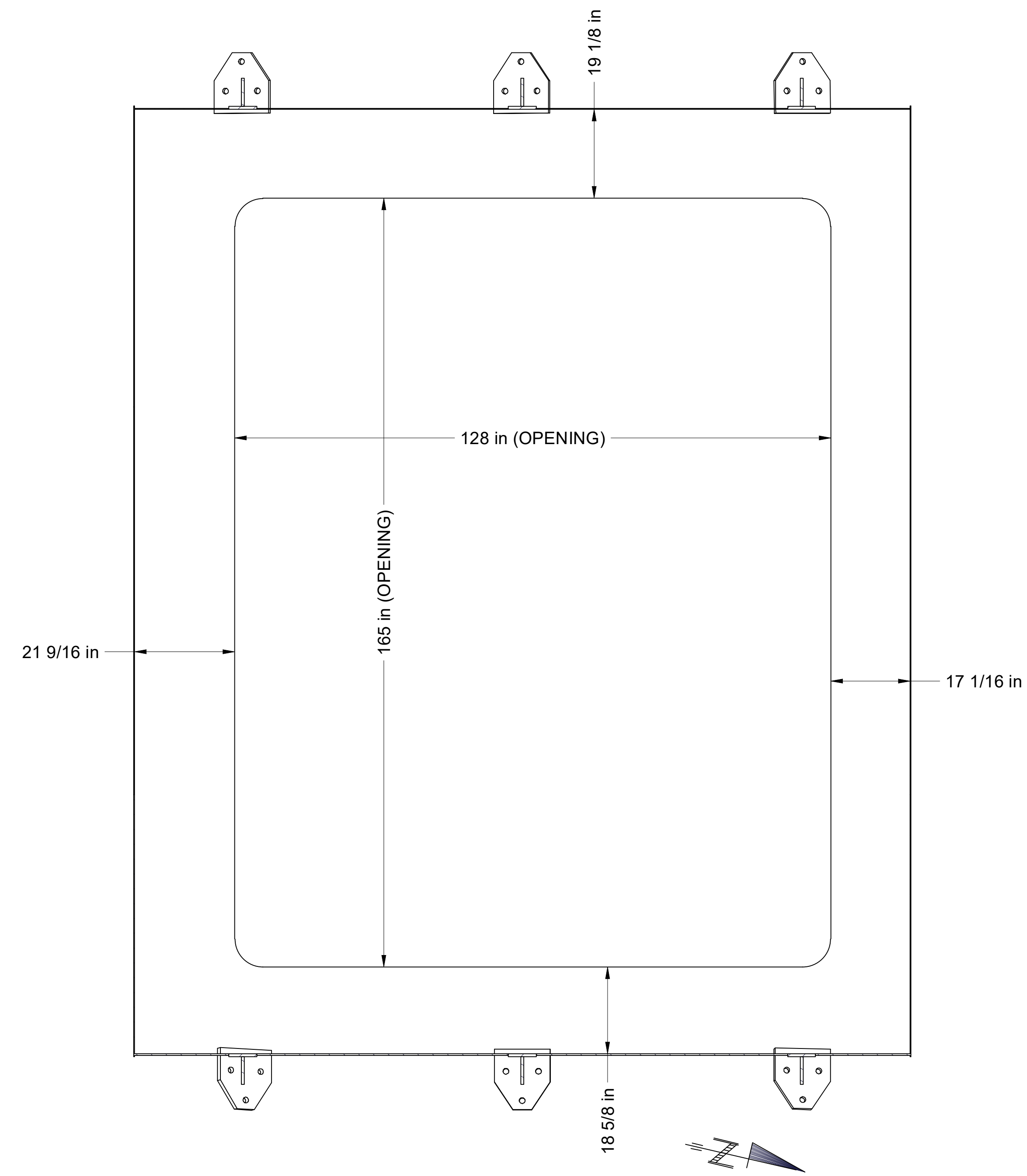
PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
LIFTING DETAILS
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 6
DWG. NO.: P60236-13-5
4

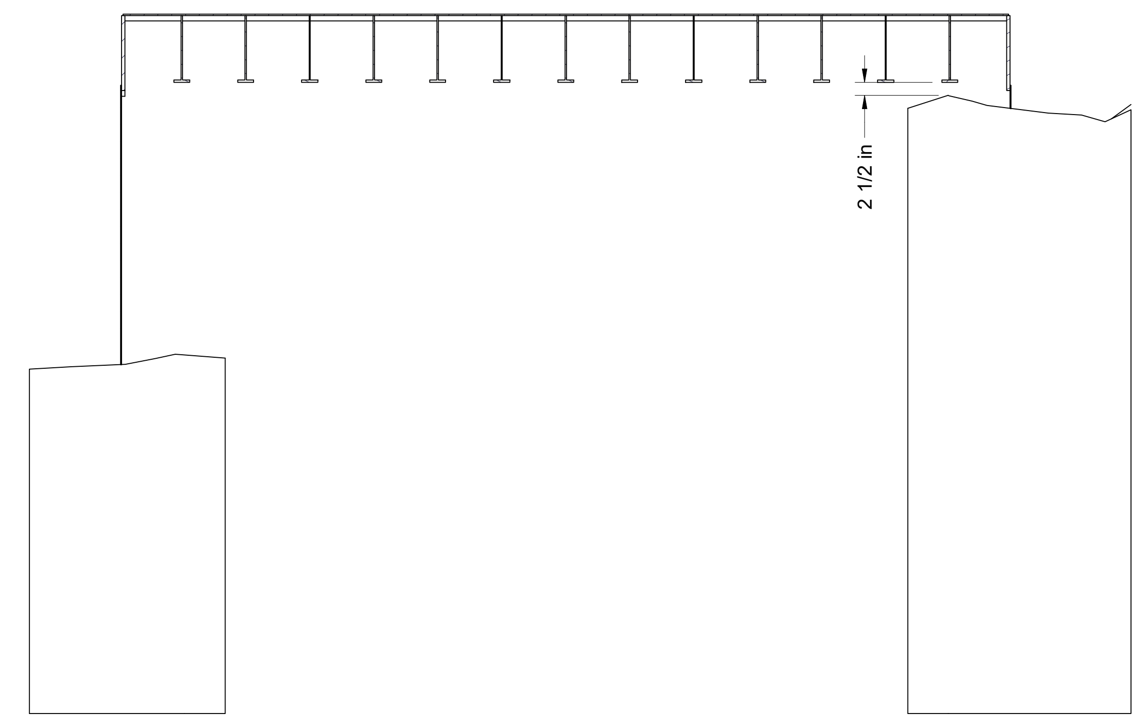
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

NOTE: THE DETAILS ON SHEET 6 ARE THE RECOMMENDATIONS FOR PLACEMENT OF THE STAINLESS STEEL COVER PROVIDED PRIOR TO INSTALLATION OF THE COVER RATHER THAN AS-BUILT DETAILS. KOVA PERSONNEL DID NOT FIELD-VERIFY THE DETAILS SHOWN PRIOR TO REMOVAL; HOWEVER, THE STAINLESS STEEL COVER COULD NOT HAVE FIR AS SHOWN IN THE AS-BUILT DETAILS WITHOUT COVER PLACEMENT SIMILAR TO THAT SHOWN.

4




OPENING TO SKIRT CLEARANCE




OPENING TO TOP COVER CLEARANCE
(LOOKING WEST)

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | NR |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FAY FINE ORE CHUTE OPENING
INSTALLATION CLEARANCES
LOCATION: 59° 33' 22.86" N 108° 28' 31.96" W NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 6
DWG. NO.: P60236-13-6
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# FH 1 - Fishhook Shaft

FH 1 - Fishhook Shaft

GENERAL NOTES:
1. ALL MATERIAL TO BE ASTM A240-316L STAINLESS STEEL.
2. MILL CERTIFICATIONS REQUIRED FOR ALL NEW MATERIALS USED.
3. ALL WELDING PROCEDURES AND PROCESSES TO MEET THE REQUIREMENTS OF AWS D1.6 LATEST EDITION.
4. ALL TOP PLATE SEAMS ARE TO BE COMPLETE JOINT PENETRATION WELDS AS REQUIRED.
5. ALL SURFACES TO BE FIELD PICKLED AND PASSIVATED FOLLOWING FIELD WELDING IN ACCORDANCE WITH QA/QC PROTOCOL. KOVA PERSONNEL TO REVIEW VISIBLE SURFACES FOLLOWING PICKLING AND PASSIVATING DURING FINAL FIELD INSPECTION.
6. FINAL FABRICATION TO BE INSPECTED BY KOVA PERSONNEL PRIOR TO CERTIFICATION. AS-BUILT DRAWINGS WILL BE CREATED FOLLOWING FINAL FIELD INSPECTION.
7. CONTRACTOR/FABRICATOR TO CONFIRM ALL NEW MATERIAL DETAILS AND DIMENSIONS FOR PROPER FIT UP.
8. THIS IS A ONE OF A KIND DESIGN AND IS NOT CERTIFIED FOR MASS PRODUCTION.
9. SAFE WORK PROCEDURE FOR INSTALLATION REQUIRED BY OTHERS.
10. ALL INFORMATION CONCERNING EXISTING COMPONENTS AND TOPOGRAPHY HAS BEEN TAKEN FROM SITE MEASUREMENTS. MATERIALS SUPPLIED ARE TO BE AS PER THE GUIDANCE OF THE INSTALLATION CONTRACTOR.
11. FIELD CUT SKIRT TO SUIT ROCK BED ELEVATION. MATERIAL FOR SKIRT TO BE SUPPLIED AS PER THE RECOMMENDATIONS OF THE INSTALLATION CONTRACTOR.
12. ROCK REMOVAL MAY BE REQUIRED DURING FIELD FIT PROCEDURE.

COVER CHARACTERISTICS:
1. SAFE WORKING LOAD CAPACITY OF COVER IS 12 kPa (250 psf) EVENLY DISTRIBUTED VERTICAL LIVE LOAD, COVER WILL SUSTAIN FOUR VERTICAL WHEEL LOADS OF 21.3 kN (4,800 LBS) WITHOUT CATASTROPHIC FAILURE.
2. RESEARCH PERFORMED BY THE BRITISH STAINLESS STEEL ASSOCIATION ESTIMATES THAT 316 STAINLESS STEEL WILL SUSTAIN A 1200 YEAR LIFE PRIOR TO PITTING CORROSION RESULTING IN A 1mm DEPTH IN A RURAL SETTING WITH MILL FINISHED SURFACES. CONSIDERING THE RESULTS OF THIS RESEARCH AND A CORROSION ALLOWANCE OF 1mm ON ANY SURFACE, THE COVER DEPICTED HAS AN ESTIMATED USEABLE LIFESPAN OF 1200 YEARS, PRIOR TO THE POTENTIAL NEED FOR REPLACEMENT. KOVA RECOMMENDS PERIODIC INSPECTIONS BE PERFORMED AS RECOMMENDED IN THE QA/QC PROTOCOL.
3. 316 STAINLESS STEEL CAN NOT BE CLEANLY CUT WITH AN OXYACETYLENE TORCH.
4. APPROX. COVER TOTAL WEIGHT = 19,000 LBS.
5. DO NOT BACK FILL WALLS OF COVER.

15 1/2 in

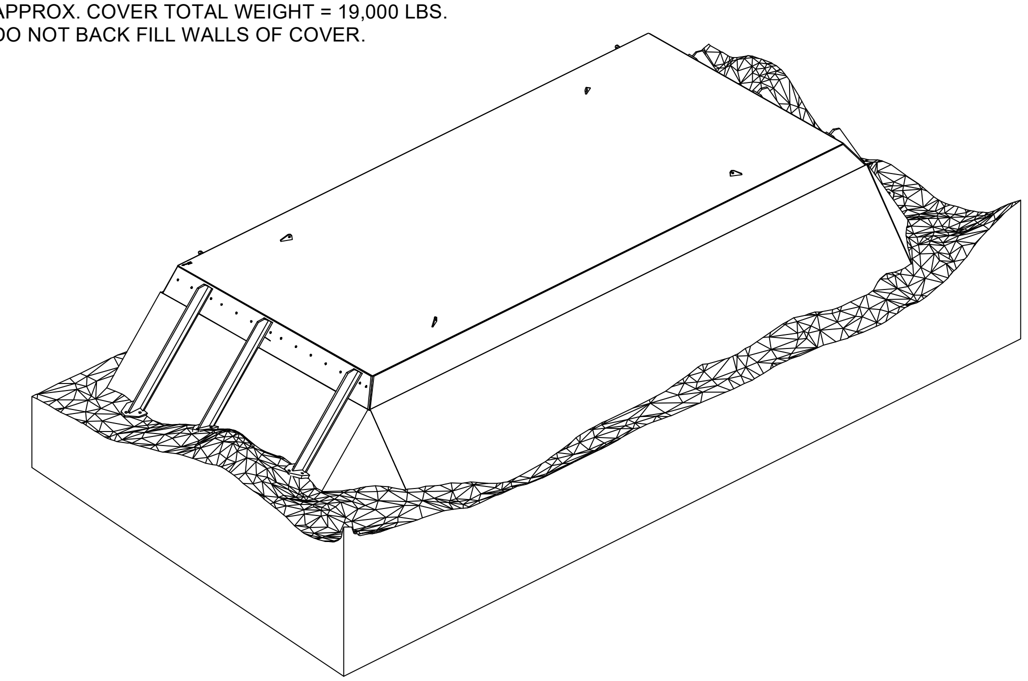
3 in

BEAVERLODGE FISHHOOK BAY OPENING COVER
GPS LOCATION: 59°27'57.57"N 108°24'37.69"W
SEALED: 2020
CONTACT THE SK MINISTRY OF ENVIRONMENT IF DAMAGED

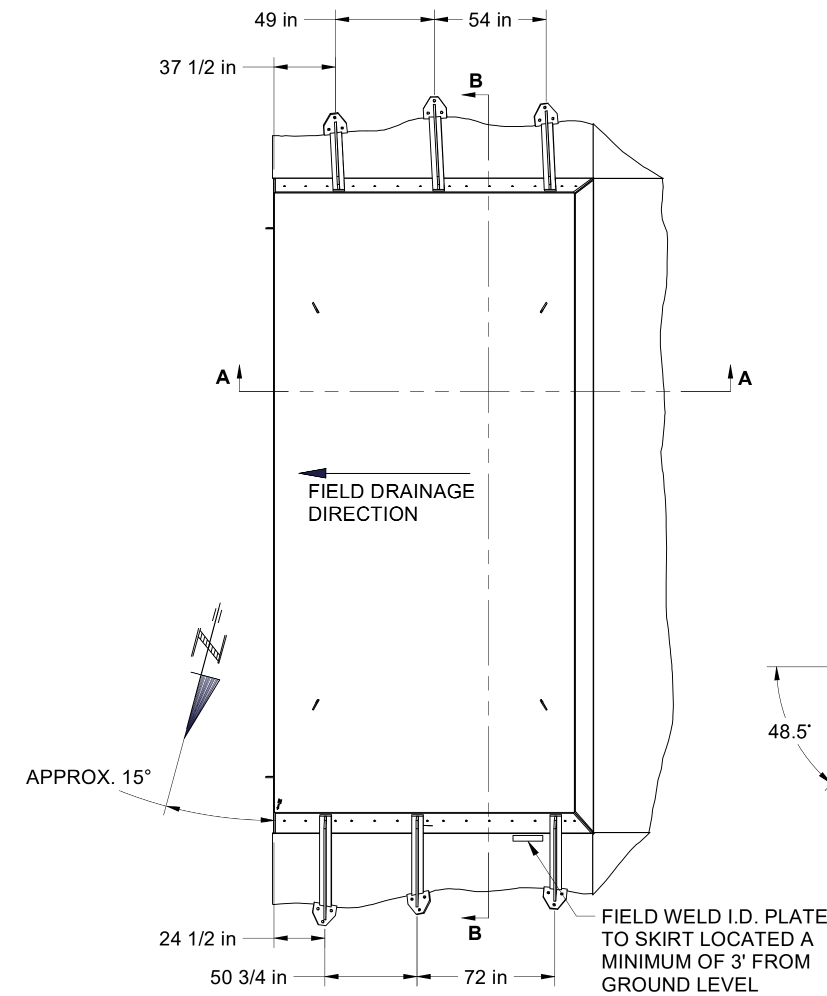
LETTERS TO BE MILLED INTO 12ga SS SHEETING AND MIN. LETTER HEIGHT IS 10mm

I.D. PLATE (SUPPLIED BY FABRICATOR)
TO BE INSTALLED BY SITE INSTALLATION CONTRACTOR

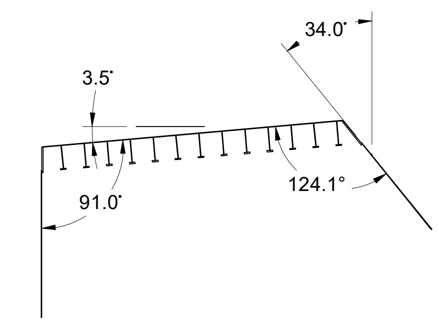
ESTIMATED WEIGHTS
TOP COVER W/O RIGGING: 12,850 Lbs
AS INSTALLED: 19,000 Lbs



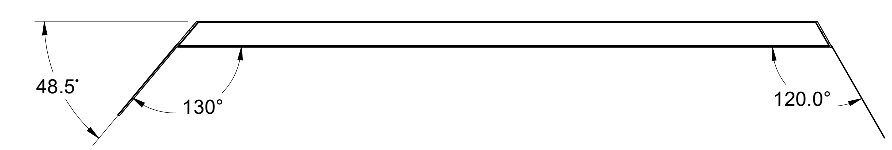
ISO VIEW
LOOKING SOUTHEAST




PLAN VIEW - FISHHOOK BAY OPENING COVER




SECTION A-A




SECTION B-B

THESE DRAWINGS ARE STRICTLY INTENDED FOR USE FOR THE PURPOSE AND PROJECT EXPRESSLY STATED HEREON. KOVA ENGINEERING (SASKATCHEWAN) LTD. AND ITS PROFESSIONAL ENGINEERS (COLLECTIVELY, "KOVA") ACCEPT NO RESPONSIBILITY OR LIABILITY FOR THE USE OF THESE DRAWINGS FOR ANY OTHER PURPOSE OR PROJECT WHATSOEVER OR BY ANY PARTY INCLUDING THE PARTY TO WHOM THEY ARE ADDRESSED, WITHOUT THE EXPRESS PRIOR CONSENT IN WRITING FROM KOVA.



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

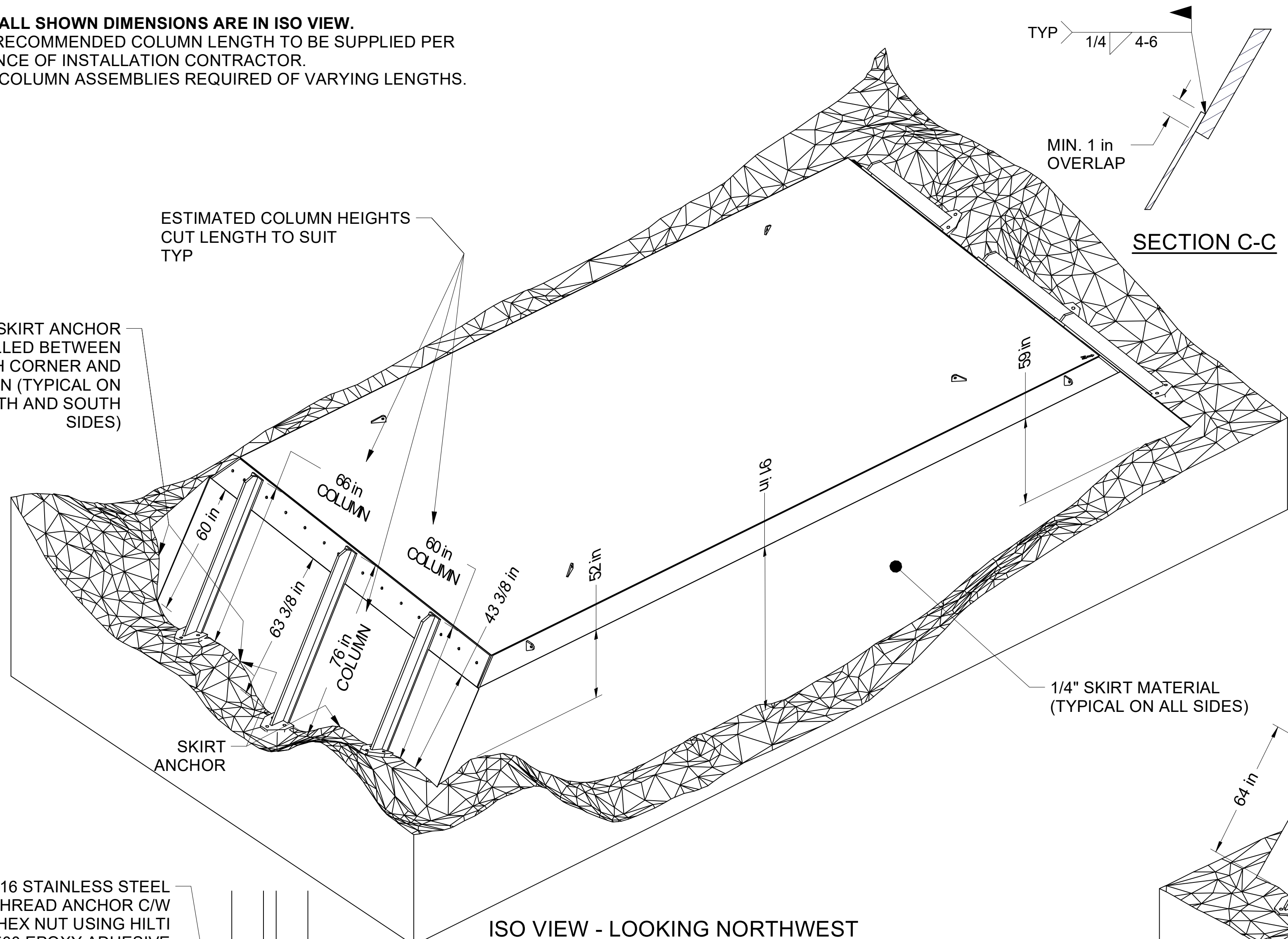
Kova Engineering (Saskatchewan) Ltd.

PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
GENERAL ARRANGEMENT AND NOTES
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 1 OF 7
DWG. NO.: P60236-11-1
REV 4

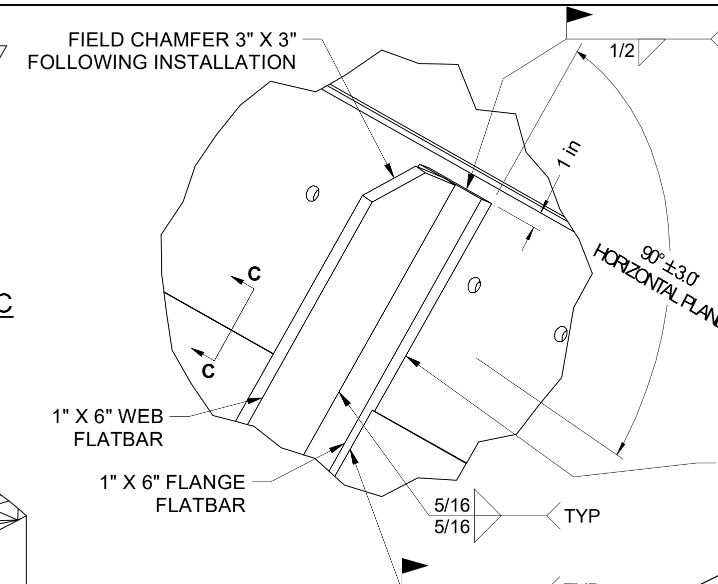
311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

**NOTE: ALL SHOWN DIMENSIONS ARE IN ISO VIEW.**
KOVA RECOMMENDED COLUMN LENGTH TO BE SUPPLIED PER GUIDANCE OF INSTALLATION CONTRACTOR.
SIX (6) COLUMN ASSEMBLIES REQUIRED OF VARYING LENGTHS.




ISO VIEW - LOOKING NORTHWEST

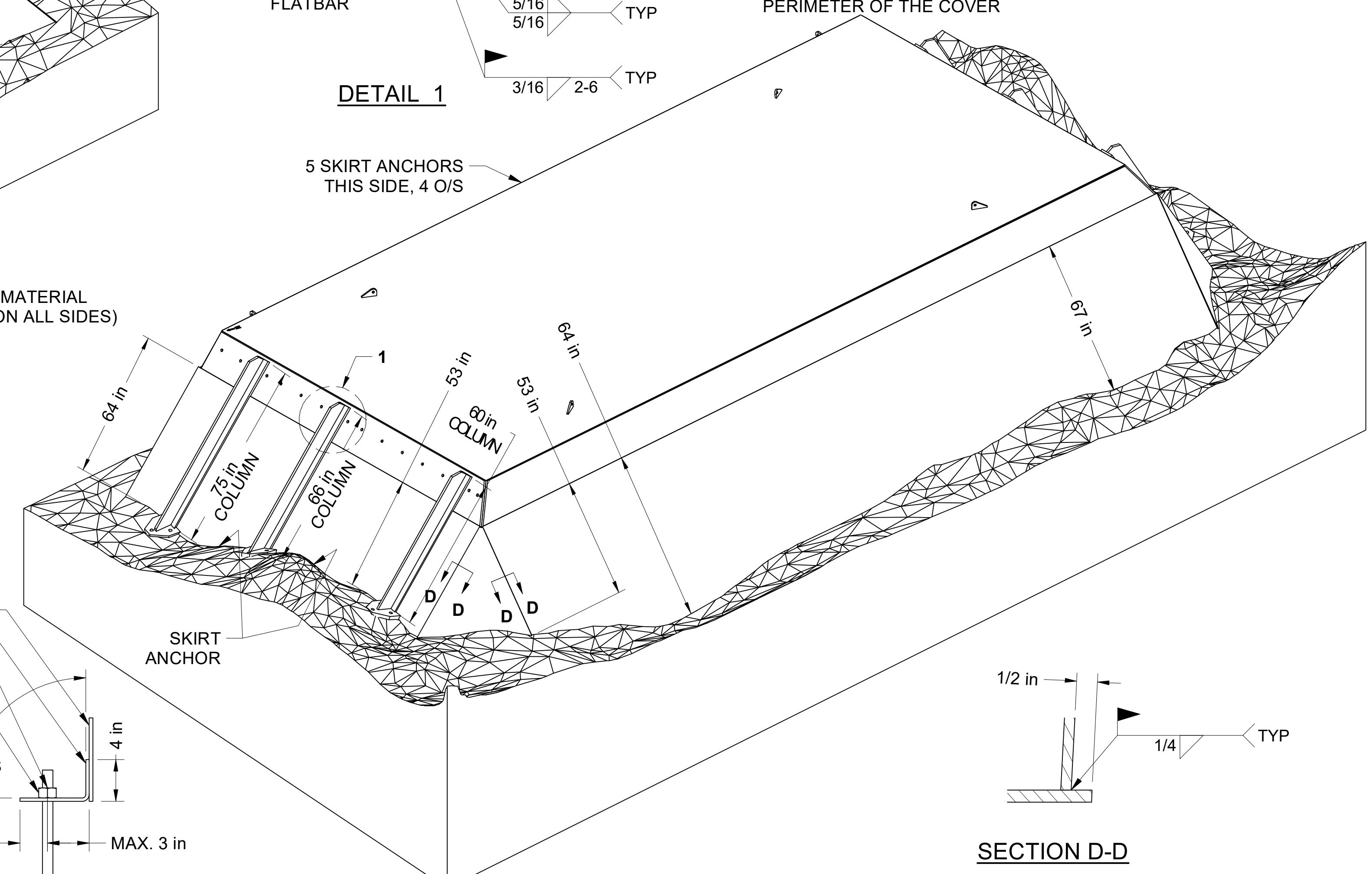
SECTION C-C




DETAIL 1

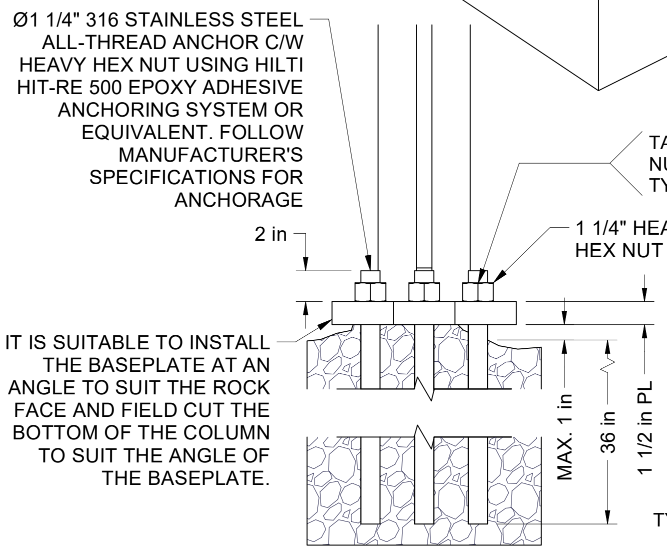
| BILL OF MATERIAL FOR SKIRT AND COLUMNS | |
|---|---|
| DISCRIPTION | QTY |
| COLUMN SECTIONS - 20' LENGTHS (SHIPPED LOOSE) | 4 |
| 1/4" SKIRT - 5' X 10' SHEETS (SHIPPED LOOSE) | 13 |

NOTE: QUANTITIES IN BILL OF MATERIALS ARE FOR BIDDING PURPOSES ONLY. SUBJECT TO CHANGE FOLLOWING AWARD.

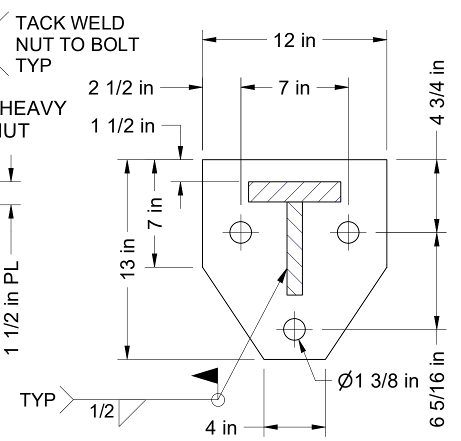



ISO VIEW - LOOKING SOUTHEAST

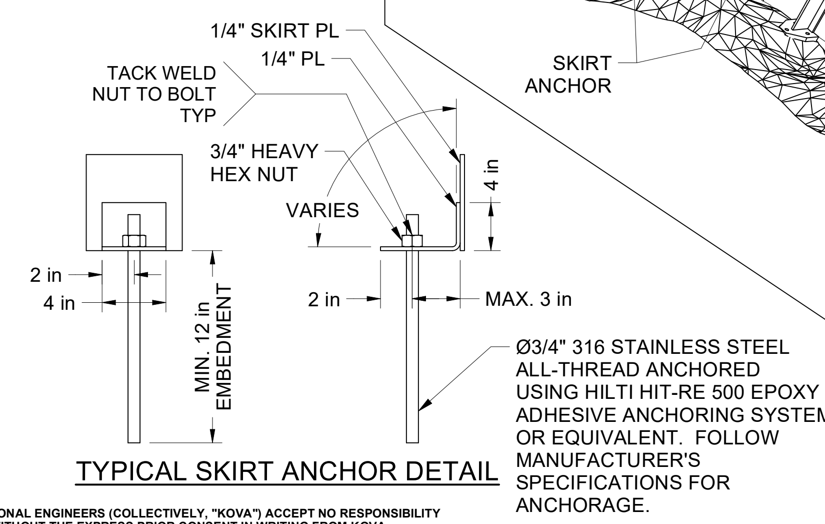
SECTION D-D




TYPICAL COLUMN ANCHOR BOLT DETAIL




TYPICAL BASEPLATE DETAIL




TYPICAL SKIRT ANCHOR DETAIL





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
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| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — SASKATCHEWAN — 20 12 18 (YR. MN DAY)

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

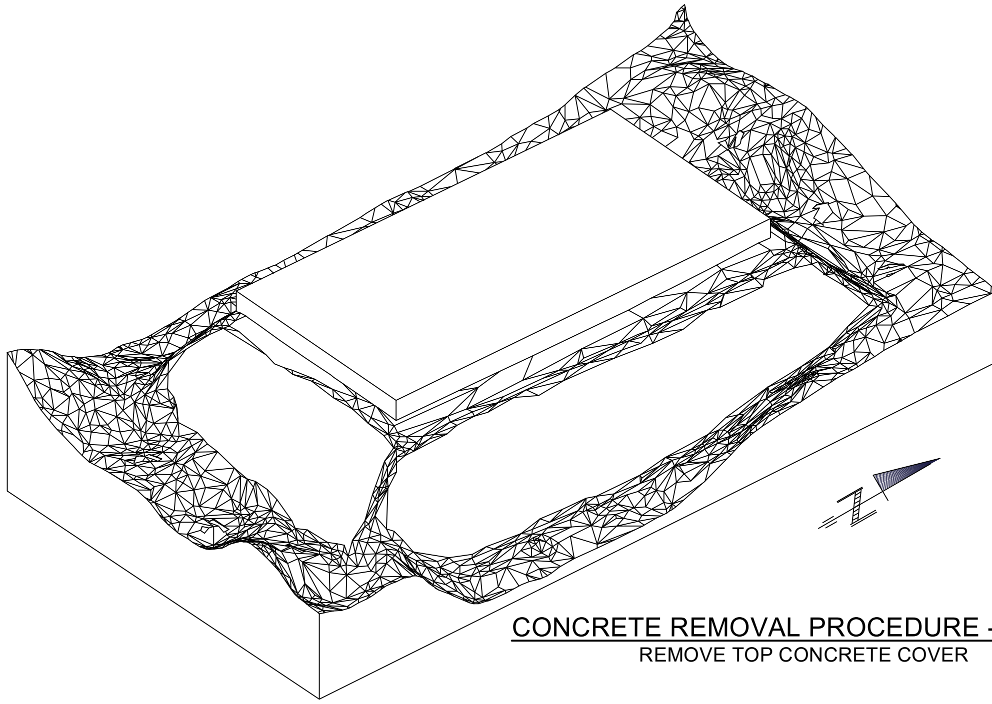
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
ISO VIEWS-ESTIMATED SKIRT AND COLUMN HEIGHTS
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

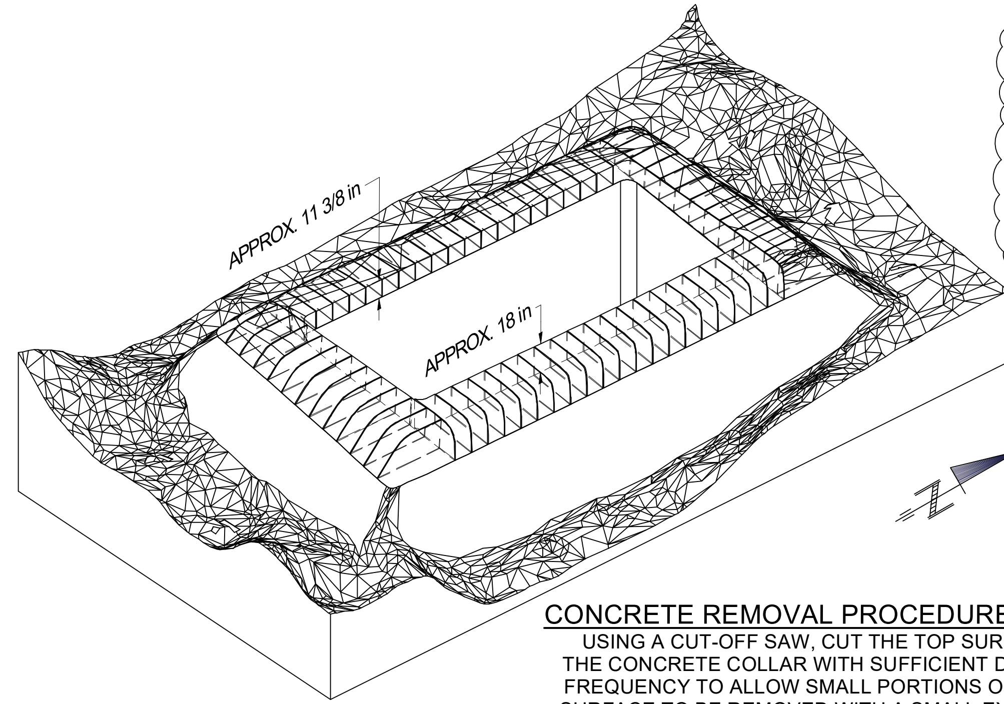
DO NOT SCALE DRAWINGS
SHEET NO.: 2 OF 7
DWG. NO.: P60236-11-2 REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



CONCRETE REMOVAL PROCEDURE - STEP 1

REMOVE TOP CONCRETE COVER

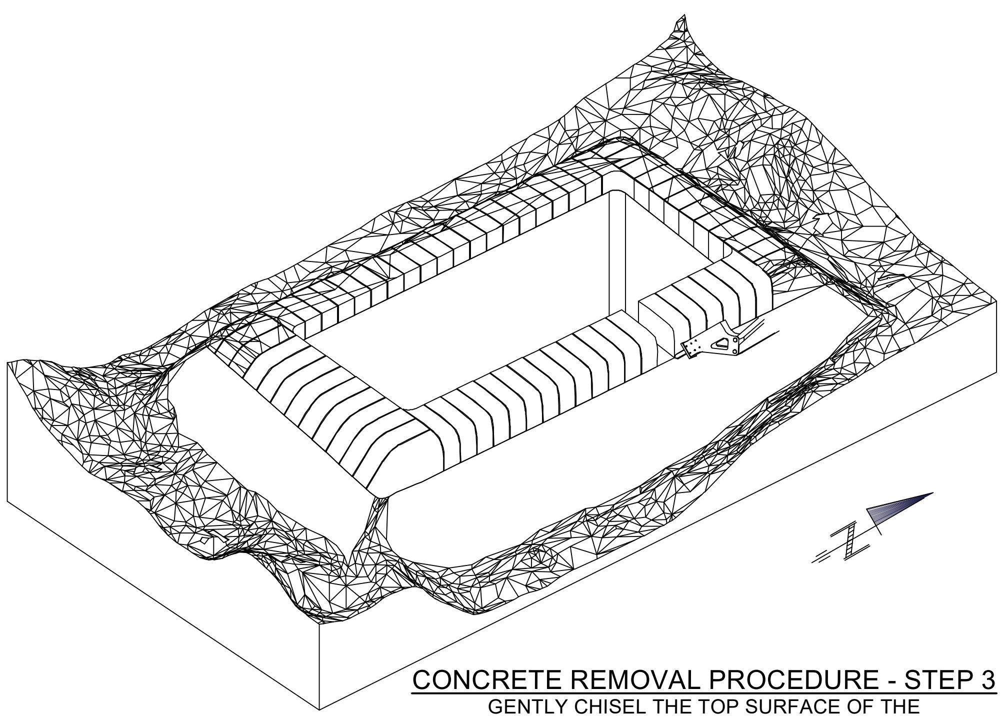



CONCRETE REMOVAL PROCEDURE - STEP 2

USING A CUT-OFF SAW, CUT THE TOP SURFACE OF THE CONCRETE COLLAR WITH SUFFICIENT DEPTH AND FREQUENCY TO ALLOW SMALL PORTIONS OF THE TOP SURFACE TO BE REMOVED WITH A SMALL EXCAVATOR-MOUNTED HAMMER.

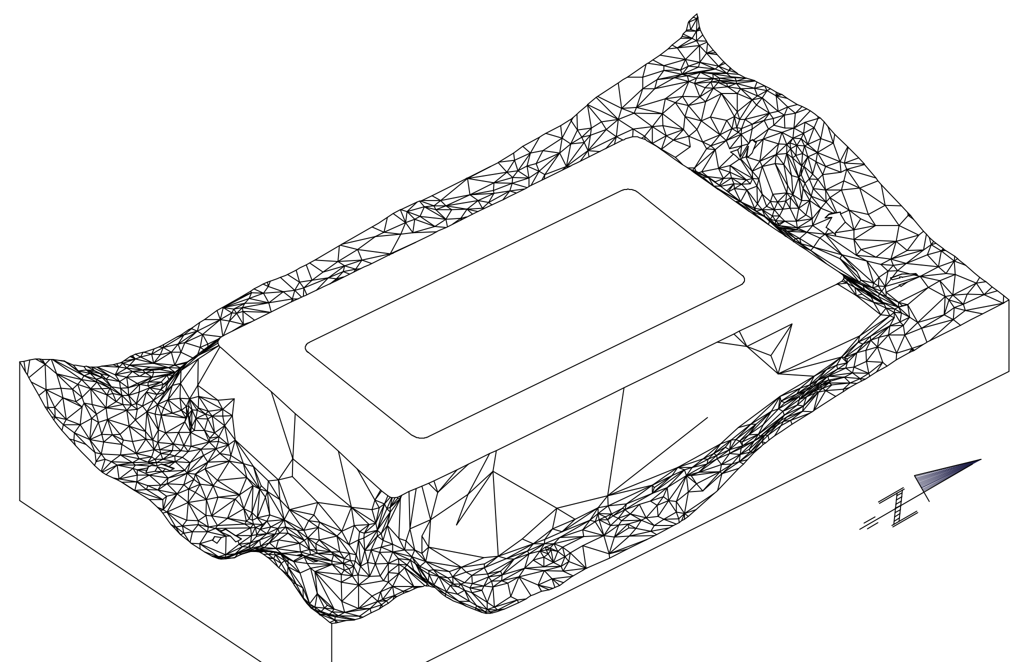
NOTE: THE DETAILS ON SHEET 3 ARE RECOMMENDATIONS FOR PARTIAL REMOVAL OF THE PREVIOUS CONCRETE COVER THAT WERE PROVIDED PRIOR TO INSTALLATION OF THE STAINLESS STEEL COVER RATHER THAN THE AS-BUILT DETAILS. KOVA PERSONNEL DID NOT FIELD-VERIFY THE DETAILS OF CONCRETE REMOVAL OF PRIOR TO INSTALLATION OF THE STAINLESS STEEL COVERS. HOWEVER, THE STAINLESS STEEL COVER COULD NOT HAVE FIT AS SHOWN IN THE AS-BUILT DETAILS WITHOUT REMOVAL OF CONCRETE SIMILAR TO THAT SHOWN.

4



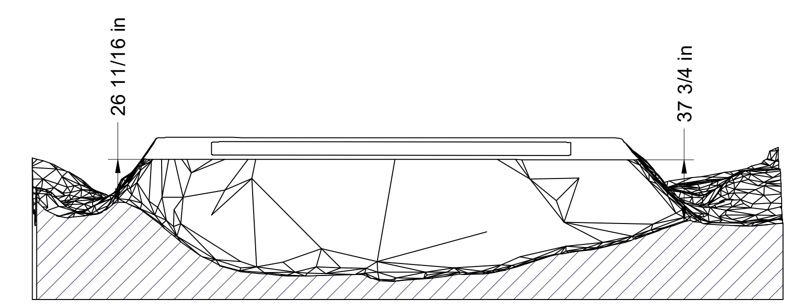
CONCRETE REMOVAL PROCEDURE - STEP 3

GENTLY CHISEL THE TOP SURFACE OF THE CONCRETE AWAY UNTIL THE DIMENSIONS SHOWN IN STEP 4 ARE OBSERVED. DO NOT DAMAGE OR FRACTURE THE MONOLITHIC CONCRETE COLLAR BELOW THE SAW CUTS.



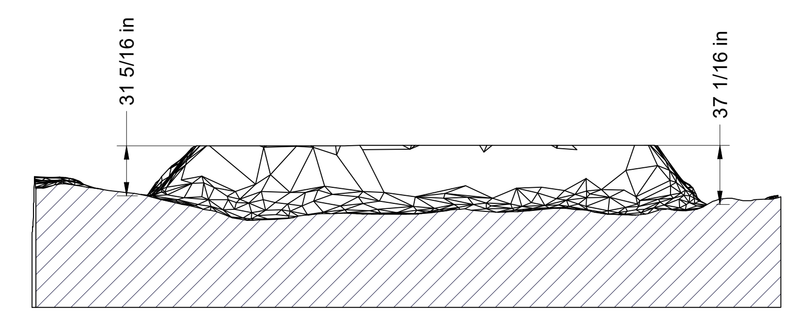
CONCRETE REMOVAL PROCEDURE - STEP 4

MEASURE TO ENSURE THE DIMENSIONS SHOWN ARE OBSERVED, THEN PROCEED WITH INSTALLATION OF THE PERMANENT COVER.




CONCRETE REMOVAL PROCEDURE - STEP 4

(LOOKING WEST)




CONCRETE REMOVAL PROCEDURE - STEP 4

(LOOKING EAST)





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.

LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

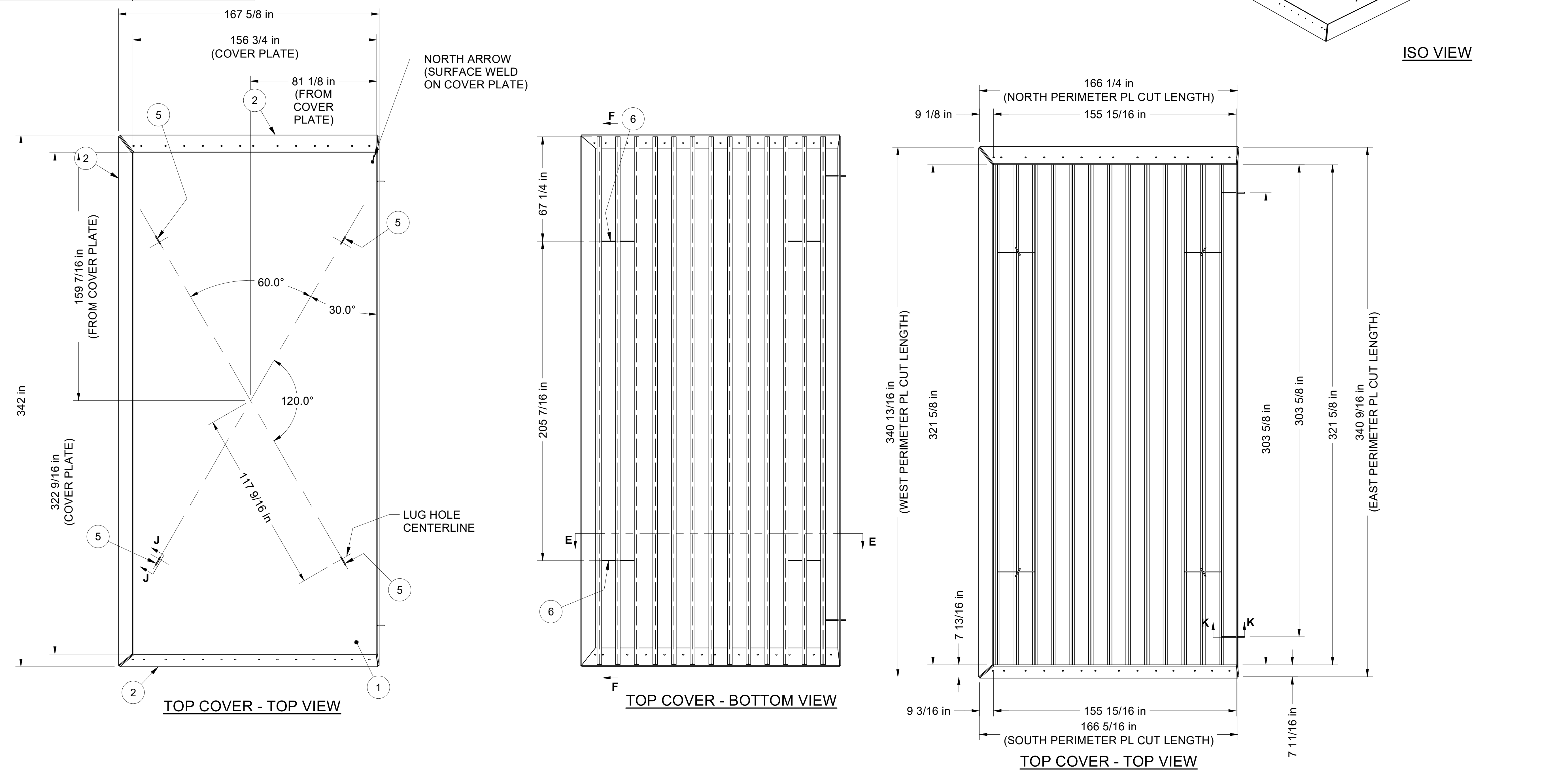
**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
CONCRETE REMOVAL PROCEDURE
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 3 OF 7
DWG. NO.: P60236-11-3
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

| BILL OF MATERIALS | | | |
|---|---|---|---|
| ITEM | QTY | DESCRIPTION | MATERIAL |
| 1 | 1 | 1/4" PL | ASTM A-240 316L |
| 2 | 4 | 3/4" PL | ASTM A-240 316L |
| 3 | 13 | 12" X 1/4" FLAT BAR | ASTM A-240 316L |
| 4 | 13 | 3" X 5/8" FLAT BAR | ASTM A-240 316L |
| 5 | 4 | 5/8" PL | ASTM A-240 316L |
| 6 | 8 | 4" X 3/8" FLAT BAR | ASTM A-240 316L |
| 7 | 2 | 5/8" PL | ASTM A-240 316L |
| 8 | 2 | 4" X 3/8" FLAT BAR | ASTM A-240 316L |

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|---|---|---|---|---|---|
| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 20 12 18 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

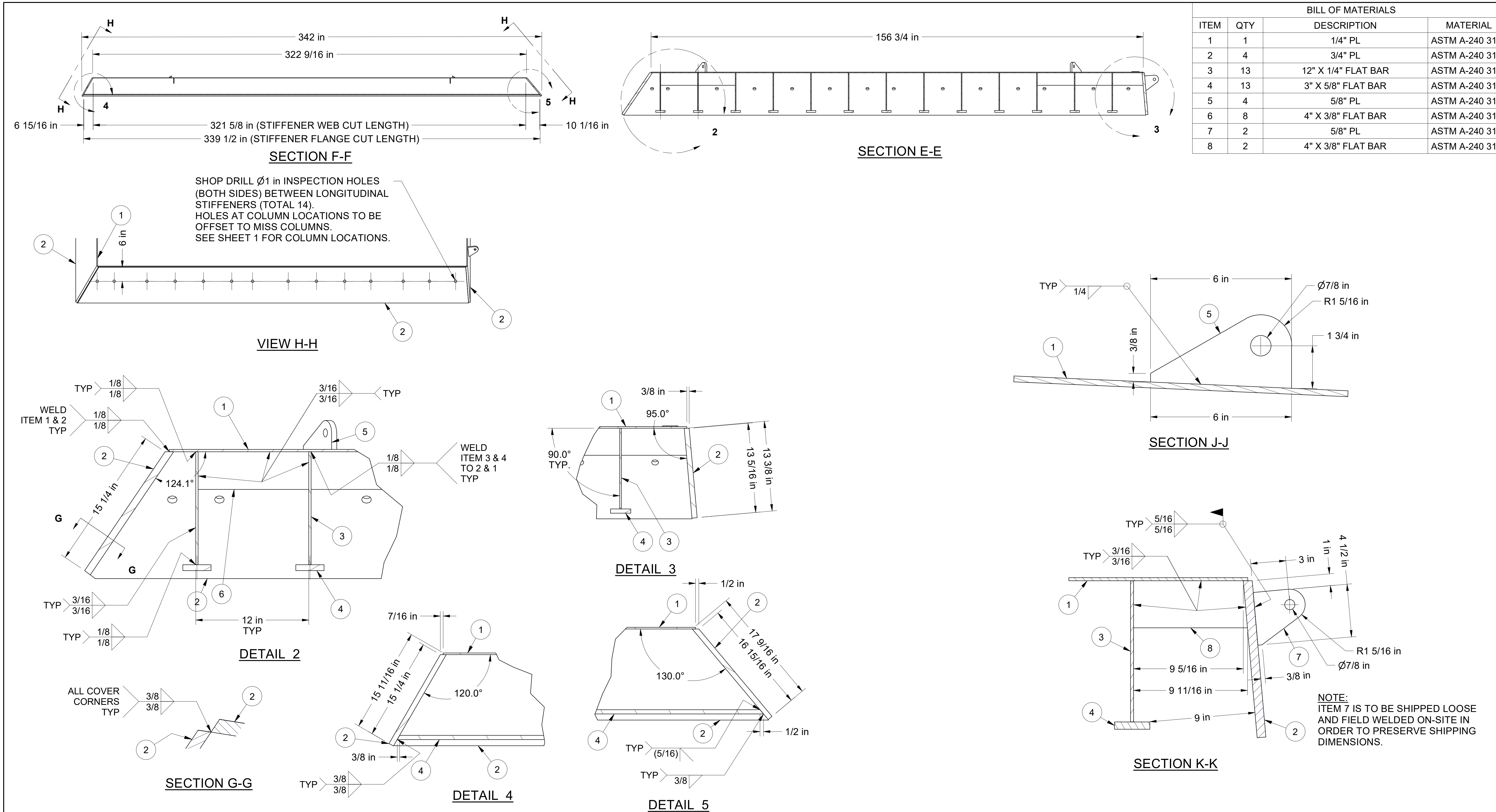
| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
TOP COVER SECTION DETAILS
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 4 OF 7
DWG. NO.: P60236-11-4 REV 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059




BILL OF MATERIALS

| ITEM | QTY | DESCRIPTION | MATERIAL |
|---|---|---|---|
| 1 | 1 | 1/4" PL | ASTM A-240 316L |
| 2 | 4 | 3/4" PL | ASTM A-240 316L |
| 3 | 13 | 12" X 1/4" FLAT BAR | ASTM A-240 316L |
| 4 | 13 | 3" X 5/8" FLAT BAR | ASTM A-240 316L |
| 5 | 4 | 5/8" PL | ASTM A-240 316L |
| 6 | 8 | 4" X 3/8" FLAT BAR | ASTM A-240 316L |
| 7 | 2 | 5/8" PL | ASTM A-240 316L |
| 8 | 2 | 4" X 3/8" FLAT BAR | ASTM A-240 316L |



| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
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TOLERANCES-U.N.O.
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MACHINED SURFACES: 125
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ALL DIMENSIONS IN INCHES

DRWN BY: ANP
DATE: 16/Dec/19
CHK'D BY: P.C.
ENG BY: P.C.

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 20 12 18 (YR. MN DAY) — SASKATCHEWAN

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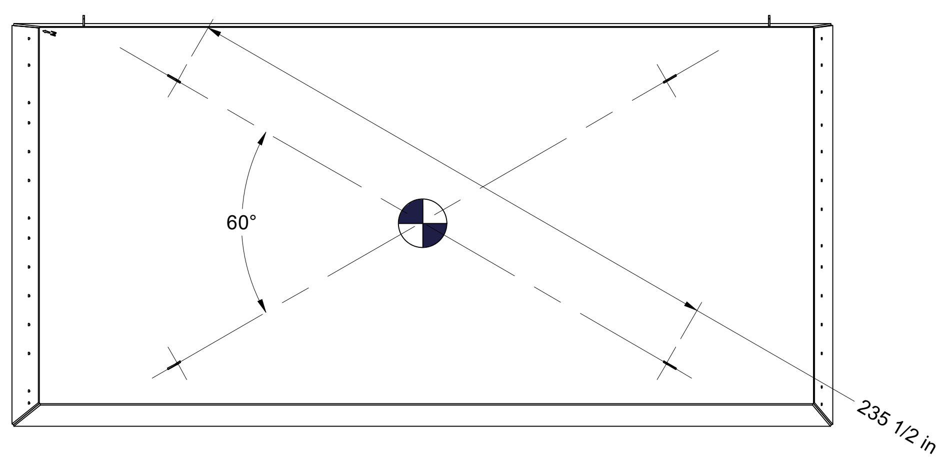
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

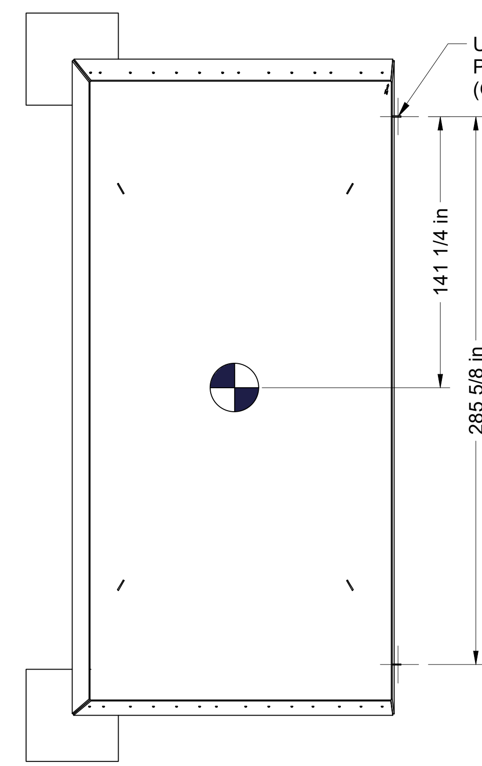
PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
TOP COVER SECTION DETAILS 2
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 5 OF 7
DWG. NO.: P60236-11-5
REV: 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059



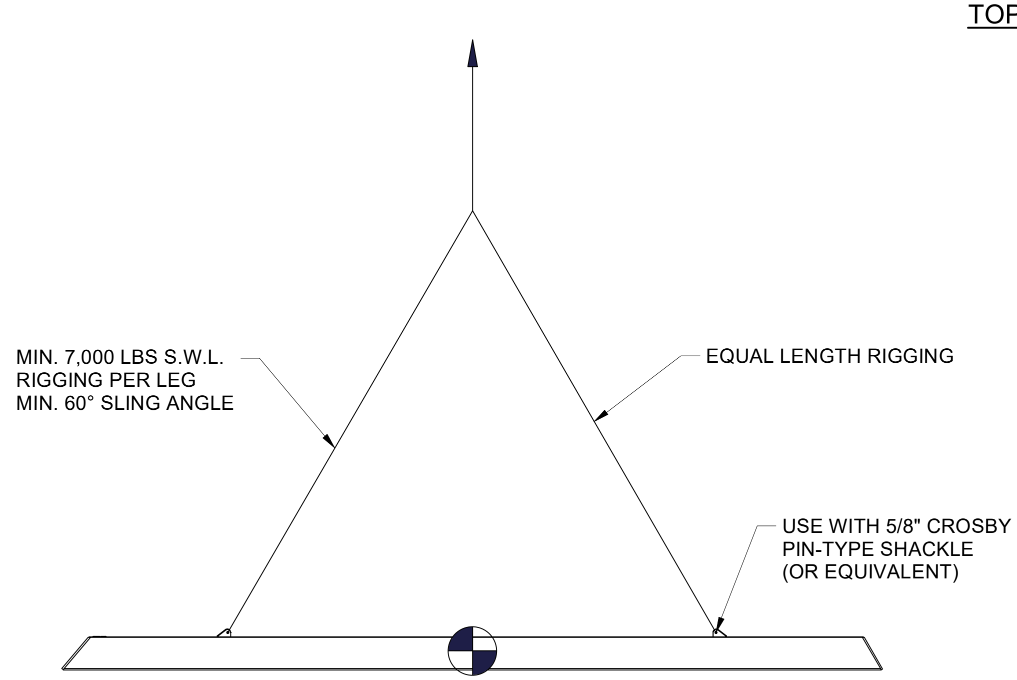

COVER SECTION LIFTING DIAGRAM - TOP VIEW



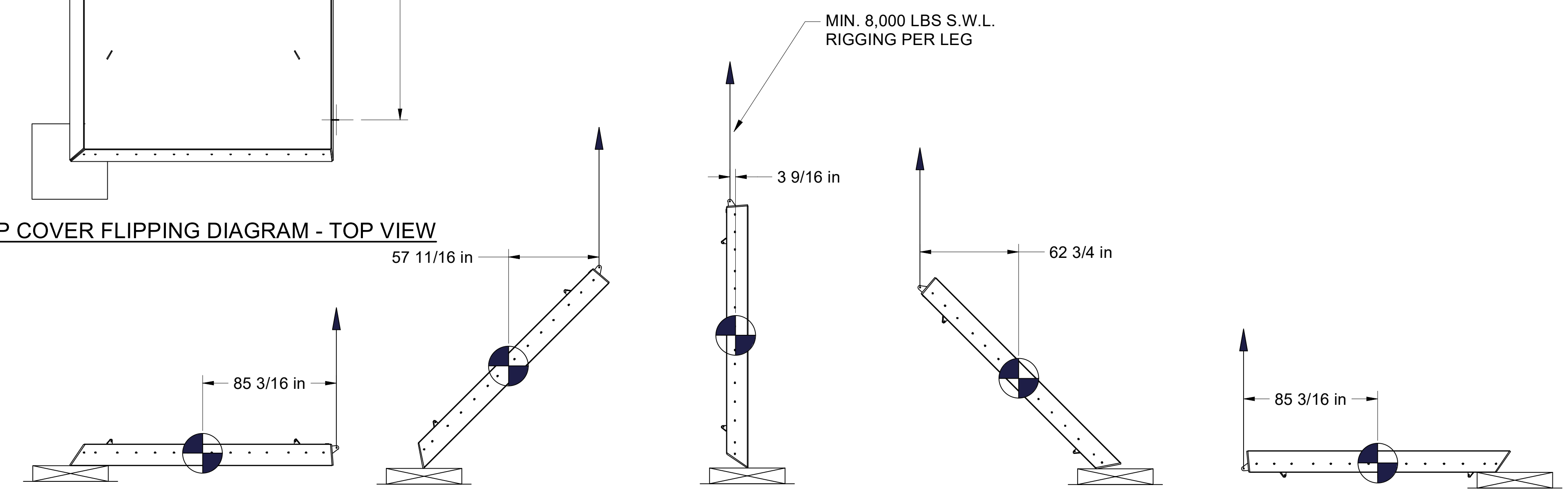

TOP COVER FLIPPING DIAGRAM - TOP VIEW

NOTE: THE DETAILS ON SHEET 6 ARE NO LONGER RELEVANT FOR THE AS-BUILT CONDITION OF THE STAINLESS STEEL COVER.

4




TOP COVER LIFTING DIAGRAM - SIDE VIEW




TOP COVER FLIPPING DIAGRAM





| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
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| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
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| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
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CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER
P.B. CAUGHLIN
MEMBER 14318
20 12 18
YR. MN DAY
SASKATCHEWAN

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| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

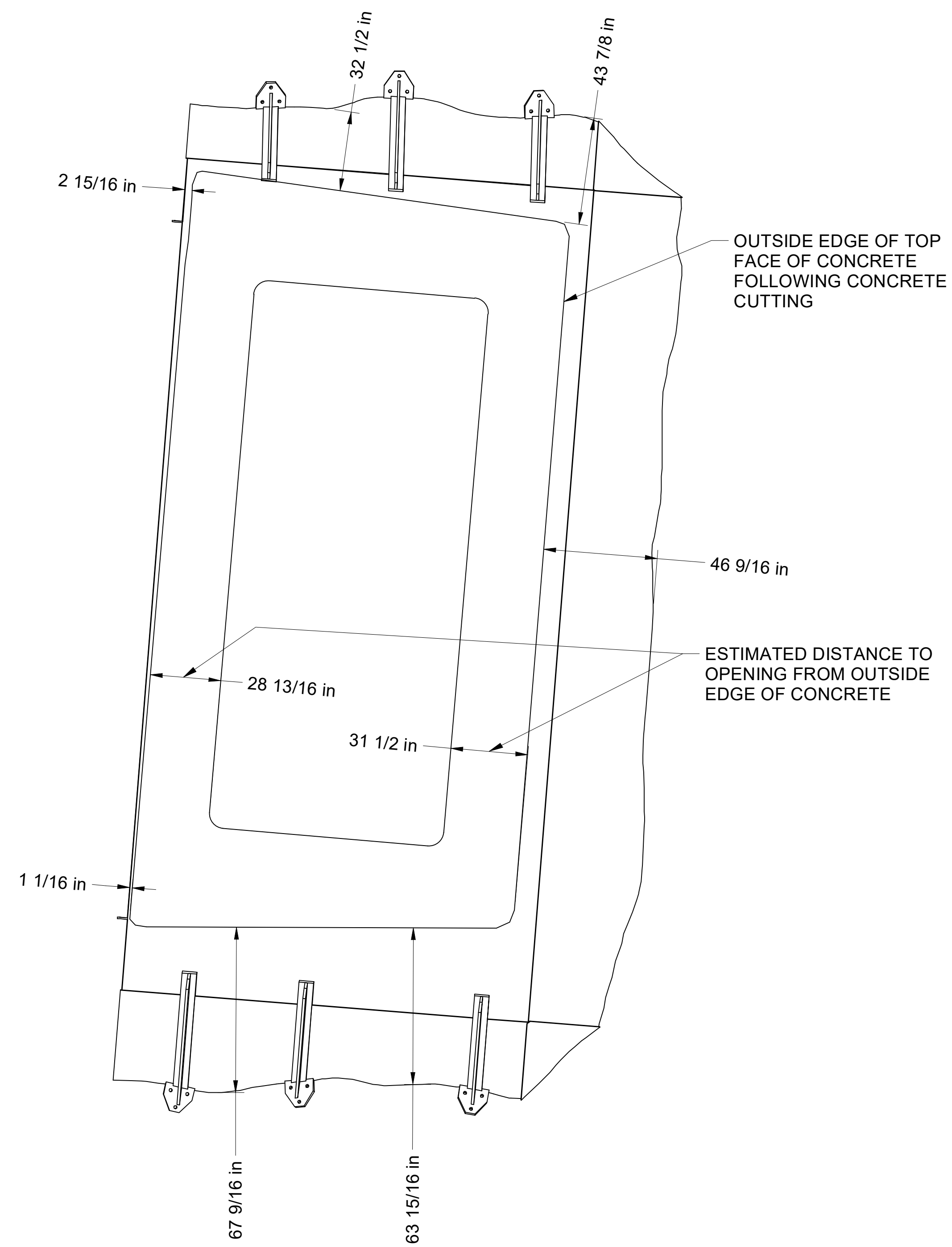
PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
LIFTING DETAILS
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 6 OF 7
DWG. NO.: P60236-11-6
4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

NOTE: THE DETAILS ON SHEET 7 ARE THE RECOMMENDATIONS FOR THE PLACEMENT OF THE STAINLESS STEEL COVER PROVIDED PRIOR TO INSTALLATION OF THE COVERS RATHER THAN AS-BUILT DETAILS. KOVA PERSONNEL DID NOT FIELD-VERIFY THE DETAILS SHOWN PRIOR TO REMOVAL; HOWEVER, THE STAINLESS STEEL COVER COULD NOT HAVE FIT AS SHOWN IN THE AS-BUILT DETAILS WITHOUT COVER PLACEMENT SIMILAR TO THAT SHOWN.

4




OPENING TO SKIRT CLEARANCE

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| DWG # | REFERENCE DRAWINGS | REV | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| | | 4 | ADDED ID PLATE DIMENSION AND AS-BUILT NOTES | 18/Dec/20 | ANP |
| | | 3 | AS-BUILT | 04/Dec/20 | ANP |
| | | 2 | ADDED BOM FOR SKIRT AND COLUMN MATERIALS | 03/Jan/20 | ANP |
| | | 1 | ISSUED FOR TENDER | 16/Dec/19 | NR |

TOLERANCES-U.N.O.
LINEAR DIMS: ± 1/16"
ANGULAR DIMS: ± 1 deg.
CUT SURFACES: 250
MACHINED SURFACES: 125
ALL PIN TOL. TO BE ANSI RC8
ALL DIMENSIONS IN INCHES

| | |
|---|---|
| DRWN BY: | ANP |
| DATE: | 16/Dec/19 |
| CHK'D BY: | P.C. |
| ENG BY: | P.C. |

PROFESSIONAL ENGINEER — P.B. CAUGHLIN — MEMBER 14318 — 20 12 18 (YR. MN DAY) — SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
Kova Engineering (Saskatchewan) Ltd.
Number C672
Permission to Consult held by:

| Discipline | Sk. Reg. No. | Signature |
|---|---|---|
| Structural | 14318 | |

**Kova Engineering (Saskatchewan) Ltd.**

PROJECT: PERMANENT COVER FOR BEAVERLODGE FISHHOOK BAY SHAFT OPENING
INSTALLATION CLEARANCES
LOCATION: 59° 27' 57.57" N 108° 24' 37.69" W, NEAR URANIUM CITY, SK
CLIENT: CAMECO SHEQ

DO NOT SCALE DRAWINGS
SHEET NO.: 7 OF 7
DWG. NO.: P60236-11-7 — 4

311 WHEELER PLACE, SASKATOON, SK, S7P 0A4 PHONE: 306.652.9229 FAX: 306.249.1059

# FAY 2, 3, 13 - Custom Crusher Openings

FAY 2, 3, 13 - Custom Crusher Openings


Photo 1: GPS location of the Custom Crusher Raises Site.

Photo 2: Overview of the Custom Crusher Raises Site.

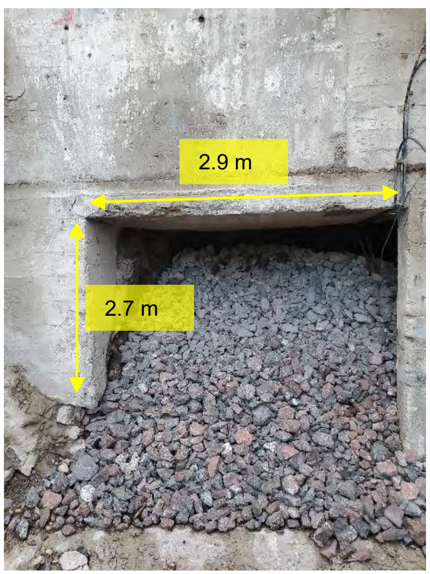



Photo 3: Close-up of Raise 1 that was backfilled with -5 to -8 inch material.

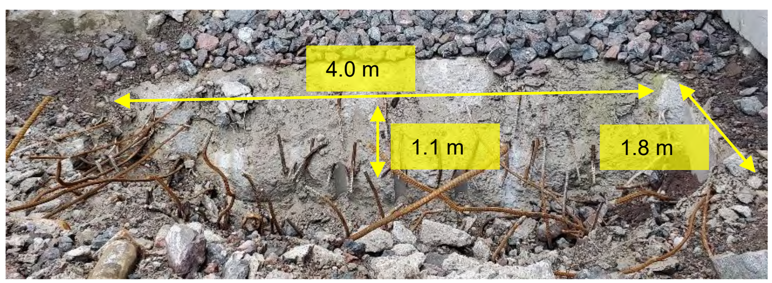



Photo 4: Close-up of Raise 2 that was excavated.

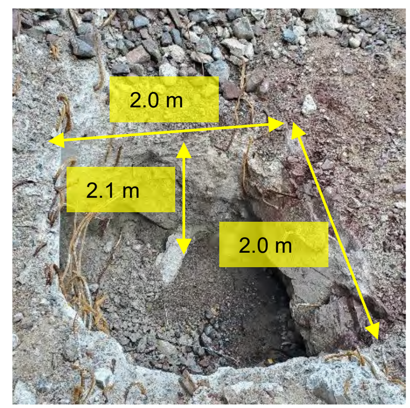



Photo 5: Close-up of Raise 3 that was excavated.

| | | | | |
|---|---|---|---|---|
| srk consulting | Cameco | Custom Crusher Raises Remediation Project | | |
| | | **Field Photographs** | | |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 | Approved: BM/ML | Photo Page: 1 |

Photo 6: Location of the boulder for Raise 3, from an area approximately 9.0 km southwest of Uranium City.

Photo 8: Boulders sourced by UCC and inspected by the SRK field engineer.


Photo 7: Dimensions of the pyramid-shaped boulder placed within Raise 3.

| srk consulting | Cameco | Custom Crusher Raises Remediation Project | | |
|---|---|---|---|---|
| | | **Field Photographs** | | |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 | Approved: BM/ML | Photo Page: 2 |


Photo 9: Rock Number 2 contributing to the wedging effect at Raise 3.


Photo 10: Top view of the 15 boulders placed at Raise 3.


Photo 11: Total of 15 boulders placed for the permanent closure of Raise 3.

| srk consulting | Cameco | Custom Crusher Raises Remediation Project | | |
|---|---|---|---|---|
| | | **Field Photographs** | | |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 | Approved: BM/ML | Photo Page: 3 |

Photo 12: Placement of coarse waste rock over the boulders at Raise 3 to safely access Raise 2.

Photo 14: Total of 11 boulders placed for the permanent closure of Raise 2.

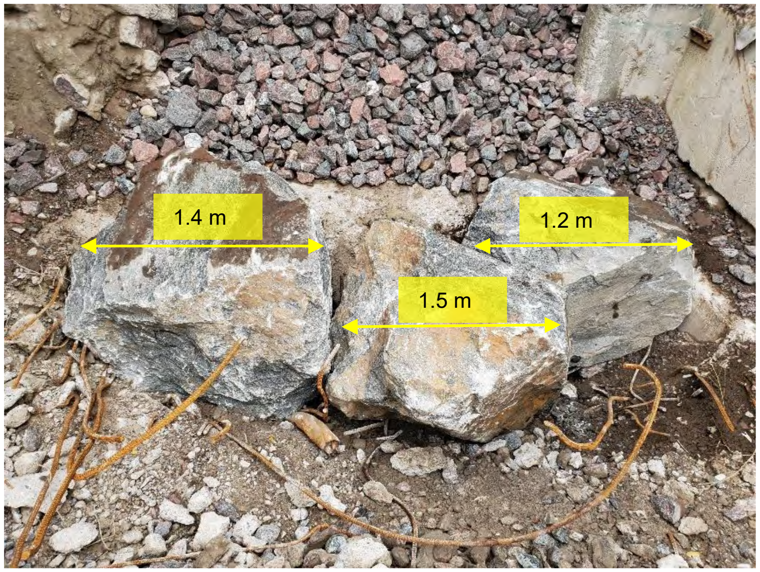



Photo 13: Three boulders creating a wedging effect at Raise 2.

Photo 15: Top view of the 11 boulders placed at Raise 2.

| srk consulting | Cameco | Custom Crusher Raises Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 · Approved: BM/ML · Photo Page: 4 |

Photo 16: Placement of coarse waste rock over Raise 3 and 2, up to the entrance at Raise 1.

Photo 17: Additional placement of coarse waste rock over Raise 3 and 2, up to the entrance at Raise 1.

| srk consulting | Cameco | Custom Crusher Raises Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 · Approved: BM/ML · Photo Page: **5** |

Photo 18: Demolition of the concrete dump chute.

Photo 19: Final placement of the gravel cover layer.

| srk consulting | Cameco | Custom Crusher Raises Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 · Approved: BM/ML · Photo Page: 6 |

# FH 3 - Adit

Fishhook 3 - Adit


Photo 1: GPS locations of the Adit Entrance and the Toe of the Placed Backfill Material.

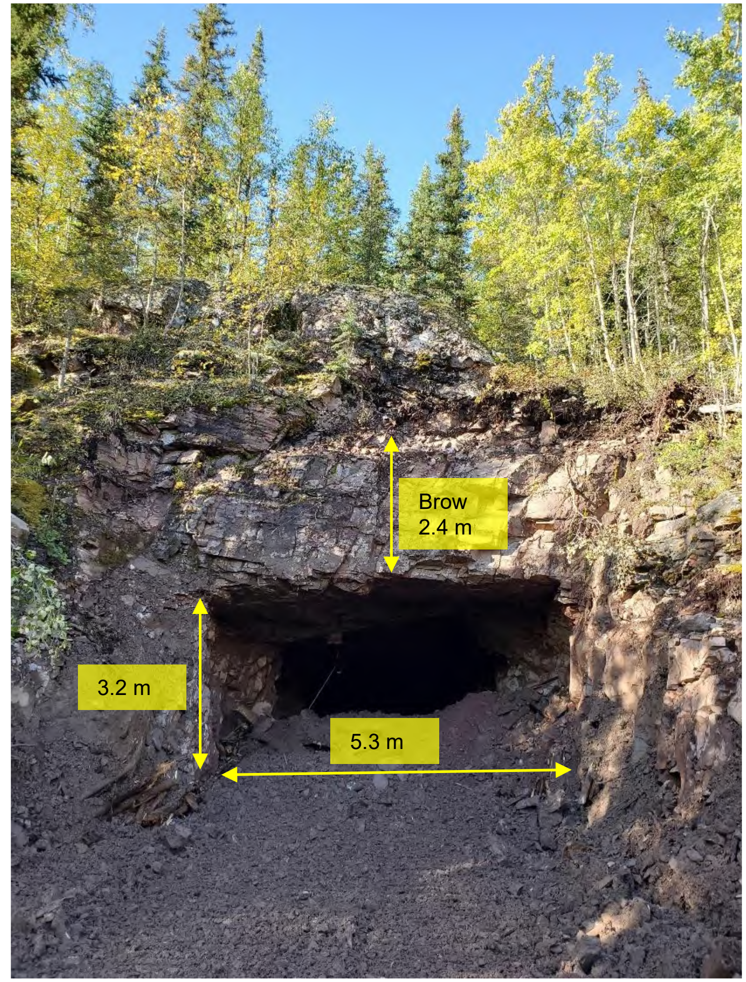



Photo 2: Overview of the Fishhook Adit and Dimensions

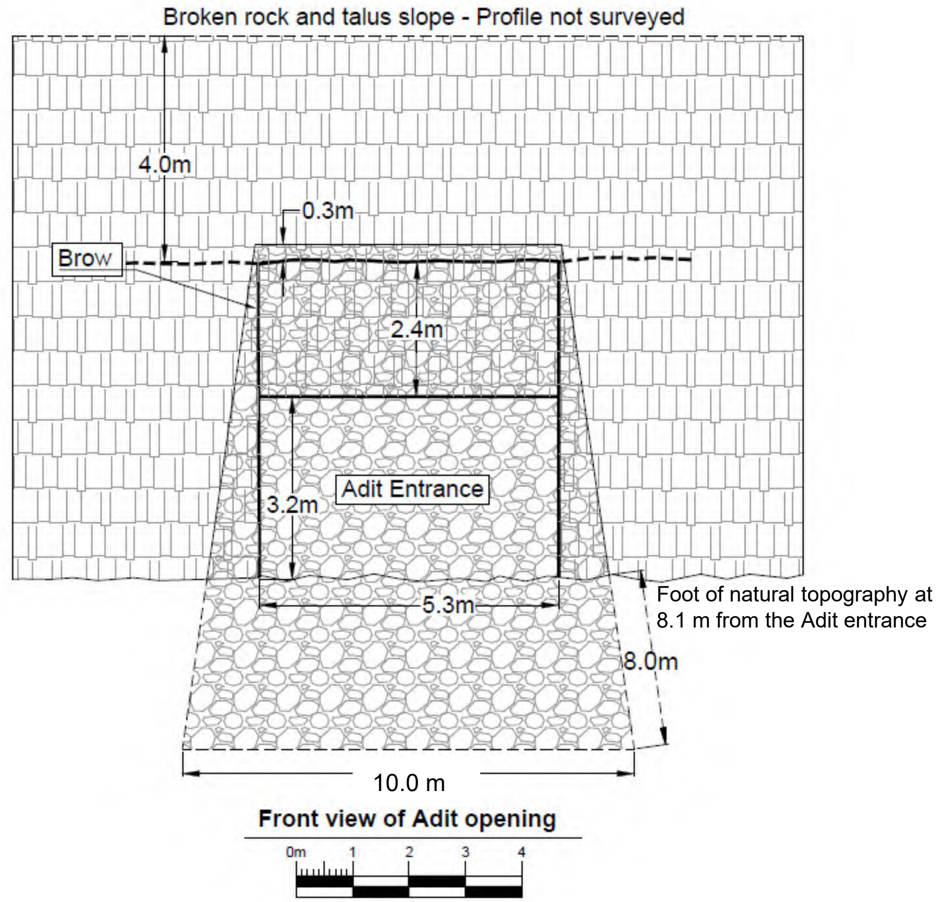
| srk consulting | Cameco | Fishhook Adit Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 \| Approved: BM/ML \| Photo Page: 1 |

Photo 3: Stages of Backfill placed in the Fishhook Bay Adit

Photo 4: Stages of Backfill placed in the Fishhook Bay Adit

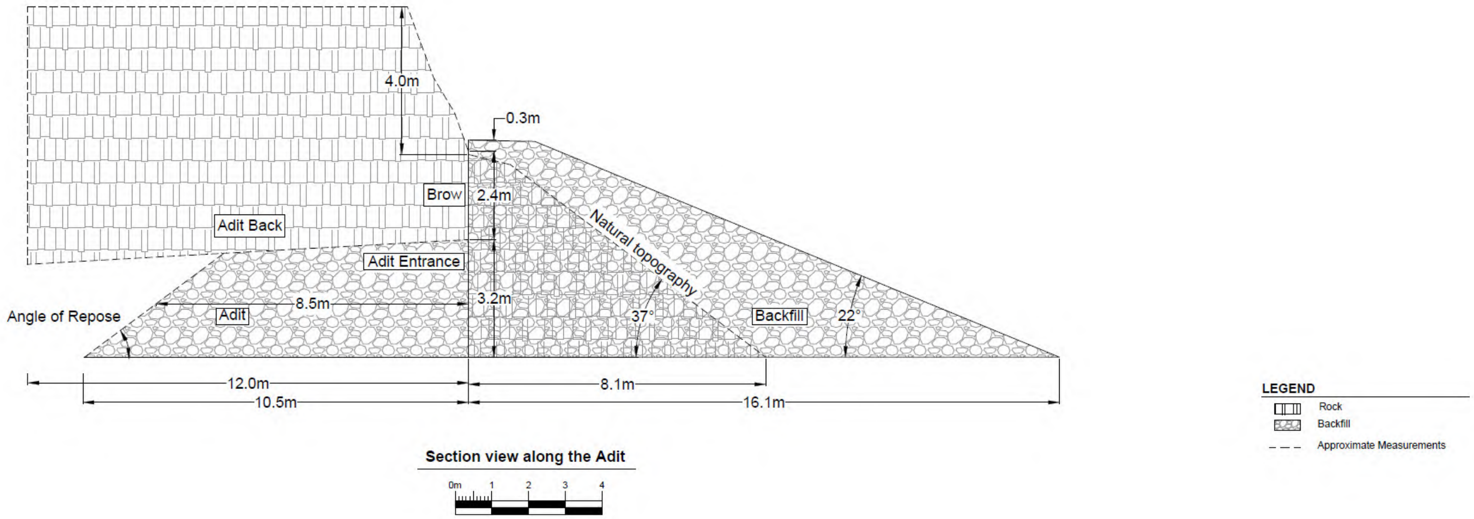
| | | |
|---|---|---|
| srk consulting | Cameco | Fishhook Adit Remediation Project<br>**Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 · Approved: BM/ML · Photo Page: **2** |

Photo 5: Final Placement of Backfill material along the Fishhook Bay Adit.

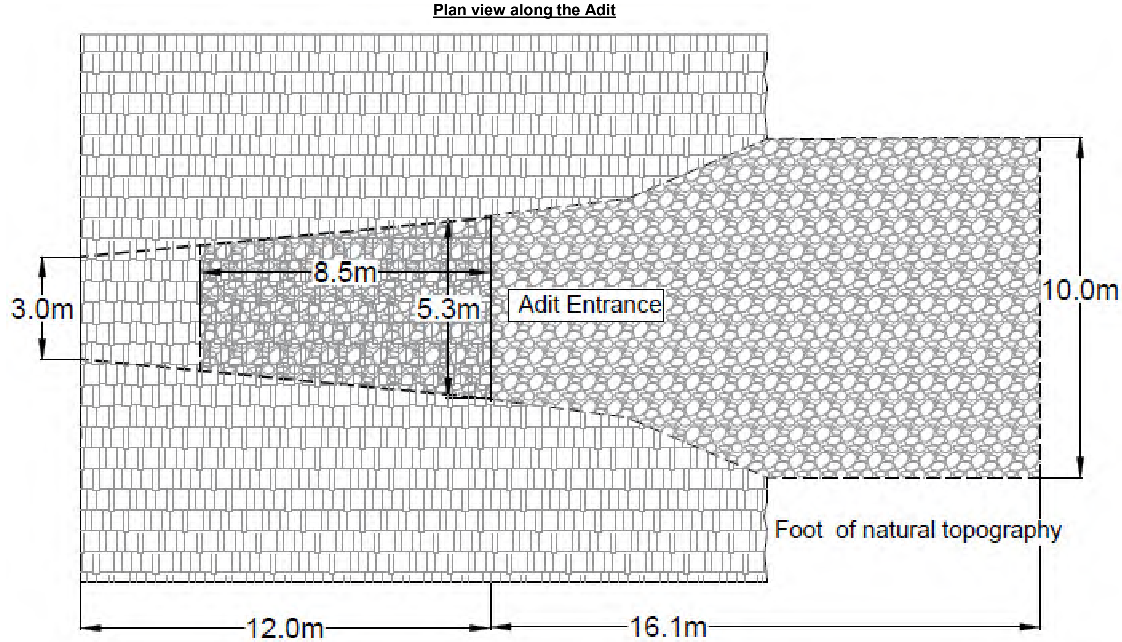



Drawing 1: Front View of the Backfill.

| | | |
|---|---|---|
| srk consulting | Cameco | Fishhook Adit Remediation Project |
| | | **Field Photographs** |
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 / Approved: BM/ML / Photo Page: 3 |




Drawing 2: Section View of the Backfill.




Drawing 3: Plan View of the Backfill.

| srk consulting | Cameco | Fishhook Adit Remediation Project<br>**Field Photographs** |
|---|---|---|
| Job No: 1CC007.069<br>Filename: BL_1CC007.069 | Beaverlodge | Date: 2020/09/28 \| Approved: BM/ML \| Photo Page: **4** |

# 2021 Cover Installation

# FAY 4 - CB-1 Access Raise

FAY 4 - CB-1 Access Raise


Photo 1: GPS locations of the CB-1 Mine Opening Entrance and the Toe of the Placed Backfill Material.


Photo 2: Overview of the CB-1 Mine Opening and Dimensions. Cables and conveyer belt visible within the opening.

PROFESSIONAL ENGINEER
T.P.S. SHARMA
MEMBER 20380
2021-11-03
YR. MM. DAY
SASKATCHEWAN

| srk consulting | Cameco | CB-1 Mine Opening Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.073<br>Filename: BL_1CC007.073 | Beaverlodge | Date: Nov 2021 / Approved: ML/TP / Photo Page: 1 |


Photo 3: Boulder 1 (1.5 m x 1.2 m x 0.85 m)


Photo 4: Boulder 2 (1.7 m x 1.3 m x 1.15 m)


Photo 5: Boulder 3 (0.75 m x 0.6 m x 0.6 m) and Boulder 4 (0.7 m x 0.6 m x 0.45 m)

Photo 6: Four boulders placed within the mine opening. Cables were present on the left-hand side (that could not be removed. The cables in no way impacts the integrity of this closure design.

PROFESSIONAL ENGINEER
T.P. SOMMA
MEMBER 20380
2021-11-03
YR. MM. DAY
SASKATCHEWAN

Photo 7: Placement of sorted waste rock (competent rock passing approximately 200 mm).

| srk consulting | Cameco | CB-1 Mine Opening Remediation Project |
|---|---|---|
| | | **Field Photographs** |
| Job No: 1CC007.073<br>Filename: BL_1CC007.073 | Beaverlodge | Date: Nov 2021 / Approved: ML/TP / Photo Page: 2 |

Photo 8: Placement of sorted waste rock (competent rock passing approximately 200 mm).

Photo 9: Placement of sorted waste rock, tight against the back (competent rock passing approximately 200 mm).

Photo 10: Placement of sorted waste rock over the brow (competent rock passing approximately 200 mm).

Photo 11: Looking southwest - Placement of sorted waste rock to level (competent rock passing approximately 200 mm).

Photo 12: Looking southwest - Placement of waste rock (various sizes).

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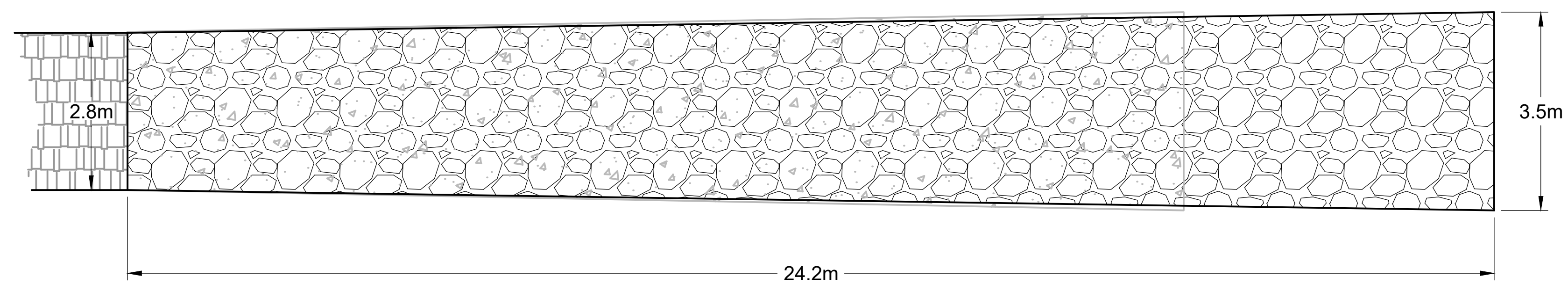
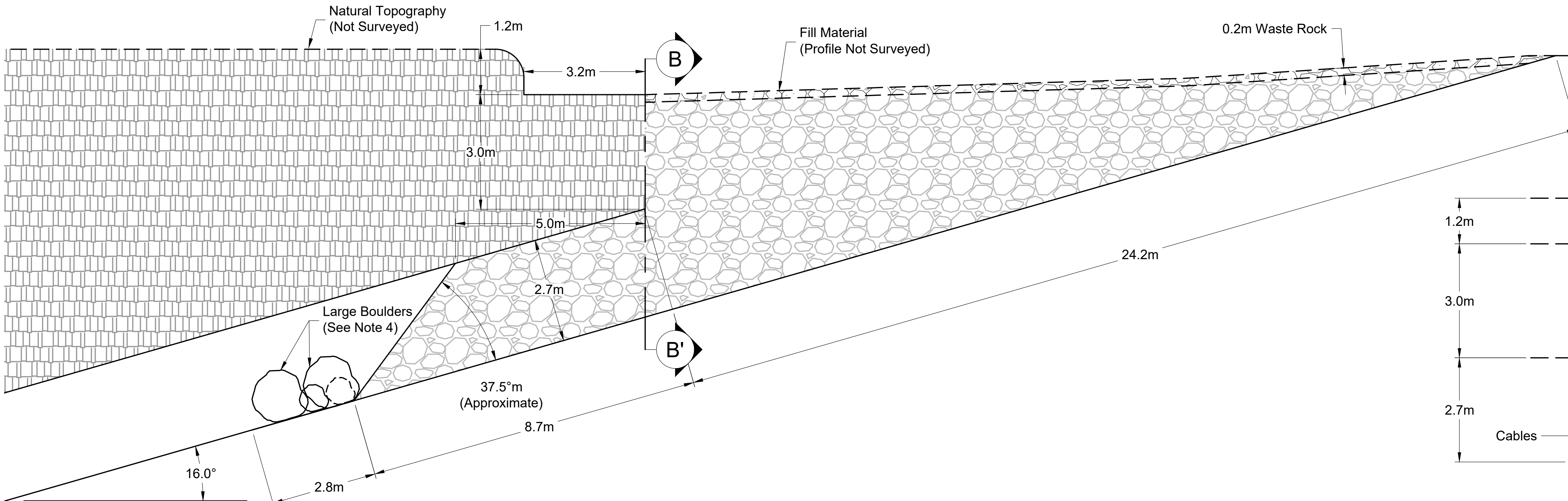
T.P. G. SHAMMA
MEMBER 20380
2021-11-03
YR. MM. DAY
SASKATCHEWAN

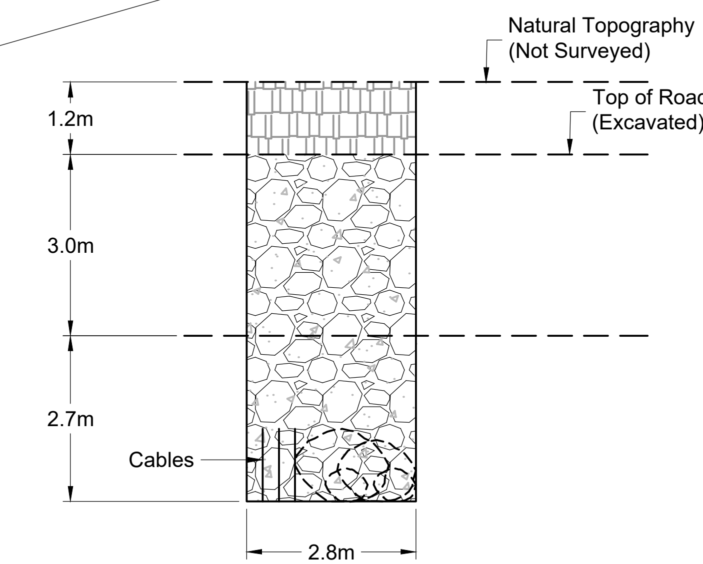
| srk consulting | Cameco | CB-1 Mine Opening Remediation Project<br>**Field Photographs** | | |
|---|---|---|---|---|
| Job No: 1CC007.073<br>Filename: BL_1CC007.073 | Beaverlodge | Date: Nov 2021 | Approved: ML/TP | Photo Page: 3 |



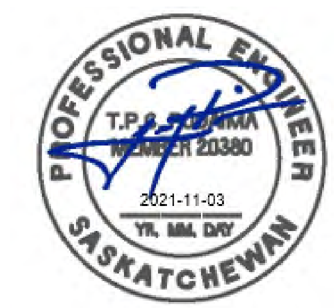

## CB-1 Mine Opening Plan View

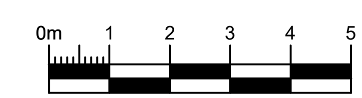



## CB-1 Mine Opening Profile View




B **CB-1 Mine Opening - Front View**




### LEGEND

| | |
|---|---|
| — — Approximate Measurements | Sorted Waste Rock (~200mm) |
| Rock | Waste Rock (Various Sizes) |

### NOTES

1. Measurements were recorded along the mine opening area and the profile using a measuring tape and are approximate.
2. The surrounding areas were trimmed of loose rocks prior to any work being conducted.
3. Material and equipment (e.g., cables) was removed from the opening, where possible. However, not all cables could be removed and was left in the opening. The cables in no way impacts the integrity of this closure design.
4. The concrete sill and concrete culvert were removed. Solid rock was exposed at the mine opening:
   - Two large boulders (minimum 1.3m diameter) were placed along the width (2.8m) of the excavation at approximately 8.7m inside from the mine opening's entrance.
   - Two additional boulders (minimum 0.7 m diameter) were placed along the width (2.8m), on the right-hand side of the excavation at approximately 8.7m inside from the mine opening's entrance. Cables were present on the left-hand side (that could not be removed). The cables in no way impacts the integrity of this closure design.
5. The material used for backfill was located on site and consisted of sorted, competent waste rock passing approximately 200mm.
6. Material was placed inside the opening for approximately 8.7m back from the entrance, up to the boulder's location, and was packed tightly against the back.
7. The material was placed 3.0m above the mine opening to counter-act potential settling. The material used to backfill the mine opening was placed using machines only.
8. Sufficient material existed to fill up the whole excavated area outside of the mine opening.
9. A layer of waste rock of various sizes was placed on top of the sorted waste rock to conform with the natural topography.
10. The final placement of the sorted waste rock was inspected and approved by the SRK field engineer.

### CLOSURE MATERIAL QUANTITIES FOR THE CB-1 MINE OPENING

| Material | Units | Quantities |
|---|---|---|
| Large Boulders (minimum 0.7m diameter) | Each | 2 |
| Large Boulders (minimum 1.3m diameter) | Each | 2 |
| Sorted waste rock (competent rock passing approximately 200mm) | m³ | 266 |
| Waste Rock (various sizes) | m³ | 56 |

| srk consulting | Cameco | CB-1 Mine Opening |
|---|---|---|
| SRK JOB NO.: 1CC007.073 | | DRAWING TITLE: As-built Drawing |
| FILE NAME: 1CC007.073 - CB-1 Mine Opening.dwg | Beaverlodge | DATE: November 2021 · APPROVED: ML/TP · FIGURE: BL-01 |

P:\Projects\01_SITES\Beaverlodge\040_AutoCAD\CB-1 Mine Opening\1CC007.073 - CB-1 Mine Opening.dwg

# APPENDIX F: BOLGER FLOW PATH RECONSTRUCTION

SRK Consulting (Canada) Inc.
205–2100 Airport Drive
Saskatoon, SK S7L 6M6

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F: +1.306.955.4750
saskatoon@srk.com
www.srk.com

# Memo

| | | | |
|---|---|---|---|
| **To:** | Mike Webster, Remediation Coordinator<br>Compliance & Licensing | **Client:** | Cameco Corporation |
| **From:** | Colin Boese, PEng<br>Trevor Podaima, PEng | **Project No:** | 1CC007.061 |
| **Reviewed By:** | Maritz Rykaart, PEng | | |
| **Cc:** | Shawn Hiller, Specialist, Compliance & Licensing | **Date:** | December 11, 2017 |
| **Subject:** | **Bolger Flow Path Reconstruction - 2017 Geotechnical Inspection** | | |

# 1 Introduction

## 1.1 Background

Historically, the Bolger Waste Rock Pile (the Site) consisted of waste rock and overburden from the historic Bolger Pit and Verna Shaft (Figure 1). This pile occupied a narrow valley next to the pit, which overlaid the former location of both Down Lake and a small creek (Zora Creek). Zora Creek linked Zora Lake to Down Lake, which then drained into Verna Lake. Zora Creek flowed intermittently (low to no flows in winter) through the base of the waste rock pile. The waste rock pile also contained a build-up of ice that impeded flow of water through the pile, which increased the extent of contact between creek water and the waste rock.

In June 2014, the Bolger Flow Path Reconstruction (the Project) commenced, which in general consisted of excavating a channel through the Site to re-establish flow in Zora Creek and limit the waste rock in direct contact with Zora Creek and water previously stored within the pile (Figure 2). The reconstructed flow path was predicted to result in improved water quality in Zora Creek, which may lead to improved water quality in Verna Lake. The Project was carried out over three construction seasons and completed in late August 2016 (SRK 2017).

The as-built channel configuration consists of a top excavation width that varies across the top flanks between approximately 40 and 90 m, a minimum base width of 2 m and a total channel length of approximately 400 m. To achieve this geometry, a series of benches (approximately 5 m wide by 6 m high) were excavated with overall side slopes that varied between approximately 1.6 horizontal:1.0 vertical (H:V) to 3.7H:1V (average is approximately 2.5H:1V).

From Station 0+000 to Station 0+090 m, the bottom 0.5 to 1.0 m of the channel was sub-cut into overburden and lined with erosion protection material comprised of boulders with sand and gravel. From Station 0+090 to Station 0+260, this sub-cut was excavated through waste rock where a small portion of the historical Down Lake remains, which has ponded water that varies seasonally from approximately 0.5 m to 0.8 m in depth. From Station 0+260 to Station 0+275, the channel is founded in bedrock. From Station 0+275 to Station 0+313, the northern side slope of the channel is in bedrock and the southern side slope is comprised of waste rock. From Station 0+260 to Station 0+313, the flow depth is 0.1 m and increases to approximately 0.17 m as the channel approaches the settling basin situated at the outlet of the channel at Station 0+313. The settling basin is founded in natural ground and is contained by bedrock outcrops. The ponding depth in the basin is approximately 0.85 m. Full details of the as constructed channel are provided in the As-Built Report (SRK 2017). The current configuration of the reconstructed channel is shown in Figures 2, 3 and 4.

## 1.2 Scope of Work

Cameco Corporation retained SRK Consulting (Canada) Inc. to carry out a geotechnical inspection of the Site in 2017. The inspection fulfills the recommendation to complete such an inspection in each of the first two years following construction (SRK 2014). The inspection frequency will be assessed as part of the 2018 geotechnical inspection and it is likely that the inspection frequency will be reduced.

This memo focuses on the geotechnical components of the inspection and concludes with recommendations for maintenance and future inspections. Maritz Rykaart, PhD, PEng, and Colin Boese, PEng with SRK, conducted the geotechnical inspection on September 29, 2017. The detailed site inspection was carried out on foot to visually inspect the various components of the reconstructed Zora Creek flow path. The weather conditions during the inspection were sunny and calm.

# 2 Inspection

## 2.1 General

The inspection was carried out in accordance with the Geotechnical Inspection Form and Check List prepared specifically for the Bolger Flow Path Reconstruction. The form and check list were developed as part of Cameco's response to the Canadian Nuclear Safety Commission (CNSC) comments regarding the Final As-Built Report for the Bolger Flow Path Reconstruction and provide a template that can be followed for future inspections. The inspection forms focus on the key design components of the reconstructed flow path, which include: access roads, channel side slopes, channel base, channel inlet and channel outlet. The checklist was developed for assessment of each of these design components, which includes: stability, vegetation, rip-rap, seepage, ponding, sediment accumulation, channel blockages, and channel flow. Completed inspection forms are included in Appendix A, which form the basis of this memorandum. The following should be read in conjunction with Figures 1 to 7, which include specific inspection photos. Photo locations are illustrated on Figure 3.

## 2.2 Access Roads

The front gate is locked restricting public vehicle access to the Site (Figure 2). On-site traffic controls included speed limit signage of 30 km/hr and road blockages reducing road width to promote decreased speeds prior to driving down towards the excavated channel.

Recommendations:

- No recommendations, as the access roads are in good condition.

## 2.3 Channel Inlet

A beaver dam and heavy vegetation were observed at the inlet of the channel restricting flow from Zora Lake into the channel (Photos 2 and 3, Figure 5). Based on discussions with Cameco, it is understood that the beaver dam was present well prior to channel excavation. The beaver dam has a stepped configuration that creates a cascading effect as the flow for Zora Lake migrates through the dam and into the channel. A portion of the flow is directed to the south, which then enters the channel as seepage through the south sidewall of the channel from approximately Station 0+015 to 0+030. The beaver dam and associated seeps do not impact the geotechnical stability of the channel. However, should there be a failure of the beaver dam, it is likely that scour of the channel will occur as well as sedimentation loading downstream. Such failure will not result in instability of the channel, but maintenance would likely be required.

Recommendations:

- At the time of the site visit, the channel was still flowing and at a rate of approximately 0.5 L/s, which was measured in the field. No maintenance is required at the channel inlet at this time. The channel inlet will be re-inspected as part of the 2018 geotechnical inspection, and if required, will include options for removing the blockages.

## 2.4 Channel Side Slope Crest

During the inspection, several small voids (typically 0.15 to 0.3 m) in the waste rock were observed, which reflects how the material was originally placed to form the Bolger Pile. Such voids make the site difficult to traverse but this does not impact the geotechnical stability or performance of the channel. The vegetation growth was none to very sparse on the slope crest. Overall the slope crest was in good condition and there are no geotechnical concerns. Current conditions of the slope crest are shown in Figure 4.

Recommendations:

- No maintenance required at this time.

## 2.5 Channel Side Slopes

As stated in the As-Built Report (SRK 2016), the lower portion of the channel slope from approximately Station 0+015 to Station 0+060 was steeper than the design slope of 1.5H:1V. This configuration was not deemed a geotechnical stability concern, which is discussed in the report; however, it was recommended to inspect this area as part of the geotechnical inspection. This area was inspected and there were no apparent changes since 2016.

There was no vegetation on the side slopes at the time of inspection. A high-water mark was observed and measured at approximately 0.25 m above the current water level. Iron staining was evident from approximately Station 0+240 and Station 0+285 along the bottom portion of the side slopes and base of the channel, which are founded in bedrock (Photo 7, Figure 5). This was discussed with Cameco and it is understood that the water quality data indicates that there is no evidence of acid rock drainage.

Recommendations:

- No maintenance required at this time.
- It is understood that Cameco will continue to monitor water quality within and downstream of the channel.

## 2.6 Channel Base

Overall, vegetation was observed to be sparse throughout the channel with the exception of the inlet from approximately Station 0+015 to Station 0+030 where it is moderate (Photo 4, Figure 5). At the time of inspection, this heavier vegetation growth was not restricting channel flow and is therefore not a concern related to channel performance.

Sediment accumulation was observed throughout most of the channel, which was more noticeable at two localized locations (Station 0+090 and Station 0+215) (Photo 5, Figure 5). Station 0+090 is where the channel transitions from overburden to waste rock and sedimentation was initially observed in 2016 subsequent to the placement of the erosion control material and may be attributed to washout of fine material (SRK 2017). The sediment was not impeding the flow of the channel and does not need to be removed. No apparent changes of this area were observed during the inspection and thus leaving the sediment in-place is not expected to impact channel performance. The channel base from Station 0+100 to 0+215 appeared to be in good condition (Photo 6, Figure 5).

Station 0+215 is immediately downstream of the channel crossing where channel flow appeared to be stagnant up until approximately Station 0+240 (Photo 8, Figure 6). This area was observed to have sediment that was approximately 1.5 m deep, which unlike Station 0+090 was easily resuspended when the surface is agitated. As identified in the as-built (SRK 2017), this is primarily lake bottom sediments as this portion of the channel was founded on the western extent of the historical Down Lake. Photos 9 and 10 on Figure 4 show before and after sediment resuspension, respectively. There are no geotechnical related concerns with the sediment; however, should it become resuspended due to scour, transportation of sediments downstream is likely to occur.

Recommendations:

- No immediate action is required; however, this may need to be reassessed if total suspended solids (TSS) is identified as a concern during Cameco's routine water quality monitoring of the channel. This location of the channel will be reassessed during the 2018 geotechnical inspection to determine what and if any maintenance actions are required.

## 2.7 Channel Outlet

The channel outlet was observed to have sparse vegetation and heavy sedimentation (Photo 11, Figure 6). At the time of the inspection, discharge was observed to be clear and flowing at a rate considered a trickle due to the low flow conditions in late September 2017.

Recommendations:

- No maintenance is required at this time; however, accumulated sediment should be reassessed as part of the 2018 geotechnical inspection.

## 2.8 Bolger Pit

The Bolger Pit, which was further backfilled with waste rock as part of the channel reconstruction was inspected and there were no geotechnical concerns (Photos 12 and 13, Figure 7).

Recommendations:

- No maintenance is required at this time.

# 3 Conclusions

The memo provides a geotechnical performance assessment of the reconstructed Zora Creek flow path. The findings are based on a walkover inspection on September 29, 2017. This is the first inspection completed by SRK since the completion of the channel reconstruction in 2016. There are no immediate or significant areas of concern with regards to the performance or geotechnical stability of the reconstructed flow path based on the 2017 physical inspection. However, subject to routine water quality monitoring, future maintenance may be required due to sediment accumulation in the channel, particularly at Station 0+215. This will be reassessed as part of the 2018 geotechnical inspection.

Prepared by: SRK Consulting (Canada) Inc.

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Colin Boese, PEng
Consultant

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Trevor Podaima, PEng
Senior Consultant

Reviewed by:

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Maritz Rykaart, PhD. PEng
Principal Consultant

# 4 References


SRK Consulting (Canada) Inc. (SRK 2014). Beaverlodge – Design Report for the Flow Path Reconstruction at the Bolger Waste Rock Pile. SRK Project Number 1CC007.044. Report prepared for Cameco Corporation, February 2014.

SRK Consulting (Canada) Inc., 2017. Bolger Flow Path Reconstruction 2016 Final As-Built Report. SRK Project Number 1CC007.062. Report prepared for Cameco Corporation, February 2017.

# Figures


## LEGEND

Historical Flow Path

Waste Rock Extents

## NOTES

1. Inferred historical flow path prior to channel excavation.

0m 3 6 9 12

srk consulting

Cameco

| | |
|---|---|
| SRK JOB NO.: | 1CC007.061 |
| FILE NAME: | 1CC007.061 - PreExisting Conditions.dwg |

Bolger Flow Path Reconstruction

2017 Geotechnical Inspection

Conditions Prior to Flow Path Reconstruction

| DATE: | APPROVED: | FIGURE: |
|---|---|---|
| December 2017 | - | 1 |

P:\01_SITES\Beaverlodge\1CC007.061_Bolger Flow Path Reconstruction\040_AutoCAD\2017 Geotechnical Inspection\1CC007.061 - PreExisting Conditions.dwg


## NOTES

1. Channel as-built configuration September 2016.

## REFERENCE

NAD83 UTM Zone 12.
Imagery collaboration 2012 - 2016, and SRK Drone Imagery 2016.

0m 50 100 150 200m

srk consulting

SRK JOB NO.: 1CC007.061
FILE NAME: 1CC007.061 - Site.dwg

Cameco

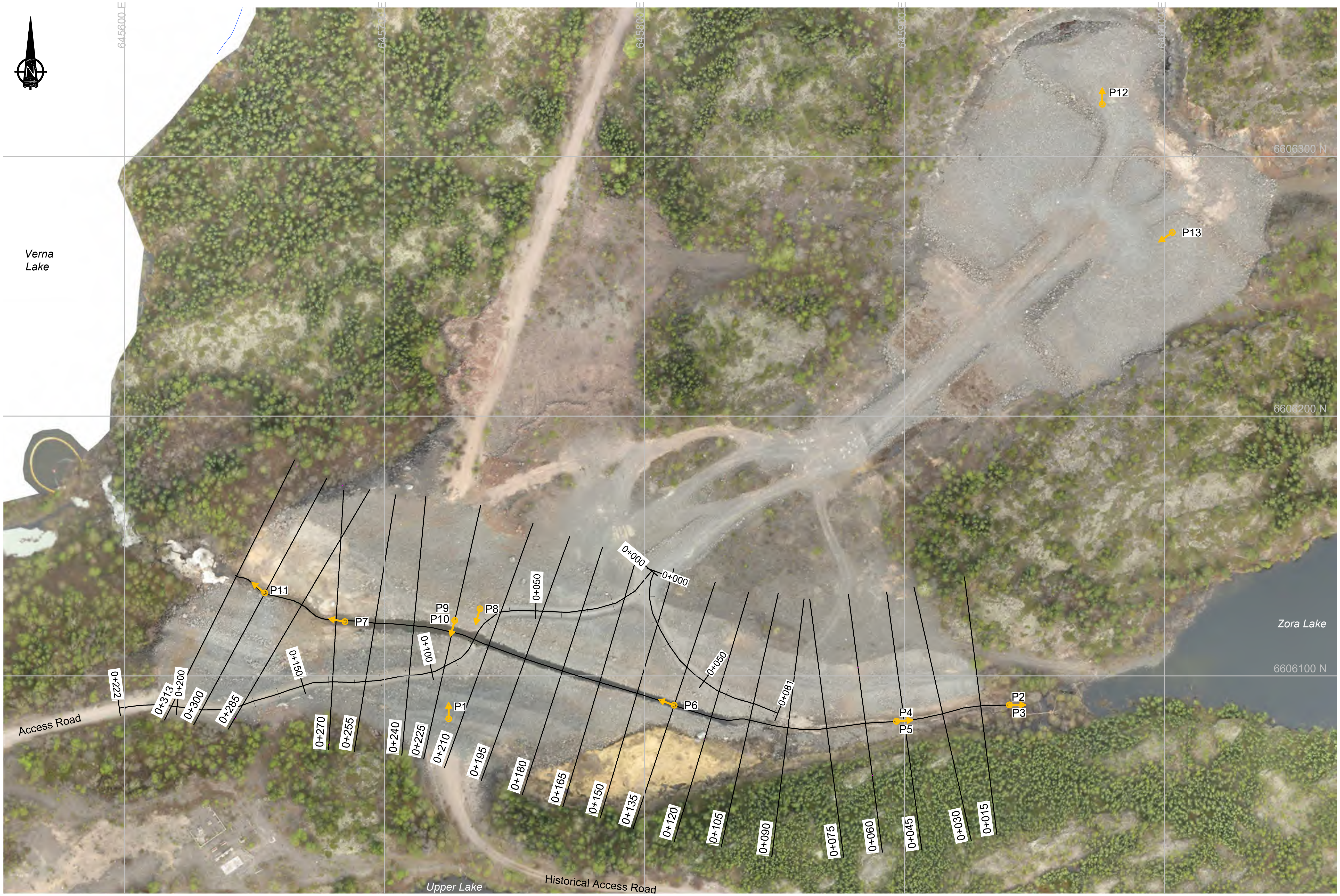
Beaverlodge

2017 Geotechnical Inspection

Bolger Site Overview
Subsequent Flow Path Reconstruction

| DATE: | APPROVED: | FIGURE: |
|---|---|---|
| 2017/12/05 | TPP | 2 |

P:\01_SITES\Beaverlodge\1CC007.061_Bolger Flow Path Reconstruction\040_AutoCAD\2017 Geotechnical Inspection\1CC007.061 - Site.dwg




## LEGEND

Photo Direction and Location

## NOTES

1. All dimensions are in meters unless noted otherwise.

## REFERENCE

NAD83 UTM Zone 12.
Imagery from Saskatchewan Geospatial Imagery collaboration 2012-2016, and SRK Drone Imagery 2016.

srk consulting

Cameco

| | |
|---|---|
| Job No.: | 1CC007.061 |
| Filename: | 1CC007.061 - GA.dwg |

Bolger Flow Path Reconstruction

2017 Geotechnical Inspection

As-built Plan View with Channel Section Stations

| Date: | Approved: | Figure: |
|---|---|---|
| December 2017 | CDB | 3 |

Photo 1: Looking North at Bolger Flow Path Reconstruction

| srk consulting | Cameco | 2017 Geotechnical Inspection |
|---|---|---|
| | | Site Inspection Photos |
| Job No: 1CC007.061<br>Filename: Bolger Flow Path Inspection Photos.pptx | Bolger Flow Path Reconstruction | Date: November 2017 / Approved: CDB / Figure: 4 |

Photo 2: Looking East at Beaver Dam in Channel Inlet

Photo 3: Looking East at Vegetation/Ponding along the south flank of Channel Inlet

Photo 4: Looking West at Channel Base from Station 0+015 to Station 0+030

Photo 5: Looking East at Vegetation Growth in Channel Base at approximately Station 0+100

Photo 6: Looking West along channel base from approximately Station 0+135

Photo 7: Looking West along channel base from approximately Station 0+270

| | | | | |
|---|---|---|---|---|
| srk consulting | Cameco | 2017 Geotechnical Inspection | | |
| | | Site Inspection Photos | | |
| Job No: 1CC007.061<br>Filename: Bolger Flow Path Inspection Photos.pptx | Bolger Flow Path Reconstruction | Date: November 2017 | Approved: CDB | Figure: 5 |

Photo 8: Looking South and downstream of Channel Crossing

Photo 9: Looking South at Channel Base Sedimentation (Station 0+215)

Photo 10: Looking South at Channel Base Sedimentation after resuspension (Station 0+215)

Photo 11: Looking West at Channel Outlet

| srk consulting | Cameco | 2017 Geotechnical Inspection |
|---|---|---|
| | | Site Inspection Photos |
| Job No: 1CC007.061<br>Filename: Bolger Flow Path Inspection Photos.pptx | Bolger Flow Path Reconstruction | Date: November 2017 \| Approved: CDB \| Figure: 6 |

Photo 12: Looking at Northeast flank of Bolger Pit

Photo 13: Looking Southwest from Northeast flank of Bolger Pit

| | | | | |
|---|---|---|---|---|
| srk consulting | Cameco | 2017 Geotechnical Inspection | | |
| | | Site Inspection Photos | | |
| Job No: 1CC007.061<br>Filename: Bolger Flow Path Inspection Photos.pptx | Bolger Flow Path Reconstruction | Date: November 2017 | Approved: CDB | Figure: 7 |

# Appendix A: Inspection Forms

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



All parts of this inspection form should be completed. Adverse conditions should be described and location stated. Additional information and relevant photographs should be attached.

Inspector: Maritz Rykaart / Colin Boese    Inspector's Employer: SRK Consulting (Canada) Inc.

Inspection Date: 29/09/2017 (DD/MM/YR)

Weather: 10 deg Celsius (Temperature)    Light wind at 6km/hr (Wind Direction/Strength (light/high/gusting))    Sunny (General Conditions)

## ACCESS ROADS

**A) Access Roads**

Photographs: Traffic control Road blockage and speed limit sign at ramp access to Bolger Flow Path Channel (Photos 1 and 2)

Entrance restricted to public  ☒ yes  ☐ none

Main entry to Bolger site is locked and restricted to the public

On-site traffic control includes waste rock road blockage and speed limit signs of 30 km/hr to reduce traffic speeds on site

Maintenance required: No maintenance required

## CHANNEL SIDESLOPE CREST

**A) Stability**

Photographs: Typical void in waste rock (Photo 3)

| | none | |
|---|---|---|
| cracking | ☒ | ☐ |
| settlement | ☒ | ☐ |
| erosion | ☒ | ☐ |
| animal burrows | ☒ | ☐ |
| other | | ☒ Small voids in waste rock observed, which are related to how waste rock was originally placed, no geotechnical concern |

**B) Vegetation**

Photographs: None

| | | |
|---|---|---|
| none | ☐ | |
| sparse | ☒ | Vegetation growth is very sparse |
| moderate | ☐ | |
| heavy | ☐ | |

**Additional Comments:**

Do any inspection items require corrective action? If yes, what is the degree of severity? Is immediate action required or monitor?

- Voids on crests are not a geotechnical concern.
- No corrective action is required.

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB    Inspector's Employer: SRK    Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL SIDE SLOPES

### A) Stability

Photographs: None

| | | | |
|---|---|---|---|
| scour at base | ☒ none | ☐ | |
| cracking | ☒ none | ☐ | |
| slumping | ☒ none | ☐ | |
| rilling | ☒ none | ☐ | |
| bulging | ☒ none | ☐ | |
| sloughing | ☒ none | ☐ | |
| erosion | ☒ none | ☐ | |
| animal burrows | ☒ none | ☐ | |
| other | | ☒ | North slope at east end of channel was a previously identified area that was observed to be over-steepened at toe. Area was inspected in 2017 and there were no apparent changes. |

### B) Vegetation

Photographs: N/A

| | | |
|---|---|---|
| none | ☒ | No vegetation observed on channel side slopes |
| sparse | ☐ | |
| moderate | ☐ | |
| heavy | ☐ | |

### C) Rip-rap

Photographs: Channel base and high water mark (Photos 4 and 5)

| | | | |
|---|---|---|---|
| erosion/movement | ☒ none | ☐ | |
| dis-coloration | ☒ none | ☐ | |
| high water mark visible | ☐ none | ☒ | High water mark measured at 0.25 m above current water level |
| adequate armor | ☒ yes | ☐ | |
| other | ☐ yes | ☐ | |

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL SIDE SLOPES (Continued)

**E) Seepage** Photographs: N/A

Seepage ☐ none ☒ Location 1 Station 0+015 to Station 0+030 along south slope

Rate: ☐ damp ☐ trickle ☒ steady ☐ _____ (L/s)

Clarity: ☒ clear ☐ muddy ☐ ____________

Sample taken: ☐ yes ☒ no

Photographs: None

☐ Location 2 ____________

Rate: ☐ damp ☐ trickle ☐ steady ☐ _____ (L/s)

Clarity: ☐ clear ☐ muddy ☐ ____________

Sample taken: ☐ yes ☐ no

**Additional Comments:**

Do any inspection items require corrective action? If yes, what is the degree of severity? Is immediate action required or monitor?

- No corrective action is required.

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB    Inspector's Employer: SRK    Inspection Date: 29/09/2017 (DD/MM/YR)

## CHANNEL BASE

**A) Rip-rap**    Photographs: Sedimentation in Rip Rap at Station 0+090 (Photo 6)

| | | | | |
|---|---|---|---|---|
| erosion/movement | ☒ | none | ☐ | |
| dis-coloration | ☒ | none | ☐ | |
| Adequate armor | ☒ | Yes | ☐ | |
| other | | | ☒ | Sedimentation observed at Station 0+090 |

**B) Ponding**    Photographs: N/A

Positive drainage ☒    No ☐ Location 1

Clarity: ☒ clear ☐ muddy ☐

Sample taken: ☐ yes ☒ no

Photographs:

☐ Location 2

Clarity: ☐ clear ☐ muddy ☐

Sample taken: ☐ yes ☐ no

**C) Sediment Accumulation**    Photographs: Downstream sedimentation accumulation (Photos 7 and 8)

Present ☒    none ☐ Location 1 Heavy sediment accumulation west of channel road crossing (Station 0+215). Sediments are primarily lake bottom sediments as this portion of the channel was founded on the western extent of the historical Down Lake

Sample taken: ☐ yes ☒ no

Photographs:

☐ Location 2

Sample taken: ☐ yes ☐ no

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL BASE (Continued)

**D) Vegetation** Photographs: Upstream Vegetation (Photo 6)

- none ☐
- sparse ☒ Sparse vegetation and moss were observed along the channel base. Upstream Vegetation observed.
- moderate ☐
- heavy ☐

**E) Blockage** Photographs: Sedimentation build up (Photos 6, 7, 8, 9 and 10)

- none ☐
- debris ☒ Minor blockage at select rip rap location near Station 0+090 and Station 0+145. No current issues with channel flow. Area should be monitored during future inspections for additional build up of debris or vegetation that restricts flow of water
- beaver dam ☐
- siltation ☒ Becomes stagnant at Station 0+215, heavy siltation on west side or road crossing
- vegetation ☐

Correction action: ☐ taken ☐ to follow

Priority Rating (Immediate Action or Monitor): ______

**Additional Comments:**

Do any inspection items require corrective action? If yes, what is the degree of severity? Is immediate action required or monitor?

- Sedimentation is quite thick and extremely fluffy. During the inspection a rock was dropped into the sediment causing sediment to form a thick cloud and become suspended.
- Vegetation is currently not a concern.
- No corrective action is required.
- Vegetation and sedimentation accumulation should be re-inspected in 2018 to determine if maintenance is required.

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB    Inspector's Employer: SRK    Inspection Date: 29/09/2017 (DD/MM/YR)

## CHANNEL INLET

**A) Blockage**

Photographs: Beaver Dam, Vegetation and Ponding (Photos 11 and 12)

- none ☐
- debris ☒ Heavy debris and vegetation is observed and restricting flow at the channel inlet.
- beaver dam ☒ A beaver dam is creating a blockage and restricting flow at the channel inlet.
- siltation ☐
- ice ☐

Correction action: ☐ taken ☐ to follow

Priority Rating (Immediate Action or Monitor): __________

**B) Erosion**

Photographs: N/A

erosion/movement of rip rap ☐ none ☒

**C) Vegetation**

Photographs: Vegetation and Ponding (Photos 11 and 12)

- none ☐
- sparse ☐
- moderate ☐
- heavy ☒ Heavy vegetation is restricting flow at the channel inlet. Water level from the lake to the inlet was observed to be ponding and stepping down in water level as it migrates through the blockages to the channel base.

**D) Flow**

Photographs: N/A

In-flow ☐ none ☒ Rate: ☐ damp ☒ trickle ☒ steady ☐ 0.5 (L/s)

Clarity: ☒ clear ☐ muddy ☐ ______

Sample taken: ☐ yes ☒ no

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB    Inspector's Employer: SRK    Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL INLET (Continued)

**Additional Comments:**

Do any inspection items require corrective action? If yes, what is the degree of severity? Is immediate action required or monitor?

- Water is continuing to migrate through the beaver dam and heavy vegetation.
- Inlet conditions should be re-inspected in 2018 to check that water continues to flow.
- No corrective action is required.

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB  Inspector's Employer: SRK  Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL OUTLET

**A) Blockage**  Photographs: Sedimentation at outlet (Photos 13 and 14)

- none ☐
- debris ☐
- beaver dam ☐
- siltation ☒ Moderate siltation observed at channel outlet.
- ice ☐

Correction action: ☐ taken ☐ to follow

Priority Rating (Immediate Action or Monitor):

**B) Erosion**  Photographs: N/A

erosion/movement of rip rap ☐ none ☒

**C) Vegetation**  Photographs: N/A

- none ☐
- sparse ☒
- moderate ☐
- heavy ☐

**D) Flow**  Photographs: V-Notch Weir

Discharge ☐ none ☒ Rate: ☐ damp ☒ trickle ☐ steady ☐ _____ (L/s)

Clarity: ☒ clear ☐ muddy ☐

Sample taken: ☐ yes ☒ no

# FIELD INSPECTION FORM
# CHANNEL INSPECTION
# BOLGER FLOW PATH RECONSTRUCTION



Inspector: MER/CDB     Inspector's Employer: SRK     Inspection Date: 29/09/2017
(DD/MM/YR)

## CHANNEL OUTLET (Continued)

**Additional Comments:**

Do any inspection items require corrective action? If yes, what is the degree of severity? Is immediate action required or monitor?

- Flow depth at V-Notch Weir was 50 mm at time of inspection.
- No immediate concerns with the channel outlet.
- No corrective action required.

**FIELD INSPECTION FORM**
**CHANNEL INSPECTION BOLGER**
**FLOW PATH RECONSTRUCTION**



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/09/2017
(DD/MM/YR)

## PHOTOS – Access Roads

1


2

**Comments:**

Photos:
1. Road blockage using large boulders
2. Speed limit signage

# FIELD INSPECTION FORM
## CHANNEL INSPECTION BOLGER
## FLOW PATH RECONSTRUCTION



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/0902017
(DD/MM/YR)

**PHOTOS – Channel Side Slope Crest**

3

**Comments:**

Photo:
3. Typical void observed on Crest

# FIELD INSPECTION FORM
## CHANNEL INSPECTION BOLGER
## FLOW PATH RECONSTRUCTION



Inspector: MER/CDB | Inspector's Employer: SRK | Inspection Date: 29/09/2017
(DD/MM/YR)

**PHOTOS – Channel Side Slopes**

4

5

**Comments:**

Photos:
4. Channel side slopes along base of channel
5. High Water Mark

# FIELD INSPECTION FORM
# CHANNEL INSPECTION BOLGER
# FLOW PATH RECONSTRUCTION



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/09/2017
(DD/MM/YR)

**PHOTOS – Channel Base**

6

**Comments:**

Photos:
6. Upstream vegetation and sedimentation at Station 0+090 looking east

# FIELD INSPECTION FORM
# CHANNEL INSPECTION BOLGER
# FLOW PATH RECONSTRUCTION

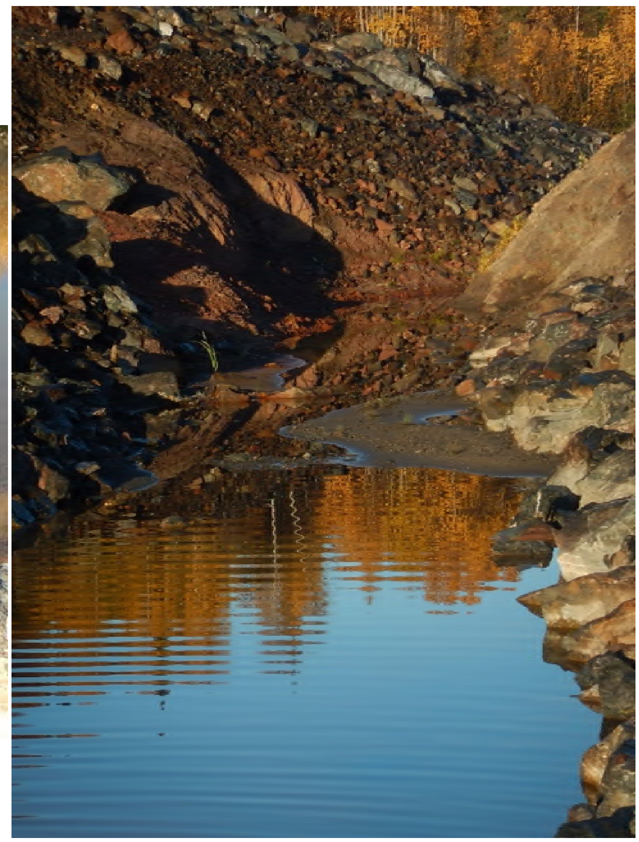


Inspector: MER/CDB　　Inspector's Employer: SRK　　Inspection Date: 29/09/2017 (DD/MM/YR)

**PHOTOS – Channel Base**

7

8



**Comments:**

Photos:

7. Downstream sedimentation at Station 0+215
8. Sedimentation extends towards downstream exposed bedrock

# FIELD INSPECTION FORM
# CHANNEL INSPECTION BOLGER
# FLOW PATH RECONSTRUCTION



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/09/2017
(DD/MM/YR)

**PHOTOS – Channel Base**

9

10

**Comments:**

Photos:
9. Upstream channel base with partial riprap blockage due to sediment build up (Station 0+145)
10. Downstream channel base (Station 0+150 to 0+210), no concerns

# FIELD INSPECTION FORM
## CHANNEL INSPECTION BOLGER
## FLOW PATH RECONSTRUCTION



Inspector: MER/CDB    Inspector's Employer: SRK    Inspection Date: 29/09/2017
(DD/MM/YR)

**PHOTOS – Channel Inlet**

11

12

**Comments:**

Photos:
11. Inlet Beaver Dam
12. Inlet Vegetation and Ponding

**FIELD INSPECTION FORM**
**CHANNEL INSPECTION BOLGER**
**FLOW PATH RECONSTRUCTION**



Inspector: MER/CDB Inspector's Employer: SRK Inspection Date: 29/092017
(DD/MM/YR)

**PHOTOS – Channel Outlet**

13

14

**Comments:**

Photos:
13. Outlet Sedimentation
14. Fow at V-Notch Weir

# 8 REGDOC 2.9.1 Environmental Principles, Assessments and Protection Measures

Canada's Nuclear Regulator

Environmental Protection

# Environmental Principles, Assessments and Protection Measures

REGDOC-2.9.1, version 1.2

September 2020

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

**Environmental Protection: Environmental Principles, Assessments and Protection Measures**
Regulatory document REGDOC-2.9.1


Cat. No. CC172-164/2016E-PDF
ISBN 978-0-660-06255-6



*Également publié en français sous le titre : Protection de l'environnement : Principes, évaluations environnementales et mesures de protection de l'environnement*

## Document availability

This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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YouTube: youtube.com/cnscccsn
Twitter: @CNSC_CCSN
LinkedIn: linkedin.com/company/cnsc-ccsn

## Publishing history

| | |
|---|---|
| December 2016 | Version 1.0 |
| April 2017 | Version 1.1 – Administrative updates to sections 2.1 (to match the French document) and 3.2.4, and to the definition of "environmental effects" in the glossary |
| September 2020 | Version 1.2 – Administrative updates throughout to reflect the *Impact Assessment Act* |

# Preface

This regulatory document is part of the CNSC's environmental protection series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*, describes:

- the CNSC's principles for environmental protection
- for all nuclear facilities or activities that interact with the environment, the scope of an environmental review and the roles and responsibilities associated with an environmental review
- the CNSC's requirements and guidance to applicants and licensees for developing environmental protection measures, including an environmental risk assessment (ERA) where required, for both new and existing facilities or activities

This document is Version 1.2. It supersedes Version 1.1, which was published in April 2017.

Environmental protection for nuclear facilities and activities is done in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it. The CNSC requires the environmental effects of all nuclear facilities or activities to be considered and evaluated when licensing decisions are made.

This document will be used to assess licence applications for proposed new nuclear facilities or activities, licence applications for existing facilities or activities (renewals and amendments), and environmental protection measures, as follows:

- all licence applications that demonstrate potential interactions between the facility or activity and the environment are subject to an environmental review
- for each facility or activity that has direct interactions with the environment, the applicant or licensee must demonstrate that environmental protection measures are or will be in place
- where an environmental risk assessment (ERA) is required for a facility or activity (details are included in this regulatory document):
    - the ERA is subject to regular updates (at least every five years, and whenever a significant change occurs in either the facility or activity that could alter the nature (type or magnitude) of the interaction with the environment within the ERA predictions)
    - the licensee's ERA informs an environmental review

In all cases, the environmental review, the environmental protection measures and the ERA (where required) are commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity.

**Note:** For facilities or activities other than Class I nuclear facilities and uranium mines and mills, the CNSC reviews every licence application to verify that there are no significant interactions with the environment (for example, for most Class II facilities, such as hospitals and universities, and for the use and transport of nuclear substances and radiation devices, there is no interaction with the environment). If the CNSC's review of the application determines that the facility or activity:

(a) has potential interactions with the environment and that additional consideration of environmental protection measures is warranted, the information in this document may be applied in a graded manner

(b) does not interact with the environment, then only the CNSC's guiding principles for environmental protection (in section 2.1 of this document) are relevant as guidance for such facilities or activities

Early engagement with CNSC staff is encouraged for facilities or activities with potential interactions with the environment or for applicants uncertain as to their facility's or activity's potential for interaction with the environment. CNSC staff can provide facility- or activity-specific guidance to assist applicants and licensees.

A document that shows the changes made to REGDOC-2.9.1, Version 1.1 is available from the CNSC upon request.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

# Table of Contents

# Environmental Principles, Assessments and Protection Measures

## 1. Introduction

### 1.1 Purpose

Environmental protection for nuclear facilities and activities is done in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under the NSCA. This legislation includes provisions to ensure that licensees are adequately protecting the environment and the health, safety and security of persons. The CNSC requires the environmental effects of all nuclear facilities or activities to be considered and evaluated when licensing decisions are made.

This regulatory document provides information to applicants and licensees on protecting the environment and the health of persons, including:

- identification of facility or activity interactions with the environment and the public
- identification and mitigation of potential environmental effects associated with these interactions
- design and implementation of effluent and emission release measures and of the environmental monitoring measures to confirm or test the predictions and the actual effects
- periodic assessments of the environmental protection measures and the licensee's performance

In particular, this regulatory document describes:

- the CNSC's principles for environmental protection
- for all nuclear facilities or activities that interact with the environment, the scope and type of environmental review, commensurate with the scale and complexity of the environmental risks
- the CNSC's requirements and guidance to applicants and licensees for developing environmental protection measures, including an environmental risk assessment (ERA) where required, for both new and existing facilities or activities

### 1.2 Scope

This regulatory document clarifies the CNSC's expectations of applicants and licensees, and provides guidance for protecting the environment and the health of persons.

This document will be used to assess licence applications for proposed new nuclear facilities or activities, licence applications for existing facilities or activities (renewals and amendments), and environmental protection measures:

- all licence applications that demonstrate potential interactions between the facility or activity and the environment are subject to an environmental review
- for each facility or activity that has direct interactions with the environment, the applicant or licensee must demonstrate that environmental protection measures are or will be in place

- where an ERA is required for a facility or activity (details are included in this regulatory document):
  - the ERA is subject to regular updates (at least every five years, and whenever a significant change occurs in either the facility or activity that could alter the nature (type or magnitude) of the interaction with the environment
  - the licensee's ERA informs an environmental review

In all cases, the environmental review, the environmental protection measures and the ERA (where required) are commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity.

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, the CNSC reviews every licence application to verify that there are no significant interactions with the environment (for example, for most Class II facilities, such as hospitals and universities, and for the use and transport of nuclear substances and radiation devices, there is no interaction with the environment). If the CNSC's review of the application determines that the facility or activity:

- has potential interactions with the environment and that additional consideration of environmental protection measures is warranted, the information in this document may be applied in a graded manner
- does not interact with the environment, then only the CNSC's guiding principles for environmental protection (in section 2.1 of this document) are relevant as guidance for such facilities or activities

Early engagement with CNSC staff is encouraged for facilities or activities with potential interactions with the environment or for applicants uncertain as to their facility's or activity's potential for interaction with the environment. CNSC staff can provide facility- or activity-specific guidance to assist applicants and licensees.

**Note:** The intent of these requirements is not to replace or duplicate other federal, provincial or territorial, and municipal legislation with which licensees must comply. Where applicable, meeting the existing legislative requirements is adequate for meeting the requirements of this regulatory document.

### 1.3 Relevant legislation

The following provisions of the NSCA and the regulations made under it are relevant to this document:

- NSCA:
  - subsection 24(4)
  - subsection 24(5)
- *General Nuclear Safety and Control Regulations*:
  - paragraph 3(1)(f)
  - paragraphs 12(1)(c) and (f)

- *Class I Nuclear Facilities Regulations*:
    - paragraphs 3(e), (g), (h) and (j);
    - paragraphs 4(c) and (e);
    - paragraphs 5(b), (i), (j) and (k)
    - paragraphs 6(h), (i), (j) and (k)
    - paragraphs 7(e), (f), (g), (h), (i) and (k)
    - paragraph 8(b)
- *Class II Nuclear Facilities and Prescribed Equipment Regulations*:
    - paragraph 3(p)
    - paragraphs 5(e), (f), (h) and (i)
- *Radiation Protection Regulations*:
    - paragraphs 4(a) and (b)
    - subsections 6(1) and (2)
    - subsection 13(1)
- *Nuclear Substances and Radiation Devices Regulations*:
    - paragraphs 3(1)(b)
    - paragraph 31(1)(i)
- *Uranium Mines and Mills Regulations*:
    - subparagraph 3(a)(v)
    - subparagraphs 3(c)(ii), (iii), (v), (vi), (vii), (viii), (ix) and (x)
    - subparagraphs 3(d)(i) and (vi)

The *Impact Assessment Act* (IAA) applies in the following instances:
- designated projects as defined in section 2 of the IAA
- projects proposed to be carried out on federal lands, as defined in section 82 of the IAA

Under section 182 of the IAA, any environmental assessment of a designated project by the CNSC commenced under the Canadian Environmental Assessment Act, 2012 (CEAA 2012), in respect of which a decision has not yet been issued before the coming into force of the IAA, is continued under CEAA 2012 as if that Act had not been repealed.

The CNSC also considers pertinent legislation from other government departments, including:
- *Canadian Environmental Protection Act, 1999*
- *Fisheries Act*
- *Species at Risk Act*
- *Migratory Birds Convention Act, 1994*

### 1.4 National and international standards

The following standards from the CSA Group are relevant to this regulatory document:
- CAN/CSA ISO-14001, *Environmental Management Systems – Requirements with Guidance for Use* (2004 edition or successor editions) [1, 2]
- CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [3]
- CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [4]
- CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [5]

- CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6]
- CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [7]

The CNSC licensing process ensures that applicable regulatory documents are considered for licensing applications. The information required to comply with those regulatory documents may contribute to meeting the requirements in this document. All regulatory documents are available on the CNSC website.

### 1.5 CNSC contact information

The applicant or licensee should engage with CNSC staff early in the planning process (before submission of a licence application) to identify the applicable regulatory documents and confirm an understanding of the licensing process.

To contact the CNSC:

- Tel.: 613-995-5894 or 1-800-668-5284 (in Canada only)
- Fax: 613-995-5086
- Email: cnsc.info.ccsn@canada.ca

# 2. The CNSC's Environmental Protection Principles

Protecting the environment is part of the CNSC's mandate. The CNSC requires the environmental effects of all facilities or activities to be evaluated and considered when licensing decisions are made (see figure 1). For each licensing decision, the CNSC (the Commission or a Designated Officer) must be satisfied that the applicant or licensee will make adequate provision for the protection of the environment and the health and safety of persons before a licence can be granted.

## 2.1 The CNSC's guiding principles for protection of the environment

The CNSC regulates nuclear facilities and activities in Canada to protect the environment and the health and safety of persons in a manner that is consistent with Canadian environmental policies, acts and regulations and with Canada's international obligations.

For each facility or activity that has direct interactions with the environment, the CNSC must determine that the licensee or applicant has made adequate provision for the protection of the environment. The applicant or licensee's licence application shall demonstrate (through performance assessments, monitoring or other assessments) that their environmental protection measures:

- are commensurate with the level of risk associated with the activity
- recognize that uncertainty exists in science and account for this uncertainty:
    - by keeping all releases to the environment as low as reasonably achievable (ALARA), social and economic factors being taken into account for nuclear substances [8]
    - through the application of the best available technology and techniques economically achievable (BATEA) for hazardous substances
- respect the precautionary principle, the "polluter pays" principle, and the concepts of pollution prevention, sustainable development and adaptive management
- are assessed against performance indicators and targets that are based on sound science

The following sections of this regulatory document provide information on how to meet these principles. The CNSC assesses proposed alternative approaches and takes into account the views and proposals of the licensee concerning their individual situations.

## 2.2 The CNSC's environmental protection framework

The CNSC's environmental protection safety and control area (SCA) covers measures that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities.

The applicant's or licensee's environmental protection measures should address all aspects of the CNSC's environmental protection SCA that are relevant to the facility or activity. The scope and complexity within each measure should be commensurate with the nature and scale of the interactions with the environment that may result from the facility or activity.

**Note:** The CNSC uses the term "environmental protection measures". The elements in these measures may be referenced by applicants and licensees in their "environmental protection programs". Applicants and licensees are not required to update their management system or other documents to reflect the term "environmental protection measures", but they must meet the requirements listed in this document.

**Figure 1: Ensuring adequate provision for protection of the environment**

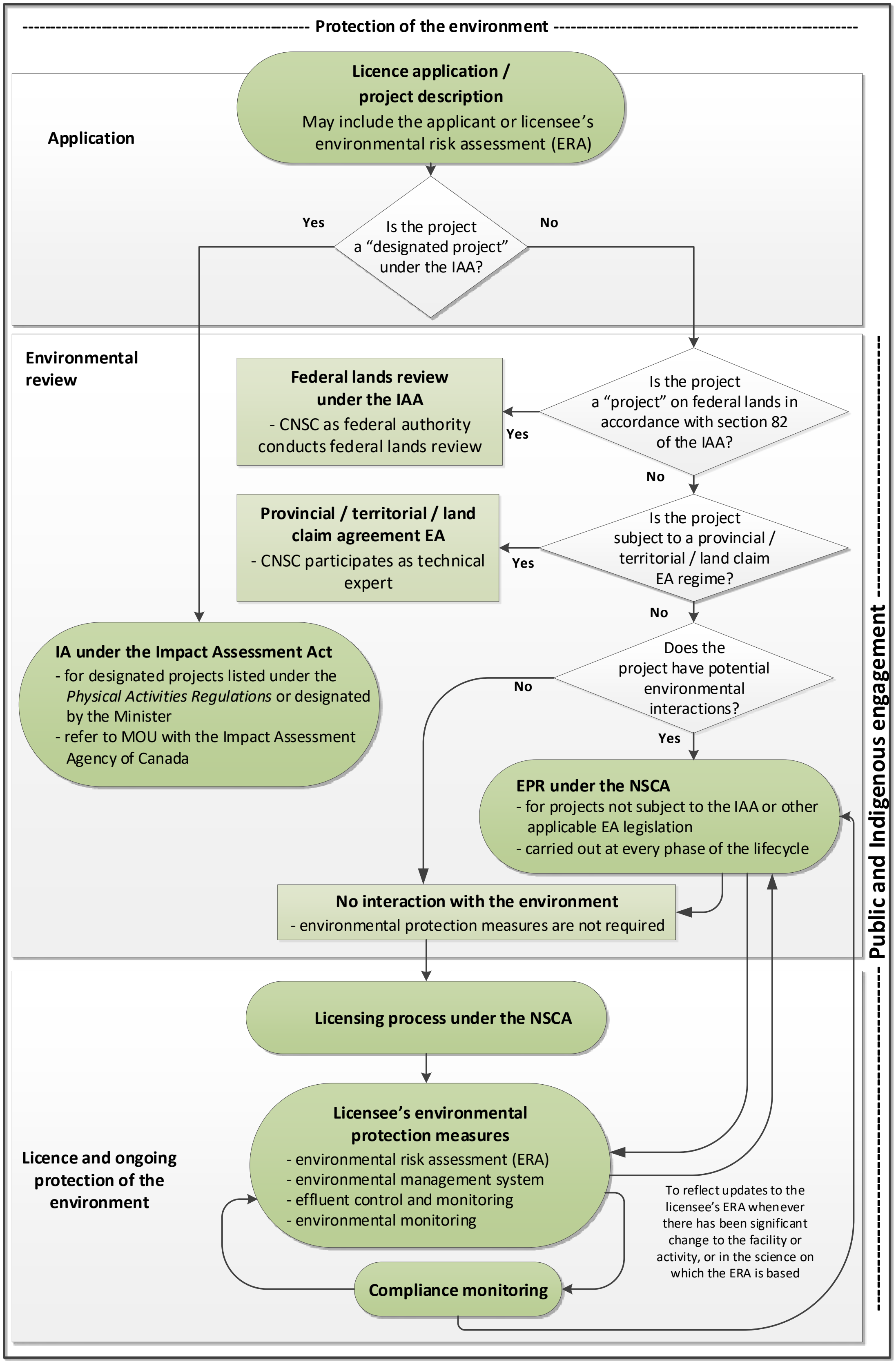
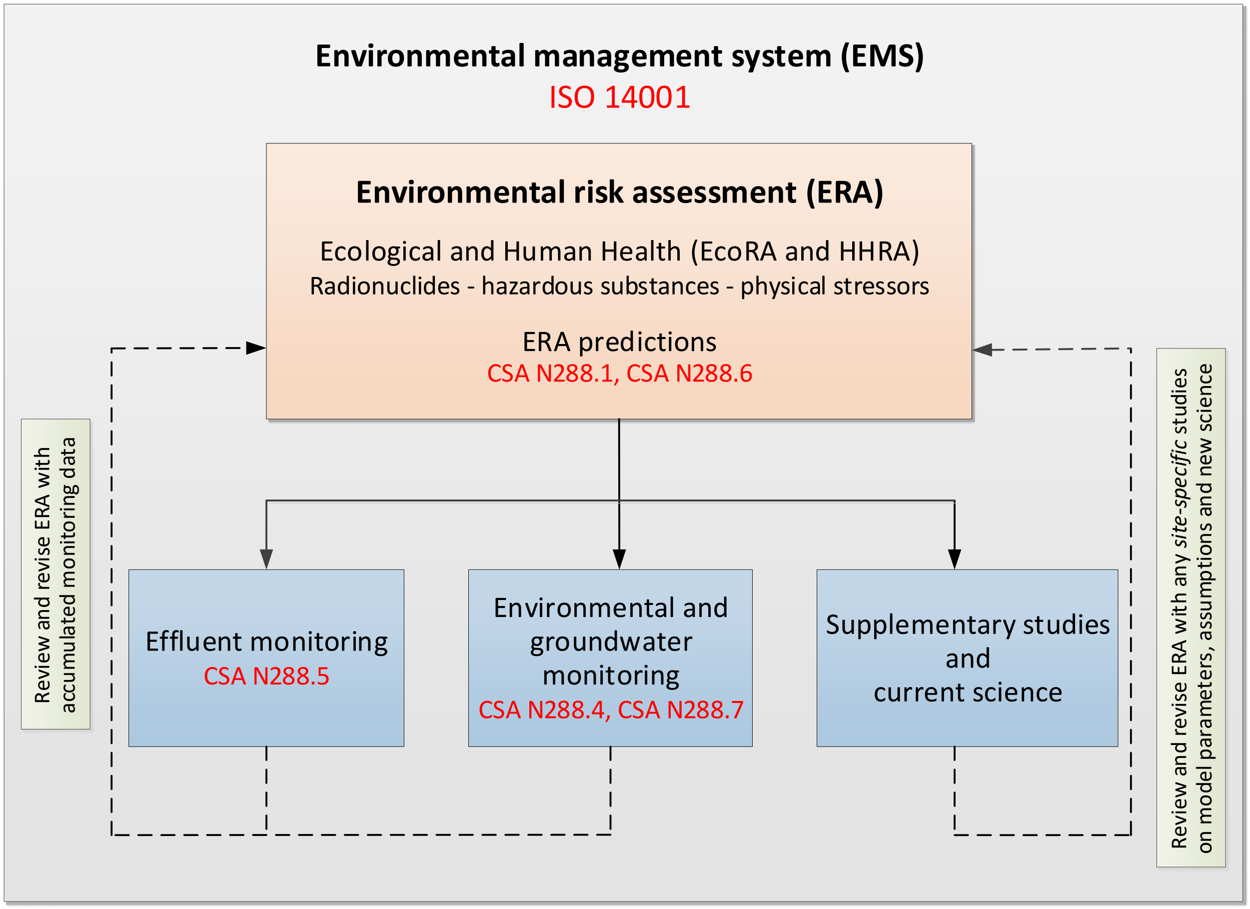


Figure 2 shows the cyclical nature of an ERA and how the ERA links to the effluent monitoring and environmental monitoring measures, illustrating how the ERA and the monitoring measures inform each other.

**Figure 2: Interrelationships between the ERA and monitoring**




The CNSC's regulatory framework for environmental protection:

- respects other federal and provincial environmental legislation
- applies the following standards in a graded approach, commensurate with risk:
  - CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [4]
  - CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [5]
  - CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6] (and, for further information on human exposure modelling, see CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [3])

- CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [7]
- CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* [1, 2]

These CSA standards apply to Class I nuclear facilities and uranium mines and mills. The CSA standards ensure that the risks associated with releases to the environment are continually assessed and mitigated; that releases are controlled and monitored; and that the environment is monitored. See section 4 for additional information on the application and implementation of these CSA standards, as well as other elements of environmental protection (for example, an environmental management system (EMS)).

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, the CNSC reviews every licence application to verify that there are no significant interactions with the environment (for example, for most Class II facilities, such as hospitals and universities, and for the use and transport of nuclear substances and radiation devices, there is no interaction with the environment). If the CNSC's review of the application determines that the facility or activity has potential interactions with the environment (such as planned releases of radioactive or hazardous substances to the environment) and that additional consideration of environmental protection measures is warranted, the applicant or licensee applies the information in section 4 to their environmental protection measures in a graded approach, commensurate with risk.

The CNSC also regulates many facilities and activities that do not have any interactions with the environment (that is, the facility or activity has no direct releases to the environment). A licence application that describes the nature of the proposed licensed activities is considered sufficient for ensuring protection of the environment, provided that CNSC staff conclude the facility or activities do not interact with the environment. In this case, the remaining information in this document does not apply to such facilities or activities.

Early engagement with CNSC staff is encouraged for facilities or activities with potential interactions with the environment. CNSC staff can provide facility- or activity-specific guidance to assist applicants and licensees.

### 2.3 Other jurisdictions and federal departments

The CNSC cooperates with other jurisdictions and federal departments to protect the environment. Where appropriate, the CNSC may enter into formal arrangements to increase the effectiveness of environmental protection. For example, the CNSC holds memoranda of understanding (MOUs) with other federal departments (such as Fisheries and Oceans Canada, Environment and Climate Change Canada). A complete list of MOUs is available on the CNSC's website.

When a proposed facility or activity must also comply with provincial or territorial legislation, the CNSC collaborates and coordinates the environmental protection processes where possible to increase efficiency and reduce duplication.

### 2.4 Public and Indigenous engagement

Participation opportunities for the public and for Indigenous groups are an important component of the CNSC's environmental reviews and licensing processes. The CNSC determines the appropriate level of participation opportunities on a case-by-case basis. The criteria include:

- interests of the public and Indigenous groups
- the complexity of the facility or activity and its potential interactions with the environment and the public
- additional factors such as other jurisdictional mandates or type of decision

For further information on the CNSC's expectations of licensees for public and Indigenous engagement, refer to:

- REGDOC-3.2.1, *Public Information and Disclosure* [9]
- REGDOC-3.2.2, *Indigenous Engagement* [10]

# 3. Environmental Reviews

The CNSC requires that the environmental effects of all nuclear facilities or activities be considered and evaluated when licensing decisions are made. All licence applications that demonstrate potential interactions with the environment are subject to an environmental review commensurate with the scale and complexity of the environmental risks associated with the facility or activity.

Early in the licensing process, CNSC staff determine which type of environmental review applies by considering the information provided by the applicant or licensee in their initial submission and supporting documentation. The information below outlines the different types of environmental reviews that may be applicable under the CNSC's current regulatory framework.

The CNSC ensures that the public has an opportunity to participate in the environmental review, and Indigenous consultation and engagement activities are integrated into the review process, to the extent possible.

## 3.1 Impact assessments under the *Impact Assessment Act*

Impact assessments are conducted on projects identified as having the greatest potential for adverse environmental effects in areas of federal jurisdiction, either listed as a "designated project" in the *Physical Activities Regulations* or as designated by the Minister of Environment. The scope of impact assessments subject to the *Impact Assessment Act* (IAA) includes the environmental, health, social and economic effects – both positive and negative – of a proposed project.

The Impact Assessment Agency of Canada (IAAC) leads the conduct of impact assessments for all designated projects subject to this legislation and works in collaboration with the CNSC to review projects that are also subject to regulation under the NSCA. Nuclear projects to be assessed under the IAA are subject to an integrated impact assessment that is carried out by a review panel. An integrated impact assessment means having a single assessment process with the shared objective that the requirements of both the IAA and the NSCA are discharged as "one project, one assessment".

A memorandum of understanding (MOU) established between the CNSC and the IAAC outlines the roles and responsibilities of each organization and helps guide collaboration into conducting integrated impact assessments under the IAA. The MOU confirms each organization's commitment to ensuring that the principle of "one project, one assessment" is followed in reviewing designated projects regulated by the CNSC, and that any reviews are conducted in an efficient and effective manner, without unnecessary delays or duplication of effort.

For more information, see:

- Impact Assessment Agency of Canada
- *Impact Assessment Act*
- MOU between the CNSC and the Impact Assessment Agency of Canada

## 3.2 Federal lands reviews under the *Impact Assessment Act*

Projects not listed in the *Physical Activities Regulations*, but proposed to be carried out on federal lands and requiring a decision by the CNSC as a federal authority, are subject to federal lands reviews under the IAA.

Upon receipt of a licence application for proposed activities to be carried out on federal lands, CNSC staff review the application and make a determination whether the proposal is subject to a federal lands review under the IAA. If a federal lands review is required, CNSC staff post a notice of this determination on the Canadian Impact Assessment Registry website, review the proposal according to the factors provided in section 84 of the IAA, and provide their recommendation to the Commission. The Commission is responsible to make the decision in determining whether the completion of the proposed project on federal lands is likely to cause significant adverse environmental effects.

The *Designated Classes of Projects Order* describes the classes of projects on federal lands that are designated by the Minister of Environment as causing only insignificant adverse environmental effects and that are, therefore, exempt from the federal lands requirements of the IAA.

The IAAC is developing further guidance and materials on federal lands reviews in collaboration with federal authorities, including the CNSC.

### 3.3 Ongoing environmental assessments under CEAA 2012

Projects with environmental assessments (EA) already initiated under the *Canadian Environmental Assessment Act (2012)* (CEAA 2012) and led by the CNSC will continue under their current processes as per the transition provision (section 182) of the IAA.

An EA under CEAA 2012 is carried out early in the licensing process (at the beginning of the project's lifecycle) and serves as a planning tool. The process for an EA under CEAA 2012 is described in appendix A.

The CNSC has in place *Generic Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012*. This document informs proponents of the information requirements for the preparation of an environmental impact statement (EIS) for a project that requires an EA under CEAA 2012. An EIS is a report written by a proponent that presents the technical studies and findings of an EA.

### 3.4 Environmental assessments under provincial regimes and land claim agreements

Some proposed nuclear projects may be subject to provincial EA legislation but not subject to the IAA. Also, in certain parts of Canada (for example, Yukon, Northwest Territories, Nunavut, parts of Quebec and parts of Newfoundland and Labrador), EA processes established under land claim agreements apply, and the IAA does not. In both cases, the CNSC acts as a technical advisor and is an active participant at all stages of the EA process; however, the CNSC has no role in making the EA decision. The Commission retains decision-making authority on licensing matters, and uses the information gathered in the EA process to inform its licensing decision under the NSCA. When multiple jurisdictions are involved, these processes are harmonized as much as possible to reduce duplication and promote efficiency.

### 3.5 Environmental protection reviews under the NSCA

The CNSC conducts environmental protection reviews (EPRs) for all licence applications with potential environmental interactions in accordance with its mandate under the NSCA to ensure the protection of the environment and the health of persons. An EPR is a science-based environmental technical assessment by CNSC staff as set out in the NSCA. Where there are potential environmental interactions, an EPR under the NSCA is conducted for projects not subject to the IAA or other applicable EA legislation (described above).

An EPR describes the outcome of CNSC staff's review of licensing and environmental compliance activities conducted under the NSCA. This review serves to assess whether the applicant or licensee will, in carrying on a licensed activity, make adequate provision for the protection of the environment and health of persons. This assessment is commensurate with the scale and complexity of the environmental risks associated with the nuclear facility or activity.

An EPR under the NSCA is a component of the CNSC licensing and compliance verification process. It is carried out as part of the CNSC's review of all licence applications of facilities and activities that have potential interactions with the environment. CNSC staff assess the environmental and health effects of nuclear facilities and activities at every phase of the lifecycle or duration. At each phase (that is, for each licence application), CNSC staff consider all future phases of the lifecycle, taking into consideration all available information. As with all other safety and control areas (SCAs), an EPR under the NSCA is a process of ongoing verification related to the environmental protection SCA.

An EPR under the NSCA is primarily based on information that the applicant or licensee is required to submit to the CNSC through the established licensing process, such as the licence application and its supporting documentation, and information on environmental protection measures. An EPR under the NSCA is also based on compliance and technical assessment activities completed by CNSC staff (for example, reviews of annual environmental monitoring reports and environmental risk assessments). An EPR under the NSCA may also be supported by independent verification activities, such as the CNSC's independent environmental monitoring program (IEMP), as well as relevant regional health studies, monitoring programs and Indigenous knowledge studies.

Within a licensing process, the results of the EPR can be presented in a supporting report to accompany staff's licensing report to the Commission, or it can be reported directly in that staff licensing report (known as a Commission Member Document (CMD)). Outside of a licensing process, the results of the EPR can be presented in a stand-alone report that is posted on the CNSC website. An EPR report is intended for two key audiences – members of the public and Indigenous groups, and within the context of a licensing process, the Commission. The EPR report is prepared with the following objectives:

- publishing a clear report or section that provides transparency to the public and Indigenous groups on CNSC staff's technical assessment
- providing evidence-based information to inform the Commission's licensing decision (note that no decision is made on the EPR report itself)

# 4. Environmental Protection Measures

The necessary measures for environmental protection are determined on a facility- or activity-specific basis. **Note:** Not every facility or activity is required to have every environmental protection measure described in this section. The applicant or licensee may address certain requirements by demonstrating that a particular measure is not necessary or does not apply to that facility or activity. A licence application that describes the nature of the proposed licensed activities is considered sufficient for ensuring protection of the environment, provided CNSC staff conclude that the facility or activities do not interact with the environment.

## 4.1 Environmental risk assessment

An ERA is a systematic process that identifies, quantifies and characterizes the risk posed by contaminants (nuclear or hazardous substances) and physical stressors in the environment. It is a practice or methodology that provides science-based information to support decision-making and to prioritize the implementation of mitigation measures.

The applicant or licensee's ERA informs an environmental review. The ERA:

- identifies facility- or activity-specific characteristics and site-specific environmental characteristics
- identifies interactions between those characteristics
- assesses the likelihood and significance of these interactions and the resulting potential effects on the environment and the public

In conjunction with regulatory monitoring requirements, the ERA and its associated performance predictions serve as the basis for control and monitoring of releases, environmental monitoring, and any supplementary studies. All of these measures are interrelated and managed within the environmental management system (EMS). For additional information on an EMS, see section 4.6.

The initial ERA for a new facility or activity is based on best estimates of the facility- or activity-specific characteristics. These characteristics are combined with sufficient environmental characterization (such as baseline) to support the assessment of potential interactions with the environment and the potential for associated environmental effects.

The ERA uses the facility- or activity-specific estimates of physical disturbances and chemical releases (both nuclear and hazardous substances) to predict:

- the source terms of gaseous and liquid discharges
- the transport of nuclear and hazardous substances through the environment
- public exposure and dose
- exposure and effects on representative biota
- changes in habitat and effects on species that rely on that habitat

These predictions establish the basis for the CNSC's compliance program for that facility or activity.

The applicant or licensee incorporates the results of the initial ERA into their EMS, including the effluent and environmental monitoring measures. The predictions for physical disturbances and releases, and the associated environmental behavior and potential effects, are measured and tested using site-specific monitoring.

The initial ERA submitted for licensing purposes for a new facility or activity is primarily predictive as it involves assessing the potential effects of a hypothetical facility or activity. As a facility or activity moves through its lifecycle, the ERA is periodically reviewed and revised (see section 4.1.2) using the accumulated site knowledge derived from operational experience, monitoring, special investigations, incorporation of advances in scientific knowledge and, where available, Indigenous traditional knowledge.

These “living” ERAs, which are informed by real data from monitoring programs (emissions, effluents, environmental) and current science, are used to assess if the original environmental impact predictions are exceeded or may be exceeded in the future. In this manner, the initial ERA evolves through the life of the facility or activity, remaining current and becoming an increasingly more powerful site-specific tool.

**Requirements**

For Class I facilities and uranium mines and mills, the licensee shall conduct an ERA in accordance with CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6].

The ERA shall be completed in a systematic, scientifically defensible manner that identifies, quantifies and characterizes the risk posed by releases of nuclear and hazardous substances and physical disturbances (stressors) on representative human and non-human biota. The licensee shall ensure that the ERA includes, as applicable to the facility or activity, both an ecological risk assessment (EcoRA) for the environment and a human health risk assessment (HHRA) for members of the public.

**Guidance**

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, the licensee should use the ERA process described in CSA N288.6 [6] in a graded approach as appropriate to their circumstances. For many of these facilities, a simple screening assessment (as described in CSA N288.6) is adequate. **Note:** Although CSA N288.6 was developed for Class I facilities and uranium mines and mills, the methodology and general principles can be applied to other facilities and activities regulated by the CNSC.

Early engagement with the CNSC is encouraged for facilities and activities that are not specifically addressed by CSA N288.6 [6]. The CNSC can provide facility- or activity-specific guidance to assist licensees.

### 4.1.1 Complexity of the environmental risk assessment

**Requirements**

The applicant or licensee shall identify facility characteristics and activities that may interact with the environment during the relevant phase of the facility or activity’s lifecycle (for example, site preparation, construction, operation and decommissioning).

This characterization shall include descriptions of facility- or activity-specific performance with respect to:

- physical disturbances (for example, footprint for surface structures, below-grade structures, diversions or flow alterations of surface or groundwater)
- emissions released to the environment
- effluents released to the environment

The facility or activity characterization shall be of sufficient detail to assess the potential for effects arising from the proposed maximum quantities and anticipated volumes and flow rates for releases associated with the facility or activity.

The applicant or licensee shall present a characterization of the baseline environment (that is, the environment before any development of the facility or activity has started) for any portion of the environment where the site characterization indicates potential for interaction.

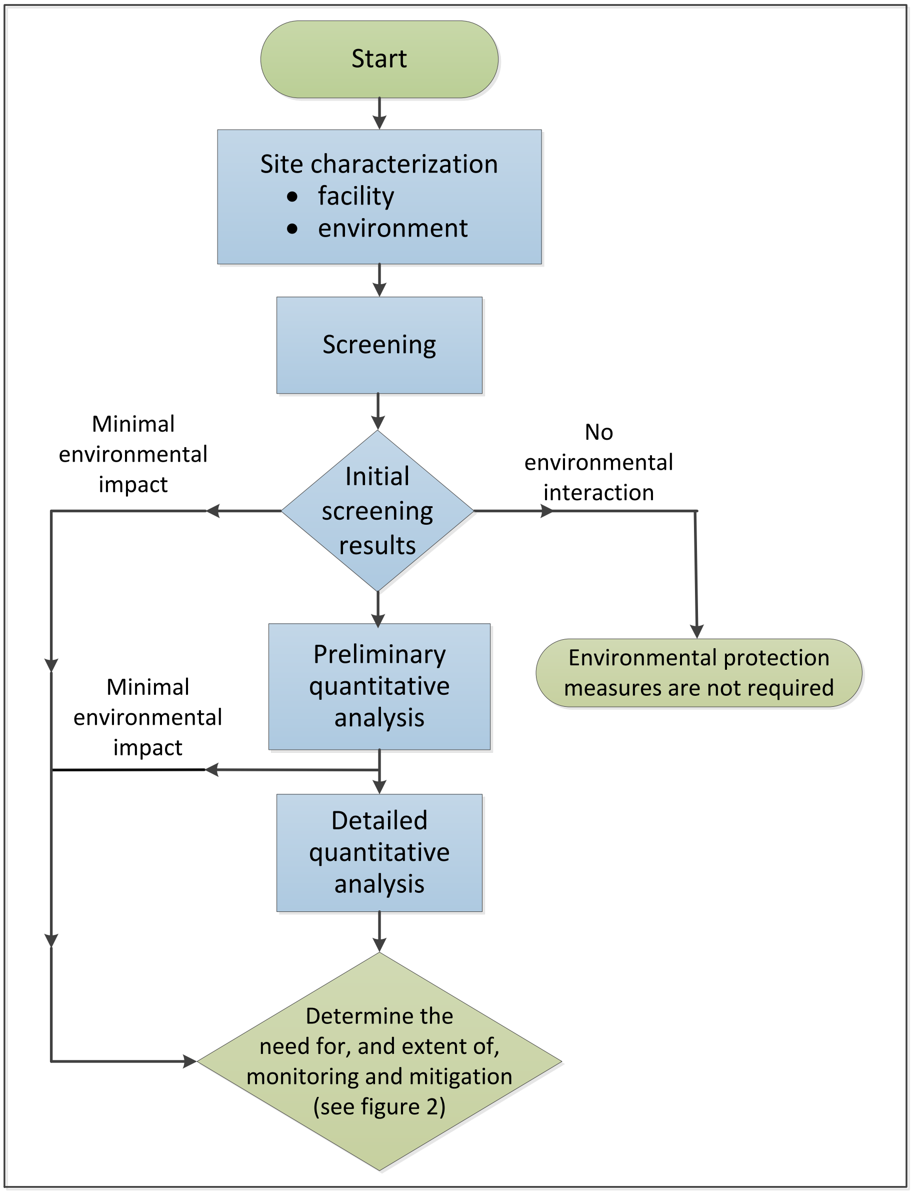
The applicant or licensee shall use the facility- or activity-specific characterization and the local environmental baseline characterization to identify the potential interactions between the facility or activity and the surrounding environment. Note that these identified interactions will become the focus of further stages within the ERA.

The applicant or licensee shall use the potential environmental interactions to support their justification as to the level of complexity for the ERA in accordance with CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6].

**Guidance**

ERAs may be completed in a tiered manner reflecting the complexity of the disturbances and releases associated with the facility or activity and with the complexity or sensitivity of the surrounding environment. This tiered approach allows the rapid completion of simple screening risk assessments for facilities or activities with limited interaction with the receiving environment or the public. However, it also allows for progressively more complex quantitative assessments for facilities or activities when warranted by the severity and the spatial and temporal extent of potential effects (see figure 3).

**Figure 3: Tiered options for environmental risk assessments (simplified from CSA N288.6 [6])**




### Reviewing and revising the environmental risk assessment

Where an ERA exists, the licensee shall review and revise the ERA in accordance with CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6]; taking into consideration whether there has been:

- a significant change in the facility or activity that could alter the nature (type or magnitude) of the interactions with the environment (such as modification, expansion or refurbishment of the facility) within the ERA predictions
- any transition to a new phase in the lifecycle (such as a transition to licence to operate, decommission or abandon) where the application for the new licensing phase includes any interactions with the environment that were not previously captured in the ERA

The ERA shall be revised with site knowledge derived from:

- operational experience (for example, performance of mitigation measures such as effluent control systems)
- results of monitoring
- supplementary studies
- incorporation of recent developments in scientific knowledge

The revised ERA shall be used to assess the environmental performance of the facility or activity. The ERA shall also be used to predict continued future performance and associated environmental effects of the facility or activity.

If the revised ERA indicates that the nature, extent and significance of environmental effects are greater than predicted, the licensee shall:

- evaluate the environmental effects in terms of risk
- investigate mitigation measures as necessary
- identify any changes needed to the effluent and emissions monitoring measures resulting from any mitigation measures

### 4.2 Effluent and emissions control and monitoring

Controls on environmental releases are established to provide protection to the environment and to respect the principles of sustainable development and pollution prevention.

**Requirements**

The preventive and control measures shall be based on the potential risks to the environment that the facility or activity may pose.

The effluent and emissions control and monitoring shall:

- identify and document the infrastructure and activities (such as pipelines or storage) with the potential for significant accidental release to the environment of nuclear and hazardous substances and the barriers (such as primary and secondary containment, and liners) to prevent releases
- identify and document the points of release to the environment and the corresponding preventive control measures and equipment necessary to regulate and control the release of these nuclear and hazardous substances in the authorized manner
- estimate or measure, document and report the quality and quantity of releases to the environment
- verify the nature and quantity of releases against compliance criteria (such as authorized release limits), performance indicators (such as action levels) and the predictions of releases used as input parameters for the site-specific ERA
- evaluate mitigation measures to further control releases when the monitoring results identify deviations from the expected performance

### 4.2.1 Control of environmental releases

The effluent and emissions preventive and control measures are established on the basis of best industry practice, incorporating the application of BATEA, ALARA, process optimization, continuous improvement and the results of an ERA.

#### Guidance

A licensee's effluent and emissions control should address the following:

- BATEA assessment of pollution prevention and control technologies:
    - design and maintenance of engineered barriers between key waste streams and sources of nuclear and hazardous substances (for example, double-lined piping, secondary containment and sumps, waste rock pads and pond liners), with maintenance programs to ensure the integrity of these barriers
    - wastewater treatment systems (for example, precipitation and settling systems, ion-exchange columns, evaporators and membrane separation systems such as reverse osmosis) that minimize the contaminants released to surface waters from liquid effluent streams with maintenance programs to ensure the availability and performance of these systems
    - air pollution control technology systems (for example, HEPA filters, baghouse filters, wet/dry scrubbers, absorption/adsorption systems) that minimize air pollutants released to the environment via air emissions through stacks or as fugitive emissions from the facilities with maintenance programs to ensure the availability and performance of these systems

- BATEA assessment of techniques:
    - a focus on BATEA optimization; that is, the application of pollution prevention performance standards, design objectives and best practices to minimize or eliminate the release of nuclear or hazardous substances to the environment:
        - both operational and managerial practices that can influence the quality of releases to the environment (for example, upstream and downstream process optimization, adequate training of staff and effective overall management of the operation)
        - application and continual review of action levels as indicators of a potential loss of control of the site-specific environmental protection measures, to ensure the process is operating within its approved design specification and normal operating conditions
    - ALARA assessments (minimization-focused); that is, the application of radiation protection principles to effectively minimize human and environmental exposure to nuclear substances

- processes and procedures to ensure effective management of the effluent and emission control systems within an EMS (for example, maintenance of treatment systems, timely replacement of filters, calibration of monitoring equipment and procedures detailing appropriate responses to action level exceedances)

After the facility or activity is licensed, BATEA assessments of pollution prevention and control technologies for releases are necessary only where effects exceed, or may exceed, those identified in the ERA and adaptive management involving the modification or reduction of releases of specific nuclear or hazardous substances is indicated.

Assessments of techniques and the processes and procedures for ensuring effective effluent and emission control programs should be reviewed as part of the EMS requirement for continuous improvement.

### 4.2.2 Monitoring of releases to the environment

In conjunction with specific regulatory monitoring requirements, the ERA provides the technical foundation and structure for identifying the need for, and details of, effluent and emissions monitoring. The site-specific effluent and emissions monitoring is designed using the characterization of the locations, the anticipated volume, chemistry and flow rate of releases, and the proposed maximum quantities and concentrations of nuclear and hazardous substances (including their physical, chemical and radiological characteristics).

For facilities and activities with no significant measurable releases to the environment, effluent and emissions monitoring is not required. In such cases, the licensee should demonstrate (through engineering or scientific methods) that appropriate barriers and practices are in place, and are monitored and maintained to prevent releases to the environment.

For facilities and activities where the releases are of low risk or quantities are too low or too difficult to measure, monitoring is not required. The licensee may estimate emissions based on site-specific process chemistry and engineering principles.

**Requirements**

For Class I nuclear facilities and uranium mines and mills, the effluent and emissions monitoring shall address the requirements in CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* [5].

The effluent and emissions monitoring shall be designed and implemented:

- to demonstrate compliance with authorized release limits
- to respond to any action levels or other performance indicators, internal objectives or targets set on releases for effluent control
- to confirm the adequacy of controls on releases from the source
- to provide supportive data required to assess the level of risk on human health and safety and potential effects on the environment as determined by the ERA or regulation

In addition, the licensee shall ensure that the effluent and emissions monitoring:

- demonstrates that controlled releases to water frequented by fish are not acutely lethal
- supports and assesses the adequacy of any adaptive management measures

For Class I nuclear facilities and uranium mines and mills, the applicant or licensee shall assess and document the need for action levels. The applicant or licensee shall engage with CNSC staff on the requirements for establishing and implementing action levels for releases to the environment.

For facilities and activities subject to the *Uranium Mines and Mills Regulations*, the licensee shall develop a facility-specific code of practice that includes, where appropriate, action levels for releases of nuclear and hazardous substances to the environment.

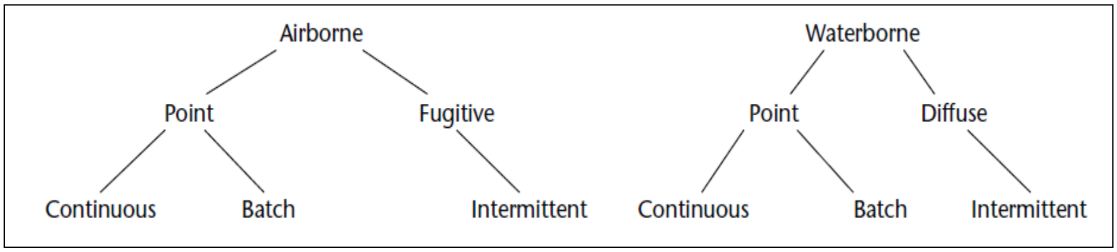
The applicant or licensee shall assess for acute lethality any effluents that are released to water frequented by fish and that contain hazardous substances that could be considered deleterious under the *Fisheries Act*. Meeting existing federal or provincial requirements for toxicity testing shall be considered as satisfying this requirement. Otherwise, the method(s), frequency of testing and actions to be implemented as a result of a test failure shall be developed during licensing and shall be informed by existing standard practices applied to other industrial sectors.

**Guidance**

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, the licensee should use the process described in CSA N288.5 [5] in a graded approach as appropriate to their circumstances. **Note:** Although CSA N288.5 [5] was developed for Class I facilities and uranium mines and mills, the methodology and general principles can be applied to other facilities and activities regulated by the CNSC.

The measurement and evaluation of environmental releases are key to verifying the efficacy of preventive and control measures. The overall process should include feedback mechanisms (both periodic and continual) to assess and implement actions to achieve performance targets. Monitoring should be conducted on a temporal scale relevant to the nature and complexity of the release (such as intermittent, continuous or batch), and should use a standard sampling methodology (or a non-standard methodology approved by CNSC staff) that is appropriate for the type of release (see figure 4).

**Figure 4: Types of releases that may be associated with a nuclear facility or activity that can influence sampling methodology and frequency (CSA N288.5 [5])**




Effluent and emission monitoring addresses both the nature and quantities of releases of nuclear and hazardous substances (including wastes). Performance indicators for operational control, such as action levels (where required), should be established to serve as early indicators of potential loss of control or deviation from expected quality or quantity of releases. Performance indicators should be designed to initiate investigation of abnormal situations and, if necessary, result in corrective measures. Measurement and evaluation should be coordinated to permit timely corrective action.

For facilities and activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, licensees should consider incorporating the development of similar environmental performance indicators, such as action levels, in their effluent and emission monitoring.

### 4.3 Environmental monitoring

Environmental monitoring consists of a risk-informed set of integrated and documented activities to sample, measure, analyze, interpret and report one or all of:

- the concentration of nuclear and hazardous substances in environmental media to assess one or both of:
    - the exposure of receptors to those substances
    - the potential effects on human health, safety and the environment
- the intensity of physical stressors and/or their potential effect on human health and the environment
- the physical, chemical and biological parameters of the environment normally considered in the design of the environmental monitoring necessary to support the interpretation of the results; some examples are supportive data for transport (such as wind velocity) or toxicity assessment (such as organic carbon or hardness) or measurements at reference stations (where incorporated in the monitoring)

**Requirements**

For Class I nuclear facilities and uranium mines and mills, the licensee shall ensure that the environmental monitoring addresses CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [4].

The licensee shall use applicable regulatory monitoring requirements and the ERA to identify the need for and complexity of the environmental monitoring. The licensee shall provide justification to support whether ERA-derived environmental monitoring is required. In the justification, the licensee shall address:

- characteristics of the licensed facility or activity
- characteristics of the surrounding environment
- nuclear and hazardous substances and physical stressors
- receptors that can be affected
- spatial extent of potential exposures
- severity, probability, and spatial and temporal extent of any potential biological effects

The licensee shall ensure that the environmental monitoring measures, plans and data provide sufficient information to assess exposure or potential effects on human health and the environment due to releases or physical perturbations resulting from the facility or activity.

The licensee shall ensure that the results of the environmental monitoring are used to confirm that the effects on the environment are within the licensing predictions and adequate provisions are in place to protect the environment.

**Guidance**

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, the licensee should use the process described in CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [4] in a graded approach, as appropriate to their circumstances. **Note:** Although CSA N288.4 [4] was developed for Class I facilities and uranium mines and mills, the methodology and general principles can be applied to other facilities and activities regulated by the CNSC.

Monitoring for the presence of stressors (physical stressors or nuclear and hazardous substances) in the environment is sometimes more informative than monitoring the release at the source. The practice of monitoring ambient air quality is common for atmospheric emissions, especially fugitive or diffuse emissions (such as radon from ore pads).

The results of the environmental monitoring should:

- be used to validate the predictions related to transport of nuclear and hazardous substances through the environment and the magnitude and extent of any effects predicted in the site-specific ERA to determine if the facility or activity continues to operate within its predicted environmental performance
- be periodically reviewed (in conjunction with the periodic revision and update of the ERA) as to its adequacy for testing the environmental predictions
- be modified as necessary to support and assess the adequacy of any adaptive management measures

Environmental monitoring may involve three basic types of monitoring objectives (see CSA N288.4 [4]):

- pathways monitoring
- biological effects monitoring
- supplementary studies

Pathways monitoring is the most common form of monitoring. It involves sampling and analyzing abiotic and biotic media that lie along the pathways connecting a source (that is, a release from a facility or activity) to a receptor (such as non-human biota or the public) to determine the concentration or level of a contaminant or physical stressor in that medium. This data, combined with environmental transfer parameters that describe the movement of contaminants or physical stressors through the environment, may be used to assess the exposure of the receptor. Some examples of the most common sampling media are:

- components of air, water, soil and sediment
- vegetation consumed by herbivorous receptors
- tissues of prey animals consumed by carnivorous receptors
- foodstuffs consumed by humans

Such environmental monitoring is only necessary for those facilities or activities where the releases have the potential to be measurable within the environment. The monitoring details, with respect to the analytes being measured (physical stressors, nuclear and hazardous substances) and the media to be sampled (air, water, and so on), are dependent on the scale and complexity of the risks associated with the facility or activity.

Biological effects monitoring is used to detect actual measurable biological responses of organisms to exposure to the stressor. For regulatory purposes, responses at the individual, population or community level of biological organization are considered to be more relevant as indicators of ecological effects. Some examples of biological effects monitoring that may be relevant depending on the risk posed by the facility or activity include:

- toxicity testing using exposure media (such as effluent receiving waters or exposed sediments)
- fish health and population indicators (such as gonadal somatic index and egg production)
- monitoring of plant or benthic invertebrate community composition (benthic invertebrates or plants)

Supplementary studies may be conducted to achieve specific well-defined objectives such as:

- providing the data required to reduce uncertainty and confounding factors in the ERA
- increasing knowledge of the behavior of contaminants and physical stressors in the environment (for example, refining environmental transfer parameters)
- investigating monitoring results that indicate potential deviation from the transport or effects predictions in the ERA or the licensing basis

## 4.4 Public dose

Radiological releases to the environment are controlled and monitored by the effluent and emissions control and monitoring and the environmental monitoring. Results of these monitoring and control activities are used to determine dose to members of the public.

A human health risk assessment (HHRA) is completed as a sub-element of an ERA for both nuclear and hazardous substances.

### Requirements

The *Radiation Protection Regulations* define prescribed dose limits for workers and members of the public, and require doses to be monitored by direct measurement or by estimation of the quantities and concentrations of any nuclear substance released as a result of a licensed activity.

The *Radiation Protection Regulations* require licensees to implement a radiation protection program for protection of the public. The focus for radiation protection within the environmental protection framework is on radiological protection of the environment and the public.

### Guidance

The development of a radiation protection program should be based on a sound policy, strategy and method for radiation protection and the achievement of ALARA, while taking into consideration the pathways and critical groups identified in the derived release limits (DRL) document (CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [3]).

The licensee should design the radiation protection program commensurate with the radiological hazards associated with the licensed activities, based on an ERA and including radiation exposure and dose assessments.

## 4.5 Groundwater protection and monitoring

Groundwater protection is a specialized element of the overall environmental protection measures. As groundwater flow and associated contaminant transport can be more difficult to detect and delineate than that of surface water, specific requirements and guidance are provided here.

Groundwater protection is an inter-related system of initiatives, processes and activities with the overall goal of protecting the quality and quantity of groundwater by minimizing interactions with the environment from activities associated with a nuclear facility, allowing for effective management of groundwater resources.

**Requirements**

For Class I nuclear facilities and uranium mines and mills, the licensee shall ensure that the need for and design of groundwater protection programs and associated monitoring address CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [7].

The applicant or licensee shall implement a groundwater protection program in a graded approach, appropriate to their circumstances, to:

- prevent or minimize releases of nuclear or hazardous substances to groundwater
- prevent or minimize the effects of physical stressors on groundwater end uses
- confirm that adequate measures are in place to stop, contain, control and monitor any releases and physical stressors that can occur under normal operation

**Guidance**

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, the applicant or licensee should implement a groundwater protection program and associated monitoring program in accordance with CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* [7] in a graded approach as appropriate to their circumstances. **Note:** Although CSA N288.7 [7] was developed for Class I facilities and uranium mines and mills, the methodology and general principles can be applied to other facilities and activities regulated by the CNSC.

Groundwater protection programs are developed on a site-specific basis and should consider the following elements:

- identification of sources of contaminants of concern
- investigation of releases under normal operation and source characterization
- site characterization
- assessment of groundwater end-use
- assessment of groundwater vulnerability
- development of a groundwater monitoring program
- risk management (as required)

### 4.6 Environmental management system

An environmental management system (EMS) refers to the management of an organization's environmental policies, measures and procedures in a comprehensive, systematic, planned and documented manner. It includes the organizational structure, planning and resources for developing, implementing and maintaining policy for environmental protection and for continuous improvement by:

- identifying and managing environmental risks associated with a facility or activity (see section 3 and section 4.1)
- the identification, implementation and maintenance of pollution control activities and technologies (see section 4.2.1)
- monitoring of releases (see section 4.2.2)
- monitoring of contaminants and for their potential effects in the environment (see section 4.3)

In addition, the EMS should address environmental emergency preparedness.

The EMS serves as the management tool for integrating all of the applicant or licensee's environmental protection measures in a documented, managed and auditable process by:

- identifying and managing non-compliances and corrective actions within the activities, through internal and external inspections and audits
- summarizing and reporting the performance of these activities, both internally (licensee's management structure) and externally (to the Commission and the public)
- training of the personnel involved in these activities
- ensuring the availability of resources (such as qualified personnel, organizational infrastructure, technology and financial resources)
- defining and delegating roles, responsibilities and authorities essential to effective environmental management

The EMS may be implemented within the licensee's integrated management system.

**Requirements**

For Class I nuclear facilities and uranium mines and mills, the licensee shall manage their environmental protection measures within an EMS that reflects the nature and complexity of their environmental protection measures.

The licensee shall:

- establish, implement and maintain an EMS that meets the requirements set by CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* (2004 edition or successor editions) [1, 2]
- ensure that the scope of the EMS is consistent with the definition of environment, environmental effects and pollution prevention provided in the glossary of this regulatory document
- conduct internal audits at planned intervals so that all elements of the EMS are audited on at least a five-year cycle
- conduct an annual management review

**Guidance**

For facilities or activities other than Class I nuclear facilities and uranium mines and mills, for which the CNSC has determined that there are direct interactions with the environment, the applicant or licensee should manage their environmental protection measures within an EMS that reflects the nature and complexity of their environmental protection measures.

In addition to the information provided in this regulatory document, the licensee should refer to the following documents:

- CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* (2004 edition or successor editions) [1, 2]
- CAN/CSA ISO 14004, *Environmental Management Systems – General Guidelines on Principles, Systems and Support Techniques* [11]

**Note:** The CNSC does not consider certification to CAN/CSA ISO 14001 by an authorized registrar or other independent third party as solely sufficient for demonstrating compliance with the requirements. The CNSC evaluates all activities in relation to the requirements of this regulatory document. The CNSC's compliance verification focuses on the effectiveness of the EMS rather than on the licensee's adherence to CAN/CSA ISO 14001 (2004 edition or successor editions) [1, 2].

During the design of an EMS, the ISO documents provide guidance and information that may be useful; however, the licensee should note that, as a federal agency, the CNSC has adopted certain key concepts in environmental protection from other federal statutes. Where applicable, the CNSC expects licensees to apply the more-demanding meanings from federal legislation in the scope of their EMS.

To avoid misinterpretation of these concepts, the licensee should review the following differences between key concepts in federal legislation and those in CAN/CSA ISO 14001 (2004 edition or successor editions) [1, 2] and consider them in the scope of their EMS:

- the CNSC's definitions of environment, environmental effect (i.e., impact) and pollution prevention (i.e., prevention of pollution) in this regulatory document are taken from federal legislation and are broader than the definitions of the related terms in CAN/CSA ISO 14001 (2004 edition or successor editions) [1, 2]
- in both the NSCA and the *Canadian Environmental Protection Act, 1999* (CEPA 1999), risk is a key concept in environmental protection that is not addressed in CAN/CSA ISO 14001 [1, 2]
- the licensee should use the ERA as one of the core sources to inform the significant environmental aspects and effects of the EMS
- CAN/CSA ISO 14001 [1, 2] provides only minimal guidance on the interpretation of adverse environmental effects

Pollution prevention is the key principle underlying the management of hazardous substances in Canada. Section 64 of CEPA 1999 defines the nature of toxic substances, explicitly defining unreasonable risk for certain scheduled substances. For other potentially hazardous substances that are not subject to legislation, unreasonable risk may be interpreted in terms of likely significant adverse effects. This concept is nearly equivalent to the CAN/CSA ISO 14001 [1, 2] concept of significant environmental effects. In the CNSC licensing process for Class I nuclear facilities and uranium mines and mills, the process for an EPR under the NSCA or an impact assessment under the *Impact Assessment Act* provides an initial framework for identifying and assessing the equivalent of ISO-significant environmental aspects in an appropriate context. This information can provide the initial foundation for the scope of the EMS.

For nuclear substances, the *Radiation Protection Regulations* require exposure and doses to persons to be managed according to the ALARA (as low as reasonably achievable) principle, while taking social and economic factors into account. G-129, *Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"* [8] provides additional information.

The *Radiation Protection Regulations* define risk for workers and the public through prescribed dose limits, and require doses to be monitored by direct measurement or by estimation of the quantities and concentrations of any nuclear substance released as a result of the licensed activity.

The EMS framework should cover the assessment of releases and potential effects, the measures to control releases of nuclear substances and hazardous substances into the environment, and the measures taken to prevent or mitigate potential effects.

The framework should be appropriate for the type of facility or activity and the licensing phase, and should be commensurate with overall regulatory requirements. In addition to the environmental protection measures described in detail earlier, the EMS should address environmental emergency preparedness.

### 4.6.1 Environmental emergency preparedness

The licensee should address environmental emergency preparedness and response in terms of:

- the proposed measures to prevent or mitigate the effects of accidental releases of nuclear and hazardous substances on the environment
- the proposed measures to ensure the availability and accessibility of environmental monitoring instrumentation during emergencies
- the inclusion of environmental monitoring instrumentation and equipment layouts in emergency plans

The licensee should address reporting requirements for potential or real emergency situations.

For additional guidance, refer to REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response* [12].

### 4.6.2 Other considerations

The licensee should describe elements of the EMS related to worker training or qualifications, and the environmental protection obligations of workers. The licensee should demonstrate how training programs will enable workers to meet their obligations with respect to environmental protection.

# Appendix A: Environmental Assessments Under CEAA 2012

**Note:** Projects with environmental assessments (EA) already initiated under the *Canadian Environmental Assessment Act (2012)* (CEAA 2012) and led by the CNSC will continue under their current processes, as per the transition provision (section 182) of the IAA. The following appendix is relevant to those ongoing projects and will remain in this regulatory document for reference purposes until those projects are completed.

The CNSC ensures that the environmental assessment (EA) requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) are met for designated projects (described in CEAA 2012) that are regulated under the *Nuclear Safety and Control Act* (NSCA).

An EA under CEAA 2012:

- predicts the environmental effects of a proposed designated project
- identifies mitigation measures
- assesses whether the proposed project is likely to cause significant adverse environmental effects, taking into account the identified mitigation measures
- ensures a follow-up program is developed to verify the accuracy of the EA predictions under CEAA 2012 and the effectiveness of any mitigation measures

An EA conducted under CEAA 2012 is a planning tool. It is carried out early in the licensing process (before any licence is granted) and considers the entire proposed lifecycle of a project. An EA under CEAA 2012 includes information prepared by the applicant and CNSC staff, as well as comments received from Indigenous groups and the public. After reviewing the EA, the Commission determines if the proposed project is likely to cause significant adverse environmental effects, taking into consideration the implementation of mitigation measures.

In accordance with paragraph 15(a) of CEAA 2012, the CNSC is the sole federal responsible authority (RA) for conducting an EA for designated projects regulated under the NSCA and described in the *Regulations Designating Physical Activities*, as follows:

> “31 The construction, operation and decommissioning of a new uranium mine or uranium mill on a site that is not within the licensed boundaries of an existing uranium mine or uranium mill.
>
> 32 The expansion of an existing uranium mine or uranium mill that would result in an increase in the area of mine operations of 50% or more.
>
> 33 The construction, operation and decommissioning of a new
>
> (a) facility for the processing, reprocessing or separation of an isotope of uranium, thorium, or plutonium, with a production capacity of 100 t/year or more;
>
> (b) facility for the manufacture of a product derived from uranium, thorium or plutonium, with a production capacity of 100 t/year or more; or
>
> (c) facility for the processing or use, in a quantity greater than $10^{15}$ Bq per calendar year, of nuclear substances with a half-life greater than one year, other than uranium, thorium or plutonium.
>
> 34 The expansion of an existing
>
> (a) facility for the processing, reprocessing or separation of an isotope of uranium, thorium or plutonium that would result in an increase in production capacity of 50% or more and a total production capacity of 100 t/year or more;

(b) facility for the manufacture of a product derived from uranium, thorium or plutonium that would result in an increase in production capacity of 50% or more and a total production capacity of 100 t/year or more; or

(c) facility for the processing or use, in a quantity greater than $10^{15}$ Bq per calendar year, of nuclear substances with a half-life greater than one year, other than uranium, thorium or plutonium, that would result in an increase in processing capacity of 50% or more.

35 The construction, operation and decommissioning of a new nuclear fission or fusion reactor.

36 The expansion of an existing nuclear fission or fusion reactor that would result in an increase in power output of 50% or more.

37 The construction and operation of a new

(a) facility for the storage of irradiated fuel or nuclear waste, on a site that is not within the licensed perimeter of an existing nuclear facility; or

(b) facility for the long-term management or disposal of irradiated fuel or nuclear waste.

38 The expansion of an existing facility for the long-term management or disposal of irradiated fuel or nuclear waste that would result in an increase in the area, at ground level, of the facility of 50% or more."

The Minister of Environment and Climate Change Canada may also designate a physical activity that is not prescribed by the *Regulations Designating Physical Activities* if the project may cause adverse environmental effects or if there are public concerns related to those effects.

For these designated projects:

- the CNSC must make an EA decision in accordance with section 52 of CEAA 2012 before a regulatory decision can be made under the NSCA to allow the project to proceed
- if the CNSC determines that the project is not likely to cause significant adverse environmental effects in accordance with subsection 52(1) of CEAA 2012, then in accordance with section 53 and through the licensing process, the CNSC establishes the mitigation measures and, where applicable, follow-up activities that the applicant must implement
- if the CNSC determines that the project is likely to cause significant adverse environmental effects, then in accordance with section 52(2) of CEAA 2012, the CNSC will refer to the Governor in Council the matter of whether those effects are justified in the circumstances

Licensing, compliance and verification activities undertaken by CNSC staff ensure that the applicant has implemented the mitigation measures identified in the EA. Where applicable, the licensing, compliance and verification activities will also be used to ensure the implementation of a follow-up program.

If an applicant proposes to carry on an activity following the completion of an EA under CEAA 2012, the applicant must complete the CNSC licensing process, including safety and control measures for protection of the environment and of the health and safety of persons.

## A.1 Environmental assessment under CEAA 2012 conducted by the CNSC

The applicant chooses whether to complete an EA under CEAA 2012 via an integrated approach with the CNSC licensing process, or a sequential approach.

Under an integrated approach, the EA is conducted at the same time as the review of the information in the applicant's licence application, enabling CNSC staff to present their recommendations for the EA and the licence application to the Commission at the same Commission proceeding (for example, a meeting, a hearing or an abridged hearing).

Under a sequential approach, the EA is conducted first, with a subsequent review of the licence application. This approach may be more appropriate when, for example, an applicant uses the EA to assess the feasibility of a project.

**Note:**

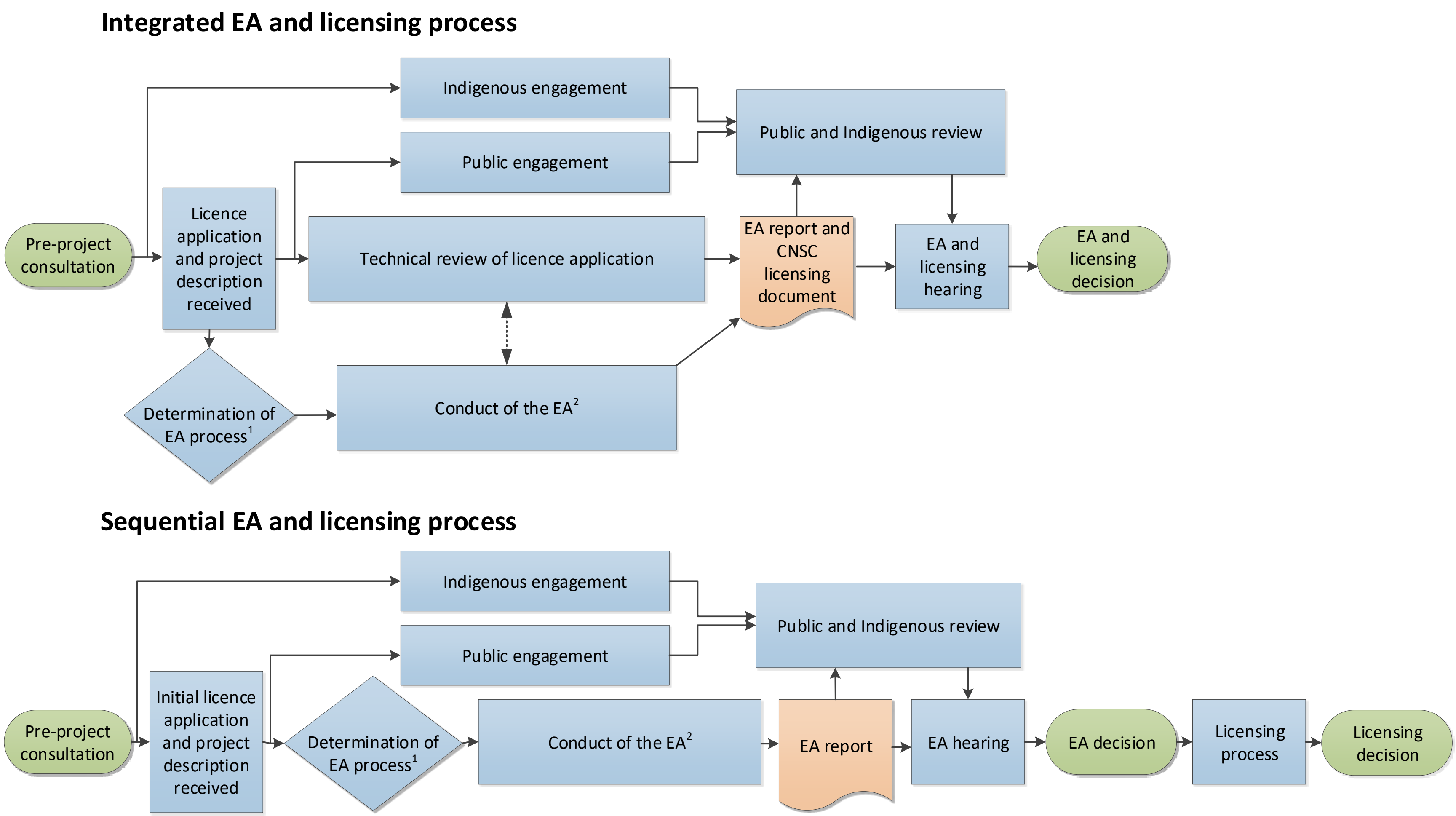
- after the EA is completed, the applicant is responsible for submitting all remaining documentation to fulfill the CNSC's licensing requirements to undertake project activities
- if sufficient time elapses between the EA decision and the submission of the corresponding licence application that there is new science and/or technology, new policy, changes in the environment, or any project modifications with a potentially different impact on the environment, CNSC staff may require the applicant to update the previous EA information to take into account these additional considerations

CEAA 2012 does not set regulated timelines for EAs conducted by the CNSC. However (pursuant to the *Class I Nuclear Facilities Regulations* and the *Uranium Mines and Mills Regulations*), the CNSC is committed to completing this process within the 24-month federal timeline for a licensing decision under the integrated approach. Furthermore, CNSC staff's service standard for completing an EA under CEAA 2012 under a sequential approach is also a 24-month federal timeline. Adherence to this schedule, for both integrated and sequential approaches, is facilitated by the completeness of information received from applicants, and the process will begin when the notice of commencement is posted.

**Note:** The 24-month federal timeline applies to CNSC activities, and not to the time periods required for steps outside the CNSC's control, such as time the applicant needs to prepare technical studies or to respond to requests for additional information or circumstances that are specific to the project.

Figure 5 and table A outline the CNSC's process for completing an EA under CEAA 2012.

**Figure 5: Overview of the environmental assessment process under CEAA 2012, using an integrated or sequential approach**




[1] If the project is not listed in the *Regulations Designating Physical Activities*, then an environmental protection review under the NSCA will be carried out (refer to section 3).
[2] The CNSC may delegate the conduct of the EA or any part thereof to another jurisdiction. In such cases, the responsibility for making a decision under CEAA 2012 remains with the Commission.

**Table A: Key steps for an environmental assessment under CEAA 2012**

| Step | Action |
|---|---|
| **Step 1** | Applicant conducts pre-project engagement with the CNSC |
| **Step 2** | Sequential approach: Applicant submits a project description and initial licence application<br>Integrated approach: Applicant submits a project description and licence application |
| **Step 3** | CNSC staff determine if an EA under CEAA 2012 is required |
| **Step 4** | CNSC staff define participation opportunities |
| **Step 5** | Commission determines the scope of the EA |
| **Step 6** | Applicant conducts technical studies and submits the environmental impact statement (EIS) |
| **Step 7** | CNSC staff perform a technical review of the EIS |
| **Step 8** | CNSC staff draft and issue the EA report |
| **Step 9** | Commission proceeding (meeting, hearing or abridged hearing) on the EA report |

**Note:** Public and Indigenous group participation opportunities, carried out by both the CNSC and the applicant, occur throughout this process.

## A.2 Key steps for an environmental assessment under CEAA 2012

The process for an EA conducted by the CNSC under CEAA 2012 includes the following key steps.

**Step 1: Applicant conducts pre-project engagement with the CNSC**

Applicants may begin to determine the feasibility of a project before submitting a project description and (for an integrated approach) a licence application. Early communication with the CNSC is recommended, to help applicants:

- identify projects that must undergo an EA in accordance with CEAA 2012
- understand the regulatory requirements
- understand the CNSC's EA and licensing processes (that is, an integrated EA compared to a sequential EA) and the associated anticipated timelines
- clarify the information to be included in the project description
- identify the potential involvement of other jurisdictions
- identify Indigenous groups whose Indigenous or treaty rights may be affected or Indigenous groups with an interest in the project
- determine the appropriate level of public and Indigenous engagement activities

To facilitate planning, the CNSC encourages applicants and licensees to submit their project descriptions as early as possible.

The CNSC may allow some applicants to apply a graded approach to the requirements for a project description as set out in the *Prescribed Information for the Description of a Designated Project Regulations*. This possibility should be discussed and determined during pre-project engagement.

For early engagement and planning purposes, the CNSC may initiate early discussions with other federal, provincial or territorial authorities and Indigenous groups as soon as an applicant indicates their intent to seek regulatory approval for a proposed project. The objective of early engagement is to support a more timely and efficient process for the EA under CEAA 2012. For more information, see step 4, below.

**Step 2: Applicant submits a project description and/or licence application**

For a sequential approach applied to a proposed new facility (that requires a new licence application), the applicant submits **both** of the following:

- a project description that provides the information set out in the *Prescribed Information for the Description of a Designated Project Regulations*
- an initial licence application with the necessary information needed to start the EA process, and a schedule for submission of the remaining material

For a sequential approach applied to an existing facility with proposed new activities (that requires a licence amendment), the applicant submits a project description only.

For an integrated approach, the applicant submits **both** of the following:

- a project description that provides the information set out in the *Prescribed Information for the Description of a Designated Project Regulations*
- a licence application

The CNSC may request additional information, even if the project description generally conforms to these regulations, as required to complete the EA determination.

**Step 3: CNSC determines if an EA under CEAA 2012 is required**

A nuclear project undergoes an EA under CEAA 2012 if it meets the description of a designated project in the *Regulations Designating Physical Activities* or if it has been designated by the Minister of Environment and Climate Change Canada. Using the information provided in the project description, the CNSC determines if the project is a designated project, and completes an EA determination memorandum that documents the findings.

If an EA under CEAA 2012 is required, the CNSC informs the applicant.

If an EA under CEAA 2012 is not required, the applicant must still meet CNSC licensing requirements before the licence is issued, including submission of information that allows CNSC staff to conduct an EA under the NSCA to ensure the applicant or licensee will, in carrying out the project, ensure the protection of the environment and of the health of persons, as described in section 3.

For an EA under CEAA 2012:

- As the sole federal responsible authority for nuclear projects, the CNSC contacts provincial jurisdictions to determine if there are any other provincial EA requirements. Where applicable, the CNSC works with other jurisdictions to determine if their EA requirements can be addressed through a single EA process (to reduce duplication and provide regulatory efficiency). Relevant federal and provincial EA agreements provide direction regarding jurisdictional roles and responsibilities in the assessment of such projects.

- The CNSC may delegate the conduct of an EA or any part thereof to another jurisdiction. In such cases, the responsibility for making a decision under subsection 52(1) of CEAA 2012 remains with the Commission. Delegation of EA-related matters for a given project are determined on a case-by-case basis in accordance with section 26 of CEAA 2012.

- The CNSC contacts other federal authorities to determine if additional regulatory decisions are required to allow the project to proceed. The CNSC also engages the appropriate federal authorities to determine whether they can provide specialist or expert information or knowledge to support the conduct of the EA.

- The CNSC ensures that a notice of commencement of an EA is posted on the Canadian Environmental Assessment Registry (CEAR). This notice provides a brief description of the project, the jurisdictions involved, and CNSC contact information. The CNSC posts a similar notice on the CNSC website, and provides a link to the notice of commencement on CEAR. The CNSC also distributes the notice to its subscription list and sends a formal notice to identified Indigenous groups.

**Step 4: Defining participation opportunities**

Indigenous consultation activities are integrated in the EA process to the extent possible. For more information, see REGDOC-3.2.2, *Indigenous Engagement* [10].

The CNSC ensures that the public is provided with an opportunity to participate in the EA. The breadth and timing of public participation is at the discretion of the CNSC. For example, a public review period may be conducted on the project description to solicit the views of the public, Indigenous groups and other stakeholders to help inform the conduct of the EA under CEAA 2012. Other opportunities could include public outreach sessions (such as open houses or information sessions); a public review on documentation (such as the environmental impact statement (EIS) or EA report); or participation in a public hearing on the EA.

**Step 5: Determining the scope of the EA**

Under subsection 19(1) of CEAA 2012, the CNSC is required to consider certain factors in the EA under CEAA 2012 (see subsection A.3). The Commission determines the scope of these factors in a Commission proceeding.

CNSC staff will notify the applicant of the final scope of factors determined by the Commission, including any additional requirements that are to be included in the conduct of the technical studies and EIS.

**Step 6: Applicant conducts technical studies and submits the EIS**

The conduct of the technical studies and preparation of an EIS are typically delegated to the applicant. The document *Generic Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012* [13] informs applicants of the information requirements for the preparation of an EIS for a project that requires an EA under CEAA 2012.

The applicant submits the EIS and any supporting technical studies to the CNSC for a technical review.

**Note:** To meet CEAA 2012 requirements, the applicant should complete a baseline environmental characterization (see appendix B), and an environmental effects characterization (see appendix C). Specific requirements under CEAA 2012 are described in subsection A.3.

**Step 7: Technical review of the EIS**

CNSC staff and, where applicable, other federal and provincial authorities perform an in-depth technical review of the EIS and supporting technical studies. If certain areas need to be clarified, confirmed or improved based on the technical review, the CNSC may ask the applicant to provide additional information to resolve these issues.

When CNSC staff are satisfied that the applicant has adequately addressed all information gaps, the technical review is considered to be complete.

**Step 8: EA report**

The CNSC must ensure that an EA report is prepared. The EA report includes CNSC staff's conclusions regarding the potential environment effects, the proposed mitigation measures, and whether the project is likely to result in significant adverse environmental effects, as well as follow-up program requirements.

CNSC staff draft the EA report, which synthesizes the applicant's technical information and takes into account the results of the technical review, including any comments received from other parties.

The CNSC may request other federal agencies to review the EA report or to provide expert information or knowledge. Comments received will be considered in the development of the EA report.

**Step 9: Commission proceeding on the EA report**

CNSC staff prepare a document summarizing the EA report's conclusions and recommendations, and outlining the EA-related decisions that the Commission needs to make. This document and the EA report are submitted to the Commission, along with any public comments received (including how the CNSC staff addressed the comments). The Commission uses this information to inform its decision.

For public hearings, a notice of public Commission hearing is posted on the CNSC website at least 60 days before the scheduled hearing to inform the public and Indigenous groups with hearing information, including information on how to intervene at the hearing. The CNSC also sends a copy of the notice to identified Indigenous groups. This procedure enables interested parties to request intervenor status from the Commission for the public hearing and to send their comments on the EA report.

Public hearings are usually held at the CNSC headquarters in Ottawa, but the Commission may decide to hold such a hearing in a community in the vicinity of the proposed project.

The exact nature of the public hearing depends on whether the project is following an integrated or sequential EA and licensing process. This information is provided in the notice of public Commission proceeding.

Where other federal authorities provided expert information or knowledge during the conduct of the EA under CEAA 2012, the Commission may request their participation in the public hearing.

Following the public hearing, the Commission makes a decision, based on the EA, on whether the project is likely to cause significant adverse environmental effects, taking into account mitigation measures that were identified during the EA. This decision must be made before a licensing decision can be made on allowing the project to proceed.

If the Commission concludes that a project is not likely to cause significant adverse environmental effects in accordance with subsection 52(1) of CEAA 2012, the Commission (in accordance with section 53) must establish through the licensing process, the mitigation measures and follow-up activities that the applicant must implement.

If the Commission concludes that a project is likely to cause significant adverse environmental effects in accordance with subsection 52(2) of CEAA 2012, the Commission refers to the Governor in Council the matter of whether those effects are justified in the circumstances.

The Commission's decision is published on the CNSC website and the CEAR. Indigenous groups and members of the public who have expressed an interest in a particular project may be directly notified of the decision.

## A.3 Specific CEAA 2012 environmental assessment requirements

Where the information is common to both the EIS and the licence application, the applicant may provide the information in either the application or the EIS, with appropriate cross-referencing between the submissions. The applicant shall clearly indicate where the requirements of both the NSCA and CEAA 2012 are addressed.

The EA of a designated project shall take into account the following factors as listed in subsection 19(1) of CEAA 2012:

a) the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to results from the designated project in combination with other physical activities that have been or will be carried out
b) the significance of those environmental effects
c) comments from the public that are received in accordance with CEAA 2012
d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project
e) the requirements of the follow-up program in respect of the designated project

f) the purpose of the designated project
g) alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means
h) any changes to the designated project that may be caused by the environment
i) the results of any relevant study conducted by a committee established under section 73 or 74 of CEAA 2012
j) any other matter relevant to the EA that the responsible authority requires to be taken into account

Pursuant to subsection 19(2) of CEAA 2012, the scope of the factors to be taken into account under paragraphs 19(1)(a), (b), (d), (e), (g), (h) and (j) is determined by the Commission, as a responsible authority.

The EIS and supporting technical studies are completed to meet the requirements of CEAA 2012, paragraphs 19(1)(a), (b), (d), (e), (f), (g), (h) and, if appropriate, (i) and (j) in accordance with the scope of these factors as determined by the CNSC. The completion of the EIS and, as necessary, supporting technical studies is typically delegated to the applicant in accordance with section 23 of CEAA 2012. This regulatory document provides requirements and guidance to support project planning and early development of these documents by the applicant. These requirements and guidance do not negate the importance of pre-project engagement or the potential for project-specific EA guidelines.

### A.3.1 Purpose of the project

Paragraph 19(1)(f) of CEAA 2012 states that the EIS shall identify the purpose of the project (defined as what is to be achieved by carrying out the project).

For further guidance, consult *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* [14].

### A.3.2 Alternative means for carrying out the project

Paragraph 19(1)(g) of CEAA 2012 states that the EIS shall identify and describe alternative means to carry out the project that are, from the perspective of the applicant, technically and economically feasible. As identified by the proponent, the alternative means include options for locations, development, and implementation methods, routes, designs, technologies, mitigation measures, and so on. Alternative means may also be related to the construction, operation, expansion, decommissioning and abandonment of a physical work.

The approach and level of effort applied to addressing alternative means is established on a project-by-project basis taking into consideration:

- the characteristics of the project
- the environmental effects associated with the potential alternative means
- the health or status of valued components (VCs) that may be impacted by the alternative means
- the potential for mitigation and the extent to which mitigation measures may address potential environmental effects
- the level of concern expressed by the public and Indigenous groups

The EIS should also describe the environmental effects of each alternative means. The criteria used to identify alternative means as unacceptable, and how these criteria were applied, should be described, as should the criteria used to examine the environmental effects of each remaining alternative means to identify the preferred alternative.

For further guidance, consult *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* [14].

### A.3.3 Environmental effects

Paragraph 19(1)(a) of CEAA 2012 states that the EA must take into account the environmental effects of the designated project.

The environmental effects that must be considered in an EA under CEAA 2012 are also requirements under the NSCA. As described in section 4, the applicant should conduct an ERA in accordance with CSA 288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* [6].

### A.3.4 Malfunctions and accidents

Paragraph 19(1)(a) of CEAA 2012 states that malfunctions and accidents shall be assessed in the EA. Malfunctions and accidents should be separated into radiological and non-radiological (conventional).

The applicant should provide an assessment of potential health and environmental effects resulting from postulated radiological and conventional malfunctions or accidents. The EIS should also include any mitigation measures such as monitoring, contingency, clean-up or restoration work in the surrounding environment that would be required during or immediately following the postulated malfunction and accident scenarios.

The EIS should provide a description of postulated malfunction and accident sequences leading to a radiological or non-radiological release considering, as appropriate, internal events, external events and human-induced events, including their frequency and an explanation of how these events were identified, and any modeling that was performed.

The applicant can use a bounding approach or use facility- or activity-specific information (for example, design, operation, projected environmental releases) in the assessment of radiological accidents and malfunctions. If a bounding approach is used, the applicant should provide a detailed rationale for the selection of each bounding scenario.

The EIS should include the source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the postulated malfunctions and accidents.

**Note:** Malfunctions and accidents are reviewed in depth under the NSCA for licensing purposes (for example, under REGDOC-2.4.1, *Deterministic Safety Analysis* [15], REGDOC-2.4.2, *Probabilistic Safety Assessments for Nuclear Power Plants* [16] and REGDOC-1.1.1, *Site Evaluation and Site Preparation for New Reactor Facilities* [17]). These scenarios should be taken into consideration by the applicant when designing environmental protection measures (see section 4).

If applicable, the applicant should use operating experience (OPEX) to identify any past abnormal operations, accidents and spills to the extent that they are relevant to the current assessment for the purposes of identifying malfunction and accident scenarios to be assessed.

### A.3.5 Cumulative effects

Paragraph 19(1)(a) of CEAA 2012 states that the applicant shall assess any residual adverse environmental effects of the project in combination with other past, present or reasonably foreseeable projects and/or activities within the study area.

The applicant should explain the approach and methods used to identify and assess cumulative effects. The approach and methods should be consistent with *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* [18].

### A.3.6 Significance of residual effects

Paragraph 19(1)(b) of CEAA 2012 states that the applicant shall assess the significance of any residual effects that persist, taking into consideration the proposed mitigation measures. These residual effects are identified during the ERA or a characterization of the environmental effects.

In the EIS, the applicant should include a detailed analysis of the significance of each residual effect. The applicant should clearly explain the method and definitions used to describe the level of the residual adverse effect (for example, low, medium, or high) for each of the issues. The applicant should also describe any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried on and how these levels were combined to reach an overall conclusion on the significance of the adverse effects for each valued component (VC).

**Guidance**

Some specific issues to be assessed are:

- magnitude of the effect
- spatial extent of the effect
- duration and frequency of the effect
- degree to which the effect can be reversed or mitigated
- ecological importance

The method used to describe the level of the adverse effect should be transparent and reproducible.

The EIS should identify additional criteria used to assign significance ratings to any predicted adverse effects. It should contain clear and sufficient information to enable the CNSC and the public to understand and review the applicant's judgement of the significance of effects. The applicant should define the terms used to describe the level of significance. In assessing significance against the criteria, the EIS should, where possible, employ relevant existing regulatory documents, environmental standards, guidelines or objectives such as prescribed maximum levels of emissions or discharges of specific hazardous substances into the environment or maximum acceptable levels of specific hazardous substances in the environment.

### A.3.7 Socio-economic environment

The applicant should characterize the socio-economic environment and identify all indirect socio-economic effects.

An indirect effect is a secondary environmental effect that occurs as a result of a change that a project may cause to the environment. Paragraph 5(2)(b) of CEAA 2012 refers to any change to the environment caused by the project on health and socio-economic conditions, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

For additional guidance, refer to *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environment Assessment Act, 2012* [19].

### A.3.8 Community and Aboriginal traditional knowledge

Subsection 19(3) of CEAA 2012 states that community and Aboriginal traditional knowledge may be considered in the EA. CNSC staff will provide guidance to the applicant at the earliest possible stage in the EA process concerning the extent to which community and Aboriginal traditional knowledge shall be considered in the EA.

For additional information, refer to:
- *Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act, 2012* [20]
- REGDOC-3.2.2, *Indigenous Engagement* [10] (for further information on the CNSC's expectations of applicants for Indigenous engagement)

### A.3.9 Assessment of effects of the environment on the project

Paragraph 19(1)(h) of CEAA 2012 states that the EIS shall take into account how the environment could adversely affect the project. The applicant shall also take into account any potential effects of climate change on the project, including an assessment of whether the project might be sensitive to changes in climate conditions during its lifecycle.

Some adverse environmental conditions are flooding, severe weather, biophysical hazards (such as algae), geotechnical hazards and seismic events.

### A.3.10 EA follow-up program

Paragraph 19(1)(e) of CEAA 2012 states that the EIS shall include a framework or preliminary program upon which EA follow-up actions will be managed throughout the life of the project.

The applicant should design the follow-up program to verify the accuracy of the EA predictions and to determine the effectiveness of the measures implemented to mitigate the potential adverse environmental effects of the project.

The applicant should also design the follow-up program to incorporate pre-project information that would provide the baseline data; compliance data such as established environmental quality criteria; regulatory documents, standards or guidelines; and real-time data consisting of observed data gathered in the field. As part of the follow-up program, the applicant should describe the compliance reporting methods to be used, including reporting frequency, methods and format.

**Note:** The CNSC, in collaboration with other federal authorities (where applicable), verifies and monitors all EA follow-up activities through the CNSC licensing and compliance process. EA follow-up monitoring activities may be integrated within the applicant's environmental protection measures.

# Appendix B: Characterization of the Baseline Environment for an Environmental Assessment Under CEAA 2012

**Note:** Projects with environmental assessments (EA) already initiated under the *Canadian Environmental Assessment Act (2012)* (CEAA 2012) and led by the CNSC will continue under their current processes, as per the transition provision (section 182) of the IAA. The following appendix is relevant to those ongoing projects and will remain in this regulatory document for reference purposes until those projects are completed.

For a new licence, the applicant should use the information in this appendix to develop a characterization of the baseline environment. During the lifecycle of the facility or activity, the licensee should use this information to review and update the characterization, and also use the information in appendix C to document and predict the future environmental effects compared to this baseline characterization.

For additional information, see appendix D for a sample matrix for mapping the facility/activity-environmental-component interactions.

## B.1 Atmospheric environment

The atmospheric environment includes the climate conditions at the site and in the local and regional study areas. It includes the seasonal variations in weather conditions within the study areas, to allow the assessment of effects on the facility or activity.

The applicant or licensee should provide a description of the existing ambient air quality in the study areas, with emphasis on characterizing radiological and non-radiological analytes.

The description should include meteorological information such as air temperature, relative humidity, precipitation, wind speed and direction, atmospheric pressure, and solar radiation. It should also include the occurrence of weather phenomena (for example, lightning, temperature inversions and fog). Special consideration should be given to the analysis of extreme and rare meteorological phenomena (for example, tornadoes).Uncertainties should be described and taken into account when discussing the reliability of the information presented.

The description should also include current ambient daytime and nighttime noise levels at the site and local study areas, and include information on its source(s), geographic extent and temporal variations. The description should provide ambient noise levels for other areas that could be affected by the facility or activity. Some examples are:

- increased traffic along transportation corridors to and from the site during construction
- receptors at residences and sensitive sites (such as hospitals, schools, daycare facilities, seniors' residences, and places of worship)

The applicant or licensee should describe the influence of regional topography or other features that could affect weather conditions in the study areas.

The baseline information should be sufficient to support the use of an atmospheric dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the project (for example, tornadoes).

## B.2 Surface water environment

The surface water environment includes all surface water features and hydrology that affect surface water at the site or in the local and regional study areas. The applicant or licensee should include delineation of drainage basins at appropriate scales.

When documenting the water quality of all surface water, the applicant or licensee should demonstrate the use of appropriate sampling and analytical protocols, for the range of analytical parameters with the potential to be influenced by the facility or activity. This information should be presented using tables, maps and figures to provide an understanding of surface water characteristics and conditions at the site and in the local and regional study areas.

The applicant or licensee should describe hydrological regimes within the drainage basin, including seasonal fluctuations and year-to-year variability of all surface waters. The applicant or licensee should assess normal flow, flooding and drought properties of water bodies as well as the interactions between surface water and groundwater flow systems. The applicant or licensee should describe all water sources used for drinking water in the area, including source water intakes for drinking water treatment facilities.

The baseline information should be sufficient to support the use of an aquatic dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the facility or activity (for example, flooding).

The applicant or licensee should document the sediment quality of all water bodies to be affected by the facility or activity, demonstrating the use of appropriate sampling and analytical protocols, for the range of analytical parameters with the potential to be influenced by the facility or activity. This information should provide an appropriate understanding of sediment characteristics and conditions on the site and in the local and regional study areas.

The study design should be fully described, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.

## B.3 Aquatic environment

The aquatic environment includes the aquatic and wetland species at the site and within the local and regional study areas, including the flora, fauna and their habitats.

The applicant or licensee should seek information from relevant authorities (such as Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO) and provincial or territorial authorities) on aquatic and wetland species and habitat for the local and regional study areas. The applicant or licensee should also undertake independent studies to gather the necessary information.

The applicant or licensee should include a description of the food chain and food web dynamics as a habitat component as this relates to fish populations, and potential effects resulting from the facility or activity (such as impingement and entrainment).

The applicant or licensee should provide detailed habitat mapping that demonstrates habitat usage by fish within the study areas. This information should include depth profiles, substrate mapping, water temperature profiles, and a description of known and potential habitat usage (such as spawning, nursery, rearing, feeding and migratory) by fish that occur in the study areas.

The applicant or licensee should identify any biological species of natural conservation status (that is, rare, vulnerable, endangered, threatened or uncommon at a federal, provincial or municipal level) and their critical habitats, if identified.

The applicant or licensee should provide baseline characterization of radionuclide and hazardous substance levels in aquatic biota to support human and ecological risk assessment.

The applicant or licensee should fully describe the study design, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline date and methods, as well as the method(s) by which they have been addressed.

## B.4 Geological and hydrogeological environment

The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.

### B.4.1 Geology

The applicant or licensee should characterize the geomorphology, topography, quaternary geology and soil characteristics, structural geology, petrology, geochemistry, economic geology and hydrogeology. The applicant or licensee should also describe the geomechanical properties that apply to the region and at the site that will be disturbed.

The applicant or licensee should provide the geotechnical properties of the overburden, including shear strength and liquefaction potential, to allow for the assessment of slope stability and bearing capacity of foundations under both static and dynamic conditions.

The description of the structural geology should include regional, local and site-specific documentation of fractures and faults. It should include a description of primary geological features and deformation fabrics both at the site and within the local and regional study areas.

If applicable, the applicant or licensee should describe the coastal geomorphology and should include the characteristics of any lakefront or ocean bluffs, shoreline, and both near-shore zone and offshore zones.

The baseline characterization should be sufficient to assess effects of the environment on the facility or activity (for example, seismic effects).

The applicant or licensee should present a geological model that incorporates all overburden and bedrock information. If extrapolation is required to derive the stratigraphy, the applicant or licensee should explicitly discuss the uncertainties and the need for additional field investigations to reduce those uncertainties.

The applicant or licensee should describe the geotechnical and geophysical hazards including the consideration of subsidence, uplift, seismicity (and active faulting), and consider the potential for movement at the ground surface (including co-seismic rupture) and earthquake ground motions. A seismic hazard assessment should be provided. Where appropriate, the narrative descriptions should be supplemented by geological maps, figures, cross-sections, borehole logs and photographs (with specific location information).

### B.4.2 Hydrogeology

The applicant or licensee should describe the hydrogeology at the site and in the local and regional study areas. The description should characterize the physical and geochemical properties of all overburden and bedrock hydrogeological units (from the ground surface to the uppermost basement unit, which is site dependent).

Units may be characterized as aquifers or aquitards, and unit descriptions should include their geochemical characteristics, vertical and lateral permeabilities, transport mechanism (diffusion versus advection) and directions of groundwater flow.

The applicant or licensee should identify the groundwater recharge and discharge areas, and describe in detail the groundwater interactions with surface waters.

The applicant or licensee should present a conceptual and numerical hydrogeological model that discusses the hydrostratigraphy and groundwater flow systems.

The applicant or licensee should provide a description of baseline groundwater quality at the site and in the local study area. The applicant or licensee should also describe local and regional potable groundwater supplies, including their current use and potential for future use.

## B.5 Terrestrial environment

The terrestrial environment includes flora and fauna, their habitats, any wildlife corridors and the soil.

The applicant or licensee should describe the terrestrial species at the site and within the local and regional study areas, including flora, fauna and their habitat. The applicant or licensee should identify all biological species at risk (that is, endangered, threatened, special concern, extirpated at a federal, provincial or municipal level) known to occur in the area or where the site is within the range of the species.

The applicant or licensee should describe the presence and importance of wildlife habitat within the study areas, including critical habitats for listed species (if identified). The applicant or licensee should also describe any wildlife corridors and physical barriers to movement.

The applicant or licensee should identify all protected and conservation areas established by federal, provincial and municipal jurisdictions (for example, wilderness areas, parks, sites of historical or ecological significance, nature reserves, federal migratory bird sanctuaries and wildlife management areas).

The applicant or licensee should describe the existing soil quality (including hazardous and radiological substance concentrations) for all study areas, as well as any additional soil quality parameters potentially relevant for modelling purposes (such as transport and bioavailability of contaminants of potential concern).

The applicant or licensee should provide baseline characterization of radionuclide and hazardous substance levels in vegetation and other non-human biota to support human and ecological risk assessment. The characterization should also take into consideration the baseline conditions of other applicable environmental components (such as the atmospheric environment).

The applicant or licensee should undertake independent studies to gather the necessary information as appropriate. The applicant or licensee should describe field studies in terms of representativeness of the target populations where possible. The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results.

The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.

## B.6 Ambient radioactivity

The ambient radioactivity arises from the sources, their activity levels and their origin, for all applicable environmental media (including air, soil, food, water, aquatic sediments and plant or animal tissue).

The applicant or licensee should describe the ambient radiological conditions at the site and in the local and regional study areas. The applicant or licensee should include information on the existing conditions, including an inventory of sources, their activity levels and their origin (natural or anthropogenic), for all applicable environmental media.

The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results.

The description should include an assessment of any limitations or gaps in the quality and extent of the baseline data and methods, as well as the method(s) by which they have been addressed.

## B.7 Human health

The potential effects of the facility or activity on human health include both radiological sources and non-radiological contaminants.

The applicant or licensee should describe the current health profiles of the communities likely to be affected by the facility or activity, including information on population health of the communities in the local and regional study areas.

The applicant or licensee should provide, to the extent available, information on current consumption of locally grown harvests and country foods, and the quality by food type, amounts consumed, parts consumed (whole body or specific organs).

## B.8 Indigenous land and resource use

Indigenous land and resource use includes lands, waters and resources of specific value; traditional activities and lifestyle; and traditional dietary habits.

Traditional land use may include areas where traditional activities such as establishing seasonal camps, camping, travel on traditional routes, gathering of country foods and medicines (hunting, fishing, trapping, planting and harvesting) are being carried out. Traditional land use also includes spiritual sites of significance to Indigenous people.

The applicant or licensee should identify the lands, water and resources of specific social, economic, archaeological, cultural or spiritual value to Indigenous people, including established and asserted Indigenous or treaty rights that may be affected by the facility or activity.

The applicant or licensee should describe Indigenous land and resource use at the site and in the local and regional study areas. The applicant or licensee should identify traditional activities, including activities for food, social, ceremonial and other cultural purposes, in relation to such lands, waters and resources with a focus on the current use of lands, waters and resources for traditional purposes.

The applicant or licensee should describe the traditional dietary habits and dependence on country foods and harvesting for other purposes, including harvesting of plants for medicinal purposes. The analysis should focus on the identification of potential adverse effects of the facility or activity on the ability of future generations of Indigenous people to pursue traditional activities or lifestyle.

# Appendix C: Environmental Effects for an Environmental Assessment Under CEAA 2012

**Note:** Projects with environmental assessments (EA) already initiated under the *Canadian Environmental Assessment Act (2012)* (CEAA 2012) and led by the CNSC will continue under their current processes, as per the transition provision (section 182) of the IAA. The following appendix is relevant to those ongoing projects and will remain in this regulatory document for reference purposes until those projects are completed.

The licensee should have already developed a characterization of the baseline environment (see appendix B) and should use the information in this appendix to document the environmental effects of a facility or activity. For additional information, see appendix D for a sample matrix for mapping the facility/activity-environmental-component interactions.

## C.1 Atmospheric environment

The licensee should characterize the effects of the facility or activity on the atmospheric environment during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios.

The licensee should identify and characterize all atmospheric emissions (radiological and non-radiological) expected to be generated during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios. This information should include average and maximum emissions from planned discharges, point sources and fugitive (non-point source) releases (including greenhouse gases).

The licensee should complete modelling that incorporates baseline (or existing ambient) air quality in combination with the predicted site-specific atmospheric characteristics (such as shoreline fumigation) to assess potential effects on air quality, the transport of atmospheric contaminants and any associated exposure to humans and non-human biota receptors.

The licensee should describe predicted effects of noise on terrestrial and aquatic species as well as on nearby residents and communities. The description should include both daytime and nighttime noise levels and tonal noise. The predicted sound levels should be compared against baseline levels and any guidelines published by recognized organizations.

## C.2 Surface water environment

The licensee should describe the effects of the facility or activity on the surface water environment during all phases of the lifecycle for the facility or activity, including accident and malfunction scenarios.

The licensee should identify and characterize all liquid effluents that could be generated during all phases of the facility or activity. Some examples are:

- average and maximum emissions from point sources (concentrations/activity levels and volumes)
- planned discharges
- fugitive releases
- deposition from airborne particulates
- surface runoff

## C.3 Aquatic environment

For all phases of the lifecycle for the facility or activity, the licensee should describe the effects of the facility or activity on aquatic flora and fauna, and include a full accounting of effects on species of natural conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment.

The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected reference condition for unexposed biota on a biological population basis, taking natural variation into account. Predictions of effects should include sufficient detail to allow follow-up verification.

Some potential effects are:

- effects on habitat, including aquatic vegetation and sensitive areas such as spawning grounds, nursery areas, winter refuges and migration corridors
- effects on aquatic species, including rare or sensitive species
- effects of blasting on fish and fish habitat on local aquatic systems
- contaminant exposures through environmental and food-chain transport
- effects on aquatic biota due to impingement and entrainment
- effects of infilling on loss of fish habitat and changes to productive capacity
- effects of thermal plume(s) on fish and fish habitat
- effects on wetlands

Under the NSCA, the CNSC assesses the ongoing operation of nuclear facilities and activities to ensure protection of the environment and the health and safety of persons.

Under the Memorandum of Understanding between CNSC and Fisheries and Oceans Canada (DFO), the CNSC is responsible for conducting reviews of licence applications to assess the potential effects on fish and fish habitat, and to ensure that the assessment process considers the intent and requirements of the *Fisheries Act*, the *Species at Risk Act* and their associated regulatory and policy frameworks.

## C.4 Geological and hydrogeological environment

The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.

### C.4.1 Geology

The licensee should fully describe any changes to the geology and geomorphology resulting from the facility or activity, including any interrelationships with the groundwater regime.

The licensee should describe any changes to the environment resulting from the removal of bedrock and/or unconsolidated deposits. The licensee should also describe the disturbance of soils or sediments that may be stockpile, used for construction purposes or otherwise perturbed.

The licensee should include an assessment of changes made that would affect coastal processes and features (such as changes to the shoreline morphology due to construction, erosion or sediment transport).

### C.4.2 Hydrogeology

The licensee should describe and assess any effects the facility or activity may have on the groundwater regime including the quantity and quality of groundwater and how these effects may influence surface waters. The licensee should carry out modelling as needed to develop and test the predicted effects.

## C.5 Terrestrial environment

The licensee should describe the effects of the facility or activity on terrestrial fauna and flora and include a full accounting of effects on species with elevated conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment. The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected "reference condition" for unexposed biota on a biological population basis taking into account natural variation. Predictions of the effects should include sufficient detail to allow follow-up verification.

Some potential effects that should be considered are:

- loss of terrestrial habitat and the quality of lost habitat for relevant species
- disturbance of feeding, nesting or breeding habitats
- physical barriers to wildlife
- disruption, blockage, impediment and sensory disturbance (such as light effects, noise and vibration) of daily or seasonal wildlife movements (such as migration or home ranges)
- direct and indirect wildlife mortality
- reduction in wildlife productivity
- contaminant exposures through environmental and food-chain transport
- effects on biodiversity

## C.6 Ambient radioactivity

The licensee should describe the effects of the facility or activity on ambient radioactivity. Humans and non-human biota exposed to ambient radioactivity should be assessed for all relevant routes of exposure (both internal and external exposure scenarios).

To support the assessment of human health (see section 3.2.7), the licensee should provide information on radiation levels to which members of the public may be exposed, including consideration of consumers of country food whose exposure pathways may differ due to cultural norms; for example, any dietary characteristics of Indigenous peoples.

## C.7 Human health

The licensee should describe the potential effects of the facility or activity on the physical well-being of Indigenous groups and other people resulting from biophysical effects, including the effects of the facility or activity on all environmental components (for example, atmospheric environment) and the resulting effects on human health.

Some examples are:

- an analysis of the effects of the facility or activity on the health and safety of the public, including the possible effects from malfunctions and accidents (radiological and conventional)

- the predicted radiation doses to members of the public resulting from activities within the scope of the facility or activity and any resulting health effects
- a description of quantitative risk assessment modeling conducted, where necessary, for any malfunctions and accidents
- an assessment of the potential effects on human health from all non-radiological contaminants released from the facility or activity, through all potential exposure pathways
- potential effects of noise generated from the facility or activity on human receptors within the study area(s)

## C.8 Indigenous land and resource use

The licensee should identify any change that the facility or activity is likely to cause in the environment and any effect of any such change on the health and socio-economic conditions, physical and cultural heritage and on the current use of lands and resources for traditional purposes by any Indigenous group including effects on hunting, trapping, fishing and gathering.

The licensee should identify any concerns raised by Indigenous people about the facility or activity in relation to any Indigenous or treaty rights.

For further information on the CNSC's expectations of licensees for Indigenous engagement, see REGDOC-3.2.2, *Indigenous Engagement*. [10]

# Appendix D: Sample Matrix of Biophysical Interactions

**Pathways to residual effects from the facility or activity on the environment**

| Phase (if applicable) | Activity | Atmospheric environment | | Surface water environment | | | | Aquatic environment | | | | Geological and hydrogeological environment | | ➔ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Air quality | Noise levels | Surface hydrology /drainage | Lake level | Shoreline / basin integrity | Water quality | Sediment quality | Aquatic habitat | Benthic invertebrate and fish population / distribution | Aquatic health | Groundwater quality and quantity | Flow or water table elevation | *(continued on next page…)* |
| **Site preparation** (e.g., site clearing, excavation) | | | | | | | | | | | | | | ➔ |
| | | | | | | | | | | | | | | ➔ |
| **Construction** (e.g., pouring foundations, facility construction) | | | | | | | | | | | | | | ➔ |
| | | | | | | | | | | | | | | ➔ |
| **Operation** (e.g., emissions and effluents) | | | | | | | | | | | | | | ➔ |
| | | | | | | | | | | | | | | ➔ |
| **Decommissioning** (e.g., cleanup and decontamination) | | | | | | | | | | | | | | ➔ |
| | | | | | | | | | | | | | | ➔ |

○ = Facility/activity-environment interactions that have been determined to result in no residual effects
● = Facility/activity-environment interactions that have been determined to result in potential residual environmental effects *(continued on next page)*

**Pathways to residual effects from the facility or activity on the environment (continued)**

| Phase (if applicable) | Activity | Terrestrial environment | | | | | Ambient radio-activity | | Human health | | | | | Indigenous land and resource use | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Soil quality and quantity | Vegetation communities / species / listed plants | Wildlife habitat | Wildlife population / distribution | Wildlife health | Radiation exposure and levels | Food stuffs | Radiation doses to the general public | Radiation doses to workers | Non-radioactive contaminant exposure to the general public | Non-radioactive contaminant exposure to workers | Conventional health and safety | Social or economic, archaeological, cultural or spiritual value for traditional purposes | Asserted Indigenous Rights or Title |
| **Site preparation** (e.g., site clearing, excavation) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **Construction** (e.g., pouring foundations, facility construction) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **Operation** (e.g., emissions and effluents) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| **Decommissioning** (e.g., cleanup and decontamination) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

○ = Facility/activity-environment interactions that have been determined to result in no residual effects

● = Facility/activity-environment interactions that have been determined to result in potential residual environmental effects

# Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

# References

The CNSC may include references to information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Web page "How to gain free access to all nuclear-related CSA standards".


1. CSA Group, CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use*, 2004 (1st edition).
2. CSA Group, CAN/CSA ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use* (successor editions).
3. CSA Group, CSA N288.1, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*.
4. CSA Group, CSA N288.4, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*.
5. CSA Group, CSA N288.5, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*.
6. CSA Group, CSA N288.6, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*.
7. CSA Group, CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*.
8. Canadian Nuclear Safety Commission (CNSC), regulatory guide G-129 revision 1, *Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable (ALARA)"*, Ottawa, Canada, 2004.
9. CNSC, REGDOC-3.2.1, *Public Information and Disclosure*, Ottawa, Canada, 2018.
10. CNSC, REGDOC-3.2.2, *Indigenous Engagement*, Ottawa, Canada, 2019.
11. CAN/CSA ISO 14004:2004, *Environmental Management Systems – General Guidelines on Principles, Systems and Support Techniques*.
12. CNSC, REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response*, Ottawa, Canada, 2016.
13. CNSC, *Generic Guidelines for the Preparation of an Environmental Impact Statement pursuant to the Canadian Environmental Assessment Act, 2012*, Ottawa, Canada, 2016.
14. CEAA, Operational Policy Statement *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012*, Ottawa, Canada, 2015.
15. CNSC, REGDOC-2.4.1, *Deterministic Safety Analysis*, Ottawa, Canada, 2014.
16. CNSC, REGDOC-2.4.2, *Probabilistic Safety Assessment for Nuclear Power Plants*, Ottawa, Canada, 2014.
17. CNSC, REGDOC-1.1.1, *Site Evaluation and Site Preparation for New Reactor Facilities*, Ottawa, Canada, 2008.
18. CEAA, Operational Policy Statement *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012*, Ottawa, Canada, 2015.

19. CEAA, Technical Guidance Document *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environment Assessment Act, 2012*, Ottawa, Canada, 2015.
20. CEAA, *Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act, 2012*, Ottawa, Canada, 2015.

# Additional Information

The following documents provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- Government of Canada, *A Framework for the Application of Precaution in Science-based Decision Making about Risk*, Ottawa, Canada, 2003

# CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

CNSC regulatory documents are classified under the following categories and series:

**1.0 Regulated facilities and activities**

Series 1.1 Reactor facilities
1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

**2.0 Safety and control areas**

Series 2.1 Management system
2.2 Human performance management
2.3 Operating performance
2.4 Safety analysis
2.5 Physical design
2.6 Fitness for service
2.7 Radiation protection
2.8 Conventional health and safety
2.9 Environmental protection
2.10 Emergency management and fire protection
2.11 Waste management
2.12 Security
2.13 Safeguards and non-proliferation
2.14 Packaging and transport

**3.0 Other regulatory areas**

Series 3.1 Reporting requirements
3.2 Public and Indigenous engagement
3.3 Financial guarantees
3.4 Commission proceedings
3.5 CNSC processes and practices
3.6 Glossary of CNSC terminology

**Note:** The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. Visit the CNSC's website for the latest list of regulatory documents.

# 9 N288.6-12 Environmental risk assessments at Class 1 nuclear facilities and uranium mines and mills CSA Group June 2012

This reference document is subject to copyright. A subscription is required to view this document. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca).

# 10 Decommissioned Beaverlodge Mine Site, Model Update and Environmental Risk Assessment Canada North Environmental Services, July 2020

The information in this reference document is subject to a request for confidentiality under rule 12 of the *Canadian Nuclear Safety Commission Rules of Procedure*. Contact the Commission Registry (interventions@cnsc-ccsn.gc.ca) for more information concerning confidentiality.

# 11 2021 CBEMP Brochure

## COLLABORATIVE APPROACH

The CBEMP aims to be a co-learning process that promotes shared knowledge, skills, and engagement with the community. It provides an opportunity for community members to become involved in the program by participating in interviews and sampling traditional foods that they consume for testing. The 2021 CBEMP was completed by Ya'thi Nene and CanNorth.

## ENGAGEMENT

Communities of the Athabasca region have extensive knowledge and experience pertaining to the region and the northern environment. The CBEMP is founded on their shared knowledge and engagement. The traditional food dietary surveys and harvest mapping allowed community interviewers to identify areas that are highly valued by community members and where research should focus.

- Interviews were confidential
- Mapping was completed by local residents
- Community members helped to collect and ship all of the samples
- Community meetings/updates were provided

In 2021, a community land technician interviewed

**35**

residents of Uranium City and Camsell Portage.

Of those interviewed, 70% indicated that traditional foods are the majority of their diet.

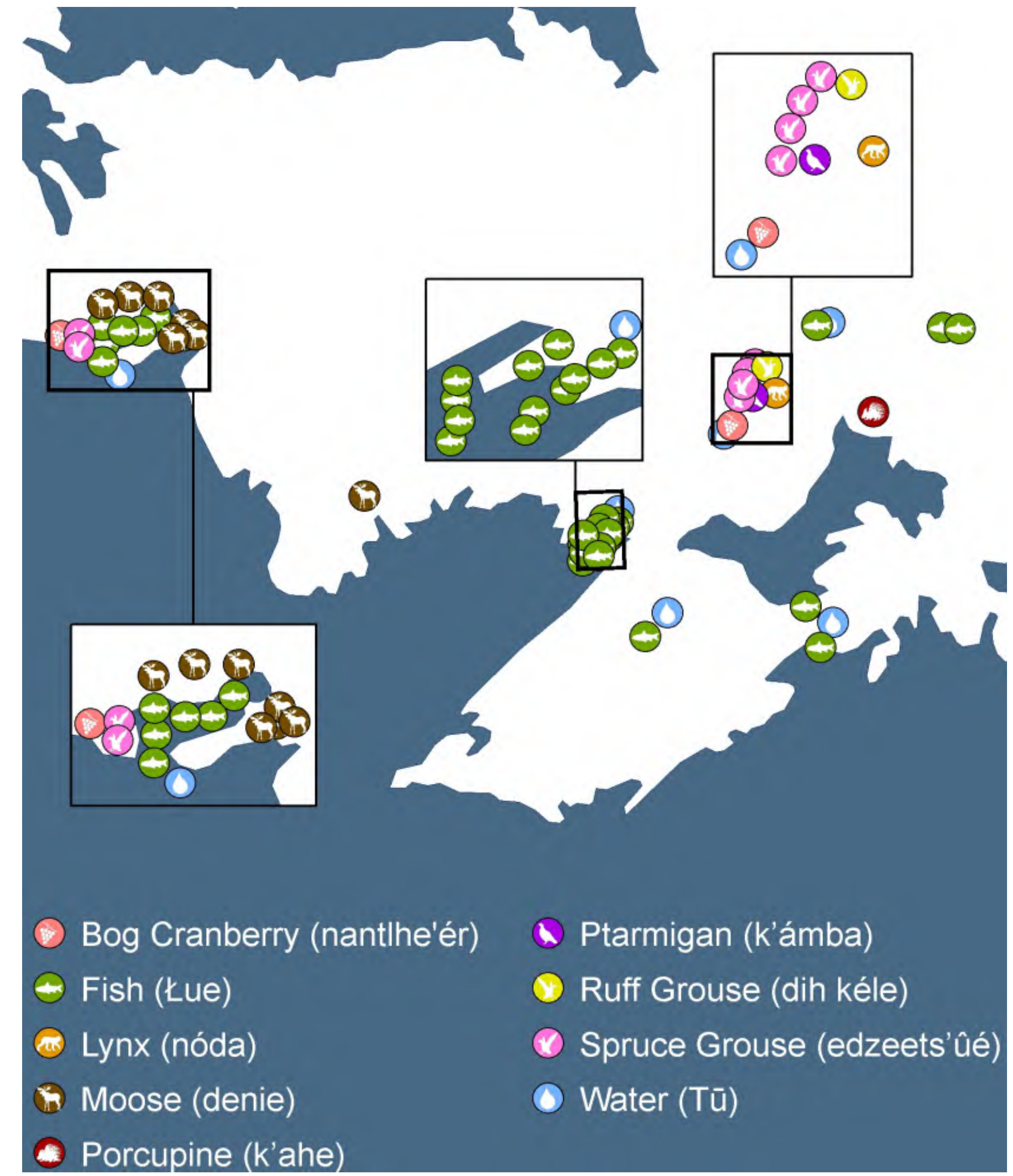
A key component of a successful CBEMP is that the project is completed by local residents.

# BRIDGING TRADITIONAL & SCIENTIFIC KNOWLEDGE

## TOP 10 TRADITIONAL FOODS EATEN


Sweet flag (rat root; dzën nı) was the most common medicinal plant consumed & is primarily used for cough, cold, flu, and toothaches.

## TRADITIONAL FOODS COLLECTED




Barren-ground caribou was consumed by

**94%**

of the population and made up

**13%**

of the community's traditional diet.

**NEARLY 70%**

of the people interviewed have diets made up of at least 50% traditional foods

## CBEMP -HUMAN HEALTH RISK ASSESSMENT

Dietary Survey + Traditional Foods Sampling Program = Evaluation of Exposure

To quantify exposure and potential risks to people consuming traditional foods

### RESULTS

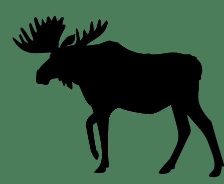
- Chemicals in traditional foods in Uranium City and Camsell Portage were generally low and within the range for the region

- Risk assessment demonstrated that there are negligible risks from eating traditional foods


- Grocery store bought food accounts for most of exposure to chemicals in the community

- Community members should continue to regularly eat locally harvested fish, wild game, berries and plants

HUNTING, FISHING, TRAPPING & GATHERING is good for physical health and social well-being!



### DID YOU KNOW?

Gathering and eating traditional foods can help reduce the risk of diabetes, heart disease, and obesity, especially when the foods are cooked in traditional ways.

Fish are an important part of a healthy diet containing high-quality protein, Vitamin B, Vitamin D, omega-3 fatty acids, other essential nutrients.

Wild meat is a good source of protein that is low in saturated fat and is an important source of minerals, vitamins, and iron.

For more information or to request a copy of the report please talk to your local AJES representative.

We would like to thank Margaret Powder and the communities of Uranium City and Camsell Portage for all their hard work on the project!

**MARSI CHO!**

CanNorth
a First Nation owned environmental services company

This project was managed by

FOLLOW US ON:

Ya' thi Néné
Lands and Resource Office
a non-profit organization owned by the Athabasca Basin communities

Cameco

Proud partners:

orano

# COMMUNITY-BASED ENVIRONMENTAL MONITORING PROGRAM

In 2016, the Ya'Thi Néné Collaboration Agreement brought together seven Athabasca Basin communities, Cameco Corporation, and Orano Canada. Within the new agreement a commitment was made to sustain and enhance the community-based environmental monitoring program (CBEMP).

The 2021 CBEMP took place in Uranium City and Camsell Portage with a traditional food study.
The study focused on collecting information from community members on the traditional foods they consume. Community members also shared information on what locations are important to them and which traditional foods should be sampled.

# 12 REGDOC 3.2.2 Indigenous Engagement

Canada's Nuclear Regulator

Public and Indigenous Engagement

# Indigenous Engagement

REGDOC-3.2.2, Version 1.2

February 2022

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

**Indigenous Engagement**
Regulatory document REGDOC-3.2.2, Version 1.2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YouTube: youtube.com/cnscccsn
Twitter: @CNSC_CCSN
LinkedIn: linkedin.com/company/cnsc-ccsn

**Publishing history**

| | |
|---|---|
| February 2016 | Version 1.0 |
| August 2019 | Version 1.1 |
| February 2022 | Version 1.2 |

# Preface

This regulatory document is part of the CNSC's Public and Indigenous Engagement series of regulatory documents, which also covers public information and disclosure. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-3.2.2, *Indigenous Engagement*, sets out requirements and guidance for licensees on Indigenous engagement. REGDOC-3.2.2 also provides procedural direction for licensees in support of the whole-of-government approach to Indigenous consultation implemented by the CNSC in cooperation with federal departments and agencies.

Indigenous groups and communities in this document include First Nations, Inuit and Métis peoples of Canada. For the purposes of this document, "licensee" refers to new licence applicants and existing licensees, and "regulated facility" refers to proposed or existing regulated facilities. "CNSC" refers to CNSC staff and "the Commission" refers to the administrative tribunal. The term "engagement" refers to the licensee's activities with Indigenous groups and the term "consultation" refers to the activities undertaken by the CNSC to fulfill its duty to consult.

This document is not a comprehensive guide on Indigenous engagement, and it does not interpret treaties or replicate information provided in federal environmental assessment legislation or other relevant statutes or guidelines.

The CNSC's approach to Indigenous consultation is found in Appendix C: *Canadian Nuclear Safety Commission (CNSC) Policy Statement: CNSC's Commitment to Indigenous Consultation and Engagement*. This approach is informed by the guiding principles for Canada outlined in *Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* [1].

The requirements in this document are in addition to those found in REGDOC-3.2.1, *Public Information and Disclosure* [2], and are meant to ensure that potential or established Indigenous and/or treaty rights and related interests are considered, as described in *Aboriginal Consultation and Accommodation – Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* [1].

As Canada's approach to the duty to consult and Indigenous engagement continues to evolve, along with the respective case law, the CNSC will review and update REGDOC-3.2.2 to reflect new and updated requirements and best practices, as needed.

REGDOC-3.2.2, *Indigenous Engagement*, Version 1.1 supersedes Version 1, which was published in February 2016. The changes in Version 1.1 do not result in new or increased obligations for licensees. A document that shows the changes made to REGDOC-3.2.2, *Aboriginal Engagement,* Version 1 is available from the CNSC upon request.

Version 1.2 includes administrative updates to references to the Secretariat. As of January 1, 2022, the Commission Secretariat was renamed the Commission Registry and the Commission Secretary became the Commission Registrar.

For information on the implementation of regulatory documents and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words “shall” and “must” are used to express requirements to be satisfied by the licensee or licence applicant. “Should” is used to express guidance or that which is advised. “May” is used to express an option or that which is advised or permissible within the limits of this regulatory document. “Can” is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee’s responsibility to identify and comply with all applicable regulations and licence conditions.

# Table of Contents

# Indigenous Engagement

## 1. Introduction

The Crown's unique relationship with Indigenous peoples gives rise to the duty to consult, and where appropriate accommodate Indigenous peoples when the Crown contemplates conduct that might adversely impact potential or established Indigenous and/or treaty rights.

As an agent of the Crown, the CNSC has responsibility for fulfilling its legal duty to consult, and where appropriate accommodate Indigenous peoples when its decisions may have an adverse impact on potential or established Indigenous and/or treaty rights. While the CNSC cannot delegate its obligation, it can delegate procedural aspects of the consultation process to licensees. In many cases, licensees are best positioned to collect information and propose any appropriate additional measures. The information collected and measures proposed by licensees to avoid, mitigate or offset adverse impacts may be used by the CNSC in meeting its consultation obligations.

Additionally, ensuring consistency between the CNSC and licensees' approach to Indigenous consultation and engagement can help minimize legal and timeline risks to proposed facilities. These details are also critical to informing the Commission in its decision making.

### 1.1 Purpose

This document identifies requirements for CNSC licensees, with respect to Indigenous engagement. It also provides guidance and information on conducting Indigenous engagement activities.

Although this document is for licensees only, information on the CNSC's approach to Indigenous consultation is found in Appendix C: *Canadian Nuclear Safety Commission (CNSC) Policy Statement: CNSC's Commitment to Indigenous Consultation and Engagement.*

### 1.2 Scope

This document sets out requirements and guidance for CNSC licensees on:

- Indigenous engagement
- reporting to the CNSC about Indigenous engagement activities and issues

This document applies to regulated facilities described in the *Class I Nuclear Facilities Regulations* and the *Uranium Mines and Mills Regulations* when a licensee's application has the potential to raise the Crown's duty to consult.

The following are examples to which the requirements contained in this document do not apply:

- licence renewals with no proposed changes to existing operations as authorized by the Commission
- administrative licence amendments
- Class II nuclear facilities in existing hospitals
- users of portable nuclear gauges and radiography equipment

As appropriate, the CNSC may also request information from licensees on regulated facilities not described in the *Class I Nuclear Facilities Regulations* and the *Uranium Mines and Mills Regulations* to determine if the requirements of this document apply.

If licensees conduct Indigenous engagement activities outside of the scope of this document or in support of due diligence, they are encouraged to share any relevant information with the CNSC, when available.

### 1.3 Relevant legislation

The following provisions of the *Nuclear Safety and Control Act* (NSCA), regulations made under the NSCA, and the *Constitution Act, 1982* are relevant to this document:

- paragraph 9(b) of the NSCA, which provides that "The objects of the Commission are
  (b) to disseminate objective scientific, technical and regulatory information to the public concerning the activities of the Commission and the effects, on the environment and on the health and safety of persons, of the development, production, possession and use referred to in paragraph (a)."
- subsection 3(1.1) of the *General Nuclear Safety and Control Regulations* (GNSCR), which provides that "The Commission or a designated officer authorized under paragraph 37(2)(c) of the Act, may require any other information that is necessary to enable the Commission or the designated officer to determine whether the applicant
  (a) is qualified to carry on the activity to be licensed; or
  (b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed."
- paragraph 3(c)(i) of the *Uranium Mines and Mills Regulations* (UMMR), which provides that "An application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*:
  (c) in relation to the environment and waste management,
  (i) the program to inform persons living in the vicinity of the mine or mill of the general nature and characteristics of the anticipated effects of the activity to be licensed on the environment and the health and safety of persons;"

- paragraph 8(a) of the UMMR, which provides that "An application for a licence to abandon a uranium mine or mill shall contain the following information in addition to the information required by sections 3 and 4 of the *General Nuclear Safety and Control Regulations*:
  (a) the program to inform persons living in the vicinity of the site of the mine or mill of the general nature and characteristics of the anticipated effects of the abandonment on the environment and the health and safety of persons;"

- paragraph 3(j) of the *Class I Nuclear Facilities Regulations*, which provides that "An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*:

(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed;"

- section 35 of the Constitution Act, 1982, which provides that
  "(1) The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.
  (2) In this Act, "aboriginal peoples of Canada" includes the Indian, Inuit and Métis peoples of Canada.
  (3) For greater certainty, in subsection (1) "treaty rights" includes rights that now exist by way of land claims agreements or may be so acquired.
  (4) Notwithstanding any other provision of this Act, the aboriginal and treaty rights referred to in subsection (1) are guaranteed equally to male and female persons."

## 2. Background

The CNSC recognizes and understands the importance of consulting with Indigenous peoples. The CNSC's approach to Indigenous consultation includes commitments to uphold the honour of the Crown through information sharing, relationship building and promoting reconciliation, as well as to meeting its common law duty to consult. The CNSC meets these responsibilities through Indigenous consultation activities, and its approach is articulated in Appendix C.

**The duty to consult**

Since 2004, the Supreme Court of Canada (SCC) has held that the Crown (federal, provincial and territorial governments) has a duty to consult, and where appropriate accommodate, when it contemplates conduct that might adversely impact potential or established Indigenous and/or treaty rights [3, 4, 5]. Existing Indigenous and/or treaty rights have been recognized and affirmed under section 35 of the *Constitution Act, 1982*. The SCC identified that the duty stems from the honour of the Crown and the Crown's unique relationship with Indigenous peoples.

The common law duty to consult, and where appropriate accommodate is raised when the following three factors are present:

- contemplated Crown conduct
- potential adverse impact
- potential or established Indigenous and/or treaty rights

The SCC has emphasized that the duty to consult, and where appropriate accommodate, is raised at a low threshold; knowledge of a credible but unproven claim suffices to raise this duty.

The SCC subsequently clarified responsibilities related to the duty to consult, and where appropriate accommodate – noting that entities such as boards and tribunals (such as the CNSC) also play a role in fulfilling the duty in its *Rio Tinto Alcan Inc. v. Carrier Sekani Tribal Council decision in 2010* [6].

The duty to consult cannot be delegated to third parties; however, the SCC has also stated that the Crown may delegate procedural aspects of the consultation process to third parties, such as licensees.

Early Indigenous engagement will help licensees determine if the activity described in their licence application could adversely impact potential or established rights and related interests. This information will also inform the CNSC's approach to conducting its own Indigenous consultation activities.

In June 2014, in *Tsilhqot'in Nation v. British Columbia* [7], the SCC granted Aboriginal title for the first time to a specific land area in Canada, and it clarified the application of provincial laws and regulatory regimes to Aboriginal title lands. For the purpose of this document, Aboriginal title, proven or unproven, is included in the consideration of potential or established Indigenous and/or treaty rights.

Indigenous consultation activities can vary depending on the activity described in the licence application. Table 1 depicts the consultation activity spectrum that the CNSC uses to consider the relevant factors to determine appropriate consultation activities.

**Table 1: Consultation activity spectrum***

| **Potential for adverse impacts to Indigenous and/or treaty rights** <br> <——————————————————————————> | |
|---|---|
| **Weak claim** <br> **No serious adverse impacts** | **Strong claim** <br> **Potential for serious adverse impacts** |
| • provision of adequate notice <br> • disclosure of relevant information <br> • discussion of issues raised in response to notice | • exchange of information <br> • correspondence <br> • meetings <br> • site visit <br> • research <br> • studies <br> • opportunity to make submissions to the decision maker <br> • determination of accommodation, where appropriate: seek to adjust project, develop mitigating measures, consider changing proposed activity, attach terms and conditions to permit or authorization, consider rejecting a project, etc. |

* Informed by *Canada's Updated Guidelines for Federal Officials to Fulfill the Duty to Consult*, March 2011 [1].

## 3. Applicability

Licensees shall conduct a review to consider whether the activity described in their licence application requesting authorization from the Commission:

- could result in impacts to the environment
- could adversely impact an Indigenous group's potential or established Indigenous and/or treaty rights, such as the ability to hunt, trap, fish, gather or conduct cultural ceremonies

If the review identifies impacts, licensees shall submit their review to the CNSC as part of their licence application or as a project description required under federal environmental assessment legislation or other relevant statutes.

**Guidance**

Licensees are strongly encouraged to submit their review to the CNSC as early as possible, preferably when they begin early discussions with CNSC staff and prior to submitting an application. This will allow the CNSC to provide feedback and guidance if required. Early discussions with the CNSC may also help licensees and the CNSC align future Indigenous engagement and consultation activities, potentially leading to a more efficient and effective regulatory review.

The CNSC encourages licensees to continue ongoing engagement and outreach with interested Indigenous groups for activities that do not raise the duty to consult, and where appropriate accommodate, which is consistent with the requirements of REGDOC-3.2.1, *Public Information and Disclosure* [2].

## 4. Licensee Requirements and Guidance for Indigenous Engagement

When licensees determine that the activity described in their licence application requesting authorization from the Commission could adversely impact potential or established Indigenous and/or treaty rights, they shall:

1. identify and engage with potentially impacted Indigenous groups
2. submit an Indigenous engagement report
3. submit material change updates to the Indigenous engagement report
4. include a summary of Indigenous engagement activities in their Commission member document (CMD)

### 4.1 Identification and engagement

Licensees shall conduct research to identify Indigenous groups whose potential or established Indigenous and/or treaty rights may be adversely affected by the activity described in their licence application, and determine the appropriate level or scope of engagement activities to be conducted with each identified group.

**Guidance**

Key factors to consider when determining which Indigenous groups to engage include:

- historic or modern treaties in the region of the regulated facility
- potential impacts to the health and safety of the public, the environment and any potential or established Indigenous and/or treaty rights and related interests
- proximity of the regulated facility to Indigenous communities
- existing relationships between Indigenous groups and licensees or the CNSC
- traditional territories
- traditional and current use of lands
- settled or ongoing land claims
- settled or ongoing litigation related to a potentially impacted group
- membership in a broader Indigenous collective or tribal council or Indigenous umbrella group

Early engagement provides the opportunity to start or further develop relationships with Indigenous communities and can help build trust and respect. For example, it may provide Indigenous groups the necessary time to gather and share information on local and Indigenous knowledge (IK). IK may help to identify potential impacts from the activity described in the licence application on traditional land use, treaty rights, Indigenous rights, and culturally important sites, including archeological sites. Gathering of IK must be approached respectfully, in collaboration with the Indigenous group, and with the understanding that the IK may be sensitive or proprietary. IK must be understood in the context of the Indigenous group's world view.

Once contact is established with Indigenous groups, licensees should ask each group how they would like to be engaged, as preferences may vary by community.

Licensees should provide Indigenous groups with:

- preliminary information on the nature and scope of the activity described in the licence application and its potential impact on the environment and possible mitigation measures if identified
- opportunities to participate in the development, implementation and review of mitigation measures

There may also be a need to address different linguistic, cultural, geographic, capacity or informational needs and to allow for a flexible approach to engagement. The CNSC encourages the development of an engagement plan that is reasonable to both parties. When developing an Indigenous engagement plan, licensees should consider:

- scope of the consultation required with each group identified, based on the preliminary analysis and the severity of the potential adverse effects on potential or established Indigenous and/or treaty rights and related interests
- incorporation of a variety of engagement forums and techniques (e.g., letters, phone calls, face-to-face meetings, presentations, working groups)
- schedules and workloads of the Indigenous groups involved
- potential engagement protocols (either drafted by the Indigenous groups or concluded between Indigenous groups and the Crown)
- assignment of a consistent representative
- translation of information into the native languages of the Indigenous groups engaged, where appropriate
- communication with identified Indigenous groups throughout the licensing period of the regulated facility

Appendices A and B provide guidance, tools and resources to assist licensees in collecting the relevant information to identify Indigenous groups to be engaged and to prepare their approach to Indigenous engagement. CNSC staff are also available to answer questions and provide guidance.

In some instances during engagement, an Indigenous group may request an additional study that falls outside of the initial scope of the activity described in the licence application. This may include traditional land use studies or archaeological assessments. Licensees are encouraged to contact the CNSC for advice related to such requests for additional studies if they are not sure how to approach the request.

### 4.2 Indigenous engagement report

The Indigenous engagement report shall include:

1. a list of Indigenous groups identified for engagement
2. a summary of any Indigenous engagement activities conducted to date
3. a description of planned Indigenous engagement activities
4. the proposed schedule for interim reporting to the CNSC

The Indigenous engagement report shall be submitted:

1. as part of a licence application, or
2. as part of a project description required under federal environmental assessment legislation or other relevant statutes.

It is essential that licensees submit all necessary and relevant information gathered pursuant to the engagement report, as this helps the CNSC to ensure an adequate Indigenous consultation process, to determine the appropriate level of Indigenous consultation activities, and to carry out an effective and efficient EA and/or licensing review.

**Guidance**

Licensees are strongly encouraged to submit a draft Indigenous engagement report to the CNSC prior to submitting a licence application. This will allow the CNSC to answer questions and provide guidance, if it is required, for a licensee's Indigenous engagement report.

#### 4.2.1 List of identified Indigenous groups

Licensees should provide the methodology and rationale used to develop the list of identified Indigenous groups.

#### 4.2.2 Summary of Indigenous engagement activities

Licensees should document all Indigenous engagement activities to track issues and concerns raised as well as any steps taken to minimize impacts or to address issues. Examples of information to include:

- meeting details (e.g. date, attendees, and topics discussed)
- information specific to the activity described in the licence application that has been provided to Indigenous groups
- any issues that have been raised related to adverse effects on the potential or established Indigenous and/or treaty rights and related interests of the Indigenous groups
- any mitigation measures proposed by either Indigenous groups or the proponent that address potential adverse impacts on Indigenous and/or treaty rights and related interests

Licensees should have a records management process in place to record Indigenous engagement activities. Records management tools may include an engagement log that lists activities by date, time and individual/group, and an issues tracking table that identifies issues raised by groups and whether and how these have been addressed or if they remain outstanding.

Licensees are encouraged to provide relevant and necessary information on Indigenous engagement activities to the CNSC, including elements of agreements with Indigenous groups, as they relate to mitigation measures and other forms of accommodation to address adverse impacts to potential or established Indigenous and/or treaty rights and related interests.

Note that, pursuant to the *Access to Information Act* and the *Privacy Act*, the CNSC is required to release certain information when requested by interested parties. Information provided to the CNSC that is to remain confidential must be provided to the Commission Registrar, under separate cover from a project description or licence application, with a request that the information be protected pursuant to section 12(1) of the *Canadian Nuclear Safety Commission Rules of Procedure*.

#### 4.2.3 Description of planned Indigenous engagement activities

The Indigenous engagement report shall include a high-level outline of proposed engagement activities. The CNSC will take licensees' planned Indigenous engagement activities into consideration when developing its own Indigenous consultation plans. Licensees are encouraged to contact the CNSC for advice on their Indigenous engagement plan.

The CNSC may participate in licensees' Indigenous engagement activities, upon request and where appropriate. Joint licensee/CNSC activities offer Indigenous groups the opportunity to learn more about the regulated facility and the roles and responsibilities of licensees and the CNSC, and to raise questions and concerns with both parties.

#### 4.2.4 Proposed interim status reporting schedule

The licensee's proposed schedule is to provide the CNSC with an interim status report (or reports) to update the CNSC on progress against the Indigenous engagement plan.

The proposed reporting schedule should be aligned with the regulatory review process, and take into account the potential impacts to established Indigenous and/or treaty rights and related interests.

The interim status report should be in the form of a hard copy and/or electronic letter, signed by the licensee's appropriate authority for Indigenous engagement, and sent to the appropriate CNSC point of contact.

The CNSC encourages licensees to share reports with identified Indigenous groups. The CNSC will share reports submitted by the licensee with Indigenous groups upon request.

### 4.3 Material change updates to the Indigenous engagement report

Licensees shall submit material change updates to the Indigenous engagement report.

**Guidance**

During the licensee's engagement process, changes from the original Indigenous engagement report may occur and need to be reported. This may include the addition or removal of groups, identification of impacts on rights, or any other issues that could affect the licensee's planned Indigenous engagement activities and/or the CNSC's planned Indigenous consultation activities. What constitutes a material change and the timing and method for reporting (e.g., email, letter) should be formalized as part of the change management process as set out in the licensee's management system.

### 4.4 Indigenous engagement information for the Commission Member Document

Licensees shall include a summary of Indigenous engagement activities in their CMD.

**Guidance**

The Indigenous engagement section of a licensee's CMD should include:

- a list of identified Indigenous groups
- a summary of Indigenous engagement activities conducted
- a summary of potential adverse impacts on potential or established Indigenous and/or treaty rights and related interests, noting concerns that were raised
- a summary of mitigation measures or plans and proposed timing for mitigation and accommodation measures to address adverse impacts
- a summary of actions taken, or proposed actions to be taken, to address previously unidentified issues or impacts raised by the CNSC and/or others
- a summary of planned Indigenous engagement activities

Much of the information required in the Indigenous engagement section of a licensee CMD is also required in the Indigenous engagement report (see section 4.2 for related guidance).

## 5. Canadian Nuclear Safety Commission activities

After the CNSC receives the Indigenous engagement report, it will provide feedback and may request further information or seek clarification. The CNSC will also conduct its own preliminary duty to consult determination to decide if Indigenous consultation activities are required by the Crown, and the scope of those activities (if appropriate).

The CNSC's determination includes creating its own preliminary list of Indigenous groups that may have interest in the activity described in the licence application. The CNSC will share its preliminary list of identified Indigenous groups with the licensee. If the CNSC identifies additional Indigenous groups not already identified by the licensee, a coordinated approach to ongoing engagement and consultation activities will be discussed with the licensee. CNSC staff also develop Indigenous consultation processes for each licence application that offer opportunities for both CNSC staff and the identified Indigenous groups to discuss issues and to encourage Indigenous groups' participation in Commission hearings.

If the CNSC determines that Indigenous consultation activities are required, it will notify the identified Indigenous groups and provide information regarding:

- the activity described in the licence application
- the regulatory review process to be followed
- the proposed scope of Indigenous consultation activities
- CNSC contact information

As more information is gathered during the consultation process, the CNSC will review its preliminary list of Indigenous groups and Indigenous consultation plan, and adjust them accordingly. This may include changing the scope of activities as appropriate or adding newly identified Indigenous groups with interest in the activity described in the licence application. The CNSC will inform licensees if, during the EA or licensing process, it becomes aware of previously unidentified issues or impacts to potential or established Indigenous and/or treaty rights and related interests, that could also be addressed through licensee Indigenous engagement activities.

For more information on the CNSC's approach to Indigenous consultation, please refer to Appendix C and the Government of Canada's *Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* [1].

# 6. Engagement Activities After an Environmental Assessment or Licensing Decision

**Guidance**

The Commission may, at its discretion, require licensees to ensure that any adverse impacts from the activity described in the licence application are avoided, mitigated or addressed through offset measures. Licensees may be required to continue to engage Indigenous groups.

Licensees may also be required to update the CNSC about their ongoing Indigenous engagement activities; for example, the status of the implementation and effectiveness of mitigation and accommodation measures. Licensees should also update the CNSC on new issues raised by Indigenous groups with respect to an adverse impact on potential or established Indigenous and/or treaty rights and related interests, which could affect future operations of the regulated facility or a future licence application. The CNSC will advise the licensee on when and how this information is to be provided, but will use existing processes (such as those set out in REGDOC 3.2.1, *Public Information and Disclosure* [2]), regulatory oversight reports, and other reporting mechanisms as applicable.

The licensee's continued communication with the identified Indigenous groups can help build long-term relationships and trust. CNSC encourages licensees to keep the identified Indigenous groups involved by sharing information on the regulated facility's operation and updates on follow-up and/or monitoring programs.

# Appendix A: Considerations for Indigenous Engagement

Licensees may use the following questions to guide them in determining if Indigenous engagement is appropriate and – if so – with whom and to what extent. These questions should be considered in conjunction with the consultation activity spectrum (see table 1) when determining the level of engagement for the activity described in the licence application. Conducting research and collecting information to respond to these questions will guide licensees in identifying potentially impacted Indigenous groups, developing engagement plans, and organizing Indigenous engagement activities. Licensees should initiate dialogue with Indigenous groups early in the project development process and to contact the CNSC if they require clarity or have questions.

**Identifying potential adverse impacts**

- ☐ Does the activity described in the licence application have likely or potential impacts on land, water and resources? Are these changes significant?  What is the spatial extent of the potential impacts? Are there potential impacts beyond the immediate footprint of the regulated facility?
- ☐ Are there any Indigenous groups that claim traditional territory that encompasses the location of the regulated facility?
- ☐ Are there any First Nations reserve lands, treaty lands, or Indigenous communities located near the regulated facility?
- ☐ Does the activity described in the licence application involve lands or resources that are currently the subject of land claim negotiations or are part of existing comprehensive land claim agreements or self-government agreements?
- ☐ Have any environmental or other assessments of the regulated facility been carried out? Have any environmental or other assessments been undertaken for similar activities in the vicinity of the regulated facility? If so, what adverse impacts on rights and/or related interests are revealed, if any, by these assessments?
- ☐ Are there any other activities occurring in the same area? Is the activity described in the licence application likely to have any cumulative effects in combination with other activities in the same or surrounding area?

**Assessing the significance of potential adverse impacts**

- ☐ Certainty of adverse impacts – what is the likelihood that the impact will occur?
- ☐ Magnitude of the adverse impacts – what is the nature and degree of the impact?
- ☐ Duration and frequency of the adverse impacts – are the potential adverse impacts that have been identified likely to be of a temporary or permanent nature? How often will the impact occur?
- ☐ Reversibility – is the adverse impact reversible?
- ☐ Spatial extent of the adverse impacts – will these be localized in nature or broader? How does the geographic extent of the adverse impact relate to the geographic extent of the right, as practiced?

**Additional considerations**

☐ Are you aware of the nature and scope of any asserted rights and/or related interests in the area?

☐ Has the Indigenous group continually occupied the area near the regulated facility?

☐ Does the group still occupy the area? If the Indigenous group does not still occupy the area, at what period of time did they occupy it?

☐ Are there historical and/or current traditional Indigenous practices occurring in the area?

☐ What is the Indigenous perspective on the importance, uniqueness, or value of a particular use, area, activity or species?

☐ What is the Indigenous group's capacity to participate in engagement activities? (capacity can include time, financial resources, technical expertise, technology, etc.)

☐ Is the Indigenous group asserting that the claimed Indigenous rights were exercised prior to European contact (or for the Métis, prior to effective control)? Do they continue to exercise these rights today in a traditional or modernized form? What impacts to an Indigenous group's rights have occurred in the past?

☐ Are you aware of any communication from Indigenous groups who are raising concerns about the regulated facility, similar facilities, or similar adverse effects in the area?

☐ Are you aware of any past grievances or issues that an Indigenous group may have with your industry or organization? How were these grievances addressed?

☐ Have any Indigenous groups expressed concerns about the activity described in the licence application and suggested any remedial measures that may accommodate the adverse impacts on their rights and/or related interests?

☐ Could the status of land claims and self-government agreements have implications with respect to the activity described in the licence application? Does this Indigenous group have a sovereign government?

☐ Are there any cultural activities or events that may prevent many community members from participating in engagement activities?

☐ Does the Indigenous group have its own consultation protocol? Licensees may want to consider whether consultation agreements with Indigenous groups could support consultation activities. These arrangements can help to define roles and responsibilities, identify points of contact, determine timelines and steps to be followed, and sometimes address capacity needs.

☐ Has the Indigenous group been involved in recent litigation or have judgments been rendered that clarify rights of the Indigenous group?

☐ Is the Indigenous group involved in the negotiation for treaty land entitlements?

☐ Is the Indigenous group currently involved in any other consultations with industry or government?

# Appendix B: Resources

The following resources are some of the available tools that support the implementation of the CNSC's Indigenous consultation approach, and that can assist licensees in planning Indigenous engagement:

### Aboriginal and Treaty Rights Information System

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) has developed the Aboriginal and Treaty Rights Information System (ATRIS) to disseminate relevant information about Indigenous groups in Canada and the Section 35 rights those groups exercise or assert. ATRIS is a web-based tool that features an interactive map and corresponding narrative content to help users identify Indigenous communities in proximity to a given project area or whose potential or established Indigenous and/or treaty rights may intersect with a project. Officials, proponents and others seeking to inform their Indigenous consultations are encouraged to carry out their preliminary research within ATRIS. The information in ATRIS references electronic data from CIRNAC databases as well as other federal sources, and includes:

- contact details for Indigenous groups and their leadership
- multipartite agreements, historic and modern treaties and their provisions
- comprehensive and specific claims
- litigation and other assertions

### Consultation Information Service

ATRIS and its content are managed by the Consultation Information Service (CIS). Queries about ATRIS or the information within it can be sent to the CIS at aadnc.sidaitatris.aandc@canada.ca.

### Other resources

Other sources of information include:

- CIRNAC regional consultation coordinators, since they may be aware of ongoing or contemplated consultation processes and any other relevant regional information
- provincial government ministries and agencies (e.g., Indigenous Affairs, Natural Resources)
- traditional-use studies; e.g., those prepared in the context of environmental assessments and land disposal
- colleagues who have worked with local Indigenous groups or consulted with them
- websites or other sources that outline legal proceedings involving Indigenous and/or treaty rights assertions and interpretation of potential and established rights
- press coverage and public statements in which Indigenous groups have asserted rights, expressed concerns and proposed desired outcomes
- Natural Resources Canada's Canada Lands Google Earth layer (includes reserves across Canada) and Canada's Atlas of Canada – historic treaty maps
- websites of community organizations and umbrella organizations (regional organizations, provincial/territorial organizations, or tribal councils)
- maps on traditional land use
- Indigenous knowledge
- The Impact Assessment Agency website

# Appendix C: Canadian Nuclear Safety Commission (CNSC) Policy Statement: CNSC's Commitment to Indigenous Consultation and Engagement

## The CNSC's commitment and ongoing obligations

The CNSC, as an agent of the Government of Canada and as Canada's nuclear regulator, acknowledges the importance of building relationships and consulting with Indigenous peoples in Canada. The CNSC ensures that all its licensing decisions under the *Nuclear Safety and Control Act* and its environmental assessment decisions under the *Canadian Environmental Assessment Act* uphold the honour of the Crown and consider Indigenous peoples' potential or established Indigenous and/or treaty rights, pursuant to section 35 of the *Constitution Act*, *1982* (together, the Indigenous interests).

The CNSC recognizes that Indigenous peoples may have concerns about the nuclear sector; it also recognizes how important it is to seek opportunities to work together to ensure safe and effective regulation of nuclear energy and materials. The CNSC will continue to communicate objective scientific, technical and regulatory information about CNSC activities and the effects of the nuclear industry in Canada, in keeping with the objectives of the *Nuclear Safety and Control Act.*

## CNSC'S approach to Indigenous consultation and engagement

*Good governance*

The CNSC strives to meet its commitment to excellence, in part through a good governance approach to effective and well-managed Indigenous consultation and engagement processes when Indigenous rights or interests could be impacted.

*Guiding principles*

The CNSC is also mindful of its role as a statutory administrative tribunal exercising quasi-judicial powers, which imposes on it the duty to treat all participants in its proceedings fairly. When developing and implementing consultation processes, the CNSC takes into account the guiding principles that have emerged from Canada's case law and best consultation practices, as outlined in the document Aboriginal Consultation and Accommodation - Updated Guidelines for Federal Officials to Fulfill the Duty to Consult - March 2011.

The CNSC builds on the guiding principles to establish project-specific processes for Indigenous consultation and engagement:

- **that provide opportunities for CNSC staff and Indigenous peoples to meet and discuss issues and to allow for reasonable opportunities for participation** in the hearing process before the Commission, such that all evidence relevant to the Indigenous interests – including any potential impacts thereon by Indigenous peoples, CNSC staff, the licensees, the various federal, provincial and territorial departments and agencies, and other interested parties – is heard and taken into account by the Commission in relation to a project, and

- **that are as accessible as reasonably possible to Indigenous peoples** through: organized community meetings, open houses, technical workshops and/or site visits; other direct consultation with Indigenous peoples where appropriate; the CNSC's public hearings which are occasionally held in host communities with opportunities for oral or written interventions by Indigenous peoples; video-conferencing facilities (in some situations) for intervenors at hearings held in Ottawa; webcast public hearings and meetings on the CNSC website; the publication on the CNSC website of hearing transcripts, information on CNSC licensing processes, technical/safety facts and publications about the nuclear industry that the CNSC regulates; and, assurance that the licensees and proponents are assisting the CNSC in consulting and engaging with Indigenous peoples.

*Scope of consultations*

The consultation and engagement activities for a given project may vary with the circumstances. For example, CNSC staff may work more closely with Indigenous peoples prior to a Commission hearing where the possibility of more serious potential adverse effects on Indigenous interests arises from a CNSC licensing decision. Indigenous peoples are encouraged to raise their concerns before the Commission.

*Accommodation measures*

The CNSC recognizes that as an effect of good-faith consultation, accommodation measures may need to be established to prevent or minimize the impacts that activities involving nuclear substances have on Indigenous interests. Accommodation will likely flow through licensing requirements on licensees subject to the CNSC's authority. Any such potential accommodation must be made within the statutory mandate of the CNSC, keeping in mind that the CNSC has a broad mandate that allows for the protection of the environment and of the health, safety and security of Canadians, and keeping in mind that there are opportunities for mitigating potential impacts on rights through the licensing processes.

*Coordinated approaches*

Insofar as its statutory functions allow, the CNSC supports a whole-of-government approach to Indigenous consultation and engagement, with a goal of coordinating consultative efforts, where feasible, with other federal, provincial and/or territorial regulatory departments and agencies, through a one-window approach for environmental assessment and licensing activities.

*Assistance of licensee to CNSC Indigenous consultation activities*

While licence applicants and existing licensees of nuclear projects do not bear the Crown's legal obligation to consult Indigenous peoples under section 35 of the *Constitution Act, 1982,* as proponents of a project that will need to be regulated by CNSC, their role to engage Indigenous peoples is important to the efficacy of the Commission's decision-making. Therefore, licensees' consultation activities are important and can inform and assist CNSC staff's consultation activities. The outcome of all such activities, including any accommodation measures proposed by the licensee, will also form part of the evidence presented by licensees for consideration by the Commission.

*Participation of Indigenous peoples*

The CNSC encourages Indigenous peoples to outline the nature and scope of their Indigenous interests that they feel may be affected by a proposed project or activity regulated by the CNSC. It also encourages them to bring forward outstanding issues and concerns throughout the regulatory process.

*Capacity*

In 2011, the CNSC established a participant funding program to ensure the timely and meaningful engagement of the public, stakeholders and Indigenous peoples in CNSC regulatory processes. The CNSC, as an independent regulator, has highly trained scientific and technical staff available to meet with Indigenous peoples to discuss regulatory or technical issues and to answer questions.

# Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

# References

1. Government of Canada, *Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult*, March 2011.

2. CNSC, REGDOC 3.2.1, *Public Information and Disclosure*, May 2018.

3. *Haida Nation v. British Columbia (Minister of Forests)*, [2004] 3 S.C.R. 511, 2004 SCC 73.

4. *Taku River Tlingit First Nation v. British Columbia (Project Assessment Director)*, [2004] 3 S.C.R. 550, 2004 SCC 74.

5. *Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage)*, [2005] 3 S.C.R. 388, 2005 SCC 69.

6. *Rio Tinto Alcan Inc. v. Carrier Sekani Tribal Council*, [2010] 2 S.C.R. 650, 2010 SCC 43.

7. *Tsilhqot'in Nation v. British Columbia,* 2014 SCC 44, [2014] 2 S.C.R. 256, 2014 SCC 44.

# Additional Information

The following documents and links provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- Canadian Environmental Assessment Agency, *Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act – Interim Principles*.
- Canadian Nuclear Safety Commission Participant Funding Program.
- CNSC, REGDOC-3.4.1, *Guide for Applicants and Intervenors Writing CNSC Commission Member Documents*, March 2017.
- Fond du Lac Denesuline First Nation v. Canada (Attorney General), [2012]. Federal Court of Appeal Decisions, 2012 FCA 73.
- Mackenzie Valley Environmental Impact Review Board, *Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment*, July 2005.
- Major Projects Management Office, *Early Aboriginal Engagement: A Guide for Proponents of Major Resource Projects*.

# CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

CNSC regulatory documents are classified under the following categories and series:

**1.0 Regulated facilities and activities**

Series 1.1 Reactor facilities
1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

**2.0 Safety and control areas**

Series 2.1 Management system
2.2 Human performance management
2.3 Operating performance
2.4 Safety analysis
2.5 Physical design
2.6 Fitness for service
2.7 Radiation protection
2.8 Conventional health and safety
2.9 Environmental protection
2.10 Emergency management and fire protection
2.11 Waste management
2.12 Security
2.13 Safeguards and non-proliferation
2.14 Packaging and transport

**3.0 Other regulatory areas**

Series 3.1 Reporting requirements
3.2 Public and Indigenous engagement
3.3 Financial guarantees
3.4 Commission proceedings
3.5 CNSC processes and practices
3.6 Glossary of CNSC terminology

**Note:** The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. Visit the CNSC's website for the latest list of regulatory documents.

# 13 REGDOC 3.2.1 Public Information and Disclosure

Canada's Nuclear Regulator

Public and Aboriginal Engagement

# Public Information and Disclosure

REGDOC-3.2.1

May 2018

Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

Canada

**Public Information and Disclosure**
Regulatory document REGDOC-3.2.1


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## Document availability

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# Preface

This regulatory document is part of the CNSC's Public and Aboriginal Engagement series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

As defined under subsection 9(b) of the *Nuclear Safety and Control Act*, the Commission has a mandate to disseminate objective scientific, technical and regulatory information to the public concerning nuclear activities.

To improve the level of understanding by the public of information about proposed or licensed nuclear facilities and activities, licensees and licence applicants are required to develop and implement a public information program that includes a disclosure protocol. Through an effective public information program, a licensee or licence applicant establishes an atmosphere of openness, transparency and trust. Licensees and licence applicants are encouraged to adopt the most appropriate and effective means of communication. Each public information program and its disclosure protocol should be designed to address the information needs of its target audience. This document clarifies the requirements of public information that, in turn, strengthens the public disclosure component.

REGDOC-3.2.1 is also intended to assist CNSC staff in assessing documentation submitted as part of an application for a new CNSC licence, a licence renewal or compliance verification.

REGDOC-3.2.1 supersedes RD/GD-99.3, *Public Information and Disclosure*, published in 2012.

**Important note:** Where referenced in a licence either directly or indirectly (such as through licensee-referenced documents), this document is part of the licensing basis for a regulated facility or activity.

The licensing basis sets the boundary conditions for acceptable performance at a regulated facility or activity, and establishes the basis for the CNSC's compliance program for that regulated facility or activity.

Where this document is part of the licensing basis, the word "shall" is used to express a requirement to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

# Table of Contents

# Public Information and Disclosure

## 1. Introduction

### 1.1 Purpose

The purpose of this document is to set out the regulatory requirements of the Canadian Nuclear Safety Commission (CNSC) for public information and disclosure, for licensees and applicants. A program for public information includes a public disclosure protocol regarding events and developments involving their facilities and/or activities. This document also provides guidance on the development and implementation of CNSC requirements for public information programs and disclosure protocols.

This document is also intended to assist CNSC staff in assessing the public information program and its disclosure protocol for a new CNSC licence, a licence renewal or continuing compliance verification.

### 1.2 Scope

This regulatory document applies to all uranium mines and mills and Class I nuclear facilities. It also applies to a Class II facility that is required to develop and implement a public information and disclosure program as a condition of its licence.

This document defines the CNSC's requirements for public information programs and disclosure protocols and related documentation as they relate to licensed activities. This document provides guidance on how licensees and licence applicants can meet the regulatory requirements by providing explanatory information, process and procedural guidance, and examples of good practices currently in use in the nuclear sector.

### 1.3 Relevant legislation

A public information program that includes a disclosure protocol is a regulatory requirement for licence applicants and licensed operators of Class I and Class II nuclear facilities, and uranium mines and mills. The requirements for public information programs and disclosure protocols are derived from the stated objectives of the Commission in the *Nuclear Safety and Control Act* (NSCA). The relevant provisions are as follows:

- subsection 9(b) of the NSCA: "The objectives of the Commission are (a)… and (b) to disseminate objective scientific, technical and regulatory information to the public concerning the activities of the Commission and the effects, on the environment and on the health and safety of persons, of the development, production, possession and use referred to in paragraph (*a*)."
- paragraph 3(j) of the *Class I Nuclear Facilities Regulations*: "…the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed."
- paragraph 3(r) of the *Class II Nuclear Facilities and Prescribed Equipment Regulations*: "…the program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the nuclear facility."

- sub-paragraph 3(c)(i) and paragraph 8(a) of the *Uranium Mines and Mills Regulations*: "…the program to inform persons living in the vicinity of the mine or mill of the general nature and characteristics of the anticipated effects of the activity to be licensed on the environment and the health and safety of persons" and "…the program to inform persons living in the vicinity of the site of the mine or mill of the general nature and characteristics of the anticipated effects of the abandonment on the environment and the health and safety of persons."

# 2. Public Information Program

## 2.1 Overview

Licensees and licence applicants of uranium mines and mills, Class I and applicable Class II nuclear facilities shall develop and implement a public information program that includes a disclosure protocol.

The primary goal of the public information program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public. As a component, where the public has indicated an interest to know, the program shall include a commitment to and protocol for ongoing, timely communication of information related to the licensed facility during the course of the licence period.

In the case of licence renewals, licensees and applicants shall describe how the public information program and its disclosure protocol builds upon past activities and how the program will be updated to address the communication needs of their target audiences during upcoming licensing periods.

The public information program and its disclosure protocol shall be commensurate with the public's perception of risk and the level of public interest in the licensed activities, which may be influenced by the complexity of the nuclear facility's lifecycle and activities, and the risks to public health and safety and the environment perceived to be associated with the facility and activities.

The public information program and its disclosure protocol shall be managed to ensure that it continues to meet its objectives.

The public information program and disclosure protocol should be developed taking into consideration:

- the type of facility and activities being regulated
- the risks to public health, safety and security, and the environment posed by the facility or activity
- the level of public interest or concern

The program should be detailed enough to ensure that target audiences affected by and interested in the licensed facilities and activities are informed on a timely basis about operations, activities, and anticipated effects on the environment and the health and safety of persons.

Where the licensee or licence applicant has established that the target audience does not wish to receive any information about the activities licensed by the CNSC, the public information program and its component disclosure protocol could be limited to a statement of these facts.

Licensed organizations that have existing public information programs that address other corporate needs are encouraged to use this infrastructure to meet the requirements in this document.

The public information program and disclosure protocol should be managed to ensure that it continues to meet its corporate, policy, social and legal objectives. Where a licensee has a management system, the program should be managed as part of that system.

## 2.2 Program elements

The proposed public information program and its disclosure protocol shall include the following elements.

### 2.2.1 Objectives

The public information program shall define measurable objectives, explained within the context of overall corporate objectives.

Licensees and licence applicants should establish the objectives of the public information program and disclosure protocol in broad terms. Objectives should be measurable and are often best explained within the context of an overall corporate objective. For example, a corporate vision, mandate or mission statement, or a specific communications policy may help describe the objectives of the public information program and disclosure protocol.

### 2.2.2 Target audience(s)

The public information program shall define the target audiences, and the rationale utilized for their inclusion. The program shall also document the rationale for exclusion of public sectors who explicitly have expressed interest in becoming part of the target audience.

Licensees and licence applicants should clearly define the target audiences for the public information program. Target audiences include the general population of the local community and other communities impacted by the licensee’s nuclear facility and related activities. This should include key opinion and political leaders, community and media groups, interveners, and Aboriginal groups. The size and variety of these audiences depends on the type and location of the facility and activities, and the geographic vicinity of the community population.

While those persons who live in close proximity to a nuclear facility usually comprise the primary target audience, the CNSC encourages licensees and licence applicants to employ a broad and inclusive interpretation of “persons living in the vicinity” to ensure that information reaches as many interested parties as possible. For example, although they are not permanent residents of the community, faculty members and students living and working on a campus with a research reactor would be a potential target audience for information about the anticipated effects of a licensed activity.

### 2.2.3 Public and media opinion

The public information program shall identify and describe community and public views, opinions and concerns in relation to the licensed activities and the means utilized to obtain them.

This information can be obtained by licensees and licence applicants through public opinion polling, surveys or analysis of media coverage. In addition, letters from the public or stakeholders received directly by licensees and licence applicants may also identify community and stakeholder perceptions and opinions.

The media may reflect and influence public opinion. Therefore, the media analysis should describe the amount and nature of media coverage related to the facility or activity, and the media involved (e.g., television, print, blogs and other social media). In addition, the support or concern that has been expressed with relation to the licence application, licensed facility or activities should be described.

Once the concerns have been identified, only those concerns related to the CNSC-licensed activities should be considered. For example, layoffs in office staff or parking details may very well be of interest to the target audience, but are not related to the CNSC licensed activities - therefore, these would not be part of the public information program and disclosure protocol.

Efforts taken by licensees and licence applicants to obtain public and media views should be commensurate with the complexity of:

- the level of public interest they generate
- the design, construction and operation of the nuclear facility and activities being licensed
- the risks to the health and safety of persons and the environment associated with the facility and activities

The views of the public and media regarding the facility and related activities are likely to influence the communications tools and information utilized by licensees to deliver an effective public information program and disclosure protocol.

### 2.2.4 Public information strategy and products

The public information program shall provide open and transparent means and access for the public to obtain desired operational, environmental and safety information about the licensed facility or activities. As part of this program, if a licensee is required to conduct an environmental risk assessment (ERA) and/or a probabilistic safety assessment (PSA), the ERA and a summary of the PSA must be posted on the licensee’s website.

The public information strategy and related products should include the following:

- information products that will be developed
- samples of the information products (if available)
- methods used to distribute the information
- how the information will address the perceived risk to health, safety and the environment of the licensed activity
- how specific target audiences will be reached
- how licensees and licence applicants will respond to and record comments, questions or concerns expressed by the target audiences
- timelines for releasing information, in accordance with the public disclosure protocol

Information related to the public information program and disclosure protocol of the licensee or applicant should be readily accessible to the target audiences. In developing the program's communication strategies and products, licensees and licence applicants may consider the following methods to ensure that the message is received by the public as intended:

- communicating information using modern electronic means, such as the Internet or social media, where possible, but also using printed material where necessary or applicable
- employing multiple communications vehicles to enhance public understanding of the information, such as a Web site, social networking, press releases, internal newsletters/intranets, posters or other print material (where applicable, the preferred option is to post the information on the licensee's and licence applicant's Web site)
- ensuring information is presented in a manner that is understandable to the public, preferably using plain, non-technical language (e.g., radiation exposure relative to natural background levels or single chest X-ray exposure)
- providing the public with easy access to licensee and licence applicant contact names so they can communicate verbally, electronically or in writing for additional information

### 2.2.5 Public disclosure protocol

The public information program shall include a public disclosure protocol describing the information and the medium of disclosure in regard to information and reports of interest to the public. Items of interest to the public may include routine and non-routine situations, events and activities.

Additional information on reporting under the public disclosure protocol is provided in section 2.3

### 2.2.6 Program evaluation and improvement process

The public information program shall include a process for evaluating its performance and for developing and implementing measures to improve effectiveness.

The program evaluation and improvement process should describe the proposed method and the timelines for:

- evaluating the performance of the public information program and disclosure protocol in meeting the stated objectives
- the measures implemented or planned to improve its effectiveness

The evaluation method may include, but is not limited to, surveys of the surrounding communities to gauge changes in public interest in and perceptions of the facility or activities or satisfaction with the information provided. This may include Web site traffic trending, frequency of Web site hits, benchmarking against similar licensees and licence applicants, and volume trending of calls, emails and letters.

Samples of information materials produced and disseminated, with a detailed description of public information and disclosure activities undertaken, should be provided to the CNSC when reporting on public information and disclosure activities. These samples are essential components of program reviews, improvement planning and compliance verification.

### 2.2.7 Contact information

The public information program shall define and provide contact information for the person(s) responsible for the program and its disclosure protocol.

## 2.3 Public disclosure protocol

An important element of a public information program is the public disclosure protocol, which is identified in section 2.2.5 above.

### 2.3.1 Requirements of a public disclosure protocol

Licensees and licence applicants shall have an established public disclosure protocol to address their target audiences' information interests in relation to the licensed activities.

The public disclosure protocol is an integral part of the public information program. Licensees and licence applicants shall describe:

- the type of information or reports to be made public
- the criteria for determining when such information and reports are to be published
- the medium of disclosure for such information and reports

Licensees and licence applicants shall consult with public stakeholders and interest groups with a primary focus on the local community to determine what types of information would be of public interest. Typical examples of such types of information can be found in section 2.3.2.

Where the licensee or licence applicant has established that the target audience does not wish to receive any information about the activities licensed by the CNSC, the public information program and its component disclosure protocol could be limited to a statement of these facts.

The public disclosure protocol shall be made available to the public and preferably, where practicable, shall be posted on the licensee's and licence applicant's Web site.

Licensees and licence applicants shall send revisions of their public disclosure protocol to the CNSC indicating feedback received from members of the public, the changes and the reasons for the changes to the protocol.

As a minimum, the protocol shall contain instructions, criteria and requirements with respect to the timely disclosure of information known to be of interest to the target audience.

### 2.3.2 Guidance for a public disclosure protocol

Licensees and licence applicants should strive to be open and transparent in their relations with community representatives, target audiences and the public. They should seek to gain an understanding of what information the public wishes to know.

In developing the protocol, licensees and licence applicants should adhere to the communication strategies and products documented in their public information programs.

Depending on the type of facilities/activities and interests of the target audience, the information to be disclosed may, for example, include (but is not limited to):

- significant operational developments such as labour disputes and expansion or changes in facility design or operation
- events with offsite effects or which could result in public interest and concern or media attention
- fires
- impact of natural events such as earthquakes, floods, lightning
- serious vehicle or industrial accidents
- planned and unplanned significant interruptions of facility operations, such as disruption of isotope production.
- routine and non-routine releases of radiological and hazardous materials to the environment
- unplanned events, including those exceeding regulatory limits
- environmental monitoring reports

Licensees should ensure that the public disclosure protocol does not prescribe the release of sensitive information, such as security-related information and trade secrets or scientific, technical, commercial, financial or labour relations information.

The information to be provided to the target audience should be linked to the public's perception of risk as it relates to nuclear safety and to the CNSC's mandate which is "to protect the health, safety and security of persons and the environment; and to respect Canada's international commitments on the peaceful use of nuclear energy."

### 2.3.3 Public disclosure notification

It is CNSC policy to promote open and transparent public relationships between licensees and applicants and their target audiences and to assist in the broader dissemination of information to the general public where appropriate.

Licensees and applicants shall inform the CNSC of disclosures made under the public disclosure protocol described in section 2.3.1 at the time of, or before, such disclosure.

Copies of public information disclosed that are sent to the CNSC should be sent to the appropriate point of contact with the subject title: PUBLIC DISCLOSURE – [facility name, date of disclosure].

## 2.4 Documentation and records

Documents and records provide an organization with a means to manage and meet its corporate, business, social, legal, regulatory, and other objectives and requirements.

Licensees and licence applicants shall maintain documents and records of their public information program and disclosure protocol. The documents and records shall demonstrate that the implementation of the program is adequate.

Documents and records describing the public information program and its disclosure protocol should be maintained for continuing management controls, independent review, submission with a licence application, and for subsequent compliance verification by the CNSC.

Documents and records on public information and disclosure activities should be readily available upon request.

# Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* (NSCA) and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

# CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the Canadian Nuclear Safety Commission (CNSC). In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

Effective April 2013, the CNSC's catalogue of existing and planned regulatory documents has been organized under three key categories and twenty-five series, as set out below. Regulatory documents produced by the CNSC fall under one of the following series:

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1.2 Class IB facilities
1.3 Uranium mines and mills
1.4 Class II facilities
1.5 Certification of prescribed equipment
1.6 Nuclear substances and radiation devices

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2.6 Fitness for service
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**Note:** The regulatory document series may be adjusted periodically by the CNSC. Each regulatory document series listed above may contain multiple regulatory documents. For the latest list of regulatory documents, visit the CNSC's website.

# 14 REGDOC 3.3.1 Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

Canada's Nuclear Regulator

Financial Guarantees

# Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

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Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

**Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities**
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## Document availability

This document can be viewed on the CNSC website. To request a copy of the document in English or French, please contact:

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# Preface

This regulatory document is part of the CNSC's financial guarantees series of regulatory documents. The full list of regulatory document series is included at the end of this document and can also be found on the CNSC's website.

Regulatory document REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*, sets out requirements and guidance for applicants and licensees regarding the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the Canadian Nuclear Safety Commission.

REGDOC-3.3.1 provides information on financial guarantees used to ensure a licensee will have sufficient funds to decommission a licensed location and dispose of any associated nuclear substances. The document is intended to form part of the licensing basis for a regulated facility or activity within the scope of the document. It is intended for inclusion in licences as either part of the conditions and safety and control measures in a licence, or as part of the safety and control measures to be described in a licence application and the documents needed to support that application.

This document supersedes G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*, published in June 2000. For information on the implementation of regulatory documents in the licensing basis and on the graded approach, see REGDOC-3.5.3, *Regulatory Fundamentals*.

The words "shall" and "must" are used to express requirements to be satisfied by the licensee or licence applicant. "Should" is used to express guidance or that which is advised. "May" is used to express an option or that which is advised or permissible within the limits of this regulatory document. "Can" is used to express possibility or capability.

Nothing contained in this document is to be construed as relieving any licensee from any other pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

# Table of Contents

# Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities

## 1. Introduction

### 1.1 Purpose

Financial guarantees for decommissioning of nuclear facilities and termination of licensed activities are implemented in accordance with the *Nuclear Safety and Control Act* (NSCA) and the regulations made under the NSCA.

Applicants and licensees are required to make adequate provision for the safe decommissioning of existing or proposed new nuclear facilities by ensuring that sufficient financial resources are available to fund all approved decommissioning activities should the licensee not be able to fulfill its obligations. Operationally, the Commission may also require that financial resources be available for termination of licensed activities other than for decommissioning of nuclear facilities.

This document provides requirements and guidance to applicants and licensees regarding the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the Canadian Nuclear Safety Commission (CNSC).

### 1.2 Scope

This document presents information for those who have incurred, or expect to incur, obligations with respect to the decommissioning of nuclear facilities or the termination of activities licensed by the CNSC.

Part I of this document pertains to financial guarantees for decommissioning of nuclear facilities or activities for Class IA and IB licences issued in accordance with the *Class I Nuclear Facilities Regulations*, uranium mines and mills licences and waste nuclear substances licences.

Part II of this document pertains to financial guarantees for the termination of licensed activities, such as for nuclear substances and radiation devices, prescribed equipment, and Class II facilities.

### 1.3 Relevant legislation

The provisions of the *Nuclear Safety and Control Act* and regulations that are relevant to this regulatory document include:

- *Nuclear Safety and Control Act*, subsection 24(5)
- *General Nuclear Safety and Control Regulations*, paragraph 3(1)(l)
- *General Nuclear Safety and Control Regulations*, subparagraph 29(1)(j)(i) to 29(1)(j)(x)
- *General Nuclear Safety and Control Regulations* subsection 29(2)

## 2. Background

The CNSC's mandate is to regulate the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public.

The CNSC defines decommissioning as the administrative and technical decommissioning actions taken to allow the removal of some or all of the regulatory controls from a facility or location where nuclear substances are managed, possessed or stored. Decommissioning actions are the procedures, processes and work activities that lead to the release of a facility or location from regulatory control, with or without restrictions on its future use (for example, decontamination and/or dismantling of structures, systems and components).

Financial guarantees are a tangible commitment by a licence applicant or a licensee that there will be sufficient resources to safely terminate licensed activities. A financial guarantee does not relieve applicants or licensees from complying with regulatory requirements for decommissioning of nuclear facilities or termination of licensed activities – the financial guarantee ensures that there are funds available to the CNSC if applicants or licensees are unable to carry out safe decommissioning or termination of activities.

Financial obligations are intended to ensure:

- funding is available to make adequate provision for the health and safety of current and future generations
- the applicants and licensees establish adequate funds to pay for the decommissioning and termination of their licensed activities

Financial guarantees must be sufficient to cover the cost of decommissioning of nuclear facilities or termination of licensed activities authorized by the current licence.

The types of instruments for financial guarantees can vary. The applicants and the licensees should select an instrument that suits the scope and the timeframe of their decommissioning plan.

The requirements and guidance for decommissioning planning are provided in REGDOC-2.11.2, *Decommissioning* [1] and CSA standard N294-19, *Decommissioning of Facilities Containing Nuclear Substances* [2].

A graded approach may be applied by the CNSC when assessing the financial guarantees. The assessment could take into consideration the facility lifecycle stage, the type and complexity of the activity, and the level of detail provided in the decommissioning plan, which should be consistent with the magnitude of risk arising from the facility's decommissioning.

## 3. Acceptance Criteria for Financial Guarantees

The following are the CNSC's general expectations for criteria of liquidity, certainty of value, adequacy of value and continuity. An applicant or licensee may propose alternative approaches to meet the intent of the acceptance criteria for financial guarantees. In all cases the financial guarantees must be accepted by the Commission or, where a designated officer has issued a licence, by the designated officer.

### 3.1 Liquidity

The proposed financial guarantee must be established so that the only requirement for drawing upon it is a formal request or demand by the Commission or a person authorized by the Commission and so that payout for decommissioning purposes is not prevented, unduly delayed or compromised for any reason.

### 3.2 Certainty of value

Applicants or licensees must select funding or security instruments or arrangements which provide full assurance of their value.

### 3.3 Adequacy of value

The value of the financial guarantees for nuclear facilities must be linked to the cost estimate set out in the most recent decommissioning plan for nuclear facilities or activities authorized under Class I uranium mines and mills licences and waste nuclear substances licences.

Financial guarantees for other licensed activities, addressed in Part II of this document, must be linked to the licence for nuclear substances and radiation devices, prescribed equipment and Class II facilities.

### 3.4 Continuity

The financial guarantees required for decommissioning and termination of licenced activities must be maintained on a continuing basis. This may require periodic renewals, revisions or replacements of securities provided or issued for fixed terms. In order to ensure continuity of coverage, financial guarantees must include provisions for advance notice to the CNSC of termination or the intent to not renew. See section 5 for additional information.

## 4. Acceptable Financial Guarantee Instruments

The following sections provide examples of acceptable financial guarantee instruments. In all cases the financial guarantee instruments must be accepted by the Commission, or where a designated officer has issued a licence, by the designated officer.

### 4.1 Cash funds

Cash funds include cash as well as other equivalent securities such as certified cheques, bearer bonds and guaranteed investment certificates.

These instruments can provide certainty and adequacy of value, ease of liquidity, and continuity. Such instruments provide maximum protection against the risk of default.

Any cash collateral or direct funding should be made into an account which is controlled by the federal government (either the CNSC or the Receiver General for Canada) or by a Canadian chartered bank listed in Schedule I or II of the *Bank Act*.

### 4.2 Investment funds

Investment funds are financial instruments that are publicly traded or can be easily liquidated if required.

Funds earmarked for financial guarantees purposes may be invested in an investment portfolio in order to earn interest income to help to cover the costs of decommissioning.

When investment funds are used, there are several economic estimates that must be made including the rate of inflation over time, and the estimated rate of return of the portfolio. Information on planned disbursements should be included in order for the CNSC to review the financial guarantee to ensure it is sufficient to cover costs of decommissioning.

### 4.3 Letters of credit

A letter of credit is an agreement between a licensee or applicant and a financial institution.

A letter of credit can provide for specific sums of money to be paid on demand to designated parties or their agents should a triggering event occur, such as a licensee defaulting on its obligation to decommission. Letters of credit can provide certainty of value, can be easily liquidated, and may be rewritten or revised as the required amount of security changes. Appendix A provides an example of a letter of credit.

Letters of credit should be issued by a Canadian chartered bank listed in Schedule I or II of the *Bank Act*.

### 4.4 Surety bonds

Surety bonds include bid bonds, performance bonds, labour and material payment bonds and maintenance bonds. Surety bonds are widely used in the construction industry.

Variations of these bond types may be appropriate as primary security, or to complement other instruments.

For example, under the terms of a performance bond agreement, a surety company could commit to responsibility for all claims and expenses for decommissioning up to a specified limit. Another form of financial guarantee will be required where the estimated cost of the decommissioning exceeds the value of the surety bond.

Surety bonds should name the CNSC as a beneficiary and the insurance or bonding agents should be Canadian companies subject to Canadian regulatory oversight.

### 4.5 Insurance

Insurance policies may be acceptable financial guarantee instruments provided the insurance policy is developed and accepted by the CNSC. Insurance policies should name the CNSC as a beneficiary, and the insurance agents should be Canadian companies subject to Canadian regulatory oversight.

### 4.6 Expressed commitments from Canadian government entities

An expressed commitment from a Canadian federal, provincial or territorial government, may be an acceptable financial guarantee instrument to cover all aspects of decommissioning a facility or site for which the government has assumed liability.

Expressed commitments from a Canadian provincial or territorial government are restricted to guarantees that the federal government has the right to offset through transfer payments as a method of enforcing the guarantee, if necessary. Universities and hospitals may also use expressed commitments as a financial guarantee instrument. In such a case, universities and hospitals must maintain a letter of commitment acknowledging the responsibility and liability for the decommissioning of the site. The letter of commitment must be signed by a person of authority at the institution[1].

Institutions that operate research reactors, such as SLOWPOKE reactors, should maintain sufficient financial guarantees in a form other than expressed commitments to bring the facility to a safe state, including removal of fuel and radioactive and hazardous materials from the site. The remaining cost for completing the decommissioning of the facility may be covered by a letter of commitment acknowledging the responsibility and liability of decommissioning. The letter of commitment must be signed by a person of authority at the institution.

### 4.7 Other types of instruments

Other types of financial guarantee instruments may be considered by the Commission as part of the licensing or renewal process. In all cases, the financial guarantee instrument must satisfy the general acceptance criteria listed in section 3. Since parent company guarantees and pledges of assets do not satisfy the acceptance criteria listed in section 3, they are not considered acceptable financial guarantee instruments.

## 5. Administration of Financial Guarantees

Financial guarantees are administered by clearly defined and legally enforceable arrangements acceptable to the CNSC. These arrangements must be structured to ensure that the financial guarantee provided by the applicant or the licensee includes the terms outlined in the following subsections:

### 5.1 Access to funds upon demand

The CNSC must be assured that it can, upon demand, access or direct adequate funds if a licensee is not available to fulfill its obligations for decommissioning. The funds must be structured such that the instrument can be drawn upon only with the prior acceptance of the CNSC and that such pay-out is not prevented, delayed or compromised, and must be structured such that the instrument can provide full assurance of value.

Where the province has a legislative framework in place, as the province of Saskatchewan does for uranium mines, the financial guarantee may be payable to a provincial entity qualified to decommission the mine, if this arrangement is approved by the Commission.

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[1] Examples of a person of authority include the president or chief financial officer of the organization.

The provincial entity is also responsible for the following institutional control program, as legislated by the province.

### 5.2 Separation of financial guarantee from licensee's other assets

The financial guarantee arrangements must be structured to ensure that the funds provided by the applicant or licensee to guarantee funding for an approved decommissioning plan are separated from its other assets. This might require the inclusion of terms restricting access to, or use of, monies realized from the funds.

Withdrawals from a fund, or access to monies realized from other security vehicles must only be permitted for approved purposes; in particular, to pay for approved decommissioning activities, or to refund excess monies to the licensee.

### 5.3 Maintenance on a continuous basis

Financial guarantee instruments must be automatically renewed and must include provisions for advance notice to the CNSC of termination or the intent to not renew.

Financial guarantee instruments should be open-ended, or if written for a specified term, must be renewed automatically unless 30 days or more prior to the renewal date the issuer notifies the CNSC (as the beneficiary) and the licensee of any intention not to renew.

### 5.4 Replacement of financial guarantee

If the licensee fails to provide a replacement acceptable to the CNSC within 10 days after receipt of notification of cancellation, the terms of arrangement should further provide that the full face value of the instrument may automatically be paid into an account which is controlled by the federal government (either the CNSC or the Receiver General for Canada) or by a Canadian chartered bank listed in Schedule I or II of the *Bank Act* prior to expiration, without proof of forfeiture required. The value of the instrument must be payable, for purposes of funding decommissioning or termination of activities.

### 5.5 Signing officers

Applicants or licensees must provide, and continually update as required, a list of signing officers who have the requisite corporate or governmental authority to bind the corporation or the government as applicable.

## 6. Reporting requirements

Licensees are required to report annually on the status and the validity of their financial guarantee. Licensees must indicate if their financial guarantee remains valid, in effect and sufficient to meet decommissioning needs according to the current decommissioning plan associated with the cost estimate used to establish the amount of the financial guarantee.

The expectations for reporting on financial guarantees are specified in the licence conditions handbook and in REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills* [3], and REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices* [4].

# Part I: Financial Guarantees for the Decommissioning of Nuclear Facilities and Activities

## 7. Introduction

### 7.1 Scope

Part I of this document provides information to applicants and licensees with regard to the CNSC's requirements and guidance for establishing financial guarantees for decommissioning of licensed facilities and activities for Class IA and IB licences issued in accordance with the *Class I Nuclear Facilities Regulations*, uranium mine and mill licences, and waste nuclear substances licences.

### 7.2 Background

The *Nuclear Safety and Control Act* (NSCA) and associated regulations require applicants and licensees to make adequate provision for the safe operation and decommissioning of existing or proposed operations.

In addition, a licence may contain conditions requiring licensees to have acceptable decommissioning plans in place, and an acceptable financial guarantee that must remain valid, in effect and sufficient to meet decommissioning needs according to the most up-to-date decommissioning plan.

## 8. Planning for Decommissioning

Planning for the decommissioning of a facility or activity is an integral part of the lifecycle planning. The lifecycle stages of a facility include siting, construction (including design), operation and decommissioning. Planning for decommissioning is an ongoing process and should be considered at each lifecycle stage of the facility.

Requirements and guidance for decommissioning planning for CNSC-regulated activities and facilities are provided in REGDOC-2.11.2, *Decommissioning* [1], and CSA standard N294-19, *Decommissioning of facilities containing nuclear substances* [2]. Decommissioning plans can vary in complexity and detail in accordance with specific circumstances but must be sufficiently detailed to enable credible estimates of the amount of financial guarantees.

## 9. Cost Estimates for Decommissioning

The cost estimate for decommissioning should be based on the most up-to-date decommissioning plan and should reflect the assumed decommissioning strategy and end state of the facility or activity.

The decommissioning cost estimates may vary depending on the stage in the lifecycle. In the case of estimates undertaken at the conceptual design stage of a project, the purpose is to:

- enable designers and client organizations to establish overall project costs
- inform the long-term financing process to provide for future funds when a facility will be decommissioned

Later, when the decommissioning project planning has advanced as a facility or activity nears the end of its period of operation, the cost estimate forms part of the basis for the detailed decommissioning planning.

Various approaches to determine the level of cost estimate accuracy exist. Organizations such as the Association for Advancement of Cost Engineering (AACE International) have guidelines for estimating cost for different industries [5]. Guidance establishing the cost estimate level of accuracy is provided in Appendix B.

## 10. Requirements for Costs to Be Included

Cost estimates must include all decommissioning activities from operations, during shutdown to the final release from regulatory control. The cost estimate for decommissioning must address the cost of the following principal activities, if applicable:

- preparation for final shutdown
- facility shutdown activities
- additional activities for safe enclosure (if applicable)
- decontamination and dismantling activities
- waste processing and storage, including used fuel
- project management, engineering and site support
- site clean-up, landscaping and restoration (if required)
- long-term management, including disposal of radioactive waste and used fuel (if applicable)
- long-term monitoring and maintenance of the site and institutional control (if applicable)
- miscellaneous expenditures

The applicant or licensee must estimate the cost for all activities included in their decommissioning plan.

## 11. Cost Categories

Four cost categories should be defined for each principal activity:

- labour cost: payments to employees including social and health benefits
- investment cost: capital/equipment/material cost
- expenses: consumables, taxes, insurance, etc.
- contingencies: a specific provision for unforeseeable elements of cost within the defined project scope

The applicant or the licensee should reflect local construction rates for labour, and provide conservative estimates for materials, equipment and administrative expenses.

An example of standardized definitions for cost categories for all major activities is presented in Appendix C.

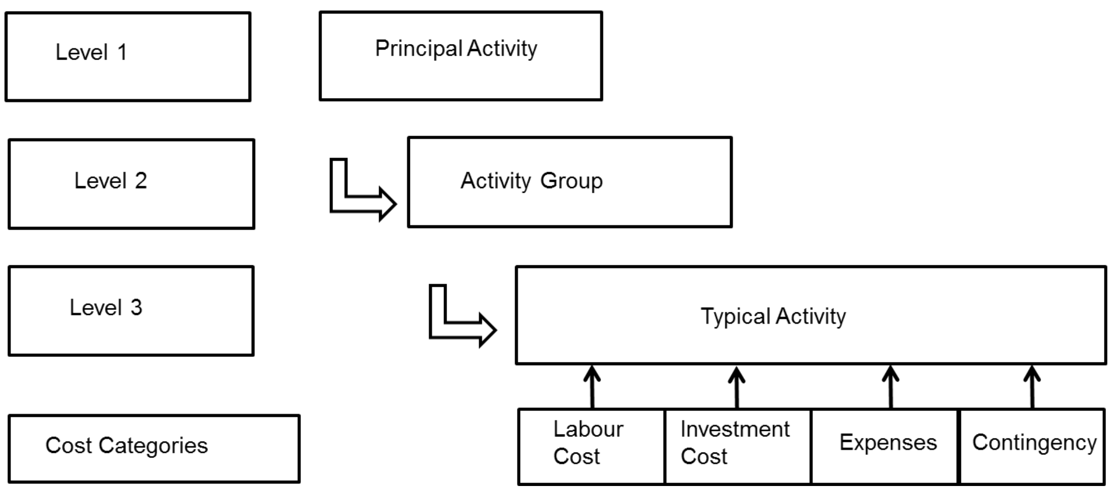
## 12. Presentation of Cost Estimate

When developing a decommissioning cost estimate, consideration should be given to the presentation of cost estimate. The method most widely used as a platform for presenting the cost estimation for establishing the funding for decommissioning is the work breakdown structure (WBS).

The WBS elements are arranged in a hierarchal format. The first level identifies the principal activities of the decommissioning project as listed in section 10 of this document. The second level presents the cost of activity groupings under which project costs would be gathered. The first and second levels are usually aggregations of the typical activities identified in the third level. The cost associated with each activity could be subdivided according to the four cost categories shown in figure 1.

An example of the hierarchal cost structure used by the International Structure for Decommissioning Costing (ISDC) is presented in figure 1 [6].

**Figure 1: Hierarchal cost structure as per International Structure for Decommissioning Costing**




Subsequent levels to the cost structure could be added in order to distinguish costs related to specific parts of the facility or specific periods of decommissioning project. The ISDC summary of cost item hierarchy is presented in Appendix D. The detailed itemization presented in the appendix provides general guidance on cost to be included in the estimate. The applicants and licensees should ensure that costs for all activities described in the decommissioning plan are reflected.

The approaches to cost estimation vary depending on the primary objective of the cost estimate, the facility lifecycle stage and the advancement of decommissioning planning. A brief description and comparison of those estimating methods is provided in table 1 in Appendix E.

## 13. Elements of Cost Estimates

When developing a decommissioning cost estimate, the four basic elements to a cost estimate should be considered: basis of estimate, structure of estimate (work breakdown structure [WBS]), schedule and uncertainty analysis. These four elements are described in detail in the following sections.

### 13.1 Basis of estimate

The basis of estimate (BOE) is the foundation upon which the cost estimate is developed. A BOE should fully reflect the current decommissioning plan prepared in accordance with REGDOC-2.11.2, *Decommissioning* [1]. The BOE should be based on the following:

- assumptions and exclusions
- boundary conditions and limitations – legal and technical (e.g., regulatory framework)
- decommissioning strategy description
- end state of the facility
- stakeholder, public and indigenous input/concerns
- facility description and site characterization (radiological/hazardous material inventory)
- waste management (packaging, storage, transportation, and disposal)
- used fuel management (activities included in a decommissioning project)
- sources of data used (actual field data vs. estimating judgment)
- cost estimating methodology used (e.g., bottom-up)
- basis for determining contingency, estimating uncertainty and risk
- discussion of techniques and technology to be used
- schedule analysis
- uncertainty analysis

The cost estimate for decommissioning should provide that, if impacts of proposed operations are difficult or impossible to estimate with precision, a credible worst-case scenario must be used. The cost estimate should not assume drawdown of nuclear substances or hazardous waste during operations. A “decommissioning tomorrow approach” must be applied, assuming that the facility is shutting down overnight, and the cost estimate must be based on the state of the facility and inventories at the time of shutdown. A credit for salvage of materials or equipment is not allowed. For the purpose of the cost estimate, they must be considered as waste.

The cost estimate for decommissioning must cover the entire decommissioning project, including, as applicable, the need for post-closure licensing, monitoring, surveillance and maintenance, and institutional control.

### 13.2 Structure of estimate

The WBS is used to categorize cost elements and work activities into logical groupings that have a direct or indirect relationship to each other and to determine how they affect the overall cost of the project. To that end, the work scope cost elements are broken down into activity-dependent, period-dependent, and collateral costs as defined in the following paragraphs.

#### 13.2.1 Activity-dependent costs

Activity-dependent costs are costs associated directly with performing decommissioning activities. Examples of such activities include decontamination; removal of equipment; demolition of buildings; and waste packaging, shipping and disposal. These activities lend themselves to the use of unit cost and work productivity factors (or work difficulty factors) applied against the facility, activity and structure’s inventories to develop the decommissioning cost and schedule.

#### 13.2.2 Period-dependent costs

Period-dependent costs include those activities associated primarily with the project duration: engineering, project management, dismantling management, licensing, health and safety, security, energy and quality assurance. These are primarily management staffing level costs, developed by estimating the manpower loading and associated overhead costs based on the scope of work to be accomplished during individual phases within each period of the project.

### 13.3 Collateral and special item costs

In addition to activity and period-dependent costs, there are costs for special items, such as for procurement of construction or dismantling equipment, site preparation, insurance, property taxes, health physics supplies, liquid radioactive waste processing and independent verification surveys. Such items do not fall in either of the other categories.

#### 13.3.1 Contingency

Contingency is a work scope element of cost and it should be applied to the base cost to account for unforeseen elements of cost that are likely to occur. Because of the unique nature of this element of cost, the application of contingency is further described in section 13.5 of this document.

### 13.4 Schedule

The project schedule is an integral part of a cost estimate.

The preparation of a schedule is a well-developed process for which proven software programs are available.

The breakdown by project phase ties together all related activities in a chronological sequence to better define the work scope and schedule. The schedule’s work breakdown structure should be the same as the cost estimate work breakdown structure.

Activity sequencing requires the determination and documentation of the relationship between activities. Work process flow charts should be used to structure the relationship between activities.

At the early stages of decommissioning planning and cost estimation, a less detailed schedule summarizing the principal activities may be provided, and a more detailed schedule should be provided later based on the detailed decommissioning planning.

### 13.5 Uncertainty analysis

The BOE should fully define the boundaries of the decommissioning project scope and set out the basis for estimating the base cost and the associated uncertainties.

Contingencies are defined as unforeseeable elements of cost **within** the defined project scope.

The base cost is first calculated on the basis of standard conditions where activities are performed within the defined project scope, without delays, interruptions, inclement weather, tool or equipment breakdown, labour strikes, waste shipment problems, disposal facility waste acceptance criteria changes, or changes in the anticipated shutdown conditions.

The following three approaches for applying contingency could be used:

- for the entire decommissioning project
- for groups of decommissioning activities
- for individual decommissioning activities

Applicants or licensees should add contingencies to the base cost as a specific provision for any unforeseeable elements of cost within the defined project scope that may occur. Applicants or licensees must provide a justification of the contingencies applied to the cost estimates and link them to the cost estimate category. Contingencies are an integral part of the cost estimate.

## 14. Development of the Financial Guarantee

Cost estimates are first prepared in current dollars assuming that the decommissioning will be executed at the time the cost is estimated. However, the time required to fully decommission can vary widely and has a significant impact on the calculation of the cost of decommissioning. Various factors must therefore be outlined in the estimate of the financial guarantee requirement:

> Inflation rate: The forecasted percentage increase in the price of goods and services annually. The rate of inflation used should be from a reasonable and credible source, such as from the Bank of Canada. Applicants or licensees must factor in inflation to ensure that there are sufficient funds reserved even when price increases are factored in.
>
> Discount rate (or expected rate of return on investment): In cases where the funds are invested, the expected rate of return that will be earned by the funds over time must be estimated. This expected rate of return should be supported by assumptions such as historical performance of the fund over time, the risk of the portfolio etc.

Another element that is important when performing this calculation is an estimate of when various elements of the work will be performed. Disbursements or planned spending must be factored in.

Starting with current value of the money, then applying the inflation rate and the discount rate, results in the net present value of funds required to be invested today, to ensure there are sufficient funds available for decommissioning in the future.

### 14.1 Constant dollars

Liabilities for decommissioning activities are reported in the present value of the underlying obligation, thereby expressing estimates in constant dollars to reflect changes in underlying funding obligations over time.

### 14.2 Cash flow and planned disbursements

A schedule of cash flow and planned disbursements for decommissioning must also be submitted in order to calculate the net present value of decommissioning requirements

### 14.3 Net present value

The net present value presents the current dollar value of estimated future cash expenditures. It depends on the timing of decommissioning activities and expected expenditure profile.

In order to determine how much money is required today to pay for future liability, economic assumptions with respect to inflation and interest rate must be considered. Applicants and licensees must indicate the inflation rate and interest or discount rate used in calculations and justify the validity of the selected rates and assumptions.

As stated above, many decommissioning activities take place over a number of years, so it is important to ensure there are sufficient funds available today to cover costs that will be incurred years into the future.

## 15. Review of Financial Guarantees

Applicants or licensees must ensure that the financial guarantee remains valid, in effect and sufficient to meet decommissioning needs according to the most up-to-date decommissioning plan. Therefore, licensees must revise their financial guarantee at a minimum every five years or earlier when requested by the Commission. Applicants or licensees may request a review of their financial guarantees by the CNSC at any time.

Applicants or licensees must submit the updated financial guarantee for review by CNSC staff and acceptance by the Commission.

# Part II: Financial Guarantees for Termination of Licensed Activities

## 16. Introduction

### 16.1 Scope

Part II of this document applies to holders of nuclear substances and radiation devices, prescribed equipment, and Class II facilities licensees. These licensees must ensure that they are financially responsible for the termination of the activities authorized by their licence. The CNSC has developed an insurance-based financial guarantee program to ensure that the Crown is not held financially responsible in the situation where a licensee has failed to properly terminate licensed activities.

## 17. Financial Guarantee Program

Under the insurance-based program, the CNSC is the insured party and the beneficiary. Licensees that participate in this program contribute to the cost of the insurance policy, in proportion to their liability. Liability is calculated on the basis of a formula that prescribes an estimated liability for each unit of prescribed equipment and sealed source as well as a room or laboratory where open source material is used.

Additional information on financial guarantees for nuclear substances and radiation devices and prescribed equipment and Class II facilities can be found on the CNSC website.

## 18. Alternatives to Financial Guarantee Program

The financial guarantee program is flexible in situations where a licensee's activities do not meet the prescribed formula. In these situations a licensee has the option to propose its own financial guarantee for review and acceptance by the Commission following the established principles of section 3 and 4 of this document.

## 19. Review of Financial Guarantees

Financial guarantees for licences are assessed annually by the CNSC staff or when required by the Commission, to ensure that coverage is sufficient for the licensed activities.

# Appendix A: Example of Letter of Credit

The following provides an example of letter of credit[2]. This template may be used by licence applicants or licensees when submitting a letter of credit to the CNSC.

1. The undersigned, hereinafter called the Guarantor, irrevocably guarantees to pay to the Beneficiary an amount not exceeding xxx Canadian dollars, including interest, costs and accessories, upon receipt of a written demand by the Beneficiary certifying that the Applicant has failed to fulfill its obligations with respect to decommissioning resulting from, or under the *Nuclear Safety and Control Act*, its regulations or licence no. xxx.

2. This Guarantee is effective from its issuance and must terminate and automatically expire on the expiry date.

3. Upon expiry of this Guarantee, by payment in favour of the Beneficiary or by lapse of time, the Beneficiary must return to the Guarantor the original of the Guarantee, bearing clear mention of its cancellation.

4. This Guarantee must be deemed to be automatically extended without amendment for a further one (1) year period from the present or any future expiration date hereof, unless at least thirty (30) days prior to the present or any future expiration date, the bank notifies you, the Beneficiary, in writing by courier or registered mail, that the bank elect not to consider this Guarantee to be renewable for any additional period. If the Applicant fails to provide a replacement financial guarantee acceptable to the Beneficiary within ten (10) days after receipt of this notification, the full face value of this Guarantee, less any partial drawings made hereunder, must be paid to the Beneficiary, or to a trustee acceptable to the Beneficiary, prior to the expiration date, with no proof of forfeiture required.

5. Partial draws by the Beneficiary are permitted hereunder. The amount of the partial draw shall be paid by the Guarantor to the Beneficiary, and the full face value of this Guarantee (i.e., the Guarantor's maximum liability under this Guarantee) shall be automatically reduced by the amount of any partial drawings made hereunder.

6. Any demand for payment must be signed by a person authorized to act on the behalf of the Beneficiary

7. The Guarantor will honour the demand of the Beneficiary without enquiring whether the Beneficiary has the right as between itself and the Applicant to make such demand and without acknowledging any claim of the Applicant.

8. The Guarantor's liability under this Guarantee must in no event exceed the sum mentioned in paragraph 1 herein, and such liability must terminate if a demand for payment made strictly in accordance with the requirements of these presents has not been received at the above branch no later than on the expiry date.

9. This Guarantee is not assignable.

[2] Note: This is an example only and not the form of any specific financial institution. In any specific case additional or varied clauses may be used or required.

10. This Guarantee is governed by the laws of xxx, and the Courts of that province must have exclusive jurisdiction on all matters relating to this Guarantee and all recourses resulting therefrom.

11. This Guarantee sets forth in its entirety all of the obligations of the Guarantor and these obligations cannot be modified, interpreted or increased by any document or agreement mentioned herein, and any reference to any such document or agreement must not be construed as incorporating same to this Guarantee.

# Appendix B: Cost Estimate Grades and Classification

A universally accepted standard for developing decommissioning cost estimates has not been established. However, organizations such as the Association for the Advancement of Cost Engineering (AACE International) have developed guidelines for estimation cost for different industries [5].

**General**

AACE International and the Construction Industry Institute have established guidelines and procedures for estimating costs [5]. These guidelines rank cost estimates as Grades A, B, or C, depending on their level of accuracy.

**Grade C (accuracy of ±25% to 30%)**

Grade C cost estimates are known as order-of-magnitude cost estimates. They are performed quickly by using shortcut techniques such as

a) escalating and/or scaling up from previous estimates
b) cost curves
c) preliminary process design and equipment sizing without plot plans or major equipment quotations

It is likely that the overall scope of the project has not been defined.

**Grade B (accuracy of ±15% to 20%)**

Grade B cost estimates are known as budgetary cost estimates. They can be developed when the scope of the project has been defined but the detailed planning has not been performed. For large projects, they can be developed as soon as the preliminary process flow diagrams, preliminary plot plans, and equipment sizing have been completed. On smaller projects, estimates are developed when approximately 10% of the engineering is completed.

**Grade A (accuracy of ±10%)**

Grade A cost estimates are known as definitive cost estimates. They can be developed when the scope of the project is well defined and the detailed planning is prepared. For large projects, a Grade A estimate are prepared when the engineering flow diagrams, facility plans, and equipment lists are completed, and design has progressed to the stage required for the bidding process. For small projects, more engineering detail is necessary, and 30% to 50% of the engineering might be required to be completed.

**Cost estimate classes**

AACE International describes a classification system for cost estimates in the process industry (see table 1). In general, the accuracy of the cost estimate increases as the level of project definition increases. Decommissioning cost estimates prepared for the PDP are typically prepared as Class 4 study-type cost estimates. For additional information refer to the AACE International’s *Required Skills and Knowledge of Cost Engineering* [5].

**Table 1: AACE International cost estimate classification for process industries**

| Estimate class | Level of definition, % of complete definition | End usage (typical purpose of estimate) | Methodology (typical estimating method) | Expected accuracy (typical variation in low and high ranges), % | Preparation effort (typical degree of effort relative to lowest cost index of 1) |
|---|---|---|---|---|---|
| Class 5 | 0% to 2% | Concept screening | Capacity factored, parametric models, judgment, or analogy | Low: -20% to -50%<br>High: +30% to +100% | 1 |
| Class 4 | 1% to 15% | Study of feasibility | Equipment factored or parametric models | Low: -15% to -30%<br>High: +20% to +50% | 2-4 |
| Class 3 | 10% to 40% | Budget, authorization of control | Semi-detailed unit costs with assembly level line items | Low: -10% to -20%<br>High: +10% to +30% | 3-10 |
| Class 2 | 30% to 70% | Control or bid/tender | Detailed unit cost with forced detailed take-off | Low: -5% to -15%<br>High: +5% to +20% | 4-20 |
| Class 1 | 50% to 100% | Check estimate or bid/tender | Detailed unit cost with detailed take-off | Low: -3% to -10%<br>High: +3% to +15% | 5-100 |

# Appendix C: Standardized Definitions for Cost Categories

This appendix provides information on standardised definitions for cost categories for all major activities. These definitions have been developed by the International Structure for Decommissioning Costing (ISDC) [6].

For each cost item, four cost categories have been defined:

1. labour costs
2. investment costs (capital, equipment and material costs)
3. expenses
4. contingency

## 1. Labour costs

Labour costs are defined as costs calculated on the basis of the workload for a particular cost item and the labour cost unit rate, including:

- salaries
- contributions to social security and health insurance
- company contributions to pension scheme and fringe benefits
- overheads

## 2. Investment costs (capital, equipment and material costs)

Investment costs are defined as costs for:

- equipment
- machinery

## 3. Expenses

Expenses are defined as costs for consumer items or expendable items, or as costs for other expenditures related to decommissioning cost items where applicable, such as:

- consumables
- spare parts
- protective clothing
- travel expenses
- legal expenses
- taxes
- value added tax
- insurance
- consultants costs
- quality assurance costs
- rents
- office material
- heating costs
- water costs

- electricity costs
- computer costs
- telephone/fax costs
- cleaning
- interest
- public relation
- licences/patents
- decommissioning authorisation
- income from asset recovery (“negative expenses”)

## 4. Contingency

Contingency, added to individual cost items of the standardised listing, is a specific provision for unforeseeable elements of costs within the defined project scope. Any impacts on cost outside of the scope of the decommissioning project are not considered.

# Appendix D: International Structure for Decommissioning Costing Cost Item Hierarchy

This appendix provides information from the International Structure for Decommissioning Costing (ISDC) [6]. The ISDC was developed as a presentation platform for standardized listing of costs within the scope of decommissioning planning. Note that cost estimation for decommissioning of nuclear facilities can vary widely in format, content and practice.

**ISDC Summary of cost item hierarchy**

**Principle activity 01: Pre-decommissioning actions**

- 01.0100 Decommissioning planning
  - 01.0101 *Strategic planning*
  - 01.0102 *Preliminary planning*
  - 01.0103 *Final planning*
- 01.0200 Facility characterisation
  - 01.0201 *Detailed facility characterisation.*
  - 01.0202 *Hazardous-material surveys and analyses*
  - 01.0203 *Establishing a facility inventory database*
- 01.0300 Safety, security and environmental studies
  - 01.0301 *Decommissioning safety analysis*
  - 01.0302 *Environmental impact assessment*
  - 01.0303 *Safety, security and emergency planning for site operations*
- 01.0400 Waste management planning
  - 01.0401 *Establish waste management criteria*
  - 01.0402 *Develop a waste management plan*
- 01.0500 Authorisation
  - 01.0501 *License applications and license approvals*
  - 01.0502 *Stakeholder involvement*
- 01.0600 Preparing management group and contracting
  - 01.0601 *Management team activities*
  - 01.0602 *Contracting activities*

**Principle activity 02: Facility shutdown activities**

- 02.0100 Plant shutdown and inspection
  - 02.0101 *Termination of operation, plant stabilisation, isolation and inspection*
  - 02.0102 *Defueling and transfer of fuel to spent-fuel storage*
  - 02.0103 *Cooling down of spent fuel*
  - 02.0104 *Management of fuel, fissile and other nuclear materials*
  - 02.0105 *Isolation of power equipment*
  - 02.0106 *Facility reuse*
- 02.0200 Drainage and drying of systems
  - 02.0201 *Drainage and drying of closed systems not in operation*
  - 02.0202 *Drainage of spent-fuel pool and other open systems not in operation*
  - 02.0203 *Removal of sludge and products from open systems*
  - 02.0204 *Drainage of special process fluids*
- 02.0300 Decontamination of closed systems for dose reduction
  - 02.0301 *Decontamination of process installations using operational procedures*
  - 02.0302 *Decontamination of process installations using additional procedures*

02.0400 Radiological inventory characterisation to support detailed planning
- 02.0401 *Radiological inventory characterisation*
- 02.0402 *Underground water monitoring*

02.0500 Removal of system fluids, operational waste and redundant material
- 02.0501 *Removal of combustible material*
- 02.0502 *Removal of system fluids (water, oils, etc.)*
- 02.0503 *Removal of special system fluids*
- 02.0504 *Removal of waste from decontamination*
- 02.0505 *Removal of spent resins*
- 02.0506 *Removal of specific operational waste from fuel cycle facilities*
- 02.0507 *Removal of other waste from facility operations*
- 02.0508 *Removal of redundant equipment and materials*

**Principle activity 03: Additional activities for safe enclosure**

03.0100 Preparation for safe enclosure
- 03.0101 *Decontamination of selected components and areas to facilitate safe enclosure*
- 03.0102 *Zoning for long-term storage*
- 03.0103 *Removal of inventory not suitable for safe enclosure*
- 03.0104 *Dismantling and transfer of contaminated equipment and material to containment structure for long-term storage*
- 03.0105 *Radiological inventory characterisation for safe enclosure*

03.0200 Site boundary reconfiguration, isolating and securing structures
- 03.0201 *Modification of auxiliary systems*
- 03.0202 *Site boundary reconfiguration*
- 03.0203 *Construction of temporary enclosures, stores, structural enhancements, etc.*
- 03.0204 *Stabilisation of radioactive and hazardous waste pending remediation*
- 03.0205 *Facility controlled area hardening, isolation for safe enclosure*

03.0300 Facility entombment
- 03.0301 *Facility entombment as end state of decommissioning strategy*
- 03.0302 *Institutional control and monitoring of the entombment end state*

**Principle activity 04: Dismantling activities within the controlled area**

04.0100 Procurement of equipment for decontamination and dismantling
- 04.0101 *Procurement of general site-dismantling equipment*
- 04.0102 *Procurement of equipment for decontamination of personnel and tools*
- 04.0103 *Procurement of special tools for dismantling the reactor systems*
- 04.0104 *Procurement of special tools for dismantling in fuel cycle facilities*
- 04.0105 *Procurement of special tools for dismantling other components or structures*

04.0200 Preparations and support for dismantling
- 04.0201 *Reconfiguration of existing services, facilities and site to support dismantling*
- 04.0202 Pre*paration of infrastructure and logistics for dismantling*
- 04.0203 *Ongoing radiological characterisation during dismantling*

04.0300 Pre-dismantling decontamination
- 04.0301 *Drainage of remaining systems*
- 04.0302 *Removal of sludge and products from remaining systems*
- 04.0303 *Decontamination of remaining systems*
- 04.0304 *Decontamination of areas in buildings*

04.0400 Removal of materials requiring specific procedures
- 04.0401 *Removal of thermal insulation*
- 04.0402 *Removal of asbestos*
- 04.0403 *Removal of other hazardous materials*

04.0500 Dismantling of main process systems, structures and components
04.0501 *Dismantling of reactor internals*
04.0502 *Dismantling of reactor vessel and core components*
04.0503 *Dismantling of other primary loop components*
04.0504 *Dismantling of main process systems in fuel cycle facilities*
04.0505 *Dismantling of main process systems in other nuclear facilities*
04.0506 *Dismantling of external thermal/biological shields*
04.0600 Dismantling of other systems and components
04.0601 *Dismantling of auxiliary systems*
04.0602 *Dismantling of remaining components*
04.0700 Removal of contamination from building structures
04.0701 *Removal of embedded elements in buildings*
04.0702 *Removal of contaminated structures*
04.0703 *Decontamination of buildings*
04.0800 Removal of contamination from areas outside buildings
04.0801 *Removal of underground contaminated pipes and structures*
04.0802 *Removal of contaminated soil and other contaminated items*
04.0900 Final radioactivity survey for release of buildings
04.0901 *Final radioactivity survey of buildings*
04.0902 *Declassification of buildings*

**Principle activity 05: Waste processing, storage and disposal**
05.0100 Waste management system
05.0101 *Establishing the waste management system*
05.0102 *Reconstruction of existing facilities for decommissioning waste management system*
05.0103 *Procurement of additional equipment for management of historical/legacy waste*
05.0104 *Maintenance, surveillance and operational support for waste management system*
05.0105 *Demobilisation/decommissioning of waste management system*
05.0200 Management of historical/legacy high-level waste
05.0201 *Characterisation*
05.0202 *Retrieval and processing*
05.0203 *Final conditioning*
05.0204 *Storage*
05.0205 *Transport*
05.0206 *Disposal*
05.0207 *Containers*
05.0300 Management of historical/legacy intermediate-level waste
05.0301 *Characterisation*
05.0302 *Retrieval and processing*
05.0303 *Final conditioning*
05.0304 *Storage*
05.0305 *Transport*
05.0306 *Disposal*
05.0307 *Containers*

05.0400 Management of historical/legacy low-level waste
- 05.0401 *Characterisation*
- 05.0402 *Retrieval and treatment*
- 05.0403 *Final conditioning*
- 05.0404 *Storage*
- 05.0405 *Transport*
- 05.0406 *Disposal*
- 05.0407 *Containers*

05.0500 Management of historical/legacy very low-level waste
- 05.0501 *Characterisation*
- 05.0502 *Retrieval, treatment and packaging*
- 05.0503 *Transport*
- 05.0504 *Disposal*

05.0600 Management of historical/legacy exempt waste and materials
- 05.0601 *Retrieval, treatment and packaging*
- 05.0602 *Clearance measurement of exempt waste and materials*
- 05.0603 *Transport of hazardous waste*
- 05.0604 *Disposal of hazardous waste at dedicated waste dumps*
- 05.0605 *Transport of conventional waste and materials*
- 05.0606 *Disposal of conventional waste at conventional waste dumps*

05.0700 Management of decommissioning high-level waste
- 05.0701 *Characterisation*
- 05.0702 *Processing*
- 05.0703 *Final conditioning*
- 05.0704 *Storage*
- 05.0705 *Transport*
- 05.0706 *Disposal*
- 05.0707 *Containers*

05.0800 Management of decommissioning intermediate-level waste
- 05.0801 *Characterisation*
- 05.0802 *Processing*
- 05.0803 *Final conditioning*
- 05.0804 *Storage*
- 05.0805 *Transport*
- 05.0806 *Disposal*
- 05.0807 *Containers*

05.0900 Management of decommissioning low-level waste
- 05.0901 *Characterisation*
- 05.0902 *Processing*
- 05.0903 *Final conditioning*
- 05.0904 *Storage*
- 05.0905 *Transport*
- 05.0906 *Disposal*
- 05.0907 *Containers*

05.1000 Management of decommissioning very low-level waste
- 05.1001 *Characterisation*
- 05.1002 *Treatment and packaging*
- 05.1003 *Transport*
- 05.1004 *Disposal*

05.1100 Management of decommissioning very short-lived waste
- 05.1101 *Characterisation*
- 05.1102 *Treatment, storage, handling and packaging*
- 05.1103 *Final management of decommissioning very short-lived waste*

05.1200 Management of decommissioning exempt waste and materials
- 05.1201 *Treatment and packaging*
- 05.1202 *Clearance measurement of exempt waste and materials*
- 05.1203 *Transport of hazardous waste*
- 05.1204 *Disposal of hazardous waste at dedicated waste dumps*
- 05.1205 *Transport of conventional waste and materials*
- 05.1206 *Disposal of conventional waste at conventional waste dumps*

05.1300 Management of decommissioning waste and materials generated outside controlled areas
- 05.1301 *Recycling of concrete*
- 05.1302 *Treatment and packaging of hazardous waste*
- 05.1303 *Treatment and recycling of other materials.*
- 05.1304 *Transport of hazardous waste*
- 05.1305 *Disposal of hazardous waste at dedicated waste dumps*
- 05.1306 *Transport of conventional waste and materials*
- 05.1307 *Disposal of conventional waste at conventional waste dumps*

**Principle activity 06: Site infrastructure and operation**

06.0100 Site security and surveillance
- 06.0101 *Procurement of general security equipment*
- 06.0102 *Operation and maintenance of automated access control systems, monitoring systems and alarms*
- 06.0103 *Security fencing and protection of remaining entrances against trespassing*
- 06.0104 *Deployment of guards/security forces*

06.0200 Site operation and maintenance
- 06.0201 *Inspection and maintenance of buildings and systems*
- 06.0202 *Site upkeep activities*

06.0300 Operation of support systems
- 06.0301 *Electricity supply systems*
- 06.0302 *Ventilation systems*
- 06.0303 *Heating, steam and lighting systems*
- 06.0304 *Water supply systems*
- 06.0305 *Sewage/waste water systems*
- 06.0306 *Compressed air/nitrogen systems*
- 06.0307 *Other systems*

06.0400 Radiation and environmental safety monitoring
- 06.0401 *Procurement and maintenance of equipment for radiation protection and environmental monitoring.*
- 06.0402 *Radiation protection and monitoring.*
- 06.0403 *Environmental protection and radiation environmental monitoring*

**Principle activity 07: Conventional dismantling, demolition and site restoration**

07.0100 Procurement of equipment for conventional dismantling and demolition
- 07.0101 *Procurement of equipment for conventional dismantling and demolition*

07.0200 Dismantling of systems and building components outside the controlled area
07.0201 *Electricity generating system*
07.0202 *Cooling system components*
07.0203 *Other auxiliary systems*
07.0300 Demolition of buildings and structures
07.0301 *Demolition of buildings and structures from the formerly controlled area*
07.0302 *Demolition of buildings and structures outside the controlled area*
07.0303 *Dismantling of the stack*
07.0400 Final cleanup, landscaping and refurbishment
07.0401 *Earthworks, landworks*
07.0402 *Landscaping and other site finishing activities*
07.0403 *Refurbishment of buildings*
07.0500 Final radioactivity survey of site
07.0501 *Final survey*
07.0502 *Independent verification of the final survey*
07.0600 Perpetuity funding/surveillance for limited or restricted release of property
07.0601 *Routine maintenance*
07.0602 *Surveillance and monitoring*

**Principle activity 08: Project management, engineering and support**

08.0100 Mobilisation and preparatory work
08.0101 *Mobilisation of personnel*
08.0102 *Establishment of general supporting infrastructure for decommissioning project*
08.0200 Project management
08.0201 *Core management group*
08.0202 *Project implementation planning, detailed ongoing planning*
08.0203 *Scheduling and cost control*
08.0204 *Safety and environmental analysis, ongoing studies*
08.0205 *Quality assurance and quality surveillance*
08.0206 *General administration and accounting*
08.0207 *Public relations and stakeholders involvement*
08.0300 Support services
08.0301 *Engineering support*
08.0302 *Information system and computer support*
08.0303 *Waste management support*
08.0304 *Decommissioning support including chemistry, decontamination*
08.0305 *Personnel management and training*
08.0306 *Documentation and records control*
08.0307 *Procurement, warehousing, and materials handling*
08.0308 *Housing, office equipment, support services*
08.0400 Health and safety
08.0401 *Health physics*
08.0402 *Industrial safety*
08.0500 Demobilisation
08.0501 *Demobilisation of project infrastructure for decommissioning*
08.0502 *Demobilisation of personnel*
08.0600 Mobilisation and preparatory work by contractors (if needed)
08.0601 *Mobilisation of personnel*
08.0602 *Establishment of general supporting infrastructure for decommissioning project*

08.0700 Project management by contractors (if needed)
- 08.0701 *Core management group*
- 08.0702 *Project implementation planning, detailed ongoing planning*
- 08.0703 *Scheduling and cost control*
- 08.0704 *Safety and environmental analysis, ongoing studies*
- 08.0705 *Quality assurance and quality surveillance*
- 08.0706 *General administration and accounting*
- 08.0707 *Public relations and stakeholder involvement*

08.0800 Support services by contractors (if needed)
- 08.0801 *Engineering support*
- 08.0802 *Information system and computer support*
- 08.0803 *Waste management support*
- 08.0804 *Decommissioning support including chemistry, decontamination.*
- 08.0805 *Personnel management and training*
- 08.0806 *Documentation and records control*
- 08.0807 *Procurement, warehousing, and materials handling*
- 08.0808 *Housing, office equipment, support services*

08.0900 Health and safety by contractors (if needed)
- 08.0901 *Health physics*
- 08.0902 *Industrial safety*

08.1000 Demobilisation by contractors (if needed)
- 08.1001 *Demobilisation of project infrastructure for decommissioning.*
- 08.1002 *Demobilisation of personnel*

**Principle activity 09: Research and development**

09.0100 Research and development of equipment, techniques and procedures
- 09.0101 *Equipment, techniques and procedures for characterisation*
- *09.0102 Equipment, techniques and procedures for decontamination*
- 09.0103 *Equipment, techniques and procedures for dismantling*
- 09.0104 *Equipment, techniques and procedures for waste management*
- 09.0105 *Other research and development activities*

09.0200 Simulation of complicated works
- 09.0201 *Physical mock-ups and training*
- 09.0202 *Test or demonstration programmes*
- 09.0203 *Computer simulations, visualisations and 3D modelling*
- 09.0204 *Other activities*

**Principle activity 10: Fuel and nuclear material**

10.0100 Removal of fuel or nuclear material from facility to be decommissioned
- 10.0101 *Transfer of fuel or nuclear material to external storage or to treatment facilities*
- 10.0102 *Transfer of fuel or nuclear material to dedicated buffer storage*

10.0200 Dedicated buffer storage for fuel and/or nuclear material
- 10.0201 *Construction of buffer storage*
- 10.0202 *Operation of buffer storage*
- 10.0203 *Transfer of fuel and/or nuclear material away from the buffer storage*

10.0300 Decommissioning of buffer storage
- 10.0301 *Decommissioning of buffer storage*
- 10.0302 *Management of waste*

**Principle activity 11: Miscellaneous expenditures**

11.0100 Owner costs

11.0101 *Implementation of transition plans*

11.0102 *External projects to be performed as a consequence of decommissioning*

11.0103 *Payments (fees) to authorities*

11.0104 *Specific external services and payments*

11.0200 Taxes

11.0201 *Value added taxes*

11.0202 *Local, community, federal taxes*

11.0203 *Environmental taxes*

11.0204 *Taxes on industrial activities*

11.0205 *Other taxes*

11.0300 Insurances

11.0301 *Nuclear related insurances*

11.0302 *Other insurances*

# Appendix E: Approaches to Cost Estimation

The Nuclear Energy Agency document *The Practice of Cost Estimation for Decommissioning of Nuclear Facilities* [7] provides a comparative overview of the cost estimation methods and their advantages and disadvantages. It is summarized in the following table.

**Table 1: Estimating method comparison**

| Estimating Method | Description | Advantages | Disadvantages |
|---|---|---|---|
| Bottom-up | In this building blocks technique, a work statement and set of drawings or specifications are used to extract material quantities required for executing each discrete task performed in accomplishing a given activity. From these quantities, direct labour, equipment and overhead costs can be derived. | Most accurate as it accounts for site-specific radiological and physical inventory. Relies on unit cost factors (UCFs). | Requires detailed description of inventory and site specific labour, material and equipment costs for the UCFs. |
| Specific analogy | Specific analogies depend upon the known cost of an item used in prior estimates as the basis for the cost of a similar item in a new estimate. Adjustments are made to known costs to account for differences in relative complexities of performance, design and operational characteristics. | Accurate if prior estimates are appropriately adjusted for size differences, inflation and regional differences in labour materials and equipment. | Adjustments as noted may require detailed documentation and introduce approximations that reduce accuracy. |
| Parametric | Parametric estimating requires historical databases on similar systems or subsystems. Statistical analysis is performed on the data to find correlations between cost drivers and other system parameters, such as design or performance. The analysis produces cost equations or cost estimating relationships that may be used individually or grouped into more complex models. | Suitable for use for large sites where detailed inventory is not readily available. Suited for Order of Magnitude estimates. | Approximations based on areas or volumes introduce additional inaccuracies. There is no way to track actual inventory. Not suited for project planning of work activities. |

| Estimating Method | Description | Advantages | Disadvantages |
|---|---|---|---|
| Cost review and update | An estimate may be constructed by examining previous estimates of the same or similar projects for internal logic, completeness of scope, assumptions and estimating methodology. | Suitable for large sites where detailed inventory is not available. Suited for update of previous estimates, or order of magnitude estimates. | There is no way to track actual inventory. Generally not suited for project planning of work activities. |
| Expert opinion | An expert opinion technique may be used when other techniques or data are not available. Several specialists may be consulted iteratively until a consensus cost estimate is established. | An expert opinion technique may be used when other techniques or data are not available. Several specialists may be consulted iteratively until a consensus cost estimate is established. | Expert opinion may not be specific to the work activities. May not reflect the radiological limitations of the decommissioning project. |

# Glossary

For definitions of terms used in this document, see REGDOC-3.6, *Glossary of CNSC Terminology*, which includes terms and definitions used in the *Nuclear Safety and Control Act* and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

## References

The CNSC may include references to information on best practices and standards such as those published by CSA Group. With permission of the publisher, CSA Group, all nuclear-related CSA standards may be viewed at no cost through the CNSC Web page "How to gain free access to all nuclear-related CSA standards".

1. Canadian Nuclear Safety Commission (CNSC). REGDOC-2.11.2, *Decommissioning*, Ottawa, 2021.

2. CSA Group. CSA N294, *Decommissioning of Facilities Containing Nuclear Substances*, Toronto, 2019.

3. CNSC, REGDOC-3.1.2, *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*, Ottawa, 2018.

4. CNSC. REGDOC-3.1.3, *Reporting Requirements for Waste Nuclear Substance Licensees, Class II Nuclear Facilities and Users of Prescribed Equipment, Nuclear Substances and Radiation Devices*, Ottawa, 2020.

5. Association for Advancement of Cost Engineering (AACE International), *Skills and knowledge of cost engineering*, 6th edition, USA, 2015.

6. Nuclear Energy Agency (NEA), Organization for Economic Co-Operation and Development (OECD), *International Structure for Decommissioning Costing (ISDC) of Nuclear Installations*, France, 2012.

7. Nuclear Energy Agency (NEA) Organization for Economic Co-Operation and Development (OECD), *The Practice of Cost Estimation for Decommissioning of Nuclear Facilities*, France 2015.

# Additional Information

The following documents provide additional information that may be relevant and useful for understanding the requirements and guidance provided in this regulatory document:

- CNSC, REGDOC-3.1.1, *Reporting Requirements: Reporting Requirements for Nuclear Power Plants*. Ottawa, 2016.

# CNSC Regulatory Document Series

Facilities and activities within the nuclear sector in Canada are regulated by the CNSC. In addition to the *Nuclear Safety and Control Act* and associated regulations, these facilities and activities may also be required to comply with other regulatory instruments such as regulatory documents or standards.

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