PLS Project
Environmental Impact Statement

Final

June 2025

Submitted to:

Saskatchewan Ministry of Environment
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Submitted by:

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LIST OF ACRONYMS

2SLGBTQIA+	Two-Spirit, Lesbian, Gay, Bisexual, Transgender, Queer and/or Questioning, Intersex, Asexual, Plus
A&M	Accidents and Malfunctions
AAQC	Ambient Air Quality Criteria
ABA	Acid Base Accounting
ACFN	Athabasca Chipewyan First Nation
ACGIH	American Conference of Governmental Industrial Hygienists
AEGL	Acute Exposure Guideline Level
AHA	Athabasca Health Authority
AHPP	Aquatic Habitat Protection Permit
AIA	Alberta Institute of Agrologists
ALARP	As Low as Reasonably Practicable
ALARA	As Low as Reasonably Achievable
ALOHA	Areal Locations of Hazardous Atmospheres
APEGA	Association of Professional Engineers and Geoscientists of Alberta
APEGM	Association of Professional Engineers and Geologists of Manitoba
APEGS	Association of Professional Engineers and Geoscientists of Saskatchewan
APGO	Association of Professional Geoscientists of Ontario
ARD	Acid Rock Drainage
ARU	Autonomous Recording Units
ASA	Aquatic Study Area
ASET	Association of Science and Engineering Technology Professionals of Alberta
ASPB	Alberta Society of Professional Biologists
ATV	All-Terrain Vehicle
BACI	Before-After-Control-Impact
BAT	Best Available Technologies
BATEA	Best Available Technology Economically Achievable
BCIA	British Columbia Institute of Agrologists
BGC	BGC Engineering Inc.
BLDFN	Black Lake Denesųłiné First Nation
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
BRS	Beaver River Sandstone
CAA	Canadian Automobile Association
CAAQS	Canadian Ambient Air Quality Standards
CAF	Cemented Aggregate Fill
CALA	Canadian Association for Laboratory Accreditation
CanNorth	Canada North Environmental Services
CCD	Counter Current Decantation
CCME	Canadian Council of Ministers of the Environment

CDA	Canadian Dam Association
CEA	Cumulative Effects Assessment
CEAA	*Canadian Environmental Assessment Act*
CEQG	Canadian Environmental Quality Guidelines
CEPA	*Canadian Environmental Protection Act*
CES	Critical Effect Size
CHF	Cemented Hydraulic Fill
Clifton	Clifton Engineering Group Inc.
CMIP6	Coupled Model Intercomparison Project Phase 6
CNSC	Canadian Nuclear Safety Commission
CO_2	Carbon Dioxide
CO	Carbon Monoxide
COPC	Constituents of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CP	Contingency Pond
CPUE	Catch Per Unit Effort
CRDN	Clearwater River Dene Nation
CRF	Cemented Rock Fill
CSA	Canadian Standards Association
CSM	Conceptual Site Model
DCE	Decommissioning Cost Estimate
DCS	Distributed Control System
DDP	Detailed Decommissioning Plan
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DRP	Decommissioning and Reclamation Plan
DTC	Duty to Consult
EAS	Exhaust Air Shaft
EASB	Environmental Assessment and Stewardship Branch
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
EEMER	Environmental Effects Monitoring Electronic Reporting
EF-scale	Enhanced Fujita Scale
EGBC	Association of Professional Engineers and Geoscientists of the Province of British Columbia
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM	Electromagnetic
EMMP	Environmental Monitoring and Measurement Procedure
EMP	Environmental Management Program
EMPA	*Environmental Management and Protection Act*
ENV	Saskatchewan Ministry of Environment
EPB	Environmental Protection Branch

EPR	Environmental Performance Report
ERFN	English River First Nation
ERPG	Emergency Response Planning Guideline
FAS	Fresh Air Shaft
FDLDFN	Fond Du Lac Denesųłiné First Nation
FEQG	Federal Environmental Quality Guidelines
FIFO	Fly-in/Fly-out
Fission	Fission Uranium Corp.
FS	Feasibility Study
FSL	Full Supply Level
F-scale	Fujita Scale
FSWT	First Stage Water Treatment
FTE	Full Time Equivalent
GCM	Global Climate Model
GGR	Gregorie
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
GS	Government of Saskatchewan
H_2SO_4	Sulphuric Acid
HCB	Heritage Conservation Branch
HDPE	High-Density Polyethylene
HHERA	Human Health and Ecological Risk Assessment
HI	Hazard Identification
HRDA	Human Resources Development Agreement
HRDP	Human Resources Development Plan
HRIA	Heritage Resource Impact Assessment
HRMP	Human Resource Management Plan
HS	Habitat Section
HSEC	Health, Safety, Environment and Community
HSU	Hydrostratigraphic Unit
HVAC	Heating, Ventilation, and Air Conditioning
HVAS	High-Volume Air Sampler
IA	Impact Assessment
IAA	*Impact Assessment Act*
IBA	Important Bird Areas
ICP	Institutional Control Program
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life or Health
IEMP	Independent Environmental Monitoring Program
IKLUOS	Indigenous Knowledge, Land Use and Occupancy Study
IMS	Integrated Management System
IPCC	Intergovernmental Panel on Climate Change
IRSP	Intermediate Runoff Settling Pond

ISP	Intermediate Settling Pond
ISEPP	Industrial Source Environmental Protection Plan
ISQG	Interim Sediment Quality Guideline
LAN	Local Area Network
Ldn	24-hour day-night sound level
LEL	Lowest Effect Level
Leq	Equivalent Continuous Sound Level
LFN	Low Frequency Noise
LHD	Load-Haul-Dump
LLRW	Low-Level Radioactive Waste
Lmax	Maximum Noise Levels
LNG	Liquified Natural Gas
LOM	Life of Mine
LPG	Liquified Petroleum Gas
LRWS	Ministry of Labour Relations and Workplace Safety
LSA	Local Study Area
masl	Metres Above Sea Level
MBA	Mutual Benefit Agreement
MBBR	Moving Bed Biofilm Reactor
MBC	Missinippi Broadcast Corporation
MBCA	*Migratory Birds Convention Act*
MDL	Method Detection Limits
MDMER	*Metal and Diamond Mine Effluent Regulations*
MECP	Ontario Ministry of the Environment, Conservation and Parks
MGR	Ministry of Government Relations
MHI	Ministry of Highways and Infrastructure
MIEPR	Mineral Industry Environmental Protection Regulation
MIL	Mildred
MKS	Métis Knowledge Study Report
ML	Metal Leaching
MLTC	Meadow Lake Tribal Council
MN-S NR2	Métis Nation Saskatchewan Northern Region 2
MN-S	Métis Nation Saskatchewan
MSLA	Mine Surface Lease Agreement
MSZ	Main Shear Zone
MW	Megawatt
N/A	Not Applicable
NAG	Non-Acid Generating
NBCC	National Building Code of Canada
NE2	No-effect Values
NexGen	NexGen Energy Ltd
NI	National Instrument
NIOSH	National Institute for Occupational Safety and Health

NNADAP	National Native Alcohol and Drug Abuse Program
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen Oxides
NPRI	National Pollutant Release Inventory
NSAD	Northern Saskatchewan Administration District
NSCA	*Nuclear Safety and Control Act*
NSTA	Northern Saskatchewan Trappers Association
NTU	Nephelometric Turbidity Units
OACETT	Ontario Association of Certified Engineering Technicians and Technologists
OHS	Occupational Health and Safety
OMS	Operation, Surveillance, and Maintenance
PAG	Potentially Acid Generating
PAGC	Prince Albert Grand Council
PBX	Private Branch Exchange
PDA	Potential Disturbance Area
PDCE	Preliminary Decommissioning Plan Cost Estimate
PDP	Preliminary Decommissioning Plan
PEGNL	Professional Engineers and Geoscientists of Newfoundland & Labrador
PEL	Probable Effect Level
PEO	Professional Engineers Ontario
PFS	Pre-Feasibility Studies
PIMA	Portable Infrared Mineral Analyzer
PLc	Patterson Lake corridor
PLS	Patterson Lake South
PM_{10}	Particulate Matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate Matter 2.5 micrometres or less in diameter
PMP	Probable Maximum Precipitation
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
the Project	The PLS Project
PSP	Permanent Sampling Plots
QA/QC	Quality Assurance/Quality Control
QFBG-GN	Quartz-Feldspar-Biotite-Garnet Gneiss
QP	Qualified Person
RCMP	Royal Canadian Mounted Police
RCP	Representative Concentration Pathway
RDL	Reportable Detection Limit
REA	Residual Effects Assessment
REF	Reference Values
ROM	Run of Mine
Rook I Project	NexGen Energy Ltd.'s Rook I Project

RQD	Rock Quality Designation
RSA	Regional Study Area
RSN	Residents of Saskatchewan's North
SAAQS	Saskatchewan Ambient Air Quality Standards
SAG	Semi Autogenous Grinding
SAPA	Saskatchewan Association of Professional Archaeologists
SAR	Species at Risk
SARA	*Species at Risk Act*
SBL	Soil-Bentonite Liner
SEAA	*The Environmental Assessment Act,* Saskatchewan
SEARP	Saskatchewan Environmental Assessment Review Panel
SEQG	Saskatchewan Environmental Quality Guidelines
SGI	Saskatchewan Government Insurance
SHA	Saskatchewan Health Authority
SHMP	Health and Safety Management Program
SIA	Saskatchewan Institute of Agrologists
SKCDC	Saskatchewan Conservation Data Centre
SLA	Surface Lease Area
SMR	Small Modular Reactor
SO_2	Sulphur Dioxide
SOCC	Species of Conservation Concern
SP	Settling Pond
SPM	Suspended Particulate Matter
SPSA	Saskatchewan Public Safety Agency
SQV	Sediment Quality Values
SRC	Saskatchewan Research Council
SRP	Surface Run-Off Pond
SSA	Site Study Area
SSWT	Second Stage Water Treatment
STEL	Short-Term Exposure Limit
STZ	Snowbird Tectonic Zone
SX	Solvent Extraction
TBD	To Be Determined
TBM	Tunnel Boring Machine
TDS	Total Dissolved Solids
TIA	Traffic Impact Assessment
TLSA	Terrestrial Local Study Area
TLU	Traditional Land Use
TMF	Tailings Management Facility
TOC	Total Organic Carbon
TOR	Terms of Reference
TP	Technical Proposal
TPS	Technology Professionals Saskatchewan

TRC	Technical Review Comments
TRSA	Terrestrial Regional Study Area
TSD	Technical Support Document
TSM	Tunnel Sheild Method
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
TSWT	Third Stage Water Treatment
TSX	Toronto Stock Exchange
UGTMF	Underground Tailings Management Facility
UMMR	*Uranium Mines and Mills Regulations*
UPS	Uninterrupted Power Supplies
U.S. EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
UTV	Utility Terrain Vehicle
VC	Valued Component
VLSA	Vegetation Local Study Area
VOC	Volatile Organic Compounds
VOIP	Voice over Internet Protocol
VRSA	Vegetation Regional Study Area
VWP	Vibrating Wire Piezometer
WAN	Wide Area Network
WCMP	Woodland Caribou Mitigation Plan
WCSB	Western Canadian Sedimentary Basin
WHO	World Health Organization
WLSA	Wildlife Local Study Area
WMMP	Wildlife Management and Monitoring Procedure
WMZ	Wildlife Management Zone
WQG	Water Quality Guidelines
WRA	Whole Rock Analysis
WRMA	Waste Rock Management Area
WRMF	Waste Rock/Stockpile Management Facilities
WRSA	Wildlife Regional Study Area; Waste Rock Storage Area
WSA	Water Security Agency
WSC	Water Survey of Canada
XRD	X-Ray Diffraction
YNLR	Ya’ thi Nene Land and Resources
ZOI	Zone of Influence

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Introduction

Fission Uranium Corp. (Fission), a subsidiary of Paladin Canada Inc., is proposing the development of a new uranium mining and milling facility, the PLS Project (the Project), in northwestern Saskatchewan. The Project is a proposed underground mining and surface milling facility to be constructed near the western shore of Patterson Lake, approximately 664 km north-northwest of Prince Albert, Saskatchewan. The Project is located within Treaty 8 Territory and the homeland of the Métis Nation, with the closest community being the northern settlement of Descharme Lake, which is located approximately 60 km south of the Project (Figure 1). The property is accessed by an all-weather highway, Highway 955, that originates at La Loche and bisects the Project.

The Project encompasses all activities, facilities, and phases necessary to support a uranium mining and processing operation that will mine and mill approximately 1,000 tonnes per day, with a current planned production of 93.7 million pounds (Mlbs) of triuranium octaoxide (U_3O_8) over a 10-year period. Construction and operation of the Project will require the development of several facilities including an underground mine, processing facilities, a tailings management facility (TMF), connective access roads, and other related infrastructure and ancillary facilities.

In Saskatchewan, *The Environmental Assessment Act* (SEAA) requires that a proponent receive the approval of the Saskatchewan Ministry of Environment (ENV) before proceeding with a project that is defined as a development. This requires completion of an Environmental Impact Assessment (EIA) and submission and approval of an Environmental Impact Statement (EIS). Fission initiated the provincial EIA process in November 2021 by submitting a Technical Proposal (TP) to the ENV in which Fission self-declared the Project as a development as per SEAA. Fission also submitted the draft Terms of Reference (TOR) at the same time as the TP under separate cover. The TOR outlined the information to be gathered during the EIA and how it would be presented in the EIS.

The Project does not satisfy the criteria outlined in the federal *Impact Assessment Act* (IAA) and associated *Physical Activities Regulations* to require completion of an environmental assessment under the IAA. While it is possible for a project to be designated for federal Impact Assessment (IA) by the Minister of Environment and Climate Change Canada, Fission was informed by the Minister in November 2022 that the Project will not be designated for a federal IA.

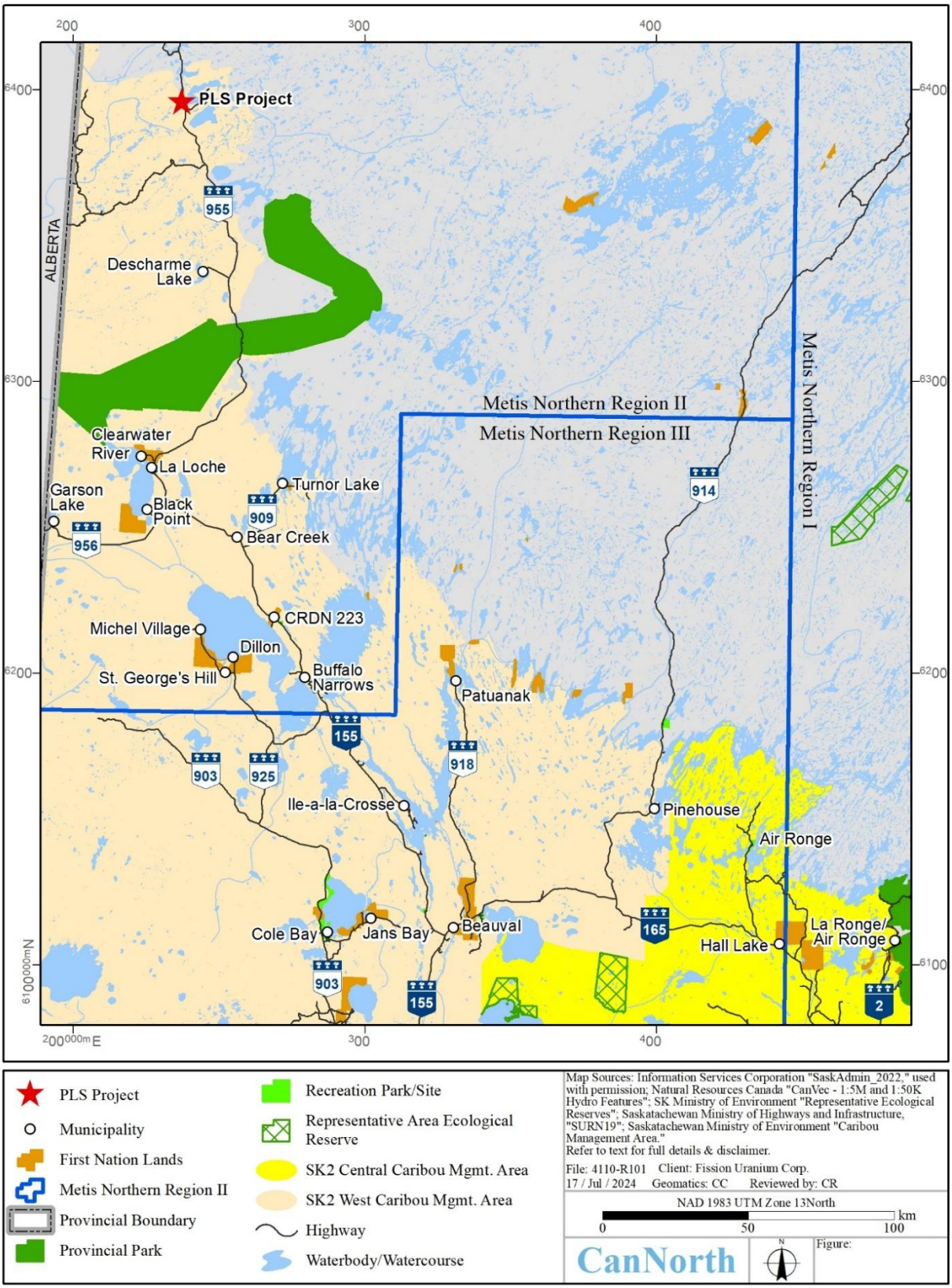

Figure 1
Location of the PLS Project

This EIS compiles and presents the results of the EIA that has been completed for the Project. The report format has been structured to align with the Guidelines for the TOR and EIS document published by the ENV in 2021.

Engagement

Engagement activities related to Project exploration and early planning initiatives began in 2013, while activities conducted to inform the EIA have been underway since 2021. Since 2021, Fission has been engaging with Clearwater River Dene Nation (CRDN), Birch Narrows Dene Nation (BNDN), Buffalo River Dene Nation (BRDN), Métis Nation-Saskatchewan Northern Region 2 (MN-S NR2), the Ya'thi Nene Land and Resource Office (YNLR), Athabasca Chipewyan First Nation (ACFN), and English River First Nation (ERFN). Interest-based engagement included local land and resource users (Big Bear Camp, Forest Lake Outfitters, Lloyd Lake Lodge, and trappers), municipal leadership, municipal residents, educational institutions, health care providers, and protective services providers.

The objectives of EIA-related engagement with stakeholders were to share details of the Project, actively solicit input on existing conditions and potential effects for the EIA, and obtain information on issues and concerns. The objectives of EIA-related engagement with Indigenous Nations and communities were to share details of the Project, actively solicit input about existing conditions and effects for the EIA, obtain information on issues and concerns related to Aboriginal and Treaty Rights, collect and integrate traditional knowledge (TK) and land and resource use information, and to seek consent for the Project. Methods for sharing and gathering information were selected by each Indigenous Nation and differed between groups, but overall included e-mail correspondence, phone calls, leadership meetings, open houses, community meetings, interviews, attending events (e.g., Treaty Days), site tours, information materials (e.g., booklets, poster boards, presentations), technical reviews, and community-led knowledge and use studies that were shared with Fission.

Early information received was used to inform the selection of valued components (VCs), key indicators, measurable parameters, and effect pathways. TK and land and resource use information was used in existing environment descriptions and to select receptor locations and vegetation and wildlife species to include in the Human Health and Ecological Risk Assessment (HHERA). Subsequent engagement activities helped to inform the screening and assessment of potential effects. Feedback received related to mitigation measures was used to inform justification and/or refinement of the Project design, mitigation measures, and development of monitoring programs and management plans. Documents indicating

support for the Project were received from CRDN and BRDN and Fission is actively engaging the other Nations to seek consent and determine how best to work together going forward. Engagement activities will continue throughout the life of the Project.

Project Description

The Project involves the development of facilities and processes to support uranium mining and milling activities at the Project. The Project currently contains probable ore reserves of 93.7 Mlbs of U_3O_8 at a grade of 1.41%. This includes ore identified in three zones, the R780E, R840W, and R00E. Further resources have been identified in two additional zones, the R1515W and R1620E. Exploration activities continue at the Project site to further delineate these additional zones and identify other potential target areas.

The current mineral reserve for the Project supports a projected mine operational life of 10 years. In order to conservatively bound the Project, the EIA assessed an operational period of 15 years. This extended time period allows for operational flexibility, including the identification of additional ore to be mined and processed. The 10 to 15-year operating period will be preceded by a 3-year construction period and followed by an active decommissioning period of 8 years and a post-decommissioning period estimated to be approximately 3 years.

The Project would provide employment opportunities, including contracting, through the construction, operations, and decommissioning phases. During the construction phase, up to 300 employees and contractors could work at the site during the peak period. During the operations phase, approximately 325 employees are anticipated while the site is at full production. During operations, approximately 75% of the workforce would be employed directly by Fission with the remaining 25% of the workforce being composed of contract positions. The on-site camp is designed to accommodate 200 workers per shift.

Project Infrastructure and Activities

Facilities, processes, and activities typical of northern Saskatchewan uranium mining and milling operations will be required to develop and execute the Project. The Project is accessed via Saskatchewan Provincial Highway 955 and infrastructure will be located on both the west and east sides of the highway. Access to either portion of the Project will be through secured and controlled gate facilities.

Infrastructure will consist of the mine site, waste rock/stockpile management area (WRMA), process plant area, TMF, personnel accommodations camp, support buildings and infrastructure, and a network of access roads throughout the site (Figure 2).

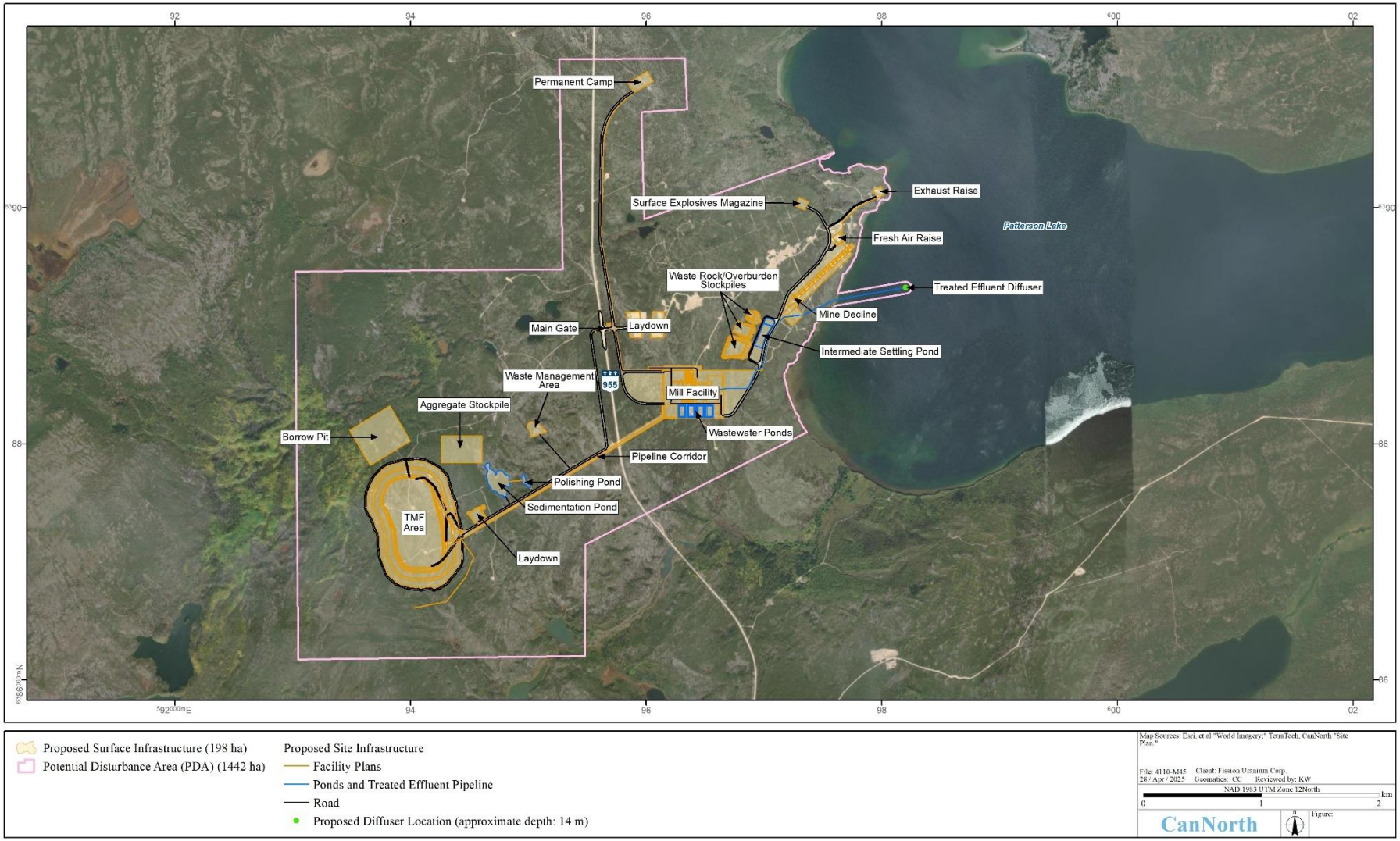

Figure 2
PLS Project preliminary site layout and infrastructure

Primary mining infrastructure will include an underground mine with fresh air and exhaust shafts, a decline for mine access and ore transport to surface, freeze plant, backfill plant, and water management and treatment facilities. Production mining at the Project is proposed to be conducted using proven methods including long hole stoping, mechanized drift and fill, and vertical cutting technologies. Lateral development methods include conventional drill and blast as well as mechanical excavation.

Waste rock generated by mining facilities will be transported to the WRMA. The WRMA will be an engineered, lined facility intended to temporarily store waste rock material until it can be utilized in the mine backfill process. All waste rock is planned to be consumed in the backfill process, leaving no waste rock on surface for continued management at the end of mine life.

The process plant area will include the ore stockpile, main process plant, solvent extraction plant, acid plant, water treatment facility, water management ponds, administration facilities, fuel storage and refuelling station, truck shop facilities, Liquefied Petroleum Gas (LPG) power generation plant, power distribution system, LPG storage, and laydown areas. Processing activities generate two primary outputs, uranium ore concentrate and tailings. Concentrate will be packaged in drums at the final processing stage prior to transport off-site via truck to facilities for further processing. Tailings will be transported via pipeline to the TMF.

The TMF is planned to consist of a purpose-built pit incorporating facilities for sub-aqueous deposition for tailings placement and an engineered double barrier to effectively prevent release of contaminated tailing and/or fluids to the environment. The facility intends to provide secure storage of mill tailings and process fluids during operations in a manner that supports secure storage and management for long-term disposal as well as mitigating radon release and dusting. The chosen purpose-built pit design supports effective management of tailings during operations followed by decommissioning of the TMF in a fashion that effectively incorporates it into the surrounding terrain and sustains saturated tailings management in the long-term.

Water management is a key activity for the Project with infrastructure designed to divert, collect, re-use, treat, and discharge water as necessary. Surface water that does not contact Project facilities will be diverted away from the site while contact water will be collected for re-use or treatment and discharge. Underground mine water will be collected for re-use or treatment and discharge. Water discharged from the Project will be treated in a water treatment plant prior to the discharge process.

The water treatment plant is planned as a conventional three-stage chemical treatment system designed primarily to remove metals and radionuclides before returning the water to a neutral pH. Treated water will be recycled into the process to reduce freshwater demand when needed. Excess treated water will report to one of the Project's three monitoring ponds. Monitoring pond water will be analyzed to ensure that the quality meets applicable discharge standards, regulations, or criteria. Once water in the monitoring ponds is acceptable for discharge, it will be released to the environment via the effluent discharge line and diffuser located in the south arm of Patterson Lake (Figure 2).

The Project is expected to generate several waste types including non-hazardous domestic and industrial waste, hazardous wastes, and low-level radioactive waste. Waste types will be segregated and managed through processes appropriate for each type. Non-hazardous waste that cannot be otherwise diverted, recycled, or reused will be transported off site to a regional landfill or the onsite waste management area. Hazardous wastes will be collected and temporarily stored in an on-site facility purpose-built for this activity prior to off-site transport and management at facilities appropriate for hazardous wastes. Low-level radioactive wastes will be segregated and collected prior to disposal off-site or in the on-site TMF or in the underground mine workings. Radioactive waste will be handled during decommissioning, and waste disposed of off-site will be confirmed safe prior to off-site disposal taking place.

Electrical power from the provincial grid is unavailable at the Project site and as such, an on-site LPG-fired power plant will be procured, installed, and operated to supply the power required for the Project. The planned power plant will have an installed generating capacity of 20 megawatts.

Freshwater requirements for the site will be supplied from groundwater wells. Freshwater will be used primarily for potable water supply, firewater for emergencies, and process water make-up in the mill. Water from other on-site activities will be utilized to the maximum extent possible for process-related activities to minimize the freshwater requirement. A potable water treatment system will treat groundwater to meet potable standards and potable water will be distributed to the various facilities on site.

Domestic wastewater generated at the Project is planned to be treated in a sewage treatment plant. Liquid effluent from this process will be discharged into a process pond for treatment along with the Project's other wastewater streams, while the sludge will be dewatered, stored, and shipped offsite for disposal.

A preliminary decommissioning and reclamation plan will be developed and updated throughout the life of the Project. Decommissioning objectives for the Project include returning the site in a safe, environmentally sound condition and allowing land use to return to as near as possible to pre-development conditions. At the conclusion of decommissioning, all site infrastructure with the exception of the TMF will have been removed and the site will have been re-vegetated with suitable native species. The closure of the TMF will be executed through the facilitation of tailings consolidation, the installation of an engineered cap and cover, contouring the facility to blend naturally into the surrounding environment, and vegetating the cover with shallow rooted species.

Financial guarantees to support decommissioning activities are a requirement for mining projects in Saskatchewan. Fission will be required to develop and continually update and maintain financial guarantees to ensure appropriate resources are available to decommission the Project through all phases of its life cycle.

Environmental Impact Assessment Methodology

The EIA involved describing the existing environment surrounding the Project and then completing an effects assessment using the methods described below.

VCs, key indicators, and measurement parameters were selected to focus the effects assessment on biophysical and human components that may be affected (positively or negatively) by the Project and are important to stakeholders and Indigenous Nations and communities. The list of VCs assessed in the EIA is broad to ensure the assessment is comprehensive. The selected VCs include:

- Air quality
- Noise and vibration
- Visual landscape
- Terrain
- Soils
- Groundwater quantity
- Groundwater quality
- Surface water quantity
- Surface water quality
- Fish and fish habitat
- Vegetation
- Woodland caribou
- Ungulates
- Furbearers
- Bats
- Amphibians
- Birds
- Economic wellbeing
- Traditional land and resource use
- Other land and resource use
- Heritage resources
- Community wellbeing and human health

Spatial boundaries included in the effects assessment were the Site Study Area (SSA) and Potential Disturbance Area (PDA), as well as Local Study Areas (LSA) and Regional Study Areas (RSA) that often differed between VCs. The SSA (400 ha) includes an estimate of the area disturbed by proposed surface infrastructure (198 ha) based on the Feasibility Study design, and a 50 m buffer around the infrastructure to provide flexibility (Figure 3). In addition to the SSA, a larger area of approximately 1,442 ha was assessed as the PDA to account for potential expansion of facilities or other design changes that are currently not foreseen and may occur as Project design progresses (Figure 3). The LSA is defined as the area adjacent to the SSA and PDA where there is the highest potential for direct and indirect Project-related impacts on VCs. The RSA is defined as a larger area adjacent to the LSA where there is the potential for indirect Project effects and/or cumulative effects on VCs.

The first step of the effects assessment was to identify all potential pathways by which the Project, or accidents and malfunctions that occur as a result of the Project, could affect VCs during all Project stages. Project design and mitigation strategies were considered to determine whether the potential effect was eliminated or reduced to a negligible level. If a greater than minor change in the measurable parameters for the VC due to the Project-environment interaction was expected after mitigation measures were applied, then a residual effects assessment was conducted. The extent and source of any uncertainty in the predicted residual effects was described. Whenever possible, follow-up measures and commitments were provided to resolve uncertainties. Residual effects were then considered in combination with other reasonably foreseeable activities in the area to determine potential cumulative effects. Climate change predictions were incorporated into assessments to the extent possible. Monitoring programs and management plans will be designed based on potential residual and cumulative effects.

Existing Environment

A detailed understanding of the existing environment surrounding the Project has been developed through extensive baseline environmental studies. The existing environment section of the EIS was primarily informed by the most recent baseline studies completed between 2018 and 2024. Provided below is summary information for select VCs to provide an overview of the Project area.

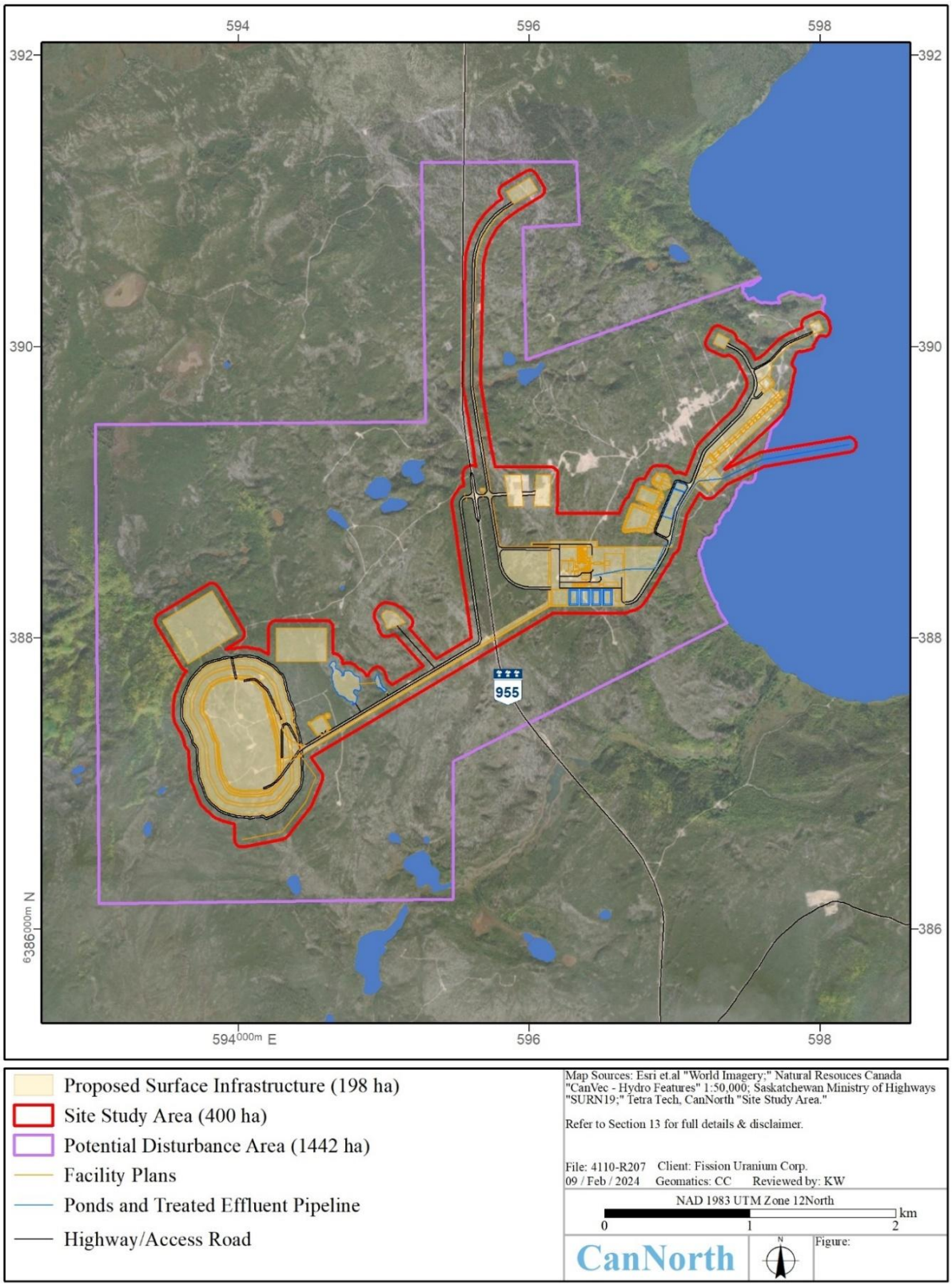

Figure 3
PLS Project Site Study Area (SSA) and Potential Disturbance Area (PDA)

Ambient air quality monitoring was conducted in the Project area over the course of 12 campaigns, starting in 2018. Generally, suspended particulate matter, nitrogen dioxide, sulphur dioxide, and external gamma and radon concentrations were below assessment criteria and consistent with a remote natural setting.

The Project is located adjacent to the western shore of Patterson Lake. Patterson Lake discharges into Patterson Creek and flows east through a series of lakes, including Forrest, Beet, and Naomi, before discharging into the Clearwater River and downstream into Lloyd Lake (Figure 4). Surface water uses in the Project area include commercial, industrial, recreational, and traditional uses.

Seasonal hydrological investigations were initiated in the study area beginning in 2014 and a full suite of baseline aquatic studies was completed between 2016 and 2023. Water quality results illustrated that waterbodies sampled in the aquatic study area (ASA) contained low levels of ions, nutrients, metals, and radionuclides. Sediment levels of metals and radionuclides tended to be low with only arsenic concentrations exceeding available guidelines at some locations. A total of 14 fish species were captured in the ASA with the most predominant species being lake whitefish (*Coregonus clupeaformis*), followed by white sucker (*Catostomus commersonii*), longnose sucker (*Catostomus catostomus*), and spottail shiner (*Notropis hudsonius*). Levels of constituents of potential concern (COPC) measured in lake whitefish and northern pike (*Esox lucius*) flesh and bone samples collected from seven lakes in the ASA were low and similar among lakes.

Baseline studies of the terrestrial environment were initiated with preliminary investigations in 2013 and expanded to comprehensive investigations between 2018 and 2022. The Project area largely traverses the Boreal Plain Ecozone, with some areas of the vegetation and wildlife LSAs extending into the Boreal Shield Ecozone. Land cover in the SSA has been affected by fire disturbance and most of the area (62%) is regenerating forest. Jack pine/blueberry/lichen and bare rock/soil were the second and third most dominant habitats, respectively.

During the baseline studies, vegetation and wildlife species of conservation concern (SOCC) were detected using a combination of field surveys, trail cameras, and automated recording units. Several species of vegetation SOCC were identified, but none were listed under the *Species at Risk Act* (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or *The Wildlife Act*. No weed species listed under *The Weed Control Act* were detected.

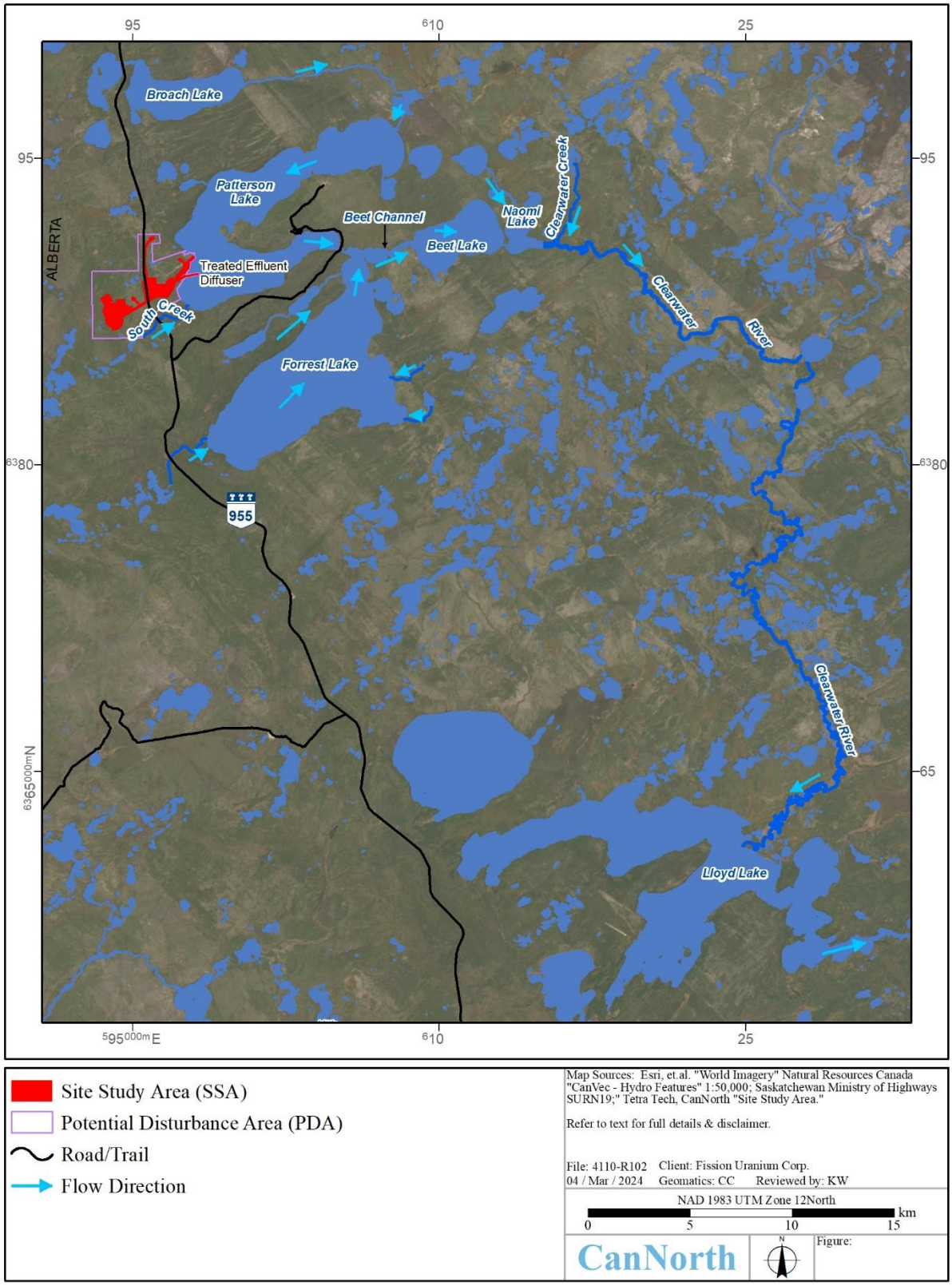

Figure 4
Waterbodies near to and downstream of the PLS Project

A total of one amphibian species, 13 bird species, and 8 mammal species (of which 5 were bat species) that are SOCC were located in either the SSA, PDA, and/or wildlife LSA.

Boreal woodland caribou (*Rangifer tarandus caribou*) were a species of focus in this EIS due to their importance to Indigenous Nations and their conservation status. Woodland caribou are listed as Threatened under the *Species at Risk Act* and as vulnerable/rare to uncommon in Saskatchewan. The Project is located within a designated Tier 1 caribou habitat management area (i.e., an area that presently yields higher habitat value and use by woodland caribou; SK2 West Caribou Administrative Unit). A Woodland Caribou Mitigation Plan (WCMP) was developed and outlines mitigation and monitoring measures that will be implemented for the Project.

Effects Assessment for the Project

During the evaluation of potential effects that the Project may have on the biophysical and human environments, all Project facilities and activities were assessed. This resulted in the identification of many potential effects that have no or negligible outcomes from Project activities once implementation of mitigation measures were considered. Key findings from the effects assessment are provided below for each VC.

Air Quality

Site activities and equipment associated with the Project have the potential to release dust and gaseous pollutants to the atmosphere and affect air quality. Changes in air quality have the potential to effect both the biophysical and human environments. An emissions inventory of air quality sources was developed, and concentrations of air quality COPC were predicted for the Project phases using dispersion modelling.

Dispersion modelling indicated that measurable increases of some COPC including dust, uranium, carbon monoxide, sulphur dioxide, nitrogen dioxide, acrolein, and radon are expected at various frequencies during different Project stages. This includes some increases above relevant assessment criteria. For dust, these increases are limited to an area near the site boundary and are expected to occur at a periodic frequency. For the remaining constituents, the increases are expected at a low frequency near the site boundary.

Although concentrations of gases in the air are predicted to exceed existing conditions, they remain below guidelines protective of human health. In addition, predicted concentrations of dust and COPC concentrations in surface water, soil, and vegetation influenced by dust deposition are below levels considered protective of human health.

The Project has mitigations planned to minimize potential impacts on air quality that include employing dust suppression technologies, utilizing sub-aqueous tailings deposition methods on the TMF, and using pollution control technologies on process plant equipment. Air quality monitoring will be conducted during all Project phases.

Noise and Vibration

Noise levels were considered during the assessment due to the potential of the Project to generate noise that is audible off-site as well as the potential for noise to change surrounding land use by humans and wildlife. No significant sources of vibration affecting humans were identified. Predictive modelling was used to estimate sound levels at sensitive receptor locations from the simultaneous operation of all identified noise sources. These predicted sound levels were compared to provincial and federal guideline limits.

The analysis predicted sound levels during construction and operations would be less than the criteria at all locations except one location at the south end of Patterson Lake near the Project. This location was predicted to be marginally above the criteria at night only.

The Project plans to reduce potential noise impacts using various mitigations including employing noise abatement measures on equipment, utilizing sound dampening technologies on the surface-installed mine ventilation equipment, and orientating this equipment in a manner that reduces noise travelling to Patterson Lake.

Visual Landscape

Changes to the aesthetics in the area around the Project were identified as being of interest by stakeholders and Indigenous Nations and communities. Therefore, changes to the landscape were evaluated at sensitive viewpoints within the LSA where people would be expected to interact with the Project.

Project development and operation are predicted to result in measurable changes to the visibility and visual contrast in the LSA. The frequency is dependent on seasonal, recreational, or traditional land users being present at the assessed viewpoints on the south arm of Patterson Lake.

The Project intends to mitigate changes to the visual landscape by maintaining natural visual screens (trees or other features) where possible and designing buildings and structures using materials, colour treatments, and finishes that aid to integrate with the surroundings and minimize contrast.

Terrain and Soils

Terrain and soils were identified as VCs because Project-related changes in terrain morphology, terrain stability, soil quantity, and soil quality have to potential to cause effects on aquatic, terrestrial, and atmospheric environments near the Project.

The residual effects identified for this VC include altered terrain and reduced soil quantity and physical properties that would result from Project activities during construction and operations. Predicted impacts to terrain and soils are limited to disturbed areas in the SSA and upon closure, the site will be returned to pre-existing conditions to the extent possible. The TMF will have terrain specifications different than the baseline conditions and will be the only permanent landform that remains on site post-decommissioning.

Mitigation measures will include using previously disturbed areas as much as possible, avoiding areas of sensitive terrain, preserving natural drainage features, using clearing equipment that minimizes surface disturbance, soil compaction, and topsoil loss, and completing both ongoing and final reclamation activities.

Groundwater Quantity

Project activities may affect groundwater quantity during various Project stages through mine dewatering, TMF development, potable water supply, and process water supply. Changes to groundwater quantity may affect the availability of groundwater for users or affect surface water levels and wetland habitat. Although there are three groundwater water wells within the Project site and one water well within 2 km of the Project site, there are presently no downgradient groundwater users; however, impacts to future potential groundwater users were considered as part of the assessment.

Modelling activities were undertaken to determine the potential extent and magnitude of groundwater drawdown in the vicinity of each area of the site that may be impacted. The residual effect assessment focused on the predicted decrease in groundwater quantity near the mine decline area during the construction and operations phases of the Project. The extent of the predicted impact is local, and the magnitude of potential effects is low. Impacts to wetlands and future users are expected to be negligible. Groundwater quantity is expected to return to pre-development conditions at the end of mine life.

The Project plans to limit potential impacts to groundwater quantity by minimizing water use where possible and maximizing re-use of water including in the process plant. A

groundwater quantity monitoring program will be implemented throughout the site during all Project phases.

Groundwater Quality

The Project has the potential to affect groundwater quality through interaction with underground mine backfill or through unintended seepage from storage facilities located on the surface including the TMF, water storage ponds, and ore and waste rock stockpiles. Changes in groundwater quality have the potential to effect future downstream groundwater users and downstream surface water quality.

A combination of analytical and numerical groundwater models was used to assess these interactions. Modelled increases in concentrations of arsenic, selenium, uranium, and sulphate that were predicted to be above background levels, but below applicable guidelines were limited to an area localized around the TMF and just southeast of the TMF. This increase is reversible in the long-term and no impact to receptors is expected.

The Project plans to mitigate the potential for these effects by utilizing lined surface storage facilities, installing sentinel style monitoring well systems around facilities, and employing adaptive management where necessary.

Surface Water Quantity

Surface water quantity may be affected by the Project's groundwater usage and discharge of treated effluent to Patterson Lake. A hydrological model was used to evaluate the effect of the Project on surface water quantity through all phases of the Project.

The residual effect that was identified was a low magnitude increase in stream flow locally in the Clearwater River at the outlet of Patterson Lake during the operations phase under natural low flow conditions. This will have a negligible impact on flood events and lake levels.

Groundwater use will be mitigated by the measures discussed above and treated effluent release quantities will be maintained at a steady rate to the extent possible. A surface water quantity monitoring program will be conducted during all Project phases.

Surface Water Quality

The principal Project interaction with surface water quality is through the year-round discharge of treated effluent into the south arm of Patterson Lake through a multi-port

diffuser. Changes to surface water quality may also result in changes to sediments, human and biota health, and may affect the use of surface water for recreation or land and resource use.

Assessment of this interaction was undertaken using a predictive contaminant dispersion and transport model. Predicted Project values for effluent discharge rate and effluent quality were utilized as inputs to the modelling process. The results of the modelling indicated that concentrations of some COPC were predicted to exceed average existing conditions in both the surface water and sediment but remain below applicable guidelines for the protection of freshwater aquatic life.

Mitigations to manage surface water quality revolve around the management of treated effluent discharge. These include minimizing water use and maximizing water re-use to limit effluent discharge volumes, effectively treating all water to be discharged prior to release, and monitoring treated effluent quality to ensure water quality criteria are met before discharge. Rigorous monitoring of treated effluent discharge and the receiving environment are required to meet both provincial and federal regulations. Discharged water quality, surface water quality, sediment quality, and aquatic biota will be monitored throughout the life of the Project.

Fish and Fish Habitat

Engagement activities with stakeholders and Indigenous Nations and communities identified fish to be of cultural, recreational, and socio-economic importance. Fish and fish habitat have the potential to be affected by numerous pathways that are caused by Project-related changes to other VCs.

Residual effects were identified for the pathways of treated effluent discharge into Patterson Lake and changes to surface water quantity. As discussed above, predicted COPC concentrations in surface water and sediment are expected to remain below guidelines established to be protective of aquatic biota, including fish. The limited extent and frequency of the potential changes in surface water flow in the Clearwater River downstream of Patterson Lake are predicted to have minor effects on fish and fish habitat.

The mitigations discussed above for surface water quantity and quality will mitigate the potential effects these pathways may have on fish and fish habitat. Monitoring of the receiving environment, including fish and fish habitat, will be completed throughout the life of the Project.

Vegetation

Vegetation was selected as a VC because Project activities could affect vegetation communities, SOCC, and vegetation health; avoidance or mitigation of SOCC and control of prohibited and noxious weeds are regulatory requirements; and vegetation has high cultural, recreational, and socio-economic importance.

The residual effects identified for this VC include loss or alteration of vegetation from land clearing during all Project stages and treated effluent discharge into Patterson Lake. As discussed above, surface and sediment COPC concentrations are predicted to remain below guidelines protective of aquatic biota, including aquatic vegetation.

Temporary changes to vegetation communities will occur during construction, operation, and decommissioning of the Project in the SSA. The plant communities and species identified by local communities as traditionally important are found in habitats that are also regionally abundant. Long-term effects of vegetation loss are largely considered reversible through reclamation. The vegetation community on the TMF will remain permanently altered; however, the footprint is small and only results in an alteration of 0.4% of habitat available regionally.

The Project plans to minimize vegetation loss and alteration by using previously disturbed areas as much as possible, preserving soil and vegetation quality and quantity to the extent practical, and completing both ongoing and final reclamation activities to return the site to pre-disturbance conditions. Re-vegetation success will be monitored during the decommissioning and post-decommissioning phases.

Wildlife and Wildlife Habitat

The Project has the potential to interact with wildlife and their habitat through multiple pathways including loss or alteration of habitat, sensory disturbance, activities that could cause injury or mortality, influence from Project air and water emissions, and barriers to movement.

Wildlife VCs were selected to represent functional groups that reside in the region and are important for ecosystem health, cultural, recreational, and/or socio-economic use. These include woodland caribou, ungulates, furbearers, bats, amphibians, and birds. Within each VC, key indicator species were selected because they have the potential to occur in the study areas and utilize various habitat types that could be influenced by Project activities.

The assessment identified three residual effects including treated effluent release into Patterson Lake, loss or alteration of wildlife habitat from land clearing, and sensory disturbances causing potential avoidance.

Predicted COPC concentrations in surface water in the south arm of Patterson Lake remain well below drinking water criteria for livestock watering. The assessment also considered exposure to wildlife from food pathways, such as fish, vegetation, and other animals potentially influenced by treated effluent release. The release of treated effluent from the PLS Project is not expected to negatively affect wildlife via food pathways for non-radionuclide intakes and radiological doses.

For all the key indicators, the amounts of their preferred habitat that could potentially be lost in the SSA or PDA was a small percentage of the amount available in the wildlife LSA and RSA. Direct loss of areas in the SSA with high habitat potential for woodland caribou constitutes only 1.6% of the LSA and 0.04% of the RSA; however, the magnitude of the effect is considered high because of the threatened conservation status of woodland caribou and the disturbance threshold criteria for the SK2 West Caribou administration unit.

Sensory disturbance from Project activities may affect all the wildlife VCs, with woodland caribou and bird species identified as the most sensitive receptors. Sensory disturbance effects are anticipated to occur for woodland caribou if they are present in the SSA and PDA. Bird species could show avoidance, particularly during their breeding periods.

The mitigation measures discussed above to minimize vegetation and soil loss and alteration will also mitigate wildlife habitat loss and alteration. Sensory disturbance will be mitigated by applying noise abatement measures to equipment and activities where possible, limiting light pollution to the extent practical, and implementing a waste management plan to reduce wildlife/Project interactions.

Economic Wellbeing

The Project is anticipated to change economic wellbeing at both the local, municipal, and provincial levels. This is through the generation of both direct and indirect employment, business and contracting opportunities, and the payment of taxes and royalties. These changes are predicted to have predominantly positive effects on economic wellbeing in both local and regional areas.

Traditional and Other Land and Resource Use

Project activities may result in changes to traditional and other land and resource use through changes to available resource quantity and quality. The Project will be located on land that is currently available for traditional land uses including hunting, fishing, trapping for food, or other traditional uses. Other land uses, including recreational and commercial activities, are also currently present in the Patterson Lake area.

There were two residual effects identified for the VCs of traditional and other land and resource use. Land cleared for the Project, as well as reduced accessibility due to security measures at the Project, will reduce the quantity of land available for these land uses in the SSA. Voluntary avoidance of the Project area may alter the quality and quantity of land that is considered suitable for both traditional and other land and resource use.

The Project plans to continue communication with local land users and groups to ensure both sides remain informed of land use in the Project area. A grievance mechanism will also be implemented that can be used to report impacts to traditional land use and users. Where loss of commercial income has been incurred, the Project will compensate for the loss of that income where required and appropriate. Fission is currently engaging with each affected Nation to identify accommodation opportunities to help offset impacts to Aboriginal and Treaty Rights that may occur as a result of increased voluntary avoidance.

Heritage Resources

Heritage resources have high importance to Indigenous Nations and communities, as identified through engagement, and they are protected by *The Heritage Property Act*. Project activities that cause ground disturbance have the potential to impact archaeological sites.

Two archaeological sites were identified in the SSA during baseline studies; therefore, this suggests that there is the potential to find additional heritage resources during Project development. A Chance Finds Procedure will be developed and implemented to outline steps that will be taken by Fission should an archaeological site be identified during Project activities. Following detailed Project design, additional heritage resource impact assessments will be completed, as required, to survey areas not previously assessed.

Community Wellbeing and Human Health

Community wellbeing and human health have several potential interactions with the Project such as potential changes in demand for infrastructure and services in local

communities, changes to employment and income levels in the local population, changes to traditional land and resource use, and changes to the natural environment affecting human health.

Both qualitative and quantitative assessment methods were employed to evaluate the effects of these potential changes to community wellbeing and human health. The assessment identified that changes to the level and distribution of employment, income, education, changes to worker rotation schedule, and changes to land and resource use were not predicted to affect the social and cultural wellbeing of the population assessed. The HHERA identified that Project-related changes to air and surface water quality are not predicted to have negative effects on human health. Additionally, Project activities are expected to have negligible effects on local infrastructure or services.

Mitigations planned to prevent potential effects from air emissions and surface water quality are discussed in their respective sections above. The Project will minimize potential impacts to local infrastructure and services by being self-sufficient to the extent possible. This includes provisions for on-site medical services and emergency response capabilities. Changes to community wellbeing will be monitored and managed with involvement of local priority communities through implementation of a Social Monitoring Program.

Cumulative Effects

The Cumulative Effects Assessment (CEA) for the Project evaluated how the combination of effects from the Project in addition to other existing, historical, or reasonably foreseeable developments in the area may impact the biophysical or human environment in the area of the Project. For the PLS Project, there are no existing or historical developments to be evaluated. The CEA considered NexGen Energy Ltd.'s Rook I Project to be a reasonably foreseeable development and utilized data presented in its EIS in the assessment. The Rook I Project is located on the eastern shore of Patterson Lake and would potentially interact with the PLS Project in several ways including the use of Patterson Lake for the discharge of treated effluent and the use of Highway 955. The PLS Project and Rook I Project potentially influence the same local Indigenous Nations, stakeholders, and communities.

Potential cumulative effects were evaluated for VCs concurrent with evaluation of residual effects of the PLS Project. The assessment considered the cumulative case assuming the two projects were constructed and operating during the same time periods. In most areas, the CEA did not predict any additional residual effects through the evaluation of the cumulative case as compared to the Project case.

Based on CEA modelling, dust concentrations generated in some areas along Highway 955 near the roadway are predicted to be above air quality criteria in the cumulative case. Based on the significantly larger traffic counts associated with the Rook I Project, and no predicted exceedances in the Project case, this change is attributable to the Rook I Project.

Evaluation of surface water quantity in the Project case indicated a low magnitude change in stream flow downstream of the Project, which may be noticeable during low flow periods. The addition of the Rook I Project's treated effluent in the cumulative case alters the low magnitude change prediction to a medium magnitude change prediction. No other changes to the evaluation of surface water quantity are predicted.

Rook I Project's gas emissions were added to the PLS Project emissions for the cumulative case. In scenarios where construction was occurring at both projects, exceedances of the 1-hr criterion for nitrogen dioxide are predicted at the Rook I Camp. The CEA also predicted the 24-hr criterion for nitrogen dioxide will be exceeded at the Rook I Camp during both construction and operations if they occur at the same time. The nitrogen dioxide exceedances at the Rook I Camp are largely related to emissions from the Rook I Project, with a small additional contribution from the PLS Project. The cumulative case also indicated a low probability scenario where the criterion for nitrogen dioxide would be exceeded on an occasional 1-hr period near the south end of Patterson Lake if both projects were constructing during the worst possible meteorological conditions. The likelihood of these cumulative effects is considered low.

The addition of Rook I Project effluent to PLS Project effluent for the cumulative case increased concentrations of some COPC in surface water. An exceedance of an aesthetic objective for total dissolved solids is predicted in the cumulative case. Consistent with the potential cumulative effects identified in the Rook I EIS, the additional consideration of the Rook I Project in the CEA identified an increase in the cancer risk above the negligible level for resource users immediately downstream of the projects. Although it is above negligible, it is considered low. The potential for cumulative effects is uncertain due to the conservative approach to the assessment and inconsistencies identified within the modelling conducted for the Rook I Project as well as the subsequent effects identified in the cumulative effects assessments.

Although there is no overlap in direct disturbance areas between the projects, habitat loss or alteration and sensory disturbance on a regional scale has potential to affect wildlife species with large home ranges or sensitivity to fragmentation, such as woodland caribou.

The regional area is considered previously disturbed from direct disturbances such as existing roads, exploration, past mining activities, and fire disturbance footprints, and indirectly disturbed due to habitat being within the 500-m disturbance buffer described for woodland caribou by Environment and Climate Change Canada. Additional mitigations are not expected to be required as the implementation of a Project-specific WCMP and adaptive management will likely reduce potential cumulative impacts.

Cumulative effects on traditional land and resource use have the potential to occur through land clearing and disturbance, changes to land access and barriers to movement, and voluntary avoidance. Both projects are actively engaging with affected Nations to establish suitable accommodations to offset the magnitude of effects, with monitoring occurring through ongoing engagement and information sharing with affected Nations and land users.

Monitoring and Management Plans

Comprehensive monitoring programs will be completed during all phases of the Project. Monitoring programs will be designed to measure potential effects of the Project, verify EIS predictions and mitigation effectiveness, address uncertainties identified in the EIS, and detect unanticipated impacts. Monitoring program results will be utilized to quantify both positive and negative impacts of the Project, ensure that public interest and safety are addressed, inform environmental performance reporting, modelling updates, revisions to monitoring and management plans, and identify if further mitigations and corrective actions are required.

Fission will implement and maintain a comprehensive environmental management program (EMP) which will include environmental protection objectives, roles and responsibilities, and detailed monitoring plans for each Project phase. The EMP will align with all applicable agency requirements and guidance, including the *Metal and Diamond Mining Effluent Regulations* (MDMER), Canadian Nuclear Safety Commission (CNSC) regulatory documents, and relevant Canadian Standards Association (CSA) standards.

The type and extent of monitoring will vary depending on the Project stage. Monitoring of direct emissions from the Project as well as the surrounding environment will occur over the life of the mine. The monitoring program will be regularly reviewed and revised as needed. Monitoring components are anticipated to include source and ambient air quality, local weather conditions, soil and vegetation quality, groundwater levels and quality, treated effluent flows and quality, surface water quantity/flows and quality, sediment quality, aquatic biota, vegetation, and wildlife.

Fission will also implement a Social Monitoring Program to monitor and manage any changes to economic, land use, and community wellbeing conditions. Socio-economic monitoring of local employment and training and local procurement initiatives will occur and will be used to inform the reporting requirements set out in the Mine Surface Lease Agreement. Employee satisfaction and retention will be monitored internally through human resource development initiatives.

Management programs and plans will be implemented during all phases of the Project to ensure mitigation measures, regulatory requirements, conditions set out in approvals, licenses, and permits, and agreements/expectations of Indigenous Nations are met.

In addition, specific studies will be undertaken to address uncertainties in the conclusions of this EIS and additional baseline studies will be conducted prior to construction to ensure all areas are fully characterized prior to construction. Numerous follow-up assessments, studies, and modelling updates are planned during the detailed design phase to inform permitting and licensing.

Fission has committed to developing mechanisms to share relevant Project information including environmental monitoring data, site safety performance, and other information required to keep all groups informed about Project activities.

Decommissioning and Reclamation Plan

Fission will develop a Preliminary Decommissioning Plan (PDP) that describes the steps to be taken to decommission Project infrastructure and reclaim the land, as well as a cost estimate for implementation of the PDP. The PDP will incorporate input from stakeholders and Indigenous Nations and communities for submission to ENV and CNSC as part of Project permitting and licensing. Updates will be completed on a regular frequency to encompass Project changes, recognize progressive reclamation activities, and ensure the continued adequacy of the plan and cost estimate. Once the operations phase of the Project is complete and a decision to decommission is made, then a Detailed Decommissioning Plan (DDP) and cost estimate will be developed, which will require approval by CNSC and ENV prior to the start of the active decommissioning phase.

Following active decommissioning, the Project would transition to post-decommissioning monitoring. The purpose of post-decommissioning monitoring will be to evaluate whether the objectives of the DDP were achieved. Once decommissioning performance criteria objectives have been met, Fission may apply to the CNSC to relinquish the Project's

licensing requirements as well as ENV to transfer the site to the Institutional Control Program.

Conclusions

Uranium was identified as a critical mineral by the Government of Canada in its Critical Minerals Strategy. In its role as a critical mineral, uranium is essential for the economic security of Canada and necessary for Canada's and the world's transition to a sustainable, low-carbon energy future. The PLS Project is ideally positioned to supply uranium to further that transition and aid Canada in advancing and achieving the objectives outlined in its strategy.

Through this EIS, Project activities have been assessed to determine their potential impact on the local biophysical environment as well as land and resource users and local communities. Fission is committed to development that is sustainable, safe, and protective of the environment, and that creates lasting value for both Fission and local Indigenous Nations, stakeholders, and communities.

SECTION 1

INTRODUCTION

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LIST OF ACRONYMS

ACFN	Athabasca Chipewyan First Nation
AHPP	Aquatic Habitat Protection Permit
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
CanNorth	Canada North Environmental Services
CEAA	*Canadian Environmental Assessment Act*
CNSC	Canadian Nuclear Safety Commission
CRDN	Clearwater River Dene Nation
CSA	Canadian Standards Association
DFO	Fisheries and Oceans Canada
DTC	Duty to Consult
EASB	Environmental Assessment and Stewardship Branch
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMPA	*Environmental Management and Protection Act*
ENV	Saskatchewan Ministry of Environment
Fission	Fission Uranium Corp.
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
HCB	Heritage Conservation Branch
IA	Impact Assessment
IAA	*Impact Assessment Act*
LRWS	Ministry of Labour Relations and Workplace Safety
MBCA	*Migratory Birds Convention Act*
MDMER	*Metal and Diamond Mine Effluent Regulations*
MN-S	Métis Nation-Saskatchewan
MSLA	Mine Surface Lease Agreement
NPRI	National Pollutant Release Inventory
the Project	The PLS Project
SARA	*Species at Risk Act*
SEAA	*The Environmental Assessment Act,* Saskatche*wan*
SEARP	Saskatchewan Environmental Assessment Review Panel
SMR	Small Modular Reactor
SOCC	Species of Conservation Concern
TOR	Terms of Reference

TP	Technical Proposal
TRC	Technical Review Comments
TSX	Toronto Stock Exchange
UTM	Universal Transverse Mercator
WSA	Water Security Agency
YNLR	Ya’ thi Nene Land and Resource Office

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1.0 INTRODUCTION

Fission Uranium Corp. (Fission, the proponent), a subsidiary of Paladin Canada Inc. is proposing the development of a uranium mining and milling operation in northwestern Saskatchewan called the PLS Project (the Project). This Environmental Impact Statement (EIS) describes the Environmental Impact Assessment (EIA) completed for the Project and includes the information described in the Project-specific Terms of Reference (TOR) (Fission 2022) and the Saskatchewan Ministry of Environment (ENV) guidelines for the TOR and EIS (ENV 2021a).

This introduction provides an overview of the Project, information on the proponent and consultants, development justification, land controls, a list of applicable regulatory requirements, and outlines the report structure. Concordance between the components of the introduction of this EIS and the ENV guidelines (ENV 2021a) is provided in Table 1-1.

1.1 Project Overview

The Project is situated adjacent to the west shore of Patterson Lake approximately 664 kilometres (km) north-northwest of Prince Albert, Saskatchewan (Figure 1-1). The Universal Transverse Mercator (UTM) co-ordinates for the approximate centre of the Project are 600,000mE, 6,387,500mN (NAD83 UTM Zone 12N). The Project is located within Treaty 8 Territory and the homeland of the Métis Nation, with the closest communities being the northern settlement of Descharme Lake, located approximately 60 km south of the Project, Clearwater River Dene Nation (CRDN), located approximately 155 km south of the Project, and La Loche, located approximately 157 km south of the Project (Figure 1-1). The property is accessed by an all-weather highway, Highway 955, that originates at La Loche and bisects the Project.

The Project is located near the southwestern edge of the Athabasca Basin, which is the most significant uranium metallogenic district in Canada. The PLS property hosts the Triple R deposit within one of the larger mineralized trends in the Athabasca Basin region and the region's largest high-grade deposit at shallow depth.

The Project encompasses all activities, facilities, and phases necessary to support a uranium mining and processing operation that will mine and mill approximately 1,000 tonnes per day, with a current planned production of 93.7 million pounds (Mlbs) triuranium octaoxide (U_3O_8) over a 10-year period (Tetra Tech 2023a). Construction and operation of the Project

will require the development of several facilities including an underground mine, process facilities, a tailings management facility, connective access roads, and other related infrastructure and ancillary facilities. The feasibility studies for the Project included a proposed site layout. This site layout, with minor modifications made in consideration of input from Indigenous Nations and communities, the environment, and ongoing Project design, was assessed in this EIS. Project planning encompassed the entire lifecycle of the Project including preliminary plans for decommissioning and reclamation as well as management and monitoring plans for all phases of development including post-decommissioning.

1.2 Purpose of Submission

In Saskatchewan, *The Environmental Assessment Act* (SEAA) requires that a proponent receive the approval of the ENV before proceeding with a project that is defined as a development (EASB 2014). Once defined as a development, completion of an EIA is required (refer to Section 1.6.2.1 for additional information). The ENV Environmental Assessment & Stewardship Branch (EASB) leads the provincial EIA process and coordinates reviews with technical experts and the public. Ultimately, the finalized EIS is submitted for a decision on whether or not to approve the proposed project.

Fission initiated the provincial EIA process on November 22nd, 2021 by submitting a Technical Proposal (TP) to the EASB in which Fission self-declared the Project as a development as per SEAA (Clifton Engineering Group Inc. 2021). Fission also submitted the draft TOR at the same time as the TP under a separate cover. The TOR outlined the information to be gathered during the EIA and how it would be presented in the EIS.

Uranium mines may also be required to undergo an environmental assessment under the federal *Impact Assessment Act* (IAA) and the associated *Physical Activities Regulations* (refer to Section 1.6.1.1 for additional information). The Project does not trigger this process as production capacity will not exceed 2,500 tonnes per day. While it is also possible for a project to be designated for federal Impact Assessment (IA) by the Minister of Environment and Climate Change Canada (ECCC), Fission was informed by the Minister on November 14th, 2022, that the Project will not be designated for a federal IA.

Although the provincial EIA decision will be independent of the federal government, the Canadian Nuclear Safety Commission (CNSC) is an active participant in this EIA process and plays a role as a technical advisor/reviewer. The CNSC is the lead federal agency involved in regulating and licensing uranium mining projects and licensing by the CNSC

will be required for the Project per the *Nuclear Safety and Control Act* and the *Uranium Mines and Mills Regulations*. The TP and TOR were submitted to the CNSC for their review to ensure the regulator understands the Project and can provide guidance on their expectations as it pertains to their involvement in the Project's lifecycle and information needs for environmental protection reviews.

Comments on the TOR were provided by the EASB and CNSC on March 23rd, 2022, and again on May 30th, 2022. The TOR was revised based on feedback from the EASB, CNSC, CRDN, and Birch Narrows Dene Nation (BNDN), and the final document was approved on July 21st, 2022 (Fission 2022). As such, the Project proceeded with the EIA, which is described in this EIS.

Community engagement was initiated in 2013. Since 2020, engagement to inform the EIA has been underway and Fission has been engaging with CRDN, Métis Nation-Saskatchewan (MN-S) Northern Region 2, BNDN, Buffalo River Dene Nation (BRDN), the Ya' thi Nene Land and Resource Office (YNLR), and Athabasca Chipewyan First Nation (ACFN). Information, input, and concerns from stakeholders and Indigenous Nations and communities, which were identified through engagement, have been incorporated into this EIS.

This EIS compiles and presents the results of the EIA that has been completed for the Project and contains relevant information prescribed by the SEAA.

1.3 The Proponent

Fission is a mineral development and exploration company focused on the uranium sector (federal business number 828435735; Saskatchewan entity number 101256882). Fission owns a 100% interest in the Project. The company is headquartered in Kelowna, British Columbia and has a regional operations office in Saskatoon, Saskatchewan. On December 23, 2024, Paladin Energy Ltd. (Paladin), via its wholly owned subsidiary 1000927136 Ontario Inc. (now Paladin Canada Inc.), completed the acquisition of Fission via a plan of arrangement under *the Canada Business Corporations Act* (the Arrangement). The Arrangement was entered into on June 24, 2024, approved by Fission shareholders on September 9, 2024, approved by the Supreme Court of British Columbia on October 8, 2024, and received clearance under the *Investment Canada Act* on December 18, 2024. Paladin subsequently listed its shares on the TSX on December 27, 2024. As a result of the completed Arrangement, Fission is now a wholly owned subsidiary of Paladin Canada Inc.

Proponent	Fission Uranium Corp.
Contact	Gary Haywood, P.Eng. VP Project Development 108-103 Marquis Court Saskatoon, SK S7P 0A3 Telephone: (306) 203-3823 Email: gary.haywood@paladinenergy.ca

The corporate management structure and a copy of the Saskatchewan Corporate Registry report are included in Appendix A.1 – Corporate Profile Report.

1.3.1 Consultants

This EIS has been prepared for Fission by several consultants, as summarized in Table 1-2. Section 12 provides a listing of key personnel involved in the EIA and associated credentials. The principal consultant responsible for the preparation of this EIS is Canada North Environmental Services (CanNorth).

Environmental Consultant	Canada North Environmental Services
Contact	Kelly Wells, M.Sc., P.Biol. Environment Division Manager 211 Wheeler Street Saskatoon, SK S7P 0A4 Telephone: (306) 652-4432 Email: k.wells@cannorth.com

1.4 Development Justification

The Government of Canada released the Canadian Critical Minerals Strategy in December 2022 that recognizes uranium as a critical mineral (Government of Canada 2022). Critical minerals are defined as those essential to Canada's economic security and/or are required for Canada's, and the world's, transition to a sustainable, low-carbon economy. The Critical Minerals Strategy is part of Canada's strengthened climate plan and it sets out five core objectives: support economic growth and competitiveness; promote climate action and environmental protection; enhance global security and partnership with allies; advance Indigenous reconciliation; and foster diverse and inclusive workforces and communities (Government of Canada 2022). Development of the Project aligns with

Canada's climate plan and Critical Minerals Strategy and the Project is designed to achieve these core objectives.

Uranium is primarily used as fuel in nuclear reactors for the generation of electricity. Nuclear power plays an important role as part of the energy solutions for limiting greenhouse gas (GHG) emissions. Currently, nuclear energy supplies approximately 10% of the world's electricity and is the world's second-largest source of low-carbon power (World Nuclear Association 2023). Demand for uranium is expected to continue to grow with approximately 59 reactors under construction and the potential introduction of Small Modular Reactor (SMR) technologies in Canada and Saskatchewan that will bring safer, more flexible power options. Furthermore, renewables require baseload support to offset the inefficiencies in power storage options and variable generation due to climate and geographic limitations. Nuclear energy can provide this GHG-free baseload power. Fission is proposing to develop the Project to supply the global market with uranium as fuel to be part of the energy solutions in limiting GHG-driven climate change.

The only previously producing mine located on the west side of northern Saskatchewan was Orano Canada Inc.'s now-decommissioned Cluff Lake mine. Its' closure limited the number of job and business opportunities in the mining industry for residents of Saskatchewan's north in the region. Fission is committed to providing employment and business opportunities and is currently working with leadership from several local communities to establish recruitment processes and training opportunities to facilitate economic participation on the Project.

Economic benefits, which include employment and government revenues, will be realized at the federal, provincial, and local levels during construction and operation of the Project. A thorough economic assessment (included in Appendix C.5) was completed for the Project in 2023 and details the predicted economic benefits of the Project.

During construction, capital expenditures are predicted to result in almost 11,300 direct, indirect, and induced full time equivalent (FTE) employment positions across Canada, 7,400 of which will be in Saskatchewan. This is expected to result in $981 million in labour income in Canada, $677 million of which will remain in Saskatchewan. During operation, direct, indirect, and induced FTEs range from 551 in Saskatchewan to 688 across Canada. Labor income during operations is estimated to be $59 million in Saskatchewan, and $66 million across Canada. Of the predicted FTEs, direct employment is expected to result in

298 positions in Saskatchewan, creating $40 million in direct labour income in Saskatchewan.

Residents of Saskatchewan's north and residents of Nations or communities located near the Project will be prioritized for direct employment and contract opportunities. Fission is actively supporting community-led training programs such as the BRDN/BNDN safety training course and will provide on-the-job training to new employees.

Fission is currently working closely with several economic development organizations from Northern Saskatchewan to identify services already available and to support local companies or Nations to grow, diversify, and/or form partnerships with the goal of building local capacity.

The Government of Saskatchewan receives revenues from the mining industry in the form of revenue royalties, profit royalties, corporate income tax, and personal income tax. The Government of Canada receives revenues in the form of corporate income tax and personal income tax. The Project is predicted to contribute $571 million in Provincial revenue royalties, $728 million in Provincial profit royalties, $1 million in Provincial personal income tax revenues, $1.9 million in Federal personal income tax, and $992 million in corporate income tax.

1.5 Land Controls

The Project is located on Crown Land, which consists of 17 contiguous mineral claims covering an area of 31,039 hectares located on the southwest margin of the Athabasca Basin. The major asset associated with the Project is the Triple R uranium deposit.

1.6 Regulatory Overview

The following guides, policies, and standards were consulted when completing the TP, TOR, and EIS for the Project:

- Provincial guidelines for completion of the TP and the TOR (ENV 2014a, 2021b)[1] and the EIS (ENV 2021a).
- Consultation with First Nations and Métis in Saskatchewan Environmental Impact Assessment (ENV 2014b).

[1] The TP and TOR were completed prior to the release of the updated 2021 guidelines.

- Proponent Handbook Voluntary Engagement with First Nations and Métis Communities to Inform Government's Duty to Consult Process (GS 2013).
- Guidelines for northern mine decommissioning and reclamation (ENV 2008).
- The Saskatchewan Environmental Code and attendant standards.
- Health Canada guidance for environmental assessments for air, water, noise and human health risk assessment (Health Canada 2016a, 2016b, 2017a, 2017b, 2019).
- Health Canada guidance for contaminated site risk assessments (Health Canada 2021a, 2021b).
- Saskatchewan guidelines for reviewing health impacts in environmental assessments (Froese and Orenstein 2014).
- Saskatchewan air quality modelling guideline (ENV 2012).
- Canadian Standards Association (CSA) standards related to environmental risk assessment (N288.6) and environmental monitoring programs (N288.4, N288.5) at nuclear facilities and uranium mines and mills.
- CNSC REGDOC-2.9.1, version 1.2 Environmental Principles, Assessments and Protection Measures (CNSC 2020).
- CNSC REGDOC-3.2-2, version 1.2 Indigenous Engagement (CNSC 2022).

This EIS will serve as the primary environmental application for the Project. Table 1-3 provides a list of federal and provincial Acts and Regulations, and rationale for their applicability. Fission recognizes that additional legislation may apply, and it is Fission's responsibility to comply with all applicable legislation.

The Project will require a number of permits, approvals, and authorizations over its lifecycle in accordance with the requirements outlined in legislation, regulations, and standards. A preliminary list of permits, approvals, and authorizations that may be required throughout the life of the Project is presented in Table 1-4, subject to confirmation with the responsible agencies.

The major regulatory frameworks and associated approvals processes for the Project are outlined in the following sections.

1.6.1 Government of Canada

1.6.1.1 Impact Assessment Act

On August 28th, 2019, the federal IAA came into force, creating the Impact Assessment Agency of Canada and repealing the *Canadian Environmental Assessment Act* (CEAA) 2012. The IAA outlines the process for the Government of Canada to assess the effects of designated projects, projects carried out on federal lands, or projects outside of Canada. Projects are designated by type and thresholds prescribed in the *Physical Activities Regulations* (SOR 2019-285) (GC 2019). Sections 18 to 25 of these regulations are designation criteria applicable to mines and metal mills and Sections 20 and 22 are appliable to the construction of a new uranium mine or mill. These criteria are:

- the construction, operation, and decommissioning, outside the licensed boundaries of an existing uranium mine, of a new uranium mine with an ore production capacity of 2,500 tonnes per day or more; and/or
- the construction, operation, and decommissioning, outside the licensed boundaries of an existing uranium mill, of a new uranium mill with an ore input capacity of 2,500 tonnes/day or more.

The Project is projected to produce approximately 1000 tonnes of ore per day. As such, the Project does not satisfy the above criteria; therefore, the IAA does not require an IA per the *Physical Activities Regulations*.

In addition to the designation of a project via the *Physical Activities Regulations, S*ection 9 of the IAA empowers the Minister of Environment and Climate Change on their own initiative or by request to designate a project not otherwise designated to undergo a federal impact assessment. This can be done, if, in their opinion, either the carrying out of that physical activity may cause adverse effects within federal jurisdiction or adverse direct or incidental effects, or public concerns related to those effects warrant the designation.

In 2022, a request for such a designation was made by the Métis Nation of Saskatchewan with respect to the Project. In November 2022, the Minister of ECCC determined that the Project does not warrant designation under the IAA.

1.6.1.2 Canadian Environmental Protection Act, 1999

The *Canadian Environmental Protection Act, 1999* provides pollution prevention and the protection of the environment and human health to contribute to sustainable development. Mandatory reporting to the Greenhouse Gas Reporting Program (GHGRP) and the National Pollutant Release Inventory (NPRI) for those who meet the requirements is prescribed under this statute. Accompanying regulations that may also apply to the Project include the *Environmental Emergency Regulations, 2019* (SOR/2019-51) and the *Federal Halocarbon Regulations, 2022* (SOR/2022-110).

1.6.1.3 Nuclear Safety and Control Act

The *Nuclear Safety and Control Act* (SC 1997, c. 9), and its regulations, is Canada's federal legislation that regulates the Canadian nuclear industry, including uranium mines and mills. The CNSC is the governing body that regulates the use of nuclear energy and materials to protect human health, safety, and security, as well as the environment. The CNSC is responsible for the regulation and licensing, as well as the decommissioning, of uranium mines and mills. The CNSC will be a lifecycle regulator of the Project; thus, the Project will be subject to the CNSC's licensing process. The CNSC requires that licensee's respect the precautionary principle and the concepts of pollution prevention, sustainable development, and adaptive management (CNSC 2020).

Fission has initiated the CNSC licensing process in parallel with the EIA process. This allows for early discussion with the CNSC on the licensing process, engagement and consultation expectations for licensing, and the scope of the Project.

1.6.1.4 Fisheries Act

The federal *Fisheries Act* (R.S.C., 1985, c. F-14) is respecting the proper management and control of fisheries, and the conservation and protection of fish and fish habitat. Under the Act, the *Metal and Diamond Mining Effluent Regulations* (MDMER; SOR/2002-222), which are administered by ECCC, apply when a mine is discharging effluent (e.g., treated mine water) containing deleterious substances into fish-bearing waters. These regulations govern the maximum authorized concentrations of regulated parameters in effluent released by the Project, as well as stipulate monitoring requirements. Once the mine is operational and MDMER treated water discharge criteria are met, the Project will be required to complete Environmental Effects Monitoring (EEM) programs that include

monitoring of treated mine water and the receiving surface waters, sublethal toxicity testing, and biological monitoring,

The *Fisheries Act* also contains provisions against the death of fish other than from fishing and the harmful alteration, disruption, or destruction of fish habitat, including by preventing pollution. An Authorization from Fisheries and Oceans Canada (DFO) may be required for certain Project activities, such as installation and operation of the treated effluent diffuser.

The Project will not meet the criteria for inclusion in the federal *Wastewater Systems Effluent Regulations* (SOR/2012-139), and as such will be exempt from those regulations.

1.6.1.5 Species at Risk Act

It is illegal to kill or harass endangered or threatened species, as designated by the *Species at Risk Act* (SARA; S.C. 2002, c. 29). The purpose of the SARA is to prevent wildlife species in Canada from becoming extirpated or extinct, to secure actions for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened because of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. The legislation also affords protection to the residences (e.g., nests, burrows) and/or critical habitats of these species from damage or destruction.

This EIS has considered SARA-protected species and provincially tracked species (S1 to S3) as Species of Conservation Concern (SOCC), and mitigation or avoidance of these species for infrastructure siting reflect the Saskatchewan Activity Restriction Guidelines for Sensitive Species (ENV 2017) to avoid disturbance to these species.

In particular, the Project has the potential to impact the boreal population of woodland caribou (*Rangifer tarandus caribou*), which is listed as Threatened under SARA. A national recovery strategy, created by ECCC in response to the federal strategy, and the province of Saskatchewan is developing a conservation strategy to protect caribou habitat and ensure the sustainability of the woodland boreal population (ENV 2013). Saskatchewan is a signatory of the Accord for the Protection of Species at Risk in Canada and, as such, the province is responsible for managing woodland caribou on private and provincial lands. In December 2018, an agreement for the Conservation of Woodland Caribou, Boreal Population in Saskatchewan (referred to as the Agreement) was made between the federal government (i.e., ECCC) and the ENV pursuant to Sections 10 and 11

of the SARA and Section 9 of *The Wildlife Act*. A Woodland Caribou Mitigation Plan for the Project was prepared as part of this EIS to lessen potential disturbance to woodland caribou and their habitat through mitigations, monitoring, and adaptive management (Appendix D.9 – PLS Project Woodland Caribou Mitigation Plan).

1.6.1.6 Migratory Birds Convention Act

The *Migratory Birds Convention Act, 1994* (MBCA; S.C., 1994, c. 22) was established in 1917, and significantly updated in June 1994, to protect migratory birds, their eggs, and their nests from destruction. The Project has considered potential effects to migratory birds, including the application of appropriate mitigation measures and best management practices for minimizing impacts to migratory birds. The *Migratory Birds Regulations* (C.R.C., c. 1035) are applicable to the Project; for example, should a nest be threatened by the Project, a Migratory Birds Damage or Danger permit from ECCC would be required to relocate any birds listed under the MBCA that are not listed under the SARA.

1.6.1.7 Canadian Navigable Waters Act

The *Canadian Navigable Waters Act* (R.S.C., 1985, c. N-22) protects the public right of navigation on all navigable waters in Canada, including those for recreational purposes or as a means of transport or travel for Indigenous peoples of Canada. As such, works that affect navigation require approval to the Navigation Protection Program. However, installation of "minor works" as defined by the Minor Works Order are exempt from approval and need only to notify the Government of Canada's Navigation Protection Program External Submission Site registry prior to beginning construction. Criteria for outfalls and water intakes (as per Section 26 of the Minor Works Order) indicate the treated water diffuser meets the criteria of a minor work; therefore, only notification is required.

1.6.1.8 Explosives Act

The *Explosives Act* (R.S.C., 1985, c. E-17) includes the provisions for the manufacturing, testing, acquisition, possession, sale, storage, transportation, importation, and exportation of explosives and the use of fireworks. Under the *Explosives Regulations*, *2013* (SOR/2013211), Fission may be required to obtain a license from Natural Resources Canada to store, manufacture, or handle explosives used in blasting at the Project. Additionally, approval for explosives magazine storage and requirements for use and handling of explosives are issued by Ministry of Labour Relations and Workplace Safety (LRWS).

1.6.2 Government of Saskatchewan

1.6.2.1 The Environmental Assessment Act

In Saskatchewan, any project that is determined to be a development requires an environmental assessment and approval from the ENV to proceed. The Environmental Assessment Act also includes provisions for public input on the EIS, including Duty to Consult (DTC).

The Project is a development per the SEAA, and as such, approval for the Project must be obtained. This approval requires submission of an EIS that presents the results of an EIA. For this EIA and in accordance with the *Government of Saskatchewan First Nation and Métis Consultation Policy Framework*, the procedural aspects of the DTC have been delegated to Fission and completion of those procedural aspects is a requirement for approval of the EIA.

A Saskatchewan Environmental Assessment Review Panel (SEARP) provides an expert, technical review of the EIS, including those from other provincial ministries and, where required, federal government reviewers. Once the EASB and SEARP have completed their reviews and the Proponent has addressed any deficiencies, the EASB will compile all review comments into the Technical Review Comments (TRC) document. This, along with this EIS, will be posted for public review for a minimum of 30 days. Upon reviewing the EIS, TRC, public comments, and any inquiry findings and relevant recommendations, the Minister will publish the decision and any conditions.

Fission will be required to comply with any other terms and conditions and follow-up commitments issued by regulatory agencies associated with approval under the EIA process. The proponent will then proceed to retain the various provincial licenses, approvals, and permits, and will adhere to relevant federal legislation requirements, as outlined in Section 1.6.1.

1.6.2.2 The Environmental Management and Protection Act, 2010

The *Environmental Management and Protection Act, 2010* (EMPA) repealed and incorporated the *Clean Air Act*, the *Litter Control Act*, and the *State of the Environment Report Act*. The purpose of the EMPA is to protect the environment (including air, soil, subsoil, sediments, consolidated surficial deposits and rock, water, organic and inorganic matter, living organisms, and interacting natural systems). The EMPA is administered by

ENV and manages activities and substances in Saskatchewan that have the potential to adversely affect the environment or human health. Empowered by the EMPA, the Saskatchewan Environmental Code is an outcome-based regulatory framework of standards and requirements such as discharge discovery and reporting, site assessments, corrective action plans, hydrostatic testing, forest products scaling, halocarbon control, and industrial air emissions. The regulations and approvals to construct, operate, and decommission the Project will largely be issued by the ENV under the EMPA's *The Mineral Industry Environmental Protection Regulations*.

An Aquatic Habitat Protection Permit (AHPP) is issued under the EMPA for 1) any work that disturbs the bed, bank, or boundary of a waterbody or watercourse, and 2) any discharge with an adverse effect on water. Depending on the works or activities, AHPPs are issued by the ENV or the Water Security Agency (WSA). An AHPP will be required for in-water work including installation, operation, and decommissioning of the treated effluent pipeline and diffuser.

Included under the EMPA are the regulations that significantly impact approvals and permits issued for the Project, such as *The Mineral Industry Environmental Protection Regulations, 1996, The Hazardous Substances Waste Dangerous Goods Regulations, 1989, The Waterworks and Sewage Works Regulations,* and *The Environmental Management and Protection (General) Regulations, 2015.*

1.6.2.3 The Water Security Agency Act

The Saskatchewan *Water Security Agency Act* (SS 2005, c. S-35.03) is applicable for works that have the potential to affect Saskatchewan water, watersheds, and related land resources. The Act manages, regulates, and controls water flow, approves and issues water rights licenses and approvals, and promotes conservation of Saskatchewan's aquatic environments with consideration of the province's economic and social needs.

Several approvals, licenses, and permits will need to be obtained by the Project from the ENV and/or WSA including a Permit to Conduct Ground Water Investigations, a Water Rights License, and an Approval to Construct and Operate Drainage Works. Submission of water use and water level data will be required as part of the Water Rights Licence and Approval to Operate.

1.6.2.4 The Provincial Lands Act, 2016

The *Provincial Lands Act, 2016* applies to all provincial Crown land. Crown resource lands are typically natural areas preserved for the protection of wildlife and wild ecosystems. A lease, permit, easement, or license that grants the holder occupation or use of Provincial Crown lands may be issued under the Act. Proposals for a surface lease are submitted to the ENV.

Pursuant to Section 5-16 of *The Crown Resource Land Regulations, 2019*, a mine surface lease must be issued for mineral mining operations on Crown lands. The *Northern Municipalities Regulations* require mineral developments in the Northern Administrative District to be governed by a Mine Surface Lease Agreement (MSLA), which includes commitments to environmental protection, occupational health and safety, and socio-economic benefits for residents of Saskatchewan's North. The ENV, the LRWS, and the Ministry of Government Relations each administer sections of the MSLA.

1.6.2.5 The Crown Minerals Act

The Crown Minerals Act (SS 1984-85-86, c. C-50.2) is administered by the Minister of Energy and Resources and applies to all Crown minerals and all Crown mineral lands in Saskatchewan. It is anticipated that the Project will be subject to the *Crown Mineral Royalty Regulations* (C-50.2 Reg 29), the *Mineral Tenure Registry Regulations* (C-50.2 Reg 27), and *Quarrying Regulations, 1957* (Sask Reg 553/67).

1.6.2.6 The Wildlife Act, 1998

The Wildlife Act, 1998 (SS 1998, c. W-13.12) protects provincially designated plant and animal species at risk, including their residences, from any harmful action, including killing, harming, disturbance, and collection without a permit. It regulates wildlife and wildlife habitat through the accompanying *Wildlife Regulations, 1981* (W-13.1 Reg 1) and *Wild Species at Risk Regulations* (W-13.11 Reg 1). The former sets out restrictions and licensing requirements for hunting wildlife and protected wildlife, while the latter provides a listing of wild species classified as at risk in Saskatchewan.

1.6.2.7 The Fisheries (Saskatchewan) Act, 2020

In addition to the federal *Fisheries Act*, *the Fisheries (Saskatchewan) Act, 2020* regulates fisheries and protects fish provincially. In Saskatchewan, it is unlawful to fish, or possess, use, carry, transport, dispose of, or kill any fish without a license or permit. This Act applies

to all fish in Saskatchewan, where fish is defined as any aquatic crustaceans, molluscs, or invertebrates, any eggs or sperm from any fish, and any part(s) of any fish. This statute includes fish from any waterbody or portion of any waterbody in Saskatchewan, including any stream, river, lake, pond, or reservoir on provincial Crown land or land where the owner and Crown have an agreement. Permits issued by the ENV are required to conduct any biological studies, including environmental monitoring programs for the Project, that require the capture of fish or invertebrates.

1.6.2.8 The Heritage Property Act, 1980

The *Heritage Property Act, 1980* is administered by the Heritage Conservation Branch (HCB) of the Ministry of Parks, Culture and Sport. It provides for the preservation, interpretation, and development of certain aspects of heritage property in Saskatchewan. In Saskatchewan, heritage resources include Precontact period and Historic period archaeological sites, built heritage sites and structures of historical and/or architectural interest, and paleontological sites. Heritage resources are the property of the Provincial Crown and are protected under *The Heritage Property Act*. Any operation or activity which may be undertaken with the potential to result in the alteration, damage or destruction of heritage property requires heritage review and approval through a clearance letter before the activity can proceed. Permits issued by the HCB are also required to conduct heritage research and impact assessments.

1.7 Report Organization

To aid in provincial review, the organization of this EIS has been structured to align with the template provided in the Guidelines for the TOR and EIS and a concordance table is provided at the start of every section indicating where specific information requested in the guidelines is located within the section (ENV 2021a). Since there are no ancillary projects currently planned to be associated with the Project, there is no section or concordance table for ancillary projects. The main report is subdivided into the following sections:

1.0 Introduction
2.0 Project Description
3.0 Engagement
4.0 Existing Environment
5.0 Effects Assessment Approach
6.0 Effects Assessment
7.0 Potential Accidents and Malfunctions

8.0 Effects of the Environment on the Project
9.0 Monitoring and Follow-up Programs
10.0 Summary and Conclusions
11.0 Conditions Management
12.0 Qualified Persons Credentials
13.0 Map Sources and Disclaimers

Supporting documents that are provided in appendices to the main report are as follows.

Project Details

Appendix A.1	Corporate Profile Report
Appendix A.2	Waste Rock Storage Area – Water Balance and Water Quality Model – 2024 Update (BGC Engineering Inc. 2025)
Appendix A.3	Feasibility Design Patterson Lake South Tailings Management Facility Athabasca Basin, SK (Clifton 2022)
Appendix A.4	Fission Uranium Corp. Feasibility Study Metallurgical Summary Report (Melis Engineering 2023)
Appendix A.5	PLS Project: Outfall/Diffuser Design (Tetra Tech 2023b)
Appendix A.6	Fission Uranium Corp. PLS Project Transportation Impact Assessment (Bunt and Associates 2023)
Appendix A.7	Fission Uranium Corp. Greenhouse Gas (GHG) Assessment PLS Project (Clifton 2024a)

Engagement and Land Use Reports

Appendix B.1	Interest-based Engagement Logs (CanNorth 2025a)
Appendix B.2	Consultation Report (CanNorth 2025b)

Baseline Reports

Appendix C.1	Baseline Air Quality Monitoring Report: Fission Uranium Corp. (IEC 2023)
Appendix C.2	Fission Uranium Corp. Hydrogeology Baseline for the PLS Project Vol. I (Clifton 2024b)
Appendix C.3	Patterson Lake South Project Environmental Baseline Report 2020 (CanNorth 2020)
Appendix C.4	Fission Uranium Corp.'s PLS Project 2021/2022 Environmental Baseline Report (CanNorth 2023a)

Appendix C.5 Human Environment Baseline Report (CanNorth 2024a)

Appendix C.6 Fission Uranium Corp. Heritage Resources Impact Assessment Permit No. 22-109 (CanNorth 2023b)

Technical Study Documents

Appendix D.1 Air Quality Technical Supporting Document Fission Uranium Corp. – PLS Project (IEC 2024a)

Appendix D.2 Acoustic Assessment Technical Supporting Document Fission Uranium Corp. – PLS Project (IEC 2024b)

Appendix D.3 Visual Impact Assessment Technical Supporting Document Fission Uranium Corp. – PLS Project (IEC 2024c)

Appendix D.4 Fission Uranium Corp. Hydrogeology Modeling for the PLS Project (Clifton 2025)

Appendix D.5 PLS Project Environmental Impact Assessment Technical Appendix Report – Water Quantity (Chernos and MacDonald 2024)

Appendix D.6 Patterson Lake Groundwater Balance for Hydrology Models Fission PLS Project (Clifton 2024c)

Appendix D.7 Human Health and Ecological Risk Assessment for the PLS Project Environmental Impact Assessment (CanNorth 2025c)

Appendix D.8 Wildlife Technical Support Document for the PLS Project Environmental Impact Assessment (CanNorth 2024b)

Appendix D.9 PLS Project Woodland Caribou Mitigation Plan (CanNorth 2024c)

Appendix D.10 Assessment of Accidents and Malfunctions – Technical Supporting Document for the PLS Project (IEC 2025)

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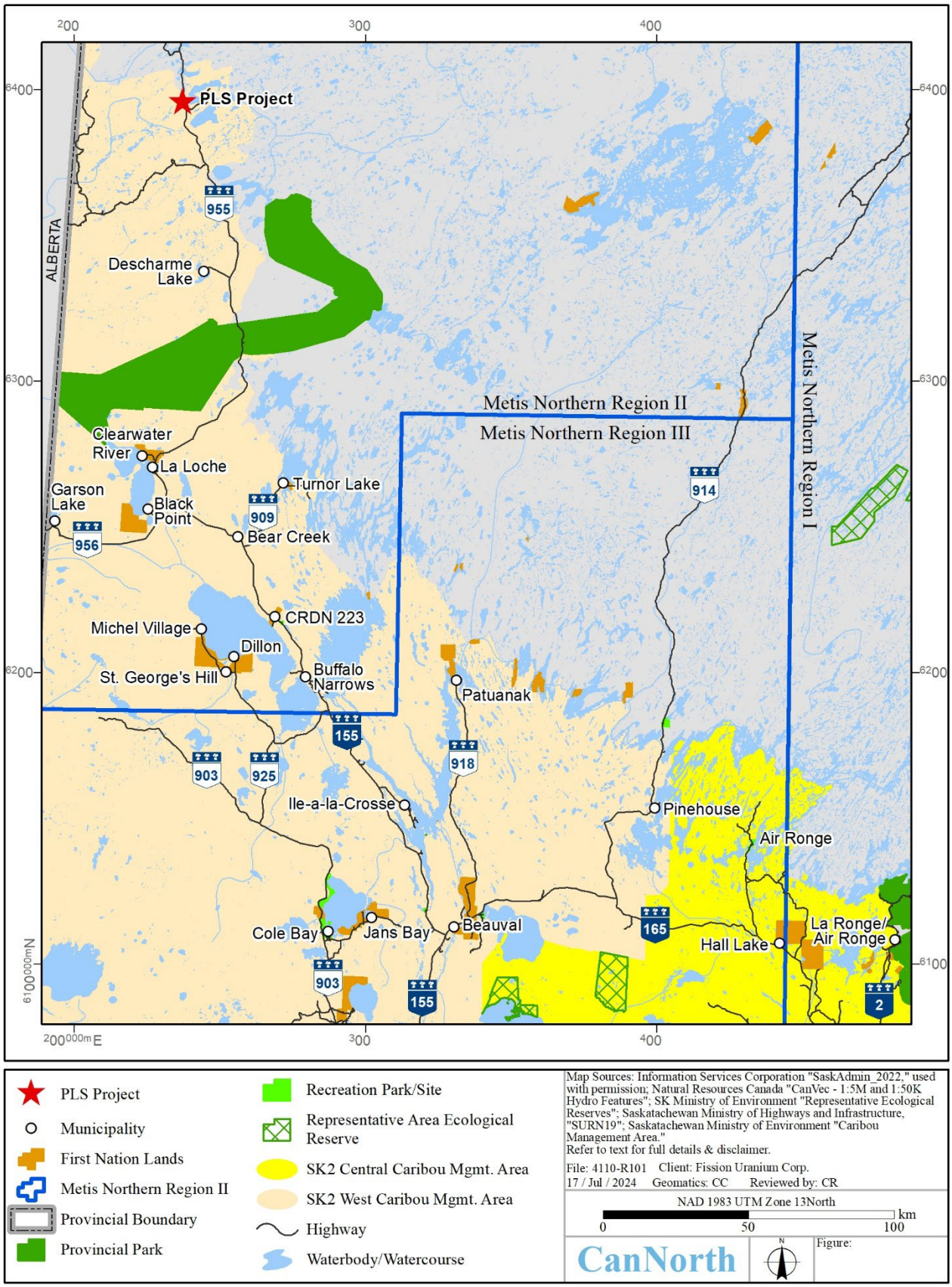

Figure 1-1
Location of the PLS Project.

Table 1-1
Concordance table – introduction.

EIS Requirement	Section and Page #
The Proponent	
c) the business number of the legal entity	The Proponent (1.3), 1-3
d) location of the head and/or regional offices	The Proponent (1.3), 1-3
e) corporate management structure and a copy of the Corporate Profile Report from Information Services Corporation in an appendix	Appendix A.1 – Corporate Profile Report
f) environmental standards certifications	The Environmental Management and Protection Act, 2010 (1.6.2.2), 1-12
g) key personnel, contractors/sub-contractors and their qualifications	Consultants (1.3.1), 1-4, Table 1-2
Development Justification	
b) detailed analysis of the benefits expected to accrue for the proponent, local and regional communities and Saskatchewan, including jobs created, local training, employment and business opportunities	Development Justification (1.4), 1-4
Land Controls	
b) detailed accounting of land controls for the development, including land use plans, bylaws, subdivision approvals, leases, mineral rights and zoning	Land Controls (1.5), 1-6
Regulatory Requirements	
Provincial and Federal Assessment Legislation	
c) updated table of applicable provincial and federal assessment legislation with specific rationale and sections	Regulatory Overview (1.6), 1-6, Table 1-3
d) rationale provided by regulators for EIA requirement	Purpose of Submission (1.2), 1-2 The Environmental Assessment Act (1.6.2.1), 1-12
e) status of a federal impact assessment, if applicable to development	Purpose of Submission (1.2), 1-2 The Impact Assessment Act (1.6.1.1), 1-8
Other Legislation, Guidance or Constitutional Requirements	
c) updated table of other regulations, guidance or constitutional requirements applicable to the development including permits, approvals and letters of permission or endorsement, indicating dates or permit/reference numbers	Regulatory Overview (1.6), 1-6, Table 1-4
d) table of approvals and permits that remain outstanding and a note on their status	Regulatory Overview (1.6), 1-6, Table 1-4
e) provincial/federal triggers of the duty to consult First Nations and Metis communities	The Environmental Assessment Act (1.6.2.1), 1-12

Table 1-1

Concordance table – introduction.

EIS Requirement	Section and Page #
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Section 1 Introduction; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (1.8), 1-17
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Report Organization (1.7), 1-15

Table 1-2

Key consultants contributing to the PLS Project environmental impact statement.

Consultant	Contribution
Canada North Environmental Services (CanNorth)	Environmental Impact Statement
	Aquatic Environment
	Terrestrial Environment
	Human Environment
	Human and Ecological Risk Assessment
	Community Engagement Program
Independent Environmental Consultants (IEC)	Atmospheric and Acoustic Environment
	Accidents and Malfunctions Assessment
Clifton Engineering Group Inc.	Hydrogeological Environment
	Tailings Management Facility Design
	Socioeconomic Analyses
	Greenhouse Gas Inventory
Bunt & Associates	Traffic Impact Assessment
MacDonald Hydrology Consultants Ltd. (MacHydro)	Hydrological Assessment
Tetra Tech Canada	Project Design and Detailed Engineering
Fission Uranium Corp. (Fission)	Geology and Geochemistry
	Project Description
	Conceptual Decommissioning and Reclamation Plan

Table 1-3
Applicable or potentially applicable federal and provincial legislation.

Act	Regulation(s)	Rationale
Federal:		
Nuclear Safety and Control Act (SC 1997, c. 9)	*General Nuclear Safety and Control Regulations* (SOR/2000-202)	CNSC licensing of uranium mines and mills fall under this legislation.
	Uranium Mines and Mills Regulations (SOR/2000-206)	
	Radiation Protection Regulations (SOR/2000-203)	
	Nuclear Substances and Radiation Devices Regulations (SOR/2000-207)	
	Packaging and Transport of Nuclear Substances Regulations, 2015 (SOR/2015-145)	
	Nuclear Security Regulations (SOR/2000-209)	
	Nuclear Non-proliferation Import and Export Control Regulations (SOR/2000-210)	
	CNSC Cost Recovery Fees Regulations (SOR/2003-212)	
	Administrative Monetary Penalties Regulations (Canadian Nuclear Safety Commission) (SOR/2013-139)	
Fisheries Act (RSC 1985, c. F-14)	*Metal and Diamond Mining Effluent Regulations* (SOR/2002-222)	Treated effluent release during the operational period will meet the criteria to trigger application of this regulation.
	Deposit Out of the Normal Course of Events Notification Regulations	Notification requirements in the event of a deposit of deleterious substances out of the normal course of events.
Canadian Environmental Protection Act, *1999* (SC 1999, c. 33)	*Environmental Emergency Regulations, 2019* (SOR/2019-51)	It is anticipated that one or more of the listed substances in Schedule 1 will be used in operations.
	Federal Halocarbon Regulations, 2022 (SOR/2022-110)	Prohibition on release of halocarbons contained in air conditioning systems, refrigeration systems, fire extinguishing systems, or halocarbon storage equipment.
	Greenhouse Gas Reporting Program (GHRP)	The Project will emit greenhouse gases and will follow these regulations.
Transportation of Dangerous Goods Act, 1992 (SC 1992, c. 34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	Applicable if any items/substances listed in Schedule 1 are to be transported to/from the Project.
Canadian Navigable Waters Act (RSC 1985, c. N-22)	Minor Works Order	With the exception of minor works, there are prohibitions on construction in Canadian waters.
Aeronautics Act (RSC 1985, c. A-2)	*Canadian Aviation Regulations*	Required if any ventilation shaft headframes meet conditions.
Species at Risk Act (SC 2002, c. 29)	Critical Habitat of the Woodland Caribou (*Rangifer tarandus caribou*) Boreal Population Order, SOR/2019-188.	This Act affords protection to listed species, as well as their residence and/or critical habitats and there are SARA listed species in the Project area (e.g., boreal woodland caribou).
Migratory Birds Convention Act, 1994 (SC, 1994, c. 22)	*Migratory Birds Regulations* (CRC, c.1035)	Migratory birds and their nests are protected from disturbance and from harmful substances. A Migratory Birds Damage or Danger Permit is required to relocate a migratory bird nest.
Explosives Act (RSC 1985, c. E-17)	*Explosives Regulations, 2013* (SOR/2013-211)	Applicable if the Project will require transportation, storage, and handling of explosives as defined in the Act.
Hazardous Products Act (RSC 1985, c. H-3)	*Hazardous Products Regulations* (SOR/2015-17)	Applicable to the use, handle, or store a product, mixture, material, or substance listed in Schedule 2.
Nuclear Terrorism Act (SC 2013, c 13)	None	Relevant to nuclear production facilities.
Nuclear Liability and Compensation Act (SC 2015, c. 4, s. 120)	*Nuclear Liability and Compensation Regulations* (SOR/2016-88)	Relevant to nuclear production facilities.

Table 1-3
Applicable or potentially applicable federal and provincial legislation.

Act	Regulation(s)	Rationale
Provincial:		
The Environmental Assessment Act (SS 1979-80, c. E-10.1)	No specific regulations related to this Act.	Applicable to any new development, as defined under the Act.
The Environmental Management and Protection Act, 2010 (SS 2010, c E-10.22)	*The Hazardous Substances and Waste Dangerous Goods Regulations* (E-10.2 Reg 3)	Applicable if the Project will use, handle, or store any substance that is designated as hazardous as per Section 3 or waste dangerous goods as per Subsection 4(4).
	The Mineral Industry Environmental Protection Regulations, 1996 (E-10.2 Reg 7)	Applicable for the construction, installation, alteration, extension, operation, or temporary closure of a pollutant control facility or decommissioning and reclamation of a mining site.
	The Environmental Management and Protection (General) Regulations (E-10.22 Reg 1)	One or more permits required under these regulations, for example for discharge of substances at or near water (Part III) or air quality (Part VI), and an Aquatic Habitat Protection Permit.
	The Environmental Management and Protection (Saskatchewan Environmental Code Adoption) Regulations (E-10.22 Reg 2)	The Saskatchewan Environmental Code includes Discharge and Discovery Reporting Chapter (Chapter B.1.1) may apply (see Table 1); Site Assessment Chapter (Chapter B.1.2); Corrective Action Plan Chapter (Chapter B.1.3); Halocarbon Control Chapter (Chapter E.1.1); Industrial Source (Air Quality) Chapter (Chapter E.1.2).
	The Waterworks and Sewage Works Regulations (E-10.22 Reg 3)	Applicable if the design flow of waterworks and sewage works exceeds 18 m^3 over 24 hours.
	The Municipal Refuse Management Regulations (E-10.2 Reg 4)	Applicable if the Project is to include a waste disposal ground.
The Wildlife Act, 1998 (SS 1998, c. W-13.12)	*The Wildlife Regulations, 1981* (W-13.1 Reg 1)	Species Detection Research Permits are required to complete species surveys; mitigation or avoidance (activity restriction guidelines) may be required if species at risk are identified within the Project area.
	The Wild Species at Risk Regulations (W-13.11 Reg 1)	Provides a listing of species at risk (provincially declared extirpated, endangered, or threatened species).
The Fisheries (Saskatchewan) Act, 2020 (SS 2020, c. 23)	No specific regulations related to this Act	Special Collection Permits are required to complete fish surveys, collect samples for chemistry, etc.
The Water Security Agency Act (SS 2005, c. W-8.1)	*The Water Security Agency Regulations* (W-8.1 Reg 1)	Applicable to works that have the potential to affect water resources in Saskatchewan.
	Ground Water Regulations (Sask Reg 172/66)	Licensing requirements for use of groundwater, drilling test holes, and wells.
The Provincial Lands Act, 2016 (SS 2016, c. P-31.1)	*The Crown Resource Land Regulations, 2019* (P-31.1 Reg 3)	Sets out conditions for Crown land leases, etc.
The Heritage Property Act (SS 1979-80, c. H-2.2)	*Heritage Property Regulations* (H-2.2 Reg 1)	Applicable if any archaeological object as defined under the regulations are found on the site, including any future mine expansions.
The Crown Minerals Act (SS 1984-85-86, c. C-50.2)	*The Crown Mineral Royalty Regulations* (C-50.2 Reg 29)	Applicable to all Crown minerals other than those that are subject to the regulations listed in Section 3.
	The Mineral Tenure Registry Regulations (C-50.2 Reg 27)	Applicable to all Crown minerals other than those that are subject to the regulations listed in Section 3.
The Natural Resources Act (SS 1993, c. N-3.1)	*The Resource Protection and Development Service Regulations, 1994* (N-3.1 Reg 1)	Applicable if any of the activities, provisions, or services as listed in Section 3 are necessary for the Project.
The Planning and Development Act, 2007 (SS 2007, c P-13.2)	*The Subdivision Regulations, 2014* (P-13.2 Reg 2)	Subdividing instruments, such as surface leases, must comply with requirements.

Table 1-3
Applicable or potentially applicable federal and provincial legislation.

Act	Regulation(s)	Rationale
Provincial:		
The Planning and Development Act, 2007 (SS 2007, c P-13.2)	*The Statements of Provincial Interest Regulations* (P-13.2 Reg 3)	As per Section 6.6 Mineral Resource Exploration and Development, the Project must abide by these Regulations to support the orderly development of land, resources, infrastructure and services, with a view to securing the economic, environmental, social and cultural well-being of urban and rural communities. Section 15(1) of *The Subdivision Regulations, 2014* requires all decisions to also be consistent with these regulations.
The Pest Control Act (RSS 1978, c. P-7)	*The Pests Declaration Regulations* (P-7 Reg 2)	Applicable if any pests, as declared by the Regulations, are found on the site.
The Pest Control Products (Saskatchewan) Act (RSS 1978, c. P-8)	*The Pest Control Products Regulations, 2015* (P-8 Reg 4)	Applicable if any pesticides are to be stored or used around the site.
The Weed Control Act (SS 2010, c. W-11.1)	*The Weed Control Regulations* (W-11.1 Reg 1)	Applicable if any of weed species listed in schedules I, II, or III are found on site.
The Management and Reduction of Greenhouse Gases Act (SS 2010, c. M-2.01)	*The Management and Reduction of Greenhouse Gases (Reporting and General) Regulations* (M-2.01 Reg 2)	Applicable to any facility that will emit more than 10,000 tonnes annually.
	The Management and Reduction of Greenhouse Gases (Standards and Compliance) Regulations (M-2.01 Reg 3)	Applicable to any facility in a regulated sector with total regulated emissions of 25,000 tonnes or more of CO2e annually (a facility with annual emissions between 10,000 and 25,000 tonnes CO2e may be voluntarily registered); facilities operating in mining sectors are subject to a 5% emissions intensity reduction. The regulations also provide for a number of flexible compliance options, including payments into a technology fund and the use of credits.
The Northern Municipalities Act, 2010 (SS 2010, c. N-5.2)	*The Northern Municipalities Regulations* (N-5.2 Reg 1)	The Project is in the Northern Saskatchewan Administration District.
The Saskatchewan Employment Act (SS 2013, c. S-15.1)	*The Minimum Wage Regulations, 2014* (S-15.1 Reg 3)	The Project will employ people.
	The Labour Relations (Supervisory Employees) Regulations (S-15.1 Reg 4)	
	The Employment Standards Regulations (S-15.1 Reg 5)	
	The Mines Regulations, 2018 (S-15.1 Reg 8)	
	Occupational Health and Safety Regulations, 2020 (S-15.1 Reg 10)	
The Boiler and Pressure Vessel Act, 1999 (SS 1999, c. B-5.1)	*The Boiler and Pressure Vessel Regulations, 2017* (B-5.1 Reg 2)	Applicable if the Project will use boilers and/or pressure vessels.
The Technical Safety Authority of Saskatchewan Act (SS 2010, c. T-9.2)	No specific regulations related to the Act	Equipment at the Project (boilers and pressure vessels, elevating devices, gas, electrical and plumbing, etc.) will be subject to safety standards for permit, inspection, and licensing services through the Technical Safety Authority of Saskatchewan
The Electrical Inspection Act, 1993 (SS 1993, c. E-6.3)	*The Electrical Inspection Regulations* (E-6.3 Reg 1)	Electrical equipment will need to be inspected and certified.
The Gas Inspection Act, 1993 (SS 1993, c. G-3.2)	*The Gas Inspection Regulations* (G-3.2 Reg 1)	Gas equipment will need to be inspected and certified.
The Public Health Act, 1994 (SS 1994, c. P-37.1)	*The Disease Control Regulations* (P-37.1 Reg 11)	The Project will employ, accommodate, and feed people.
	The Health Hazard Regulations (RRS c P-37.1 Reg 10)	
	The Food Safety Regulations (P-37.1 Reg 12)	
The Reclaimed Industrial Sites Act (SS 2006, c. R-4.21)	*The Reclaimed Industrial Sites Regulations* (R-4.21 Reg 1)	Prescribed conditions for a closed site to be accepted into the Institutional Control Program.
The Dangerous Goods Transportation Act (SS 1984-85-86, c. D-1.2)	*The Dangerous Goods Transportation Regulations* (D-1.2 Reg 1)	Applicable if federal regulations (*Transportation of Dangerous Goods Regulations* [SOR/2001-286]) are applicable.

Table 1-3
Applicable or potentially applicable federal and provincial legislation.

Act	Regulation(s)	Rationale
Provincial:		
The Fire Safety Act (SS 2015, c. F-15.11)	*The Fire Safety Regulations* (RRS c. F-15.11 Reg 1)	Inspecting, reporting, and suppressing fires; owner, occupant responsibilities.
The Wildfire Act (S2 2014, c W-13.01)	*The Wildfire Regulations* (RRS c W-15.01 Reg 1)	Industrial and commercial responsibilities for fire suppression, prevention, and preparedness. Regulated activities and prohibitions on equipment and activities. Wildfire reporting requirements.
The Northern Saskatchewan Economic Development Act (RSS 1978, c. N-7)	No specific regulations related to this Act	The Project is located in northern Saskatchewan.
The Surface Rights Acquisition and Compensation Act (RSS 1978, c. S-65)	*The Surface Rights Acquisition and Compensation Regulations* (c. S-65 Reg 1)	Procedures for acquiring surface rights, compensation, and maintenance and reclamation of land acquired under the Act.
*The Forest Resources Management Act (*SS 1996, c F-19,1)	*Forest Resources Management Regulations* (F-19.0 Reg 1)	Procedures for acquiring a Forest Product Permit for the clearing or removal for forest products (vegetation).

Table 1-4
Status of applicable permits, approvals, and authorizations.

Permit, Approval, or Authorization[1]	Issuing Agency	Status	Project Phase	Permit/Reference Number
Federal				
Licence to Prepare Site and Construct a Uranium Mine and Mill	Canadian Nuclear Safety Commission	In progress	Construction	
Licence to Operate a Uranium Mine and Mill	Canadian Nuclear Safety Commission	Future Requirement	Operations	
Licence to Decommission a Uranium Mine and Mill	Canadian Nuclear Safety Commission	Future Requirement	Decommissioning	
Licence to Abandon a Uranium Mine and Mill	Canadian Nuclear Safety Commission	Future Requirement	Post-Decommissioning	
Permit Authorizing an Activity Affecting Listed Wildlife Species Regulations	Environment and Climate Change Canada	As required	Various	
Migratory Birds Damage or Danger Permit	Environment and Climate Change Canada	As required	Various	
Fisheries Act Authorization	Fisheries and Oceans Canada	Future Requirement	Construction	
License to Store, Manufacture, or Handle Explosives	Natural Resources Canada	Future Requirement	Construction	
Provincial				
Environmental Assessment Process	SK Ministry of Environment, Environmental Assessment and Stewardship Branch	In progress	-	
Surface Lease	SK Ministry of Government Relations	Future Requirement	Construction	
Mineral Lease	SK Ministry of Energy and Resources	Future Requirement	Construction	
Subdivision Approval	SK Ministry of Government Relations, Community Planning Branch	Future Requirement	Construction	
Approval to Construct and Operate a Storage Facility (Hazardous Materials and Waste Dangerous Goods)	SK Ministry of Environment, Industrial Branch	Current	All	63215
Approval to Construct/Alter Highways Approach	SK Ministry of Highways and Infrastructure	As required	Construction	
Forest Product Permit	SK Ministry of Environment	As required	Construction	
Miscellaneous Use Permit	SK Ministry of Environment	As required	Various	
Construction Permit	SK Ministry of Environment	Future Requirement	Construction	
Approval to Construct and Operate an Industrial Effluent Works	SK Ministry of Environment	Future Requirement	Construction	
Approval to Operate Pollutant Control Facilities	SK Ministry of Environment	Future Requirement	Construction	
Environmental Protection Plan for Industrial Sources	SK Ministry of Environment	Future Requirement	Construction	
Approval to Decommission Pollutant Control Facilities	SK Ministry of Environment	Future Requirement	Decommissioning	
Release from Decommissioning and Reclamation	SK Ministry of Environment	Future Requirement	Post-Decommissioning	

Table 1-4

Status of applicable permits, approvals, and authorizations.

Permit, Approval, or Authorization[1]	Issuing Agency	Status	Project Phase	Permit/Reference Number
Provincial				
Provincial Acceptance of Decommissioned and Reclaimed Site into Institutional Control Program	SK Ministry of Environment	Future Requirement	Post-Decommissioning	
Heritage Clearance	SK Ministry of Parks, Culture and Sport (Heritage Conservation Branch)	As required	Various	
Aquatic Habitat Protection Permit	Water Security Agency	As required	Various	
Approval to Construct and Operate Waterworks (Surface Water Withdrawal and Groundwater Withdrawal)	Water Security Agency	Future Requirement	Construction	
Approval to Construct and Operate Drainage Works	Water Security Agency	Future Requirement	Construction	
Approval to Construct and Operate Sewage Works	Water Security Agency	Future Requirement	Construction	
Permit to Conduct Ground Water Investigation	Water Security Agency	As required	Various	

[1]Any permits, approvals, and authorizations may be subject to the duty to consult if decisions related to those permits, approvals, and authorizations have the potential to create impacts to Aboriginal and Treaty rights.

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LIST OF ACRONYMS

ACFN	Athabasca Chipewyan First Nation
ALARA	As Low as Reasonably Achievable
BAT	Best Available Technologies
BNDN	Birch Narrows First Nation
BRDN	Buffalo River Dene Nation
CAF	Cemented Aggregate Fill
CCD	Counter Current Decantation
CDA	Canadian Dam Association
CHF	Cemented Hydraulic Fill
CNSC	Canadian Nuclear Safety Commission
CO_2	Carbon Dioxide
CP	Contingency Pond
CRDN	Clearwater River Dene Nation
CRF	Cemented Rock Fill
DCE	Decommissioning Cost Estimate
DCS	Distributed Control System
DDP	Detailed Decommissioning Plan
EAS	Exhaust Air Shaft
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
ERFN	English River First Nation
FAS	Fresh Air Shaft
Fission	Fission Uranium Corp.
FIFO	Fly-In/Fly-Out
FS	Feasibility Study
FSWT	First Stage Water Treatment
GHG	Greenhouse Gas
HDPE	High-Density Polyethylene
ICP	Institutional Control Program
IRSP	Intermediate Runoff Settling Pond
ISP	Intermediate Settling Pond
LAN	Local Area Network
LHD	Load-Haul-Dump
LLRW	Low-Level Radioactive Waste
LPG	Liquified Petroleum Gas
LOM	Life of Mine
MBBR	Moving Bed Biofilm Reactor

MLTC	Meadow Lake Tribal Council
MN-S	Métis Nation – Saskatchewan
MW	Megawatt
NAG	Non-Acid Generating
NexGen	NexGen Energy Ltd
PAG	Potentially Acid Generating
PBX	Private Branch Exchange
PDA	Potential Disturbance Area
PDCE	Preliminary Decommissioning Plan Cost Estimate
PDP	Preliminary Decommissioning Plan
PFS	Pre-Feasibility Study
PMP	Probable Maximum Precipitation
the Project	The PLS Project
ROM	Run of Mine
SAG	Semi Autogenous Grinding
SBL	Soil-Bentonite Liner
SP	Settling Pond
SRP	Surface Run-Off Pond
SSA	Site Study Area
SSWT	Second Stage Water Treatment
SX	Solvent Extraction
TBM	Tunnel Boring Machine
TIA	Traffic Impact Assessment
TMF	Tailings Management Facility
TOR	Terms of Reference
TSM	Tunnel Shield Method
TSWT	Third Stage Water Treatment
UPS	Uninterrupted Power Supplies
UTM	Universal Transverse Mercator
VOIP	Voice over Internet Protocol
WAN	Wide Area Network
WRMA	Waste Rock Management Area
YNLR	Ya’ thi Néné Land and Resource Office

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2.0 PROJECT DESCRIPTION

This project description has been developed as an update to the project description submitted to the Saskatchewan Ministry of Environment (ENV) in November of 2021 that initiated the Environmental Impact Assessment (EIA) process. The information contained herein is largely based on the Feasibility Study (FS) completed for the PLS Project (the Project) by Tetra Tech (2023) and further detailed project information where available. This level of detail is sufficient to understand potential effects and design mitigations while understanding that Project details may change or be refined during the detailed design, permitting, and licensing stages of development.

The concordance table comparing ENV guidelines (ENV 2021) for the completion of Terms of Reference (TOR) and Environmental Impact Statements (EIS) project descriptions is available in Table 2-1.

2.1 Siting

The Project is located in northern Saskatchewan, approximately 550 km north-northwest of Prince Albert by air and 157 km north of La Loche via Provincial Highway 955 (Figure 2-1). The Universal Transverse Mercator (UTM) co-ordinates for the approximate centre of the Project are 600,000 m E, 6,387,500 m N (NAD83 UTM Zone 12N).

The Project is located on Crown Land within Treaty 8 territory (Figure 2-2). Fission Uranium Corp. (Fission) has been actively engaging with community representatives and stakeholders in the Project area since 2013. Engagement with Indigenous Nations and communities and stakeholders will be ongoing during Project development, operation, and closure.

Fission identified Indigenous Nations to engage with in consultation with ENV and the Canadian Nuclear Safety Commission (CNSC). This resulted in eight Indigenous Nations or organizations being identified for engagement, mirroring the groups identified by project proponents for similar current development projects in the Athabasca region. These Nations or organizations include:

- Clearwater River Dene Nation (CRDN)
- Birch Narrows First Nation (BNDN)
- Buffalo River Dene Nation (BRDN)
- Métis Nation – Saskatchewan (MN-S)

- Ya' thi Néné Land and Resource Office (YNLR)
- Athabasca Chipewyan First Nation (ACFN)
- English River First Nation (ERFN)
- Meadow Lake Tribal Council (MLTC)

The Project is located in an area of active mineral exploration. Exploration in the Project area has been conducted from 1977 to present. With the exception of Highway 955, there is no permanent infrastructure at the Project location. To facilitate on going site work, a small, 12-person camp, access trails, and other facilities including core storage, fuel storage, core logging, and shop facilities are located at the Project. A commercial camp facility (Big Bear Camp) operated by Big Bear Contracting Ltd. is located approximately 20 km north of the Project and is utilized by Project personnel for housing accommodations and camp services.

The former Cluff Lake Uranium Mine was located approximately 90 km north of the Project along Highway 955 (Figure 2-3) and has completed the decommissioning process and is now in the Institutional Control Program (ICP) managed by the province of Saskatchewan. The previous owner and operator (Orano Canada Inc.), no longer occupies the Cluff Lake site full-time, has removed the entrance gates, and does not control or restrict access to the Cluff Lake site. The Cluff Lake site is open to the public and is safe to use for traditional purposes such as hunting, fishing, trapping, and gathering (Orano 2023).

Several companies are in the early to advanced stages of exploration in the Project area, particularly for uranium and oil sands resources. Figure 2-4 illustrates 19 exploration companies with mineral leases surrounding the Project. Of particular interest is NexGen Energy Ltd. (NexGen) that is proposing development of a uranium mining and milling operation near to the Project on the north side of Patterson Lake. This project is currently in the environmental assessment and CNSC licensing phase of the project life cycle.

With respect to forest management, there are no forestry leases in Project area. The Project area is located outside of the commercial forest zone and will not interact with any harvesting activities by forestry companies in the area.

Additionally, there are three groundwater water wells within the Project site and one water well within 2 km of the Project site (Table 2-2).

2.2 Site Layout

The Project is located on the west side of Patterson Lake with access via Provincial Highway 955. The highway bisects the proposed layout of the Project. West of the highway, proposed infrastructure includes the Tailings Management Facility (TMF) and associated infrastructure as well as the proposed waste management, aggregate stockpile, and borrow pit areas. The area east of the highway will contain the remaining infrastructure including the mill and administration facilities, waste rock and water management areas, the mine access decline, the fresh air and exhaust shafts, effluent diffuser, backfill plant, freeze plant, personnel accommodation camp, and any other infrastructure required to support Project activities (Figure 2-5). Further details on Project infrastructure are provided in Section 2.3.

The site layout for the Project was designed to be efficient spatially while providing adequate separation between the camp and mine and mill infrastructure as well as Patterson Lake and the TMF to mitigate potential effects. The disturbance area for the planned infrastructure is 198 hectares; however, for assessment purposes in this EIA, a 50-metre buffer has been applied to the infrastructure, the Site Study Area (SSA) totaling 400 hectares, in order to enable flexibility in facility siting. Additionally, a Potential Disturbance Area (PDA) of 1442 hectares is being assessed as part of this EIA process. The PDA aligns with the surface lease(s) that Fission may apply for use with the Project as well as allows for potential facility expansion or other unforeseen changes. The locations of the SSA and PDA are illustrated in Figure 2-6.

2.3 Site Infrastructure

The proposed facilities being assessed are comprised of a new uranium mine and milling facility located in the western Athabasca Basin region of northern Saskatchewan. The facility will be designed to produce 10.6 million pounds of uranium on an annual basis for a planned mine life of 10 years. Facilities and activities typical of northern Saskatchewan uranium mines will be required to achieve the mine plan. Descriptions of key facilities and activities can be found below. Project information in this section is based on feasibility level design and, where available, more detailed engineering. Details of specific Project components (i.e., size, flow rate, capacity) identified below that do not materially affect the outcome of this assessment may change as the Project advances engineering work related to project development.

Access to the Project area is provided via Highway 955. Current access to the site areas from Highway 955 is provided by roads suitable for supporting exploration activities. However, these roads will need to be upgraded as well as further road construction completed to provide suitable external and internal access to the Project to support construction and operations activities.

No permanent source of electrical power is available at the Project site. A study of options to provide power was conducted and considered the construction of a high-voltage transmission line connected to the provincial grid, and on-site power generation provided by either diesel or Liquified Petroleum Gas (LPG) power plants. The LPG plant was selected as the preferred option largely due to its favourable emissions profile and cost as compared to diesel power generation.

Additionally, no cellular service or other means of external communication are available at the site. Installation of a new fibre optic line has been considered along Highway 955 from SaskTel's central office in La Loche to the site. The fibre optic line will allow Fission to implement application such as 5G/LTE technology, tele-remote operation, video streaming, centralized operations, camo Wi-Fi, TV/live streaming, site-site connectivity, and cloud-based applications. A communications tower may be installed to provide local cellular and two-way radio services in and near the Project.

Principal water requirements for processing and other mining and milling activities will be met using water reclaimed from the mine dewatering system, drainage collection, and water from the TMF and water treatment plant. Water for reuse from these areas will be treated to meet the requirements of the intended reuse activity. Fresh water requirements for potable water or other processes requiring fresh water will be met via groundwater wells at the Project site.

Primary mining infrastructure will consist of fresh air and exhaust shafts, a decline for mine access and ore/waste rock transport to surface, freeze plant, backfill plant, and water management and treatment facilities. Production mining at the Project is proposed to be conducted using proven methods including long hole stoping, mechanized drift and fill, and vertical cutting technologies. Lateral development methods include conventional drill and blast as well as mechanical excavation. Shaft development will utilize vertical cutting technology, blind shaft sinking, Alimak raising, or bench slashing methods. Internal raises will utilize long hole drop raising techniques. Decline development through the overburden

will be completed using either a Tunnel Boring Machine (TBM) or Tunnel Shield Method (TSM) followed by drill and blast or mechanical excavation.

The process plant area will include the ore stockpile, main process plant, solvent extraction (SX) plant, acid plant, effluent treatment facility, surface run-off and monitoring ponds, assay laboratory, administration facilities, fuel storage and refuelling station, truck shop facilities, machine shop and warehouse, power generation plant, power distribution system, LPG storage, and laydown areas. There will be other site support infrastructure beyond the process plant area, including surface explosive magazine, site communication tower, security gatehouse with access controls, and other infrastructure that may be required. The process plant pad will be graded to take advantage of the natural topography and facilitate gravity flows between ponds.

The TMF related systems will consist of infrastructure that is required to safely manage the tailings including tailings transport system, deposition system, a reclaim water system, a sedimentation pond, and a polishing pond.

The following sections provide detailed information on the above-mentioned infrastructure that will comprise the Project.

2.3.1 Surface Infrastructure

2.3.1.1 Access Roads and Security

The Project site is accessed by ground transport on Highway 955 via the main access gate located north of the mill area and facilities. The intersection will allow access to both the east and west sides of the highway. The east side will have a security gate and guardhouse, while the west side will have a security gate. The east side will allow restricted access for personnel, materials, and contractors to enter and exit the site as well as allow the shipment of produced yellowcake from the site. The west side will allow restricted access to the TMF, waste management area, and associated infrastructure to authorized personnel only.

The gatehouse is planned to be an approximately 22 m^2 single story modular building. The building will include a reception area, waiting area, and washroom facilities. Controls in the gatehouse will manage the security gates allowing controlled access to the east and west sides of the site.

Internal site roads will be required to allow access between the various areas of the site including process plant area, mine decline area, and ventilation shafts. Access to the TMF

will require personnel to access the west side of the highway through the main gate. Additionally, to limit traffic on Highway 955, an internal road roughly parallel to the highway is planned to allow access between the permanent camp and the process plant area.

2.3.1.2 Truck Shop Complex

The truck shop complex will consist of an approximately 80 m long x 24 m wide building designed to accommodate facilities for the repair, maintenance, and rebuilding of underground mining equipment, haul trucks, light vehicles, and other mobile equipment. The facility will also provide storage space for spare parts and consumables, offices, lunchroom, washrooms and dry for truck shop personnel, first aid, emergency response station, and necessary equipment storage.

The truck shop complex will be located near the process plant. The planned total usable ground floor area of the building is approximately 1,900 m^2, including three vehicle service bays, one wash bay, one tire change and lube bay, first aid and emergency response station (where the fire truck and ambulance are stationed), a welding area, a machine shop, and a warehouse. The ground floor will provide an additional 400 m^2 of change facilities complete with lockers, showers, and washrooms. The second floor will include a lunchroom and office space.

The vehicle service and wash bays will have vehicle access doors on both ends to facilitate vehicle drive-through to eliminate the need for backing up vehicles or making U-turns, which enhances traffic safety for other road users in the area.

The mine rescue substation will be approximately 238 m^2 in size and will be dedicated to mine rescue and recovery operations. In accordance with the *Saskatchewan Mines Regulations 2018*, the area will be equipped with closed circuit breathing apparatus, self-rescuers, and an oxygen cylinder recharging system. Rescue equipment and tools for rescue and recovery operations will also be stored in the substation.

The machine shop will be outfitted with machine tools and cutting equipment. Ventilation fans and flash shields will be provided in the welding area for personal protection. Air compressors and receiver tanks inside the truck shop complex will provide compressed air for pneumatic tools.

Inside the truck shop, durable sealants will be applied to the entire shop floor space, including repair bays and wash bays, to prevent fluids from seeping through the foundation joints. The shop floor is planned to be sloped toward the center of the shop where a drain and sump are located, which will contain any fluids such as motor oil, coolant, and lubricants spilled on the shop floor. The drain and sump will be lined and sealed for fluid containment. Contents in the sump will be disposed of in the tailings slurry pump box and pumped with the tailings slurry to the TMF.

The wash bay will have a small trench drain around its perimeter to intercept and direct any used water toward the drain and sump located in the center of the wash bay. An oil separator included in the wash bay will separate oil from the used wash water. Oil removed from the oil separator will be purged and stored in certified oil containers for recycling. Wash water and solids collected in the sump will report to the tailings slurry pump box and be pumped with the tailings slurry to the TMF.

The maintenance and heavy equipment truck bay facilities have been designed to integrate a floor sump to collect debris and contamination from wash down and cleaning of equipment. A specific sump has not yet been specified and selected; it is expected that this decision will be made at the time of detailed engineering.

A modularized lubricant storage enclosure will house tanks for storing lubricants, coolants, and waste oil for the mine and plant mobile equipment fleets. The lubricant storage enclosure will also contain air-operated transfer pumps for supplying lubricants to the truck shop dispensing reels in the service bays. A pipe rack will connect the truck shop to the lubricant storage building. A separate modular exterior storage unit will be provided for waste oil and spent coolants. Waste lubricant recovery systems will pump used oil and coolant to holding tanks located at the lubrication storage facility for recycling. A bermed spill containment area, sorbents, and spill kits will be provided where the new and used fluids are stored. Fire-proof containers will be provided for storing used oily rags prior to disposal. The modularized lubricant storage enclosure will be separated from the truck shop, with sufficient fire safety separation in between.

The spare parts warehousing section of the truck shop complex will house materials, service parts, and supplies for mine and plant mobile equipment maintenance. The warehousing section is designed to be serviced by electric forklifts. A ready line outside the truck shop complex will provide parking for mine mobile equipment units awaiting service or repairs.

Any paved surface areas adjacent to the truck shop that are subject to fluid spillage will be sealed and sloped toward the sump located in center of the shop to prevent the spilled fluid from flowing toward to the surrounding environment. A small trench drain around the truck shop perimeter and truck waiting area will intercept any fugitive contaminated water from flowing beyond the truck shop perimeter and truck waiting area.

2.3.1.3 Permanent Camp

Accommodations at the Project site will be required for personnel throughout the operations and decommissioning phases of the Project. This is proposed to consist of modular building sections for reception, office space, storage, kitchen, dining hall, recreation area, and seven 30-person dormitories (210 single-occupancy rooms), with provision for an additional 30-person dormitory for a future addition.

The camp will be constructed as per applicable building and fire code requirements including appropriate fire detection, suppression, and communication equipment. The camp will be built for occupancy, with all electrical, communication, lighting, mechanical, sprinklers, plumbing equipment and fixtures, finishes, furniture, and related items, as well as inspected, tested, pre-wired, pre-piped, and pre-assembled as much as practically possible before shipment to site. All dorm rooms will be single occupancy only and equipped with a bathroom and other facilities required to house personnel. The permanent accommodation camp is planned to be constructed and ready for operations during the last year of construction.

Other support facilities will also be located around the camp building. These will include parking, emergency backup power generator, waste management facilities, and potable water supply and treatment equipment (see below).

Accommodations for personnel required for the construction phase of the Project will be provided via an off-site commercial camp facility located approximately 20 km north of the Project site, as described in Section 2.1.

2.3.1.4 Administration and Dry Facilities

Administration and dry facilities for the Project will be included within the primary mill and administration building. These facilities will include lockers, washrooms, and change facilities as well as the offices, conference rooms, and workstations required for mine administration. The facility will be located in the main mill site area (Figure 2-7).

The dry facilities will be separated into “clean” and “dirty” sides in a manner conventional to uranium mining. This facilitates contamination control by allowing workers to enter the dry on the “clean” side, change into clean work clothing and proceed to conduct work activities. When returning from work, personnel enter the “dirty” side of the facility where they can remove potentially contaminated work clothing for laundering, shower, and enter the “clean” side to don clean clothing and leave the area. Wastewater from the shower and laundry facilities will be collected and directed to water treatment facilities, like other potentially contaminated water at the Project.

2.3.1.5 Warehouse and Cold Storage Facilities

Primary materials storage for the Project will be provided through a heated warehouse storage area and an unheated cold storage area. The heated warehouse area will be included within the process plant and administration building and be complete with a 5-tonne overhead crane and truck receiving platform.

The cold storage area will be located near the process plant and administration building, fenced to control access, and may provide covered storage for items as required.

2.3.1.6 Power Supply and Distribution

The Project will require power generation on site in the absence of grid supply. There is potential of SaskPower extending grid supply to the region in the future; however, the assessments are yet to be completed. To support the needs of the Project, an onsite LPG-fired power plant will be procured, installed, and operated. The planned power plant will be based on eight LPG-fired generator sets, with seven operating and one on stand-by, each rated at 2.5 megawatts (MW), with a total installed generating capacity of 20 MW. Critical spare parts will be stored on site and engines will be rebuilt periodically to minimize unplanned downtime. Uninterrupted Power Supplies (UPS) and battery banks on site will provide the power supply to critical electronics and safety equipment in case of interruptions in power generation or distribution.

Each generator assembly will be housed in a prefabricated, insulated, and sound-attenuated enclosure with a skid mounted heat recovery system. These enclosures will also house the ancillary equipment and associated infrastructure, including switchgear, motor control centres, low voltage distribution and grounding systems, and control equipment and panels.

All enclosures will have a fire detection system and alarm panels with aerosol-based fire suppression systems. The generators will also be fitted with a heat recovery system to recover the waste thermal energy produced during combustion for plant and infrastructure heating. Power distribution to the mine, TMF, permanent camp, and other areas within site will be provided by 13.8 kV overhead distribution lines.

An LPG receiving and storage area is required to supply the power plant. The area will consist of an LPG offloading pump station to transfer LPG from shipping tankers to insulated storage tanks, a vapourizer for turning LPG into gaseous form, a waste heat vapourizer, water/glycol pumps for building heating, a control room, and pipeline infrastructure for transporting LPG within site. The storage area will house six 100 m^3 LPG storage tanks, providing approximately five days of power generation capacity. The laydown area will be lined to prevent seepage of fluid and will also be constructed with drainage channels and a sump to collect the rain/snow melt. Periodically, it will be pumped to the site water treatment facility for treatment.

2.3.1.7 Acid Plant

Based on sulphur-burning technology, the sulphuric acid requirement for leaching, Counter Current Decantation (CCD), SX, and effluent treatment will be provided by an on-site acid generation plant. The plant can produce a maximum of 250 t/d of monohydrate sulphuric acid (98.5% w/w) using the double absorption-conversion process and consists of four catalyst beds. In addition to acid generation, the acid plant will produce superheated steam that will be utilized in the leaching and other circuits within the process plant.

The plant components will be modularized and shipped for final assembly and installation at the site with technical support from the manufacturer. The acid plant will be housed in a 60 m x 48 m insulated, single-storey, pre-engineered building containing three areas: sulphur handling and storage area, sulphur melting, filtration and storage area, and acid generation area along with laydown, mechanical, electrical rooms, and storage tanks for sulphuric acid. The building will be supplied with truck access for sulphur receiving.

2.3.1.8 Surface Explosives Magazine

A surface explosives magazine will be required to receive shipments of explosives prior to transport to the underground magazines for use. The magazine and area will be designed to applicable regulatory requirements and access will be controlled and restricted to personnel meeting explosives handling requirements.

2.3.1.9 Fuel Storage and Dispensing

Double walled steel tanks will be used to store fuel (diesel and gasoline) at site. Fuel will be transported to site using B-trains or regular tanker trucks and will be unloaded into the storage tanks. Each tank is protected by a cage consisting of welded steel beams that protect the tank from external impact. The tanks will be routinely inspected, tested, and preventive maintenance will be carried out as necessary.

The fuel storage tanks will be placed in a designated fuel farm in the main mill complex area. Modular fuel dispensing stations will provide a means for fueling mobile equipment. The tank storage area will be protected by spill containment berms and fuel resistant liners as well as drainage channels and a sump to collect precipitation falling on the area and direct the water for treatment. The spill containment area will be designed to meet applicable regulatory requirements. The containment areas will be instrumented with monitoring devices, which will alert the control centre of any detected leakage or spillage.

2.3.1.10 Communications

A voice and data communications system will be established at the mine site to enable internal and external communications. All telecommunication systems will be supplied as a design-build package.

A communications network will be established among occupied buildings utilizing fibre-optic technology and wireless communication for voice, internet, and intranet traffic. The design will include the following.

- Voice over Internet Protocol (VOIP) technology using wide area network (WAN) links for voice communications and video conferencing systems.
- VHF radio system with provision for handheld units, mobile units, and base stations.
- A telephone private branch exchange (PBX) system and cellular phone service for telephone communications.
- Satellite television in the camp.
- A base and client station for wireless connection to the network system; the system will include a smart card access system to enable secure login to the network for desktop and laptop users.
- The local area network (LAN) system will utilize switches to connect to users' computers, and the WAN system will use routers with multi-protocol label switching capabilities to support voice and high bandwidth capabilities.

A backup system rated to handle the full communications bandwidth will also be installed. Backup power to communication and critical control systems will facilitate the orderly shutdown and start up of equipment, control systems, and backup computers.

A pre-manufactured trailer consisting of the main communication systems and all sub-systems will act as a main telecommunication central office during the construction phase. For the operations phase of the Project, the communications systems will be located in the administration area.

2.3.1.11 Heating and Ventilation

Heat recovery from the power plant will provide heating for buildings and facilities near the power plant. Waste heat from the power plant will be transferred by transfer pumps through a primary glycol circulating system loop throughout the mill and administration facilities. A secondary circulating loop will be the distribution system for individual complexes and facilities. A backup heat source using a propane-fueled boiler will be provided where required.

The facilities, such as office space, board rooms, dining space, electrical, and communication and control rooms will be air-conditioned. Localized controls will provide climatic control for these areas.

Continuous ventilation will be provided for all personnel-occupied and selected unoccupied spaces. Ventilation rates will vary depending on the level of occupancy and the intended use of the area. Ventilation systems will include make-up air units for a continuous supply of tempered air, general exhaust fans for contaminant removal, and, where appropriate, localized exhaust fans to remove contaminants directly.

Dust collectors, baghouses, and air filters will be used where required for dust mitigation. Dust particulates collected in the baghouses or dust cyclones will be collected and disposed of in the tailings slurry pump box and pumped with the tailings slurry to the TMF for permanent storage. Potentially contaminated air filters will be disposed of in the TMF or sealed in drums for offsite or underground disposal. Uncontaminated reusable air filters will be cleaned for reuse.

2.3.1.12 Fresh and Fire Water

Freshwater requirements for the site will be supplied from groundwater wells. Freshwater will be used primarily for potable water supply, firewater for emergencies, and process

water make-up. Water from other on-site activities will be utilized to the maximum extent possible for process-related activities to minimize the freshwater requirement.

Potable water for the site will be pumped to the water treatment units (chlorination and ultra-violet disinfection), stored in a potable water tank, and distributed to the various facilities on the site.

Fresh water and fire water for the plant and other facilities on the site will be stored in a fresh/fire water tank located at the process plant with a fire water reserve. A firewater loop will be installed throughout the site with a backup diesel pump and jockey pump to supply water to the fire hydrants. Fire extinguishers and automatic sprinkler systems will also be installed throughout the facilities. Emergency showers and eye wash stations will be established at predetermined locations.

The SX plant will be provided with a specially designed fire suppression system. The SX plant will utilize a carbon dioxide (CO_2)-based fire suppression system. Spare CO_2 cylinders will be stored in a connected backup configuration. The complete fire suppression system will be integrated with the Distributed Control System (DCS) for auto-operation. In an emergency, the fire system will take control of the process for an orderly shutdown. Fire alarm systems at site facilities will report to a continuously monitored central location for emergency response.

2.3.1.13 Sewage Treatment

Domestic wastewater (sewage) treatment for the Project is proposed to be a system based on Moving Bed Biofilm Reactor (MBBR) technology. The system will include several treatment stages including a pre-treatment stage, a MBBR stage including coagulation, flocculation, clarification, and ultra-violet disinfection, and a sludge dewatering stage.

The facility will be located near the mill and administration building with wastewater from the permanent camp, security gatehouse, and other outlying buildings trucked to the facility for treatment. The treated liquid sewage will be discharged into a process pond for treatment along with the Project's other wastewater streams. The MBBR sludge dewatering system can generate up to 58 kg of dry sludge per day, based on the 60 m^3 per day average design flow. The sludge will be dewatered, stored, scanned/confirmed safe, and approved for removal before sent off-site.

2.3.1.14 Medical/First Aid

A health centre will be located in the mill administration area with an ambulance bay, a fully equipped ambulance for advanced life support, and a fully equipped fire station located adjacent to the health center facility. Ancillary first aid centers will be provided at the accommodation camp. Medical personnel will be present on site as required by regulatory requirements. Emergency Med-Evac air ambulance services will be contracted out to registered services in the nearby communities.

2.3.1.15 Waste Management Infrastructure

The Project is expected to produce waste that can be separated into five main categories:

- non-hazardous (domestic and industrial) waste;
- hazardous waste;
- low-level radioactive waste;
- tailings; and
- waste rock.

The Project will implement procedures and processes to limit the amount of waste at the Project that requires ongoing management. These include processes for waste reduction at the source as well as recycling, reusing, repurposing, and recovering waste where possible. Despite these efforts, the Project will require facilities to either temporarily or permanently manage waste from each of the categories, as discussed below.

Non-Hazardous Waste Management

Non-hazardous waste includes both domestic and industrial waste streams. Non-hazardous domestic waste will be primarily composed of recyclable and non-recyclable materials including food waste, plastic, glass, paper, cardboard, metal food containers, and electronics. Non-hazardous industrial waste will be primarily composed of waste generated in the mine, mill, and other site areas without potential radioactivity. This includes items such as rigid plastic, plastic film, paper, carboard, metal, clean wood, painted or treated wood, tires, and other materials. These items will be collected and segregated in designated, centrally located collection areas near Project facilities before being transported for further handling in the waste management area.

Non-hazardous domestic and/or industrial waste that cannot be otherwise diverted, recycled, or reused will be transported off site to a regional landfill or the industrial landfill

located proximal to the TMF. The industrial landfill facility will also be located in the waste management area and accessed from the road required for TMF access. The landfill design will include features for environmental protection including the following:

- seepage barrier system;
- surface water management system;
- groundwater monitoring system;
- landfill gas management system;
- leachate collection and management system; and
- final cover system.

Hazardous Waste Management

Hazardous waste generated at the site will be collected, segregated, and temporarily stored in a facility purpose built for this activity. Wastes managed at this facility will include:

- waste oils;
- oil and fuel filters, spill pads, and rags;
- waste fuel;
- paints and antifreeze;
- aerosol containers;
- automotive batteries;
- household batteries;
- solvents and degreasers; and
- other miscellaneous materials.

The facility will provide secondary containment sufficient to mitigate risk from the quantity of waste stored at the facility. The facility will include provisions to prevent precipitation from interacting with the waste, or a collection system to manage any such precipitation and collect it for further management.

Hydrocarbon impacted soil and snow will be managed in a lined land farm facility that will include run-off collection for water management. The soil will be bio-remediated prior to re-use at the Project site.

For the other materials, periodically, or when the facility is nearing capacity, arrangements for off-site transport and disposal of these materials will be made with an external contractor specializing in handling and disposal of these waste types.

Low-Level Radioactive Waste

Low-Level Radioactive Waste (LLRW) includes waste with radionuclide content above established unconditional clearance levels and exemption quantities but typically have limited amounts of long-lived radionuclides. This may include waste generated in the mill, mine, shipping/receiving area, and other site areas that may have contacted radioactive material and does not include ore, waste rock, or tailings.

Disposal locations for this material will include disposal in the underground mine or disposal in the TMF.

Waste Rock Management

Project construction and mining activities generate waste materials, including overburden and waste rock, that consist of two types – Potentially Acid Generating (PAG) and Non-Acid Generating (NAG). Facilities will be constructed to manage waste rock prior to re-use as a component of the backfill utilized underground at the conclusion of the mining cycle. All waste rock generated by the Project will be re-used in this manner, resulting in no waste rock material remaining on surface at the Project at the end of mine life.

The overburden stockpile is designed to manage approximately 55,000 m^3 of material generated principally from the excavation of the boxcut and mine decline. This material will be stored on a facility located at the Waste Rock Management Area (WRMA) near the mine portal. The facility includes a high-density polyethylene (HDPE) liner and diversion ditches designed to direct water collected at the facility to the intermediate settling pond (ISP) and on for further treatment or re-use.

Approximately 500,000 m^3 of waste rock is expected to be generated by the Project. This is comprised of 74% (370,000 m^3) NAG and 26% (130,000 m^3) PAG. Based on geochemical testing and modelling of the behaviour of the waste rock with respect to the creation of acid rock drainage and metal leaching potential, along with the Project's waste rock management plans and reuse strategy, the Project's waste rock may successfully be stored separately or comingled (see Appendix A.2). Any comingled waste rock will be then considered PAG. Currently, separate facilities have been planned for PAG and NAG waste rock, though a single facility may be constructed if comingling of the waste types is determined to be optimal during a later design phase. In either scenario, the waste rock management facility(s) will include dual HDPE liners, leakage collection, and diversion

ditches to direct water collected at the facilities to the ISP for further treatment or re-use (Figure 2-8).

2.3.1.16 Tailings Management Facility

Extraction and processing of ore at the Project will result in tailings being produced. Tailings management is planned to consist of a purpose-built pit incorporating facilities for sub-aqueous deposition of tailings and an engineered double barrier to effectively prevent release of contaminated tailing and/or fluids to the environment. The facility will provide secure storage of mill tailings and process fluids during operations in a manner that supports safe storage and management for long term disposal (approximately 10,000 years) as well as mitigating radon release and dusting. The chosen purpose-built pit design will support effective tailings management during operations followed by decommissioning of the TMF in a fashion that effectively incorporates it into the surrounding terrain and sustains saturated tailing management in the long-term.

The design of the TMF will combine a below ground excavation with an above ground constructed dyke to contain the required volume of tailings. Subaqueous deposition of thickened tailings into the lined facility will be achieved using a relocatable barge or combination of a barge and submerged pipelines. The permeable foundation soils require construction of an engineered barrier (liner) system to effectively prevent releases of tailings and water to the environment. Tailings will be transported to the TMF in a pipeline as a thickened slurry. A water cover will be maintained to support barge deposition of tailings while preventing freezing of the tailings and providing a barrier to low energy radiation, dust, and radon release. Excess water will be returned to the process plant via a combination of a reclaim barge and under drain and following treatment, may be reused or released into the environment following the Project's effluent release processes.

The TMF will also provide emergency storage for site stormwater from a major storm event (e.g., a Probable Maximum Precipitation (PMP) event) that exceeds the water management capacity of the site's normal processes and facilities. Excess water in the TMF will be returned to the mill for treatment over time and subsequent re-use or release to the environment.

The TMF incorporates a modified version of technology successfully used at other uranium tailings management sites in the Athabasca Basin of northern Saskatchewan. Constructing the TMF in permeable drift sediments requires design considerations to maintain containment during operations, as the proposed facility location does not have an available

supply of naturally occurring low conductivity materials, such as clay. An engineered barrier system is proposed to prevent release of contaminated fluids to the surrounding soils.

The TMF is designed to provide containment during operations and decommissioning phases through use of perimeter and basal drains that will promote consolidation with the entire facility contained within an engineered barrier. Pore water that is expelled through the drains will be collected in an underdrain where it will be returned to the mill for treatment.

Upon mine decommissioning the tailings water cover will be drained, the tailings mass loaded with soil to promote further consolidation and then capped with an engineered soil cover. The engineered cover system will provide a barrier to the inflow of fresh water from precipitation and runoff while limiting ingress of oxygen to mitigate both acid drainage and leachate generation. The proposed cover system is a zoned store and release cover. The liner may be constructed with locally sourced fine-grained materials, fines manufactured through the mill or imported bentonite, geosynthetic liner options may also be considered.

The long-term objective of the TMF is to leave the site in a state that is physically safe and provides secure, long-term storage of the tailings with acceptable levels of predicted future impacts. To that end, the design objectives for the facility included demonstrating that the facility is technically feasible, environmentally acceptable, and can be effectively decommissioned. This includes application of best available technologies (BAT) for TMF design in a fashion that produces a high level of environmental protection that is As Low as Reasonably Achievable (ALARA) while also considering social and economic factors.

The guiding principles used for the design of the TMF included the Canadian Dam Association (CDA) guidelines (CDA 2013) and the 2019 technical bulletin on the application of the CDA guidelines to mining dams (CDA 2019), with the understanding that certain items will need input from other sources.

The design work for the TMF has considered construction, operation, closure, and landform stages. The design has adopted the philosophy of "designing and operating for closure" (MAC 2021). This philosophy considers closure of the TMF at any stage of design or operation to limit the additional engineering and effort required to return the TMF site to a natural landform, reducing the potential for long-term adverse environmental impacts and attendant corporate liability.

Geotechnical Design

A comprehensive discussion of the design and construction of the TMF and water management system is provided in Appendix A.3 and is summarized below.

Geotechnical design of the TMF will be in accordance with the CDA guidelines and the technical bulletin on the application of the guidelines to mining dams (CDA 2019). The geotechnical design of the TMF has resulted in the general arrangement (Figure 2-9) and typical details illustrated in Figure 2-10 and Figure 2-11.

An engineered barrier/liner system is proposed to prevent release of contaminated fluids to the surrounding soils. A preliminary design of the barrier system was produced during the Project's FS (Tetra Tech 2023) to demonstrate that a high level of environmental protection that is ALARA can be obtained. This design of the liner system included separate designs for the TMF floor and for TMF side slopes.

The engineered barrier system is essential for successful operation of the TMF. The engineered barrier on the TMF floor consists of a Soil-Bentonite Liner (SBL) overlain by a geomembrane. The SBL has been designed with a low hydraulic conductivity to provide a second barrier to seepage loss from the TMF. In addition, the ion exchange capacity of the soil-bentonite barrier will further attenuate releases of metals and radionuclides that may pass through the geomembrane liner.

The barrier system for the dyke or berm slopes consists of a double geomembrane liner without a SBL underlay. The second membrane will maintain secure containment on the slopes where the applied head will be small due to the overlying free-draining filter that will conduct the tailings solution to the underdrain.

A network of monitoring wells outside the confining berms of the TMF will be installed to facilitate TMF performance monitoring and provide early detection in the event of release of fluid from the TMF.

The barrier/liner system for the TMF floor and dyke side slopes will be optimized during subsequent phases of design with the objective of maintaining at least the same level of environmental protection, while improving constructability and operability, and reducing material quantities.

TMF Sizing

The TMF footprint, pit depth, and berm height have been sized to provide secure storage of tailings for the duration of expected mine life as well as provide freeboard to accommodate a design rainfall event and design wind based on the CDA Guideline. The general arrangement of the TMF is provided in Figure 2-10.

The FS estimated a required design capacity to support a 10-year mine life with 1,000 tonnes of ore processed daily. A metallurgical summary report completed by Melis Engineering Ltd provided a characterization of the tailings that was used to estimate the volume of tailings placed in the TMF each year as well as the consolidation that was expected occur with time (Melis Engineering 2023). After processing and the generation of precipitates, a total of 1,240 tonnes of tailings solids will be produced daily.

The tailings slurry as deposited in the pit will have a bulk density of approximately 41% solids by mass and will rapidly settle to a bulk density of approximately 50%. Sizing of the TMF was based on this rate of settlement plus on-going consolidation of the tailings, inclusion of a 3 m deep water cover, and provision for maintaining a minimum freeboard in the final year of operation. The total storage available in the TMF is approximately 7,400,000 m^3 and will store approximately 4,800,000 m^3 of partially consolidated tailings at the end of the 10-year mine life.

The estimated final elevation of the tailings, 3 m water cover, and minimum freeboard requirements (as per CDA Extreme Classification) were used to determine the required berm/dyke crest elevation.

The TMF layout developed in the FS (Figure 2-10), includes one single cell facility that is approximately 1,000 m by 560 m. Depth below ground surface varies from near surface to 10 m with a berm height of approximately 16 m above ground surface. During subsequent phases of design, alternative TMF layouts and optimizations will be evaluated which include dividing the current single cell facility into multiple smaller cells that could be constructed in different stages. As well, an area immediately north of the TMF has been identified as a potential additional cell (expansion cell) that could provide approximately 5 additional years of tailings storage.

2.3.1.17 Water Management Infrastructure

Water management at the facility has several objectives. These are:

- Diverting non-contact surface runoff away from the Project site.
- Collecting surface water that may have been influenced by the Project site for treatment.
- Collection of underground mine water for treatment.
- Reuse of as much water as possible in site activities to reduce discharge volumes.
- Treating and discharging water at volumes and with concentrations of contaminants of potential concern that meet discharge requirements and keep the downstream environment protected.

Meeting these objectives requires various types of infrastructure as described below.

Surface Drainage

Surface drainage works are required to successfully manage contact and non-contact water. Where possible, run-off water from site area catchments that does not come into contact with areas of potential mine or mill area influence will be diverted away from or around the site to limit the volume of water that is collected and subsequently requires treatment. Conversely, run-off water from catchments that does contact areas of potential mine or mill area influence will be collected for subsequent re-use and/or treatment and discharge.

This water management will be achieved through the use of natural and artificial gradients as well as collection and diversion ditches. Run-off water designated for collection will be directed to one of two collection ponds – the ISP or the Surface Run-Off Pond (SRP). Run-off storage and conveyance facilities have been designed to manage precipitation from a 24-hour duration 1 in 100-year storm with a factor applied to account for the impact of climate change.

Intermediate Settling Pond

The ISP and Intermediate Run-Off Settling Pond (IRSP) ponds will be located near the WRMA. The IRSP is a 3,655 m^3 dual-lined facility that collects the run-off from the waste and overburden stockpiles and directs this water to the ISP. The ISP is a 65,000 m^3 dual-lined facility located near the WRMA intended to collect water from several sources before transferring this water along to the Settling Pond (SP) and into the water treatment process. Sources feeding this pond will include the underground mine dewatering water, decline dewatering water, water from the waste rock stockpiles, and surface run-off water.

Surface Run-Off Pond

The SRP is a 37,500 m^3 dual-lined facility located near the water treatment plant intended to collect water from multiple sources before forwarding this water into the water treatment process. Sources feeding this pond will include water collected from the ore stockpile and surface run-off water.

Settling Pond

The SP is a 13,600 m^3 dual-lined facility located near the water treatment plant intended to collect water from several sources before conveying it into the water treatment process. Sources feeding this pond will include water from the ISP, SRP, TMF reclaim water, and water collected from the truck shop, dry, or other surface facilities.

Contingency Pond

The Contingency Pond (CP) is a 13,600 m^3 dual-lined facility located near the water treatment plant intended to act as supplemental water storage and to provide processing/treatment flexibility.

Monitoring Ponds

There are three monitoring ponds planned for the facility. These ponds are approximately 10,000 m^3 lined facilities located near the water treatment plant intended to receive treated water from the water treatment plant where it can be held while analytical work can be completed to ensure the water meets the discharge criteria. Collectively the monitoring ponds have 33,900 m^3 storage capacity. Once the water meets the discharge criteria, it may be discharged to Patterson Lake via the effluent discharge line and diffuser.

TMF Dewatering Retention Areas

Small-scale dewatering areas may be required during construction of the TMF but are not intended to be used during operations. For this purpose, two water storage areas are planned. Both the sedimentation and polishing ponds are intended to operate as infiltration ponds that allow stored groundwater to infiltrate back to the water table downstream of the construction area. Water produced from construction activities will report to the sedimentation pond. If the water inflow rate exceeds the storage and infiltration capacity of the sedimentation pond, it will report to the polishing pond via a lined channel between the two. If the polishing pond capacity is exceeded, a lined channel will convey water south for further infiltration.

2.3.1.18 Water Treatment Plant

The Project is proposing a water treatment plant to treat water for reuse and/or discharge to Patterson Lake. Water requiring treatment including potential contact water from site surface facilities, site run off, process plant water, tailings reclaim water, and water from other surface facilities will be treated to remove elements of concern to produce water suitable for release. Predicted effluent quality was determined through metallurgical and process testing (see Appendix A.4). Subsequently, this predicted quality and quantity of effluent was utilized in conducting a human health and ecological risk assessment to determine any potential Project effects from effluent treatment and discharge. Predicted potential effects from this activity were determined to be acceptable and indicate that the environment downstream of the Project will remain protected (see Appendix D.7).

The water treatment plant is planned as a conventional three-stage chemical treatment system designed primarily to remove metals and radionuclides before returning the water to a neutral pH. Treated water will be recycled into the process to reduce freshwater demand when needed. Excess treated water will report to one of the Project's three monitoring ponds. Monitoring pond water will be analyzed to ensure that its quality meets applicable discharge standards, regulations, or criteria. Once water is acceptable for discharge, it may be released to the environment via the effluent discharge line and diffuser located in Patterson Lake.

In the event that water in a monitoring pond does not meet the criteria required for discharge, this water will be returned to the treatment process for further treatment. This will include returning the water to the contingency pond, settling pond, and/or the TMF. The water will then be mixed with other water treatment plant feed water and undergo the entire treatment process again.

Feed water will be pumped to First Stage Water Treatment (FSWT). In the first stage, reagents will be added at a low pH to initiate precipitation of metal hydroxides, radium, molybdenum, arsenic, and selenium. The FSWT clarifier overflow will feed the Second Stage Water Treatment (SSWT). In the SSWT, reagents will be added at a neutral pH to further precipitate contaminants prior to the SSWT clarifier reporting to the Third Stage Water Treatment (TSWT). The TSWT will utilize reagents at high pH to finish contaminant removal before returning the water to a neutral pH for reuse or potential discharge to Patterson Lake.

2.3.1.19 Treated Effluent Diffuser

Water that has been successfully treated in the water treatment plant that is not required for reuse is designated for discharge to Patterson Lake via an effluent discharge pipeline and diffuser. The Project had considered several potential discharge options and in 2023 engaged a consultant to produce an initial design for a discharge pipeline and diffuser, including preferred pipe routing and diffuser placement within the lake (see Appendix A.5).

The diffuser pipeline will be a single walled HDPE pipeline that runs overland at grade using small diameter pipe. The routing travels existing disturbed areas and is located adjacent to other planned infrastructure. Following the overland portion of the route, the pipeline enters the south arm of Patterson Lake near the Project site and extends approximately 600 m into the lake terminating with an effluent diffuser located at an approximate depth of 14 m (Figure 2-12). The diffuser design includes five ports designed to create optimal mixing of effluent discharged. Based on predicted effluent quantity and quality data, mixing and plume modelling was conducted using software designed for these purposes to ensure that target dilution was achieved at a distance 100 m downstream of the discharge location.

2.3.2 Underground Infrastructure

2.3.2.1 Mine Refuge Stations

Refuge stations will be constructed underground to meet regulatory requirements. The primary refuge station on the 400 level will be a permanent refuge station capable of accommodating the total amount of personnel expected to be underground during a shift. This refuge location on 400 level has been selected so that it remains in fresh air at all times and is located more than 100 m from the explosives and detonator magazines as per regulations.

The primary refuge will have all the equipment and supplies needed to sustain occupants for 36 hours during an emergency event. It also has a secondary use as a lunchroom for personnel to use on a regular, non-emergency basis.

Mobile refuge stations will be strategically placed during development and construction of the decline and other lateral development areas as the mining schedule advances. These mobile refuge stations follow advancing development and will be distributed as required to support underground personnel. The mobile refuge stations will provide refuge for

workers within a reasonable distance of all locations in the mine. These refuges can sustain occupants for 36 hours should an emergency occur.

2.3.2.2 Dewatering and Process Water Systems

Overburden Dewatering System

Project development will require construction of a boxcut and decline for mine access. Fission is considering two methods to complete this work (see Section 2.4.1). Depending on the decline development technology selected, groundwater contained in the overburden may be dewatered. If required, a pumping system designed to manage overburden dewatering requirements will be installed with infrastructure to convey the water to the ISP for further management, as described in Section 2.4.1.4.

Underground Dewatering System

Continuous dewatering of the underground workings will be required during the initial development of the mine, through operations, and terminating with mine closure. Mine water is planned to be pumped to the ISP. The pumping and piping system is designed and sized with emergency installed capacity sufficient to manage the lower bound unmitigated predicted inflows, able to process a total of 125 m^3/h (3,000 m^3/day)

Dirty water will be collected at the working faces using air-operated diaphragm pumps. Depending on proximity, water will be sent directly to either the nearest settling station or booster pump skid. The booster pump skid can receive water from multiple diaphragm pumps. There are two primary decantation/pumping stations planned for the mine. One on the 400 Level near the R00E Zone and a second on the 260 Level of the R780E Zone. The decanting stations are designed with three individual sturda weir/decanting drifts; one in operation/filling, one drying, and one on standby. Each decanting drift/weir has been sized to provide a target of 24 days of solids capacity based on 63 m^3/hr @ 1% wt solids.

Process Water System

A process water system is planned to supply the underground mining operations. This water will be routed from surface and go into the mine to supply equipment and infrastructure. On surface, a water tank will be situated that supplies water to each level of the mine by gravity. To reduce the line pressure, two different systems will be used. The first one is an open (non-pressurized) tank where a mechanical float controls the tank level to maintain a sufficient volume. The second system is a dual pressure relief valve system, where two

valves are placed in parallel. This will ensure that process water will always be available even when a valve needs to be replaced. After the water has been used, it will be collected via the dewatering system described in the previous section.

2.3.2.3 Explosives and Detonator Magazines

The explosive and detonator magazines are planned to be in the R00E Zone on the 400 level. The explosive and detonator magazine are designed to meet regulatory requirements and have been isolated from the main fresh air circuit. For safety purposes, an auxiliary fan will be installed to circulate air in the explosive magazine and a locking swing gate will prevent unauthorized access to both rooms. The explosive magazine is large enough to allow a truck to park inside the swing gate.

2.3.2.4 Underground Electrical and Compressed Air Systems

The main electrical feed to the underground is 13.8 kilovolts that is then stepped down to 600 volts for equipment and infrastructure use. Additional equipment will include all switchgear, transformers, distribution panels, and cabling as required to service the underground workings.

The compressor room is planned to be located on the 400 level and provide compressed air for the mobile equipment fleet and dewatering system.

2.3.2.5 Maintenance Facilities

Underground maintenance facilities will consist of a tire wash bay. Primary maintenance services are located on the surface.

The underground tire wash bay is planned for the 400 Level in the R00E Zone. It will be complete with a pressure washer, a water cannon and a water collection system, and an oil/water separator. Water will be recirculated as much as practicable to reduce water consumption. The tire wash bay is planned near the bottom of the main ramp access. It is designed as a pass-through tunnel with sprinklers on both sides to spray vehicle tires as they pass through. All dirty water from the facility will be transferred to the dirty water sumps on the 400 Level.

2.3.2.6 Grade Control System

A grade control system in the form of a scanner is planned for the 400 Level. The system will give the truck operator a signal indicating the approximate ore grade in the truck to ensure that the material is sent to the correct mill stockpile.

2.3.2.7 Ventilation

The primary ventilation system will consist of intake and exhaust fans located on surface at their respective shafts; Fresh Air Shaft (FAS) and Exhaust Air Shaft (EAS). The primary intake fans will consist of two 186 kW (250 hp) fans arranged in parallel. They will sit horizontally behind the mine air heaters and be attached to the FAS via a sub-collar plenum. The selected fans can produce a flow rate of 350 m^3/s at a pressure of 1.8 inches of water gauge. The exhaust fans will be the primary air movers in the main ventilation network and generate negative pressure to remove air from the mine. There will be two 274 kW (370 hp) fans arranged in parallel capable of producing a flow of 320 m^3/s at negative pressure of 6.9 inches of water gauge. The exhaust air fans will be installed horizontally inline with ductwork and an elbow that is placed over the EAS.

Due to the northern location of the mine, the ventilation system will require a heating system to condition the air in winter. For this purpose, a 22.5 MW direct fire heater fueled by natural gas has been chosen. It will be integrated with the primary intake fans. The exhaust fans will be the primary air movers in the main ventilation network and consist of two 274 kW (370 hp) fans arranged in parallel. Primary ventilation fans will be provided with sound attenuation facilities to minimize noise generated by fan operation.

A ventilation on demand system is also planned and is designed to control the air distribution into the mine. All airflow and quality data will be directed to the mine control room where ventilation can be managed and controlled by an operator. This system has two main features, an airlock, and automatic louvers. The objective of the airlock is to stabilize the pressure and prevent a short circuit of the primary ventilation system. The louvers will be installed on all production levels at the connection to the exhaust/raise system. They will be operated from the surface control room and opened or closed to adjust air flow as needed.

The mineralized zones will be kept under negative pressure by an auxiliary ventilation system designed to ensure that single-pass air is used in production headings.

2.3.2.8 Refrigeration Plant and Brine Distribution

To facilitate mining of ore near the top of the R780E and R00E, an artificial ground freezing method will be employed to stabilize the ground and limit water infiltration near the overburden-bedrock interface. A refrigeration plant will be located on surface which will pump a chilled 30% calcium chloride to and from surface via dedicated 10-inch diameter insulated pipes. The brine solution will be fed through dedicated freeze drifts to a series of freeze pipes that have been installed in a fan pattern along the entire strike of the targeted orebodies. The refrigeration plant will contain five operational skid-based compressors. Each unit will have a 325 tonnes of refrigeration capacity and consist of a 1,000 hp compressor and a 100 hp brine pump capable of feeding the surface brine mixing tank with brine at a design temperature of -35°C. From the brine mixing tank, two 100 hp pumps (one operational, one standby) will feed brine solution underground.

2.3.2.9 Backfill Plant

A backfill plant is required to supply backfill for areas where ore has been extracted. Three types of backfill will be utilized by the Project to meet specific needs. These are Cemented Rock Fill (CRF), Cemented Aggregate Fill (CAF), and Cemented Hydraulic Fill (CHF). CRF is a backfill consisting of Project waste rock and local sand to backfill mined out stopes. Not enough waste rock will be produced by the Project to meet all backfilling needs. Once all waste rock has been consumed, CAF will be used as stope backfill. CAF utilizes locally available aggregate and sand. CHF will be used to fill the drift and fill excavations concentrated along the top of the deposit. CHF is created using locally available sand.

The backfill plant will be located adjacent to the mine portal and the surface waste stockpile area. The proposed plant is designed to produce CRF, CAF, and CHF with the sharing of facilities such as the feed hopper and cement handling system. The proposed plant can be arranged to supply both CRF and CHF concurrently in batches as needed. The CRF plant has also been designed to allow the batching of concrete for construction use when required. Please see Figure 2-13 for a general arrangement of the backfill plant.

2.3.3 Ore Processing Infrastructure

Processing facilities proposed for the Project to be able to successfully produce uranium ore concentrate and maintain mine and worker safety are described below. A simplified flow sheet is provided in Figure 2-14.

2.3.3.1 Ore Receiving and Storage

Run of mine (ROM) ore will be trucked from the mine to the ore stockpile pad adjacent to the processing plant. The stockpile pad will be lined with two layers of HDPE liner with a leakage detection between the liners. Run-off water will be collected, contained, and sent to the SRP.

Ore will be placed on the pad in graded stockpiles consisting of low, medium, and high-grade ore. A loader will place a predetermined ratio of the graded piles into the mill feed bin to ensure a consistent average grade is provided to the mill.

2.3.3.2 Grinding and Classification

The ROM ore will be ground in a single stage Semi-Autogenous (SAG, uses a small amount of steel balls to assist grinding) mill. Mill discharge will be screened using a SAG mill trommel (rotating or mechanical screen). Oversize will be collected and recycled to mill or discarded to the waste rock storage facility, as determined by grade. The mill discharge will then be pumped to a classifying cyclone (centrifugal separator). Cyclone underflow will gravitate to the mill feed hopper and enter the mill with fresh ore feed. Cyclone overflow will gravitate to the pre-leach thickener.

2.3.3.3 Thickening and Storage

The neutral thickener will thicken the milled pulp to approximately 52% solids. Overflow water will gravitate to the process water tank for recycling to the SAG mill. SAG mill circuit makeup water sourced from the water treatment pond or tank will be added as required. Thickener underflow will be pumped to the pre-leach pulp storage air-agitated pachucas. The thickener and the pachucas will enable additional smoothing of the uranium head grade reporting to the leaching circuit and decoupling the grinding circuit from the leaching circuit.

The pre-leach storage tanks will consist of two air-agitated conical bottom tanks (pachucas). These tanks will provide up to 12-hours of surge capacity.

2.3.3.4 Leaching

Atmospheric leaching will be carried out in a train of six mechanically agitated rubber-lined carbon steel tanks equipped with dual axial flow impellers. Pulp will flow by gravity cascading from the No. 1 leach tank sequentially through to the No. 6 leach tank. It will be

possible to bypass any tank for maintenance and select residence by operating five or six tanks. The tanks will have closed tops and be vented via a scrubber to the atmosphere to minimize worker exposure to acidic steam and radon emissions.

Steam, sulphuric acid, and hydrogen peroxide will be introduced into the tanks to create and maintain ideal process conditions. Discharge slurry density will be approximately 45% solids. The final leach tank discharge reports to a pump box that feeds CCD.

2.3.3.5 Counter Current Decantation

There will be six CCD thickeners, each with its own feed mix tank. Thickened pulp will be pumped from the cone of each thickener to the mix tank feeding the next downstream thickener. Thickener overflow will be pumped to the mix tank feeding the upstream preceding thickener. The mixed diluted slurry will flow by gravity from the mix tank overflow to the centre well of the thickener. Flocculant will be added into the flow from the mix tank overflow launder. Internal auto-dilution will enable density control of the feed to the centre well.

Each thickener will operate at equal underflow density. Wash water comprised of raffinate (a liquid from which impurities have been removed by solvent extraction) and recycled water will be added to the no. 6 mix tank to achieve the most effective counter current wash to leach feed ratio. The pH in the CCD no. 6 thickener feed well will be controlled by adding acid when necessary to prevent possible uranium precipitation at a higher pH. The CCD circuit dissolved uranium recovery will be 99.5% to 99.7%.

2.3.3.6 Pregnant Leach Solution Clarification and Solvent Extraction

Pregnant leach solution (solution containing uranium) from the CCD will report to a clarifier where coagulant and flocculant may be added. Settled solids from the clarifier will be pumped back to CCD. Clarifier overflow will be pumped to sand filters for polishing. Polished pregnant leach solution will be pumped to a surge tank followed by a heat exchanger to raise its temperature prior to feeding SX.

Solvent extraction will purify and concentrate uranium in the solution for yellowcake precipitation and consists of extraction, scrubbing, stripping, acid washing, and regeneration stages:

- At extraction, four mixer settlers will be used to extract uranium from the pregnant leach solution via the introduction of an organic solution.
- Loaded organic solution will exit extraction and enter the single mixer settler tank in the scrubbing stage where entrained aqueous droplets will be removed from the loaded organic.
- The stripping stage will contain five mixer settlers where a strip liquor of sulphuric acid will be introduced to move uranium to the aqueous phase.
- The acid wash stage will consist of a mixer settler used for acid recovery and reuse.
- The regeneration stage will consist of a mixer settler where approximately 50% of the organic flow will be regenerated by contact with sodium carbonate to prevent a buildup of contaminants. Spent regeneration aqueous solution will be pumped to effluent treatment.

2.3.3.7 Gypsum Precipitation and Dewatering

Gypsum precipitation will be carried out in a series of six mechanically stirred tanks. The pH will be gradually raised as the solution flows by gravity overflow down the series of reactor tanks. A recycle stream of gypsum thickener underflow will be directed to precipitation tank no. 1 to provide an abundance of gypsum seed crystals for nucleation. The flow from the sixth reactor will be pumped to a gypsum thickener.

Thickened gypsum slurry will be pumped from the thickener underflow to a vacuum belt filter. Wash water will be added to the filter cake in the wash zone to displace the uranium solution. The filtered cake will be repulped with acid water and pumped to a two-stage two-hour uranium leach to dissolve uranium that may be associated with the gypsum and washing of uranium solute off the gypsum particles. The re-leached slurry will be pumped to a second belt filter to recover dissolved uranium in the filtrate.

Wash water will be added to the wash zone on the filter. Filter cake will be repulped and pumped to the tailings neutralization circuit. The filtrate containing recovered uranium from the second belt filter will be returned to the first belt filter feed tank, whereas the filtrate from the first belt filter will be pumped to the No. 1 gypsum precipitation reactor as a heat diluent or to No. 1 CCD, depending on operational requirements.

2.3.3.8 Yellowcake Precipitation and Dewatering

Yellowcake will be extracted from the hopper by a ribbon screw feeder and discharged into the rotary dryer. The nominal peak operating temperature for the dryer will be 475°C, achieving a chemically stable product enriched to 95% U_3O_8.

The dryer will produce two gas streams. The uncontaminated combustion gas will discharge through a stack, and the contaminated process gas will be drawn through a wet scrubber before being released through a stack. Scrubber effluent will be reintroduced to the yellowcake precipitation circuit.

Dried yellowcake will discharge into a storage bin. The bin feed and product transfer points are kept under negative pressure by an induced draft fan that will draw air and dust through to a dust capture baghouse. Captured dust will be discharged to the calcine bin.

Yellowcake will be metered from the bottom of the storage bin into 210 L steel drums conveyed on a semi-automated packaging system. The system will be sealed and under negative pressure to prevent any dust from contaminating the area. The drums will be sampled before lids and seal rings are fitted. The drums will then be washed and dried. After being weighed, an ID label will be attached to the drum. There will be approximately 40 to 60 drums packaged per plant operating day.

A drum storage facility will provide sufficient room to store nested empty drums and approximately 200 full drums. Full drum consignments will be trucked off-site regularly.

2.3.3.9 Tailings Neutralization

The CCD circuit underflow, filtered gypsum, and FSWT clarifier underflow will be pumped to the no. 1 tailings reaction tank, where lime, ferric sulphate, and barium chloride will be added to neutralize the pulp and precipitate dissolved contaminants.

The overflow from the no. 1 tailings reaction tank and the SSWT clarifier underflow will report to the no. 2 tailings reaction tank, where lime will be added to increase pH to 7. The overflow from no. 2 tailings reaction tank and the TSWT clarifier underflow will report to tailings reaction tank no. 3, where final lime will be added to increase the pH to 10. Each tank will provide one hour of residence time.

Neutralized tailings slurry will be pumped from the third reaction tank into the feed well of the tailings thickener. The tailings thickener underflow will be pumped to the TMF and

the thickener overflow will be sent to the first stage of effluent treatment (see Section 2.3.1.18).

2.4 Project Activities

Project activities are planned to proceed generally in phases, including site preparation and construction, operations, decommissioning and reclamation, and post-decommissioning. The design schedule for the Project consists of 3 years construction, 10 years of operation, 8 years of decommissioning, and approximately 3 years of post-decommissioning monitoring; however, the operational timeline assessed in this EIA was extended to 15 years to allow for flexibility and to ensure the EIA is providing a conservative assessment over an extended timeline. Thus, the total Project timespan being evaluated in this EIA extends over a period of 29 years; please see Figure 2-15 for a Project schedule.

2.4.1 Site Preparation and Construction

Site preparation is a set of activities designed to prepare the site for more advanced construction activities by providing infrastructure, services, and work areas needed for general construction. Key activities currently will include:

- Access improvement/establishment from Highway 955 to the Project site.
- Clearing and grubbing of the Project area.
- Establishment of internal site roads and facility pads.
- Boxcut development.
- Work area/local dewatering and treatment facilities.

The current access to the Project area from Highway 955 will be improved to facilitate site preparation and construction activities.

Clearing and grubbing of the planned development areas will be required prior to construction activities. Organic material suitable for future reclamation activities will be collected and stockpiled at an appropriate site location(s). If a potential archeological site is identified, the Project's process for managing heritage resources will be initiated (i.e., Chance Finds Procedure). Following clearing and grubbing, construction of internal site roads needed to access facility locations as well as cut and fill activities to develop facility pads will be undertaken.

Preparing for mine access requires excavation of a boxcut. Temporary dewatering requirements during boxcut and decline development will be determined based on the technology selected.

As the boxcut is developed, the decline roadway will be established to allow truck access to the work area to remove excavated material to the overburden stockpile. Once the boxcut is completed, the portal collar will be established on the headwall of the boxcut. This includes the installation of soil nails, shotcrete and geotextile fabric required to support the portal collar.

Construction activities will comprise all remaining preparation and construction activities required to bring the Project to the operating phase of the life cycle. Commissioning activities occur following the construction of the various facilities and works to ensure that they operate in the intended manner. Key activities in this phase include construction and completion of the following facilities:

- Mine access decline, and initial underground workings and facilities.
- Fresh air shaft and the exhaust air shaft.
- Waste rock management facilities.
- Waste management facilities.
- Water management facilities.
- Backfill plant.
- Mill and process facility.
- Freezing plant and associated infrastructure.
- Administration building and other surface buildings.
- Personnel accommodation.
- TMF and associated facilities.

2.4.1.1 Decline Development and Initial Underground Development

The Project is currently considering two methods for development of the decline, the TSM and the TBM method. Both methods involve driving the decline down at a -15% slope using mechanical tunnelling equipment with the excavated material being removed from the workface and placed on the appropriate stockpile while concrete tunnel liner segments are installed to form the decline ground support system. The segments form a hydrostatic barrier with a 6.0 m to 7.0 m inside diameter, depending upon the choice of methodology

and equipment available at the time of construction. Both methods achieve the same result, including removal of the same amount of waste material for temporary storage and reuse.

In terms of water management, it is anticipated that the TSM will require more dewatering compared to the TBM method. Should dewatering be required, temporary ditches, sumps, and any infrastructure needed to convey water from the boxcut to the ISP or other approved location will be installed. Once local dewatering reaches a level below the floor of the boxcut, development of the boxcut can be completed and any temporary dewatering infrastructure will be removed. Some dewatering infrastructure may be maintained to supply groundwater for process needs.

Following the completion of the decline, underground development will proceed using conventional drill and blast or mechanical mining methods.

2.4.1.2 Development of Fresh Air and Exhaust Shafts

The FAS is planned to be a finished diameter of 5.5 m and depth of 120 m. An escapeway is planned to be installed in the FAS to serve as an emergency means of personnel egress. The EAS is planned to have a finished diameter of 5.5 m and depth of 100 m.

As with development of the decline, the Project is considering two methods for construction of the FAS and EAS. The first is a conventional shaft sinking using artificial ground freezing supplied by a mobile freeze plant. With this method the shafts will be constructed in series with the FAS being completed prior to the EAS. Once complete, both shafts will be concrete lined with intake fans and mine air heating facilities installed on the FAS and exhaust fan facilities installed on the EAS.

The second method being considered for shaft development is construction of the shafts as diaphragm wall shafts. With this method, the overburden portion of the shafts will be formed of interlocking diaphragm wall panels installed during excavation utilizing a trench cutting machine installed on the surface. Once through the overburden, conventional blind sinking or Alimak raising and benching will be used to complete the shafts to depth in bedrock. With this method, the shafts could be constructed partially in parallel with the FAS being completed prior to the EAS. As with the conventional shaft sinking method, both shafts will be lined with internal and external facilities installed as described above.

2.4.1.3 Waste Rock Management Facilities

Waste rock management facilities are required prior to the excavation of material intended for temporary disposition on each pile. Three stockpile type storage locations are planned for the Project (Section 2.3.1.15), an overburden stockpile, a PAG material stockpile, and a NAG material stockpile. A single stockpile for both NAG and PAG waste rock is being considered to facilitate waste rock management as separation of the PAG and NAG material underground can be problematic. If the NAG waste rock is isolated, it may be used for site construction activities where appropriate. The facilities are planned to be constructed near the decline to minimize travel time and site traffic.

2.4.1.4 Water Management Facilities

Components of the Project's overall water management infrastructure (see Section 2.3.1.17) are required at various stages of the construction process to manage water generated or encountered by the Project. Some facilities may be temporary in nature as they are required only for construction purposes. Initial facilities will likely include the ISP and other facilities that may be required for boxcut and decline dewatering. Prior to decline construction, depressurization and dewatering will occur. In preparation for mine access, water will be conveyed to the ISP or other approved location for collection and treatment during the temporary excavation to a level below the floor of the boxcut. Dewatering infrastructure for the boxcut will remain in place for decline development.

The Project is considering use of either the TSM or the TBM method using an earth pressure boring machine that will reduce the need for dewatering. The contribution of the boxcut and decline dewatering flows will be conveyed to the ISP for treatment in a temporary water treatment facility prior to discharge through the diffuser into Patterson Lake South Arm. The management of overburden and waste rock as part of decline construction will involve temporary stockpiling of these materials on surface at the lined WRSA. Seepage from these stockpiles and runoff from the WRSA will also be captured at the IRSP, which reports to the ISP. The ISP will receive flows from the IRSP and the flows from dewatering and depressurization wells during the temporary decline dewatering in construction. Water from the ISP will be treated, as needed, at a temporary (for construction) water treatment facility such that water released will meet discharge criteria. The water balance and water quality model provide further detail in Appendix A.2.

2.4.2 Operations

2.4.2.1 Mining

Extraction, Lateral Development

The "Triple R" deposit consists of five zones. Three primary zones – R780E, R00E, and R840W and two secondary zones R1515W and R1620E. Further exploration of the deposit may identify additional resources suitable for extraction. Extraction methods for the deposit may consist of a combination of longhole open stoping, mechanized drift and fill, and non-entry underground mining utilizing surface mounted vertical cutter technology.

Long hole open stoping involves excavating ore in a series of horizontal levels, known as stopes. In long-hole open stoping, a series of vertical or inclined production holes are drilled from the top of the stope to the bottom in ore drives developed using conventional drill and blast methods. These holes are typically drilled using an in the hole configured long hole drill rig. The holes are drilled in a pattern of rings, with multiple holes per ring and are spaced at regular intervals across the stope. Once the holes are drilled, a subset of rings are blasted, and the broken ore is removed using a load-haul-dump (LHD) vehicle from the extraction drift and trucked to surface for processing.

Mechanical drift and fill will be conducted using either conventional jumbo development or roadheaders, or a combination of both. Roadheaders use boom mounted cutting heads and conveyors to cut the ore-bearing rock and convey it to the rear of the machine where it will then be transported to surface for further processing. Mechanical drift and fill will utilize a jumbo for drift development. Jumbos are drilling rigs used to drill into the rock face to allow the loading of explosives. After the explosives are detonated, the broken rock material will then be mucked and transported to surface via a fleet of LHDs haul trucks. Vertical cutter technology mining involves vertically cutting a shaft from the surface into the ore bearing zone where a resulting ore slurry is then pumped to the surface for further processing.

Lateral development in waste bedrock is planned to be conducted using either conventional drill and blast technology or mechanical excavation methods.

Ore Transport

Ore transport is planned to be conducted using 30 tonne trucks exiting the underground via the decline and proceeding to the ROM pad and ore stockpiles. A grade control system is

planned for installation on the 400 Level to give the truck operator an indication of the ore grade and thus the correct mill stockpile for deposition. Further information on the grade control system is available in Section 2.3.2.6.

Backfill

Following ore extraction, backfilling of the excavation is required for mine ground support and to mitigate groundwater inflow. A backfill plant (see Section 2.3.2.9) is proposed for the Project that will enable the production of CRF, CAF, CHF, and construction concrete as required. CRF and CAF backfill will be hauled from the surface backfill plant to underground production areas where it will be loaded by LHDs and placed into stopes. CHF backfill will be pumped from the surface for placement in the areas where it is required.

Aggregate and sand required for backfill production are locally available. Construction of the TMF will result in the excavation of these materials which will be stockpiled near the TMF for subsequent use as backfill. An additional source of these materials has also been identified just to the north of the planned TMF construction.

Underground Ventilation

Underground ventilation for the Project has been designed with the use of a FAS, EAS, and decline portal. The ventilation system was developed to ensure that one-pass air is used at all times to mitigate the risk of exposure to airborne contaminants. Air is designed to be down-cast through the FAS and up-cast through both the portal and the EAS. Current design for the intake of the system is for 350 m^3/s, though optimization at detailed design may impact the final plan and amount of ventilation required. Due to the geographic location of the Project, the heating of mine air will be required for approximately 8 months of the year, and as such, a heating system will be integrated with the primary intake fans.

The primary intake fans are designed to act as a blower to add pressure to the ventilation system and induce the surface decline to exhaust. The primary exhaust fans will carry the primary ventilation load and maintain the system under negative pressure. This will remove the potential for air to recirculate in the underground workings. Ventilation to each of the mine levels will be controlled by louvers installed in each of the bulkheads on the return side of production cross-cuts. These louvers will be automated and remotely controlled at the mine control room. See Section 2.3.2.7 for additional information.

Underground Dewatering

Continuous dewatering of the underground workings will be required during the initial development of the mine, through operations, and terminating with mine closure. Mine water is planned to be pumped to the ISP for further treatment and reuse, or discharge. The dewatering system design is based on predicted mitigated water inflows. Inflows will be mitigated through grouting of the upper development headings as required. Additionally, the system is designed with emergency installed capacity sufficient to manage the lower bound unmitigated predicted inflows. See Section 2.3.2.2 for more information.

Ground Freezing

Artificial ground freezing required in the operations phase of the Project will be provided through the provision of a refrigeration plant and associated infrastructure (see Section 2.3.2.8) required to conduct freezing activities in the crown pillar areas of the R00E and R780E zones or any other areas determined to require freezing.

The crown pillar geotechnical designs conducted as part of the FS, including plans for ground freezing, ground support, cemented backfill, and probe and grout cover in unfrozen zones are designed to minimize deformation in the crown pillar between the mining excavations and the soil-bedrock contact. The crown pillars will also be left in place for the entirety of the mine life (they will not be mined), and there is considerable overburden thickness above the crown pillars. Therefore, the potential for ground deformation to extend to surface and cause subsidence is considered low.

The freeze layout includes drilling and installation of freeze circulation pipes on a 4-metre spacing from an underground drift on the footwall side of the orebody. Drill stations will consist of four drill holes fanned out to target the bulk freeze zone. Once drilling and installation of the brine circulation network is completed, freezing will begin targeting a bulk freeze of -5°C or colder. The bulk freeze is intended to extend approximately 10 m vertically into the saturated overburden and 15 m down into the Basement contact.

2.4.2.2 Mineral Processing

The processing plant (see Section 2.3.3 for infrastructure details) has been designed to process ore at a nominal throughput of 1,000 t/d to produce market grade uranium concentrate. The average Life of Mine (LOM) mill feed grade is planned to be 1.41% U_3O_8, and the anticipated recovery is projected to be 97.0%. The annual LOM average production

will be approximately 4.8 million kg per year (10.6 million lb per year) of concentrate at 95% U_3O_8.

A conventional grinding and leaching circuit will be used for the recovery process. The ore will be trucked from the mine to the ore pad and ground in a SAG circuit to 150 µm. The ground ore slurry will be leached using sulphuric acid and hydrogen peroxide at 50°C. The leached slurry will be fed to a counter-current decantation circuit followed by a clarification stage to produce the pregnant leach solution. A solvent extraction circuit will purify and concentrate uranium in the solution for yellowcake precipitation. Gypsum will be precipitated to reduce the sulphate content in the strong acid strip solution before precipitating the yellowcake. Hydrogen peroxide and magnesium oxide (MgO) will be used for yellowcake precipitation. The precipitated yellowcake will be dried at 450°C before packaging in drums.

The produced tailings will be neutralized and then deposited in the TMF. The effluent and any contact water will also be treated, monitored, and sampled as per the applicable environmental standards and regulations before being discharged into the environment.

A simplified overall process flowsheet is shown in Figure 2-14.

2.4.2.3 Uranium Ore Concentrate Storage and Shipment

The plant is expected to produce between forty and sixty drums of yellowcake per day. Storage for approximately 200 drums is planned via a dedicated storage area. Approximately two to four shipments of uranium ore concentrate per week are planned by the Project. These shipments, as with all uranium ore concentrate shipments from northern Saskatchewan, may have various destinations. Shipment via truck to concentrate processing facilities in North America are common. Additionally, shipments of concentrate to customers around the world via the ports of Vancouver and Montreal are also typical.

2.4.2.4 Waste Rock Management

Project construction and mining activities generate waste materials including overburden and waste rock which consists of two types – PAG and NAG. Facilities will be constructed to manage waste rock during the construction and operations phases of the Project (see Section 2.3.1.5). Waste rock and overburden will be hauled via truck to the appropriate storage facility for storage and management prior to re-use. Overburden may used in construction activities at the site as appropriate in order to reduce local resource usage or

in CHF production. All waste rock material generated is planned to be used in the composition of backfill material and will be returned underground to backfill completed stopes at the conclusion of the mining cycle.

2.4.2.5 Tailings Management

During operations, tailings and process fluids will be transported to the TMF in a pipeline as a thickened slurry and then sub-aqueously deposited in the TMF (see Section 2.3.1.16) using a relocatable barge or a combination of a barge and submerged pipelines in a manner that facilitates an even distribution of tailings and prevents particle segregation to produce a uniform, low permeability consolidated tailings mass. Spill prevention and control measures for the slurry pipeline will be incorporated to provide protection against leaks and spills along the tailings pipeline corridor. A water cover consisting of a clarified tailings solution will be maintained to support deposition of tailings while preventing freezing of the tailings and providing a barrier to low energy radiation, dust and radon release. Excess water will be returned to the process plant for treatment and re-use or release to the environment.

The TMF can also act as an emergency storage for site water if there is a large storm event that overwhelms the site storage (e.g., a PMP event). Excess water will be returned to the process plant for treatment over time and released to the environment.

Freshwater in the vicinity of the TMF will be diverted around any infrastructure to limit the amount of impacted freshwater on the site. Any runoff in contact with infrastructure will be managed through the Project's water management processes.

Tailings solution in the TMF will report to the underdrainage system for recirculation to the mill or to the TMF for maintenance of the water cover.

An operational water budget was completed to estimate the process flows in various segments of the TMF. The main water input to the TMF is process water incorporated in the tailings slurry. In the first few years of TMF operation, a large volume of water will be required to develop and maintain the 3 m water cover; consequently, makeup water will be required from the sentinel wells and limited to no water will be returned to the mill.

2.4.2.6 Water Management

Water management is a key activity in the construction, operations, and decommissioning phases of the project. Water management facilities and infrastructure (Section 2.3.1.17) have been designed to facilitate the following activities:

- diversion of clean surface run-off water away from and around the Project site;
- retention of potentially site influenced water on the Project site for treatment and reuse or discharge;
- management of mine water that enters the underground workings for treatment and reuse, or discharge; and
- management of water from the process facility and tailings reclaim water for treatment and reuse or discharge.

The Project site is being designed to withstand a 24-hour 1:100-year storm event. However, it is recognized that a PMP event may also occur and as such, facilities to direct excess water to the TMF for temporary storage and eventual treatment will allow the Project to handle such an event.

Mine water and other site influenced water will be retained in dual contained storage facilities (ponds or pads) prior to conveyance to water treatment facilities for treatment and reuse or discharge. Water from processing facilities may be directed to water treatment facilities for treatment, or to the TMF for management along with tailings reclaim water. The TMF will retain a minimum 3 m water cover over deposited tailings. When water is in excess of this requirement, it will be transferred to water treatment facilities for treatment and reuse, or discharge to the environment.

Discharge of water to the environment will be conducted through a batch treatment and release process. Water exiting the treatment plant that is designated for discharge will be stored in a monitoring pond, sampled, and analyzed to ensure discharge criteria are met. If the criteria are not met, the water can be returned for further treatment. Once the criteria are met, water will be discharged through the effluent pipeline and diffuser into Patterson Lake. Water will be again sampled as it is discharged, and confirmatory laboratory analysis completed to verify discharged water quality. The Project plans to discharge up to 7,600 m^3 per day (at a maximum rate of 510 m^3 per hour for 15 hours a day) during the operating period. A simplified site water balance is presented in Figure 2-16.

2.4.2.7 Waste Management

The Project is expected to produce waste that can be separated into five main categories:

- non-hazardous (domestic and industrial) waste;
- hazardous waste;
- low-level radioactive waste;
- tailings; and
- waste rock.

The Project will implement procedures and processes to limit the amount of waste at the Project that requires ongoing management. These include processes for waste reduction at the source (source reduction) as well as recycling, reusing, and recovering waste where possible. Despite these efforts, the Project will require processes and activities to either temporarily or permanently manage waste from each of the categories, as discussed below. Waste management facilities are also discussed in Section 2.3.1.15.

Non-Hazardous Waste Management

Non-hazardous waste will include both domestic and industrial wastes. Domestic waste is waste typically generated from site offices and accommodations including areas such as coffee rooms and kitchens. This will consist of recyclable and non-recyclable materials including food waste, plastic, glass, paper, carboard, metal food containers, and electronics. These items will be collected and segregated in designated, centrally located collection areas near Project facilities before being transported for further handling in the waste management area. Potential generation quantities are noted in the Table 2-3. Domestic waste will be preferentially recycled. Waste that is not suitable for recycling will be transported off site to a regional landfill or the on-site industrial landfill if required.

Industrial waste is waste typically generated in the mine, mill, warehouse, and other site areas that is removed from potential radioactivity. These may include plastic, plastic film, paper, cardboard, metals, clean wood, painted or treated wood, tires or other materials. Potential generation quantities are noted in Table 2-4. Industrial waste suitable for recycling and off-site transport will be preferentially recycled. Waste that is not suitable for recycling may disposed of in an on-site landfill or hauled off site to an approved facility.

Hazardous Waste Management

Hazardous waste generated at the site will be collected, segregated, and temporarily stored in a facility purpose built for this activity. The facility will provide secondary containment sufficient to mitigate risk from the quantity of waste stored at the facility. The facility will include provisions to prevent precipitation from interacting with the waste, or a collection system to manage any such precipitation and collect it for further management. Hazardous wastes and potential quantities to be generated at the facility are noted in Table 2-5.

Hydrocarbon impacted soil and snow will be diverted to the waste management area to determine suitable disposal options. Arrangements for off-site transport and disposal of these materials will be made periodically with an external contractor specializing in the handling and disposal of these waste types.

Low-Level Radioactive Waste

Waste generated in the mill, mine, shipping/receiving area, and other site areas that may have come into contact with radioactive material. LLRW includes waste with radionuclide content above established unconditional clearance levels and exemption quantities but typically have limited amounts of long-lived radionuclides. This waste type includes radiologically contaminated materials from mining and processing activities but does not include ore, waste rock, or tailings. Types of materials and potential generation quantities are identified in Table 2-6. Disposal locations for this material will include disposal in the underground mine or disposal in the TMF.

2.4.3 Traffic and Personnel Transport

An estimate of the traffic that will be generated by the Project was completed. This estimate includes traffic required to provide the necessary goods, services, and personnel to and from the Project needed to facilitate Project activities. This estimate determined that the Project will add on average approximately 22 vehicle trips per day to the road network used to access the site.

Based on this estimate, a Traffic Impact Assessment (TIA; see Appendix A.6) was completed in accordance with guidelines provided by the Saskatchewan Ministry of Highways. This assessment concluded that no changes to the assessed road network were required based on the additional traffic generated by the Project.

The Project is being planned as a primarily fly-in/fly-out (FIFO) operation. However, the Project is not constructing a dedicated airport for this purpose and instead intends to utilize other existing or currently planned facilities in the region to meet its air transport needs.

2.4.4 Decommissioning and Post-decommissioning

Decommissioning and reclamation objectives for the Project include:

- Returning the site to a safe, environmentally sound condition as near as possible to pre-development conditions.
- Allowing land use availability to return as near as possible to pre-development conditions.
- Executing decommissioning and reclamation activities in a manner that allows for eventual release from all regulatory requirements including CNSC licensing requirements.
- Return of the Project site to the Province of Saskatchewan via the province's ICP.

Achieving these objectives requires project planning and execution in several phases including pre-development design, operations, active decommissioning, and post-decommissioning monitoring. Active decommissioning for the Project is expected to take 8 years. Post-decommissioning monitoring is currently planned for 3 years; however, it is acknowledged that this timeline is preliminary. It was chosen for assessment purposes with an understanding that it could change due to the complexity of factors that could influence the timeline to meet the objectives stated above. The detailed decommissioning plan will further refine the objectives and timelines of post-decommissioning.

2.4.4.1 Design and Operations

Design and placement of Project facilities to minimize disturbance and aid decommissioning and reclamation activities is an integral part of project development. At the Project, minimizing site disturbance, placing facilities to minimize cut and fill requirements, and retention of organics and soil disturbed by construction activities for future use have been considered in project design and are considered on an on-going basis. Soil salvage and stockpiling will follow industry best practices, ensuring there are no bulk soil losses due to erosion and no nutrient losses due to admixing.

Progressive decommissioning and reclamation is a technique where site areas and infrastructure that are no longer required are decommissioned and reclaimed while site

operations activities are ongoing. These activities serve to lower the Project's future decommissioning liabilities and lessen the overall decommissioning timeline.

Progressive decommissioning at the Project will focus on waste management and reclamation of unused areas developed for site use. Significantly, the Project design includes consumption of the entirety of the waste rock planned to be generated by the Project in the mine backfill process, resulting in no waste rock remaining on surface at the end of the operations phase. The development waste rock produced over the life of mine will be completely consumed by the end of year 8, and the remaining stopes will be filled utilizing CAF, which will utilize aggregate materials that are sourced from a nearby location north of the TMF. The aggregate source will provide adequate supply to meet the backfill needs of the operation in the later years of the mine life, when all remaining development waste has been consumed in backfill. In essence, the CAF replaces the development waste rock with aggregate produced within a closed circuit crushing and screening plant located on surface. Dust generation from the crushing and screening plant was assessed in the air dispersion modeling in both the construction and operations phases of the Project. The backfill balance calculations included a swell factor of 35% for broken rock to account for volumetric displacement. This reclamation of waste rock also minimizes the requirements for waste rock storage and management throughout the Project's lifecycle.

Other waste management activities will include active management of unused equipment, infrastructure, or other materials to ensure they reach their final disposition point in an expedient manner to minimize the storage and handling of these materials. This will reduce the Project footprint and simplify future decommissioning efforts.

In addition to waste management, reclamation of developed areas of the site no longer required for the Project will be completed when those areas become available. Project design has been carried out with the intention of disturbing the least land area possible, and as such opportunities for reclamation of this type may be limited until final decommissioning.

2.4.4.2 Decommissioning Planning and Financial Guarantee

As part of the regulatory process, Fission will be required to develop a Preliminary Decommissioning Plan (PDP) and a Preliminary Decommissioning Plan Cost Estimate (PDCE). These documents are developed using a "decommission tomorrow" strategy and serve to provide a plan and cost estimate to decommission current site facilities and

disturbed areas in the event Fission is unable to complete decommissioning and reclamation activities and responsibility for the site returns to the province. The PDCE estimates the cost of these activities and a financial guarantee, usually in the form of surety bonds or irrevocable letters of credit, is provided to the province by Fission to cover the costs of these activities.

The plan and cost estimate are reviewed on a five-year cycle to ensure continued suitability and are generally revised to account for new construction/operations activities and any decommissioning or reclamation that may have taken place.

At the end of the operations phase of the Project, and a decision to decommission is made by Fission, a Detailed Decommissioning Plan (DDP) and Decommissioning Cost Estimate (DCE) will be developed. After approval of the DDP and DCE by CNSC and ENV, decommissioning will proceed to the active decommissioning phase following the approved plan.

2.4.4.3 Active Decommissioning

Active decommissioning will include site characterization for any potential radiological or chemical hazards, removal of site infrastructure in a systematic, strategic manner, and reclamation of the Project area including re-vegetation with suitable native species to encourage re-growth and a return to pre-disturbance conditions. Preliminary plans are described below and will continue to be refined during detailed engineering design and throughout the operational period.

Equipment, Machinery, Materials

Equipment, machinery, and materials will be drained of any hazardous fluids and characterized for potential radiological contamination. Items that meet the radiological criteria to be removed from site may be salvaged, sold, disposed of in on-site waste management facilities, or removed off-site for recycling or other means of disposal. Materials, that do not meet radiological release criteria may be cleaned until they meet release criteria and managed accordingly or may be disposed of at an approved off-site facility, onsite in the underground workings, TMF, or other suitable location based on material type and characterization.

Mine Access and Openings

When access to the underground workings is no longer required, the FAS, EAS and mine portal will be sealed with engineered closures. Mining zones are planned to be hydrostatically sealed at the completion of mining each zone. Any remaining unsealed workings will be sealed from Patterson Lake during active decommissioning and allowed to fill with water.

Mine production headings are planned to be backfilled with cemented rock fill and cemented hydraulic fill (both of which are engineered backfills) directly following mining activities.

Surface Buildings and Facilities

Surface buildings and facilities will be characterized for radiological contamination and assessed for potential salvage value or disposal options. Buildings and facilities will be dismantled and demolished. Radiologically contaminated materials will be placed in the TMF or underground workings. Items that meet the radiological criteria to be removed from site may be salvaged, sold, disposed of in on-site waste management facilities, or removed off-site for recycling or other means of disposal.

Concrete foundations will be removed where possible. Where not possible, portions of the foundations above grade will be removed. Hazardous materials will be collected, characterized, and disposed of in approved facilities, typically off-site.

Ponds, Pads, and Stockpiles

When no longer required, water management ponds will be drained, containment liners removed for disposal, and the pond blended into the surrounding landscape. The liners will be radiologically characterized and disposed of in an appropriate on-site or off-site location. Similarly, when the ore storage pad is no longer required, the pad's containment liners and cover material will be radiologically characterized and disposed of in an appropriate location on-site. Contouring of the pad area (if needed) will be completed in conjunction with contouring of the larger process plant area.

Tailings Management Facility

The TMF will require time after the cessation of operations to allow for the consolidation of tailings. This will be accomplished by removing the water cover and progressively adding local fill material over the tailings material to provide drainage and maintain filter

compatibility with the tailings. This addition of fill will squeeze tailings pore water from the tailings with this pore water reporting to the TMF underdrain where it will be conveyed to the water treatment plant for treatment prior to release to the environment. Once the tailings have reached their target density, the underdrain will be disconnected and sealed. This is projected to occur over an 8-year period. At this stage, the water treatment plant may also be decommissioned.

Following the completion of tailings consolidation, a final engineered cap and cover for the facility will be installed. The cover will be designed as a zoned cover with a barrier system to reduce infiltration of water and exposure to oxygen. A drainage layer will be placed above the cover with the entire system overlain with material to support vegetation. The zoned cover is planned to be constructed of local, natural materials excepting requirements for fine grained silt or clay which will likely require off-site sourcing. Given the geomorphology of the area, fines manufactured through the mill or imported bentonite may be needed to modify the sand for an acceptable cover material. It is expected that any locally sourced silt alone will be used to reduce the quantity of bentonite required for the cover. Geosynthetic liner options may also be considered. The entire cap and cover design is intended to support drainage and reclamation and be contoured to blend in with the local topography.

Following the removal of all infrastructure, remediation of all areas to meet clean up criteria, closure of the TMF, and revegetation of the Project site, the site will transition to post-decommissioning monitoring. Please see Figure 2-17 to Figure 2-19 for conceptual renderings of the Project area post-reclamation.

Landfill

At the end of the landfill's life, decommissioning and reclamation of the facility will commence. This process will follow regulatory requirements and guidance from the province of Saskatchewan including obtaining necessary permits and use industry best practices to ensure effective facility closure. In general, the process will include complete clean up of the landfill area including removal of any remaining refuse, removal of any surface infrastructure, and the installation of a temporary cover to limit wildlife interactions and wind effects on the facility. An engineered final cover system following best management practices will then be installed limit surface water infiltration and promote vegetative growth.

Environmental monitoring and inspections of the facility to verify performance will take place along with other post-decommissioning monitoring activities for the Project. A complete decommission and reclamation plan for the facility will be provided during the permitting process for the facility.

2.4.4.4 Reclamation

Following decommissioning of physical structures and facilities, areas disturbed by the Project will be contoured to blend into the surrounding topography and replicate as near as possible surface conditions pre-development. Surface materials and overburden displaced during construction activities will then be replaced to serve as a substrate for revegetation. If the local soils do not satisfy the requirements to facilitate plant growth, an amendment will be used. A local source of amendment will be the organic soils that were stripped and stockpiled during the construction stages of the Project, which could be used as soil conditioner.

Revegetation using native species of trees and grasses will take place across the entirety of the disturbed Project area, returning it to as near as possible pre-disturbance conditions. Following decommissioning, the TMF will be reclaimed and revegetated. In the case of the TMF, the remaining structure will remain as a new landform, though this new landform will be blended to match the surrounding topography.

2.4.4.5 Post-Decommissioning Monitoring

Post-decommissioning monitoring will focus on monitoring the Project site to ensure the objectives of the DDP were met. This stage will include environmental inspection and monitoring to verify that environmental targets are achieved, and that site re-growth is progressing as expected. Once decommissioning objectives have been met and are stable, the Project may apply to the CNSC to be released from their licensing liabilities as well as apply to the province to transfer the site to the ICP.

2.4.5 Employment and Contracting

The Project will provide employment and contracting opportunities throughout the entirety of its life cycle. Approximately 300 people will be required to support construction activities during the 3-year construction period. This workforce need will be supplied primarily through contracting opportunities. During the operating phase of its life cycle, the Project requires approximately 320 full time employees. Most employees will work a

12-hour day, with two weeks on-site and two weeks away from site being the typical work rotation. Approximately 75% of these roles will be directly employed by the Project, with the remaining 25% of roles being contracting opportunities. Please see Figure 2-20 for a breakdown of the required roles by education type. Employees and contractors from local communities and Indigenous Nations will be targeted for employment and contract opportunities.

2.5 Inputs and Outputs

2.5.1 Products

The Project will produce uranium ore concentrate (yellowcake). The current mine production plan is provided in Table 2-7.

2.5.2 Resource Use

Resources required for the Project and their uses are outlined in Table 2-8.

2.5.3 By-Products, Reagents, and Emissions

By-products in the form of waste materials are generated during all phases of the Project. For a discussion of waste, please see Section 2.4.2.7. Reagent usage is required for the processing of ore into concentrate and water treatment activities. Reagents and approximate usage rates are provided in Table 2-9. In addition to these reagents, cement binder material is required to be added to the Project's waste rock material to produce mine backfill at the end of the mining cycle.

A greenhouse gas (GHG) assessment was conducted for the Project (see Appendix A.7). Emissions for the Project lifespan were estimated at 1,688,253 tonnes of CO_2 equivalent. Static natural gas combustion, mobile diesel combustion and impacts related to land use changes were determined to be the predominant contributors to the GHG emission profile of the Project. Emissions intensity for the Project lifespan is estimated to be 0.48 tonne of CO_{2e} per tonne of ore produced. This is comparable to similar mining operations in northern Saskatchewan. Advancing technological options to reduce emissions including the potential for usage of battery-operated vehicles for mine operations will be evaluated and implemented where appropriate.

2.6 Alternative Means of Carrying out the Project

Project development has been underway in various forms since the discovery of the deposit in 2013. A preliminary economic assessment of the Project was undertaken following the spring 2015 drilling program with two Pre-Feasibility Studies (PFS) being completed in 2019 as well as a FS completed in 2023.

This on-going work resulted in various iterations of Project design, siting, execution strategies or other items required to see the Project through from design and construction to operations and closure. Key decisions or trade-offs are identified below.

2.6.1 Hybrid Open Pit and Underground Mine

The original development plan for the Project included a hybrid mine design. A portion of the resource would be mined using open pit techniques, with the remainder being mined from underground. This development plan would have required a cut-off wall be placed in Patterson Lake and removal of water from part of the lake to facilitate the open pit portion of the mine. Due to the technical challenges associated with this work as well as in response to concerns from stakeholders and Indigenous Nations and communities regarding impacts to Patterson Lake, this option was removed and an underground only mine plan selected in 2019.

2.6.2 Highway 955 Relocation

Pre-feasibility level project designs included the relocation of Saskatchewan Provincial Highway 955 to the west, around the location of the Project's TMF. This option was removed in favour of the current design which leaves the highway in place, bisecting the Project. Relocation of the highway was identified as not favourable by Project stakeholders and Indigenous Nations and communities; thus, Fission responded by re-designing the Project to leave the highway unaltered.

2.6.3 TMF Siting

A TMF location adjacent to Patterson Lake was initially proposed in the preliminary economic assessment. That location was subsequently rejected due to proximity to Patterson Lake and a siting study was undertaken during the development of the PFS to identify suitable alternative locations.

The PFS siting study proposed two alternative TMF locations (primary and secondary) that were screened during a 2019 field investigation (Clifton Associates Ltd. 2019). A preferred location was selected approximately 5 km southwest, with a secondary location approximately 4.3 km directly west of the mine. The study identified that the preferred location was more favourable, though the use of the secondary location was not precluded.

The primary location was selected as it allowed the TMF to be fully sited in the Patterson Lake watershed, while the secondary location could have potential drainage into Alberta. The layout of the TMF was subsequently confirmed in the preferred location to make the best use of local topography, reduce earthwork quantities, and provide better integration with the topography at closure.

2.6.4 Treated Effluent Discharge Location

Over the course of Project development, various options for treated effluent discharge were considered. These included discharge to a creek near the Project site as well as several locations in Patterson Lake's South Arm. In 2023, during the EIA, Fission commissioned TetraTech to complete an effluent discharge pipeline and diffuser design report to identify the optimal path for the discharge pipeline as well as the optimal location for the diffuser within Patterson Lake.

Based on this work, a diffuser location in Patterson Lake was chosen as it provided optimal water depth and effluent mixing (see Appendix A.5).

2.6.5 Facility Siting Optimization

In addition to the specific alternatives discussed above, numerous changes were made to the planned facilities and their siting between the completion of the PFS in 2019 and the completion of the FS in 2023. These changes include:

- Relocating the process plant, WRMA, and other facilities to the south to improve constructability and lessen land disturbance.
- Relocation of the boxcut, decline and portal, and moving mine access to the hangingwall to reduce the possibility of the ramp intersecting mineralized material in planned waste development drifts. Intersecting mineralized material would potentially affect the planned underground ventilation design.

- Removal of the construction camp in favour of the utilization of a local commercial camp to lessen land disturbance, waste generation, and improve the Project schedule.
- Removal of the site airstrip in favour of using other local air facilities to lessen land disturbance and mitigate regulatory risk.

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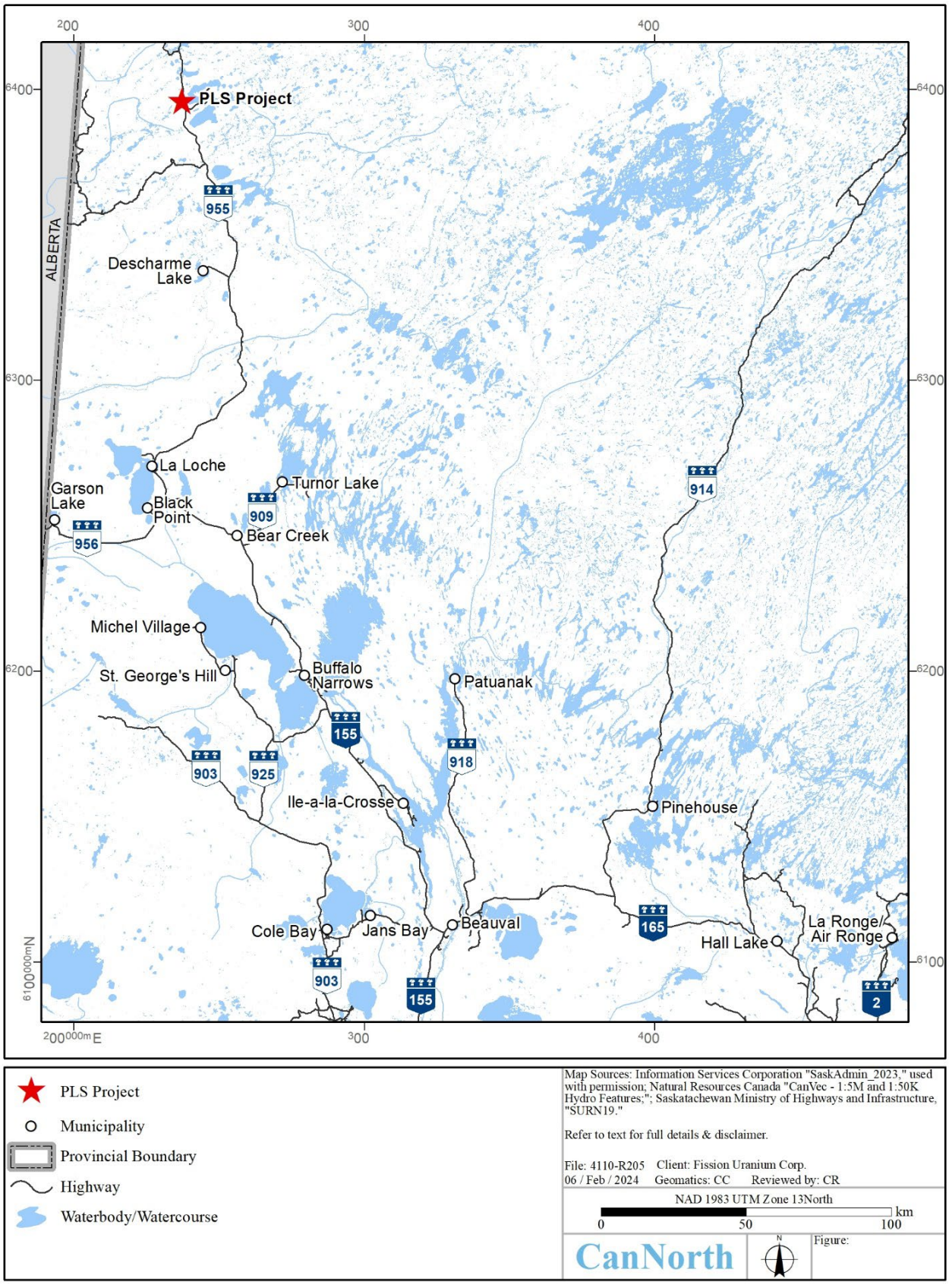


Figure 2-1
Location of the PLS Project within Saskatchewan.

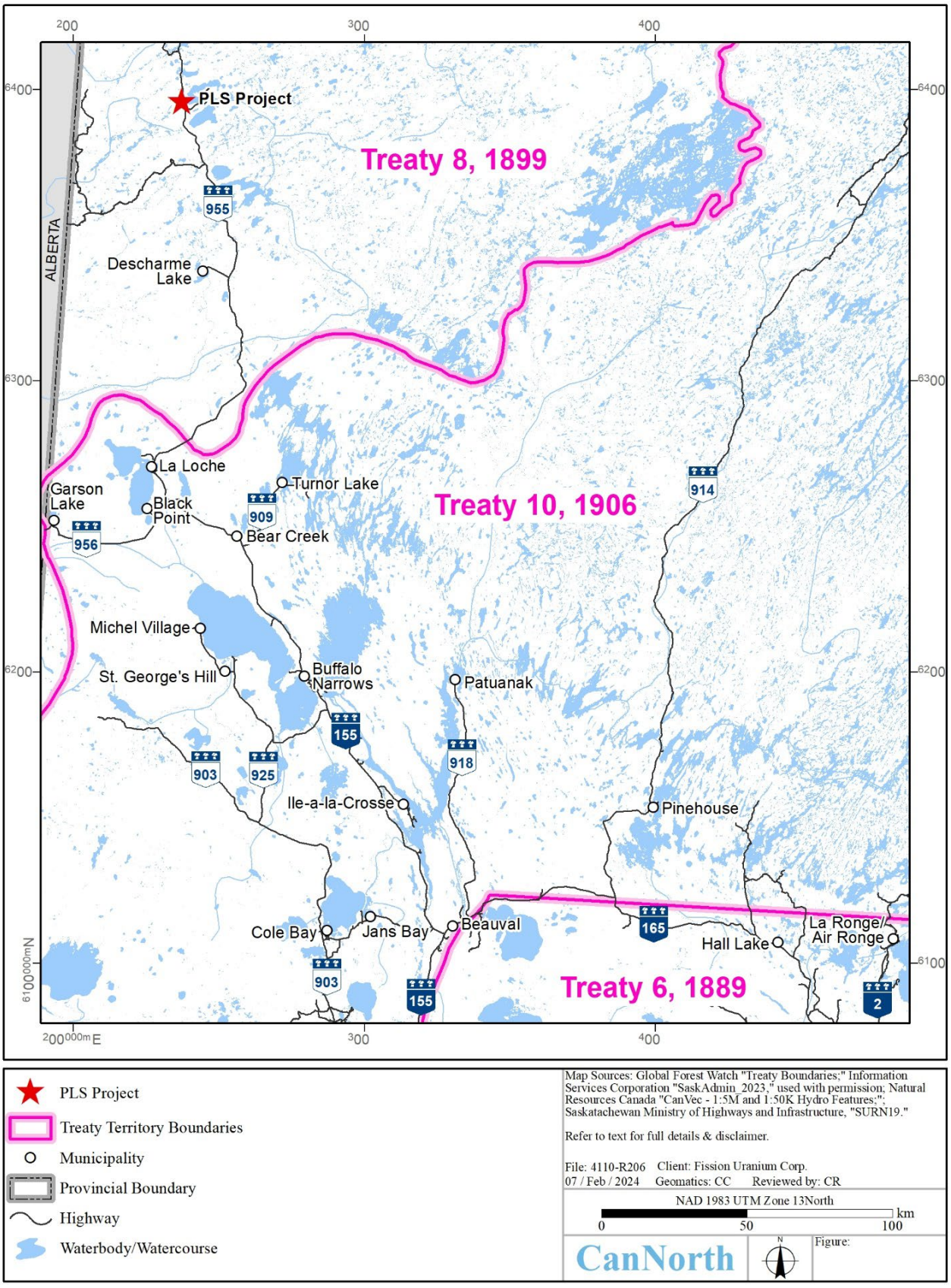


Figure 2-2
PLS Project with respect to Treaty boundaries.

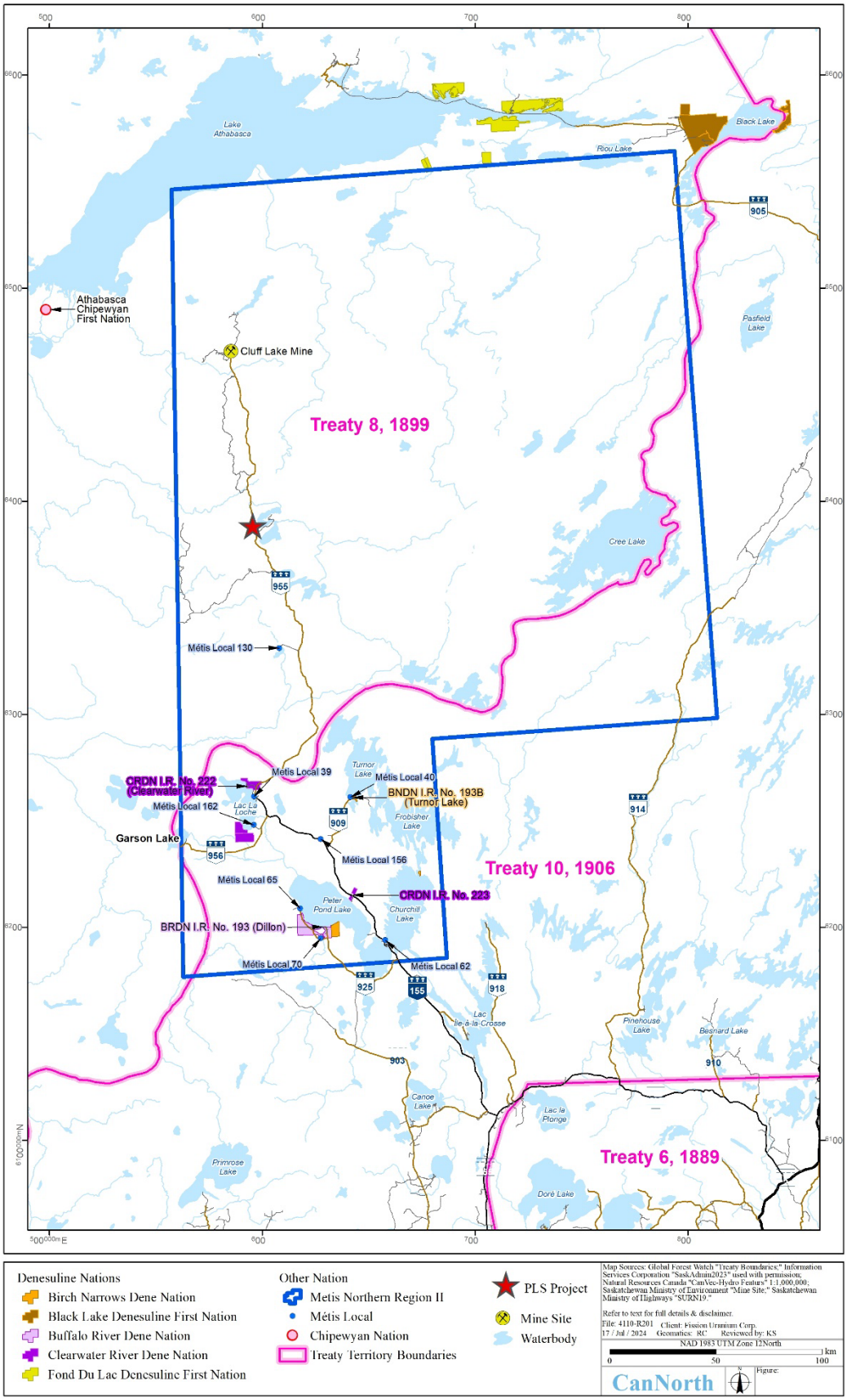


Figure 2-3
Indigenous Nations and communities.

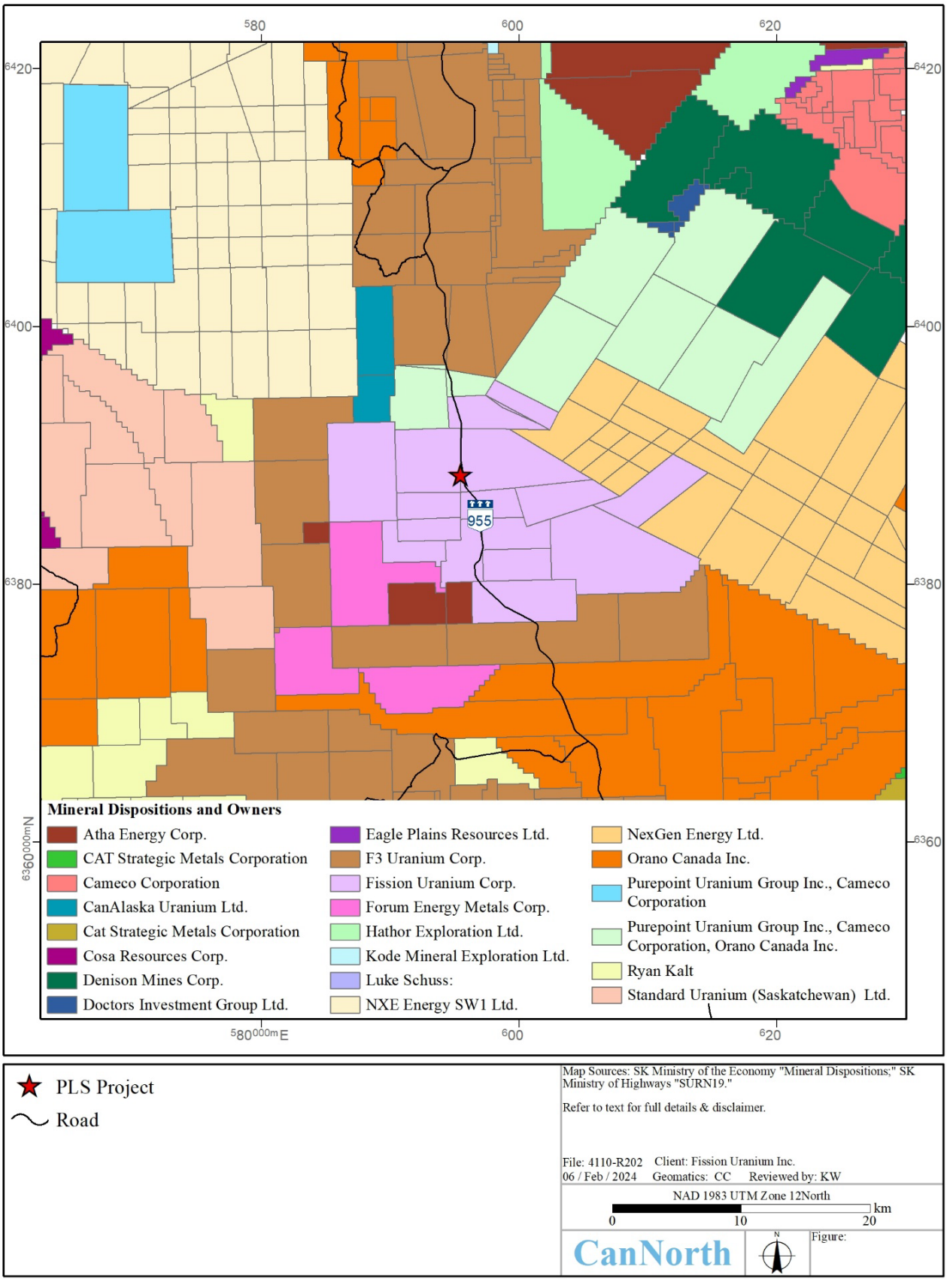


Figure 2-4
Mineral dispositions and owners.

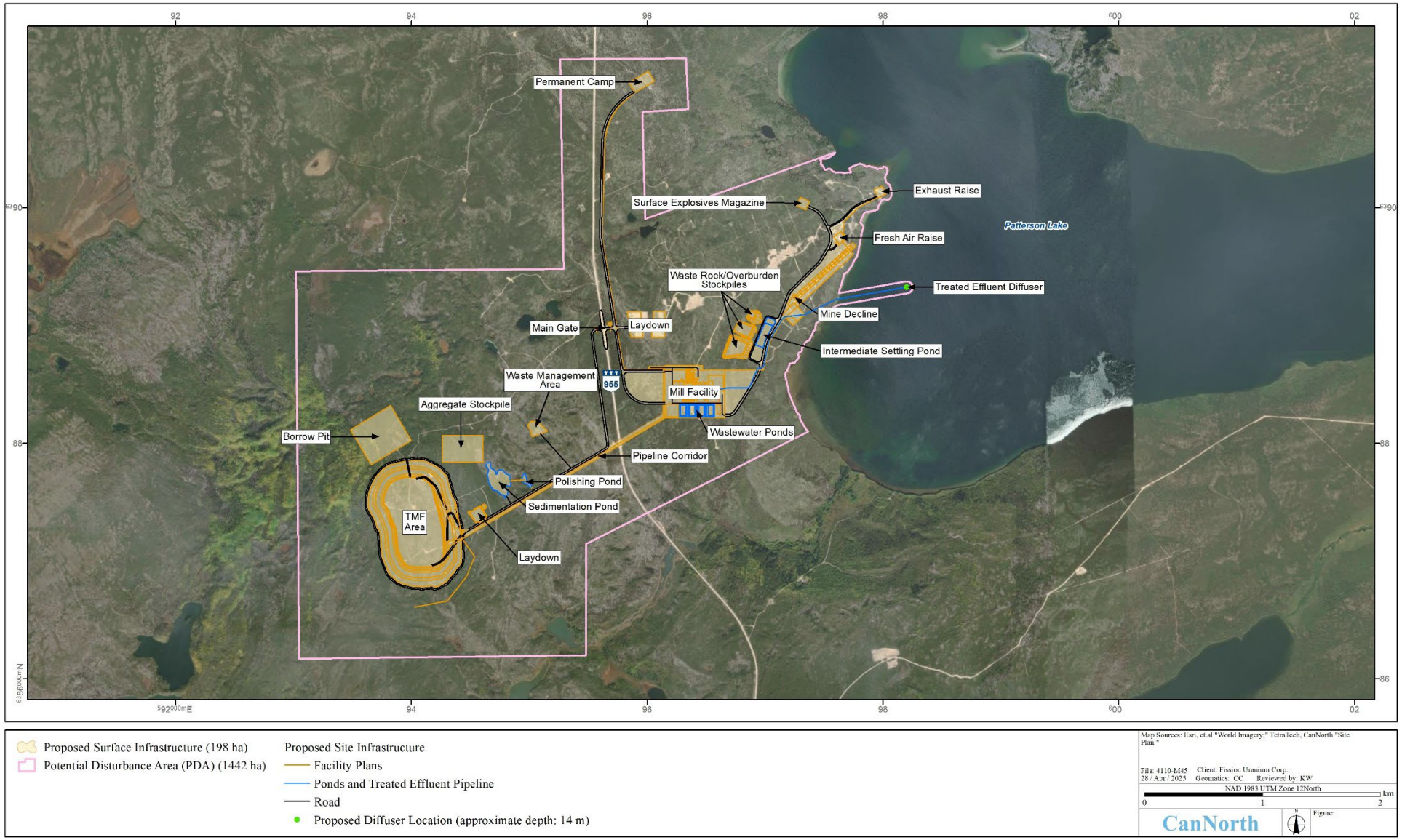


Figure 2-5
PLS Project preliminary site layout and infrastructure.

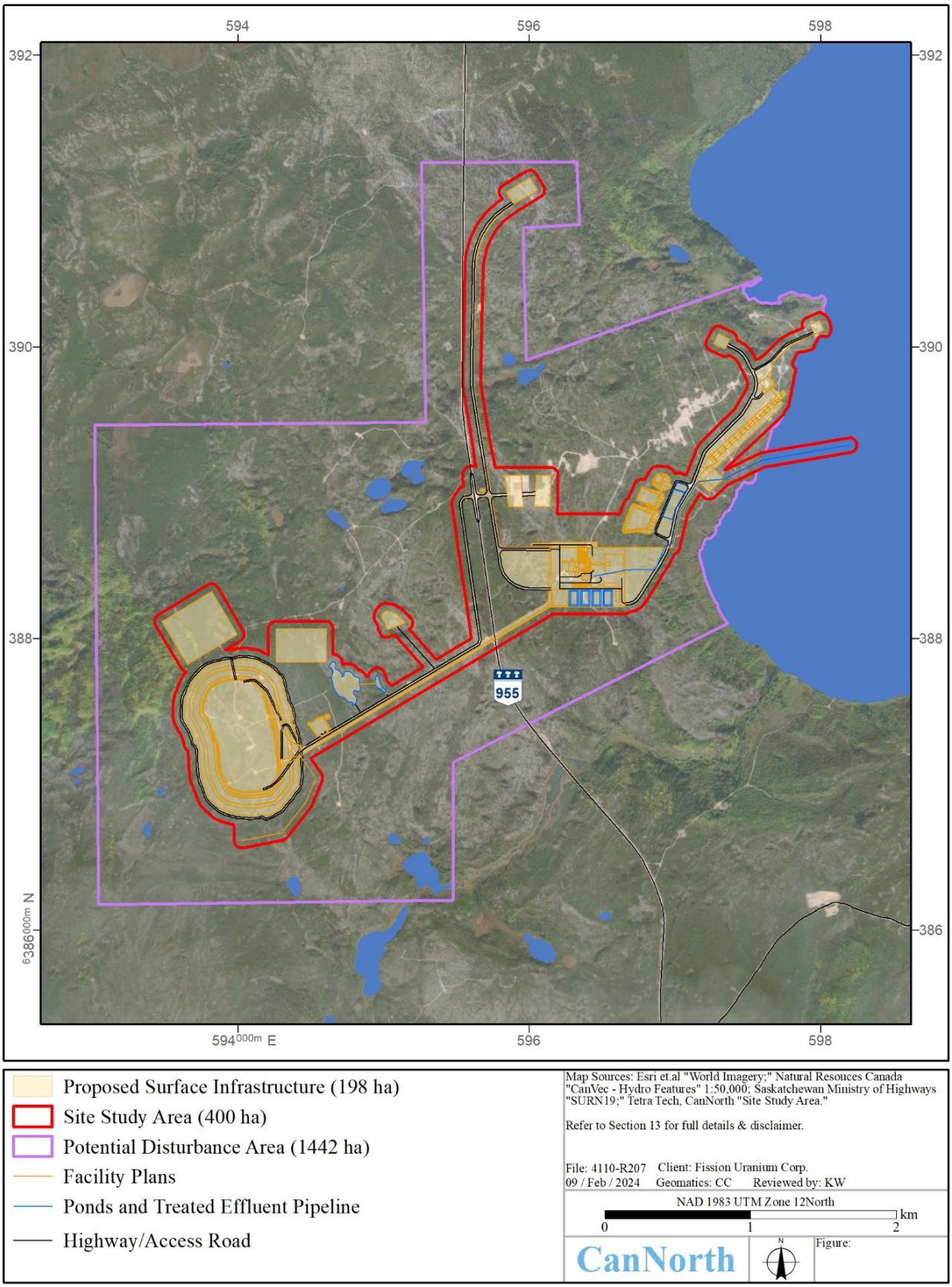
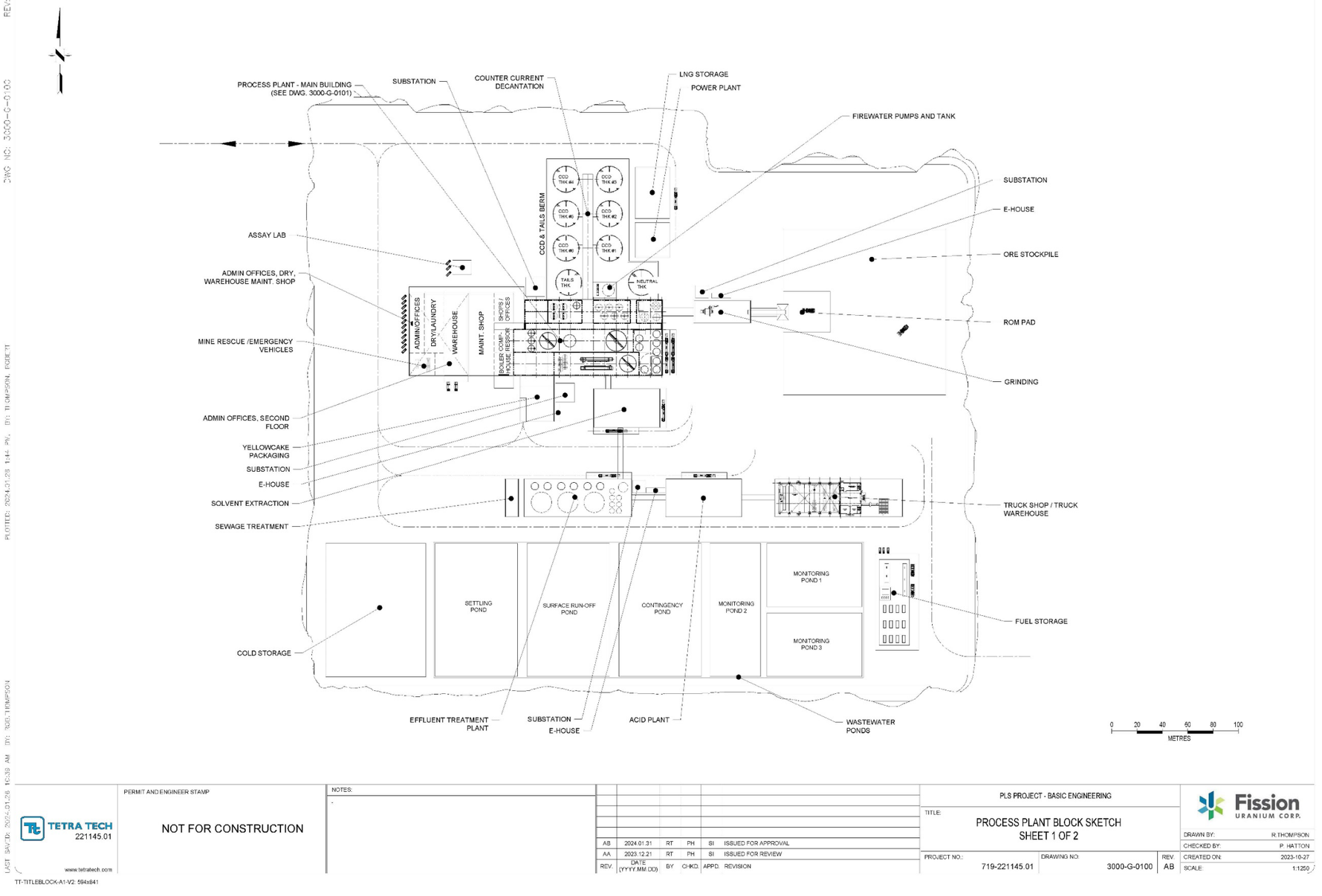


Figure 2-6
PLS Project SSA and PDA.



PLOTTED: 2024.01.29 1:44 PM, BY: TROY THOMPSON, FORMAT

LAST SAVED: 2024.01.26 10:39 AM BY: TROY.THOMPSON

REV: AB

DWG NO: 3000-G-0100

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NOTES:
-

REV.	DATE (YYYY.MM.DD)	BY	CHKD	APPD	REVISION
AB	2024.01.31	RT	PH	SI	ISSUED FOR APPROVAL
AA	2023.12.21	RT	PH	SI	ISSUED FOR REVIEW

PLS PROJECT - BASIC ENGINEERING

TITLE:
PROCESS PLANT BLOCK SKETCH
SHEET 1 OF 2

PROJECT NO.:	DRAWING NO:	REV.
719-221145.01	3000-G-0100	AB

Fission URANIUM CORP.

DRAWN BY:	R.THOMPSON
CHECKED BY:	P. HATTON
CREATED ON:	2023-10-27
SCALE:	1:1250

TT-TITLEBLOCK-A1-V2: 594x841

Figure 2-7
Project mill and administration area.

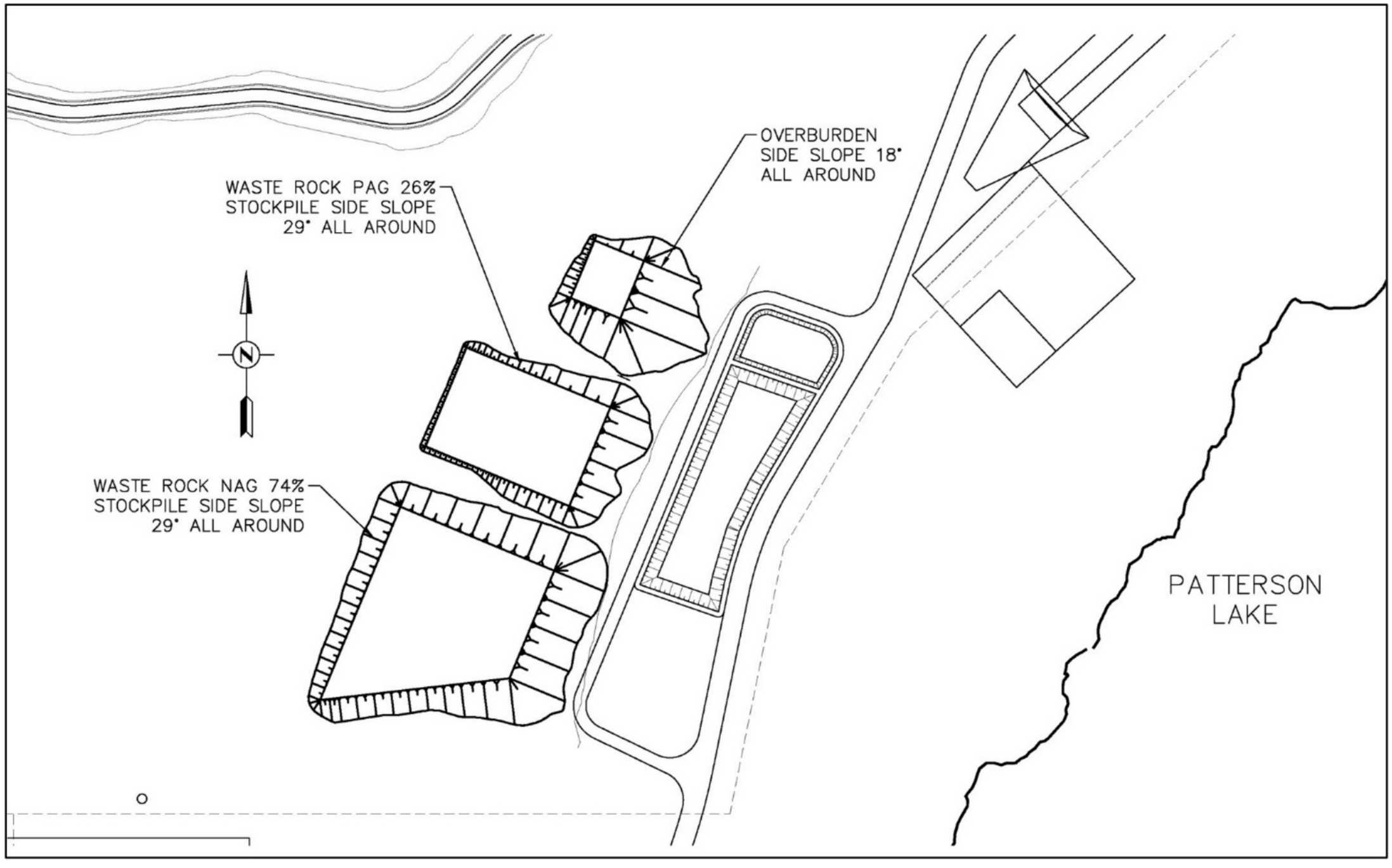


Figure 2-8
Waste rock management area general arrangement**.**

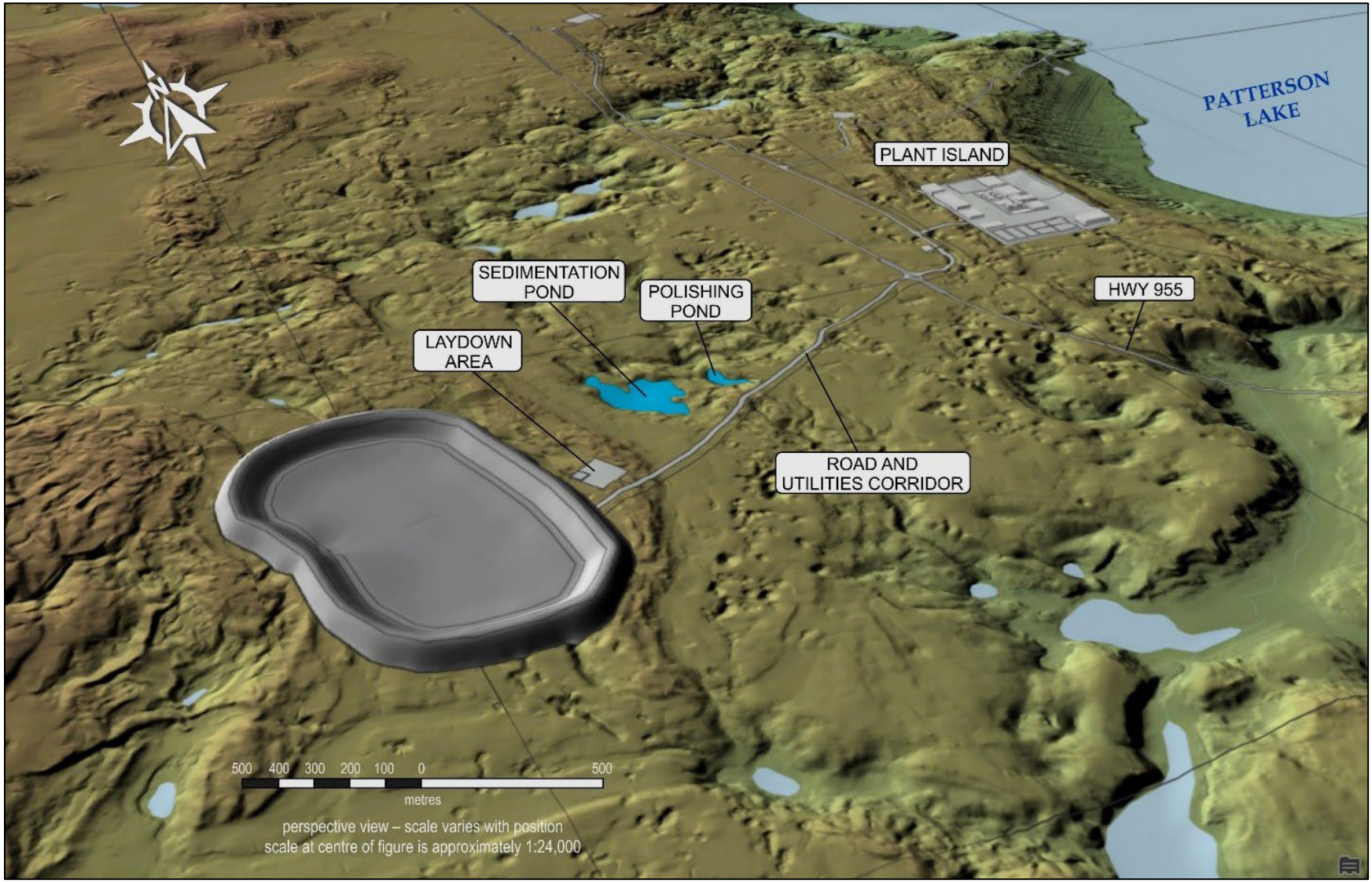


Figure 2-9
Tailings Management Facility general arrangement.

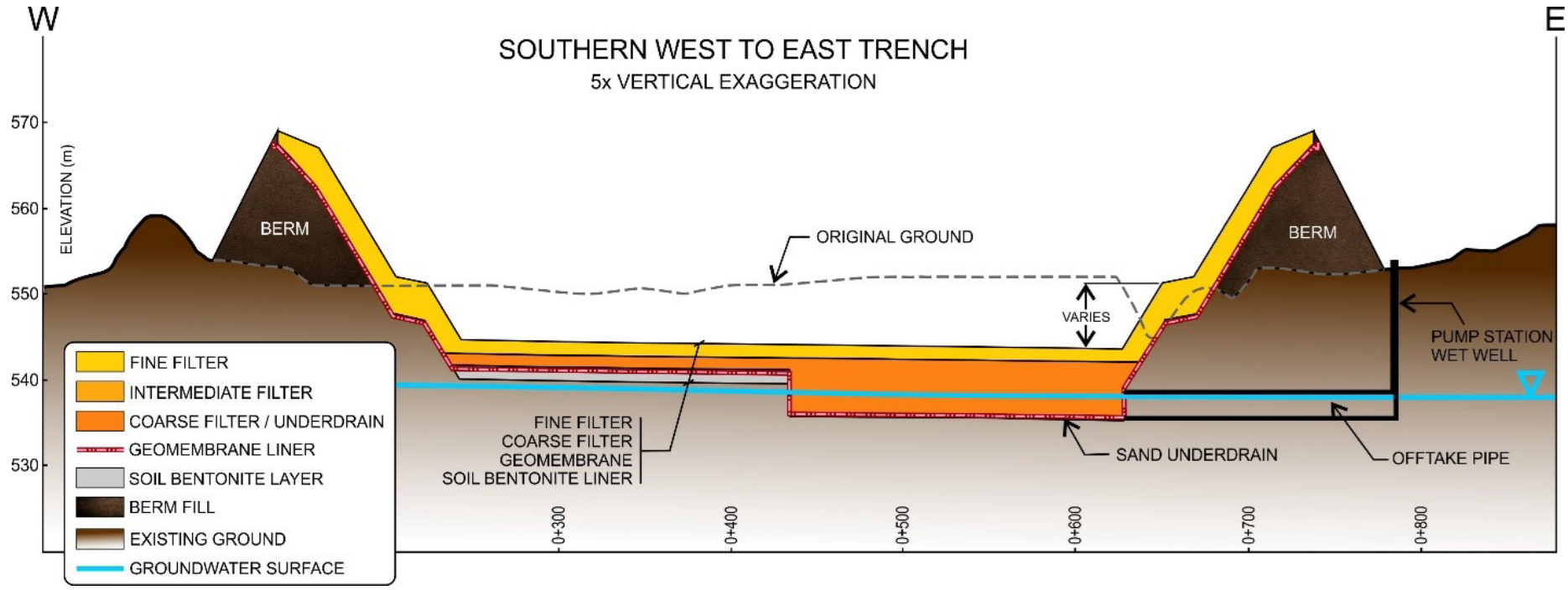


Figure 2-10
Tailings Management Facility east-west cross-section.

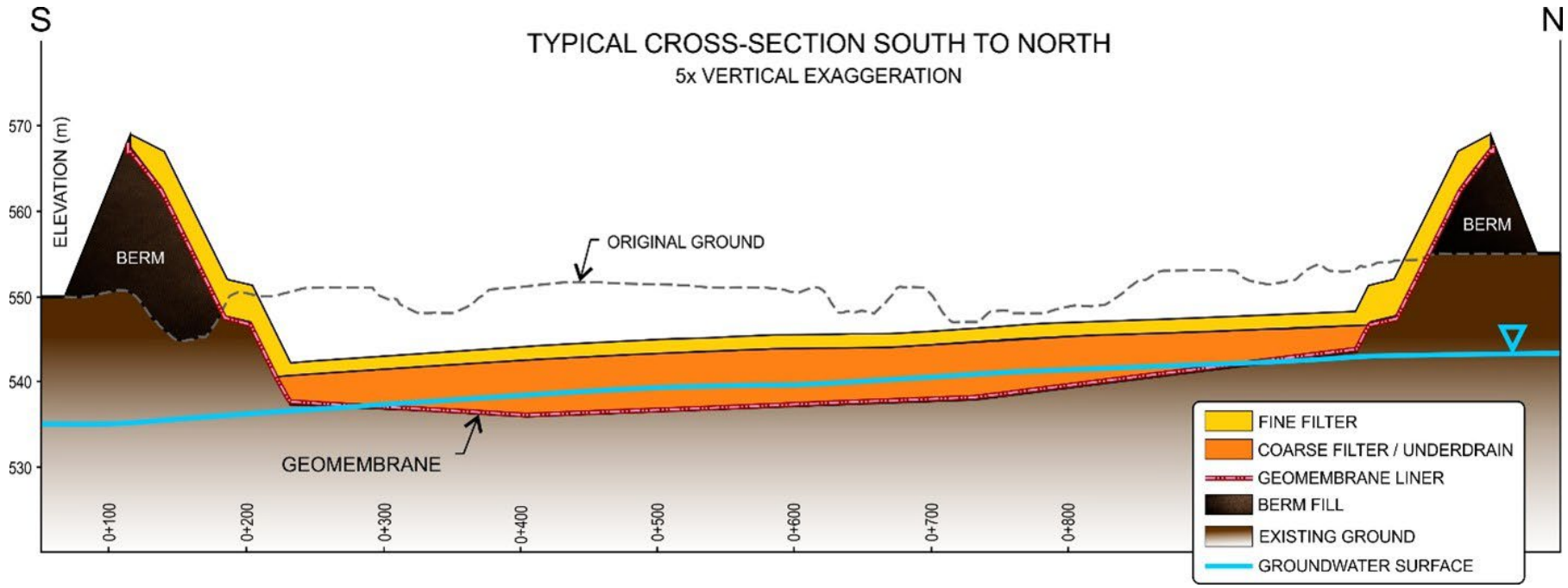


Figure 2-11
Tailings Management Facility north-south cross-section.

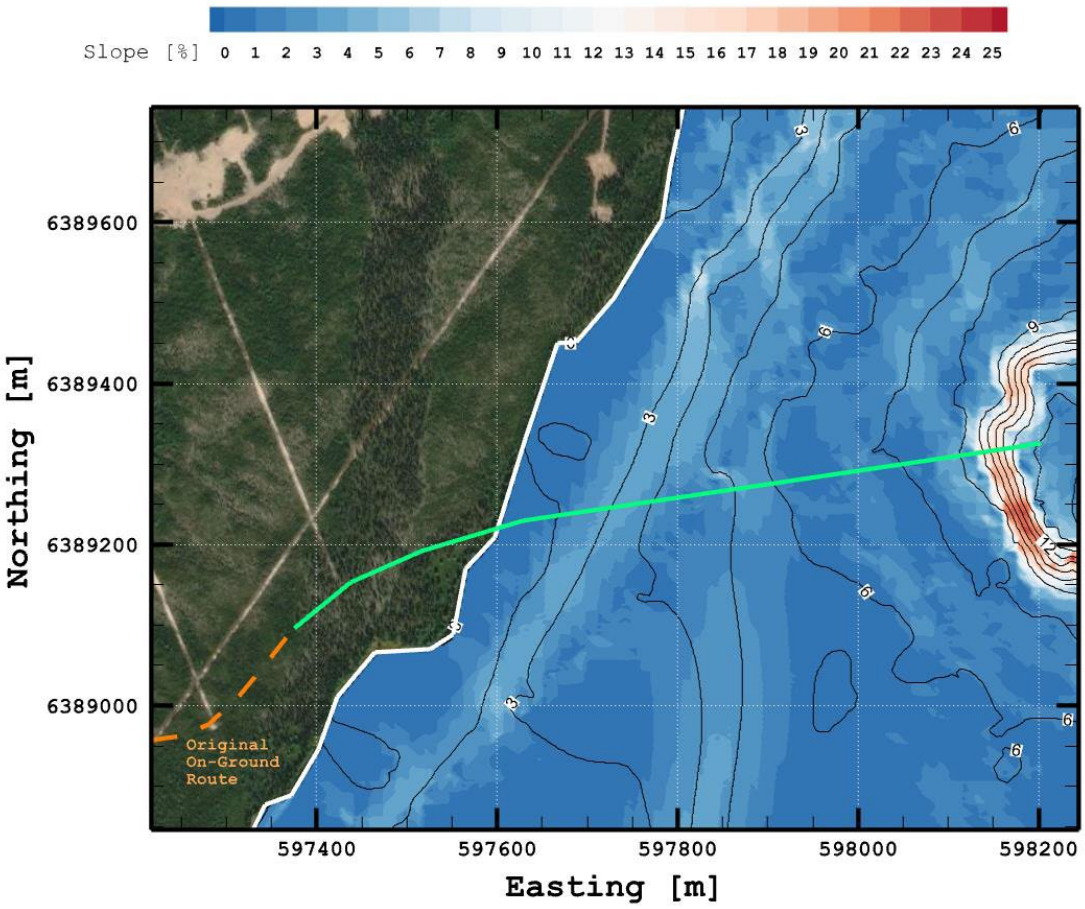
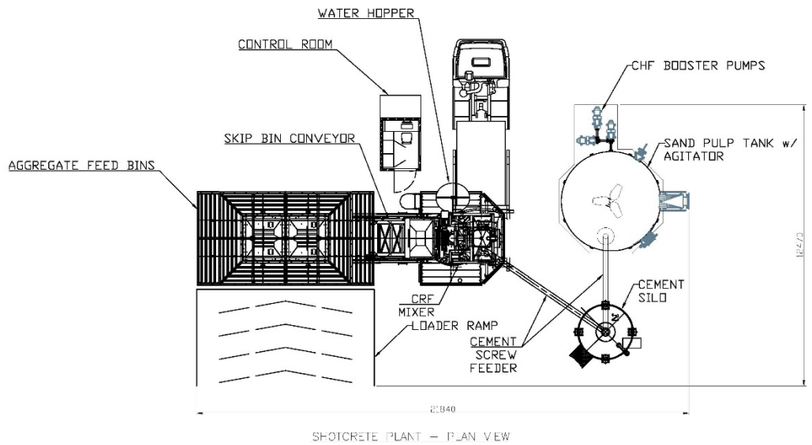
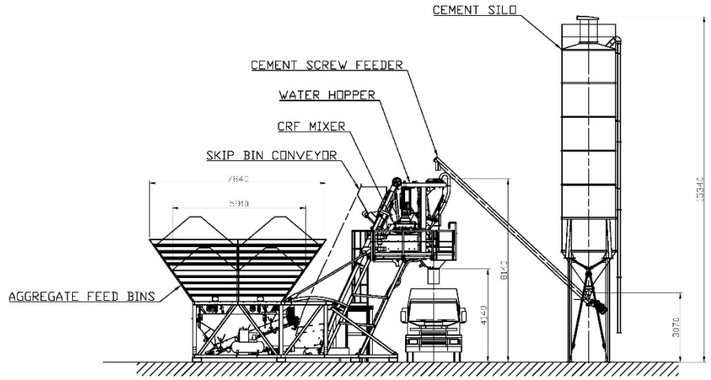


Figure 2-12
Treated effluent diffuser pipe routing.

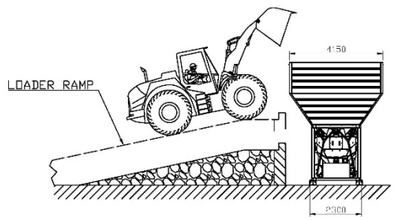


SHOTCRETE PLANT – PLAN VIEW

NOTES:
1. CEMENTED HYDRAULIC FILL PLANT SAND FEEDER NOT SHOWN IN CURRENT LAYOUT
2. WATER TANK AND PUMP NOT SHOWN IN CURRENT LAYOUT
3. SAND PULP TANK AND BOOSTER PUMPS NOT SHOW IN ELEVATION VIEWS
4. WINTER BUILDING NOT SHOWN



CEMENTED ROCKFILL PLANT – ELEVATION VIEW A



CEMENTED ROCKFILL PLANT – ELEVATION VIEW B

Rev	Date	Author	Description
A	2022-10-07	RP	ISSUED FOR REVIEW

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CLIENT DWG. NO.

PROJECT: PATTERSON LAKE SOUTH - FISSION URANIUM

TITLE: CEMENTED ROCK & HYDRAULIC FILL GENERAL ARRANGEMENT

SCALE	DRAWING NUMBER	SHEET	REV	SIZE
NTS	21064-GA-0001	1	A	A1

Figure 2-13
Backfill plant general arrangement.

Figure 2-14
Simplified process flow sheet.

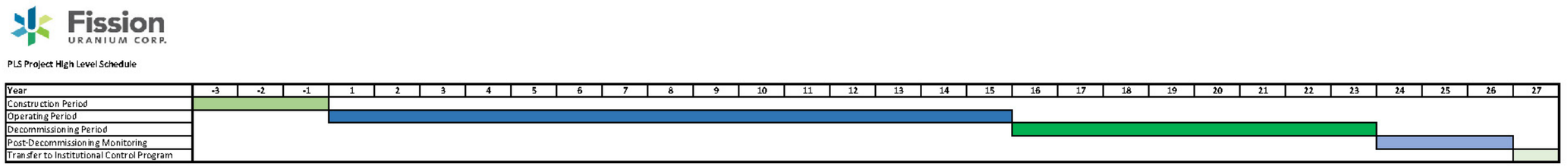

Figure 2-15
High-level Project schedule.

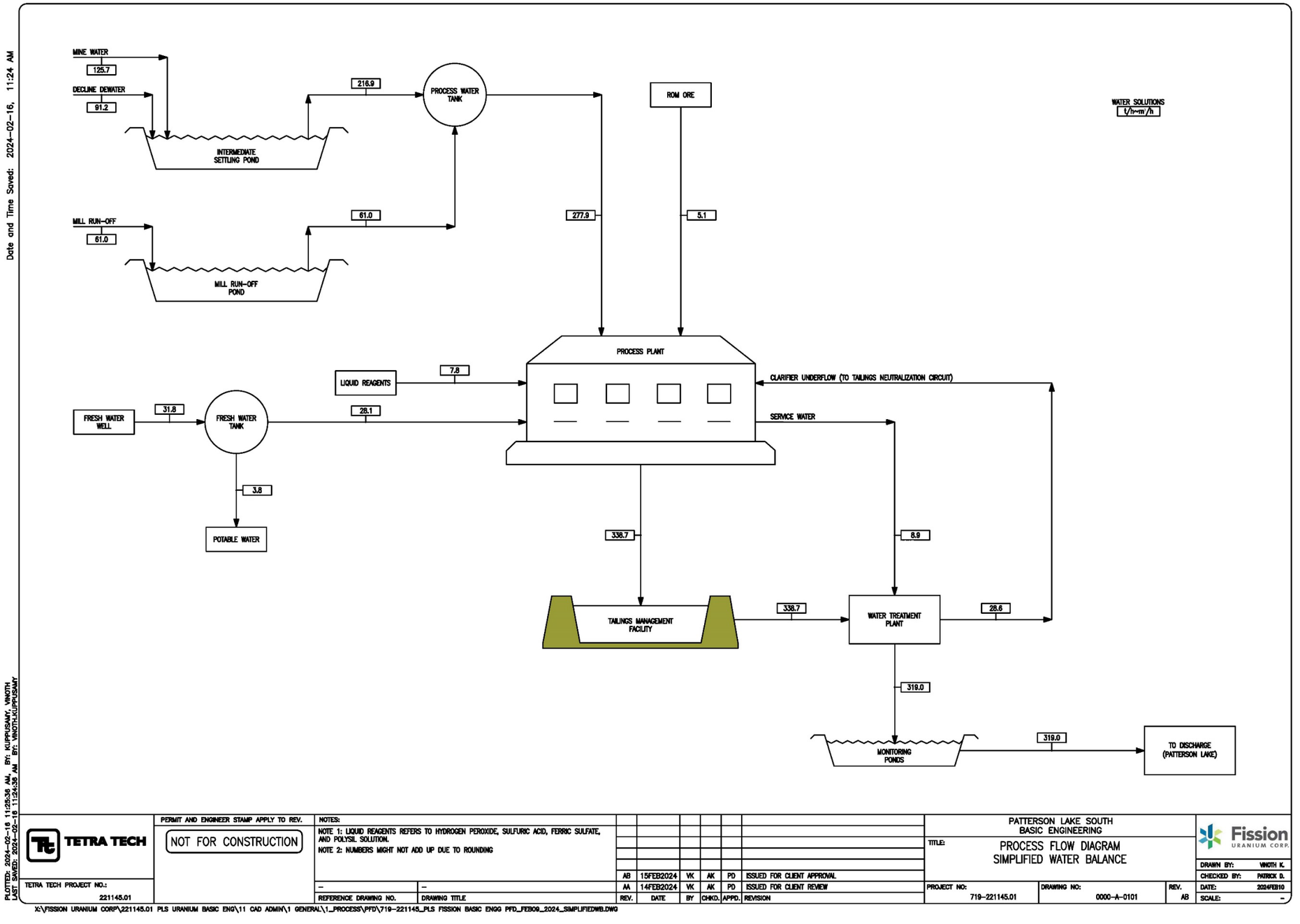

Figure 2-16
Simplified site water balance.

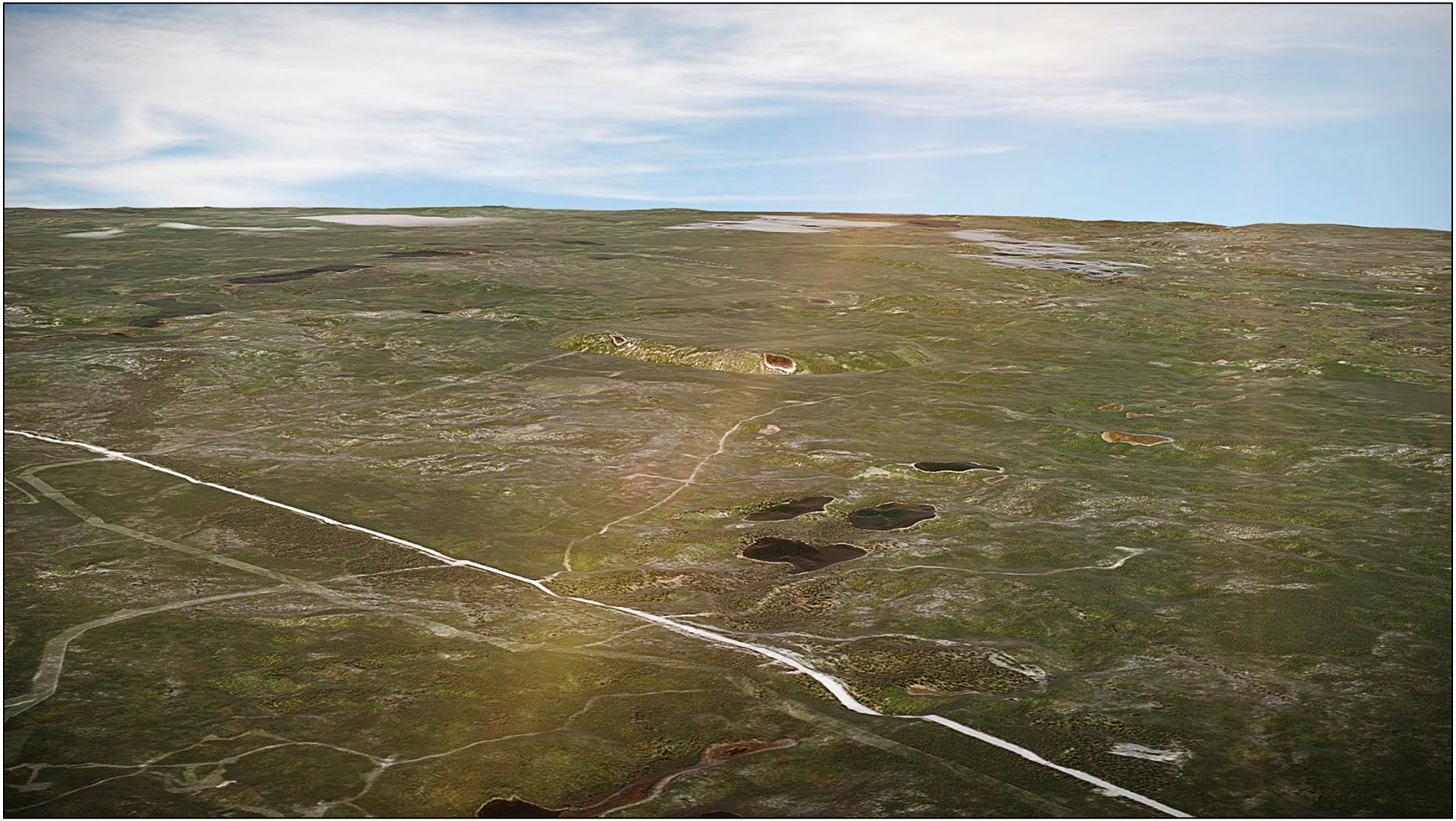

Figure 2-17
View of the Project Site post-reclamation from the northeast.

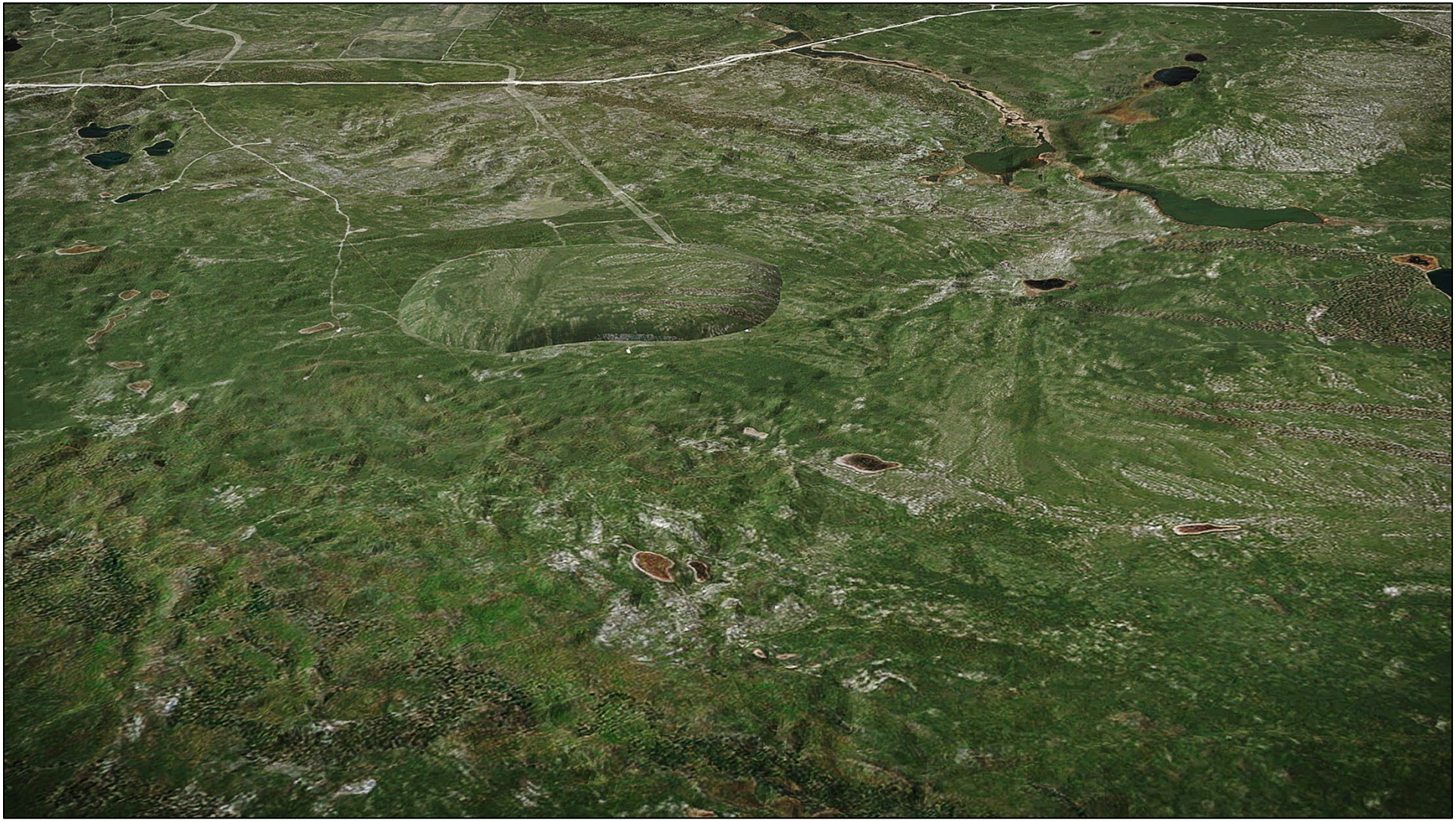

Figure 2-18
View of the TMF area post-reclamation from the west.

Figure 2-19
View of the Project area post-reclamation from the east.

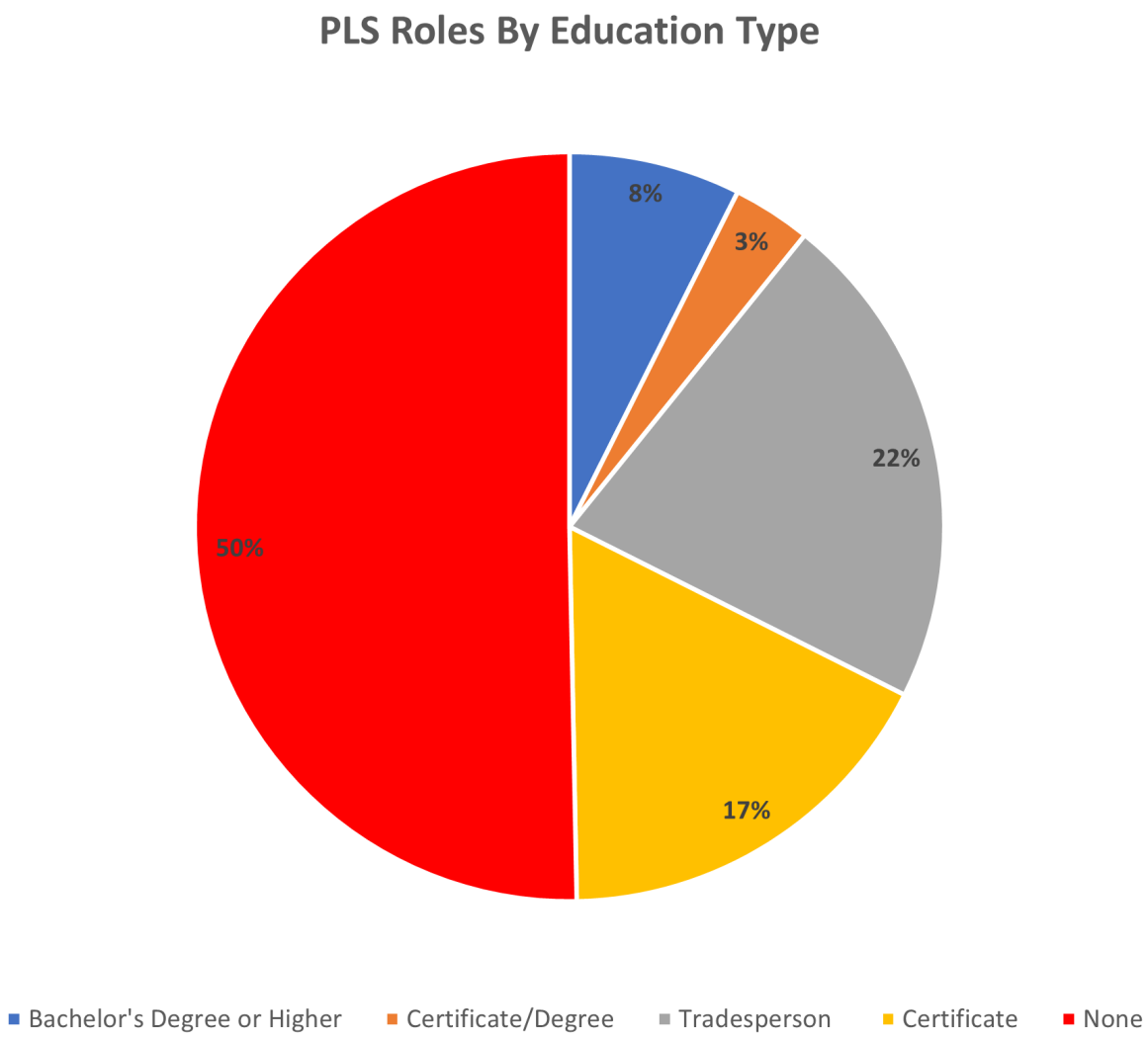

Figure 2-20
PLS roles by education type.

Table 2-1
Concordance table – project description.

EIS Requirement	Section and Page #
Siting	
b) township/range and/or universal transverse Mercator (UTM) coordinates of the main development site	Siting (2.1), 2-1
c) coordinates of endpoints for linear developments	N/A
d) current land uses in the area	Siting (2.1), 2-2
e) land ownership (e.g. private, crown), including any access limitations and how these will be identified	Siting (2.1), 2-1, Figure 2-4
f) the environmental significance and value of the geographical setting in which the development will take place, including proximity to sensitive air and water receptors, national, provincial and regional parks, ecological reserves, ecologically sensitive areas and know habitats of federally or provincially listed SOCC	Siting (2.1), 2-2
g) description and locations of all surface water or groundwater sources and municipal or private drinking water sources	Siting (2.1), 2-2
h) communities and notable industries in the vicinity of the development site	Siting (2.1), 2-2, Figures 2-1 to 2-4
i) identification of First Nations and Métis communities, including those outside of Saskatchewan but in geographic proximity to the development	Siting (2.1), 2-1, Figures 2-1 to 2-4
j) culturally important features of the landscape	Siting (2.1), 2-2
Infrastructure	
b) detailed description of all on-site components of the development and associated off-site infrastructure (e.g. production and processing facilities, waste handling facilities, water management infrastructure, transportation infrastructure, gravel/borrow sources)	Site Infrastructure (2.3), 2-3
Activities	
General	
b) development scheduling by phase, including Gantt chart or similar illustration, showing proposed development timelines	Project Activities (2.4), 2-33
c) information regarding potential future expansions of the development area to end of life	Project Activities (2.4), 2-33
Site Preparation and Construction	
b) detailed descriptions of the nature and locations of all activities a phase, focusing particularly on those likely to create ecological, social, or economic disturbance	Site Preparation and Construction (2.4.1), 2-33
c) summary of any substantive changes made to this phase of the development relative to the technical proposal or TOR	N/A
Operation	
b) detailed descriptions of the activities occurring in the phase, focusing particularly on those likely to create ecological, social, or economic disturbances	Operations (2.4.2), 2-37
c) summary of any substantive changes made to this phase of the development relative to the technical proposal or TOR	N/A
Decommissioning and Reclamation	
b) conceptual decommissioning and reclamation plan, focusing particularly on those elements addressing important ecological, social, or economic impacts likely to result from the development, including: • decommissioning objectives and timeframes for all components • potential for consultation with First Nations and Métis communities regarding decommissioning • preferred methods for decommissioning • progressive decommissioning and reclamation activities, if appropriate • alternative procedures for decommissioning site facilities	Decommissioning and Post Decommissioning (2.4.4), 2-45

Table 2-1

Concordance table – project description.

EIS Requirement	Section and Page #
Decommissioning and Reclamation	
• environmental impacts of mitigation and reclamation measures • identification of acceptable post-operational land use options for the site • long-term institutional control measures proposed for the site, if required • identification of monitoring required to manage potential short term, long term and permanent impacts following decommissioning and reclamation • proposed contingency measures	Decommissioning and Post Decommissioning (2.4.4), 2-45
Inputs and Outputs	
Products	
b) complete characterization of all intended product(s) or service(s) in sufficient detail to assess the potential impact they may have on environmental VCs	Products (2.5.1), 2-51
Resource Use	
b) detailed description and quantification of the primary and secondary resources that will be required to make the intended products or services	Resource Use (2.5.2), 2-51
By-Products, Reagents and Emissions	
b) the fate and complete characterization of amounts and rates of: • solid and liquid wastes • waste process water • runoff water • other site water (e.g. from dewatering) • air emissions (including greenhouse gases and $C0_2$ e) • dust	By-Products, Reagents, and Emissions (2.5.3), 2-51
c) information about known hazards and toxicity associated with each element or compound and compare expected levels to relevant guidelines	Section 6.0 Effects Assessment
Sensory Outputs	
b) anticipated levels of sensory outputs by distance from the development site during all phases of the development and comparison to relevant guidelines	Section 6.0 Effects Assessment
Alternative Means of Carrying Out The Development	
c) consider best available technologies in determining and justifying selection of the preferred alternatives	Alternative Means of Carrying out the Project (2.6), 2-52
d) brief descriptions of each proposed alternative in sufficient detail to evaluate the potential environmental, social and economic effects, and impacts on Treaty and Aboriginal rights and traditional uses	Alternative Means of Carrying out the Project (2.6), 2-52
e) maps showing land cover on which alternatives are overlaid	N/A
f) criteria used to evaluate the environmental soundness and determine technical and economic feasibility of possible alternative means	Alternative Means of Carrying out the Project (2.6), 2-52
g) stakeholder and engagement feedback on each alternative	Alternative Means of Carrying out the Project (2.6), 2-52
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Section 2 Project Description; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (2.7), 2-54
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 2 Project Description; throughout

Table 2-2
Water wells in the vicinity of the PLS Project.

Well Name	Land Location	Distance from Project Site
Fission Uranium Corp.	5-SW-33-99-21-3	0 km
Fission Uranium Corp.	5-SW-33-99-21-3	0 km
Pellizzari	SE-03-48-21-3	0 km
Rosetown	NE-33-99-21-3	1.2 km

Source: Water Security Agency. 2023. Water Well Information Database. Website https://www.wsask.ca/Water-Info/Groundwater/Information-Services. Available: June 2023.

Table 2-3
Domestic waste generation.

Construction period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	11,408	19,044	28,336
Glass	2116	3,036	3,680
Paper	8,096	11,132	13,616
Cardboard	7,728	10,672	12,696
Food waste and compostable paper	49,680	78,660	115,552
Metals	3,312	7,084	12,420
Other household waste	6,440	17,664	35,328
Total	**88,780**	**14,7200**	**221,628**
Operations period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	12,400	20,700	30,800
Glass	2,300	3,300	4,000
Paper	8,800	12,100	14,800
Cardboard	8,400	11,600	13,800
Food waste and compostable paper	54,000	85,500	125,600
Metals	3,600	7,700	13,500
Other household waste	7,000	19,200	38,400
Total	**96,500**	**160,000**	**240,900**
Decommissioning period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	2,480	4,140	6160
Glass	460	660	800
Paper	1,760	2,420	2,960
Cardboard	1,680	2,320	2,760
Food waste and compostable paper	10,800	17,100	25,120
Metals	720	1,540	2,700
Other household waste	1,400	3,840	7,680
Total	**19,300**	**32,000**	**48,180**

Table 2-4
Industrial waste generation.

Construction period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic (rigid)	10,857	14,718	18,579
Plastic film	1,221	1,650	2,079
Paper	1,287	1,749	2,211
Cardboard	64,086	86,988	109,857
Metal	38,874	52,734	66,627
Clean wood	17,754	24,090	30,426
Painted or treated wood	1,980	2,673	3,366
Tires	27,390	37,158	46,959
Miscellaneous	90,618	122,991	155,364
Total	**254,067**	**344,751**	**435,468**
Operations period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic (rigid)	32,900	44,600	56,300
Plastic film	3,700	5,000	6,300
Paper	3,900	5,300	6,700
Cardboard	194,200	263,600	332,900
Metal	117,800	159,800	201,900
Clean wood	53,800	73,000	92,200
Painted or treated wood	6,000	8,100	10,200
Tires	83,000	112,600	142,300
Miscellaneous	274,600	372,700	470,800
Total	**769,900**	**1,044,700**	**1,319,600**
Decommissioning period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic (rigid)	6,580	8,920	11,260
Plastic film	740	1000	1,260
Paper	780	1060	1,340
Cardboard	38,840	52,720	66,580
Metal	23,560	31,960	40,380
Clean wood	10,760	14,600	18,440
Painted or treated wood	1,200	1,620	2,040
Tires	16,600	22,520	28,460
Miscellaneous	54,920	74,540	94,160
Total	**153,980**	**208,940**	**263,920**

Table 2-5
Hazardous waste generation.

Construction period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Waste oils (L)	92,736	175,720	258,704
Oil and fuel filters, spill pads, rags	2,116	4,048	6,072
Waste fuel (L)	10,396	23,736	29,072
Paints, Antifreeze (L)	12,512	23,736	34,960
Aerosol Containers	276	460	736
Hydrocarbon impacted materials (soil, snow)	127,236	254,472	50,8944
Automotive batteries	4,784	9,016	13,248
Household batteries	736	1,380	2,116
Solvents and degreasers	5,704	10,764	15,824
Other (mercury, electronics, miscellaneous)	5,428	10,212	15,088
Total	**261,924**	**513,544**	**884,764**
Operations period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Waste oils (L)	100,800	191,000	281,200
Oil and fuel filters, spill pads, rags	2,300	4,400	6,600
Waste fuel (L)	11,300	25,800	31,600
Paints, Antifreeze (L)	13,600	25,800	38,000
Aerosol Containers	300	500	800
Hydrocarbon impacted materials (soil, snow)	138,300	276,600	553,200
Automotive batteries	5,200	9,800	14,400
Household batteries	800	1,500	2,300
Solvents and degreasers	6,200	11,700	17,200
Other (mercury, electronics, miscellaneous)	5,900	11,100	16,400
Total	**284,700**	**558,200**	**961,700**
Decommissioning period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Waste oils (L)	20,160	38,200	56,240
Oil and fuel filters, spill pads, rags	460	880	1,320
Waste fuel (L)	2,260	5,160	6,320
Paints, Antifreeze (L)	2,720	5,160	7,600
Aerosol Containers	60	100	160
Hydrocarbon impacted materials (soil, snow)	27,660	55,320	110,640
Automotive batteries	1,040	1,960	2,880
Household batteries	160	300	460
Solvents and degreasers	1,240	2,340	3,440
Other (mercury, electronics, miscellaneous)	1,180	2,220	3,280
Total	**56,940**	**111,640**	**192,340**

Table 2-6
Low-level radioactive waste generation.

Construction period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	25,465	34,095	42,730
Paper	4,705	6,300	7,895
Cardboard	11,385	15,245	19,105
Metals	52,980	70,945	88,910
Wood	27,425	36,725	46,020
Miscellaneous	108,990	145,945	182,900
Total	**230,9950**	**309,255**	**387,560**
Operations period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	509,300	681,900	854,600
Paper	94,100	126,000	157,900
Cardboard	227,700	304,900	382,100
Metals	1,059,600	1,418,900	1,778,200
Wood	548,500	734,500	920,400
Miscellaneous	2,179,800	2,918,900	3,658,000
Total	**4,619,9000**	**6,185,100**	**7,751,200**
Decommissioning period (kg/year)			
Waste Type	**Low**	**Medium**	**High**
Plastic	12732.5	17,047	21,365
Paper	2352.5	3,150	3,947
Cardboard	5692.5	7,622	9,552
Metals	26490	35,472	44,455
Wood	13712.5	18,362	23,010
Miscellaneous	54495	72,972	91,450
Total	**1,154,975**	**154,627**	**193,780**

Table 2-7
10-year production plan for PLS Project.

Year	Ore Processed (t)	Head Grade (% U_3O_8)	Overall Recovery (%)	Yellowcake Grade (% U_3O_8)	Recovered U_3O_8 (million lb)
Year 1	217,303	1.38	97.0	95.0	6.40
Year 2	340,686	1.32	97.0	95.0	9.59
Year 3	351,186	1.68	97.0	95.0	12.59
Year 4	358,996	1.15	96.9	95.0	8.81
Year 5	357,670	1.29	97.0	95.0	9.84
Year 6	348,675	1.87	97.0	95.0	13.98
Year 7	311,574	1.83	97.0	95.0	12.23
Year 8	361,360	1.11	96.9	95.0	8.56
Year 9	215,252	1.15	96.9	95.0	5.31
Year 10	144,786	1.15	96.9	95.0	3.56
Total	**3,007,487**	**1.41**	**97.0**	**95.0**	**90.86**

Table 2-8
Required PLS Project resources and their usage.

Resource	Uses/Outputs
LPG	Electrical Power
LPG	Heating
Diesel	Mobile/Stationary Equipment
Gasoline	Mobile Equipment
Propane	Mobile Equipment/Heating
Water	Human Consumptive Use
Water	Fire Protection
Water	Process Operations
Water	Mining Operations

Table 2-9
Required production reagents and their consumption rates.

Reagent/Consumable	Consumption (t/d)
Sulphur	50.95
Hydrogen peroxide (50% H_2O_2)	19.20
Sodium carbonate	1.39
MgO	3.03
Barium chloride	0.58
Ferric sulphate (60% solution)	9.54
Lime	66.24
Flocculant (Magnafloc 333 or eq.)	0.35
Flocculant (Magnafloc 10 or eq.)	0.02
Alamine	0.08
Isodecanol	0.07
Kerosene	0.41
Grinding Media	0.54

SECTION 3

ENGAGEMENT

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LIST OF ACRONYMS

ACFN	Athabasca Chipewyan First Nation
BLDFN	Black Lake Denesųłiné First Nation
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
CNSC	Canadian Nuclear Safety Commission
CRDN	Clearwater River Dene Nation
DTC	Duty to Consult
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
ERFN	English River First Nation
FLDFN	Fond Du Lac Denesųłiné First Nation
FIFO	Fly-in/Fly-out
Fission	Fission Uranium Corp.
HHERA	Human Health and Ecological Risk Assessment
MBA	Mutual Benefit Agreement
MBC	Missinipi Broadcasting Corporation
MKS	Métis Knowledge Study Report
MLTC	Meadow Lake Tribal Council
MN-S NR2	Métis Nation Saskatchewan Northern Region 2
MN-S	Métis Nation Saskatchewan
NSAD	Northern Saskatchewan Administrative District
NSTA	Northern Saskatchewan Trappers Association
PDA	Potential Disturbance Area
PLS	Patterson Lake South
the Project	The PLS Project
RCMP	Royal Canadian Mounted Police
SHA	Saskatchewan Health Authority
SSA	Site Study Area
TOR	Terms of Reference
VC	Valued Component
YNLR	Ya’ thi Nene Land and Resources

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Table 3-1 Concordance table – engagement.

3.0 ENGAGEMENT

Fission Uranium Corp. (Fission) conducted engagement activities with stakeholders and Indigenous Nations and communities to share details of the PLS Project (the Project) and to actively solicit feedback, input for the Environmental Impact Statement (EIS), and information on land use and concerns. This section includes a summary of consultation activities; detailed information is provided in Appendix B. The concordance table for components for the EIS from the Saskatchewan Ministry of Environment (ENV) Guidelines for the Terms of Reference (TOR) and Environmental Impact Statement (ENV 2021) for engagement is provided in Table 3-1.

3.1 Interest-based Engagement

Interest-based engagement activities related to Project exploration and early planning initiatives began in 2013, while activities specifically conducted to inform development of the EIS have been underway since 2021. The decisions identified for engagement, stakeholder groups engaged, a summary of engagement activities completed, and plans for future engagement are detailed in this section. Supplementary information and communication logs are available in Appendix B.1.

3.1.1 Decisions Identified for Engagement

Interest-based engagement activities were designed to collect feedback to inform decisions at each phase of the Environmental Impact Assessment (EIA) development, namely EIA scoping to define valued components (VCs) and receptor locations, identification of potential effects and effect pathways, and refinement of mitigation measures and monitoring.

Early feedback received related to interests and concerns was used to inform the rationale for inclusion of selected VCs, key indicators, measurable parameters, and effect pathways. Later discussion of interests and concerns during engagement activities helped to inform the screening and assessment of potential effects. Feedback received related to mitigation measures was used to inform justification and/or refinement of the Project design, mitigation measures, and development of monitoring programs and management plans.

3.1.2 Stakeholder Groups Engaged

Stakeholder groups to be engaged and justification for their inclusion in engagement activities were identified in the TOR submission and include the following key groups:

- other land and resource users;
- municipal leadership;
- municipal residents;
- educational institutions;
- health care providers; and
- protective services providers.

Other land and resource users located in proximity to the Project have the potential to experience effects to their continued use of the land due to Project activities. Land users engaged to inform development of the EIA included:

- Outfitters, lodges, and camps (Big Bear Camp, Forest Lake Outfitters, and Lloyd Lake Lodge).
- Trappers (Northern Saskatchewan Trappers Association [NSTA] and the Fur Block N-19 Trappers Board Committee).

Residents of municipalities located in proximity to the Project will be prioritized for workforce recruitment and have potential to experience changes to community wellbeing and human health as a result of increased levels of employment. Increased participation in the workforce also has the potential to result in changes to the demand for municipal services, which may fall under the jurisdiction of municipal leadership. Leadership in the following municipalities were invited to engage with Fission to identify interests and concerns and share feedback on predicted effects and mitigations through a series of phone calls, emails, and meetings between December 2022 and February 2024.

- Saskatchewan Ministry of Government Relations, Northern Municipal Services, as the representative for the Northern Saskatchewan Administrative District (NSAD) and the governing body for the Northern Settlements of Descharme Lake, Bear Creek, and Garson Lake;
- Northern Village of La Loche;
- Northern Village of Buffalo Narrows;
- Northern Village of Île-à-la-Crosse;
- Northern Village of Beauval;
- Northern Hamlet of Black Point;
- Northern Hamlet of Turnor Lake;
- Northern Hamlet of St. George's Hill; and

- Northern Hamlet of Michel Village.

Municipal residents from these communities were invited to share feedback on interests and concerns at public open houses held in La Loche and Buffalo Narrows.

Educational institutions were engaged to generate interest in the Project as a prospective career option for students, and because employment of the workforce has potential to result in changes in demand for educational services and facilities. The following educational institutions were engaged to identify current educational conditions and concerns regarding future capacity:

- Dene High School, La Loche;
- Twin Lakes Community School, Buffalo Narrows; and
- Northlands College (multiple campuses serving northern Saskatchewan).

A new mining project provides opportunities for employment and economic growth for people who reside in proximity to the Project; however, it also could put a strain on current health service providers. Physical health care services will be available at the Project site. As a regulatory requirement, Fission must ensure that the Project site has adequate emergency and evacuation services to respond to potential injuries and incidents.

An increase in mental wellness issues can result from increased employment income coming into the priority recruitment communities. According to information shared through Fission's stakeholder interview program, previous land claim settlements, where community members received $15,000 each, resulted in an increase in mental health issues, lateral violence, accidents, and deaths (BRDN Int. Health 2023). Increase in wealth when people are not prepared with financial planning knowledge may result in a greater prevalence of drugs and alcohol use in the community.

Through the EIA, Fission considered the potential for increased demand for health services as a result of the Project, and how that may affect health services capacity in local communities.

To seek input on potential mitigation for these issues, Fission sought the advice of health care providers in the area, including:

- La Loche Health Centre and Hospital;
- Buffalo Narrows Health Centre;

- Saskatchewan Health Authority, Integrated Northern Health Portfolio; and
- Buffalo River Dene Nation Health Services (part of the Meadow Lake Tribal Council Health Services Portfolio).

The Project has the potential to introduce or increase income disparity within families and communities where members are employed at the mine. In communities with a history of low or below average incomes, when some members earn a significantly higher income than others, in addition to mental health issues, it can create the potential for tension, crime, or violence between family and/or community members.

To learn more about the communities' capacity to address these issues, Fission interviewed protective services providers in nearby communities, including:

- Royal Canadian Mounted Police (RCMP) - La Loche detachment;
- RCMP - Buffalo Narrows detachment;
- RCMP - Île-à-la-Crosse detachment; and
- NorGuard Security – Île-à-la-Crosse.

3.1.3 Engagement Activities

Fission used a range of engagement activities and methods which were selected according to the preference and size of the group, purpose, and desired outcomes of each activity. A complete log of interest-based engagement activities that took place between December 2022 and February 2024 is provided in Appendix B.1. The key activities conducted, the stakeholder groups engaged, and issues raised and addressed through each activity are summarized below. Input was provided through the following means:

- Email correspondence;
- Small group meetings;
- Public open houses;
- Subject matter expert interviews; and
- Open lines of communication.

3.1.3.1 Email Correspondence

Introductory Letters

Formal engagement for the EIA process began in late 2022 with Fission sending a project brochure via email to the mayor, or, in the case of the Northern Settlements, the Northern Municipal Services Branch of the Ministry of Government Relations, with an invitation to meet to discuss the project in detail.

Invitations were sent to the following municipalities on December 21st, 2022:

- Saskatchewan Ministry of Government Relations, Northern Municipal Services, as the representative for the NSAD and the governing body for the Northern Settlements of Descharme Lake, Bear Creek, and Garson Lake;
- Northern Village of La Loche;
- Northern Village of Buffalo Narrows;
- Northern Village of Île-à-la-Crosse;
- Northern Village of Beauval;
- Northern Hamlet of Black Point;
- Northern Hamlet of Turnor Lake;
- Northern Hamlet of St. George's Hill; and
- Northern Hamlet of Michel Village.

Project Updates

Fission provided Project updates to leadership of potentially impacted municipalities in July 2023, December 2023, and February 2024. Each update provided a brief overview of the Project, the status of development including any recently achieved milestones, information about upcoming meetings or engagement opportunities, how communities could contact Fission to apply for the community investment program, and how to participate in current or future procurement or employment opportunities.

3.1.3.2 Small Group Meetings

Municipal Leadership

Small group meetings took place with municipal leadership either virtually or in person between December 2022 and April 2023. In-person meetings were scheduled when at all

possible. Due to schedule conflicts that prohibited travel, two of the introductory municipal meetings took place virtually via Microsoft Teams.

Two rounds of small group meetings took place and included introductory meetings followed by update meetings (upon request). The purpose of the first round of meetings was to introduce the Project and provide municipal leadership with an opportunity to get to know the Fission team, ask questions, and identify potential municipal interests and concerns. Update meetings were organized upon request from municipal leadership and were used to provide Project updates and opportunity for further discussion regarding interests, concerns, and possible mitigation measures (if applicable).

Introductory meetings took place with the Northern Village of Buffalo Narrows (February 13th, 2023), Northern Village of La Loche (February 14th, 2023), Northern Hamlet of Black Point (February 14th, 2023), Northern Settlement of Descharme Lake local advisory committee (February 15th, 2023), The Saskatchewan Ministry of Government Relations (April 11th, 2023), Northern Hamlet of Turnor Lake (April 26th, 2023), and the Northern Hamlet of Michel Village (April 27th, 2023).

Despite several attempts (detailed in Appendix B.1), Fission was unable to arrange an introductory meeting with leadership from the Northern Village of Beauval. Instead, Mayor and Council opted to review the Project presentation (PLS Project Presentation, February 2023) and committed to follow-up with Fission if concerns or interest were identified. To date, Fission has not received feedback from the Northern Village of Beauval.

Meetings were chaired by the mayor or delegate. Project information was shared with leadership during introductory meetings either by slideshow presentation (PLS Project Presentation, February 2023) or verbal discussion by Fission technical experts. The method of information delivery was selected depending on leadership preference and the technical equipment available. In all cases, a paper or electronic copy of the presentation was shared with leadership following the meeting.

Project information shared included:

- key facts about the Project and a map of the Project site;
- initial site layout drawings;
- status and results of Project-related studies (including feasibility, environmental baseline, and engineering studies);
- the EIA process and schedule; and

- Project timelines, milestones, and next steps.

Leadership was encouraged to ask questions throughout the presentation. To identify how the Project might impact the delivery of municipal services, the following specific questions were asked of leadership to ensure interests and concerns were identified for the effects assessment.

- How might the Project impact your community; and what, specifically, are your interests or concerns?
- How would you prefer to receive information about the Project?
- How would you suggest we engage with residents in your community?
- Who else in your community would you suggest we engage (businesses, service delivery providers, etc.)?

Minutes were taken and shared for review by leadership before being considered final records. Leadership was made aware that their responses would inform Fission's final list of VCs identified in the EIS. Several key interests and concerns that were mentioned during introductory meetings are summarized below.

Leadership from each municipality shared similar interests during introductory meetings. Access to training, employment, and contract opportunities was the key interest noted. While not directly related to municipal services or infrastructure, leadership expressed interest in protecting the natural environment in the vicinity of the Project and wanted to know how Fission will protect the quality of water in Patterson Lake.

Key concerns raised by municipal leadership varied by community. Some municipalities expressed concern about potential impacts of Project activities on local roads and highways, specifically Highway 155, due to a higher volume of heavy equipment traffic. In response to this feedback, Fission assessed predicted changes to traffic levels compared to existing conditions as a measurable parameter of the community wellbeing and human health VC (Section 6.17.2). A Transportation Impact Assessment (Appendix A.6) was also completed to assess if roadway infrastructure on the transportation route had capacity to support increased traffic levels, and increased traffic levels were considered as part of the accidents and malfunctions assessment (see Section 7).

Leadership in La Loche and Buffalo Narrows expressed concern about the potential need for more health and wellness services, and education and training services due to a possible increase in population in the area, either temporarily or permanently. Leadership noted that

often these needs are expected to be met by existing municipal budgets, which is unsustainable. To investigate this concern further, health care providers from communities located in proximity to the Project were interviewed as part of the fall 2023 interview program detailed later in this section. The potential for temporary and permanent population increases and increased demand on health care and educational services and facilities were assessed as a potential effect pathway in Section 6.17.2.2.

A lack of overnight (short or long term) accommodations for those needing to travel to participate in training opportunities in the municipalities was also noted as a concern. Fission acknowledged the lack of student accommodations currently in both La Loche and Buffalo Narrows and agreed to continue discussions with municipal leadership and engage with regional educational institutions to address these needs as the full complement of training requirements are identified through the Project lifecycle. Educational attainment requirements for employment positions are discussed in Section 6.17.2.2.

Municipal leadership who provided feedback on how to engage their residents suggested that Fission host a come-and-go style community open house where residents could learn more about Fission and the Project and ask questions of technical experts present. Fission held two public open houses in the fall of 2023, details of which are outlined later in this report.

Fission was also encouraged to explore opportunities for presenting to students at local schools to make students aware of the range of employment opportunities in mining projects and the secondary and post-secondary education required. Post-secondary institutions were also suggested by leadership as another group of potential stakeholders to engage to ready a future local workforce. Fission will continue to explore ways to engage these groups through career fairs and classroom/school presentations.

Finally, municipal leadership suggested that Fission reach out to local businesses to ensure they are aware of employment or contracting opportunities. As part of Fission's procurement process, a database of qualified local contractors is maintained. Fission invited municipal leadership to encourage interested local businesses in the area to contact Fission to have their names and contact information added to the database so they can be notified of upcoming opportunities.

To facilitate ongoing and open lines of communication, each leadership group provided a designated contact and encouraged that information is provided to that contact by telephone or email unless a virtual or in-person meeting was needed. The need for a future meeting

would be identified by leadership depending upon the complexity of the topic to be discussed and leadership's advice on how the broader community might want to learn more about various project activities.

As part of the first round of introductory meetings to municipal leadership, Fission committed to provide Project updates to municipalities via email when Project milestones were achieved or when activities might impact municipal infrastructure or services. Fission provided Project updates by email to leadership of potentially impacted municipalities in July 2023, December 2023, and March 2024 (results of the EIA).

In February 2024, Fission met in person with the Mayor and Council of La Loche (February 6th) and Buffalo Narrows (February 8th) to share the results of the effects assessment before submitting the draft EIS.

Fission shared the "PLS Project Update Winter 2024" presentation, which included information about Fission's Community Investment Program, key facts about the Project, benefits of the Project, employment opportunities, site layout and infrastructure, the regulatory process, the EIA process and status, a refined list of VCs assessed, and the key preliminary results of effects to the VCs that pertained to municipalities. Printed copies of the presentation were provided to each group for their further review.

Neither Council expressed concerns with the preliminary results shared; however, both Councils asked that Fission consider placing additional safety signage along Highway 155. The Buffalo Narrows Council also noted a potential need for safety signage near the Buffalo Narrows bridge, where people sometimes walk or ride bikes as well as the corner known locally as "Johnson corner" coming into Buffalo Narrows from the north. Fission committed to work with Buffalo Narrows Council to address the need for road safety signage within Village limits. Fission also committed to discuss the suggestions for highway safety signage with the Provincial Ministry of Highways.

Local Trappers Groups

Trappers with traplines in the N-19 Fur Block have the potential to be affected by changes to land and resources in the Patterson Lake area that may result from Project activities. The Northern Saskatchewan Trappers Association (NSTA) was contacted by email and Fission was directed to contact the N-19 Trappers Committee.

Disbanded through the COVID-19 pandemic, this group resumed regular meetings in December 2023. Fission met with a local trapper incidentally at the La Loche Open House on September 25th, 2023, and indicated their interest in meeting or interviewing trappers using Fur Block N-19. Between September and December 2023, a new chair and board was selected to represent N-19 trappers, and a meeting between the newly established board and Fission took place in La Loche on January 16th, 2024. The purpose of the meeting was to introduce the Project to the newly established N-19 Fur Block Board (N-19 Board); identify current uses in the area, potential effects, and mitigation measures; and to establish a communication process between Fission and the trappers using the area.

The meeting opened with introductions followed by a verbal description of the Project location, activities, and schedule. Tabletop maps and copies of the 2024 Information Booklet were provided, which included a preliminary overview of predicted effects of the Project (Appendix B.1).

The N-19 Board shared information and observations about land in the Patterson Lake area and current issues they are experiencing as trappers. They voiced concerns associated with the Project based on their experiences working at or near other mine sites in the province. Fission informed them that regulations and requirements have changed, and mines are held to a higher standard of safety and environmental protection now than they used to be.

Current use information shared at this meeting was used to inform existing environment information in the other land and resource use section discussion (see Section 4.7).

During the meeting attendees raised concerns about impacts to water and requested transparency with data regarding contamination levels. Predicted effects of Project activities on surface water quality and quantity were assessed in Sections 6.9 and 6.10, and surface water monitoring programs that will be conducted during all Project phases are discussed in Section 9.

Concerns were raised about the tailings being stored on surface instead of underground and a preference was noted for the tailings to be returned underground. Fission explained that given the conditions associated with the Project deposit, depth, and ground conditions, an above ground tailings facility was selected because it would be more environmentally sound and manageable than returning tailings underground where there was increased risk of impacts to groundwater, and less ability to address any leakages once the material was deposited. N-19 Board members asked how long the liner for the tailings management

facility would last. Fission responded that it was a clay liner assessed for a 10,000-year period.

Concerns about decommissioning plans were also raised, citing that former mining companies were observed taking “short cuts” in the past at other nearby mines. Fission noted that a decommissioning and reclamation plan is required prior to approval of the Project and must be updated at regular intervals.

Concerns were raised about impacts to caribou and what mitigations Fission would use to protect caribou, sharing an example from Alberta where if a caribou is seen on site, the mine shuts down. Fission responded that it is a similar process in Saskatchewan, where if a caribou is seen, work in the immediate area of the sighting will stop until the animal has left the area. The potential for Project activities to affect caribou are discussed in Section 6.13, and a woodland caribou mitigation plan that was developed for the Project is presented in Appendix D.9.

Trappers noted that they would like to have a system developed where they can voice concerns or grievances to Fission and have someone respond. Fission shared contact information that the N-19 trappers can use to get in touch with company representatives until a formal grievance mechanism is developed and shared publicly.

3.1.3.3 Community Open Houses

Fission hosted public open houses in the communities of La Loche and Buffalo Narrows in September 2023 to provide opportunities for stakeholders and area residents to learn more about the Project and share with Fission any concerns or interests. The venues, dates, and times of the sessions were decided in collaboration with staff of both village offices to ensure an ideal time to support a good turnout. Leadership of all potentially impacted municipal communities were made aware of, and encouraged, to attend one or both events.

The events were marketed through several channels including advertisements on social media, print media, and radio with the goal of casting a broad reach to all residents of potentially affected municipalities. Paid print advertising appeared in the Northern Pride Magazine and radio advertising was purchased on Buffalo Narrows and La Loche local stations and the Missinippi Broadcasting Corporation (MBC) in English, Cree, and Dene.

Email invitations were sent to local municipal leadership, local First Nations and Métis leadership, and Provincial leadership.

A come and go open house format was used for both events. Project information was provided through poster boards, information packages, and maps. Poster boards set up in the room displayed the following information:

- welcome board, encouraging people to ask questions and complete a feedback form;
- background on Fission and their community investment program;
- key facts about the Project and the Project schedule;
- Project map and details about the location;
- site infrastructure (surface and underground);
- EIA process and timelines; and
- employment opportunities and a fact sheet that outlines skills needed in the mining industry, and the associated training required, as well as specific jobs Fission will need to fill as the Project develops.

An information package containing similar information was given to each attendee, and Fission representatives sat with participants to go through the package and discuss topics of interests and answer questions. Table maps were set out to help illustrate the location of the Project and the Project footprint. Participants were encouraged to mark these maps with any areas of interest or concern.

Fission technical experts were on-hand to discuss the Project and answer questions for the duration of the evening. Saskatchewan Ministry of Environment staff were also present and available to answer questions specific to the EIA process.

Feedback forms were provided at each event which invited participants to provide their overall feedback on the set-up of the session, the quality of the information shared, any outstanding questions, concerns, or interests, as well as how they would prefer to engage with Fission going forward.

Fission invited guests to stay and visit over coffee and light refreshments and, at each session there was a door prize draw for one of four $50 gift cards. Details and outcomes of each event are provided below including a summary of key interests and concerns raised.

La Loche Open House

Thirty-two people attended the public information session held at the Friendship Center between 4:00 p.m. and 7:30 p.m. in La Loche on September 25th, 2023. Of those 32 people,

13 completed feedback forms. Table maps were used to guide discussion, but no participants marked up the maps to indicate any points of interest or concern during these conversations.

Feedback received from local residents and members of the public on key interests included access to good paying jobs, the positive economic impact of the Project, and learning more about Fission's community investment program. A summary of economic benefits is included in Section 6.13.2.

Key concerns included how the Project would impact future land use in the Project area, specifically the effect of the Project on animals and their habitat around Patterson Lake, as well as potential impacts of chemicals in the lake that could affect natural wild food sources. Impacts to future land use and effects to wild food sources were assessed in Section 6.14.2 and Section 6.15.2.

Buffalo Narrows Open House

This event took place at the Lakeview Recreation Complex in Buffalo Narrows between 3:30 p.m. and 7:00 p.m. on September 26th, 2023, and 16 people attended. Fission received five completed feedback forms. As in La Loche, participants did not mark up the maps set out on the tables.

Interests identified through the feedback forms and anecdotally through discussions during the session included employment opportunities, especially local employment, and local contracts for supplying goods and services for the Project. Fission has responded to these interests by ensuring that information about jobs, contracting opportunities, the economic impact of the Project and the community investment program is included in Project updates to the community, and that the community is aware of Fission's Community Liaison Office in nearby La Loche. Residents were encouraged to contact the La Loche office or stop by to talk directly with a Fission staff member about questions or concerns, including potential opportunities for employment. Fission has developed a database of qualified local businesses which whom they share notices of any upcoming contract or employment opportunities.

Participants inquired about potential training opportunities to help youth become qualified for future employment. Fission shared a list of potential roles required through the construction and operation of the Project and let participants know that plans for training were still in development.

One participant also identified the need for childcare among parents and guardians of young children, especially when shiftwork is required. Lack of access to 24-hour daycare was identified as a potential barrier to employment with Fission as shift work is typically required. Access to childcare was discussed as a potential barrier to participation in the workforce (Section 4.7).

Key concerns identified included the sustainability of having two new uranium mills in the area, with a suggestion that NexGen Energy Ltd. and Fission could combine efforts to build and operate only one mill since the Rook 1 Project and the Project are located on opposite ends of Patterson Lake. Fission acknowledged participants' concerns about the sustainability of potentially having two new uranium mines and mills in the area. Currently, Fission is required to progress the Project on its own merits. However, when appropriate, Fission would welcome the opportunity to discuss regional needs and shared service opportunities with other area operators. To better understand the potential effects of having two mines operating in proximity to one an another, cumulative effects assessments were completed in Section 6 for all VCs where residual effects were present.

Participants also expressed concern with how waste from the mine would be managed, and concern about protecting Patterson Lake from contamination. A waste management plan will be developed to guide the management of waste materials with the goal of preventing impacts to the environment, including Patterson Lake. A Human Health and Ecological Risk Assessment (HHERA; Appendix D.7) has been completed to assess the potential for effects to occur as a result of treated effluent release. An accidents and malfunctions assessment (Section 7; Appendix D.10) was also completed that identifies the risk of unplanned or untreated effluent release occurring and the predicted effects to Patterson Lake should that scenario occur.

Wear and tear on Highway 155 and heavier traffic flows from mining traffic, as both a strain on infrastructure and a potential safety concern for community members, were also noted as concerns. As noted earlier in this section, Fission has conducted a Transportation Impact Assessment (Appendix A.6) and increased traffic numbers were considered in assessment of impacts to community health and wellbeing (Section 6.17.2.8).

3.1.3.4 Stakeholder Interviews

In response to key areas of concern identified through early engagement with municipalities, residents, and Indigenous Nations, a key-person interview program was developed to collect additional information from subject matter experts to inform Fission's

understanding of the existing environment and the effects assessment. The subject matter expert groups targeted as part of the interview program include health and wellness service providers, lodges and outfitters, and protective services providers. Unique interview guides were developed for each subject matter expert group (Appendix B.1). A summary of key concerns identified during the interview program is described below for each group.

Health and Wellness Services

A new mining project in the area provides opportunities for employment and economic growth for people in the area. Fission heard from municipal leadership that it could put a strain on current providers of health and wellness services. Fission wanted to learn more about current health services in the area, and how the construction and operations of the Project might affect future delivery of these services.

To identify subject matter experts in the health and wellness field to invite to participate in an interview, the Meadow Lake Tribal Council (MLTC) Sub-Office in Buffalo Narrows was contacted. Contact information was provided for health care service providers for the nine MLTC member Nations. Despite considerable outreach efforts to the contact names provided, only two interviews were completed.

Interviews were completed with representatives of the Saskatchewan Health Authority (SHA) Clinic in Buffalo Narrows via telephone on September 15th, 2023, and with representatives from Buffalo River Dene Nation Health Services on October 26th, 2023. Key issues identified and possible mitigation measures identified for consideration were similar between these two interviewees and are summarized below.

Interviewees noted a number of vacancies in current positions which is putting a strain on nurses and other service workers. They noted that there doesn't seem to be enough funding to maintain the staffing levels needed to provide an adequate level of care for people in the area.

Interviewees predicted that Project activities have potential to create changes to the demand for health and wellness services in the communities. Pathways for these changes to occur are described below.

An increase in wealth when people are not prepared with financial knowledge or planning may result in mental health issues, (e.g., a greater use of drugs and alcohol in the community). This has potential to overwhelm health and wellness services that are already

at capacity due to staffing shortages. The potential for changes in level and distribution of income to affect social and cultural wellbeing was assessed in Section 6.17.2.2.

Shift work fly-in/fly-out schedules (FIFO) could impact mental health for the worker, or in the case of those with children, the parent or guardian left behind at home. Changes to the number of people employed in FIFO worker rotations and the potential for those changes to affect social and cultural wellbeing were assessed in Section 6.17.2.2.

Interviewees also noted that closure of the mine would also have a negative impact on mental health of former employees and the local communities. For example, Uranium City was built up and then abandoned, which had significant negative impacts not only on the environment but also on people in the surrounding area, including former employees. Changes to economic wellbeing as a result of changes to level and distribution of employment opportunities were assessed in Section 6.13.2.2 and 6.17.2.2.

To increase capacity of health and wellness service providers and support increased ability to respond to potential changes in demand for services, or to help reduce the risk of impacts occurring, the following mitigation measures were proposed by interviewees:

- Establish a way to recruit and retain health care workers in remote communities, (e.g., updates to current rates for northern living allowance).
- More funding for community services, such as service centres offering care and special education for mental health and wellness.
- A specialized addictions treatment center in communities – a local facility would eliminate the challenge of traveling away from home for participants and could also alleviate the workload of workers who are not specifically trained to deal with overdoses or other emergencies that arise as a result of addictions issues prevalent in many of the potentially affected communities.
- Providing programs for youth in communities, which could serve as an alternative to drug and alcohol use and could also reduce risk.
- Assistance with day care needs to support workers, especially single parents who need to leave young children at home to seek employment.
- Fission could support its employees with financial planning services and skills.

Information provided by interviewees about the current condition of health care services is included Section 4.6. Suggested mitigation measures were used to inform selection of design features and mitigation measures included in Table 6-2, Section 6.

Lodges & Outfitters

Project activities have the potential to impact land and resources in the Patterson Lake area. Local tourism-focused lodges and outfitters were targeted for interviews to seek information about what land and resources are used as part of the business operation, and what effects lodge and outfitter operators predict could occur to their businesses as a result of Project activities. Tourism-focused lodges invited to participate in an interview included Lloyd Lake Lodge and Forrest Lake Outfitters.

A telephone interview was conducted with a representative from Forest Lake Outfitters on October 10th, 2023, and with Lloyd Lake Lodge on October 19th, 2023. Predicted impacts to lodges and outfitters that were identified and summarized below.

Interviewees noted that increased noise and disruption to the environment (e.g., helicopters and transportation of heavy equipment) could negatively impact business as people travel to northern Saskatchewan for the pristine, quiet environment. The potential for increased sensory disturbances to affect other land and resource use was assessed in Section 6.15.2. It was also mentioned that road improvements for the Project may increase accessibility to formerly private accommodations, which might seem attractive to businesses but also poses significant risks of property damage and theft to buildings that were formerly not easily accessible. The potential for changes in accessibility to affect other land and resource use was assessed in Section 6.15.2.

Interviewees noted that further impacts to road conditions and safety for local road users may occur as a result of increased traffic on Highway 955. Effects of increased traffic levels on road conditions, access, and capacity were assessed in Section 6.17.2.8.

It was mentioned that if Project services are not awarded to nearby communities, the Project would impact local businesses in a negative way. It would take away employment from local people. The changes to economic wellbeing as a result of increased economic opportunities was assessed in Section 6.13.2.

To address the concerns raised above, interviewees suggested continuing or increasing engagement with property owners to identify ways to help protect private property from changes to accessibility, and way to support and provide business to local lodges and outfitters (such as using local lodges and outfitters for staff retreats and time off).

Representatives from Big Bear Contracting were also interviewed given their proximity to the Project. A telephone interview took place on November 8th, 2023. Unlike the tourism-based lodges and outfitters, Big Bear provides accommodation, transportation, and construction services to industrial clients. During the interview it was noted that Project could affect business in a positive way by increasing the need for services, which would bring about the need to employ more people locally to serve new customers. It was also noted that during decommissioning, the decline in accommodations needed would result in a reduction in employment for the local community.

To reduce potentially adverse effects, it was suggested that there is potential for the Project to use local businesses for lodging or recreation which could help offset a loss of customers due to noise and other related construction activities of the Project. It was also suggested that Fission seek services from local businesses where possible, including decommissioning work. The potential for the presence of sensory disturbances to affect other land and resource uses was assessed in Section 6.15.2. Effects to economic wellbeing are discussed in Section 6.13.2.

Information provided about the current conditions for lodge and outfitter operations is included Section 4.7.2.

Protective Services

Project activities associated with employment and transportation of the workforce have potential to result in increased psychosocial stressors in communities such as changes to family dynamics due to shift work, changes in income disparity, and increased access to disposable income, which may increase the demand for protective services in the communities. Fission contacted local law enforcement organizations to learn about current capacity, if effects similar to those mentioned above have been observed in the past, and if service providers have capacity to respond to changes in demand. Service providers invited for interviews included RCMP - La Loche detachment, RCMP - Buffalo Narrows detachment, RCMP - Île-à-la-Crosse detachment, RCMP Turnor Lake/Birch Narrows Dene Nation detachment, and NorGuard Security in Île-à-la-Crosse.

A total of two interviews were completed and took place with representatives from RCMP - Île-à-la-Crosse detachment on October 3rd, 2023, and NorGuard Security in Île-à-la-Crosse on November 3rd, 2023.

Interviewees noted that increased employment is good, but it can lead to increased crime rates, which can put a strain on community safety and security providers. More money in the community supports local economies but even with an increase to recreational activities, there is a greater demand on protective services. Any growth means more services are needed. The potential for increased employment to result in changes to demand for emergency services was assessed in Section 6.17.2.

With respect to current capacity levels, interviewees shared that there is currently not enough capacity in the RCMP to police the communities for the foreseeable future (five years was the timeframe provided). Despite being short staffed, it was noted that the RCMP are always prepared to respond to an increase in crime. They are willing and able to partner with other groups, such as provincial and community social services, schools, and mental health resources. Interviewees suggested that capacity concerns could be mitigated by supporting partnership opportunities between RCMP and other service groups.

Interviewees noted that negative effects to community wellbeing and safety were experienced after the closure of other mines in northern Saskatchewan and advised that a new mine must plan to be there for the communities when the mine closes to avoid negative impacts to local communities.

It is important to note that NorGuard Security was established by Sakitawak, the economic development arm of the Northern Village of Île-à-la-Crosse in 1995. Their primary focus is on mine site security and protection of mining site assets. They also provide security services at the Île-à-la-Crosse hospital. The interview was insightful as the interviewee shared similar observations as the RCMP representative with regard to increased crime in the community and a decline in RCMP staffing and capacity. However, NorGuard does not provide the same types of protective services as the RCMP so could not comment on potential mitigations to any concerns about the Project.

Information on existing conditions related to protective services was described in Section 4.7.1.

3.1.3.5 Open Lines of Communication

Fission has implemented tools to support open lines of communication with stakeholders to help them correspond with Fission in a timely fashion, should any questions or concerns arise.

In mid-2023, Fission opened an office in La Loche. The office is staffed by a Community Liaison Officer who is available to share information, answer questions, and meet directly with people in La Loche and the surrounding area.

Fission has invited all stakeholders to contact them by phone or email with questions or concerns. Contact information was provided in all presentations and information packages shared as part of engagement events. Contact information is also provided on the Fission website.

3.1.4 Future Engagement Plans

Fission will continue to maintain open lines of communication with municipal leaders and interested stakeholder organizations through email correspondence, which will include an invitation to meet in person when preferred by stakeholder or community.

Notice of economic opportunities will continue to be shared with municipal leadership and economic development arms to ensure that residents and companies from priority recruitment communities are aware of and can pursue opportunities as they arise.

Fission will develop a Public Information Program that includes a protocol for public disclosure of activities that could affect the health or safety of people and the environment. The program will demonstrate how Fission will establish and maintain an atmosphere of openness, transparency, and trust with potentially impacted groups.

Fission will continue to look for opportunities to present at local educational institutions to raise awareness about the employment opportunities that will be available, and the educational requirements associated with the available positions.

3.2 First Nation and Métis Consultation

The Project has been assessed by ENV as having the potential to adversely impact the exercise of established or credibly claimed Treaty and Aboriginal rights to hunt, fish, and trap for food and the carrying out of traditional uses on unoccupied Crown land or occupied Crown land to which First Nations and Métis have a right-of-access.

On December 13th, 2021, ENV provided notice to Fission that the Duty to Consult (DTC) had been triggered by the Project. To assist in fulfilling its DTC, the Province assigned Fission various procedural aspects of the consultation process for the Project, these procedural aspects include:

- Provide information to First Nations and Métis communities including, the nature of the proposed activities, potential environmental impacts, and short, medium, and long-term mitigation plans.
- Arrange mutually agreed upon meetings with First Nations and Métis elected leadership and/or their formally authorized designate to discuss consultations plans and appropriate budgets.
- Consult with First Nations and Métis communities to understand community's land and resource use in the Project area and the potential adverse impacts of the Project on the communities' ability to exercise their Treaty and Aboriginal rights to hunt, fish, and trap for food and to carry out traditional uses.
- Consider the information provided by the First Nations and Métis communities on how their community is using the Crown land in the proposed Project area for the exercise of rights and traditional uses.
- Work with the communities to determine reasonable accommodations to avoid, minimize, or mitigate potential adverse impacts on the First Nations and Métis people's ability to hunt, fish, and trap for food and carry out traditional uses.
- Provide a Consultation Report in the EIS.

The Ministry relied on Fission to consult with the following potentially affected First Nation and Métis communities in the development of their EIS:

- Clearwater River Dene Nation (CRDN);
- Birch Narrows Dene Nation (BNDN);
- Buffalo River Dene Nation (BRDN);
- La Loche Métis Local 39;
- Descharme Lake Métis Local 130;
- Turnor Lake Métis Local 40; and
- Athabasca Chipewyan First Nation (ACFN).

During engagement activities, it was determined that Descharme Lake Métis Local 130 is not currently active and consultation with this community through Local leadership was not possible. Upon further discussions, Fission was advised that the interests of the Locals would be represented by Métis Nation Saskatchewan Northern Region 2 (MN-S NR2) which is comprised of the Regional Director and the Presidents of all Locals in the region. MN-S NR2 Locals to be engaged by Fission include:

- La Loche Métis Local 39;
- Descharme Lake Métis Local 130 (when active);
- Turnor Lake Métis Local 40;
- Buffalo Narrows Local 62;
- St. Georges Hill Local 70;
- Garson Lake Local 127;
- Bear Creek Local 156; and
- Michel Village Local 65.

Fission was also advised that Métis Nation Saskatchewan (MN-S) was invited by MN-S NR2 to provide administrative, legal, and consultation support to the MN-S NR2 council with engagement activities.

In June 2024, ENV provided notice to Fission that Turnor Lake Métis Local 40 and La Loche Métis Local 39 had formally delegated their responsibility for the DTC to MN-S, and advised that all future consultation activities with Métis citizens should proceed through MN-S.

Additional First Nations groups who have traditional territories, lands, or land claims that overlap or are in close proximity to the development area were identified for voluntary engagement. These groups include:

- English River First Nation (ERFN);
- Ya' Thi Néné Lands and Resources Office (YNLR);
    - Black Lake Denesuline First Nation (BLDFN); and
    - Fond du Lac Denesuline First Nation (FLDFN).

Key information about each of the Indigenous Nations and communities engaged is provided in Appendix C.5 and Appendix B.2. The location of reserve lands and communities for each of the Nations and their proximity to the Project area is provided in Figure 4-44.

The CRDN, BNDN, BRDN, and ERFN are members of the MLTC. While Fission has engaged with the MLTC in the past, MLTC was not identified as an Indigenous group to be engaged because the member Nations listed above have elected to represent themselves in engagement activities with Fission going forward. Community-specific consultation information provided in the sections below detail efforts made by Fission to complete the

assigned procedural aspects of the consultation process. Voluntary engagement activities with Nations who were not identified by ENV in the letter delegating procedural aspects of the DTC are also discussed in this section.

3.2.1 Approach

Fission values the development and maintenance of long-term, constructive, and mutually beneficial relationships with affected Indigenous Nations based on principles of respect, honesty, integrity, and transparency. Creating a meaningful and partnered approach to engagement with the affected Indigenous Nations is a key component of the Project and has been since the planning and exploration phases started in 2013.

Fission's engagement approach has been informed by relevant regulatory guidance, specifically the Government of Saskatchewan's Guidelines for the Terms of Reference and Environmental Impact Statement (2021), Canadian Nuclear Safety Commission (CNSC) REGDOC-3.2.2 Indigenous Engagement (REGDOC 3.2.2, 2022), and the Government of Saskatchewan's Proponents Guide: Consultation with First Nations and Métis in Saskatchewan Environmental Impact Assessment (2014). Fission's engagement approach was designed by incorporating best practices from across Canada and internationally, and formatting those in a way that exceeds regulatory requirements and aligns with community expectations. Community expectations were identified through a collaborative approach to engagement planning where Fission shared a list of the EIA decisions that could be informed by input from potentially affected Nations, and each Nation prepared a workplan and budget detailing the engagement activities best suited to their members or citizens that could be used to collect feedback to inform the EIA.

The key decisions or groups of decisions identified as the focus of engagement activities included:

- Project scoping decisions including selection and refinement of VCs, key indicators, measurable parameters, and potential effect pathways.
- Identification or confirmation of existing environment conditions.
- Evaluation of effects and refinement of mitigation measures.

Some Nations chose to provide input on all EIA decisions, and others provided input on select decisions. Approved workplans and budgets were included as part of overarching engagement agreements. The following engagement agreements were established to inform EIA decisions:

- CRDN – Engagement and Capacity Agreement (March 2021);
- BRDN – Engagement & Communication Agreement (July 2022);
- BNDN – Engagement & Capacity Agreement (November 2022);
- MN-S – Capacity Funding Agreement (December 2022);
- YNLR on behalf of BLDFN and FLDFN – Capacity & Funding Agreement (June 2022); and
- ACFN – Agreement for ACFN Technical Review (October 2022) and Amendment Agreement to Capacity Funding Agreement (May 2024).

Each agreement and workplan was unique but generally included the details of how each Nation would like to receive, share, and validate information, preferred engagement activities, opportunities to build capacity in communities, and how funding will be allocated to the Nation to support the engagement activities identified.

Additional details about the engagement approach and specific engagement activities conducted in collaboration with each Nation are provided in Appendix B.2.

3.2.2 Project Information Shared

Between 2021 and the end of 2024, Fission recorded over 350 interactions with Indigenous Nations about the Project. Project information was shared at each phase of the EIA process to ensure that Nations had sufficient information and detail about the Project to provide meaningful input into key decisions associated with each phase. Detailed Indigenous engagement logs are included in Appendix B.2. A summary of the key Project information shared to inform the EIA during each phase, the decisions it was meant to inform, the mediums used to share information, and list of Nations who received the information are provided below.

3.1.3.6 Project Introduction

The Project Overview Brochure was shared at CRDN and BRDN Treaty Days events in June 2022 and included information about Fission as a company, the Project, the engagement process to date, and unique local benefits of the Project. Information from this brochure was also featured in an overview article posted to the CRDN App in 2022, which is accessible to CRDN members. A similar presentation called Project Introduction Presentation was delivered to ACFN in October 2022, and one called Project Overview Presentation – November 2022 was shared with BNDN in November 2022, which included introductory Project information.

A Project introduction package was prepared to facilitate information sharing at community meetings which took place in April 2023. The package was shared with leadership and members from BRDN and BNDN in April 2023, and included a presentation, information booklet, poster boards, tabletop maps, and video. The package was also shared digitally with CRDN (June 2023) and MN-S NR2 (June 2023).

The presentation shared as part of the Project introduction package was named "Patterson Lake South Project Introduction Presentation – Spring 2023" and included a summary of key Project facts, location, site layout and infrastructure, employment opportunities, Project schedule, regulatory approvals, and contact information.

The booklet was called "Patterson Lake South Information Package– Spring 2023" and included the same information as the presentation, plus information about Fission as a company, the community investment program, the EIA process, and VCs proposed for consideration in the EIA.

The poster boards did not have a public facing title but are referred to as "Project Introduction Poster Boards" in the logs. These were developed using information from the booklet above and touched on the EIA process and VCs, an overview of Fission as a company, the community investment program, employment opportunities and educational attainment requirements, Project location, layout, infrastructure, and schedule.

The tabletop maps also did not have public facing titles but are referred to as "Site Layout Satellite Imagery – April 2023" and "Site Layout No Background – April 2023" in the logs (Appendix B.2). As the titles suggest, one map displayed the proposed site layout overlaying satellite imagery and the other displayed the site layout without satellite imagery.

The video shared is called "Fission Uranium PLS Project Animation". The animation was accessible on the Fission website until January 2025 and provided a 3-dimensional view of the construction process and timeline for development of proposed surface and underground infrastructure.

Project Shapefiles were shared with YNLR in January 2022 and with ACFN in January 2023.

It is also noted that because engagement started at different time periods with different Nations, some Nations who were engaged prior to initiation of the EIS in early 2022 may

have received several rounds and iterations of introductory information that reflected the Project design plans and information available at the time. Nations who were engaged prior to 2022 may have informed their input and comments based on their knowledge of all the current and historical Project information available to them.

3.1.3.7 Project Updates

Between the initial Project introductory phase and the preparation of the Preliminary Effects Assessment Results (discussed below), several Project updates were provided to the Nations during small group meetings or through email. Project update presentations and materials shared with Indigenous Nations between 2021 and 2023 are discussed below.

In May 2021, a Project Update Presentation was shared with YNLR. The November 2021 Project Update Presentation was shared with BRDN in November 2021, YNLR in January 2022, and ACFN in March 2022. A Project Update Presentation was also shared with CRDN in July 2022. All versions of the Project Update Presentation included information on Project location, the surface infrastructure plan, schedule, and contact information.

Project Update Presentation – September 2022 was shared with BRDN at a site visit in September 2022.

Project Update October 2022 was shared with ACFN at a meeting in October 2022 and includes information about key Project facts, proposed surface infrastructure plan, progress to date, timelines, licencing and approvals processes and schedule, and contact information.

Project Update May 2023 shared with MN-S NR2 leadership included key Project facts, location, proposed site layout and infrastructure, employment opportunities, Project progress to date, regulatory approvals, federal and provincial licencing and assessment process, Project schedule, EIA development process, engagement on the EIA, and contact information.

Initial Receptor Location maps showing the receptor locations used in the Rook I Project EIS were sent to BRDN, BNDN, CRDN, and MN-S NR2 in May 2023 to seek input on selection of receptor locations for the Project.

3.1.3.8 Preliminary Effects Assessment Results

The Preliminary Effects Assessment Results Package combined information from the PLS Project Introduction Package, with preliminary results of the effects assessment. The

package was used to guide conversations about the preliminary effects assessment with leadership and community members between December 2023 and May 2024. The package included a PowerPoint presentation ("PLS Project Update Winter 2024"), information booklet, print versions of poster boards, and tabletop maps.

The "PLS Project Update Winter 2024" presentation included information about Fission, their commitment to invest in northern communities, key facts about the Project, location, Project benefits, employment opportunities, site layout and infrastructure, overview of Project activities, schedule, regulatory approvals, EIA process and progress, refined list of VCs assessed and overview of key preliminary results of effects to each VC, and Fission's contact information.

The booklet was called "Patterson Lake South Information Package Winter 2024" and included corporate information about Fission, Project benefits, location, site study area (SSA) and Potential Disturbance Area (PDA), site layout and infrastructure, key project activities, employment information, regulatory approvals, EIA, refined list of VCs, preliminary residual effects summaries for each VC, and contact information. A digital copy of the booklet was also provided to CRDN leadership in January 2024.

The poster boards did not have a public facing title but are referred to as "Preliminary Effects Poster Boards" in Appendix B.2, and included information about the Project location, schedule, key facts about mining uranium, site layout and infrastructure, the EIA process and refined list of VCs assessed, preliminary residual effects results for each VC.

Tabletop maps also did not have a public facing title but are labelled in the Appendix B.2 according to their contents as "Q1 2024 Site Map", "Q1 2024 SSA and PDA", and "Q1 2024 Aquatic Study Areas".

A complete communication log is included in Appendix B.2 and details the dates, attendees, purpose, information shared, issues raised, and how issues were addressed by Fission for each key engagement event that took place between Fission and Indigenous Nations from January 2021 to December 2024.

3.1.3.9 Draft Environmental Impact Statement

A copy of the March 2024 version of the draft EIS was provided to CRDN, BRDN, BNDN, MN-S, YNLR, and ACFN for technical review and comments in March 2024. Due to the large file size of the documents, the engagement team for each Nation was provided with

a link to a SharePoint folder where the documents were stored and could be downloaded. For the most part, the Indigenous Nations and ENV received the same draft EIS documents to review in March 2024. The only exception is in Appendix B.2 Consultation Report where each Nation received a copy of the Consultation Report section specific to their Nation for their review and comment instead of the version with information about all Nations.

3.2.3 Traditional Knowledge Collected

Traditional knowledge and land and resource use information was collected from CRDN, BRDN, BNDN, MN-S, YNLR, and AFCN between 2021 and 2024. The information collected by each Nation and shared with Fission was used to inform Fission's understanding of the existing environment (Section 4), VCs and potential effect pathways (Section 5), the potential for effects to occur, key land use locations or environmental features of interest (receptor locations) to use for predictive modelling, evaluation of the predicted effects, and potential mitigation options to reduce impacts. An overview of the information collected and the format in which it was received, is discussed in this section specific to each Nation. A short summary of key traditional use information is provided at the end of the section with detailed use information provided in Section 4.7 and Appendix B.2.

CRDN shared traditional knowledge and use information through several engagement activities. In 2021, CRDN provided an overview of their Indigenous Rights which also described land and resource uses across their traditional territory. In 2021, CRDN conducted a community survey in which 41 CRDN members participated. The survey informed CRDN that the community is reliant on the land for food, culture, and well-being as well as an interest in learning more about the Project. Local land users shared land use information including cabin locations while visiting the Fission booth at Treaty Days in June 2022. Finally in September 2023, a draft Socio-economic and Harvest Study – Clearwater River Dene Nation was provided to Fission by CRDN which detailed current or recent socio-economic conditions related to population, land use and harvesting, education levels, health services, workforce characteristics, and overall community infrastructure. Potential effects were identified as part of the study, recommendations, and mitigation measures were suggested for Fission's consideration. CRDN conducted, analyzed, and presented results from 31 CRDN member interviews and included types and quantity of traditional foods consumed, importance of being on the land and barriers that prevent land use. The 2023 study also provided Fission with an updated traditional

knowledge and land use map. CRDN was invited to complete a technical review of the March 2024 draft EIS and to provide Fission with comments. Fission was provided with comments on Appendix B.2 Consultation Report in March 2025 and changes were made to the document as a result of the advice received.

BRDN shared traditional knowledge and land and resource use information through numerous mediums. BRDN leadership shared traditional knowledge and land and resource use experiences with Fission during small group meetings which took place between 2022 and 2024. BRDN members worked with Fission's consultants to conduct environmental baseline studies in 2022. Any knowledge shared by BRDN members during surveys was recorded in the field notes and validated by the knowledge holder. BRDN members participated in two site tours at the Project exploration site where some traditional knowledge and use information was shared with Fission. Traditional use information was also shared with Fission representatives by BRDN members who visited the Fission tent at Treaty Days events in June 2022 and June 2023. Knowledge was also shared during community meetings in April 2023 and January 2024. The majority of traditional knowledge and land and resource use shared with Fission was included in the Buffalo River Dene Nation Knowledge and Use Study which was prepared for Fission's use in September 2023. This community-led study was developed using a combination of desktop research and first-person mapping interviews with 12 BRDN land users and included information related to land and resource use, harvesting practices, current barriers to use, and socio-economic impacts to BRDN communities. The 2023 study also identified a set of values related to hunting and trapping, water and fishing, and cultural continuity along with a summary of BRDN land use values near the Project area. Comments and guidance to improve integration and use of BRDN knowledge and information in the EIS were provided to Fission by BRDN during technical review of the draft EIS. The final EIS was updated to reflect the requested changes where possible.

BNDN leadership shared traditional knowledge and land and resource use information during small group meetings between 2022 and 2024. In 2021, BNDN leadership shared an overview of traditional uses in the Patterson Lake area in a letter detailing their review of the draft Project Description. BNDN members also participated in the environmental baseline studies described above and shared their knowledge during community meetings in April 2023 and January 2024. BNDN completed an Indigenous Knowledge and Occupancy Study and provided a summary of the report to Fission to inform the EIS in May 2024. This community-led study included an interview program and mapping exercise with 25 BNDN members. The study identified key points and observations related to

harvesting and fishing, Indigenous ecological knowledge, culture and occupancy, cumulative effects, and concerns related to the Project and community hopes. The 2024 study also provided Fission with a map of Indigenous knowledge, land use, and occupancy sites within the Project area. Comments and guidance on integration and use of BNDN knowledge and information in the EIS was provided to Fission by BNDN during technical review of the draft EIS. The EIS was updated to include BNDN information with consideration of the guidance provided.

MN-S NR2 shared traditional knowledge and land and resource use information in the draft Métis Knowledge Study Report (MKS) which was submitted to Fission in December 2023. The MKS was prepared through a review of historical studies and available literature and through first-person interviews with MKS advisors from the following Locals:

- La Loche Métis Local 39;
- Bear Creek Métis Local 156;
- Turnor Lake Métis Local 40; and
- Buffalo Narrows Métis Local 62.

The MKS conducted, analyzed, and presented results from 20 land use interviews and included a mapping exercise to identify ecological knowledge features, culturally significant areas, heritage sites, harvesting sites, commercial harvesting sites, and occupancy sites. In addition to land and resource use information, the MKS also shared Métis input on socio-cultural VCs including economic wellbeing and community wellbeing and human health. Potential effect pathways were identified, and suggestions were provided for mitigation or benefit enhancement measures. Comments to improve integration and use of Métis recommendations in the EIS were provided to Fission by MN-S NR2 during technical review of the draft EIS. The recommendations provided focused primarily on accommodation requests and future Métis involvement, which will be discussed as part of ongoing engagement efforts between Fission and MN-S.

YNLR submitted the Fission Patterson Lake South Engagement Agreement: Summary Report (2022-23) to Fission on May 26th, 2023. The study report was a community-led study completed by YNLR. The study report included high level information about land uses and Project-related concerns collected through interviews with 18 Athabasca community members. Detailed information about land and resource use and harvesting in the Patterson Lake area was not included in the study report. YNLR provided information about Project-concerns and key interests as part of the technical review of the draft EIS. In

the draft EIS technical review, YNLR identified woodland caribou, fish, and water quality as highly valued by the Athabasca Denesułiné.

ACFN conducted a desktop level screening of traditional land uses in the Fission Project area; however, did not provide detailed information about traditional land and resource uses that ACFN members engage in, or the locations of any geographically fixed features or areas of cultural importance. ACFN provided information about Project-concerns and key interests as part of the technical review of the draft EIS; however, did not provide Indigenous knowledge or land and resource use information. In May 2024, a letter was provided to Fission by ACFN legal counsel which described ways that the Project was anticipated to impact ACFN rights. Information from this letter was used to inform the updated EIS.

Key traditional use information shared by each Nation is described in detail in Section 4.7 and Appendix B.2. In general, traditional land and resource users who were interviewed in community-led studies identified hunting, trapping, fishing, gathering of plants and medicines, ground and water transportation routes, cabins, camping sites, and traditional camps as uses that take place in the Patterson Lake area. Transmission of intergenerational knowledge was emphasized as an activity that occurs in the Patterson Lake area alongside traditional land and resource use activities and is a critical component of cultural continuity.

3.2.4 Future Engagement Plans

Fission has continued engagement activities with each interested Nation and is in the process of working with all identified Nations to formalize how they would like to be engaged and involved in the Project going forward.

In January 2025, Fission and BRDN signed a Mutual Benefits Agreement (MBA) which lays out mechanisms and high-level schedules for ongoing engagement on the Project for the life of the mine. In February 2025, Fission and CRDN signed a MBA that also lays out mechanisms and schedules specific to how CRDN would like to be engaged and involved for the life of the Project. Fission has invited BRDN and CRDN for a site tour in the summer of 2025, and has requested approval to host a community meeting in each Nation, also proposed for summer 2025. Due to recent or upcoming elections, no firm dates for these events have been set yet.

Fission is actively engaged in ongoing discussions with BNDN and MN-S in an effort to establish benefit agreements unique to each Nation. Establishing a communication and information sharing protocol and high-level schedule for engagement will be a component of each agreement. Both Nations have agreed to allow Fission to host community meetings in their communities in June 2025. These meetings are still in the planning stages. Dates for tours of the PLS site are still under discussion and have not yet been finalized.

Discussions are also ongoing with YNLR and ACFN to establish engagement capacity agreements, or similar, to enable engagement, involvement, and information sharing with these Nations for the life of the Project.

In March 2025, Fission reached out to ERFN by email to provide a brief Project overview and an invitation to meet to discuss the Project in detail. To date, a response has not been received and Fission will attempt alternative methods of outreach.

Through the engagement process, several commitments were made to Indigenous Nations to provide the opportunity for the Nations to review the following documents once they are developed:

- Heritage Resource Management Plan including a Chance Finds Procedure;
- Human Resource Development Plans;
- Travel and Traffic Management Plan;
- Public Information Program;
- Woodland Caribou Mitigation Plan; and
- Environmental Management Plan.

Fission also committed in the EIS to include Indigenous Nations in the design and data collection aspects of monitoring programs including the Traditional Foods Study and Regional Social Monitoring Program.

Fission has initiated the CNSC licensing process and is currently in the process of developing the documentation required for that process. All of the Indigenous groups engaged to inform the EIS were also identified as having a potential interest in being consulted on the CNSC licensing process.

3.3 Literature Cited

ENV (Saskatchewan Ministry of Environment). 2021. Guidelines for the terms of reference and environmental impact statement. Prepared by the Environmental Assessment and Stewardship Branch, Ministry of Environment, November.

Statistics Canada. 2023. Census profile. 2021 Census of population. Statistics Canada catalogue no. 98-316-X2021001. Released March 29, 2023. Ottawa. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed June 1, 2023).BRDN Int. Health, 2023. 2023. Fission 2023 Interview program - Health care professionals.

Table 3-1
Concordance table – engagement.

EIS Requirement	Section and Page #
Interest-Based Engagement	
d) Dates, locations, and attendance numbers for all engagement events	Interest-Based Engagement (3.1), 3-1
e) Concerns raised at each event, the immediate response by the proponent (if applicable) and the measures proponents propose to address the concerns	Interest-Based Engagement (3.1), 3-1
f) Indication, throughout the EIS, of how local knowledge was used to assess impacts and develop mitigation	Interest-Based Engagement (3.1), 3-1
g) Identification of stakeholders, interested persons or organizations that wish to be notified direction for the formal 30-day public review period	Interest-Based Engagement (3.1), 3-1
h) Plans for future engagement activities	Interest-Based Engagement (3.1), 3-1
i) A complete communication log including dates, places, participants, nature of communication (e.g., email, meeting, phone call), key topics addressed and outcomes	Interest-Based Engagement (3.1), 3-1
First Nations and Métis Consultation Plan	
c) Summarize the following information in this section of the EIS: • how information about the development was effectively communicated to communities • how traditional knowledge was collected during the EIA • key traditional use information gathered from First Nations and Métis communities • a complete communication log including dates, places, participants, nature of communication (e.g., email, meeting, phone call), key topics addressed and outcomes • plants for future engagement activities for the life of the development	First Nation and Métis Consultation (3.2), 3-20
d) The above information should be further analyzed in detail in the "Effects on First Nation and Métis Communities – Consultation Report"	Appendix B.2

Table 3-1
Concordance table – engagement.

EIS Requirement	Section and Page #
Consultation Report – Effects on First Nation and Métis Communities	
c) Dates, locations, and attendance numbers for all engagement events	Appendix B.2
d) Concerns raised at each event, the immediate response to the proponent (if applicable) and the measures proponents propose to address the concerns	Appendix B.2
e) Indication, through the EIS, of how local knowledge was used to assess impacts and develop mitigation	Appendix B.2
f) Identification of stakeholders, interested persons or organizations that wish to be notified directly for the formal 30-day public review period	Appendix B.2
g) Plans for future engagement activities	Appendix B.2
h) Complete communication log including dates, places, participants, nature of communication (e.g., email, meeting, phone call), key topics addressed and outcomes	Appendix B.2
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Section 3 Engagement throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (3.3), 3-32
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 3 Engagement throughout

SECTION 4

EXISTING ENVIRONMENT

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LIST OF ACRONYMS

2SLGBTQIA+	Two-Spirit, Lesbian, Gay, Bisexual, Transgender, Queer and/or Questioning, Intersex, Asexual, Plus
AAQC	Ambient Air Quality Criteria
ABA	Acid Base Accounting
ACFN	Athabasca Chipewyan First Nation
AHA	Athabasca Health Authority
ARD	Acid Rock Drainage
ARU	Autonomous Recording Units
ASA	Aquatic Study Area
BACI	Before-After-Control-Impact
BGC	BGC Engineering Inc.
BLDFN	Black Lake Denesuline First Nation
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
BRS	Beaver River Sandstone
CAA	Canadian Automobile Association
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
Clifton	Clifton Engineering Group Inc.
COPC	Constituents of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch Per Unit Effort
CRDN	Clearwater River Dene Nation
DO	Dissolved Oxygen
ECCC	Environment and Climate Change Canada
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM	Electromagnetic
ENV	Saskatchewan Ministry of Environment
FDLDFN	Fond du Lac Denesuline First Nation
FEQG	Federal Environmental Quality Guidelines
FIFO	Fly-in/Fly-out
Fission	Fission Uranium Corp.
GGR	Gregorie
GS	Government of Saskatchewan
HCB	Saskatchewan Heritage Conservation Branch
HRIA	Heritage Resource Impact Assessments

HS	Habitat Section
HSU	Hydrostratigraphic Unit
HVAS	High-Volume Air Sampler
IBA	Important Bird Areas
IKLUOS	Indigenous Knowledge, Land Use and Occupancy Study
ISQG	Interim Sediment Quality Guideline
LEL	Lowest Effect Level
Leq	Equivalent Continuous Sound Level
LSA	Local Study Area
masl	Metres Above Sea Level
MBCA	*Migratory Birds Convention Act*
MECP	Ontario Ministry of the Environment, Conservation and Parks
MIL	Mildred
MKS	Métis Knowledge Study
ML	Metal Leaching
MLTC	Meadow Lake Tribal Council
MN-S	Métis Nation Saskatchewan
MN-S NR2	Métis Nation Saskatchewan Northern Region 2
MSZ	Main Shear Zone
NE2	No-effect Values
NI	National Instrument
NNADAP	National Native Alcohol and Drug Abuse Program
NO_2	Nitrogen Dioxide
NSAD	Northern Saskatchewan Administration District
NTU	Nephelometric Turbidity Units
PAG	Potentially Acid Generating
PAGC	Prince Albert Grand Council
PDA	Potential Disturbance Area
PEL	Probable Effect Level
PIMA	Portable Infrared Mineral Analyzer
PLc	Patterson Lake corridor
PLS	Patterson Lake South
the Project	The PLS Project
PSP	Permanent Sampling Plot
QA/QC	Quality Assurance/Quality Control
QFBG-GN	Quartz-Feldspar-Biotite-Garnet Gneiss
RCMP	Royal Canadian Mounted Police
RDL	Reportable Detection Limit
REF	Reference Values
RQD	Rock Quality Designation

RSA	Regional Study Area
SAAQS	Saskatchewan Ambient Air Quality Standards
SAR	Species at Risk
SARA	*Species at Risk Act*
SEQG	Saskatchewan Environmental Quality Guidelines
SGI	Saskatchewan Government Insurance
SHA	Saskatchewan Health Authority
SKCDC	Saskatchewan Conservation Data Center
SO_2	Sulphur Dioxide
SOCC	Species of Conservation Concern
SPM	Suspended Particulate Matter
SPSA	Saskatchewan Public Safety Agency
SRC	Saskatchewan Research Council
SQV	Sediment Quality Values
SSA	Site Study Area
STZ	Snowbird Tectonic Zone
TIA	Transportation Impact Assessment
TLSA	Terrestrial Local Study Area
TLU	Traditional Land Use
TMF	Tailings Management Facility
TOC	Total Organic Carbon
TOR	Terms of Reference
TRSA	Terrestrial Regional Study Area
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
VC	Valued Component
VLSA	Vegetation Local Study Area
VRSA	Vegetation Regional Study Area
VWP	Vibrating Wire Piezometers
WCSB	Western Canadian Sedimentary Basin
WLSA	Wildlife Local Study Area
WMZ	Wildlife Management Zone
WRA	Whole Rock Analysis
WRSA	Wildlife Regional Study Area
WSC	Water Survey of Canada
XRD	X-Ray Diffraction
YNLR	Ya’ thi Néné Land and Resource Office

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4.0 EXISTING ENVIRONMENT

4.1 Introduction

Characterization of the existing environment surrounding the PLS Project (the Project) forms the basis for assessing the potential influence the Project may have on Valued Components (VCs). Baseline data were used in this Environmental Impact Statement (EIS) to aid in selecting VCs, to provide information for modelling potential changes to the environment, to support the effects assessment, Project design, and mitigation planning, and to aid in the design of future monitoring programs and management plans. Baseline studies were conducted between 2013 and 2023 to characterize existing conditions near to the Project as well as to establish temporal and spatial variation in the local and regional study areas. Most of the information presented herein was collected during baseline programs conducted between 2018 and 2023 to provide recent information, but longer data sets are necessary for certain study components. In addition to site specific field studies, existing information was used where relevant, and databases were accessed to identify known occurrences of Species of Conservation Concern (SOCC). As requested in Saskatchewan Ministry of Environment (ENV), raw data supporting conclusions in the EIS will be made available to the Ministry, should it be requested (ENV 2021a).

Baseline study areas varied by component and are described in the sections below with additional context of how they fit within the spatial boundaries of the effects assessment. The Site Study Area (SSA) and Potential Disturbance Area (PDA) delineated for this Environmental Impact Assessment (EIA) were applied to all VCs. The SSA includes the currently planned locations of site facilities and infrastructure surrounded by a 50 m buffer to allow for small variances as the Project design moves forward. The PDA includes a larger area surrounding the SSA that was assessed to provide flexibility and account for potential expansion of facilities or other design changes that may occur and are currently not foreseen. This conservative approach was undertaken to ensure effects are not underestimated and to encompass potential uncertainties as Project design progresses. Local Study Areas (LSA) and Regional Study Areas (RSA) varied between study components and sometimes differed between the effects assessment (refer to Section 6) and baseline studies. The sections below discuss the data collected in the study areas utilized for the baseline investigations and the information is discussed in the context of the study areas delineated for this EIA where possible.

The objective of this existing environment section is to provide summary information on components and study areas relevant to the effects assessment. Detailed baseline data are provided in Appendices C.1 to C.5 depending on the study component (specific references are provided in the relevant subsections below). The concordance table for components for the EIS from the ENV guidelines for the Terms of Reference (TOR) and EIS (ENV 2021a) for the existing environment description is provided in Table 4-1.

4.2 Atmospheric and Acoustic Environment

Baseline investigations of the atmospheric environment began in 2014 with meteorological data collection. Air quality, external gamma and radon, as well as noise data collection began in 2018 and continued through 2022. The locations of the sampling stations in relation to the SSA and PDA are illustrated in Figure 4-1. The following sections provide summary information to characterize the atmospheric and acoustic environment; comprehensive atmospheric and acoustic data are provided in Appendix C.1.

4.2.1 Climate

In August of 2014, a continuously monitoring meteorological station was installed at the Project site (Figure 4-1). Meteorological sensors that continuously monitor temperature, precipitation, relative humidity, wind speed and direction, solar radiation, and barometric pressure were installed at this station. The most recent data collected from the station was from the fall of 2022. The information collected at this station was compared to the regional climatic information collected by Environment and Climate Change Canada (ECCC) between 1981 to 2010 at the climate station in Cluff Lake, Saskatchewan, located approximately 125 km to the north of the Project area, as well as from a climate station at Cree Lake (for additional wind data from 1971 to 2000), located 125 km to the east (ECCC 2023). The most recent climate information collected at the site was presented in the PLS 2021/2022 Environmental Baseline report (Appendix C.4). Summary data from 2014 to 2022 are presented in Table 4-2.

4.2.1.1 Temperature

Local average daily temperatures were typically below freezing from November to April in each year. Mean daily temperatures recorded at the station ranged from -19.6°C in February to 16.4°C in July across the baseline monitoring period (Table 4-2). Daily mean temperatures were similar to the regional climate normals at the Cluff Lake station between 1981 to 2010 (ECCC 2023); however, extreme maximum and minimum temperatures

recorded during the baseline monitoring period in the Project area (39°C and -40.2°C, respectively), were higher than the regional climate normals calculated for the Cluff Lake site between the 1981 and 2010 period (36°C to -49.0°C, respectively).

4.2.1.2 Precipitation

The average annual precipitation based on data collected locally within the Project area from 2014 to 2022[1] was 357.0 mm with June receiving the highest average monthly amount (54.9 mm) and January receiving the lowest (16.9 mm) (Table 4-2). This value is lower than the regional climate norms for the area due to issues with the precipitation gauge on site. Average annual precipitation recorded at the Cluff Lake site between 1981 and 2010 was 451.1 mm.

Between 2014 and 2022, the month with the highest amount of precipitation recorded locally was June 2016 (97.8 mm), while the day with the highest amount of precipitation being recorded was August 9th, 2022 (39.9 mm) (Appendix C.4). An extreme daily rainfall of 62.2 mm on July 7th, 1981 was recorded at the Cluff Lake station (ECCC 2023).

4.2.1.3 Wind Direction and Wind Speed

Average monthly local wind speeds ranged from 7.1 km/h in the west-northwest direction (December) to 10.2 km/h in the northwest direction (October) between 2014 to 2022 (Table 4-2). Regional data collected from the Cree Lake station between 1971 to 2000 ranged from 9.4 km/hr in the west direction (December) to 12.9 km/hr in the southwest direction (October; ECCC 2023).

Wind rose diagrams show the magnitude of the directional frequency and wind speed values, increasing outward from the centre of the plots, with values corresponding to 16 different cardinal directions. Between 2014 and 2022, the prevailing wind direction was from the northwest and the average wind speed from the northwest direction was approximately 14.2 km/h (Figure 4-2).

[1] Due to equipment issues throughout the monitoring period, multiple data points were removed; therefore, data sets for some years are incomplete and the average annual precipitation data reported in the Project area is less than the actual precipitation (Appendix C.4).

4.2.2 Air Quality

Ambient air quality monitoring was conducted in the Project area over the course of 12 campaigns, starting in 2018. This information is summarized in the PLS Project Baseline Air Quality Monitoring Report (Appendix C.1). Air quality monitoring included measuring concentrations of suspended particulate matter (SPM; PM_{10} and $PM_{2.5}$), settleable particulate matter (or dustfall), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2). The field surveys and sampling methodologies were conducted in accordance with numerous guidance documents (ENV 2012; ASTM 2004). Preferred monitoring locations were chosen based on aerial photography and the potential Project site layout at the time of the baseline program (Figure 4-1). As noted in Appendix C.1, there were Quality Assurance/Quality Control (QA/QC) issues throughout 2018, 2019, and 2022 that may affect the results below.

4.2.2.1 Particulates

Suspended particulate matter data collected at two stations located east and west of the site (AQM-W and AQM-E) in 2018 and 2019, and at one central station (high-volume air sampler; HVAS) in 2022 indicate baseline levels are generally below the criteria set by the Saskatchewan Ambient Air Quality Standards (SAAQS) and the Canadian Ambient Air Quality Standards (CAAQS) (ENV 2012; CCME 2012). The average total suspended particulate (TSP) concentrations were 13.9 $\mu g/m^3$ at AQM-E, 14.4 $\mu g/m^3$ at AQM-W, and 23.3 $\mu g/m^3$ at the central HVAS station, which are below the 24-hour and annual criteria of 100 $\mu g/m^3$ and 60 $\mu g/m^3$, respectively.

The central station could sample a higher particulate loading (due to a higher sampler flow rate); thus, it was possible to complete a metals analysis on the collected samples. As there are no federal or provincial criteria for metals in ambient air, ambient air quality criteria (AAQC) were adopted from the Ontario Ministry of the Environment Conservation and Parks (MECP) for use in assessing the measured concentrations (MECP 2019). Of the 29 metals included in the analysis, 8 were considered constituents of potential concern (COPC) for the air quality effects assessment (refer to Appendix D.1). The metals considered COPC included arsenic, cadmium, cobalt, copper, lead, nickel, selenium, and uranium. All metal COPC remained below the AAQC in 2022 (Table 4-4).

The mean concentrations of settleable particulates measured at four stations located north, south, east, and west of the Project (AQM-N, AQM-S, AQM-E, and AQM-W; Figure 4-1)

from 2018 to 2022 were below the ENV Monitoring Guideline of 2 mg/cm^2/30-days (ENV 2012), with deposition rates ranging from 0.16 to 0.22 mg/cm^2/30-days (Table 4-5).

4.2.2.2 Gases

The NO_2 and SO_2 data collected from passive samplers situated at stations AQM-N, AQM-S, AQM-E, and AQM-W (Figure 4-1) ranged from averages of 0.15 ppb to 0.24 ppb and 0.20 ppb to 0.27 ppb, respectively. These concentrations were well below the applicable criteria, as to be expected for a remote, natural setting (Table 4-6).

4.2.3 External Gamma and Radon

Although external gamma and radon are not included in either the SAAQS or CAAQS, the nature of the operation (i.e., uranium mining) at the Project warrants baseline monitoring to establish existing environment conditions and to track levels as the Project moves through its life cycle. External gamma was measured at two stations, in gross gamma exposure, normalized to a daily and monthly dose, using gamma dosimeters over five rounds during 2018 and 2019 in three-month to one-year periods. Radon measurements were collected over six rounds during 2018, 2019, and 2022 at six locations in the SSA/PDA (future exposure areas) and six locations throughout the region (future references areas) (Figure 4-1).

For external gamma, the daily and monthly doses were similar across the various campaigns, with average daily exposures of 2.28 ± 0.47 µSv and average monthly doses of 70.8 ± 14.4 µSv (Table 4-7).

For radon, most of the samples collected were non-detectable. Only three samples had detectable radon levels, which were collected at locations RAD1 (reference), RAD7 (exposure), and RAD8 (exposure) (Figure 4-1). The detectable weighted averages of radon concentrations at these locations were 12.5 Bq/m^3, 25.6 Bq/m^3, and 13.6 Bq/m^3, respectively (Table 4-8). These fall within the normal range of background concentrations of radon (<7.4 Bq/m^3 and 25.0 Bq/m$^{3)}$ found throughout northern Saskatchewan (CNSC 2018).

4.2.4 Noise

The baseline noise assessment focused on determining the existing sound environment in close vicinity to the Project and in the surrounding region (Figure 4-1). Prior to completing the noise assessment, it was determined that there was one sensitive receptor (Forrest Lake

Outfitters) in the Project area and as such, the noise assessment included a location near their main outfitting lodge (Station Noise 3). The noise study was completed seasonally in 2018 (May, August, and October) and this information is summarized in Appendix C.3.

Average sound levels recorded at the three stations throughout the monitoring period ranged from 29.4 dBA to 54.9 dBA (Table 4-9). These upper and lower Equivalent Continuous Sound Level (Leq) values were measured at Station Noise 1, which was located at the Project site. Noise levels were generally highest during the summer monitoring period. This is likely due to the increased activity in the Project area (people working around core camp [Station Noise 1] and people visiting the fishing lodge [Station Noise 3]) during the summer months (Table 4-9). The sound levels recorded in the Project area and region are typical of baseline environmental noise recorded in other areas (ERCB 2007). Noise levels of 40 dBA to 50 dBA are commonly cited as values observed for streams, bird calls, and wind rustling through trees (Acoustical Solutions 2012).

4.2.5 Visual

The baseline visual assessment aimed to determine the area in which the development may be visible, the different user groups who may experience views of the development, the places where they will most likely be affected, and the nature of the views and visual amenity at these points (viewpoints). As there are no permanent settlements or communities located near the Project, community engagement activities were used to inform the visual baseline assessment, focused on determining locations/areas of recreational and cultural importance and traditional land use (TLU) areas (BRDN 2023a; CRDN 2023; MN-S NR2 2023). Eight viewpoints were selected, and a photographic inventory of these preliminary viewpoints was completed in October 2023 to document their existing visual character (Appendix D.3). Views at the viewpoint locations included Highway 955 surrounded by jack pine (*Pinus banksiana*) forest; views of a dirt road looking northeast towards the proposed Tailings Management Facility (TMF); and views from Patterson Lake showing the shoreline and views of the SSA, showing a traditional use/recreational use route looking towards the SSA, and from the boat launch on the south shore of Patterson Lake towards the SSA.

4.3 Geology and Geochemistry

4.3.1 Regional Geology

Northern Saskatchewan has been subject to multiple glaciation events, and the present-day landscape and glacial deposits are predominantly the result of Late Wisconsin glaciation (Campbell 2005). Wisconsin glaciation has imparted a strongly defined northeast-southwest orientation to most of the landforms around the Project.

The major sedimentary basins and cratonic elements of northern Saskatchewan consist of the Western Canadian Sedimentary Basin (WCSB), Athabasca Basin, Hearne Province, and the Rae Province (Figure 4-3).

The WCSB is the second largest intracratonic basin in the world, covering over 1.4 million km^2 of western Canada, including a significant portion of northwest Saskatchewan (MacKay and Pedersen 2022). The WCSB forms a wedge of undeformed Phanerozoic sedimentary strata lying above older crystalline basement rocks and is estimated to be approximately 7 km deep on the western margin, gradually tapering out to zero on the eastern margin (Mossop and Shetsen 1994).

The Athabasca Sedimentary Basin is an erosional remnant of at least three stacked Paleoproterozoic to Mesoproterozoic sedimentary basins, all of which had unique depositional axes (Bosman and Ramaekers 2015). The Athabasca Basin is oval shaped and covers approximately 100,000 km^2 of northern Saskatchewan, and a small portion of northeastern Alberta. Units comprising the Athabasca Basin consist of relatively undeformed and unmetamorphosed quartz arenitic sandstones, with a current estimated maximum thickness of approximately 1.5 km. The Athabasca Basin is overlain atop crystalline basement and straddles the moderate to steeply dipping Snowbird Tectonic Zone (STZ), which is a major tectonic feature separating the geologically distinct crustal blocks of the Rae Province to the west, and the Hearne Province to the east (Card 2021).

The Project lies within the southern Rae Province, west of the STZ, within a region referred to as the Taltson Domain (Card 2021). Rock exposures southeast of the Project area indicate that the region is dominated by granulite-facies orthogneisses, derived mainly from intermediate protoliths (Card 2021). Limited age determinations suggest a range of emplacement ages for the Taltson Domain rocks, from 2,529 Ma to 2,422 Ma (Card 2021). Basement rocks in the region were metamorphosed to granulite facies conditions, with a subsequent amphibolite-facies metamorphic event that resulted in widespread hydration of

granulite-facies assemblages in rocks near shear zones (Card 2021). The Taltson Domain rocks are intruded by the north-northeast trending Clearwater Domain anorthosite complex, which includes post-metamorphic, biotite bearing peraluminous granites (Potter et al. 2020). On a regional scale, the Taltson Domain is characterized by a prominent southwest to northeast trending structural grain, defined by alternating linear aeromagnetic highs and lows, that is transposed to the north-northeast approaching the STZ (Card et al. 2014). Brittle-ductile and brittle shear zones and faults interpreted from aeromagnetic data are numerous in northwest Saskatchewan, and trend in a number of orientations, including northeast, northwest and west, likely represent late, brittle-ductile and brittle fault zones with unknown displacements (Card et al. 2014). Major structural features in the PLS region of the Rae Province include the Patterson Lake Corridor, Beatty River shear zone and the Virgin River shear zone (referred to as the STZ where it underlies the Athabasca Basin).

4.3.2 Local Geology

An overview map of the interpreted local scale geology at the Project is presented in Figure 4-4.

4.3.2.1 Quaternary

A thin soil layer blankets the Project, with observed thickness up to 50 cm, classified by the Soil Landscapes of Canada as Dystric Brunisol (Soil Landscapes of Canada Working Group 2010). Dystric Brunisols cover a large portion of the Canadian Shield and form primarily in acidic, sandy glacial sediments under jack pine forests. Due to the weathering-resistive parent material, Dystric Brunisols are typically thin and are comprised of a variably decomposed leaf litter layer, absence of a well-developed mineral-organic Ah horizon, and a B horizon with a pH of <5.5. Detailed information on soil map units and organic material in the SSA is provided in Section 4.6.1.

The Project is covered by a rolling layer of Quaternary glaciofluvial, lacustrine, and morainal sand and gravel deposits, which range in thickness from approximately 5 m near the eastern claim boundary to over 100 m directly west of Patterson Lake (Thomas 2011). Rare occurrences of diamictite (also referred to as lodgement till), described as poorly sorted, grey mud to sand with matrix supported clasts, has been intersected near the contact with underlying bedrock. The thickness of diamictite in the Patterson Lake region ranges from 0 m to 43 m (Bosman et al. 2017).

Outcrop has not been identified on the Project to date.

4.3.2.2 Mannville Group

The Project overlies the northeastern extent of the Lower-Cretaceous Mannville Group, which are the oldest Cretaceous rocks comprising the WCSB. (Glass 1997) The upper Manville lithotype found in the project area is generally a green to grey to black, very fine to medium grained sandstone, interbedded with fissile mudstones (Bosman et al. 2017). The thickness of Manville in the Patterson Lake region ranges from 0 m to 78 m (Bosman et al. 2017).

4.3.2.3 Elk Point Group

Lower – Middle Devonian aged sedimentary rocks occur on the Project, interpreted to belong to the lower Elk Point Group of the WCSB (Glass 1997). The Elk Point Group is composed generally of red to pale green to buff coloured medium to very coarse-grained sandstone with carbonate cement (Bosman et al. 2017). In the Patterson Lake region, the thickness of Devonian sedimentary rocks ranges from 0 m to 42 m (Bosman et al. 2017).

4.3.2.4 Athabasca Supergroup

Athabasca Supergroup sedimentary rocks have not been identified on the Project to date and the interpreted southwest edge of the Athabasca Basin lies between 0 km to 5 km northeast of the eastern-PLS property boundary. Proterozoic sedimentary basins like the Athabasca are considered key components in the development of unconformity-associated uranium deposits and as such, a description is provided despite the observed absence of these rocks on the project.

The Athabasca Basin is a large (approximately 400 km by 250 km) Paleo-to Mesoproterozoic sedimentary basin developed in the Canadian Shield (Ramaekers et al. 2007). The sedimentary rocks in the basin are generally flat-lying, and the basin is considered as an intracratonic basin without significant deformation and magmatism (Jefferson et al. 2007; Ramaekers et al. 2007).

The sedimentary sequence of the Athabasca Basin is called the Athabasca Group (Ramaekers et al. 2007), which has been recently combined with an older stratigraphic unit in the region (Martin Group) to form the Athabasca Supergroup (Bosman and Ramaekers 2015). The Athabasca Group is divided into four unconformity-bounded sequences, which are, from bottom to top, the sandy to conglomeratic Fair Point Formation (sequence 1), the quartz-arenitic Read, Smart and Manitou Falls formations (sequence 2), the pebbly sandy

Lazenby Lake and mudstone-rich Wolverine Point formations (sequence 3), and the pebbly to sandy and conglomeratic Locker Lake, sandy Otherside, mudstone-rich Douglas, and dolomitic Carswell formations (sequence 4) (Ramaekers et al. 2007). The time duration of sedimentation in the basin has been loosely constrained to be from 1760 Ma to 1500 Ma (Ramaekers et al. 2007), based on estimation of a ca. 1750 Ma age for onset of rapid erosion of the Trans-Hudson orogeny (Annesley et al. 1997), a U-Pb age of 1644 ± 13 Ma for igneous zircon in a tuffaceous unit in the Wolverine Point Formation (Rainbird et al. 2007), and a Re-Os isochron age of 1541 ± 13 Ma for carbonaceous shales in the Douglas Formation (Creaser and Stasiuk 2007). The Athabasca Basin has experienced significant exhumation, and the current remnant Athabasca Supergroup has a maximum thickness of approximately 1,500 m in the center of the basin (Ramaekers et al. 2007).

4.3.2.5 Crystalline Basement

The primary basement rock types at the Project consist of intermediate orthogneisses, interpreted to belong to the Taltson Domain. The orthogneisses are variably altered, medium- to coarse-grained and are comprised of quartz-feldspar-biotite-chlorite (after garnet or pyroxene) (Card 2021). Lesser amounts of mafic to ultramafic intrusions occur within the orthogneisses, often oriented parallel or subparallel to foliation along with coarse to very coarse grained, alkali feldspar dominated pegmatites.

Consistent identification of the various basement rock units at the Project is complicated by the fact that metasomatic alteration and hydrothermal mineral assemblages are very common, relatively unaltered rocks are rare, and completely unaffected rocks are effectively absent (Card 2021). These hydrothermal alteration events, and subsequent metasomatic mineral assemblages occur preferentially in the vicinity of the large-scale structural corridors throughout the project, which ultimately results in the near complete overprinting of the primary lithologies.

A structural study conducted in 2019 analyzed drill core and aeromagnetic data over a 30 km long northeast-southwest area which included the PLS Project (Johnstone et al. 2019). The study determined that basement lithologies in the locality are defined by northeast trending, steeply dipping, heterogeneous high-strain corridors, bounded by comparatively less altered and deformed orthogneisses. Within these high-strain corridors, fabrics evolved through a sequence of deformation phases, starting with pre-Athabasca Basin intense regional ductile deformation (D_1–D_3), one phase of pre-Athabasca ductile shearing (D_{4a}), one phase of pre- to syn-Athabasca Basin semi-brittle deformation (D_{4b}), and three major

phases of syn to post-Athabasca Basin brittle deformation ($D_{5a–c}$) (Johnstone et al. 2019). Early S_1/S_2 gneissosity aligns with unit contacts, striking 034° with a SE dip of 57° and locally, S_3 schistosity refolds earlier fabrics into tight F_3 folds, with NE-oriented axial planes plunging gently northeast. Figure 4-5 summarizes ductile structures in the PLS project locality, Figure 4-6 summarizes brittle structures in the PLS project locality recorded by (Johnstone et al. 2019).

4.3.3 Geology of the Patterson Lake Corridor

The Patterson Lake corridor (PLc) is a complex package of NE-SW-trending rocks with a long, protracted history that includes a number of significant tectonic, depositional, and hydrothermal events.

At one point in time, the entirety of the PLc was overlain by rocks of Athabasca Basin, but these rocks have been subsequently removed by later erosional events. The genetic model for unconformity-associated uranium deposits involves circulation of uranium-bearing oxidizing brines within the Athabasca Basin and underlying basement rocks, which interact with a reducing media (e.g., iron rich rocks or fluids within a shear zone) during deformation. Uranium is precipitated at the location where this oxidation-reduction reaction occurs.

The PLc has been primarily defined by its NE-SW trending Electromagnetic (EM) signature and has been confirmed to extend for over 50 km. Geophysical surveys have identified a corridor of EM conductors throughout the PLc, which are thought to represent anastomosing graphite-sulphide rich fault zones, which are commonly associated with high-grade unconformity related uranium deposits found in the Athabasca Basin.

The PLc is host to a number of significant unconformity-associated uranium deposits, of which Triple R is included. Triple R was first discovered in 2012 by Fission Uranium Corp. (Fission) in drill hole PLS12-022, which targeted a northeast trending EM conductor with a coincident resistivity low and intersected 8.5 m of 1.07% by weight (wt%) U_3O_8. Additional drilling delineated what was subsequently termed the R00E Zone. Since the discovery of R00E, the PLc trend has been the primary focus of exploration work by Fission consisting of multiple drill campaigns and geophysical surveys. This additional exploration work has resulted in the discovery of four additional zones of uranium mineralization, are collectively termed the Triple R deposit (Zones: R1515W, R840W, R00E, R780E, R1620E).

4.3.3.1 Quaternary Geology

Quaternary material overlying the PLc are predominantly thick glaciofluvial sand and gravel ice contact deposits overlying till interlayered with reworked glaciofluvial outwash (BGC Engineering 2023). The predominant surficial material encountered at the PLc is a relatively uniform fine to medium sand with scattered cobbles and boulders at surface. The presence of these cobbles and boulders generally decreases in quantity with depth. Quaternary material along the PLc ranges in thickness between 50 m over Patterson Lake to over 100 m just west of Patterson Lake. There has been no observed expression of faulting into the overburden from the underlying basement rock.

A simplified Quaternary sequence has been proposed by BGC Engineering Inc. (BGC) over the PLc as follows (BGC Engineering 2022):

- Glaciofluvial: Medium to low energy glaciofluvial deposits of fine to medium sand between 20 m and 60 m thick with isolated zones of laminated silt and sand interpreted as backwater deposits. Boulders are frequently present at ground surface representing a boulder-lag deposit, but their frequency decreases with depth.
- Till 2: Comprised of gap graded sand and gravel, with trace to some cobbles. Silt content was observed to vary from some silt to silty. In some places a thin lodgement till was encountered. The lodgement till is likely attributed to the same glacial advance as Till 2, and as such will be referred to as Till 2 to maintain consistency with proximal area investigations.
- Till 1: Predominantly consists of disturbed Cretaceous-derived siltstones and claystones. Interbedded clean glaciofluvial outwash sands are encompassed between packages of Cretaceous-derived till, interpreted to have acted as a plane of thrusting for the basal till during glacier advance. Rare instances of a thin lodgement till were observed near the base of Till 1, which is considered a component of the basal till. The basal till was observed to vary in thickness across the Project site, influenced by thrusting.

4.3.3.2 Mannville Group

The Cretaceous Manville Group has been intersected sporadically in drillholes between Patterson Lake and the western property boundary, interpreted to belong to the Cantuar Formation. The Cantuar Formation is black to dark grey in colour and generally consists of fine to coarse-grained, cross-bedded beige sandstone with minimal mudstone. The

Cantuar Formation is occasionally host to bitumen and can contain centimetre to decimetre-scale coal beds and dark grey, very fine grained to silty sediments with occasional coal seams (Bosman 2017). The thickness of Cantuar Formation sediments can be highly variable from drillhole to drillhole but have been intersected in lengths exceeding 15 m. Current interpretations of site geology indicate that the Cantuar Formation material has been transported via glacier advance and retreat during the late Wisconsian glaciation, and as such, should be considered to be part of the Quaternary material described previously (BGC Engineering 2023).

4.3.3.3 Elk Point Group

Thin lenses of Meadow Lake Formation, belonging to the Lower-Middle Devonian Elk Point Group, have been intersected within depressions in the crystalline basement topography near Patterson Lake. The Meadow Lake Formation consists of poorly sorted green to red, fine to coarse-grained sandstone and conglomeratic sandstones with carbonate cement (Bosman 2017). Intersections of Elk Point Group on the property range from 10.0 cm to 15.7 m in thickness.

4.3.3.4 Crystalline Basement

The following description of the crystalline basement at the Project is taken from Tetra Tech Feasibility Study, National Instrument (NI) 43-101 Technical Report for the PLS Property (Ghaffari et al. 2023) with revisions after the 2023 drilling.

The PLS Property covers two geological domains; the western portion covers the Clearwater Domain while the eastern portion covers the Taltson Domain. To date, drilling at the PLS Property has been focused on the basement rocks of the Taltson Domain. In the vicinity of PLc uranium mineralization, the basement rocks are comprised of a northeast trending belt of variably altered and sheared pyroxene bearing orthogneisses bound to the northwest and southeast by an apparently thick package of quartz-feldspar-biotite-garnet gneiss (QFBG-GN). The pyroxene bearing orthogneisses and QFBG-GN are intruded by numerous sheared, fine-grained granite lenses (Figure 4-10).

The pyroxene bearing orthogneiss comprises the core of a northeast trending belt of alteration and structural disruption along the PLc and dips steeply to the southeast. The orthogneisses are intensely sheared, faulted, and altered into an intercalated sequence of fine-grained ribbony graphite-sulphide gneiss and medium grained garnet porphyroblast

gneiss with subordinate garnetite, graphitic mylonite, and cataclasite. The sheared graphitic rocks are collectively termed the Main Shear Zone (MSZ).

The MSZ is constrained to the north and south by QFBG-GN. The QFBG-GN is comprised of approximately 60% quartz and plagioclase, 20% biotite, 15% garnet, and trace pyrite, sillimanite, and graphite.

Lenses of dark green to black, sheared, fine grained granitoid intrude the QFBG-GN and MSZ along the extent of the PLc drilled to date. The sheared granitoids are interpreted to be roughly concordant with the regional geology (i.e., steeply dipping to the southeast) except in the eastern R780E where a thick lens is interpreted to dip shallowly to the east. Away from uranium mineralization, the basement rocks immediately in the Project area are either paleoweathered, weakly altered, or fresh. The paleoweathered rock displays the typical downward gradational profile of a thin bleached and strongly kaolinite altered zone to a hematite dominated and then into a chlorite dominated zone. The paleoweathering profile can extend several metres into the basement rock and completely alters the primary mineralogy to secondary clay minerals and quartz.

Away from paleoweathered areas, later-stage hydrothermal alteration is common throughout the basement. In particular, a broad zone of alteration occurs around mineralization where fresh basement is rarely encountered. Dark green chlorite alteration of garnet, biotite, and Al-silicates along with fracture infill to disseminated graphite and whitish green clay alteration of feldspar is the most abundant type of basement alteration. Patchy pink to red hematite occurs in the basement lithologies and is often associated with elevated radioactivity. Similarly, patchy, blebby limonite alteration almost entirely occurs with moderate to strong intervals of radioactivity. Along the MSZ and hanging wall QFBG-GN contact, a broad zone of silicification almost completely overprints the QFBG-GN. This silicified unit was initially considered as quartzitic gneiss but later was reinterpreted as a silicified version of the southern QFBG-GN based on textural observations and the gradational nature of the contact between the southern QFBG-GN and silicified zone.

On a regional scale, the paleotopography in the vicinity of the PLc is flat lying. The mineralized zones occur in slight basement topographic lows and are separated by relative highs. Near Triple R, the basement surface shows many small-scale offsets, which are interpreted to be caused by a series of stacked foliation-parallel reverse faults, now partially eroded. Based on processed orientated core data, downhole televiewer surveys and closely spaced grid drilling, the main structural trend along the PLc appears to be an early ductile

regional foliation steeply dipping to the southeast (Figure 4-11) and foliation parallel fractures and faults (Figure 4-12). Nine common cross fracture/fault orientations have been identified through drill core and geophysical surveys and around the Triple R deposit which are broadly east-west, northeast and northwest trending (Figure 4-10). These cross faults are often difficult to confidently observe and correlate in drill core due to the extreme alteration associated with uranium mineralization which often precludes the use of orientated core or televiewer surveying. Kinematic indicators measured from drill core suggests the aforementioned reverse sense, and dextral strike-slip movement are dominant along the MSZ. In plan view, the more significant pods comprising Triple R are associated with broad left bends in the MSZ, which in an interpreted dextral strike-slip setting suggests these pods were formed in compressional damage zones. Within these damage zones there is a marked increase in fracture intensity and fracture orientation relative to the country rock (Figure 4-11).

4.3.4 Uranium Mineralization

The following description of uranium mineralization at the Project is taken from Tetra Tech Feasibility Study, NI 43-101 Technical Report for the PLS Property (Ghaffari et al. 2023) and revised after the 2023 drilling.

Appreciable high-grade uranium mineralization is known to occur on the Project in five zones, which collectively make up the Triple R deposit. From west to east, these zones are: 1) R1515W, 2) R840W, 3) R00E, 4) R780E, and 5) R1620E, the most significant of which is the R780E zone. Uranium mineralization discovered on the Project to date is hosted primarily in basement lithologies with subordinate amounts intersected in the overlying Devonian sedimentary rocks. Mineralized zones occur within or near to the MSZ over a 3.17 km strike length along the PLc and between approximately 50 m to 300 m vertically below surface (Figure 4-12 and Figure 4-13).

No significant uranium mineralization has been intersected in exploration drilling away from the PLc.

Uranium mineralization at the PLS Property is hosted primarily within metamorphosed basement lithologies and, to a much lesser extent, within overlying Meadow Lake Formation sedimentary rocks.

Mineralization within the Meadow Lake Formation sedimentary rocks typically occurs as fine-grained disseminations, sooty blebs, and rarely semi-massive uranium mineralization.

Uranium concentrations within the Meadow Lake Formation are generally low to moderate, however, grades greater than 1.00 wt% U_3O_8 have been intersected. When mineralized, the Meadow Lake Formation is typically strongly clay and chlorite altered, though locally can be pervasively hematite stained a deep red. Relative to basement hosted mineralization, only a very small amount of mineralized Meadow Lake Formation has been intersected on the PLS Property to date.

Basement hosted mineralization at the PLS Property occurs in a wide variety of styles, the most common of which appears to be fine-grained disseminated and fracture filling uranium minerals strongly associated with hydrocarbon/carbonaceous matter within the MSZ. Uranium minerals, where visible, appear to be concordant with the regional foliation and dominant structural trends identified through oriented core and fence drilling (i.e., steeply dipping to the southeast). Typically, mineralization within the MSZ is associated with pervasive, strong, grey-green chlorite and clay alteration. The dominant clay species identified through portable infrared mineral analyzer (PIMA) analysis are kaolinite and magnesium-chlorite interpreted to be sudoite. The pervasive clay and chlorite alteration eliminate the primary mineralogy of the host rock with only a weakly defined remnant texture remaining. Locally, intense rusty limonite-hematite alteration in the orthogneisses strongly correlates with high grade uranium mineralization and a “rotten”, wormy texture.

Less common styles of uranium mineralization within the MSZ, which are often associated with very high-grade uranium, include: semi-massive and hydrocarbon rich, intensely clay altered (kaolinite) with uranium-hydrocarbon buttons, and massive metallic mineralization. These zones of very high-grade mineralization generally occur along the contact of the MSZ and intensely silicified QFBG-GN and comprise a high-grade mineralized spine. This spine may represent a zone of intense structural disruption which has been completely overprinted by alteration and mineralization; however, drill holes that undercut the strongly mineralized spine have failed to show signs of significant structural damage. Particularly well mineralized drill holes are often associated with thin swarms of dravite-filled breccia.

Uranium mineralization within the north and south QFBG-GN which bound the MSZ generally occurs as fine-grained disseminations and is almost always associated with pervasive whitish-green clay and chlorite alteration with local pervasive hematite. The mineralized zones within the QFBG-GN are interpreted to be stacked structures parallel to the MSZ strike and dip along the PLc.

Results of the detailed mineralogical work at the Project indicate that the dominant uranium mineral present is uraninite, with subordinate amounts of coffinite, possible brannerite and U-Pb oxide/oxyhydroxide. Uranium minerals occur mainly as anhedral grains and polycrystalline aggregates with irregular terminations; irregularly developed veinlets, locally showing extremely complex intergrowths with silicates; micrometric inclusions and dendritic intergrowths with silicates; and very fine-grained dissemination intercalated with clays. In the samples studied, uranium minerals also occur as fine-grained inclusions in carbonaceous matter (hydrocarbon).

4.3.5 Stability

Geotechnical work completed for the feasibility study (Ghaffari et al. 2023) indicated that at shallow depths stability is governed by the strength of the glaciofluvial sands that comprise the near-surface soils throughout the property. The free-draining nature and moderate frictional strength of the sands combined with relatively low relief results in limited potential for instabilities within the undisturbed natural slopes across the Project area. At moderate depth, stability is governed by the Till 1 unit, which is a basal till generally consisting of disturbed Cretaceous-derived siltstones and claystones. It comprises interbedded layers of low to high plastic clay, low plasticity silt with uniformly graded fine to medium sand, containing local variations of trace to some gravel in the sand layers. The Till 1 does not daylight at surface but is expected to govern foundation stability for the waste rock stockpiles. At depth, underground excavation stability is governed by the highly altered hangingwall unit, the resource unit, and main shear zone unit. The potential for mining-induced subsidence is dependent on stability of the stope hangingwalls and crown pillar, with mine design components such as excavation dimensions, backfill, ground freezing, ground support, and mine schedule designed with consideration to minimizing mining-induced deformations and maintaining stability. With maintenance of excavation stability, the small mining footprint and thick overburden deposits also contribute to the relatively low potential for significant subsidence.

Geotechnical stability analyses for surface and underground mine infrastructure including analytical, empirical, and numerical methods. Numerical methods include two-dimensional limit equilibrium modelling and two-dimensional finite-element modelling, including pseudo-static analyses (consideration of seismic loading) for surface infrastructure. The geological and geotechnical models for the stability analyses were based on six years of site data collection (since 2016) including soil and rock drilling, standard penetration testing, cone penetration testing, downhole and surface geophysics, oriented core drilling,

televiewer surveys, packer testing, piezometer installations, and test pitting. In addition, geotechnical data collected during exploration drilling programs was also used to supplement the geotechnical characterization of the basement bedrock. Where relevant to the analyses, in-situ stresses were estimated based on work by Bell and Grasby (2012). Faults were considered in the geotechnical stability analyses conducted as part of the rock mechanics assessments for the underground mine design. The geotechnical consultants worked closely with the mine planners to incorporate mine sequencing (excavation and backfilling) and stockpile sequencing (lift thickness and rate) into the analyses, where relevant.

The relative seismic hazard of the Project site (and resulting potential for large magnitude earthquakes) is "low" (1 on a scale of 5; Geological Survey of Canada 2015). Several faults have been interpreted on the Project site through geophysical investigations and drilling results. Most are steeply dipping and oriented north-south, while the target uranium mineralization is hosted in a steep southeast-dipping basement fault. Generally, any reduction in rock mass quality associated with faulting has been overprinted by moderate to strong alteration during uranium mineralization. Where practicable, mine development has been planned a minimum of 50 m from identified major structures. Else, detailed geotechnical assessments were completed to inform recommended excavation dimensions and ground support to reduce the potential for fault-slip and instability. Geotechnical monitoring will be conducted on surface and underground throughout the mine life to monitor stability and subsidence.

The location, thickness, orientation, and rock mass quality of major structures was considered in the geotechnical assessments conducted as part of the Feasibility Study. Further studies were conducted in 2023 to confirm that major structures were not interpreted to affect stability at the shaft or decline locations. Within the production and development excavations, it is expected that the rock mass quality of the faults will be similar to the resource unit and will behave similarly to the rock within the stopes. Individual mine drifts that intersect faults may require additional support in localized areas, but apart from the MSZ which hosts the mineralization, major structures at the Project are relatively thin (<5 m true thickness) and are not significantly weaker than the surrounding rock mass.

Hydrogeological testing of the rock mass was completed as part of the Feasibility Study and further studies were conducted in 2022 and 2023 by completing packer tests and pumping tests in the basement rock. A review of packer tests completed within interpreted

fault zones was completed, and in general, packer tests results for tests completed within the MSZ or other interpreted major faults indicate a lower hydraulic conductivity than the surrounding rock mass. In the case of the MSZ, this is attributed to the intense clay alteration.

Hydraulic heads in the basement rock are monitored with vibrating wire piezometers (VWPs). Hydraulic heads in the basement rock of the area of the R00E and R780E are observed to be similar to the elevation of Patterson Lake. While data are generally limited within major structures to data collected within the MSZ, the available head data does not suggest elevated or reduced pore pressures relative to the surrounding rock mass in the MSZ. Therefore, differential head within and across fault zones is unlikely to control the slip tendency of the faults or contaminant transport.

4.3.6 Geochemistry

Between 2018 and 2021, a total of 202 geochemical samples were collected by BGC Engineering from existing drillholes to assess the acid rock drainage and metal leaching (ARD/ML) characteristics of anticipated mine waste associated with the Project (BGC Engineering 2021).

Geochemical samples were chosen to represent material which would be stockpiled on surface during mining and consisted of waste rock, low grade uranium ore, and Quaternary material. Rock samples were proportionally sourced from the three main mineralized zones (R780E, R00E, R840W) and from the main rock types expected to be encountered in the proposed workings.

All samples were submitted for modified Sobek Acid Base Accounting (ABA), element analysis was primarily provided by Fission, short-term soluble leach testing was also conducted as well as mineralogy via X-Ray diffraction (XRD) and whole rock analysis (WRA). Laboratory work was performed by the Saskatchewan Research Council (SRC) Environmental Analytical Laboratory in Saskatoon, Saskatchewan and SGS Canada Inc. in Lakefield, Ontario.

Results from ABA indicated sulphide species generally represented the dominant sulphur species in 187 or the 202 samples analyzed. The majority of rock units tested indicated acid neutralization potential was reflective of a mixture of carbonate and silicate minerals; Devonian sandstone was the one exception with dominantly carbonate-based acid-buffering capacity. Sulphide-S values up to 9.58% S and along with XRD analysis

suggested pyrite is likely the dominant sulphide mineral. Samples of the silicified hanging wall, Devonian sandstone and overburden generally had consistently low total sulphur (i.e., ≤0.03% S), with correspondingly low sulphide-S values.

The geochemical testing programs suggested that 74% of the dataset is classified as not potentially acid generating (PAG) based on its modified Sobek neutralization potential ratio value. The Devonian sandstone was the only rock unit without any PAG, between 13% to 52% of the remaining rock units were considered PAG. With respect to metal leaching potential for the bedrock units, aluminum, arsenic, cadmium, molybdenum, and uranium were commonly elevated in all units tested. Exceedances of radium-226 were noted for four of the six bedrock units (BGC Engineering 2021).

Further work is ongoing, including mineralogical assessment, expansion of the dataset, and the initiation of humidity cell testing such that long-term metal leaching can be evaluated. Interim results from some of this on-going work can be found in Appendix A.2.

4.4 Hydrogeological Environment

The existing baseline hydrogeological conditions of the Project site are detailed by Clifton Engineering Group Inc. (Clifton) in Appendix C.2 based on a review of existing information from various studies and desktop information available for the hydrogeological LSA and RSA. This report provides the basis for the development and calibration of the numerical groundwater flow model that is being utilized to represent baseline conditions.

Figure 4-14 delineates the hydrogeological environment RSA and LSA, respectively. The RSA was selected to cover an area of sufficient size to describe key hydrogeological features for the region, provide context for the site geology, and to consider cumulative effects of other activities in the region. The RSA covers an area of approximately 1,000 km^2. The LSA spans the areal extent of drilling investigations conducted by Clifton and BGC in the areas of the TMF and underground mine works. The LSA covers the extent of the planned site facilities and the PDA. The LSA was selected to be of sufficient size to develop a numerical groundwater model to aid in the assessment of potential impacts associated with the construction, operation, and decommissioning phases of the Project.

4.4.1 Topography and Drainage

The RSA resides within the Clearwater River drainage basin. The Clearwater River flows south-eastward from its headwaters at Broach Lake through Patterson Lake. The

Clearwater River system joins the Athabasca River at Fort McMurray before flowing into the Mackenzie River which in turn discharges into the Beaufort Sea.

Local topography controls drainage within the LSA. A terminal end moraine approximately 4 km west of Patterson Lake acts as a regional drainage divide marking the boundaries between watersheds (NHN Watershed 07CD; GC 2016). Surface water east of the watershed boundary drains towards Patterson Lake; surface water west of the watershed boundary drains to the west towards Alberta.

The lateral groundwater flow direction follows the local topography eastward towards Patterson Lake which is interpreted to be the primary discharge location in the LSA. Groundwater also likely discharges to local creeks and streams throughout the area which in turn discharge into Patterson Lake. The depth to groundwater ranges from 5 m to 20 m below ground across the LSA. The average horizontal gradient is 0.01 m/m, ranging as high as 0.03 m/m where the gradient was the steepest in the direction of Patterson Lake and South Creek (creek south of the TMF that flows into Patterson Lake) and as low as 0.008 m/m in the northwest of the LSA.

4.4.2 Hydrostratigraphic Units

Data from field investigations conducted by Clifton and BGC were used to develop a conceptual site model comprised of four hydrostratigraphic units (HSUs) within the LSA. A HSU is a combination of different lithological units that show similar hydraulic characteristics (e.g., hydraulic heads). Table 4-10 lays out the hydrostratigraphic framework for the LSA.

From youngest to oldest the HSUs in the LSA include:

- HSU1 which predominantly consists of glaciofluvial sand.
- HSU2 which predominantly consists of sand till.
- HSU3 which consists predominantly of finer silt and clay rich sand tills, as well as any underlying pre-glacial Phanerozoic bedrock sediments.
- HSU4 which consists of Proterozoic crystalline basement rocks.

Figure 4-15 shows east – west (A-A') and north – south (B-B') stratigraphic cross-sections across the LSA.

Structure contour maps were created for the base of HSUs 1 to 3 using Surfer, a grid-based mapping program that interpolates irregularly spaced XYZ data into a regularly spaced grid. Test hole coordinates and elevations of stratigraphic picks were used to create grid files in Surfer using Kriging with the default linear variogram option. The grid files and Lidar data for the site were also used to create a 3D block model shown in Figure 4-16.

HSU1 was a thick unconfined aquifer that ranged from 12 m to 70 m in thickness across the LSA (Figure 4-17). Depth to water generally ranged 555 metres above sea level (masl) to 492 masl northwest to southeast across the site. HSU1 had a geometric mean hydraulic conductivity of $1x10^{5}$ m/s, with 10^{th} and 90^{th} percentile values of $4x10^{-7}$ m/s and $2x10^{-4}$ m/s for the field and laboratory tests reviewed.

HSU2 consisted of till predominantly composed of fine-grained sand with variable finer (e.g., silt and clay) and coarser materials (e.g., sand, gravel, and intermittent boulders). The upper contact of this unit was often demarcated by the occurrence of rocks and cobbles and a zone of oxidization. The thickness of this unit ranged from 0.4 m to 83 m (Figure 4-18). HSU2 was absent in some test holes drilled near Patterson Lake. HSU2 had a geometric mean hydraulic conductivity of $1x10^{-6}$ m/s, with 10^{th} and 90^{th} percentile values of $9x10^{-9}$ m/s and $4x10^{-5}$ m/s, for the field and laboratory tests reviewed. Hydraulic heads in this unit were almost identical to that observed in HSU1, with the vertical component of groundwater flow being weakly downward between the two units.

HSU3 included all deposits below the sand till (aka HUS2) and above the basement bedrock. HSU3 consisted predominantly of silt and clay rich till and underlying silts, clays, and silty sands. The thickness of HSU3 ranged from less than 1 m and up to 95 m (Figure 4-19). This unit was absent in some test holes drilled near Patterson Lake. The thin veneer of Phanerozoic bedrock sediments that were encountered in some test holes were included in HSU3. HSU3 had a geometric mean hydraulic conductivity of $1x10^{7}$ m/s, with 10^{th} and 90^{th} percentile values of $1x10^{-10}$ m/s and $5x10^{-5}$ m/s, for the 141 field and laboratory tests reviewed. A relatively weak reversal of vertical hydraulic gradients (i.e., upward instead of downward) was observed between HSU3 and the overlying units in some locations across the LSA.

HSU4 comprised the Proterozoic bedrock. The bedrock consisted of an upper zone of paleo weathered and fractured rock underlain by competent bedrock. This hydrostratigraphic unit was interpreted to be confined across the LSA. A weak upward vertical hydraulic gradient was observed between HSU4 and the overlying units especially in the vicinity of Patterson

Lake. HSU4 had a geometric mean hydraulic conductivity of $6x10^{-8}$ m/s, with 10th and 90th percentile values of $2x10^{-9}$ m/s and $5x10^{-6}$ m/s, from the field tests reviewed. The results of the hydraulic testing were used to subdivide HSU4 into the following:

- HUS4 upper - depth of 55-100 m had a geometric mean hydraulic conductivity of $1x10^{-7}$ m/s.
- HUS4 lower - depth >100 m had a geometric mean hydraulic conductivity of $4x10^{-8}$ m/s.

4.4.3 Groundwater Chemistry

A total of 38 groundwater samples were submitted for analytical testing between 2016 and 2023. The groundwater samples were taken from 23 monitoring locations distributed across the LSA by Clifton (in the vicinity of the TMF) and BGC (in the vicinity of Patterson Lake).

Water levels were recorded in standpipe piezometers prior to sampling. *In-situ* water parameters were collected during sampling, including temperature, dissolved oxygen, electrical conductivity, pH, and oxygen reduction. Water chemistry parameters tested for included routine ions, total and dissolved metals, and radionuclides. Following analysis, data were screened including setting all values less than the Reportable Detection Limit (RDL) equal to the RDL. Ionic balances were reviewed where available and any samples with an ionic balance greater than 10% were flagged for further review. Separate statistical analyses were completed for the glacial overburden samples and for the basement bedrock samples. The geometric mean, 10th and 90th percentile, median, and count values for each parameter was calculated. Detailed results are presented in Appendix C.2 while a summary of the groundwater COPC that were selected as per the rationale provided in Appendix D.4 are described below.

Groundwater sampled from HSUs 1, 2, and 3 was generally of the calcium-magnesium bicarbonate type and were grouped together for statistical analysis (Table 4-11). COPC exceedances of the Saskatchewan Environmental Quality Guidelines (SEQG) were limited to cadmium (at the geometric mean and above for aquatic life). Exceedances were sporadic across the PDA and not centralized around one location. No exceedances of SEQG for radionuclides were observed (GS 2023a).

Groundwater sampled from HSU4 was of the calcium-magnesium-chloride-sulphate type and descriptive statistics for the COPC are summarized in Table 4-12. COPC exceedances

of the SEQG were observed for arsenic (at the median and above for aquatic life; at the 90th percentile and above for potable water), cadmium (at the geometric mean and above for aquatic life), and uranium (at the 90th percentile for aquatic life and potable water). Additionally, exceedances of SEQG of the radionuclide COPC radium-226 were also observed (at the 10th percentile and above) in the Patterson Lake area, particularly limited to one production well drilled on the ore body.

4.5 Aquatic Environment

Baseline investigations of the aquatic environment began in 2013 with components that have continued up to the present. The study components, areas, and objectives have evolved over the monitoring period as Project plans have developed. Early-stage baseline investigations occurred in 2013 and included water quality, fish community, and fish habitat surveys in select locations specific to the Project area. Seasonal hydrological investigations were initiated in the study area beginning in June 2014 and a full suite of baseline studies (surface water and sediment quality, plankton and benthic invertebrate communities, and fish spawning, community, chemistry, and habitat studies) were completed between 2016 and 2020 to inform Project planning. Additional surface water quality and fish data collected in 2022 and 2023 were focused in the area near the proposed effluent discharge location and along the shoreline near the deposit within Patterson Lake to provide detailed information in the future near-field exposure area.

More specifically, fish surveys were completed in 2013, 2016, 2017, 2019, and 2022, and benthic invertebrate community studies were conducted in 2017 and 2019, with further follow-up studies planned prior to treated effluent release. The aquatic baseline studies that will be conducted in the Aquatic Study Area (ASA) prior to treated effluent release will provide up-to-date information and inform monitoring study designs; refer to Section 9, Monitoring and Follow-up Programs. Included in this work will be collecting water quality, sediment quality, benthic invertebrate community, and fish community information immediately downstream of the final treated effluent diffuser location and at reference areas to obtain site characterization information from future near-field exposure and reference stations. The need for additional fish chemistry data will be considered but is unlikely due to the quantity of fish chemistry data already obtained from Patterson Lake during the baseline period.

The Project ASA was subdivided into primary and secondary assessment areas (Figure 4-20). The primary ASA encompasses waterbodies potentially directly influenced by the

Project footprint including runoff or by treated effluent release as well as associated reference areas. The proposed treated effluent discharge point is located on the western shore of Patterson Lake near the location of the Triple R deposit (Figure 4-20). Patterson Lake discharges into Patterson Creek and flows east through a series of lakes including Forrest, Beet, and Naomi before discharging into the Clearwater River and downstream into Lloyd Lake. Broach and Hodge lakes were sampled during the baseline period to obtain data from waterbodies that can potentially act as reference areas in the future. These waterbodies are located approximately 3 km and 13 km (respectively) north of Patterson Lake (Figure 4-20). South Creek[2] as well as Ponds 1 and 2 have also been incorporated into the primary ASA due to their proximity to the site and potential for interactions with Project activities.

The secondary ASA encompasses waterbodies in close proximity to the primary ASA with the potential to be influenced by Project activities such as atmospheric dispersion of COPC (Figure 4-20). This includes the unnamed lakes surrounding Patterson and Forrest lakes (lakes A, B, C, D, E, and F).

The following sections provide summary information to characterize waterbodies within the primary and secondary ASA based on the baseline data collected to date as summarized in Table 4-13. Comprehensive aquatic baseline programs are detailed in Appendix C.3 and C.4. Summary existing environment information on aquatic vegetation and semi-aquatic wildlife species is provided in Section 4.6.

4.5.1 Surface Hydrology

Hydrometric data are essential to quantify the movement of surface water throughout the Project area and to document the natural fluctuations in lake storage prior to any project development. Over a longer period, these data, combined with local meteorological observations, can be used to characterize the various inputs and outputs in the surface water balance of lakes and streams in the Project area. This information is important in understanding the rainfall–runoff characteristics and potential hydrograph response to rainfall and snowmelt events in order to separate natural hydrologic variability from any project impacts.

[2] Additional hydrology, water quality, and sediment quality baseline data is planned to be collected in South Creek to provide further characterization information prior to Project construction.

Baseline hydrological monitoring began in the spring of 2014 and has continued through 2022. Historically, monitoring was completed at 19 stations in both the primary and secondary ASA, with 5 stations established to monitor water level elevations on a continuous basis and 14 stations established to monitor lake level elevations instantaneously. Recently, monitoring has occurred at 14 stations exclusively in the primary ASA, with 4 stations monitoring water level elevations on a continuous basis and 10 stations used to monitor lake level elevations instantaneously.

4.5.1.1 Primary ASA

A total of six lakes (Patterson, Forrest, Beet, Naomi, as well as two potential reference lakes (Broach and Hodge lakes)) and four stations along the Clearwater River (Jed Creek, Patterson Lake Outlet, Beet Lake Outlet, and the Clearwater River (near field)), were monitored to define the hydrological characteristics within the primary ASA (Figure 4-21). The morphometric and hydrological characteristics are summarized in Table 4-14 and Table 4-15 and detailed in Appendix C.3 and C.4.

Watershed boundaries within the primary ASA are delineated in Figure 4-21. The ASA lies within the larger Athabasca River drainage basin. The major stream draining the ASA is the Clearwater River. The Clearwater River has a total length of 403 km and originates from the area surrounding Broach Lake. After Broach Lake, it flows southeastward through a series of lakes including Patterson, Forrest, Beet, Naomi, and Lloyd and then west through Warner Rapids towards the Saskatchewan-Alberta border. The river eventually drains into the Athabasca River at Fort McMurray. From the Athabasca River, waters then reach the Mackenzie River which in turn discharges into the Beaufort Sea of the Arctic Ocean. Additional tributaries of the Clearwater River include Descharme River and McLean River in Saskatchewan and the Christina River in Alberta.

The upper reaches of the Clearwater River flow over the Canadian Shield and are characterized by rough patches with rapids and small waterfalls while the lower reaches are more meandering with numerous sandbars and small islands. This system was an important trade route and has been designated a Canadian Heritage River.

The following sections describe the morphometric and hydrological characteristics of the waterbodies within the primary ASA.

Patterson Lake

Patterson Lake is large with a surface area of 38.1 km^2 and a volume of 525.3 x 10^6 m^3. The lake is composed of three sub-basins, resulting in a relatively complex shoreline. The northern half of Patterson Lake has a small northeast basin (Northeast Arm) that accepts the flow from Jed Creek and has a maximum depth of approximately 24 m. This basin is separated from the western half of the northern portion of the lake (Northwest Arm) by a shallow sand bar. The larger Northwest Arm has a maximum depth of approximately 44 m and is separated from the southern basin (South Arm) by a shallow area near the Project location. The South Arm has a maximum depth of approximately 48 m (the deepest point measured in the entire lake). The mean depth of Patterson Lake is 13.8 m. Patterson Lake has a shore length of 53.9 km and has one small island. A bathymetric map of Patterson Lake is provided in Figure 4-22.

Water level elevation monitoring at this station began in 2014 with the installation of a staff gauge downstream of the proposed treated effluent discharge location in the South Arm of Patterson Lake (Figure 4-21). Between 2014 and 2022, water levels recorded at this station varied by 0.425 m with the highest water levels being recorded in June 2021 and the lowest being recorded in September 2017 (Table 4-16).

Forrest Lake

Forrest Lake is the largest lake in the ASA with a surface area of 42.8 km^2 and a volume of 1,129 x 10^6 m^3. It is relatively deep with a mean and maximum depth of 26.2 m and 82.9 m, respectively. Water enters the small northern basin of Forrest Lake through Patterson Creek and continues into Beet Lake through the Beet Lake Channel. Additionally, water from Lake E travels through Creek E into the northern basin of Forrest Lake. The northern and southern basins of Forrest Lake are separated by a shallow area extending approximately 1 km from the northernmost tip of the lake (Figure 4-23). Flows coming from Patterson Creek, generally flow east through this northern portion of the lake and out through the Beet Lake Channel without very much mixing with the water in the larger southern basin of the lake. The larger, deeper southern basin contains the bulk of the lake volume but only has a minor inflow discharging into the southwest side of the basin (Figure 4-23).

A staff gauge was installed on the east side of Forrest Lake, adjacent to Lake F, in the spring of 2016 (Figure 4-21). Water levels recorded at this station were slightly less variable than those recorded in Patterson Lake (0.370 m); however, the minimum and

maximum elevations recorded in Forrest Lake also occurred in September 2017 and June 2020, respectively (Table 4-16).

Beet Lake

Beet Lake has one major inlet, the Beet Lake Channel, that flows from Forrest Lake into the west end of the lake and one major outlet that flows into Naomi Lake (Figure 4-24). Depths in the Beet Channel range from 1 m to 2 m. Beet Lake has a surface area of 9.84 km^2 and a volume of 92.1 x 10^6 m^3. Beet Lake has a mean and maximum depth of 9.4 m and 33.1 m, respectively.

Water level elevation monitoring of Beet Lake began in the spring of 2016 and continued until September 2022 with a staff gauge located on the south side of the lake (Figure 4-21). Variability in recorded water level elevations throughout this period mirrored that measured in Patterson Lake (0.424 m) (Table 4-16).

Naomi Lake

Naomi Lake is located immediately downstream of Beet Lake and the outlet of the lake leads into the Clearwater River. It is a relatively small and shallow lake, with a surface area of 2.56 km^2 and a mean depth of 1.7 m (Figure 4-25). It has a complex shoreline, two inflows, and one outflow. The southern section of the lake is located along the flow path of the Clearwater River, while the northern section is deeper and receives input from a drainage to the north of the lake (Figure 4-21).

Water level elevation monitoring in Naomi Lake also began in the spring of 2016 with the installation of a staff gauge in the northern basin of the lake. Between the spring of 2016 and the fall of 2022 elevations at this station varied by 0.388 m with the highest elevations being recorded in June 2021 and the lowest elevations being recorded in September 2017 (Table 4-16).

Reference Lakes

Reference lakes remain unaffected by the Project due to their geographic location either upstream of the Project or in a different drainage area. They are important to monitor as comparisons can be made between reference waterbodies and Project-influenced (exposure) waterbodies to help determine if any future changes in the exposure waterbodies are due to mining and milling activities or if they may be attributed to natural variation or changes over time. Broach Lake is located north of Patterson Lake and is the headwater for

the Clearwater River system. Broach Lake drains into the Northeast Arm of Patterson Lake through Jed Creek. This lake was chosen as a reference waterbody for the aquatic baseline program as it is upstream of any project development, was the largest lake in the vicinity of the Project, and is of similar depth to Forrest Lake (mean depth of 26.8 m and a maximum depth of 86.3 m). Broach Lake has a surface area of 9.4 km^2 and a volume of 251.2 x 10^6 m^3. A bathymetric map of Broach Lake is provided in Figure 4-26. Due to its large size, the variability in water level elevations recorded at the staff gauge located on the west side of Broach Lake was lower than that recorded elsewhere in the primary ASA (0.273 m). Similar to Patterson Lake, water levels recorded in June 2021 were the highest during the monitoring period while those recorded in September 2017 were the lowest (Table 4-16).

Hodge Lake was added to the baseline program in 2019 as a second reference lake as it is similar in depth to Patterson Lake and is one of the larger lakes in the nearby area. Hodge Lake is a medium sized lake located in the northernmost part of the ASA that is not connected to Patterson Lake. It has a surface area of 5.45 km^2 and a volume of 92.2 × 10^6 m^3. The mean and maximum depths are 16.9 m and 44.4 m, respectively, similar to those in Patterson Lake. A bathymetric map of Hodge Lake is provided in Figure 4-27.

A staff gauge was installed on the west side of Hodge Lake in the spring of 2019. The water level elevations recorded at this station between 2019 and 2022 varied by 0.269 m, similar to the variability recorded at Broach Lake (Table 4-16).

Ponds 1 and 2

Pond 1 and Pond 2 are very small with surface areas of 0.005 km^2 and 0.013 km^2, respectively. Their shorelines are only a few hundred metres in length (266 m and 496 m for Pond 1 and Pond 2, respectively). No bathymetric data are available for these ponds.

Clearwater River

The main watercourse flowing through the primary ASA is the Clearwater River. To characterize this watercourse, four continuous hydrological monitoring stations were established in the area (Figure 4-21). Monitoring locations along the Clearwater River include:

- Jed Creek

- Patterson Lake Outlet[3]
- Beet Lake Outlet[4]
- Clearwater River (near-field)[5]

Channel and flow characteristics for each of these locations are presented in Table 4-15, while hydrometric data (including discharge (m^3/s), water level elevation (stage [m]), and stream temperature) collected during the monitoring period are illustrated in Figure 4-28 to Figure 4-31. At all four stations, a backwater effect (i.e., increase in recorded water level elevations that does not correspond to an actual increase in water level elevation or discharge) was noted. This same characteristic has been documented by the Water Survey of Canada (WSC) at the Douglas River hydrometric gauging station (07MA003) located approximately 70 km north of the ASA (WSC 2023). Due to this backwater effect, all ice affected water level records (those recorded when water temperature was stable at approximately 0° C) were removed from the datasets of each station.

Jed Creek

Jed Creek is the main inlet of Patterson Lake, located upstream of the potential treated effluent discharge point. The creek flows from Broach Lake to Jed Lake, and into the northeast of Patterson Lake, draining an area of approximately 127.5 km^2. Hydrometric monitoring at this station began in 2014 at a station located approximately 20 m upstream of Patterson Lake. Discharge was highest at this station in 2014, 2020, and 2021, and lowest in 2017, ranging from a minimum daily flow of 0.363 m^3/s on October 8th, 2017 to a maximum daily flow of 1.42 m^3/s on June 7th, 2020 (Figure 4-28; Table 4-15). A wide range of water level elevations (0.479 m) were recorded across the monitoring period.

Patterson Lake Outlet

Patterson Lake Outlet, located downstream of the Project and the proposed treated effluent discharge point and upstream of Forrest Lake, drains an area of approximately 263.4 km^2. Established approximately 20 m downstream of Patterson Lake (upstream of the NexGen Energy Ltd. access road bridge), the hydrometric monitoring station has been collecting data since 2014. During the monitoring period, discharge was greatest in 2014, 2020, and 2021, and lowest in 2015 and 2017, ranging from a minimum daily flow of 0.351 m^3/s on

[3] Referred to as "Patterson Creek" in Appendix C.3 (2020 Baseline report).
[4] Referred to as "Beet Creek" in Appendix C.3 (2020 Baseline report) and as "Clearwater River below Beet Lake" in Appendix D.5.
[5] Referred to as "Clearwater River below Naomi Lake" in Appendix D.5.

November 15th, 2015 to a maximum daily flow of 2.38 m^3/s on June 7th, 2020 (Figure 4-29; Table 4-15). Water level elevations at this station displayed a wide range of variability (0.487 m) between 2014 to 2022.

Beet Lake Outlet

The Beet Lake Outlet monitoring station, established in 2019, is located approximately 0.4 km from the outlet of Beet Lake and drains an area of approximately 454 km^2. Water levels at this station were lowest in 2019 and highest in 2020. Between 2019 and 2022, daily discharge ranged from 1.92 m^3/s to 8.33 m^3/s (June 1st, 2019 and October 14th, 2020, respectively), and water level elevations varied by 0.375 m (Figure 4-30; Table 4-15).

Clearwater River (near-field)

The Clearwater River (near-field) monitoring station was established in 2016 and is located approximately 2 km from the outlet of Naomi Lake and drains an area of approximately 648 km^2. This monitoring station captures roughly 20% of the flow volumes of the Clearwater River above Lloyd Lake. Discharge was highest in 2020, and lowest in 2017, ranging from a minimum daily flow of 0.706 m^3/s on September 17th, 2017 to a maximum daily flow of 10.7 m^3/s on May 12th, 2020 (Figure 4-31; Table 4-15). This station recorded the largest range of water level elevations (0.634 m) throughout the monitoring period.

4.5.1.2 Secondary ASA

Morphometric characteristics of Lakes A through F are summarized in Table 4-17 while detailed bathymetric maps are included in Appendix C.3. Lakes A, B, and C are located to the northwest of Patterson Lake and were found to have no connection to Patterson Lake following field investigations. Lake A is one of the deeper lakes of the unnamed lakes in the Project area, with a mean depth of 4.5 m, a maximum depth of 10.9 m, and a volume of 2.7 x 10^6 m^3. Lakes B and C are very similar with mean depths of 1.4 m and 1.6 m respectively, and maximum depths of 2.5 m and 2.4 m, respectively.

Lake D intermittently flows into Lake E, which eventually discharges into the northwest side of Forrest Lake. Lake D has a mean depth of 2.8 m, a maximum depth of 4.5 m, and a volume of 2.9 x 10^6 m^3. Lake E has a surface area of 0.79 km^2 and a volume of 6.5 x 10^6 m^3. The mean and maximum depths of Lake E are 8.2 m and 20.5 m, respectively.

Lake F is located immediately east of Forrest Lake and is separated from Forrest Lake by a small ridge. This lake is the deepest of the unnamed lakes, with a mean and maximum

depth of 9.4 m and 36.4 m, respectively. Lake F has a surface area of 1.21 km^2 and a volume of 11.5 x 10^6 m^3.

Instantaneous water level measurements were taken three times throughout each year at lakes A, B, and C from May 2016 to September 2017 and at lakes D, E, and F from May 2016 to May 2018 (Appendix C.3). Variability in elevations across this time period measured at lakes A, B, and C was 0.296 m, 0.167 m, and 0.310 m, respectively. Similarly, variability in elevations measured in lakes D, E, and F ranged from 0.215 m at Lake D to 0.289 m in Lake E.

4.5.2 Surface Water Quality

The baseline surface water conditions of 23 locations within the primary and secondary ASA have been assessed between 2016 and 2022 (Figure 4-32). Additionally, some targeted field measured water quality data were available from 2013 from Ponds 1 and 2. Seasonal surface water quality monitoring was initiated within the Project area in the summer of 2016 to characterize the existing conditions within the primary and secondary ASA. One full set of seasonal data was collected for the initial baseline investigation between 2016 and 2017. In the spring 2019, an additional year of seasonal sampling was completed with the addition of five new sampling stations within the primary ASA, while no additional sampling was completed in the secondary ASA. Additional seasonal sampling within the primary ASA was completed in 2022 with some slight modifications to the program to include only those monitoring locations within the potential treated effluent flow path. Additionally, two locations within South Creek were newly assessed.

In 2023, water quality sampling focused on two new locations, one station in Patterson Lake (called Patterson Lake South) closer to the planned treated effluent release and one corresponding reference location in Hodge Lake. The sampling completed in 2023 was intended to be downstream of the treated effluent diffuser location; however, as Project planning progressed and modelling exercises were undertaken, the diffuser location was re-situated to a deeper area in Patterson Lake to further promote mixing; thus, the station sampled in Patterson Lake in 2023 is no longer downstream of the planned treated effluent diffuser location. Further surface water quality sampling is planned downstream of the final planned treated effluent discharge location prior to treated effluent release.

A detailed description of baseline water quality in the ASA is provided in Appendix C.3 and C.4. A summary of the limnological and water chemistry characteristics is provided in the following subsections for the primary and secondary ASAs. Descriptive statistics

including number of samples, mean, maximum, and minimum were computed for the *in situ* measured parameters while additional descriptive statistics including 5th and 95th percentiles were calculated for select water chemistry parameters. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics. Where available, water quality parameters were compared to the SEQGs for the protection of freshwater aquatic life (GS 2023a), the Federal Environmental Quality Guidelines (FEQGs; ECCC 2021), and the Canadian Environmental Quality Guidelines (CEQG; CCME 2023) (Table 4-18).

4.5.2.1 Primary ASA

General Characteristics

Physiochemical parameters were measured *in situ* at each water quality monitoring location. Field measured water quality parameters included temperature, dissolved oxygen (DO), specific conductance, and pH. These measurements were collected as depth profiles at monitoring locations with station depths >1.0 m. Water transparency (Secchi disc depth) and snow and ice thickness were also measured, where relevant. Additional general characteristics were measured in water chemistry samples, including measures of water clarity (total suspended solids [TSS] and turbidity), measures of productivity (nutrients including nitrogen compounds and total phosphorus), and inorganic ion concentrations. A summary of the field measured water quality parameters is provided in Table 4-19 and the water chemistry general characteristics in Table 4-20.

As anticipated, the temperature of the waterbodies within the primary ASA varied seasonally, with thermoclines often evident during the open water season as detailed in Appendix C.4. Dissolved oxygen concentrations were typically above the lower limit (6.5 mg/L) of the SEQG; however, exceptions were found in some instances such as in the bottom portions of some deeper stations in all seasons. Summer DO levels in the ASA were generally lower than in the spring and fall, which is expected with higher water temperatures and less mixing of the water column. The average pH was near neutral, with most measurements within the SEQG and CEQG recommended range of 6.5 to 9.0.

Waterbodies within the primary ASA were characterized as having low ionic composition. Mean specific conductance ranged between 27.8 µS/cm and 63.2 µS/cm and inorganic ion concentrations were low and relatively consistent between waterbodies. Chloride and sulphate concentrations remained well below available SEQG for the protection of freshwater aquatic life.

Water clarity was high within the waterbodies of the primary ASA, with most Secchi disc depth readings reaching the bottom of the shallower sampling locations in Beet Channel and Naomi Lake South. The deepest water quality monitoring stations had the highest water clarity, with average readings exceeding 5.0 m at most of the deeper monitoring stations. Water clarity was slightly lower in the shallower areas of Naomi Lake and Lloyd Lake Inlet, averaging between 2.0 m and 3.0 m as well as at the northeast station in Patterson Lake where it averaged 3.9 m. For the stream sampling areas, turbidity is a better measure of water clarity. Average turbidity in the Clearwater River (near-field) was very low, measuring 1.9 nephelometric turbidity units (NTU), similar to turbidity observed in the Lloyd Lake Inlet (1.7 NTU) and at Warner Rapids (1.8 NTU).

The baseline water chemistry data consistently illustrated low nutrient levels within the primary ASA. Total phosphorus concentrations measured near to the RDL of 0.01 mg/L in all sampling locations except Lloyd Lake Inlet, where mean concentrations measured 0.05 mg/L. Nitrate levels were also low, with ammonia as N, un-ionized ammonia, and nitrate remaining below available SEQG and CEQG. Given the high water clarity and low nutrient levels within the waterbodies of the primary ASA, all waterbodies were classified as oligotrophic according to Wetzel (2001). When compared to the CEQG narrative guideline, all lakes in the primary ASA were oligotrophic except for South Creek, which was mesotrophic, and Lloyd Lake Inlet, which was eutrophic based on their respective mean phosphorus concentrations.

Constituents of Potential Concern

Surface water chemistry data available for waterbodies and watercourses within the primary ASA are summarized for COPC based on the rationale provided in Appendix D.7. Summary statistics for the measured COPC in the primary ASA are presented in Table 4-20. Detailed tables of the existing water quality data are provided in Appendix C.4.

The water chemistry data consistently illustrated low levels of COPC within the primary ASA. Mean iron concentrations exceeded the SEQG of 0.3 mg/L at both South Creek locations, Naomi Lake, and Clearwater River (near-field). Lead concentrations exceeded the SEQG and CEQG of 0.001 mg/L at South Creek Upstream, Patterson Lake North, and Beet Lake in July 2022, but the mean concentrations remained below the guideline. Select aluminum concentrations at Naomi Lake, Lloyd Lake Inlet, and Warner Rapids were also above available guidelines, but similarly, the mean concentrations remained below

guidelines. The higher levels of COPC during baseline conditions reflect naturally occurring elevated levels of iron, lead, and aluminum in the region.

4.5.2.2 Secondary ASA

Water quality in the secondary ASA waterbodies displayed similar general characteristics to those of the primary ASA, with seasonal temperature variation and thermal stratification of the water column at the deeper sampling areas of Lake E and Lake F during the open water season (Appendix C.3). DO levels on average remained above the minimum SEQG of 6.5 mg/L but fell below this level at times, particularly near the bottom of the water column (Table 4-21). Specific conductance and inorganic ions concentrations were low, with chloride and sulphate remaining well below the available SEQG (Table 4-22). Water clarity was moderate, with Secchi disc depth readings of the deeper waterbodies averaging between 2.6 m and 3.5 m. Low nutrient concentrations and water clarity determined that the secondary ASA waterbodies were classified as oligotrophic per Wetzel (2001).

Summary statistics for the water quality COPC levels from the secondary ASA are provided in Table 4-22. The data consistently illustrated low levels of COPC with values remaining below available SEQG for the protection of freshwater aquatic life, with the exception of mean iron which exceeded the SEQG of 0.3 mg/L at Lake C and Lake E.

4.5.3 Sediment Quality

Sediment quality is an important aspect of aquatic ecosystems, as it can influence the quality of overlying waters and the benthic invertebrate community residing within the sediment. Baseline sediment quality was investigated in the ASA in 2017 and 2019. In 2017, six locations in the primary ASA and six locations in the secondary ASA were assessed (Figure 4-33). In 2019, six of the primary ASA waterbodies from 2017 (Broach Lake, Patterson Lake West, Forrest Lake, Beet Lake, Naomi Lake, and the Clearwater River [near-field]) were resampled; however, the sampling area in Beet Lake was relocated in 2019 to an area that is along the flow path to the Clearwater River (called Beet Lake Inlet). The primary ASA was expanded in 2019 to include Hodge Lake as an additional potential reference area, three additional sampling areas in Patterson Lake, and Lloyd Lake Inlet.

The study design targeted depositional areas as they can accumulate concentrations of parameters over time. Due to the high sand content of the area, significant effort was put into finding depositional zones in each lake that were sufficient for sediment coring and

benthic invertebrate sampling. Sediment chemistry and characterization stations were co-located with the benthic invertebrate community stations to provide supporting data for interpretation of benthic invertebrate results. In order to obtain adequate densities of benthic invertebrates, station depths were targeted to be a maximum of approximately 8 m deep depending on the waterbody's morphometry and substrate composition.

A detailed description of baseline sediment quality in the ASA is provided in Appendix C.3. A summary of the particle size and sediment chemistry characteristics is provided in the following subsections for the primary and secondary ASA. Summary statistics including the minimum, mean, maximum values were summarized for the combined 2017 and 2019 dataset. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics. Concentrations of parameters in sediment were compared to the CEQG for the protection of aquatic life (CCME 2023) and to sediment quality guidelines recommended for the uranium mining and milling industry in Canada by Thompson et al. (2005). The Canadian Council of Ministers of the Environment (CCME) interim sediment quality guideline (ISQG) represents the concentration below which there is unlikely to be any adverse biological effects (CCME 2023). The CCME probable effect level (PEL) is the guideline level above which adverse effects are expected to frequently occur (CCME 2023). The lowest effect level (LEL) represents the concentration below which harmful effects on benthic invertebrates are not expected to occur (Thompson et al. 2005). Further, sediment chemistry results were compared to proposed sediment quality values (SQVs) for uranium operations in northern Saskatchewan. Reference values (REF) were derived based solely on sediment metal and trace element concentrations from reference sites, and no-effect values (NE2) incorporate sites where benthic invertebrates were unaffected by effluent (Burnett-Seidel and Liber 2013).

4.5.3.1 Primary ASA

Sediment quality characteristics including particle size composition and COPC levels are summarized in Table 4-23 for the primary ASA. Fine and coarse sand tended to dominate the particle size, with some variability evident between years as less sand particles were evident in 2019 as compared to 2017 (Appendix C.3). The total organic carbon (TOC) content varied greatly between waterbodies, with the lowest levels observed in Beet Lake (0.3%) and the highest levels observed in Naomi Lake (22.6%). COPC levels tended to be low throughout the primary ASA and reflective of baseline conditions. Of the COPC, only

arsenic concentrations exceeded available guidelines at some locations, specifically in Patterson Lake West and Naomi Lake.

Sediment concentrations of several COPC in Naomi Lake were higher than all other areas; this was particularly evident for mean cobalt and nickel concentrations as well as radium-226 activity levels. Sediment concentrations in Patterson Lake West were second highest to Naomi Lake in several cases and were highest in some cases, notably mean concentrations of arsenic and uranium were generally higher than any of the other study areas. Beet Lake Inlet followed by Patterson Lake East and Patterson Lake North, generally had the lowest parameter concentrations, which can likely be attributed to their high coarse sand content.

4.5.3.2 Secondary ASA

Sediment quality in the secondary ASA was generally similar to the primary ASA, though lakes A, B, and C tended to be predominantly comprised of silt as compared to sand like the other areas (Table 4-24). TOC was highest in Lake B (32.2%) and lowest in Lake E (4.6%). COPC levels were low throughout the secondary ASA, with average concentrations below available guidelines.

4.5.4 Aquatic Macrophyte Chemistry

Aquatic macrophyte chemistry data were collected from the primary ASA in July 2016 to provide background chemistry data for rooted macrophytes from the region. Contaminants in sediment may be taken up by the roots and transferred to the shoots of the aquatic plant via the plant's vascular system. Since animals may consume aquatic macrophytes, the plants may serve as a vector for contaminant transfer from plant to primary consumers in the ecosystem.

The baseline sampling program consisted of the collection of macrophyte shoots and roots, and the surrounding sediment for chemical analyses. Macrophyte species collected were sedges (*Carex* spp.), as they were the most commonly occurring macrophyte species in the study area. Macrophyte and sediment samples were collected at the outlets of three waterbodies, namely Broach Lake, Patterson Lake, and Naomi Lake (Figure 4-34). Aquatic macrophyte samples from each replicate station were separated into two components for chemical analysis: shoots (above the sediment/water interface) and roots (below the sediment/water interface). All macrophytes were washed with lake water prior to separation to avoid confounding chemistry results (e.g., uncertainty as to the origin/source

of contaminants). Sediment was collected from around and beneath the macrophyte samples (approximately the 0 cm to 5 cm horizon). Detailed chemistry results are provided in Appendix C.3, while minimum, mean, and maximum COPC levels are summarized in Table 4-25. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics.

Mean metal and radionuclide levels measured in shoot and root samples were generally low, often measuring below the laboratory RDL, and were comparable between waterbodies. Notable differences between study areas included mean uranium concentrations, which were higher in the Patterson Lake shoot and root samples than concentrations measured in Naomi and Broach lakes and mean nickel concentrations, which were higher in the Naomi Lake Outlet root samples as compared to those in Patterson and Broach lakes. Sediment was the least variable media analyzed for the macrophyte program and concentrations of parameters were generally low and similar between waterbodies.

4.5.5 Plankton Communities

Plankton communities are important to sample to understand the primary and secondary production in the ASA. Phytoplankton composition and biomass (primary production) provide an assessment of water quality conditions and can also be used as a general indicator of eutrophication (nutrient enrichment). Zooplankton composition and biomass (secondary production) provide insight to the quality of the food web and energy flow through the system (Green et al. 2015). The objective of the plankton community sampling program was to collect baseline data on phytoplankton and zooplankton structure, density, richness, and diversity in the ASA.

Plankton samples were collected concurrently with summer water quality samples from the following 14 waterbodies in 2016, including 8 primary ASA (Broach Lake, Patterson Lake East, Patterson Lake West, Forrest Lake, Beet Channel, Beet Lake, Naomi Lake, Naomi Lake South) and 6 secondary ASA (Lakes A through F) locations. In the summer of 2019, an additional two primary ASA waterbodies were sampled: Hodge Lake and Lloyd Lake Inlet. Detailed methods and results of the program are available in Appendix C.3 and summarized in this section with a focus on the primary ASA.

Phytoplankton samples were collected from the euphotic zone of the water column via two hauls of Tygon tubing (12.7 mm internal diameter) extended from the surface to twice the Secchi depth. Zooplankton samples were collected with a Wisconsin plankton net (20-cm

mouth diameter, 100-cm length, and 80-µm mesh size). All plankton samples were submitted to a qualified taxonomist for analysis.

Phytoplankton communities were dominated by cyanophytes (blue-green algae) in 12 of the 16 locations assessed in the ASA in 2016 and 2017, while Chrysophyta (golden algae) were most prevalent in the remaining four waterbodies. To lesser extents, diatoms, cryptophytes, green algae, dinoflagellates, and euglenoid Protozoa occurred in the ASA (Figure 4-35). The community metric of density had a wide range from approximately 237 thousand cells/L (Broach Lake) to 14.0 million cells/L (Lloyd Lake Inlet), while taxon richness assessed at the Family level ranged from 14 (Broach Lake) to 22 (Naomi Lake). Simpson's diversity was moderate to moderately high in the primary ASA (between 0.61 and 0.82) and Simpson's evenness was low in all phytoplankton communities ranging between 0.10 and 0.38, which was related to the dominance of a few golden algae or blue-green algae families in each community (Table 4-26).

Zooplankton communities in the primary ASA consisted of a mix of mostly cladocerans, cyclopoids, and rotifers (Ploima and Floscullariacea; Figure 4-36). Density ranged between 20 organisms/L (Patterson Lake East) and 299 organisms/L (Beet Lake). Taxon richness assessed at the Family level ranged between 8 taxa (Forrest Lake) and 14 taxa (Naomi Lake South). Diversity tended to be moderate in most communities, though slightly lower in Naomi and Hodge lakes (0.36). Simpson's evenness was low in all areas except Patterson Lake West (0.59), Forrest Lake (0.41), and Beet Lake (0.52), where levels were considered moderate (Table 4-27).

4.5.6 Benthic Invertebrate Communities

Benthic invertebrate communities are an important component of fish habitat and are considered useful indicators of ecological health due to their sensitivity to contaminants. The objective of the benthic invertebrate sampling program was to collect baseline data on benthic invertebrate community structure, density, richness, diversity, and biomass.

In 2017 and 2019, benthic invertebrates were collected co-incident and co-located with the sediment quality samples[6]. Every effort was made to match substrate composition and sampling depths across waterbodies (to a maximum of 8.0 m) so that the benthic invertebrate community data would be comparable between sampling areas. This type of design is useful for possible future Before-After-Control-Impact (BACI) studies; however,

[6]The five replicate stations were spaced a minimum of 20 m apart as recommended in EC (2012c).

matching suitable sampling depths was not always achievable, namely in Forrest Lake, Clearwater River (near-field), Lake B, Lake C, and Lake D, whose stations were shallower (ranging from approximately 0.5 m to 2.0 m), and Hodge Lake and Beet Lake Inlet, whose stations were deeper (ranging from approximately 6.0 m to 8.0 m).

Each benthic invertebrate community sample was a composite of five grabs using an Ekman dredge (0.052 m^2 sampling area) and each grab was field sieved through a 500 µm nitex mesh bag before preservation with 10% buffered formalin and sent to a qualified taxonomist for identification and enumeration as well as biomass estimations. Detailed methods and results from the primary and secondary ASA are available in Appendix C.3 and are summarized below for the primary ASA.

The most abundant taxa were usually Chironomidae (non-biting midge larvae) followed by Amphipoda (*Gammarus* and *Hyalella*, also called scuds and freshwater shrimp), which together generally accounted for more than half of the percent densities in most areas (Figure 4-37). Molluscs were another common group, accounting for approximately 5% to 10% of the densities in most areas. The remaining groups were present in low numbers or were absent, such as Ephemeroptera (mayfly nymphs), Oligochaeta (aquatic earthworms), and Trichoptera (caddisfly larvae).

In terms of biomass in 2017 and 2019, Chironomidae and Amphipoda were again the dominant taxa, although molluscs were often notable due to their heavy weight (Figure 4-38). The biomass in both Naomi Lake (in 2017 and in 2019) was almost entirely accounted for (>80%) by Chironomidae while the remaining groups accounted for very little of the biomass composition.

The benthic invertebrate community metrics of density and taxon richness spanned a wide range in both 2017 (Table 4-28) and 2019 (Table 4-29). Density and taxon richness ranged widely across waterbodies, with the highest mean density observed in Forrest Lake containing the highest density and taxon richness (24,492 organisms/m^2 in 2019 and 20.4 taxa/m^2 in 2017, respectively). Density and taxon richness was lowest in Naomi Lake (824 organisms/m^2 in 2017 and 5.8 taxa/m^2 in 2017, respectively). Patterson Lake tended to fall intermediate to these locations, with mean density ranging between 1648 and 7753 organisms/m^2 and mean taxon richness ranging between 12.6 and 16.2 taxa/m^2 depending on the sampling location within Patterson Lake.

Simpson's diversity was moderate to moderately high in most study areas in 2017 (Table 4-28) and 2019 (Table 4-29), ranging between 0.44 and 0.73. Simpson's diversity in

Patterson Lake ranged from 0.58 to 0.73. Average Simpson's evenness was generally low across the study area, ranging from 0.11 to 0.49, indicating a dominance of a few taxonomic groups across most communities (i.e., non-biting midge larvae). Simpson's evenness in Patterson Lake fell intermediate to the overall range, measuring between 0.21 and 0.30.

4.5.7 Fish and Fish Habitat

Fish community composition, spawning areas, and habitat quality were assessed between 2013 and 2022 at several locations within the primary and secondary ASA. The objectives of the community survey were to assess species composition, abundance, morphometry, and fish health in the ASA. Additionally, large-bodied fish flesh and bone samples were assessed for levels of metals and radionuclides to establish background levels in predatory and bottom feeding species within the ASA. Spawning surveys were conducted in order to document specific locations in the ASA that are used for spawning by large-bodied fish so that Project planning can mitigate potential impacts to critical fish habitat. Habitat assessments were also completed to document areas that contain high quality habitat that could potentially be used for spawning by large-bodied fish species residing in the ASA as the data obtained during the spawning surveys represent a snapshot in time. The detailed results of the baseline investigations on fish and fish habitat assessed in both primary and secondary study areas are presented in Appendix C.3 and C.4. The following sections summarize the existing fish and fish habitat conditions in the ASA, with a focus on the primary ASA.

4.5.7.1 Fish Community

Fish community surveys were completed during four separate periods between 2013 and 2022, with the most comprehensive surveys completed in July 2016 and July 2019. Additionally, data available from the spawning surveys completed in 2017 were utilized to provide additional species observation information. The survey completed in 2013 focused on Patterson Lake and Ponds 1 and 2, while the most recent survey in 2022 focused specifically on the potential treated effluent discharge location in Patterson Lake[7]. A variety of methods were used during the fish community surveys including boat and backpack electrofishing, minnow traps, half-standard gang gill nets, short-length gill nets, and box nets. Descriptions of these methods are provided in Appendix C.3 and C.4.

[7] The treated effluent diffuser location assessed as part of the 2022 survey has subsequently moved with continued Project planning. In 2024, substrate mapping was completed in the area surrounding the final diffuser location.

A total of 14 fish species were captured with the primary ASA (Table 4-30), with the most prevalent species captured across all survey types being lake whitefish (*Coregonus clupeaformis*), followed by white sucker (*Catostomus commersonii*) and longnose sucker (*Catostomus catostomus*), and spottail shiner (*Notropis hudsonius*; Table 4-31). As shown in Table 4-31, species composition and abundance varied by waterbody assessed. Patterson Lake had the highest fish species richness in the primary ASA, with 13 species observed. This was followed closely by Forrest and Beet lakes, with one less species (n = 12) captured during the surveys. The most prevalent species in Patterson Lake were white sucker and trout perch (*Percopsis omiscomaycus*), with subdominant species including lake whitefish and spottail shiner. Of the lakes assessed in the primary ASA, Naomi Lake had the lowest species richness, with five species observed.

Community composition is best examined when looking at non-selective fishing methods. Table 4-32 summarizes catch-per-unit-effort (CPUE) from boat electrofishing and half-standard gang gill net sets. Boat electrofishing was the method that captured the most species in each waterbody, while half-standard gang gill netting was more successful at capturing a greater diversity of large-bodied fish species. The electrofishing CPUE was dominated by white sucker, trout perch, and spottail shiner in Patterson Lake, with half-standard gang capture success dominated by lake whitefish and walleye (*Sander vitreus*). Trout perch dominated the boat electrofishing capture success in Patterson Lake near the proposed treated effluent discharge location, while walleye dominated the half-standard gang success.

Fish community composition and capture success in the secondary ASA is summarized in Table 4-33 to Table 4-35. Minnow traps were more successful in the secondary ASA as compared to the primary ASA; thus, species capture success for minnow traps are also included. Between one and three species were captured in lakes A to E, with the species composition and CPUE differing between these smaller lakes. Lake F had a higher diversity and density of fish with seven species captured that were dominated by spottail shiner. In Ponds 1 and 2, overnight minnow trap sets and backpack electrofishing were conducted around the entire perimeter of each pond during the 2013 investigations and no fish were captured (CanNorth 2014).

Local Buffalo River Dene Nation (BRDN) and Clearwater River Dene Nation (CRDN) land users interviewed in 2023 identified walleye, northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), Arctic grayling (*Thymallus arcticus*), lake whitefish, suckers, and burbot (*Lota lota*) as important traditional foods consumed in the region, though it is noted

that not all species were captured in the primary or secondary ASA (BRDN 2023a; CRDN 2023). Local CRDN land users also identified brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and yellow perch (*Perca flavescens*) as important traditional foods consumed in the region, though it is noted that not all species were captured in the primary or secondary ASA (CRDN 2023). Important harvested fish species identified by Métis Nation Saskatchewan (MN-S) advisors and secondary sources were cisco (*Coregonus artedi*), walleye, northern pike, trout, lake whitefish, suckers, burbot, and a species referred to as "catfish mullet" (MN-S 2023). It is noted that not all species were captured in the primary or secondary ASA. Birch Narrows Dene Nation (BNDN) identified harvesting large numbers of northern pike and walleye in the region (BNDN 2024) Commercial fishing is permitted on Patterson Lake, Forrest Lake, and Beet Lake, with quotas established for lake whitefish, northern pike, walleye, and lake trout. Additionally, commercial fishing is permitted on Naomi Lake with quotas established for lake whitefish, northern pike, and walleye and on Broach Lake and Hodge Lake with quotas established for lake whitefish, northern pike, and lake trout. However, commercial fishing on these lakes has not occurred since before 2018 (ENV 2023a). Additional details related to traditional and commercial use of fisheries resources in the area are provided in Section 4.7.2 and Section 4.7.5.

4.5.7.2 Fish Spawning and Habitat

Three fish spawning surveys were completed in the primary ASA in 2017. The spring spawning survey was completed from May 15th to June 4th, 2017, targeting large-bodied spring spawning species known to occur in the ASA, such as northern pike, walleye, white sucker, yellow perch, Arctic grayling, and longnose sucker. Two separate fall spawning surveys were completed in 2017; the first survey targeted lake trout and extended from September 21st to October 4th, while the second survey was completed from October 12th to October 22nd, with lake whitefish as the target species. During the spawning surveys, three different fish capture methods were used: hoop nets, short length gill nets, and angling. In addition, egg searches were completed using a combination of vegetation sweeps, egg suctioning, and kick netting methods. Fish spawning surveys were not completed for Lloyd Lake Inlet or the reference lakes (Broach Lake and Hodge Lake).

The completion of aquatic habitat assessments allows for the mapping of potential critical fish habitat throughout the ASA and is not reliant on point in time observations of habitat use, that can vary from year to year. Aquatic habitat assessments were completed during four separate periods between 2013 and 2022, with the most comprehensive surveys

completed in July 2016 and July 2019. In 2022, detailed habitat data including substrate and vegetation mapping was collected from the proposed treated effluent discharge location in Patterson Lake. In addition, habitat data were collected from the lower portion of South Creek in 2022. South Creek was determined to be not suitable for fish spawning, assuming fish are migrating from Patterson Lake, due to the intermittent presence of water and obstructions, hence is not discussed further.

Mapping of the quality and quantity of critical fish habitat in the ASA focused on spawning habitat; however, summary sections are provided that discuss nursery, rearing, feeding, and overwintering habitat and detailed aquatic habitat results from the primary and secondary ASA, including mapping, are provided in Appendix C.3 and C.4. The following section provides a high-level overview of the available habitat and spawning utilization of Patterson Lake with a more detailed description of habitat availability and use within the area surrounding the potential treated effluent diffuser in Patterson Lake.

Patterson Lake

The Project is located on the southwest side of Patterson Lake. Patterson Lake receives water from Jed Creek into the northeast basin, flows continue southwest through the north basin before flowing through the east basin and exiting the lake through Patterson Creek (Figure 4-20). The littoral zone of Patterson Lake was comprised mainly of sand dominated substrates; however, cobble was the dominant substrate type in some areas. Water depths ranged between 0.4 m and 2.0 m approximately 5.0 m from the shore. The level of rock cleanliness varied drastically between areas, with either clean rocks or dense algal coverage of the rocks occurring regularly.

Fish cover was created by dense overhanging vegetation and bank undercuts, with some large woody debris, large rocks, and dense aquatic vegetation. Areas of Patterson Lake provided moderately to highly suitable spawning habitat for yellow perch, walleye, lake whitefish, lake trout, and sucker species. Evidence of spawning (i.e., the presence of fish eggs) sucker species, walleye, lake trout, and lake whitefish were observed during the 2017 spawning investigations. Despite not being discovered in Patterson Lake, northern pike eggs were found in Jed Creek and Patterson Creek, the lake's inlet and outlet.

In 2022, a detailed assessment of the littoral zone of Patterson Lake in the general area near the treated effluent discharge point was completed with a total of 20 habitat sections (HSs) delineated. As shown in Figure 4-39, HS 11 delineates the littoral zone near the shoreline surrounding the current location of the treated effluent pipeline and diffuser. The HS 11

substrate was made up of mainly sand and cobble with smaller amounts of gravel, boulder, and organics. Fish cover at HS 11 included moderate amounts of overhanging vegetation and undercut banks with sparse amounts of rock and large woody debris. Aquatic vegetation was mostly absent with sparse amounts of submergent vegetation as well as moss and algae. The near shore habitat where the treated effluent pipeline and diffuser is proposed to be located was rated as not suitable spawning habitat for northern pike, lake trout, and Arctic grayling, and marginally suitable for walleye, lake whitefish, yellow perch, white sucker, and longnose sucker. North of HS 11, two areas (HS 2 and HS 7) were identified as providing moderately suitable spawning habitat for walleye, lake whitefish, white sucker, and longnose sucker spawning as they contained dense fish cover from overhanging vegetation, undercut banks, and substrate dominated by sand and cobble (Figure 4-39). One area south of HS 11 (HS 13) was found to be moderately suitable for northern pike and yellow perch spawning due to the dense submergent aquatic vegetation cover, dense overhanging vegetation cover, and shallow depth. Additionally, one area (HS 20) was found to be moderately suitable for yellow perch spawning due to the high density of overhanging vegetation and lack of current.

Substrate mapping of the area surrounding the originally proposed treated effluent discharge location as well as the final proposed treated effluent discharge location are both shown in Figure 4-39. The final proposed diffuser location contained more silt/clay at its eastern extent than did the original location; nevertheless, both areas were mainly composed of sand and silt/clay with little to no aquatic macrophytes, making the areas not suitable spawning habitat for northern pike, lake trout, and Arctic grayling, and marginally suitable for walleye, lake whitefish, yellow perch, white sucker, and longnose sucker.

Forrest Lake

From Patterson Creek, water flows through the north end of Forrest Lake before continuing down the Clearwater River drainage; thus, the focus of the assessments was the north end of Forrest Lake. Due to the variable habitat throughout the lake, some areas were more suitable for spawning for some species than others. Areas containing moderately clean rocks were most suitable for walleye, lake whitefish, suckers, and lake trout and evidence of spawning for all of these species was observed during the 2017 spawning investigations. Areas with dense amounts of large woody debris or emergent vegetation were most suitable for yellow perch and northern pike. Northern pike eggs were found in the north area of Forrest Lake where dense beds of sedge (*Carex* spp.) occurred and the substrate was predominantly organic.

Beet Channel and Beet Lake

After Forrest Lake, the Clearwater River continues to flow east through Beet Channel and Beet Lake. In Beet Channel, substrate was dominated by sand along the north side of the channel, with organic matter or a mix of sand, rock, and organic matter occurring in other areas. In Beet Lake, the dominant substrate types were sand and rock, while a few areas were dominated by a mixture of silt/clay. Dense amounts of large woody debris occurred throughout Beet Channel and in some areas of Beet Lake, resulting in moderately or highly suitable spawning habitat for yellow perch. Most areas were unsuitable spawning habitat for walleye, lake whitefish, lake trout, and suckers because of the scarcity of clean rock habitat in Beet Channel, with walleye being the only species of fish eggs located during spawning surveys. Given the large amounts of clean gravel, cobble, and boulder substrates located in Beet Lake, the spawning habitat was most suitable for walleye, lake whitefish, sucker species, and lake trout species and this was confirmed by the presence of eggs for all these species.

Naomi Lake

Water flow continues east from Beet Lake through the lower portion of Naomi Lake before discharging into the Clearwater River. The substrate of Naomi Lake is dominated by sand, with patches of silt/clay, organic matter, or cobble and boulder substrate. The main cover types for fish were overhanging vegetation, large woody debris, and aquatic vegetation, thus providing moderate to highly suitable spawning habitat for yellow perch and northern pike and was supported by the presence of northern pike eggs. Clean cobble and boulder substrate was found in one area of the lake and was found to be moderately suitable for walleye, lake whitefish, and suckers, although evidence of spawning (i.e., eggs) was only found for walleye.

Clearwater River

The area of the Clearwater River assessed in 2016 largely consisted of slow-moving glides and pools with sandy substrate, though one riffle area was identified. The predominant fish cover type was moderately dense to dense overhanging vegetation. The riffle area contained patches of clean cobble substrate that provided moderate to highly suitable spawning habitat for walleye, lake whitefish, Arctic grayling, and sucker species. Moderately suitable habitat for northern pike spawning was also identified in slow moving waters with emergent vegetation. Eggs were found for both northern pike and sucker species in the near-field area of the Clearwater River.

The far-field portion of the Clearwater River immediately upstream of the inlet to Lloyd Lake was surveyed in the summer of 2019. Substrates consisted of silt/clay and organic materials. Marginally suitable spawning habitat for northern pike was determined for this area of the Clearwater River due to the scarcity of aquatic vegetation. Suitable spawning habitat was not identified for walleye, lake whitefish, lake trout, Arctic grayling, yellow perch, and sucker species in this reach.

Lloyd Lake Inlet

In the area surrounding the Clearwater River outlet, the predominant cover type for fish was dense aquatic vegetation with sparse amounts of large woody debris, which provided highly suitable spawning habitat for northern pike and one area of moderately suitable spawning habitat for yellow perch. The littoral zone substrate was silt/clay and organics in the wetland areas and predominantly cobble and boulder in all the other areas assessed. These clean, rocky substrates provided moderately to highly suitable spawning habitat for walleye, lake whitefish, lake trout, and sucker species.

Reference Lakes

Broach Lake is located north of Patterson Lake and is the headwater for the Clearwater River. The littoral zone varied throughout the lake. The dominant substrate in most of the HSs was comprised of cobble and boulder, followed by sand. Areas with aquatic vegetation coincided with substrate dominated by organic matter and were found most suitable for northern pike spawning. Areas which were dominated by cobble and boulder substrates were marginally to highly suitable for walleye, lake whitefish, and suckers.

Hodge Lake contained sparse to moderate amounts of aquatic vegetation with considerable amounts of organic matter; the habitat was rated as being moderately to highly suitable for northern pike spawning. The majority of Hodge Lake had clean cobble and boulder substrates which made moderately suitable spawning habitat for walleye, lake whitefish, and sucker species and two small areas were rated as moderately suitable for lake trout spawning. The general absence of woody debris determined Hodge Lake to be unsuitable to moderately suitable for yellow perch.

4.5.7.3 Fish Chemistry

During the 2016 and 2019 surveys, five northern pike and five lake whitefish were retained for chemical analysis from select lakes (Hodge Lake, Broach Lake, Patterson Lake, Forrest Lake, Beet Lake, Naomi Lake, and Lloyd Lake Inlet) in the primary ASA. Samples, for the

most part, consisted of individual fish; however, in some instances composite samples were required to meet the minimum weight requirements. Detailed data are presented in Appendix C.3, while COPC are summarized in Table 4-36 and Table 4-37. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics. Selenium levels measured in the flesh samples were compared to the United States Environmental Protection Agency (U.S. EPA) selenium criterion for fish muscle (flesh) of 11.3 µg/g dry weight (U.S. EPA 2016). Similarly, mercury levels were compared to the Health Canada recommended value of 0.5 ppm (0.5 µg/g wet weight) for safe consumption since provincial guidelines are specific to a waterbody and fish size (GS 2015).

Primary ASA

Metal and radionuclide levels of COPC in both lake whitefish and northern pike flesh and bone samples were often near or below the RDL and similar between lakes. All flesh samples contained selenium concentrations below the U.S. EPA selenium criterion for fish muscle (flesh) of 11.3 µg/g dry weight (U.S. EPA 2022). Although not a COPC, mercury levels were compared to the Health Canada recommended value of 0.5 ppm (0.5 µg/g wet weight) for safe consumption (GS 2015). Mercury concentrations in lake whitefish and northern pike samples were all below the recommended values, with one exception, one northern pike sample from Hodge Lake (reference) exceeded the recommended level (3.3 µg/g dry weight [0.72 µg/g wet weight]).

Methylmercury comprises 95% or more of total mercury in fish muscle tissue (EC 2012a); thus, the baseline fish tissue mercury data, although analyzed for total mercury, provide an indication of existing methylmercury levels in fish. Based on the predicted sulphate concentrations associated with the Project effluent, increased bioaccumulation rates of methylmercury in fish tissue are not expected to be a concern. Mercury concentrations in fish will be analyzed as part of regular monitoring.

4.6 Terrestrial Environment

Baseline studies of the terrestrial environment were initiated with preliminary investigations in 2013 and expanded to comprehensive investigations between 2018 and 2022. The most relevant comprehensive baseline data are presented in Appendix C.3 and Appendix C.4. The 2018/2019 studies focused on characterizing soils, vegetation, habitat types, and wildlife (i.e., mammals, birds, amphibians) within the Project area, and offered early insights for Project planning. Studies completed in 2022 were designed to gather current data in consideration of the revised Project footprint, and to inform the

development of a Woodland Caribou Mitigation Plan (Appendix D.9). These studies entailed comprehensive desktop analysis and targeted field surveys and sampling; the results of these efforts are the emphasis of this section.

Baseline study areas established for 2018/2019 terrestrial baseline studies included a SSA (i.e., 5 km by 5 km; 25 km²), terrestrial local study area (TLSA) (i.e., 15 km by 15 km; 225 km²), and terrestrial regional study area (TRSA) (i.e., 45 km by 45 km; 2025 km²) (Appendix C.3). The SSA, TLSA, and TRSA were applied to the 2022 surveys; however, survey effort was particularly focused in areas within the updated Project footprint that were previously un-surveyed in 2018/2019 (Appendix C.4), which included the TMF, the mill area, a waste rock/overburden stockpile, the permanent camp, and along proposed roads.

Baseline study results are discussed in reference to the SSA, PDA, LSA, and RSA that were delineated for vegetation and wildlife VCs for the EIA (Figure 4-40). The LSA and RSA applied to vegetation and wildlife VCs differ due to wildlife movement and home ranges affecting the potential for Project-environment interactions. The vegetation local study area (VLSA) is a 600 m buffer around the PDA, and the vegetation regional study area (VRSA) is a 5 km buffer around the PDA. The wildlife local study area (WLSA) matches the VRSA. The wildlife regional study area (WRSA) is a 30 km radius from the approximate center of the PDA. The larger RSA is relevant to studying indirect effects and cumulative effects of the Project in a broader context, particularly impacts on large mammal VC such as boreal woodland caribou (*Rangifer tarandus caribou*).

4.6.1 Topography and Soils

The Project area largely traverses the Boreal Plain Ecozone, with some areas of the VLSA and WLSA extending into the Boreal Shield Ecozone. The PDA is encompassed within the Firebag Hills Landscape Area of the Mid-boreal Uplands Ecoregion, and the VLSA and WLSA are comprised of the Firebag Hills Landscape Area of the Mid-boreal Uplands Ecoregion, and the McTaggart Plain Landscape Area of the Athabasca Plain Ecoregion (Acton et al. 1998).

The topography of the Firebag Hills Landscape Area of the Mid-boreal Uplands Ecoregion consists of both strong and gentle rolling morainic hills, creating variable gradients of elevation. Eroding slopes along watercourses in this landscape area support Regosolic soils, and more stabilized slopes and upland areas exhibit Dystric Brunisolic soils segmented above sandy glacial till and glaciofluvial deposits. Water distributed across this

landscape area drains through the Clearwater River and connected watercourses. Upland areas feature mainly jack pine forests with lichen understoreys; conditions that result from recurring forest fires atop sandy soils. Poorly drained expanses of this landscape area contain both forested and non-forested wetlands, including peatlands dominated by tamarack (*Larix laricina*) and black spruce (*Picea mariana*) (Acton et al. 1998).

The topography of the McTaggart Plain Landscape Area of the Athabasca Plain Ecoregion exhibits northward sloping hills originating from its southern extent. Sandy glaciofluvial deposits and eskers are widespread throughout this landscape area. In contrast, well-drained slopes and glacial till plains are characterized by Brunisolic soils. Poorly drained depressional areas of this Landscape Area yield predominantly Gleysolic and Cryosolic soils. Upland areas, such as the slope sides of eskers, are dominated by jack pine and black spruce. Jack pine are also widely distributed across sandy glaciofluvial areas, whereas black spruce forests with stunted growth characterize wetland features, such as bogs (Acton et al. 1998).

4.6.1.1 Soil Series

A soil classification survey was conducted within the 2018/2019 baseline SSA[8] in 2018 to inform soil management decisions. The objective of the survey was to generate a soil resource inventory that could provide preliminary information related to materials handling and conservation and reclamation planning. Site and soil profile characteristics were collected and assessed according to standard guidelines and classification systems. Detailed results from these efforts are presented in Appendix C.3 and are summarized below.

Twenty-four soil series and variants were identified within the 2018/2019 baseline SSA. Soil series were evaluated for reclamation suitability using criteria for northern forest regions defined in Soil Quality Criteria Relative to Disturbance and Reclamation guidelines (Alberta Agriculture 2004). Most topsoils (i.e., upper lifts) within the 2018/2019 baseline SSA were deemed poorly suitable for reclamation use; approximately 80% of soil inspection sites were limited by coarse soil textures and/or coarse fragment contents. Most upper subsoils (i.e., lower lifts) were assessed similarly but more limited; approximately 91% of soil inspection sites yielded upper subsoils that were poorly suitable (84%) or

[8] The SSA evaluated during the 2018/2019 baseline studies differs slightly from the SSA being evaluated as part of this EIA since the current SSA is designed to encompass the current site layout planned for Project development.

unsuitable (7%) for reclamation use due to coarse soil textures and/or coarse fragment contents.

Soil susceptibility to wind erosion was classified at all soil inspection sites using criteria established by Coote and Pettapiece (1989). Using criteria outlined by the Transportation Association of Canada (2005), susceptibility to water erosion was determined based on observations of soil texture, slope class, and length. Within the 2018/2019 baseline SSA, approximately 83% of soil inspection sites were evaluated as highly susceptible to wind erosion, implying a high risk for soil loss if the assessed areas were disturbed. Approximately 12% of soil inspection sites were assessed as highly susceptible to water erosion. The majority of soils were ranked as having a low (39%) or moderate (46%) susceptibility to water erosion. Soils within the 2018/2019 baseline SSA were also determined to be low risk for compaction; approximately 83% of soil inspection sites yielded low susceptibility to compaction.

4.6.1.2 Soil Map Units

A total of 13 unique soil map units were identified to represent common soil and landscape patterns within the 2018/2019 baseline SSA (Figure 4-43)[9]. Three additional non-soil map units were also identified, totalling 16 map units overall. For the purpose of reclamation planning, simplified soil map units were made by grouping alike soil series (Table 4-38). This yielded eight soil map units and three non-soil map units (Figure 4-43). The largest soil map unit detected in 2018/2019 baseline studies was Mildred (MIL). The Mildred soil series is dominated by Eluviated Dystric Brunisols with a hummocky surface expression. It was determined that this soil unit covered approximately 1,547 hectares (ha) of the 2018/2019 baseline SSA.

4.6.1.3 Available Soil Quantity for Reclamation

Available soil quantity for reclamation was estimated using the mean topsoil and subsoil thickness and areal extent presented in Table 4-39. For mineral soil map units, MIL has the largest quantity of topsoil at 1,547 ha. For organic soil map units, Gregorie (GGR) has an organic matter quantity of 7 ha. Within the 2018/2019 baseline SSA, there is approximately 2,668,700 m^3 of mineral topsoil and 79,800 m^3 of organic matter available for reclamation (Table 4-39).

[9] The location of the TMF was added after the soil survey was completed. Follow-up studies are planned prior to construction to characterize the entire SSA.

During the soil baseline, bedrock was not encountered due to the target assessment depths of 120 cm for mineral soils, and 160 cm for organic soils. Since bedrock was not encountered, an estimate of mineral subsoil could not be calculated. However, information provided in the geology report states the material above bedrock (i.e., Quaternary) ranges in thickness between 50 m over Patterson Lake to over 100 m west of Patterson Lake (BGC Engineering 2023). Using an average of these two values and the areal extents in Table 4-39, there is an estimated 8,790,000 m of mineral subsoil available for reclamation. Based on the information available at the time of the EIS, the amount of topsoil, subsoil, and organic matter should be sufficient for active decommissioning and final reclamation. Overall, it was determined that soils within the 2018/2019 baseline SSA were highly susceptible to wind erosion, moderately susceptible to water erosion, at a low risk for compaction, and poorly suited for reclamation use based on the coarse-grained texture and coarse fragment content. Suitable soil that is temporarily removed by site preparation activities will be stockpiled, covered, and subsequently used for reclamation during future progressive and final closure activities. Unsuitable soil will undergo processes to either decreased coarse fragment content or increase soil workability through the addition of organic matter. More information on this process is described in the design and reclamation sections of the DRP.

4.6.1.4 Soil Chemistry

Chemical testing was conducted on soil samples as part of the 2018/2019 baseline studies. This testing was completed within the 2018/2019 baseline LSA to determine existing parameter concentrations in soil samples collected from Permanent Sampling Plots (PSPs). The PSPs were established upwind (future reference) and downwind (future exposure) of the site considering the predominant wind direction since soil chemistry could be potentially impacted by aerial dispersion of COPC from the Project (Figure 4-42). Vegetation samples were collected alongside the soil chemistry samples to assess for potential uptake from the soil to plants. The vegetation chemistry data are presented in Section 4.6.4.2.

Detailed results are presented in Appendix C.3, while minimum, mean, and maximum COPC[10] levels are summarized in Table 4-40. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics. Between the reference and exposure PSPs, the majority of mean COPC concentrations were similar. The pH levels

[10] COPC selection was based on those used in air quality modelling (Appendix D.1).

were acidic in the soils measuring between 3.73 and 4.94. Acidic pH values (i.e., <5.5) are common in coarse-textured forest soils, such as Dystric Brunisols (Maja et al. 2021). These soils are low in base cations (i.e., low pH buffering capacity), as they form on non-calcareous parent materials (Smith et al. 2011). All COPC were well below the available SEQG criteria for residential/parkland and industrial soils (GS 2023a). Data collected during the baseline period will be used for comparative purposes to data collected during the operation period.

4.6.2 Land Cover Classification

A key objective of the terrestrial baseline investigations was to complete land cover modelling and mapping of baseline conditions of the SSA, PDA, VLSA, VRSA/WLSA, and WRSA. The model was created with multispectral satellite imagery in Esri ArcGIS, using object oriented, supervised classification algorithms. Classification training areas were identified from forest ecosite and wetland classification surveys completed during the field baseline programs. The majority of ground truthing data were collected during the 2018/2019 baseline studies (Appendix C.3). As the Project footprint evolved, additional wetland and watercourse mapping was completed as part of 2022 investigations (Appendix C.4). The following section describes the field studies utilized to inform the habitat modelling results (i.e., land cover classification and mapping), and details the final land cover classification of the Project study areas (Figure 4-43 and Figure 4-44).

In 2018, field assessments classified ecosites according to the most current classification system applicable to forest ecosystems in Saskatchewan; the McLaughlan et al. (2010) classification system. A revised classification approach was used in cases where incompatible habitats (e.g., regenerating forest) were encountered. Field assessments completed in 2018 confirmed that the SSA contained a large quantity of disturbed and regenerating habitat that could not be categorized by the McLaughlan et al. (2010) classification system.

Additionally, a subset of wetlands and watercourses in the 2018/2019 and 2022 baseline SSA[11] were classified to document existing conditions and categorize wetland and watercourse types. This included 37 wetlands; 30 wetlands were classified in the 2018/2019 baseline SSA and seven wetlands were classified in the 2018/2019 baseline

[11] The SSA, LSA, and RSA evaluated during the baseline studies differ slightly from the study areas being evaluated as part of this EIA since the current SSA is designed to encompass the current site layout planned for Project development and the current LSA and RSA were adjusted accordingly.

LSA. Of these wetlands, eight wetland types were identified under the Smith et al. (2007) and McLaughlan et al. (2010) classification systems. These wetland types are generally categorized as swamps, bogs, fens, and open-water wetlands according to shared drainage, soil, and vegetation characteristics. No additional wetlands were classified during 2022 baseline studies. However, one additional watercourse was classified in the PDA. This watercourse was classified as a perennial stream and yielded a high probability of supporting plant SOCC. The proposed Project footprint will not directly impact this feature.

Detailed field forest ecosite and wetland classification data are presented in Appendix C.3 and C.4. These data were used to inform the final landcover classification modelling used for the current Project study areas (Figure 4-43 and Figure 4-44). Results from modeling were the foundation for understanding existing conditions for vegetation and wildlife VCs. Land cover types determined for the Project area included, but were not limited to: graminoid wetland, open water, immature upland forest, mature upland forest, recent burn upland, and existing disturbance. Ecosites continued to be classified according to McLaughlan et al. (2010), and a modified approach was used for inapplicable habitats (e.g., regenerating forest). Sixteen ecosites were recorded during field studies. However, only nine were used for land cover modelling, as they had been sampled with enough frequency to be statistically viable (n>5). The percentages of each ecosite type within the SSA, PDA, VLSA, VRSA/WLSA, and WRSA are presented in Table 4-41.

The majority of all study areas were found to be affected by fire disturbance. Most of the area within the SSA was determined to be regenerating forest (i.e., no ecosite classification value; 61.8%). Jack pine/blueberry/lichen (BS03; 14.5%) was the second most dominant habitat across the SSA, and bare rock/soil (i.e., no ecosite classification value; 6.5%) was the third main habitat. Land cover in the PDA was expectedly similar to the SSA and contained 60.8% regenerating forest.

The primary habitat within the VLSA and VRSA/WLSA was regenerating forest (i.e., no ecosite classification value; 53.6% and 47.0%, respectively). Like the SSA and PDA, jack pine/blueberry/lichen (BS03; 13.4%) was the second most dominant habitat in the VLSA. Although BS03 was prevalent in the VRSA/WLSA (15.2%), water (i.e., no ecosite classification value; 16.0%) was the second most dominant habitat type present. Water is included in the study area as it will house the treated effluent diffuser for the Project. Jack pine/blueberry/lichen (i.e., BS03; 16.1%) was the third main habitat within the VRSA/WLSA.

Within the WRSA, the main habitat type was jack pine/blueberry/lichen (i.e., BS03; 34.1%) with regenerating forest as the second most dominant habitat type (i.e., no classification value; 26.8%). The third and fourth main habitats within the WRSA were comparable in percent cover, and included water (i.e., no classification value; 12.6%) and jack pine - black spruce/feathermoss (i.e., BS04; 12.4%).

4.6.3 Regulatory Context for Vegetation and Wildlife

4.6.3.1 Species of Conservation Concern

Terrestrial environment baseline investigations for the Project placed special focus on plant and wildlife SOCC and their habitats. For the purposes of this EIS submission, SOCC are defined as legislated Species at Risk (SAR), and species identified as sensitive on federal and provincial tracking lists, and/or activity restriction guidelines. SOCC in Saskatchewan meet one or more of the following criteria:

- species listed under Schedule 1, Schedule 2, or Schedule 3 of the federal *Species at Risk Act* (SARA) as Endangered, Threatened, or Special Concern (SARPR 2023);
- species listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened, or Special Concern that are not listed under SARA (COSEWIC 2023);
- species listed as Endangered, Threatened, or Vulnerable in Saskatchewan's *The Wildlife Act* (i.e., Wild Species at Risk Regulations) (GS 1998);
- species listed as ranking of S1, S2, or S3 or a combination of rankings (including an applicable rank modifier such as "M" for migrant and "H" for historical) by the Saskatchewan Conservation Data Centre (SKCDC; 2023a, 2023b) and,
- species identified in the Saskatchewan Activity Restriction Guidelines for Sensitive Species (ENV 2017).

4.6.3.2 Migratory and Non-Migratory Birds

Migratory and non-migratory birds were another focus of terrestrial environment baseline investigations. In Saskatchewan, the majority of bird species and their nests are protected under federal and provincial legislation. For the purposes of this EIS submission, migratory and non-migratory birds are defined as those species that meet one or more of the following criteria:

- species identified under the federal *Migratory Birds Convention Act* and *Migratory Birds Regulations*; and/or,
- species identified under Saskatchewan's *The Wildlife Act* and *The Wildlife Regulations*.

4.6.3.3 General Wildlife and Places of Habitation

Terrestrial environment baseline investigations also gave attention to general wildlife and places of habitation. Many wildlife species in the province are protected under Saskatchewan's *The Wildlife Act* and The Wildlife Regulations. This legislation affords protection to places of habitation as well, such as dens, hibernacula, and roosts.

4.6.4 Vegetation

Vegetation assessments completed during 2018/2019 and 2022 baseline studies entailed desktop database searches, inventory surveys, and chemistry sampling and analysis. Desktop searches involved the review of federal, provincial, and academic databases to identify vegetation SOCC and associated habitats with the potential to occur in the Project area. Field survey and sampling designs and methodologies were directed by these results, ENV's species detection protocols, and peer-reviewed sampling and analysis techniques. Species Detection Research Permits were obtained by ENV for all vegetation surveys.

4.6.4.1 Inventory

Desktop database searches preceded vegetation inventory surveys in both 2018/2019 and 2022 baseline studies. Database search results completed in advance of the 2018/2019 baseline studies (Appendix C.3) yielded one plant SOCC record in the 2018/2019 baseline SSA; heart-leaved twayblade (*Neottia cordata*), which is not currently listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations). This plant SOCC is currently ranked as vulnerable/rare to uncommon (S3) by the SKCDC (2023a), and has provincial activity restriction guidelines recommended for its occurrences (ENV 2017)[12]. A broader database search revealed 250 plant SOCC have the potential to occur in the Mid-Boreal Upland and Athabasca Plain ecoregions; hence, these plant species have the potential to occur in the Project area. None of these plant species are listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations); however,

[12] Note that at the time of the 2018/2019 baseline report, heart-leaved twayblade was ranked as imperiled/very rare (S2).

provincial activity restriction guidelines are recommended for occurrences of all plant SOCC (ENV 2017).

An updated database search preceding the 2022 baseline investigations (Appendix C.4), identified heart-leaved twayblade and three additional plant SOCC within 1 km of the 2022 baseline LSA. This included beautiful sedge (*Carex concinna*), Hudson Bay sedge (*Carex heleonastes*), and water lobelia (*Lobelia dortmanna*). These three additional plant SOCC are also ranked S3 by the SKCDC (2023a). None of these plant species are listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations); however, occurrences of these plant species have recommended provincial activity restriction guidelines (ENV 2017).

Vegetation inventory surveys were completed in 2018 and 2022 for both terrestrial and aquatic habitat types. In 2018, 63 terrestrial vegetation inventory transects, and one aquatic vegetation inventory consisting of 30 sampling points were surveyed. In 2022, surveys entailed 68 terrestrial vegetation inventory transects and one aquatic vegetation inventory consisting of 256 sample points. The 2018/2019 vegetation and land cover mapping data were used to inform survey location selection and sampling intensity within the 2022 baseline LSA. Incidental observations of plant SOCC were also recorded.

Terrestrial and aquatic vegetation surveys completed in 2018 detected 198 plant species across both survey types. A total of 147 plant species were detected overall during 2022 terrestrial and aquatic vegetation surveys. Of these species, a total of 22 plant SOCC were identified, including 3 of the 4 SOCC identified in database searches (Table 4-42). Figure 4-45 and Figure 4-46 show the locations of terrestrial and aquatic SOCC plant species identified in the baseline study areas. As per the SKCDC (2023a), three of the detected plant SOCC are currently ranked as critically imperiled/extremely rare (S1), five are ranked imperiled/very rare (S2), and 14 are currently ranked vulnerable/rare to uncommon (S3). Provincial activity restrictions are recommended for all identified plant SOCC (ENV 2017).

Of all plant SOCC identified in 2018 and 2022, none are listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations). No weed species listed under *The Weed Control Act* (GS 2010) were detected in 2018 or 2022 baseline studies.

The following plant species were identified in the Clearwater River Dene Nation Socio-economic and Harvest Study in 2023 as being consumed by CRDN members throughout their traditional territory: muskeg, Labrador tea (*Rhododendron tomentosum*), juniper

(common juniper [*Juniperus communis var. depressa*]), sweet grass (*Anthoxanthum hirtum ssp. arcticum*), stinging nettle (*Urtica dioica ssp. gracilis*), rat root (sweet flag [*Acorus americanus*]), and berries including blueberry (*Vaccinium myrtilloides*), blackberry (*Rubus x paracaulis*), huckleberry, buffalo-berry (*Shepherdia argentea*), chokecherry (*Prunus virginiana var. virginiana*), cranberry, raspberry (American red raspberry [*Rubus idaeus ssp. strigosus*]), Saskatoon berry (*Amelanchier alnifolia var. alnifolia*), strawberry (American wild strawberry [*Fragaria vesca ssp. americana*]), pin cherry (*Prunus pensylvanica*), gooseberry (*Ribes spp.*), and cloudberry (*Rubus chamaemorus*) (CRDN 2023).

4.6.4.2 Chemistry

Chemical testing was completed on vegetation samples as part of 2018/2019 baseline studies. This testing was completed to determine existing parameter concentrations in samples of blueberry stems and leaves, and star-tipped reindeer lichen (*Cladina stellaris*) collected from PSPs located within the 2018/2019 baseline LSA. As previously discussed in Section 4.6.1.4, the PSPs were established upwind and downwind of the site considering the predominant wind direction since vegetation chemistry could be potentially impacted by aerial dispersion of COPC from the Project (Figure 4-42). Blueberry was selected for analysis due to its abundance in the Project area, and lichen was selected as a known bioaccumulator of airborne pollutants, such as heavy metals, radon progeny (lead-210, polonium-210, etc.), and sulphur dioxide (Glavich and Geiser 2008; Sheard et al. 1988). Soil chemistry samples were collected alongside vegetation samples to assess potential uptake to the plants from the soil and these data are presented in Section 4.6.1.4.

Detailed results are provided in Appendix C.3, while minimum, mean, and maximum COPC[13] levels are summarized in Table 4-43. All values lower than the RDL were set equal to the RDL for the calculation of the summary statistics. The majority of mean COPC levels in the blueberry and lichen samples were similar between reference and exposure PSPs; however, variability between PSPs was apparent for some parameters, such as lead and lead-210 (Table 4-43). Mean uranium, radium-226, and thorium-230 levels were notably higher in exposure lichen and blueberry samples when compared to data collected from the reference PSPs. Data collected during the baseline period will be used for comparative purposes to data collected during the operational period.

[13] COPC selection was based on those used in air quality modelling (Appendix D.1).

4.6.5 Wildlife

As part of 2018/2019 and 2022 baseline studies, desktop searches of federal, provincial, and academic databases were completed to identify wildlife SOCC and associated habitats with the potential to occur in the Project area. Field survey design and methodologies were informed by these results, ENV's species detection protocols, and federal and peer-reviewed detection strategies. Innovative detection technologies (i.e., autonomous recording units [ARU], trail cameras, bat detectors) were applied to further enhance detectability rates for wildlife in assessed areas. Species Detection Research Permits were obtained from ENV for all wildlife surveys and detection technologies.

4.6.5.1 Amphibians

Desktop database searches for 2018/2019 and 2022 baseline studies yielded no amphibian SOCC occurrences in the Project area. However, two amphibian SOCC were assessed as having the potential to occur based on suitable habitats observed in the PDA and 2018/2019 baseline SSA and LSA, and 2022 baseline LSA; Canadian toad (*Anaxyrus hemiophrys*) and northern leopard frog (*Lithobates pipiens*). The Canadian toad is not currently listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations), and is currently ranked as apparently secure (S4) by the SKCDC (2023b). The northern leopard frog is currently listed as Special Concern under SARA, and is ranked S3 by the SKCDC (2023b). Provincial activity restriction guidelines are recommended for the breeding and overwintering habitats of both amphibian species (ENV 2017).

Amphibian acoustic surveys were conducted in 2018 and 2022 using ARU and *in situ* surveys to identify the presence and distribution of amphibian species and their breeding habitats. Because amphibians are known biological indicators of an environment, these surveys also served as a tool for evaluating ecosystem health (Welsh and Ollivier 1998). In 2018, 18 survey sites were established throughout the 2018/2019 baseline SSA; ARU were deployed at 12 of these locations, and *in situ* surveys were completed at the additional six locations. Only ARU were used during surveys in 2022; nine were deployed in the PDA, and one was deployed in the 2022 baseline LSA. Previously undocumented amphibian species and amphibian SOCC were also recorded if incidentally observed during other surveys.

Two amphibian species were detected in 2018; boreal chorus frog (*Pseudacris maculata*) and Canadian toad. During 2022 surveys, one amphibian species was detected in the PDA and 2022 baseline LSA; wood frog (*Lithobates sylvaticus*). Both the boreal chorus frog and

the wood frog are currently ranked as secure/common (S5) in Saskatchewan, and are not currently listed under SARA, COSEWIC, or *The Wildlife Act*. No provincial or federal activity restriction guidelines apply to these species. The Canadian toad is an amphibian SOCC and was identified within the 2018/2019 baseline LSA (Figure 4-47; Table 4-44). Although no amphibian SOCC were detected in the PDA in 2022, the detection of the Canadian toad in 2018 in the baseline LSA suggests that this species has the potential to occur.

No amphibian species listed under SARA, COSEWIC, or *The Wildlife Act* were recorded in the SSA or PDA during 2018/2019 or 2022 baseline studies.

When interviewed in 2023, local Indigenous community members did not make special note of the importance of amphibians in their traditional territories.

4.6.5.2 Birds

Desktop database searches completed in 2018 determined that nine bird SOCC had been previously recorded near the 2018/2019 baseline SSA and LSA; common nighthawk (*Chordeiles minor*), Bonaparte's gull (*Chroicocephalus philadelphia*), olive-sided flycatcher (*Contopus cooperi*), common loon (*Gavia immer*), bald eagle (*Haliaeetus leucocephalus*), barn swallow (*Hirundo rustica*), herring gull (*Larus argentatus*), American white pelican (*Pelecanus erythrorhynchos*), and common tern (*Sterna hirundo*). Among these species, the barn swallow is currently listed as Threatened under SARA, and the common nighthawk and olive-sided flycatcher are currently listed as Special Concern (SARPR 2023). These bird SOCC are not listed as Wild Species at Risk under *The Wildlife Act*. The Bonaparte's gull, common loon, bald eagle, herring gull, American white pelican, and common tern are not listed under SARA, COSEWIC, or *The Wildlife Act*, but do have provincial activity restriction guidelines recommended for their breeding colonies and nest sites (ENV 2017). All nine bird SOCC are ranked apparently secure (i.e., S4) to common/secure (i.e., S5) by the SKCDC (2023b).

During 2022 desktop database searches, 18 additional bird SOCC to those described above were determined to have the potential to occur near the 2022 baseline LSA, including 5 additional SOCC that are currently listed under SARA; Canada warbler (*Cardellina canadensis*), piping plover (*Charadrius melodus circumcinctus*), rusty blackbird (*Euphagus carolinus*), horned grebe (*Podiceps auritus*), and bank swallow (*Riparia riparia*). These bird SOCC range from Special Concern to Threatened to Endangered under SARA (SARPR 2023), and are ranked from S3 to S5 by the SKCDC (2023b). The lesser

yellowlegs was also identified as a bird SOCC that could occur in the Project area, and although it is not yet listed under SARA, it was assessed as Threatened by COSEWIC in 2020 (SARPR 2023). This species is ranked S4B by the SKCDC, and it does not have recommended federal or provincial activity restriction guidelines. The remaining bird SOCC identified are ranked S3 to S5, and provincial activity restriction guidelines are recommended for the occurrences, breeding colonies, and/or nest sites of most of these species (ENV 2017; SKCDC 2023b). None of the 27 bird SOCC identified as previously occurring or potentially occurring within the Project area are listed as Wild Species at Risk under *The Wildlife Act*. It was also determined through desktop database searches that no Important Bird Areas (IBA) are located within the 2022 baseline LSA.

Bird species identified in the field during 2018/2019 and 2022 baseline studies were detected by acoustic surveys using ARU (n = 15 in 2018 and n = 10 in 2022) and *in situ* breeding bird point counts, including targeted common nighthawk and yellow rail surveys. Aerial waterbird and raptor surveys were also completed as part of surveys in 2018. The 2018 raptor data were supplemented by general avian surveys completed in 2022, including forest bird surveys and ARU analysis (including over 1,000 hours of audio recordings from ten ARU units). Two raptor SOCC (bald eagles and osprey) were detected using this method, but no nests were observed. Incidental observations of undocumented bird species and bird SOCC were also recorded during other surveys.

A total of 113 bird species were identified throughout the 2018/2019 baseline LSA during 2018, and 94 bird species were identified in the PDA during 2022 baseline studies. The majority of bird species detected during 2018/2019 and 2022 surveys are protected under the *Migratory Birds Convention Act* (MBCA) (GC 1994), and/or *The Wildlife Act*.

Nine bird SOCC were detected during 2018 surveys (Table 4-44); common nighthawk, Bonaparte's gull, olive-sided flycatcher, rusty blackbird, common loon, bald eagle, herring gull, osprey (*Pandion haliaetus*), and American white pelican. The osprey is not listed under SARA, COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations). This species is ranked S3B by the SKCDC (2023b), and provincial activity restriction guidelines are recommended for their nest sites (ENV 2017).

Along with confirming the presence of the nine SOCC observed during 2018 surveys, 2022 surveys also identified the red-throated loon (*Gavia stellata*), barn swallow, pine grosbeak (*Pinicola enucleator*), and lesser yellowlegs in the PDA and 2022 baseline LSA (Table 4-44). The red-throated loon and pine grosbeak are not currently listed under SARA,

COSEWIC, or *The Wildlife Act* (i.e., Wild Species at Risk Regulations), and are currently ranked by the SKCDC (2023b) as S1B and S2B, S4N, respectively. Provincial activity restriction guidelines are recommended for breeding red-throated loons (ENV 2017). The locations of observed bird SOCC from 2018 and 2022 baseline investigations are shown in Figure 4-48 and Figure 4-49.

Bird SOCC surveys for common nighthawk and yellow rail yielded contrasting findings. The abundance and distribution of common nighthawk observations documented during targeted surveys in 2018 and 2022 suggests that the species is common and widely-distributed throughout the PDA and has potential to occur in the SSA as well. Conversely, no yellow rail detections resulted from bird SOCC surveys in 2018 or 2022. There is a low probability for this particular bird SOCC to occur in the SSA based on these survey results and the habitat types present.

CRDN members consume the meat and sometimes the eggs of various bird species from their traditional territory including duck (*Anatidae*), goose (*Anatidae*), ptarmigan (i.e., willow ptarmigan [*Lagopus lagopus*]), gull (*Laridae*), and grouse (*Tetraonidae*) (CRDN 2023). It is unknown how many of these species are harvested within the study areas.

4.6.5.3 Mammals

Desktop database searches in 2018 yielded one mammal SOCC that had previously been recorded in the Project area; woodland caribou. The boreal population of woodland caribou is listed under SARA as Threatened and is ranked as S3 by the SKCDC (2023b). There is a federal recovery strategy in place for the boreal population of woodland caribou, but this species does not currently have recommended provincial activity restrictions. Two additional mammal SOCC were identified as having the potential to occur within the study areas based on habitat types present and known species ranges; little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*). Both of these bat species are currently listed as Endangered under SARA, and are currently ranked as S4 and S3, respectively (SKCDC 2023b). Provincial activity restriction guidelines are recommended for the roosting and foraging habitats of these species (ENV 2017). None of the identified mammal SOCC are listed as Wild Species at Risk under *The Wildlife Act*.

An additional mammal SOCC of the wolverine (*Gulo gulo*) was identified through a database search in 2022[14]. Like the woodland caribou, the wolverine has had previous occurrence reports within the 2022 baseline LSA. The wolverine is listed as Special Concern under SARA (GC 2002) and is ranked S2 by the SKCDC (SKCDC 2022). Although no provincial activity restriction guidelines are recommended for this species, federal activity restriction guidelines apply to wolverine dens year-round (EC 2009). The wolverine is not listed as a Wild Species at Risk under *The Wildlife Act*.

Mammalian species composition, distribution, and abundance were determined in 2018/2019 and 2022 baseline studies using winter track count surveys, ungulate pellet and browse surveys, semi-aquatic mammal surveys, trail cameras, and bat detectors. In 2018, aerial ungulate surveys were completed over 16 parallel flight transects in the 2018/2019 baseline RSA. Winter track count surveys entailed the surveying of 15 3-km triangular transects in the 2018/2019 baseline RSA. Throughout the 2018/2019 baseline LSA, 15 trail cameras were installed, 9 pellet group and browse surveys were completed, 1,500 hours of small mammal trap surveys were conducted, and 33.3 km of semi-aquatic mammal surveys were completed. Five bat detectors were also installed in the 2018/2019 baseline SSA in 2018. Incidental observations of unrecorded mammal species and mammal SOCC were also documented during other field surveys.

During 2018/2019 baseline studies, aerial surveys detected two ungulate species in the 2018/2019 baseline RSA, including woodland caribou and moose (*Alces alces*). Winter track survey findings included 3,598 observations of mammal or Phasianidae bird signs. The snowshoe hare (*Lepus americanus*) was the species or sign of species most widely detected. Observations of 193 scat or pellet groups resulted from pellet browse surveys, totalling 71.48 scat or pellet groups/ha. Species identified by scat included moose, woodland caribou, grey wolf (*Canis lupus occidentalis*), snowshoe hare, Phasianidae bird species, black bear (*Ursus americanus*), and red fox (*Vulpes vulpes*). Trail cameras distributed throughout the 2018/2019 baseline LSA produced a total of 508 images depicting identifiable mammals, including moose, grey wolf, wolverine, snowshoe hare, river otter, Canada lynx (*Lynx canadensis*), American marten (*Martes americana*), American mink (*Vison vison*), red squirrel (*Tamiasciurus hudsonicus*), American black bear, and red fox. In 2018, bat detectors documented 7,154 bat passes between late June

[14] River otter (*Lontra canadensis*) was also identified through a database search; however, the river otter does not qualify as a mammal SOCC in this EIS because it is ranked as S3 by the SKCDC and does not have federal or provincial activity restriction guidelines. It is also not listed under SARA, COSEWIC, or *The Wildlife Act*.

and early October, with bats in the high frequency phonic group and myotis frequency phonic group accounting for the most bat passes.

A total of eight mammal SOCC were detected in the Project area in 2018/2019; wolverine, big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), silver-haired bat (*Lasionycteris noctivagans*) or hoary bat (*Lasiurus cinereus*)[15], little brown myotis, northern myotis, and woodland caribou (Figure 4-50; Table 4-44). COSEWIC has recently listed the silver-haired bat, eastern red bat, and hoary bat as Endangered, though they are still under review for addition to Schedule 1 (SARPR 2023). As noted earlier, the little brown myotis is currently listed as Endangered under SARA and by COSEWIC. All of these bat species are ranked S4B to S5B by the SKCDC (2023b), and have provincial activity restriction guidelines recommended for roosting and foraging sites (ENV 2017).

Of the mammal SOCC identified in 2018/2019, five of these species were detected in the SSA (i.e., all bat SOCC), and all of these species were detected in the PDA. The brown bat, eastern red bat, hoary bat, and little brown myotis were also detected in the 2018/2019 baseline LSA, and the wolverine was detected in the 2018/2019 baseline LSA and RSA. The woodland caribou and signs of this species were detected in the 2018/2019 baseline RSA.

In 2022, nine winter tracking survey/ungulate pellet and browse survey transects were completed; eight were situated in the PDA, and one was situated in the 2022 baseline LSA. Of 12 semi-aquatic mammal survey transects, 11 were located in the PDA, and 1 was located in the 2022 baseline LSA. Nine trail cameras were deployed in the PDA, and one trail camera was deployed in the 2022 baseline LSA. Four bat detectors were installed in the PDA, and one bat detector was installed in the 2022 baseline LSA. Survey data were also supplemented by incidental observations.

Winter tracking surveys in 2022 yielded a total of 590 observations of mammal or Phasianidae bird species signs. Alike 2018/2019 surveys, the snowshoe hare was the most abundant species detected. A total of 849 scat or pellet groups were detected during pellet group surveys in the PDA. Trail camera footage captured nine mammal species in the PDA,

[15] Bat passes analyzed in 2018 were categorized into either the high frequency group (expected to be primarily little brown myotis, but likely including northern myotis) or low frequency group (expected to be primarily composed of silver-haired or hoary bats; M. Brigham, pers. comm. November 6, 2018). Note that an improvement in analysis techniques used on the 2022 data confirmed the presence of all these species except for silver-haired bat in the Project area. Based on biogeographical range, it is expected that silver-haired bats may be present, although their vocalizations were not confirmed.

all of which had been previously recorded during 2018/2019 surveys. Browse surveys identified that the overall forage potential in the PDA was moderate to low for moose and moderate for woodland caribou. Bat detectors deployed in 2022 detected bat species in both high-frequency and low-frequency phonic groups throughout the PDA.

Seven mammal SOCC were detected during 2022 surveys, all of which were previously identified during the 2018/2019 surveys (Figure 4-50; Table 4-44). All of these species or signs of these species (i.e., woodland caribou pellet group) were documented within the PDA. With the exception of the northern myotis, all detected bat SOCC were also recorded in the 2022 baseline LSA.

CRDN members reported consuming beaver (i.e., North American beaver [*Castor canadensis*]), rabbit (i.e., snowshoe hare), moose, elk (*Cervus elaphus*), deer (*Odocoileus spp.*), and caribou (i.e., woodland caribou) in their traditional territory (CRDN 2023). It is unknown how many of these wildlife species are harvested in the study areas. Of those species listed, the snowshoe hare, moose, and woodland caribou were observed in the study areas during baseline studies. BRDN members identified moose, caribou, deer, rabbit, and beaver as important traditional foods consumed in the region. BRDN members also noted that moose and woodland caribou are present in the WLSA (BRDN 2023a). MN-S reported hunting moose, deer, black bear, woodland caribou, and rabbit in the region, species identified for trapping include, rabbit, beaver, coyote, fisher, fox, lynx, marten, mink, muskrat, otter, porcupine, rabbit, skunk, squirrel, weasel, wolf, and wolverine (MN-S 2023). BNDN members reported the importance of hunting moose and caribou in the region (BNDN 2024).

Woodland Caribou

The identification of critical habitat for woodland caribou was a priority of baseline investigations due to the study areas falling within the northern edge of the SK2 West Caribou Administration Unit (northern subunit) and the northern portion of the Project overlapping the SK1 Caribou Conservation Unit. (ENV 2021c). The SK1 Woodland Caribou Conservation Unit has very high fire disturbance, in combination with low human-caused disturbance (ENV 2021); it differs from ranges of most other populations in Canada that informed the disturbance model used by Environment Canada (2011) and results from research showed a stable population status (McLoughlin et al. 2019). Two subunits (southern and northern) were created in SK2 West due to differing levels of human disturbance and fire regimes. The most northern part of the SK2 West administrative unit

is very similar to SK1 with very high levels of fire and relatively low anthropogenic disturbance. In Saskatchewan, the woodland caribou population inhabiting the SK2 Caribou Administrative Unit is likely not self-sustaining. This is due to the absence of the necessary threshold of undisturbed habitat (i.e., 65%) required for a self-sustaining population (ECCC 2020).

The detection of woodland caribou during both 2018/2019 and 2022 baseline studies confirmed the continuing presence of this mammal SOCC in the study areas. However, the overall availability of woodland caribou habitat types is limited. Upland areas comprised of mature to old-growth coniferous forests (i.e., black spruce and jack pine with extensive lichen cover) and conifer-dominant bogs and fens characterize the preferred habitats of woodland caribou (EC 2012b; ECCC 2019; GC 2019). Currently, mature to old-growth forests are not widely available within the SSA and PDA due to wildfires from previous years. However, some of these regenerating areas will have reached the 40-year threshold for removal from ECCC's disturbed classification within the 29-year lifespan of the Project. These areas may therefore provide higher habitat potential for woodland caribou within the lifetime of the Project than they do currently. Shorelines, islands, and peatlands are also important habitats for woodland caribou, particularly for cows seeking secluded areas with reduced predation risk during calving season. Some of these habitats have been identified within the study areas; although, they occur marginally in the SSA and PDA.

As part of the 2018/2019 baseline studies, a systematic ungulate aerial survey was completed by helicopter in winter (i.e., late February) to determine the presence and density of woodland caribou in the 2018/2019 baseline RSA. Woodland caribou or signs of woodland caribou were detected at nine locations (Figure 4-50). Most observations of woodland caribou consisted of cratering (i.e., six locations), and all observations were mainly documented on the peripheries of the RSA in open wetland or jack pine-dominant forest habitats. Group size ranged from two to five individuals and was estimated where possible based on distinguishable individual paths. One visual observation of a group of three individuals was also recorded. Due to the distance of the observed group from the helicopter, the sex of these individuals was indeterminable. Aerial surveys indicated that the overall density of woodland caribou in the RSA was relatively low (0.01/km^2). Aerial ungulate surveys were not completed as part of 2022 baseline studies.

Winter tracking surveys completed for 2018/2019 baseline studies were focused in the 2018/2019 baseline RSA, and were used to determine the presence, distribution, and abundance of woodland caribou activity in the winter. Signs of woodland caribou were

detected at two locations in the east corner of the 2018/2019 baseline LSA during these surveys; one track was identified in regenerating forest (i.e., 0.24 tracks/km-day), and one trail produced by several individuals was identified in a treed wetland (i.e., 0.12 tracks/km-day) (Figure 4-50). Winter tracking surveys completed in 2022 were concentrated in the PDA and yielded no signs of woodland caribou.

As part of 2018/2019 baseline studies, pellet and browse surveys were completed to document the presence and distribution of woodland caribou in the 2018/2019 baseline LSA. A total of two pellet groups produced by woodland caribou (n = 2) were detected at two locations along transect segments (Figure 4-50). One pellet group was identified in open wetland habitat (i.e., 9.09 pellets groups/ha), and one was identified in regenerating forest (i.e., 0.73 pellet groups/ha). The overall density of caribou pellets detected in the 2018/2019 baseline LSA was 0.74 pellet groups/ ha. No scat or pellet groups produced by woodland caribou were detected during pellet and browse surveys conducted in 2022. However, one pellet group produced by woodland caribou was observed incidentally during semi-aquatic mammal surveys. The location of this observation was west of Highway 955, approximately 1 km from the PLS work camp.

Browse observations made during 2018/2019 and 2022 baseline studies were used to determine foraging potential for woodland caribou in study areas. Reindeer lichen was recorded in 201 of plots sampled in 2018, with an estimated total cover of 5,760 m² within all plots sampled. These findings indicated that the forage potential for woodland caribou in the 2018/2019 baseline LSA was high. In 2022 baseline studies, 84 sampled plots contained preferred browse species (i.e., 64.6% of plots). Reindeer lichen was detected in 72 of 130 sample plots (55.4%) with variable degrees of cover (5% to 95%), and 32 of the 130 plots contained 50% or more of lichen cover (24.6%). Reindeer lichen is a critical food source for woodland caribou, especially during winter months. Overall, a low to moderate rank forage potential for woodland caribou was determined for the PDA and 2022 baseline LSA. Foraging potential for woodland caribou may change over the lifetime of the Project as habitats within the LSA regenerate, or if additional areas are impacted by future forest fires.

Trail cameras deployed during in the PDA and 2018/2019 baseline LSA did not capture images of woodland caribou.

As previously noted, CRDN members stated that they consume caribou (i.e., woodland caribou) in their traditional territory (CRDN 2023), and BRDN members indicated that

woodland caribou are present in the WLSA (BRDN 2023a). Athabasca Chipewyan First Nation (ACFN) noted that caribou is considered a keystone species and integral to ACFN members' food and cultural systems (ACFN 2022).

4.7 Human Environment

The description of the existing human environment includes consideration of social, economic and health conditions, heritage resources, and First Nations and Métis land use.

The spatial scales and key inputs used to inform the existing conditions for each component of the human environment are described at the beginning of each section.

4.7.1 Social, Economic, and Health

The spatial scales used to describe the human environment include the SSA, PDA, LSA, and RSA. The SSA and PDA, which are defined in Section 5.3.4. are consistent across all components of the human environment, while the LSA and RSA vary between components.

The social, economic, and health component is described using the socio-economic LSA (Figure 4-51) and RSA (Figure 4-52) primarily; however, the description of land and resource use applies the land use LSA and RSA (Figure 4-53). These study areas are consistent with those used for the assessment of effects to social-, economic-, health-, and land use-related VCs in Section 6.

The socio-economic LSA includes communities of interest with population data available, who have lands overlapping, or adjacent to, the SSA and PDA, or populated centers that are primarily accessed using the Project transportation route (Highway 955 and Highway 155). The communities of interest that comprise the socio-economic LSA include:

- Clearwater River Dene Nation:
  - La Loche Indian Reserve (I.R.) 222 (Clearwater River), and
  - La Loche I.R. 223 (The Landing);
- Métis Nation Saskatchewan Northern Region 2 (MN-S NR2):
  - La Loche Metis Local 39,
  - Black Point Métis Local 162,
  - Bear Creek Métis Local 156,

    - Turnor Lake Métis Local 40,
    - Buffalo Narrows Métis Local 62,
    - St. Georges Hill Métis Local 70,
    - Michel Village Métis Local 65, and
    - Descharme Lake Métis Local 130;
- Buffalo River Dene Nation (BRDN):
    - Peter Pond Lake I.R. 193 (Dillon);
- Birch Narrows Dene Nation (BNDN):
    - Turnor Lake I.R. 193B;
- Black Lake Denesuline First Nation (BLDFN);
- Fond du Lac Denesuline First Nation (FDLDFN);
- Athabasca Chipewyan First Nation (ACFN)
- Northern Settlement of Descharme Lake;
- Northern Hamlet of Turnor Lake;
- Northern Village of La Loche;
- Northern Hamlet of Black Point;
- Northern Settlement of Bear Creek;
- Northern Hamlet of Garson Lake;
- Northern Village of St. George's Hill
- Northern Hamlet of Michel Village;
- Northern Village of Buffalo Narrows;
- Northern Village of Beauval; and
- Northern Village of Île-à-la-Crosse.

For the most part, the socio-economic LSA is described as a single population which is comprised of the combined data for each of the populated centres noted above. The population of individual communities within the socio-economic LSA is only discussed if the existing conditions suggest that the community would be more vulnerable or less resilient to Project effects. However, a demographic summary of each populated center in the LSA is provided in Section 4.6.1.1, below, for introductory context, and Community Profiles are provided in Appendix C.5, which contain additional community-specific details.

The socio-economic RSA is comprised of all populated centers within the Northern Saskatchewan Administration District (NSAD). The socio-economic RSA is represented by the Division No. 18 Census Division census profile. With the exception of ACFN, the

LSA communities are located within the socio-economic RSA, and their populations are reflected in the Division No. 18. counts.

The land use LSA matches the WLSA and includes a 5 km radius from the boundaries of the PDA. The land use RSA matches the aquatic LSA and includes the Clearwater River watershed boundary to Naomi Lake.

Information about existing social, economic, and health conditions was collected from sources such as Statistics Canada 2021 Community Profiles, Indigenous Services Canada First Nation Profiles, community or regional websites, community-led study reports, online interactive mapping platforms, and first-person interviews with subject matter experts.

Existing social, economic, and health conditions are described in this section in terms of demographic and social environment, food security; infrastructure and services; land and resource use; employment, income and education; workforce model and mobility; health care services; and cultural continuity and vitality. Additional detail on these topics is also provided in Appendix C.5.

4.7.1.1 Demographic and Social Environment

Within the socio-economic LSA and RSA, there may be subsets of the population who experience disproportionate impacts as a result of the Project. Some subsets of the population that are historically at greater risk of experiencing disproportionate impacts or disproportionate barriers to accessing Project benefits are women, girls, and feminine presenting people (women +), Indigenous people, people with disabilities, 2SLGBTQIA+ people, people aged 65+, children, people who are not participating in the labor force, underhoused and economically underprivileged people, adults without a high school diploma, and people who do not speak fluent English. Populations who are subject to increasing or unmanaged psychosocial stressors have the potential to be less resilient to changes in the demographic and social environment than other populations.

There is demographic data available for the population of women+, Indigenous people, people aged 65+, children aged 0-19, people who are not participating in the labour force, people without a high school diploma, and people who do not speak English, which is included for each study area below, where available. Information about existing psychosocial stressors has also been included, where available. In many cases, people may be part of more than one subset of the population, and the population of each subset will change overtime.

Socio-economic LSA

The socio-economic LSA is comprised of 28 governing bodies with jurisdiction in 18 populated centres. Highway 955 and Highway 155 comprise the proposed Project transportation route and serve to connect 15 of the population centres to other areas of Saskatchewan. In 2021, the total population of the LSA was 10,360 which is an increase of approximately 6% since 2016.

Of the total population with demographic data available in 2021, 51% of the LSA was women+. Women are historically underemployed in the mining sector and may have more barriers to accessing employment and income opportunities than men+.

In the 2021 census, 7% of the population was aged 65+, and 38% was children aged 0-19. People are not eligible for employment through the Project until they reach age 18. As such, people aged 0-17, which is expected to be the majority of those in the 0-19 age category, cannot access employment and income opportunities until they come of age. Similarly, people aged 65+ are more likely to experience barriers to accessing employment and income opportunities than those aged 18-65.

Approximately 96% of the LSA identifies as Indigenous, with 62% identifying as First Nations, and 33% identifying as Métis.

Approximately 99.6% of the LSA population speak English, 52% speak an Athabascan language (Dene), 4% speak a Cree language, and 4% speak Michif. Given that nearly all residents of the socio-economic LSA speak English, language barriers are not anticipated.

In 2021, 47% of the population aged 15+ participated in the labour force. Of those who reported the industry they were employed in, 5% reported that they were employed in the Mining, Quarrying, and Oil and Gas Extraction sector. Labour force participants without experience in the mining sector may face barriers to seeking employment in roles where experience is required. Approximately 53% of the population aged 15+ did not participate in the labour force. This subset of the population may not be participating in the labour force for a variety of reasons. Those who are unable to participate in the labour force have potential to experience disproportionate barriers to accessing employment and income opportunities.

Approximately 50% of the population aged 15+ in private households reported that they had not received a high school diploma in the 2021 census. Those who do not have a high

school diploma will have a more difficult time accessing employment and income opportunities.

Within the LSA, the population increased overall between 2016 and 2021 by 6%. In the 2021 census, mobility status is provided for 1 year prior to the census, and 5 years prior to the census. Within the LSA, approximately 2% of residents left their home community within a year before the census, and 9% left the community within the previous 5 years. This data suggests that, overall, the population and demographics in the LSA have remained fairly stable over the last 5 years, and there is no evidence of a large influx or outflux of people to or from communities in the LSA.

Within the socio-economic LSA, specific groups or subsets within each population centre may also have potential to experience disproportionate impacts as a result of the Project. A summary of key population and demographic information for each LSA community, and rationale for their inclusion in the socio-economic LSA is provided in Appendix C.5.

Socio-economic RSA

The socio-economic RSA is the NSAD and is comprised of 25 incorporated municipalities and the "District" which is comprised of Northern Settlements, Resort Subdivisions, and leased and titled properties. In 2021, the total population of the socio-economic RSA was 35,986 people which is a decrease of approximately 3% since 2016.

Of the total population with demographic data available in 2021, 50% of the socio-economic RSA were women+.

In the 2021 census, 8% of the population was aged 65+, and 39% was children aged 0-19, which was similar to the socio-economic LSA.

Approximately 85% of the RSA identifies as Indigenous which is lower than the LSA. Approximately 70% identified as First Nations and 15% identified as Métis.

Approximately 99.7% of the RSA population speaks English, 20% speak an Athabascan language (Dene), 22% speak a Cree language, and 1% speak Michif. This differs notably from the LSA where the percentage of Dene and Michif speakers was higher, and the number of Cree speakers was lower.

In 2021, 45% of the population aged 15+ participated in the labour force. Of those who reported the industry they were employed in, 7% reported that they were employed in the

Mining, Quarrying, and Oil and Gas Extraction sector, which is slightly higher than the percentage reported in the LSA.

Approximately 47% of the RSA population aged 15+ in private households reported that they had not received a high school diploma in the 2021 census, which is similar to levels in the LSA.

Within the RSA, the population decreased by 3% between 2016 and 2021. In the 2021 census, mobility status is provided for 1 year prior to the census, and 5 years prior to the census. Within the RSA, 3% moved away from their home community with the year prior to the census, and 16% moved within the 5 years prior to the census. This data suggests that, overall, the population and demographics in the RSA have remained stable over the last 5 years, and there is no evidence of a large influx or outflux of people to or from communities in the RSA.

4.7.1.2 Food Security

A 2018 report by the Saskatchewan Food Costing Task Group found that the average weekly cost of the National Nutritious Food Basket for a family of four in the northwest part of Saskatchewan was $321.63, and the far north was $421.64 (SFCTG 2019). These numbers are 31% and 71% higher than the provincial average of $245.68 per week. Food prices in Saskatchewan have increased since 2018. When adjusted for a 20% inflation of food in Saskatchewan (Statistics Canada 2023a), this cost of food in the northwest comes to $385.96 in 2023.

Grocery stores within the LSA are located in La Loche (Centerpoint Grocery Store, Northern Store, and Lakeshore Express Convenience Store), Birch Narrows (Birch Narrows Grocery-Gas Bar), Dillon (Convenience Store), Buffalo Narrows (Northern Store and Snack Shop), Beauval (Beauval General Store and Northern Store), Ile a la Crosse (Co-op Grocery, Northern Store, and Yewr Way Confectionary), Black Lake (Northern Store and Rick's Convenient Store), and Fond du Lac (Northern Store).

Residents living in LSA communities have noted that traditional foods are preferred to store bought foods which are expensive and lack nutritional quality (CRDN 2023; MN-S 2023). BRDN members expressed a strong preference for traditional foods over store-bought foods (BRDN 2023a). Data collected from community members indicates that almost all CRDN members consume traditional foods in one form or another with reliance on traditional foods as great as 70% of their diet for some members interviewed. It was

generally recognized that harvesting and consumption of traditional foods and the ability to live off the land provides cultural and spiritual value for CRDN members which cannot be measured.

Food sharing is a valued cultural practice for communities in the LSA (BRDN 2023a; Community Food Centres Canada 2023; CRDN 2023).

Several sustainable food initiatives exist within the LSA to increase food security. Northern Municipal Services listed the following initiatives on the Planning for Growth website:

- Île-à-la Crosse Fish Plant Inc.;
- J. Waite Fisheries Inc. (Buffalo Narrows);
- La Loche Modular Farm;
- La Loche Community Greenhouse (at Friendship Centre);
- Sakitawak Market Garden (Île-à-la Crosse);
- Beauval Grow Tunnels;
- Black Lake Community Greenhouse; and
- Buffalo Narrows Community Garden.

Additional initiatives include the Turnor Lake & Birch Narrows Community Food Centre which provides programs like community gardens, workshops on food preparation, and land-based programs where youth learn to hunt, fish, and snare for food (Community Food Centres Canada 2023).

4.7.1.3 Infrastructure and Services

Existing conditions of transportation, utilities, and protective infrastructure and services in the PDA and LSA are described in this section.

Transportation

The modes of transportation used most often to service the PDA and LSA are transportation by road, air, and water.

Within the PDA, transportation infrastructure includes a portion of Highway 955, a series of trails that intersect the highway, Fission-operated access roads and a Fission-operated dock on Patterson Lake. This infrastructure supports access to the PDA by vehicle, float plane, helicopter, and boat. Within the PDA, transportation is primarily by foot, utility vehicles, and roadway approved vehicles.

Highway 955 is maintained by the Saskatchewan Ministry of Highways and Infrastructure. Based on Google Earth imagery from 2023, 11 trails intersect Highway 955 within the PDA, with four located on the west side of the of the highway and 7 located on the east. There is also a portion of an additional trail located in the PDA that is accessed from just outside the north boundary of the PDA. All trails appear to have been used in recent years to support exploration activities, as well pads are also visible along the trails. Some of the trails have well pads visible closer to the Highway, but then the trail continues on to provide access to other lakes in the area. It is assumed that these trails were present prior to exploration activities. The Fission dock is located in the PDA on the shore of Patterson Lake and used to support access to water and air transportation. Trails that serve as Project-related access roads in the PDA and the Fission dock are maintained by Fission as needed to support Project activities.

Transportation infrastructure and services in the socio-economic LSA also support transportation by road, air, and water.

The primary road infrastructure in the socio-economic LSA is Highway 955 and Highway 155. These two highways provide access to services in southern Saskatchewan for all communities in the LSA. Communities have expressed concern about transportation safety in the LSA specifically related to the condition of the Highways and risks associated with increased traffic (ACFN Mtg. 1 March 18 2022; ACFN Mtg. 3 October 18 2022; BRDN Mtg. 3 February 10 2023; CRDN Mtg. 1 March 18 2021; CRDN Mtg. 3 July 6 2022). While there are several roadways located in the socio-economic LSA, discussion of roadway conditions in the LSA is focused on infrastructure and services that overlap the Project transportation route. Daily traffic rates were determined using a combination of the 2021 Traffic Volume Map from the Ministry of Highways and Infrastructure and traffic counts recorded in 2023 and included in the Transportation Impact Assessment (TIA) (Appendix A.6). The TIA recorded traffic volumes at key intersections for a total of 6-hours with consideration of peak hours in the am, midday, and pm. These counts were broken out by car traffic and truck traffic (heavy vehicle traffic). Existing daily traffic volumes were estimated in the TIA by taking the pm peak hour count, multiplying it by 10, and rounding to the nearest hundred. It is assumed that this calculation was chosen to reflect an accurate estimate of daily traffic counts. The percentage of heavy vehicle traffic recorded during the 6-hour assessment at each intersection was applied to the total daily traffic volume estimates in the TIA to estimate the total daily volume of heavy vehicles at each intersection.

Traffic on Highway 955 ranges from 100 vehicles per day north of the PDA to 3,300 vehicles per day north of the intersection of Highway 155 near La Loche (Appendix A.6). The proportion of daily traffic recorded for the TIA that was comprised of heavy vehicles was highest at the NexGen access road at 24% (24 heavy vehicles); at the intersection of Highway 155 near La Loche, only 1% (47) of traffic recorded was heavy vehicles. The 2021 Traffic Volume Map from the Government of Saskatchewan showed an annual average of 290 vehicles daily on Highway 955 between the PDA and La Loche, and 1,850 at La Loche (MoH 2021).

Highway 155 was voted one of the Top Ten Worst Roads in the province by Canadian Automobile Association (CAA) Saskatchewan in 2014, 2015, 2016, 2017, and 2022 (CAA Saskatchewan 2023). The busiest section of Highway 155 was west of the Highway 955 intersection, near La Loche, where a daily traffic count of 6,200 was recorded in 2023. On Highway 155, between La Loche and Buffalo Narrows, daily traffic counts ranged from 200 to 420. At Johnson Street in Buffalo Narrows, the traffic count was 1,900 vehicles per day, both north and south of the intersection. Approximately 5% (88) of vehicles at this intersection are predicted to be heavy vehicles. Between Buffalo Narrows and the Highway 55 intersection, daily traffic counts on Highway 155 ranged from 200 to 1,200 vehicles. The percentage of heavy vehicle traffic in this area ranged from 9% (46 vehicles) at the Highway 925 intersection to 32% (383 vehicles) at the Highway 165 intersection.

In summary, the lowest traffic level recorded between both studies was 100 vehicles per day on the north edge of the PDA, and the highest traffic level is near La Loche where 6,200 vehicles per day were recorded.

Traffic Collision Reports were available from Saskatchewan Government Insurance (SGI) and the years of 2019 to 2022 were reviewed. In 2019, a total of 11 collisions occurred on Highway 955, two of which resulted in personal injury (SGI 2020). In 2020, Highway 955 had a total of 9 collisions, 2 of which resulted in personal injury (SGI 2021). In the 2021 Saskatchewan Traffic Collisions Report, 3 collisions occurred on Highway 955, none of which resulted in injury or fatality (SGI 2022). In the 2022 Saskatchewan Traffic Collisions Report, 4 collisions were recorded, none of which resulted in injury or fatality (SGI 2023). In summary, collision rates in 2021 and 2022 were notably lower than those reported in 2019 and 2020. In February of 2023, a collision occurred on Highway 955 north of La Loche that took the life of one person and caused injuries to 3 people (RCMP 2023).

On Highway 155, 48 collisions were recorded in 2019, 6 of which resulted in personal injury and 1 resulted in a fatality (SGI 2020). In 2020, 69 collisions were recorded 8 of which resulted in personal injury and 2 resulted in fatality. A total of 59 collisions were recorded in 2021 including 15 personal injuries and 2 fatalities (SGI 2022). In 2022, 56 collisions were recorded on Highway 155 which included 12 personal injuries and one fatality. Collision rates increased in 2020, and then began to steadily reduce in 2021 and 2022. From 2019 to 2022, all but one of the reported fatalities occurred on Highway control section 155-01 which spans from Green Lake to the junction of Highway 165. The vehicle collision rate for this control section in 2022 was 1.43 collisions per million vehicle km (coll/MvKm) which was slightly higher than the provincial average of 1.03 coll/MvKm and the rural municipality rate of 1.37 coll/MvKm. A review of annual daily traffic volumes was completed for this section of Highway 155 to determine if a correlation is present between increased traffic levels and increased occurrence of collisions. The annual daily traffic volume for the 2020 SGI report appears to be an error, and instead of being 176 vehicles per day, it is assumed that the number was meant to be 576 which more closely aligns with counts of neighbouring years and with annual traffic data counts collected by the Government of Saskatchewan (MoH 2020). In 2021, this section of Highway 155 had the highest daily traffic counts of the years assessed, but also the lowest number of collisions. The second highest daily traffic counts were recorded in 2020, which is the year when the greatest number of collisions were recorded. The third highest traffic volumes were recorded in 2019 followed by 2022, however more collisions were recorded in 2022 than in 2019. This data suggests that a modest increase in traffic levels does not directly correlate to an increase in collision rates. The increase in annual daily traffic counts between the year with the least traffic and the year with the most traffic was a change of approximately 11%. Of the communities in the LSA that are located on the Project transportation route, the Northern Village of Buffalo Narrows experienced a total of 6 collisions in 2021, one of which caused personal injury; and the Northern Village of La Loche experienced 19 collisions, two of which caused personal injury (SGI 2022). No collisions were recorded in 2021 in Clearwater River, and the number of collisions at The Northern Settlement of Bear Creek was not provided.

Within the socio-economic LSA, provincial airports are located in the Northern Villages of La Loche, Buffalo Narrows, Île-à-la-Crosse, Beauval, and Fond du Lac (provides service to FLDFN). The Stony Rapids airport provides services to the community of BLDFN. A helipad is also located at Buffalo Narrows. Air transportation services are provided by several companies which offer fixed-wing aircraft services or helicopter services.

One private airstrip associated with the Rook 1 Project is proposed in the LSA within 15 km of the PDA and is currently undergoing the federal Impact Assessment process (NexGen 2023a). An airstrip is also proposed at Big Bear Camp located 20 km north of the PDA by road and is currently subject to a provincial environmental assessment (NexGen 2023a; Outfitters and Lodges Int. November 8 2023).

Within the priority recruitment communities, 35% of people who shared commute to work information reported commuting to locations outside of their census subdivision for work (Statistics Canada 2023b). Approximately 7.5% of people who commute to work reported their main mode of commuting to be "other method" which has potential to include air travel (Statistics Canada 2023b). While this data does not confirm the percentage of people in the LSA who commute to work by air, it does suggest that the number of people working away from their home community, or in locations accessed by methods other than car, van, truck, public transit, walking, or bicycle, are relatively low.

Within the socio-economic LSA, transportation by boat for commercial, recreational, cultural, and subsistence purposes is also present, and utilizes infrastructure such as boat launches, docks, or similar structures on dozens of lakes within the study area. Several of these navigable waterways and the infrastructure associated with them are accessible from Highway 955 and Highway 155, the Project transportation route. Patterson Lake is accessed using a land user-maintained boat launch located in the land use LSA south of the PDA.

Utilities

The PDA does not have power, telephone, or natural gas services or infrastructure. The Project site currently generates its own power for electricity and heat and has internet service provided through Starlink satellite. Adjacent to the PDA, NexGen is proposing to run a fibre optic line for communication purposes to their proposed Rook 1 Project site from the Northern Village of La Loche. This line is envisioned to either run above ground or below, but a preferred method was not identified (NexGen 2023a). A confirmed date for construction of this line was not provided but is predicted to occur within the next 10 years alongside the approvals and construction phases of the Rook 1 Project.

In the socio-economic LSA, electricity is provided by SaskPower through an overhead distribution line which runs adjacent to existing road right of ways. In Descharme Lake, SaskPower is currently building a solar-battery-diesel combination microgrid to help power the community.

Telecommunication services including land line, cellular telephone, and internet are provided in the LSA. Landline utility lines are located adjacent to Highway 155. Cellular service is provided in some communities but is not reliable on Highways 155 and 955 between communities. No cellular service is available on Highway 955 between Clearwater River and the PDA. Mobile internet data is available in most communities in the socio-economic LSA, however, is not reliable in areas along Highway 155, and on all of Highway 955.

Oil, wood, and propane are used as heating fuels, as natural gas is not provided to the area.

Protective Services

The police reported crime rate in northern Saskatchewan is measured annually through the Crime Severity Index available on the Statistics Canada website. In 2022, the Crime Severity Indexes reported by RCMP detachments in the LSA ranged from 391.58 to 1,237.17. Even the lowest end of the scale was notably higher than the provincial rate (152.46) (Statistics Canada 2023b). In 2021, northern Saskatchewan ranked highest in number of crimes involving firearms (Cotter 2022). The LSA communities are relatively isolated when compared to larger municipal centers, with limited access to health care, social services, welfare, employment, and adequate housing. These factors, among others, can contribute to the rate of violent and non-violent crime in these areas.

Community leadership within the LSA has also acknowledged crime rates in the communities and have made efforts to address issues. In 2022, BRDN re-instated a state of emergency to seek additional policing support to address increased gang activity and violence in the community (Patterson 2022).

Prevalent social issues in the community of Turnor Lake include lateral violence and suicide. The community is also working on reconciliation through social healing. BNDN members have access to crisis and healing support services (BNDN 2017).

Police services in the LSA are provided by the following groups:

- Royal Canadian Mount Police (RCMP) with detachments in La Loche, Turnor Lake/Birch Narrows, Buffalo Narrows, Ile a la Crosse, Beauval, and Fond du Lac.
- NorGuard provides protective services in Ile a la Crosse.

A member of the RCMP in the LSA noted that the detachment is currently short staffed, and this is not anticipated to change for at least five years. This is due to staff shortages

across the country and not enough new officers are being trained (RCMP Int. October 3 2023).

During an interview, a protective services expert from Île-à-la-Crosse shared that should rates of crime increase in the communities their company serves, the organization is equipped to respond to that increased need. Furthermore, they expressed that in the event of mine closure and job loss, they are prepared to hire more community members. They noted that they have not seen much of a crime increase due to employment change and confirmed that there are issues with drug trafficking in the north (Protective Services Int. November 3 2023).

Fire protection services in the PDA are provided by Fission using on-site infrastructure and personnel. Within the LSA, most communities have volunteer fire departments and/or fire crews that respond to fires within populated centers. Emergencies in Saskatchewan are usually managed at the local level but if the situation escalates, the Saskatchewan Public Safety Agency (SPSA) will provide assistance. The PDA and the majority of the LSA communities are located in Buffalo Narrows and Ile a la Crosse Protection Areas. Fire bases are located in La Loche, Buffalo Narrows, and Ile a la Crosse, and satellite bases are located at Dillon, Turnor Lake, and Beauval. BLDFN and FDLFN are located in the Northern Response Center Area with a fire base located in Stony Rapids which serves the Athabasca communities (SPSA 2023).

In 2023, 499 wildfires were reported in Saskatchewan which is an increase from 2022 and is higher than the average (SPSA 2023). The LSA was affected by multiple fires in 2023 which resulted in road closures, evacuations, power outages, and supply shortages.

4.7.2 Land and Resource Use

Land and resource use is described in this section in terms of current and expected future industrial, recreational, and commercial land uses in each of the study areas. First Nation and Métis Land Use is described in Section 4.7.5.

The land use LSA matches the wildlife LSA and includes a 5 km radius from the boundaries of the PDA for a total area equivalent to 7,854 ha (78.54 km^2). Waterbodies and watercourses within the LSA include Patterson Lake, Patterson Creek, Lake A, Lake B, Lake C, Lake D, Vermeersch Lake, and approximately 20 additional small unnamed waterbodies and water courses. In addition to waterbodies, the primary land cover in the LSA is regenerating forest (see Section 4.6.2). Built infrastructure in the LSA includes a

portion of Highway 955, numerous trails, a Fission operated dock, a community operated boat launch and informal recreational area, and a portion of the NexGen Rook 1 access road.

The land use RSA matches the aquatic LSA from the effects assessment (Section 6.0) and includes the Clearwater River watershed boundary north of Broach Lake to the Naomi Lake outlet inclusive of the area of potential air dispersion effects (see Figure 4-53). The total area of the land use RSA is equivalent to 52,973 ha (529.73 km^2). In addition to these waterbodies, the primary land cover in the RSA is also regenerating forest.

4.7.2.1 Industrial Uses

Within the PDA, the confirmed predominant land uses are industrial in nature, with mineral exploration activities being the primary land use. Approximately 3% of the PDA is anthropogenically disturbed. Disturbances include access roads, a temporary camp with other temporary structures including a core storage area, lay down areas, fuel storage, core logging tents, and a shop. Access to the eastern portion of the PDA where active exploration activities are ongoing, is restricted to the public by use of a security gate.

Industrial uses in the LSA are largely focused on mineral exploration and extraction. Companies with dispositions in the LSA include Fission Uranium, Purepoint Energy, and NexGen. In May of 2023, NexGen received approval from ENV to undertake their 2023 Site Infrastructure and Confirmation Program. Of the activities included in this program, those that occur in the LSA include conducting upgrades to the Rook 1 Access Road (NexGen 2023b). To facilitate these upgrades, an aggregate pit and crushing site was developed along the access road and within the LSA which is visible on satellite imagery.

Current industrial uses in, or interacting with, the land use RSA include exploration and mine construction activities. Fission, CanAlaska Uranium Ltd., F3 Uranium Corp, Purepoint Energy, Cameco Corporation, Orano Canada Inc. and NexGen hold mineral disposition in the RSA and may conduct exploration activities now and in the future. Additional activities associated with NexGen's 2023 Site Infrastructure and Confirmation Program noted above have already or are planned to occur in the near future in the land use RSA including the expansion and upgrade of temporary camp facilities, site access improvements, and Patterson Creek bridge upgrades (located at the Patterson Lake outlet) (NexGen 2023b).

4.7.2.2 Commercial Uses

Land within the portion of the PDA that is located west of Highway 955 is currently publicly accessible and is not restricted by physical barriers or signage. The attributes present that may support commercial and recreational uses in the PDA include the presence of natural landforms such as forest, wetland, and lake habitats, built infrastructure such as access roads, and the presence and abundance of numerous species of plants, wildlife, and fish.

Commercial uses with potential to occur in the PDA include commercial fishing, trapping, outfitting, or gathering. Commercial fishing is permitted on Patterson Lake, Broach Lake, Beet Lake, and Forrest Lake in the land use RSA; however, commercial fishing on these lakes has not occurred since before 2018 (ENV 2023a).

The PDA is located in Furblock N-19. Trapping occurs within this furblock, but it is not known if or how many furs were harvested in the PDA, LSA, or RSA.

Forest Lake Outfitters is the only lodge or outfitting business located in, or currently using, the RSA. Forest Lake Outfitters has a main camp located on Beet Lake, and an outpost camp located on Forrest Lake (Figure 4-54). It is a non-guided fishing camp and lodge that provides accommodations and access to recreational fishing within the RSA at Patterson Lake, Forrest Lake and Beet Lake (Forest Lake Outfitters 2013). Lakes are accessed by boat or all-terrain vehicles. Fish species advertised include walleye, northern pike, and lake trout.

In addition to Forest Lake Outfitters, the closest lodge to the PDA is Big Bear Camp which is located approximately 20 km to the north, but outside of the RSA. Big Bear Camp currently provides accommodation and construction services to support the PLS Project exploration and baseline study activities.

4.7.2.3 Recreational Uses

Environmental attributes are present within the PDA with the potential to support recreational activities including, but not limited to hunting, fishing, gathering, recreational vehicle use, and water transportation.

Hunting in the area, both recreational and subsistence, is administered by the ENV. The PDA, LSA, and RSA are located within Wildlife Management Zone (WMZ) 75 and Game Bird Management Zone 6. Hunting and fishing are allowed in unoccupied areas if

individuals have the appropriate hunting and fishing licences. Hunting and fishing licences can be obtained through the ENV.

Species that can be hunted with a hunting license in WMZ 75 and Game Bird Management Zone 6 include wolf, moose, black bear, dark geese, white geese, sandhill cranes, ducks, coots, snipe, sharp-tailed grouse, gray partridge, ptarmigan, spruce grouse, and ruffed grouse (ENV 2023b). Recreational hunting in the LSA and RSA has not been confirmed; however, has the potential to occur.

Recreational fishing takes place within the PDA and LSA on Patterson Lake and may occur on smaller unnamed lakes within the LSA as well. Within the RSA, fishing takes place on Patterson Lake, Forest Lake, and Beet Lake (Forest Lake Outfitters 2013), and is likely to occur on Broach Lake as well.

Recreational vehicle use, such as use of boats and all-terrain vehicles, occurs in the RSA (Forest Lake Outfitters 2013).

4.7.3 Employment, Income, and Education

Current economic conditions were assessed within the PDA, socio-economic LSA, socio-economic RSA, and the Province of Saskatchewan. Information about existing Traditional economies was collected for the land use LSA and land use RSA.

4.7.3.1 Local, Municipal, and Provincial Economy

Within the PDA, in addition to mining-related economic activities, there is potential for traditional economies to occur. Traditional economies may include fishing, trapping, and gathering for commercial sale. Commercial fishing is permitted on Patterson Lake and several other area lakes; however, commercial fishing on these lakes has not occurred since before 2018 (ENV 2023a). The total value of furs harvested through trapping from N-19 in 2020-2021 was approximately $6,258 which included 126 furs harvested from coyote, fisher, fox, lynx, and marten (Koback 2021). It is not known if any of these furs were harvested in the PDA. Information regarding the presence of gathering for commercial sale was not available but has potential to occur in the PDA and surrounding area.

Key economic sectors within the LSA are discussed below by industrial sector along with the percentage of the labor force aged 15+ who reported working in that sector between January 2020 and May 2021. Educational services (16%) was the largest reported sector in

2021 followed by public administration (14%), healthcare and social assistance (13%), retail trade (10%), and construction (8%) (Statistics Canada 2023a).

Within the LSA, several communities have established economic development organizations to support economic growth in several sectors, and to help meet the demand for goods and services associated with the mining sector. These include:

- Clearwater River Dene Nation Development Corp.
- Birch Narrows Dene Nation Development Inc.
- Buffalo River Enterprises Corporation
- Saskatchewan Metis Economic Development Corporation
- Athabasca Basin Development
- Beauval Development Inc.
- Buffalo Narrows Economic Development Corp.
- Sakitawak Development Corporation
- La Loche Economic Development Corp.

Key economic sectors within the RSA are described below by industrial sector and percentage of respondents from the labor force aged 15+ employed in each sector between January 2020 and May 2021. Similar to the LSA, the largest industrial sectors in the RSA were educational services (17.1%), public administration (14.4%), and health care and social assistance (14.0%). Retail trade (10.1%) and construction (6.7%) were also within the top five economic sectors in the RSA, with mining, quarrying, and oil and gas extraction not far behind at 6.4% (Statistics Canada 2023a).

In 2020, there were 1,767 residents of the RSA employed or contracted at mine and mill sites in northern Saskatchewan comprising 41% of the workforce. A total of $83 million in wages were paid out in 2020 to employees from the RSA. Approximately $103 million was used for purchases in the RSA associated with the mine sites (GS 2020).

Key economic sectors in the Province of Saskatchewan, categorized from the largest labour force to the smallest labour force, include health care and social assistance (13.9%), retail trade (10.6%), agriculture, forestry, fishing and hunting (8.4%), educational services (8%), and construction (7.6%) (Statistics Canada 2023b). Mining, quarrying, and oil and gas extraction employed 3.2% of the labour force aged 15+ in Saskatchewan.

Mining is considered the largest economic sector in the Province of Saskatchewan in terms of its contribution to gross domestic product. The mining sector accounted for 12% of the gross domestic product in 2021 and provided employment for nearly 12,000 people (GS 2023b). As part of Saskatchewan's Critical Mineral Strategy, the Province has set a goal to increase the production of uranium.

The Province also receives revenues from the mining industry in the form of revenue royalties, profit royalties, corporate income tax, and personal income tax. Royalty payments are calculated by taking the sum of the basic royalty (5% of gross revenue) and the profit royalty (10-15% of net profits), less the Saskatchewan resource credit (0.75% of gross revenue) (GS 2021).

4.7.3.2 Employment

People who are aged 15+ in the LSA are eligible to participate in the labour force. Approximately 53% of the eligible population of the LSA reported that they did not participate in the labour force in the 2021 census (Statistics Canada 2023b). This is similar to the numbers reported in the NSAD (55%) but is higher than the numbers reported for Saskatchewan (34%). Segments of the population within the LSA and RSA who are not participating in the labour force may experience increased barriers to accessing Project benefits related to increased employment, income, and training opportunities.

In the LSA, 47% of the population reported participating in the labour force during the 2021 census, meaning they are employed or available for employment (Statistics Canada 2023b). The percentage of people in LSA participating in the labour force who were employed during the 2021 census was 76%, which is lower than that of the NSAD (81%), and lower still than the provincial rate (92%).

Of those who reported being employed in the LSA, 5% were employed in mining, quarrying, and oil and gas extraction. This is slightly lower than the NSAD (7%) but higher than the provincial rate (3%).

Within the LSA communities, the distribution of people employed in mining, quarrying, and oil and gas was notable. The populations of Clearwater River Dene Nation I.R. 222, the Northern Hamlet of Turnor Lake, the Northern Village of Buffalo Narrows, and the Northern Hamlet of St. George's Hill reported no employment in mining, quarrying, and oil and gas extraction (Statistics Canada 2023b). The population with the highest

percentage of employment in mining, quarrying, and oil and gas extraction was Fond du Lac I.R. 227 with 13% of their labour force being employed in the sector.

Since 2021, Fission has provided direct employment to 54 residents from LSA communities. Hiring was conducted using local service support vendors to provide direct program staffing in various capacities in support of active work programs. Fission also supported indirect employment opportunities in the LSA through the award of $5.7 million in contracts to 13 companies either based in, partnered with, or employing residents of the LSA.

Information about the number of people in the LSA who are engaged in shift work where they reside away from home, such as Fly-in/Fly-out (FIFO) work models, was not available. Within the LSA, approximately 8% of people who commute to work reported their main mode of commuting to be “other method” which has potential to include air travel (Statistics Canada 2023a), and 7% report that their commute is longer than 60 minutes. While this data does not confirm the percentage of people in the LSA already engaged in FIFO work arrangements, it does suggest that the number of people working in locations more than 60 minutes commute away and accessed by methods other than car, van, truck, public transit, walking, or bicycle, are relatively low. Within the RSA, approximately 5% of people commute to work using an “other method”, and 6% have a commute that is longer than 60 minutes.

4.7.3.3 Income

The median income in 2020 among those aged 15+ in private households who received income in the LSA was $31,200. The median total income level received by men was $28,600, and $35,600 was received by women.

Of those in the LSA who received income in 2020, 46% of people received employment income, and 23% received government transfers. The median employment income in the LSA for 2020 was $28,400, and the median government transfer income was $16,600.

In the RSA the median income was $30,600, with men receiving a median of $28,000 and women receiving slightly more, at a median of $32,800.

In the RSA, 50.6% of those aged 15+ in private households received employment income, and 85% received government transfers. The median employment income was $28,400 in the RSA, and the median government transfer income was $8,800.

In June of 2021, CRDN received $122.3 million from the Government of Canada related to the "cows and plows" stipulation. The compensation received was distributed to over 2,600 members on June 1, 2021, with each person receiving $44,000, a figure notably higher than the 2020 median income in the LSA. Half of the members who received payments were under the age of 18. These members will gain access to their settlement portion when they reach adulthood (Risom 2021).

BRDN is expected to receive a settlement from the Government of Canada for Agricultural Benefits as well, but a payment date had not yet been determined (BRDN 2023b). BNDN was also pursuing compensation for Agricultural Benefits, but additional information was not available. These one-time settlement payments also have the potential to temporarily increase income levels within the LSA.

4.7.3.4 Education

Primary and secondary level educational services in the LSA are offered through the Northern Lights School Division #113, which serves Bear Creek, Beauval, Buffalo Narrows, La Loche, and St. Georges Hill. Ile a la Crosse School Division #112 serves Ile a la Crosse. The Athabasca Denesuline Education Authority serves Black Lake and Fond du Lac. CRDN provides educational services to Clearwater River, BRDN provides educational services to Dillon, and BNDN provides services to Turnor Lake.

Select post-secondary education programs in the LSA are provided by Northlands College in Buffalo Narrows and La Loche, and Gabriel Dumont Institute in La Loche and Ile a la Crosse. The Methy Housing Corporation in La Loche also provides employment training, adult education upgrading, and post-secondary training to its tenants (GS 2022).

While some post-secondary programs are offered in the LSA, there is not sufficient capacity to accommodate the number of people who would like to participate in those programs (GS 2024; Tayler 2016).

In 2021, 50% of the eligible population of the LSA did not have a certificate, diploma, degree or high school equivalent, which is similar to the RSA (47%). It has been noted that, in the context of students in La Loche, that the value of formal education is not being stressed to students by parents, and this may be leading to reduced attendance rates (CRDN 2023).

In the LSA, approximately 25% of the eligible population attained their high school diploma as their highest level of education, which is similar to the RSA (26%).

High school graduates have access to drivers' education and can secure their industry safety tickets through the school in La Loche (CRDN 2023). Students in the LSA also have access to training programs provided through partnerships between community and industry. Between 2022 and 2023, BNDN and BRDN, with funding from Fission and other industry partners, led a safety training certificate program for ~90 residents from the LSA.

Of those in the LSA those who reported their highest level of education in the 2021 census, 8% attained an apprenticeship or trades certificate or diploma, 9% have a college or other non-university certificate or diploma, 1% have a university certificate or diploma below bachelor level, and 6% have a university certificate, diploma, or degree at bachelor level or above as their highest level of education (Statistics Canada 2023b).

In the RSA, of those who reported their highest level of education in the 2021 census, 7% attained an apprenticeship or trades certificate or diploma, 10% have a college or other non-university certificate or diploma, 2% have a university certificate or diploma below bachelor level, and 8% have a university certificate, diploma, or degree at bachelor level or above as their highest level of education (Statistics Canada 2023b).

4.7.3.5 Health Care Services

The Saskatchewan Health Authority (SHA) operates the following health centres in the LSA that offer Primary Health Care Services:

- La Loche Health Centre and Hospital (SHA)
- Clearwater River Dene First Nation Health Centre (Meadow Lake Tribal Council [MLTC])
- Buffalo Narrows Health Centre
- Beauval Health Centre (SHA)
- St. Joseph’s Hospital and Health Centre (SHA)
- Black Lake Denesuline Health Centre/Nursing Station (Athabasca Health Authority [AHA]; Prince Albert Grand Council [PAGC])
- Fond du Lac Denesuline Health Centre/Nursing Station (AHA, PAGC)
- Birch Narrows First Nation Annie Bagg Memorial Nursing Station (MLTC)
- Buffalo River Health Centre (Dene Wellness Centre) (MLTC)

The Buffalo River Health Centre (Dene Wellness Center), serves approximately 1000 people per year from BRDN, St Georges Hill, and Michel Village and has four registered nurses (BRDN Int. Health 2023).

The following hospitals and facilities with emergency rooms in the LSA include:

- Buffalo River Health Centre (Dene Wellness Centre) (MLTC) has one emergency room, but generally, emergency cases are transported to St. Josephs Hospital in Ile a la Crosse (BRDN Int. Health 2023)
- St. Joseph's Hospital and Health Centre (SHA)

Emergency Medical Services (EMS) in the LSA are provided by the Saskatchewan Health Authority (SHA) for both off-reserve and on-reserve populations. Ambulance services are provided to:

- Buffalo Narrows Health Centre (SHA)
- Beauval Health Centre (SHA)
- St. Joseph's Hospital and Health Centre (SHA)

Emergency air medivac services are available at:

- La Loche Health Centre and Hospital (SHA)
- Fond du Lac Denesuline Health Centre/Nursing Station (AHA, PAGC)

SHA also offers travel coordination for those on social assistance or medical assistance to help people keep their medical appointments at other facilities when needed.

Mental health and addiction services are provided in the following health centres:

- Armand Bekkattla Treatment Centre (National Native Alcohol and Drug Abuse Program [NNADAP])
- Buffalo Narrows Health Centre (SHA)
- Beauval Health Centre (SHA)
- Birch Narrows First Nation Annie Bagg Memorial Nursing Station (MLTC)
- Black Lake Denesuline Health Centre/Nursing Station (AHA, PAGC)
- Clearwater River Dene First Nation Health Centre (MLTC)
- St. Joseph's Hospital and Health Centre (SHA)
- Fond du Lac Denesuline Health Centre/Nursing Station (AHA, PAGC)

Mental health workers also available at BRDN who are employed by the Nation and through the NNADAP; however, these are considered to be limited resources and staff are overworked (Patterson 2022).

Addictions treatment centres in the LSA are located in La Loche at the Armand Bettakkla Treatment Centre, and in Black Lake through the Athabasca Health Authority (ISC 2023). The Northern Village of Buffalo Narrows is currently exploring funding and infrastructure options for development of an addictions treatment center in the community (SHA Int. September 15 2023).

While there are several health care facilities and access to service providers in the LSA, the demand for health care services is already high or increasing, there is limited access to services like treatment centres and specialists, and local health care providers are not confident that they would have capacity to respond to increased demand for services.

Mental health and addictions service providers have noted an increase in drug and alcohol use, drug overdoses, and patients going through alcohol withdrawal (SHA Int. September 15 2023). In 2022, BRDN reinstated a state of emergency in response to gang violence and drug activity, calling for increased support for policing and mental health and addictions services (Patterson 2022).

The ability for health care service providers to respond to increased demand for services depends on the amount of funding available to operate the services and the amount of space available to house new staff and services (BRDN Int. Health 2023; SHA Int. September 15 2023). If the demand for health care services were to increase, SHA would not have the resources to respond to the increased demand. SHA clinics in the LSA are understaffed and it is challenging to recruit and retain workers in remote communities. Mental health services might be able to handle increased capacity in Buffalo Narrows, but not in La Loche. There are currently 12 vacancies in nursing positions in La Loche. Primary care services are already overloaded (SHA Int. September 15 2023).

4.7.3.6 Cultural Continuity and Vitality

Cultural continuity was described by all Indigenous Nations who provided input on traditional land and resource use. Each Nation’s perspectives on cultural continuity are described in detail in Appendix B2 and key points are shared in this section. According to BRDN, cultural continuity is closely tied to cultural identity and connection to land, andrefers to the ability to practice and preserve valued knowledge and traditions, and to

pass these on to future generations (BRDN 2023a). CRDN shared that when people are able to be on the land, it supports the continuance of traditional ways of life, the practice of culture, and improves health in mind, body, and spirit (CRDN 2023).

Hunting was noted as an activity that is integral to CRDN culture and forms the basis of cultural transference (CRDN 2023). Lands, waters, and resources throughout BNDN territory were noted as essential to the well-being and survival of BNDN people (BNDN Ltr. March 9 2021). MN-S shared that Métis maintain a strong connection to the land, culture and each other, the need to protect the land, traditional foods and medicines ensures cultural continuity (MN-S 2023).

BRDN culture is expressed through hunting, trapping, traditional crafts, harvesting and tending to plant foods and medicines, recognition of Dene place names, and in healing and ceremony (BRDN 2023a). Also integral in BRDN culture is the passage of knowledge and skills from generation to generation which often takes place in the context of land-based learning, organized culture camps, and the gathering of Dene communities for seasonal harvesting and worship (BRDN 2023a).

Existing barriers to accessing and being on the land include access to vehicles, cost of fuel, loss of interest, reduction of resource (game and fish), and presence of increased human and industrial activity (CRDN 2023). Other barriers noted include changes in lifestyle, decline of traditional foods and medicines, changes in the frequency and timing of wildfires, and lack of access and infrastructure (BRDN 2023a).

Since 2019, Fission has sponsored several cultural events hosted by communities in the LSA including but not limited to National Aboriginal Day in La Loche Local 39, Buffalo Narrows Summerfest, an elders fish fry at Yanessa Cultural Days, Palmbere Métis Days, Treaty Days celebrations at CRDN, an Elders area for BNDN treaty days, sweat lodge and beading materials for BNDN Culture Days, ACFN Dene Days, Descharme Days, and transportation to the Gathering of Nations Powwow for CRDN.

4.7.4 Heritage

In Saskatchewan, heritage resources include Precontact period and Historic period archaeological sites, built heritage sites and structures of historical and/or architectural interest, and paleontological sites. Heritage resources are the property of the Provincial Crown and are protected under *The Heritage Property Act* (GS 1980). Heritage Resource Impact Assessments (HRIAs) were completed in the vicinity of the Project in 2013 and

2022 (Appendix C.6) and were focused on the footprints available at that time (Figure 4-55).

The 2013 HRIA was focussed on three areas within the SSA and PDA (CanNorth 2013). CanNorth archaeologists initially reviewed the development area for heritage sensitivities and submitted the Project to the Saskatchewan Heritage Conservation Branch (HCB) to determine HRIA requirements. The HCB determined that there were no known archaeological sites in conflict with the PLS Project; however, all areas within 250 m of a significant water source are considered to have moderate to high heritage potential and an HRIA (including post-impact of access roads and drill pads) was required (HCB File Nos. 12-1422 and 12-2758). The HRIA was completed under Archaeological Resource Investigation Permit 13-117.

The project area was initially surveyed from a boat to identify the areas of highest potential along the lake; low-lying and wet areas were not surveyed. All areas considered to have moderate to high heritage potential were assessed using a combination of pedestrian reconnaissance, the excavation of shovel probes, and examining surface exposures including tree throws and cut lines. In total, approximately 155 ha were assessed including the excavation of 155 shovel probes, 27 shovel tests, and the examination of 167 surface exposures. Three new archaeological sites (HjOi-1, HjOi-2, and HjOi-3) and four traditional land use sites (TLU-1, TLU-2, TLU-3, and TLU-4) were identified and recorded during the HRIA (Figure 4-55).

HjOi-1 is an artifact scatter site identified along a 30 m by 5 m area along an exposed cutbank approximately 4 m north of Patterson Lake. Artifacts identified include three tertiary flakes, three pieces of shatter made from pinkish/purple quartz, and a Beaver River Sandstone (BRS) broken biface. Nine shovel tests were excavated along the top of the exposed cutbank adjacent to the surface finds, no buried cultural materials were identified. Given the lack of buried and intact cultural levels observed at archaeological site HjOi-1, low artifact density (n = 5), and a lack of culturally or temporally diagnostic material, the HCB determined that the site had been adequately tested and mitigated and no further work was required (HCB File No. 12-1422).

HjOi-2 is an artifact scatter site located along the top of an esker adjacent to Patterson Lake. This site was discovered after a projectile point was identified in a tree throw on top of an esker adjacent to the Patterson Lake shoreline. Along with the projectile point, three tertiary quartz flakes were identified on the surface. Eight shovel tests were excavated in the

immediate area of the surface finds to identify other heritage resources and determine the extent of the site. Artifacts identified in two shovel tests included a fine-grained BRS finishing flake, one piece of quartz shatter, and one quartz flake. Given the scientific and interpretive value of HjOi-2, site avoidance or additional archaeological work (i.e., excavation) is required to mitigate adverse impacts to this site. If HjOi-2 cannot be avoided, the HCB will require a Phase I mitigation consisting of a 10 m² excavation at this site. Based on the results of the Phase I mitigation, additional archaeological work (i.e., Phase II mitigation, 20 m² excavation) may be required.

HjOi-3 is a single feature site, consisting of a single stone feature and is located on a large lake rampart approximately 5 m from Patterson Lake. The stone feature consists of 25 small to medium sized cobbles, approximately 10 cm to 20 cm in diameter, placed in a diamond pattern and oriented (with the point of the diamond) north/south. Four shovel tests (50 cm by 50 cm) were excavated along the top of the lake rampart surrounding the stone feature. In an attempt to determine the function of the stone feature, the stone feature was cross sectioned from east to west with a 75 cm by 25 cm shovel test. No buried cultural materials were observed at HjOi-3. Given the lack of buried and intact cultural levels observed at archaeological site HjOi-3, the HCB determined that the site had been adequately tested and mitigated and no further work was required (HCB File No. 12-1422).

Four Traditional Land Use Sites (TLU) were identified in the Project area (Figure 4-55). These include a site with three fire pits located along a trail leading north to Patterson Lake (TLU-1), a rectangular log feature (TLU-2), a boat launch with two fire pits (TLU-3), and a site with two fire pits (TLU-4). The traditional land use sites (TLU-1, TLU-2, TLU-3, and TLU-4) are not considered to be archaeological sites and, therefore, are not protected under *The Heritage Property Act*. However, it is recommended that local First Nation groups and communities are consulted prior to any future developments (i.e., roads, mine site) that may impact these sites and the surrounding areas.

A second HRIA was completed in 2022 under Archaeological Investigation Permit No. 22-109 (CanNorth 2023). CanNorth archaeologists initially reviewed the development area for heritage sensitivities and submitted the Project to the HCB to determine HRIA requirements. The HCB determined that the project development will impact areas of intact forest near Patterson Lake and is located in the Firebag Hills Landscape Area on which several archaeological sites have been documented in Saskatchewan and to the west across the provincial border in Alberta (HCB File No. 21-1552). A pre-impact HRIA to assess

areas to be impacted by the mine development and a post-impact assessment of areas disturbed by exploration was required (HCB File No. 21-1552).

Heritage sensitive segments of the proposed infrastructure locations were assessed using a combination of pedestrian reconnaissance, the excavation of 314 subsurface shovel probes, and a post-impact assessment of access roads (approximately 36.2 km), 89 associated drill pads (~7.14 ha), road cuts, push piles, surface exposures, and tree throws. No heritage resources were identified in conflict with the proposed Project during the HRIA.

Updated Project plans were submitted to the HCB in June 2023. The HCB reviewed the updated plans and determined that portions of the Project footprint have not been assessed and are located on heritage sensitive terrain. Therefore, a pre-impact HRIA is required for areas that have not been previously assessed under Permits Nos. 13-117 and 22-109 (HCB File No. 23-509). Additionally, a post-impact HRIA is required for disturbed areas that were not assessed under Permit No. 22-109 (HCB File No. 23-509). Fission has committed to conducting these assessments prior to ground disturbance.

A desktop screening of known paleontological and built heritage sites was completed. The Heritage Conservation Branch's paleontological database was consulted to determine the type of known sites near the PLS. No sites were recorded in the PDA (E. Guinan, Provincial Archaeological Inventory and Regulatory Compliance Specialist, pers. comm., February 5th, 2024). A Saskatchewan Heritage Property Search was completed utilizing the Province of Saskatchewan's online database, and there are no built heritage sites in the PDA. No paleontological or built heritage sites were identified during the HRIAs and it is not anticipated that they may be identified in the PDA. Therefore, further discussions of heritage resources only pertain to archaeological sites.

4.7.5 First Nation and Métis Land Use

First Nation and Métis Land Use is described in this section and includes details about contemporary use of land in the PDA, land use LSA, and land use RSA by Indigenous Nations and groups.

The land use LSA matches the wildlife LSA and includes a 5 km radius from the boundary of the PDA. Waterbodies and watercourses within the LSA include Patterson Lake, Patterson Creek, Lake A, Lake B, Lake C, Lake D, a portion of Vermeersch Lake, and approximately 20 additional small unnamed waterbodies and watercourses. In addition to waterbodies, the primary land cover in the LSA is regenerating forest. Built infrastructure

in the LSA includes a portion of Highway 955, numerous trails, a Fission-operated dock, a community-operated boat launch and informal recreational area, and a portion of the NexGen Rook I Access Road.

The land use RSA matches the aquatic LSA and includes the Clearwater River watershed boundary to the outlet of Beet Lake. In addition to these waterbodies, the primary land cover in the RSA is also regenerating forest.

Indigenous Nations with documented traditional territories or use areas located in the study areas include CRDN, MN-S, BRDN, BNDN, BLDFN, FLDFN, and ACFN. The location of reserve lands proximate to the PDA, land use LSA, and land use RSA is provided in Figure 4-56.

Information sources used to inform this section include a combination of comments received on the draft PLS Technical Proposal and Terms of Reference documents, input received from meetings or emails, and community-led reports provided to Fission by participating Nations.

A summary of the sources of land use information provided to Fission by each Indigenous Nation (as a function of the Duty to Consult procedural aspects) is provided below followed by a summary of contemporary land use (including timing, duration, and frequency) and environmental attributes (including access and travel routes) important for the exercise of rights and traditional uses by each Nation.

4.7.5.1 CRDN

Information on rights and traditional uses in the study areas was provided to Fission by CRDN in a letter, dated February 1st, 2021, containing comments on the draft Technical Proposal for the PLS Project and a Draft Socio-economic and Harvest Study – Clearwater River Dene Nation, dated September 5th, 2023. The Socio-economic and Harvest Study was a community-led study completed by CRDN and funded by Fission through the CRDN Engagement and Capacity Agreement signed in 2021. The study detailed socio-economic and land use data collected through interviews with 63 CRDN members in 2022 and follow up harvest-related interviews with 31 people in 2023.

CRDN is a Treaty 8 Signatory with documented traditional territory and use areas overlapping the PDA, land use LSA, and land use RSA. The nearest CRDN reserve is located 100 km south of the PDA.

In 2022, over half of those interviewed reported that they practice their culture around the Patterson Lake area. CRDN shared that sites of cultural importance, such as Dene place names, stories, or death sites are located on Patterson Lake (in the LSA and RSA) and Forrest Lake (within the RSA) (CRDN 2023).

Of the 31 CRDN members interviewed in 2023, almost all respondents shared that they consume traditional foods in one form or another and some noted that as much as 70% of their diet consists of traditional foods (CRDN 2023).

In 2021, CRDN provided a list of rights that are exercised within the Traditional Territory. These rights are listed in the paragraphs below along with supporting information about the exercise of each right in the study areas.

CRDN members have the right to hunt large mammals, including moose, caribou, mule deer, white-tailed deer, Kodiak bear, and black bear (CRDN Ltr. February 1 2021). Moose, caribou, and black bear were observed in the PDA and LSA during 2018/2019 baseline surveys (Appendix C.3). A CRDN hunting area overlaps the PDA, land use LSA, and at least a portion of the land use RSA (land use information for the full RSA was not available) (CRDN 2023). In 2023, 31 interviewees identified that they consume moose, elk, deer, and caribou, and that these mammals are harvested and consumed mostly in the fall season. None of those interviewed noted consuming bear. During times when wild game is available, the majority of those interviewed (19 people) noted that they consume wild game approximately 20 times per month. Some high consumers, however, report eating up to 40 meals of wild game per month. When wild game is not abundant, the majority of interviewees (23 people) reported eating approximately 10 meals per month of wild game (CRDN 2023).

CRDN has the right to hunt or trap small mammals, including rabbit, beaver, otter, muskrat, lynx, wolverine, badger, weasel, squirrel, marten, wolf, coyote, and fox (CRDN Ltr. February 1 2021). Snowshoe hare, river otter, Canada lynx, wolverine, American mink, red squirrel, American marten, grey wolf, and red fox were observed in the PDA and LSA during 2018/2019 baseline surveys. In 2023, 31 interviewees identified that they consume rabbit and beaver, but do not consume squirrel, marten, otter, lynx, badger, coyote, fox, or wolf. As noted earlier, a hunting area overlaps the PDA, LSA and at least a portion of the RSA. A trapping area is located in lands surrounding Patterson Lake and overlaps a portion of the PDA, LSA, and RSA (CRDN 2023).

CRDN has the right to hunt birds, including partridge, grouse, geese, ducks, and swans, and to harvest duck eggs (CRDN Ltr. February 1 2021). In 2022, all 31 people interviewed reported that they consumed goose, goose eggs, ducks, duck eggs, grouse, ptarmigan, and also seagull eggs (CRDN 2023). As noted earlier, a hunting area overlaps the PDA, LSA and at least a portion of the RSA.

CRDN has the right to fish, including jackfish/northern pike, grayling, pickerel/walleye, ling cod, whitefish, and trout (CRDN Ltr. February 1 2021). In 2022, all interview participants noted that they consume walleye, northern pike, lake trout, rainbow trout, brook trout, perch, grayling, whitefish, and burbot. Of these species, whitefish was most popular, and most preferred to cook it over an open fire. Fish are consumed most often by participants in the spring and summer. Lake trout, lake whitefish, northern pike, white sucker, and yellow perch were observed in Patterson Lake in 2016/2017 baseline surveys (Appendix C.3). CRDN members reported that Patterson Lake, Lake D, Lake E, Forrest Lake, Vermeersch Lake, and Beet Lake are used for fishing, all of which are located within the PDA, LSA, and/or RSA. When fish are available, the majority of respondents (19 people) noted that they have 20 meals of fish per month. The high consumers for fish report eating 35 meals per month when fish are available. When fish are less available, the majority (21 people) say they eat about 10 meals of fish per month.

CRDN has the right to harvest berries, including Saskatoon berries, wild strawberries, blueberries, raspberries, chokecherries, low bush cranberry, and high bush cranberry (CRDN Ltr. February 1 2021). In 2022, those interviewed noted that they commonly harvest blueberries, blackberries, huckleberries, buffalo berries, chokecherries, cranberries, raspberries, Saskatoon berries, strawberries, pin cherries, gooseberries, and cloudberries. Berries are harvested throughout the summer when they are in season. A harvesting area is located along a traditional travel route within the LSA and a portion of the RSA. It originates at Highway 955 at the trail to the Patterson Lake boat launch south of the PDA. It then extends east across Patterson Lake across the Patterson Lake outlet, across the north edge of Forrest Lake, and into Beet Lake (CRDN 2023).

CRDN has the right to harvest plants (CRDN Ltr. February 1 2021). In 2022, those interviewed noted that they commonly harvest muskeg, Labrador tea, juniper, sweet grass, stinging nettle, and rat root (CRDN 2023). Of these, juniper, sweetgrass, chaga, and rat root are used as medicines. Plants are most often harvested during the summer months.

CRDN has the right to harvest wood for domestic use, tepees, overnight shelters, fuel in camps, and domestic heating (CRDN Ltr. February 1 2021). The PDA and LSA are primarily regenerating forest. Old growth wood is less abundant due to historic wildfires in the area. Evidence of the use of wood harvested in the LSA was present near the informal recreational area near the Patterson Lake boat launch, south of the PDA (Figure 4-54).

CRDN has the right to quarry rock, such as pipestone for ceremonial purposes (CRDN Ltr. February 1 2021). Information about quarrying rock in the study areas was not available.

CRDN has the right to collect potable water for camp and domestic purposes (CRDN Ltr. February 1 2021). Given the proximity of several cabins or camping spaces to lakes within the PDA, LSA and RSA, it is assumed that water from these lakes have potential to be used for camp and domestic purposes.

CRDN has the right to construct and maintain cabins, camps, and overnight shelters. (CRDN Ltr. February 1 2021). No cabin or camping locations are present in the PDA. Three cabin locations were identified in the LSA. One is located near the Patterson Lake boat launch south of the PDA. In September 2023, efforts were made by Fission staff to confirm the presence of the cabin. A cabin structure was not observed; however, an outhouse, debris, and a fire pit were observed in this general area which suggests it was recently used for camping purposes. The other two cabin areas in the LSA are located along the north shore of Patterson Lake. A total of four cabin sites were identified within the RSA. In addition to the three cabins located in the LSA, an additional cabin area is located along the north shore of Patterson Lake, one is located at the Patterson Lake outlet, along the Rook I Access Road, one is located on the southeast shore of Forrest Lake, and one is located on the west shore of Beet Lake. Additional cabins and camping sites have potential to be located in the RSA that were not identified on the updated traditional use map (CRDN 2023).

CRDN has the right to travel to and access hunting, fishing, trapping, and harvesting areas using land and water travel routes, and to build, use, and maintain trails. (CRDN Ltr. February 1 2021). Two parallel traditional travel routes run north-south through the PDA in the general area of Highway 955. A small portion of a travel route branches off of the north-south route within the northwest portion of the PDA and divides into a route providing access to areas north, west, and south of the PDA. The southern route runs through a portion of the LSA and then crosses through the western most portion of the PDA before continuing to Vermeersch Lake. In the LSA several additional travel routes are

present. South of the PDA, a travel route is present which originates at Highway 955 and overlaps the Rook I Access Road. Branches from this route within the LSA provide access to Forrest Lake, Patterson Lake, and Lake D. Five trails and two staging areas originate at Highway 955 and provide access to the western portion of the LSA including Vermeersch Lake and Wenger Lake (outside of the LSA). A traditional travel route is also located north of the Rook I Access Road and is surrounded by a general harvesting area. It originates at Highway 955 at the trail to the Patterson Lake boat launch and extends east across Patterson Lake. With the RSA, this same trail and harvest area travels through the Patterson Lake outlet, across the north edge of Forrest Lake, and into Beet Lake. In the northern portion of the LSA, three trails are accessible from Highway 955 and provide access to the cabins on the north shore of Patterson Lake, to Patterson Lake itself, and to Broach Lake (outside of the LSA). One final trail is accessed from the north portion of the LSA which heads northwest and provides access to Gedak Lake (outside of the LSA).

4.7.5.2 MN-S NR2

Information on rights and traditional uses in the study areas was provided to Fission by MN-S on behalf of MN-S NR2 and Métis locals, #39 - La Loche, #156 - Bear Creek, #40 - Turnor Lake, #62 - Buffalo Narrows, and #65 - Michel Village/ St. Georges Hill in the draft report titled Fission Uranium Corp. Métis Knowledge Study (MKS) dated December 15, 2023. The MKS was a community-led study funded by Fission through the MN-S NR2 Capacity Agreement signed in 2022. The study detailed socio-economic and land use data collected through review of secondary literature and interviews with 20 Métis citizens in September 2023.

The MN-S NR2 homeland, 2019 Land Claim, and several traditional use areas overlap the PDA, land use LSA, and land use RSA. The nearest active MN-S Local is located in La Loche, 150 km south of the PDA.

As detailed in the MKS, those interviewed reported land and resource use in and around the Patterson Lake area including cabin and camping areas, access trails, trapping, hunting, fishing, gathering, and transmission of intergenerational knowledge.

Cabins and Camping Areas

Within the LSA, MN-S NR2 identified two cabins and one traditional camp – one cabin and the traditional camp are located in proximity to the Patterson Lake boat launch and camping area on the southwest shore of Patterson Lake, and the other cabin is located at

the far west boundary of the LSA. Within the RSA, seven additional cabin locations and one traditional camp location are present. Five of the cabins are located on the north shore of Broach Lake, north of the LSA, and remaining two cabins and the traditional camp are located on the south shore of the north arm of Patterson Lake.

Access Trails

Within the LSA, one trail is present on the west side of Highway 955 and provides access from the Highway to the cabin area on the west boundary of the LSA. Four trails are located on the east side of Highway 955 within the LSA and provide access from the highway to other areas of Patterson Lake and to Broach Lake. The trails located on the east side of the highway also extend into the RSA providing access to cabins and traditional camp sites at Broach Lake and the north arm of Patterson Lake. One additional trail (referred to as the Langley Lake to Patterson Lake trail) and a boat route are also present along the eastern boundary of the RSA, and a snowmobile trail is present in the northern portion surrounding Broach Lake.

Trapping

A trapping area was identified which covers the majority of the LSA except for a small area in the southwest quadrant. This trapping area also overlaps the majority of the RSA. An MKS advisor interviewed shared that an established trap line that is passed down generationally is present and extends from the northern part of Forrest Lake to the north end of Murison and Minto lakes, but has not been used for some time (since the downturn in fur prices). Based on the description of the trap line location it is predicted to be located in the northeast portion of the RSA. Specific species harvested in this area were not shared, but species harvested near Wenger Lake (west of the RSA) included mink, beaver, wolf, fox and squirrel. Species harvested in areas outside of the LSA and RSA also included otter and fisher, so it is assumed that these species have potential to be harvested in the LSA and RSA as well if they are present. Of the species noted in the MKS, river otter, American mink, red squirrel, grey wolf, and red fox were observed in the PDA and LSA during the 2018/2019 baselines surveys (Appendix C.3).

Hunting

A large hunting area was identified in the MKS which straddles Highway 955 and overlaps the LSA and RSA entirely. MN-S NR2 advisors reported hunting moose, chicken, and rabbit around Patterson Lake (overlaps the LSA), Beet Lake, and Forrest Lake which are

all located in the RSA. In addition to moose, caribou are also hunted at Broach Lake which is also located in the RSA. Moose, caribou, and snowshoe hare were observed in the PDA and LSA during the 2018/2019 baseline surveys. Additional species that MKS advisors reported hunting outside of the RSA that were observed to be present in the PDA and LSA in the 2018/2019 baseline surveys, and have potential to be hunted, if present, include black bear, river otter, Canada lynx, wolverine, American mink, red squirrel, American marten, grey wolf, and red fox (Appendix C.3).

One MKS advisor noted feeling that hunting in the Project area (specifically near Preston Lake and Lloyd Lake – south of the RSA) was dangerous due to the increased traffic in the area. Another advisor shared an observation that moose populations have declined around Patterson Lake since the exploration camp (presumably the PLS exploration camp) was built and noted that the land use experience around Patterson Lake has been impacted as a result of increased noise levels from exploration activities.

Fishing

Fishing was identified at all lakes located within the LSA and RSA. The species harvested from Broach Lake included trout, jackfish, catfish mullet, suckers, and whitefish. Information regarding species harvested in other lakes in the RSA was not shared but may include those harvested from Broach Lake and/or additional species that were harvested in areas outside of the RSA which included cisco, walleye, and mariah (burbot). In 2023, all interview participants noted that they consume all species of freshwater fish harvested in northern Saskatchewan with whitefish, walleye and northern pike the most popular. Fish are consumed by participants year-round with emphasis placed on the winter. Fish harvested are eaten smoked and fresh, fish are also smoked and/or frozen to be consumed throughout the year (MN-S NR2 2023). Lake whitefish, lake trout, northern pike, white sucker, and yellow perch were observed in Patterson Lake during the 2016/2017 and/or 2021/2022 baseline surveys (Appendix C.3 and C.4). Of the species harvested by MN-S NR2 citizens, Lake whitefish, lake trout, northern pike and white sucker were observed in Patterson Lake which suggests that fishing for these species may occur in the LSA.

Gathering

Gathering was identified in areas located within the LSA and RSA. MN-S NR2 citizens identified a berry picking area that overlaps the majority of the LSA (with the exception of a small sliver of land on the western boundary) and RSA (with the exception of an area near the eastern boundary). Wild rice gathering areas and plant gathering areas were also

marked on the MKS maps. Plants (such as Labrador tea, rat root, blueberry leaves, spruce gum, jack pine gum, wild mint and other herbs) and fungi (chaga and morels) are harvested along Highway 955 from La Loche to Cluff Lake, around Wenger and Broach Lakes. Berries that are commonly harvested by MN-S NR2 citizens include Saskatoon berries, wild strawberries, blueberries, raspberries, strawberries, chokecherries, and cranberries. In 2023, those interviewed noted that they commonly harvest in the summer and fall, and berries are dried and/or frozen to be consumed throughout the year. Of the plant and berry species harvested by MN-S NR2 citizens, blueberries, cranberries, Labrador tea, white and black spruce and Jackpine were observed in the Project area during the 2016/2017 and 2021/2022 baseline surveys (Appendix C.3 and C.4). during baseline surveys.

Intergenerational Knowledge and Cultural Continuity

MN-S NR2 citizens also noted that all traditional use areas are used to support intergenerational knowledge transfer and cultural continuity. Being on the land, with family and as a community provides opportunities for the transmission of cultural values and traditional knowledge (MN-S NR2 2023). The importance of generational transfer through land uses was emphasized by MN-S throughout the MKS. It is assumed that given the presence of land and resources uses in the LSA and RSA that intergenerational knowledge transfer and activities important for cultural continuity are also taking place in these study areas.

Existing Barriers to Traditional Land and Resource Use

The MKS identified several government laws, policies, and practices which have historically, or are presently, impacting land and resource use of MN-S NR2 citizens. These include allotment of scrip, Natural Resources Transfer Agreement, Fur Conservation Blocks, wildfires and let it burn policies, fur prices, and industrial development.

MN-S NR2 citizens shared that cultural practices are challenged due to colonialism, industrial development and climate change. It was noted that forest fires, climate change and industrial development threatens the balance between all living and non-living things which is required to sustain ecosystems and habitats. One MKS advisor noted feeling that hunting in the Project area (specifically near Preston Lake and Lloyd Lake – south of the RSA) was dangerous due to the increased traffic in the area. Another advisor shared an observation that moose populations have declined around Patterson Lake since the exploration camp (presumably the PLS exploration camp) was built and noted that the land

use experience around Patterson Lake has been impacted as a result of increased noise levels from exploration activities.

Within the MKS, it was noted that MN-S NR2 citizens interviewed for the Traditional Land Use and Diet Study for the NexGen Rook I Project noted a change in their experience harvesting in and around the proposed Rook I Project area (located within the RSA) due to safety concerns with the proximity to a mine and feelings of being watched.

4.7.5.3 BRDN

Information on rights and traditional uses in the study areas was provided to Fission by BRDN in the Buffalo River Dene Nation Knowledge and Use Study for Fission Uranium's Patterson Lake South Project dated September 22nd, 2023. The Knowledge and Use Study was a community-led study completed by BRDN and funded by Fission through the BRDN Engagement and Capacity Agreement signed in 2022. The study detailed land use data collected through interviews with 12 BRDN members in 2023.

BRDN is a Treaty 10 Signatory with documented traditional territory and use areas overlapping the PDA, land use LSA, and land use RSA. BRDN has one reserve which is located 320 km south of the PDA.

BRDN identified and provided contemporary use information about traditional land use activities that members felt had potential to be affected by the Project. The Knowledge and Use Study was organized into sections which included hunting and trapping, water and fishing, and cultural continuity. Following further engagement with BRDN over email in July 2024, it was clarified that harvesting of berries and medicines occurs in all areas of BRDN Territory where plants sustainably grow, including in the Project study areas. A summary of the environmental attributes required for each activity, presence of those attributes in the PDA, LSA, and RSA, and records of use in the study areas are described in this section for each activity.

Hunting and Trapping

Hunting and trapping included key habitat and harvesting areas for large and small game, supporting infrastructure including cabins and trails, and sites for the intergenerational sharing of traditional knowledge pertaining to animal behaviour, harvesting, and processing (BRDN 2023a).

Within, or overlapping the PDA and extending into the LSA and RSA, BRDN respondents identified a moose harvesting site and a travel route used to access Barren-ground caribou hunting grounds. Caribou is a central component of the traditional diet of BRDN members. BRDN members identified that a corridor (approximately 2 km in width) along Highway 955 was used for hunting and trapping. In the LSA, an additional hunting and trapping area was identified at Patterson Lake, outside of the PDA.

The portion of Highway 955 within the LSA and RSA is used as the primary access route to caribou hunting grounds at Cluff Lake and Lake Athabasca (BRDN 2023a).

The continuance of hunting and trapping activities is important to BRDN members for the following reasons:

- extensive knowledge of animal behaviour, local ecology, and the interconnectedness of the territory through land and waterways;
- subsistence through year-round contributions to diets;
- cultural continuity through multi-generational knowledge transmission;
- maintenance of community ties through communal hunting, trapping, and processing; and
- enjoyment and fulfillment through hunting and trapping for animal meat consumed for food by humans.

BRDN members shared existing barriers to hunting and trapping within their Traditional Territory which may be applicable to hunting and trapping activities within the LSA and RSA:

- decrease in animal quantity, quality, and habitat degradation due to forest fires, human and industrial noise, and recreational hunting pressure enabled by industry-related infrastructure;
- regulatory impacts such as meat seizures and fines;
- concerns over animal quality due to pollutants;
- contamination from industrial activity such as mining operations observed in the health of local animal populations;
- historical declines in economic yields from fur trapping and related encroachment and proliferation of dangerous animals on previously trapped species;
- impacted trust towards bears due to observed aggression from recent behavioural changes; and

- historical and on-going climate-level impacts such as an increase of forest fires.

BRDN members noted that hunting in the Traditional Territory takes place year-round when the animals are available. For example, moose and ducks are hunted in the fall, but rabbits are hunted throughout the year. Trapping, on the other hand, takes place mostly during the spring and fall in the Traditional Territory. Specific information about frequency and seasonality of hunting and trapping in the PDA, LSA, and RSA are not known.

Water and Fishing

Water and fishing includes sites for fishing and the collection of drinking water, ancestral values associated with lakes and streams, routes and aides for travel and navigation, sites for teaching water-based traditional practices and water safety and supports for BRDN livelihoods through commercial fisheries (BRDN 2023a).

Within the PDA and extending into the LSA, habitat and harvesting sites for pike, walleye, whitefish, suckers, and trout are present. A travel route used to access commercial fishing locations is also present in the PDA and LSA. Within the RSA, additional harvesting sites were recorded for the species above. Patterson Lake is known by BRDN members for its consistent movement, depth, sandy beaches, and rocky shorelines.

BRDN shared that access to water and fishing resources provides a suite of benefits including:

- subsistence through contributions to daily diets year-round;
- cultural continuity, as the subject of BRDN traditional knowledge and vehicle through which that knowledge is transmitted;
- contributions to livelihoods through participation in commercial fisheries;
- reinforcement of Dene identity through proximity to water and the continuation of traditional resource harvesting practices;
- connection to ancestors and ancestral places through histories and remembrances of fishing and water-oriented travel;
- maintenance of community ties through the sharing of fish; and
- a venue for recreation and teaching of water safety.

Existing barriers to continued use of water and fishing for BRDN members across the Traditional Territory have the potential to occur or affect land use in the LSA and RSA. These include:

- the colonization of traditional diets by convenience foods, with associated impacts on fishing practices in BRDN communities;
- declining fish populations due to non-subsistence overfishing, e.g., for the purposes of mink farming;
- regulatory impacts such as commercial fishing license restrictions, surveillance of food fishers, and historical fisheries closures;
- fish species are susceptible to changes is water quality and quantity;
- potential contaminant dispersion into connected stream networks in the region that reach local waterways;
- contamination from industrial activity including oil and gas exploration and mineral prospecting and mining, with observed health impacts in neighbouring Dene communities and on local fish populations;
- aesthetic impacts, avoidance of ancestral fishing areas, and impediments to travel and cultural continuity as a result of freshwater eutrophication and associated algal blooms;
- ongoing concerns about drinking water quality and chemical exposure in local water supplies; and
- historical and on-going climate-level impacts such as an increase of forest fires and eutrophication of freshwater systems.

Fishing is conducted by BRDN members using rod and reel, netting, and snaring. In the spring, fish can be snared in streams or fished from the ice before it fully thaws. Fish quality changes throughout the year with different fish species becoming less abundant in certain seasons, and other species becoming more abundant during those times. BRDN members fish and use water year-round in their Traditional Territory, but frequency and seasonality of use in the PDA, LSA, and RSA is unknown.

Cultural Continuity

Cultural continuity includes engagement with ancestral places and place names, traditional practices such as crafts, plant harvesting, healing, and ceremony, sense of place associated with being on the land, and the intergenerational sharing of BRDN traditional knowledge and skills (BRDN 2023a).

BRDN culture also persists through hunting and trapping activities which have been recorded in the PDA, LSA and RSA. It is assumed that other activities related to cultural continuance may also take place in the study areas alongside hunting and trapping.

BRDN cultural continuity is expressed through, and dependent on, a variety of practices and processes including:

- continued interaction with ancestral and childhood places;
- the persistence of traditional practices such as hunting, trapping, fishing, crafts, plant harvesting, healing, and ceremony;
- the recognition of Dene place names;
- a sense of serenity and security associated with being on the land;
- the intergenerational sharing of traditional knowledge and skills in both formal and informal settings; and
- the gathering of Dene communities for seasonal harvesting and worship.

Existing pressures on BRDN cultural continuity include:

- a shift away from traditional livelihoods and lifestyles, in part attributed to the decreased accessibility of traditional foods and medicines;
- impacts to quality of traditional foods and medicines from potential industry-related contaminants;
- the sharing of potential contaminated traditional foods and medicines could expose a larger population to potential contaminants;
- increased cancer rates attributed to contemporary convenience diets;
- impacts to traditional foods and medicines from extreme climactic events such as forest fires;
- an increasing prevalence of garbage, camps, and cabins associated with tourism in the region;
- the continued need for a ‘critical mass’ of access and infrastructure on BRDN traditional lands; and
- encroachment on traditional lands and resources by climate-level impacts such as changes in the timing and magnitude of forest fires.

Hunting, trapping, and fishing, which are activities critical to BRDN cultural continuance are conducted year-round within the traditional territory. It is unknown how often, or specific times of the year that these activities are conducted in the PDA, LSA, and RSA.

4.7.5.4 BNDN

BNDN is a Treaty 10 Signatory with documented traditional territory and use areas overlapping the PDA, land use LSA, and land use RSA. BNDN has one reserve which is located 234 km south of the PDA by road.

In December 2020, a draft version of the Technical Proposal (also referred to as the Project Description) document was shared with BNDN leadership for review. Comments were received from BNDN in a letter dated March 9th, 2021. Included in the letter was a list of BNDN rights and concerns about potential impacts to rights. Information shared is listed below:

- Exclusion of BNDN members from the Project site.
- Avoidance of the Project site from BNDN members due to disturbance and fears.
- Impacts on hunting, trapping, and gathering and the availability of traditionally important species.
- Impacts to Aboriginal fisheries associated with changes to the existing aquatic ecosystem including potential disruption of spawning sites.
- Impacts to cultural sites or archaeological features (BNDN Ltr. March 9 2021).

On May 14th, 2024, BNDN provided Fission with a summary of results from the community-led Indigenous Knowledge, Land Use and Occupancy Study (IKLUOS). This study was conducted by BNDN and funded primarily by Fission as part of the Engagement and Capacity Agreement signed in 2022. The IKLUOS summary detailed traditional land and resource uses and practices of 25 BNDN members.

BNDN included in the summary a map of land and resource use sites and some key points and observations. A description of the location and nature of the sites and a summary of the key points and observations related to existing conditions for land and resource use in each of the Project study areas (PDA, LSA, and RSA) are discussed below by key land use activities described in the mapping results.

Several additional sites and areas were identified outside of the PLS study areas but within the BNDN study area. These locations are focused around Wenger Lake, Lloyd Lake, Preston Lake, Dahle Lake, Bolton Lake, Broach Lake, Hodge Lake, and Murison Lake (BNDN 2024).

Subsistence and Gathering

Subsistence is described in the map from the summary as a combination of points, areas, and routes. Within the PDA, one subsistence point is identified on the shore of Patterson Lake, and directly south of that point, two gathering areas are identified in the PDA. All of Patterson Lake is considered a subsistence area by BNDN with several routes and key points identified along the shorelines and within the lake. The majority of these locations are within the LSA, but they also extend into the RSA. Aside from Patterson Lake, subsistence locations in the RSA are also identified on the east shore of Forrest Lake and along a route extending west from Highway 955 south of Forrest Lake toward Wenger Lake (BNDN 2024).

Habitation

Habitation sites were not identified within the PDA. Within the LSA habitation sites are located in proximity to the recreation and camping site south of the PDA and at a location on the north shore of the Patterson Lake South Arm. Several habitation sites are also located in the RSA. Two sites are located along the north shore of Patterson Lake, one is located at Broach Lake near Highway 955, and two are located on the north shore of Forrest Lake. BNDN members noted that wildfires are currently a threat and have been known to burn down homes and cabins (BNDN 2024).

Transportation

Transportation routes were not identified as present within the PDA, but several routes were identified in the LSA and RSA. A trail that originates from near the recreation and camping area south of the PDA was identified and while it originates in the LSA, it extends into the RSA and provides access to Patterson Lake, Forrest Lake, Beet Lake, and areas in between. A trail that originates at Highway 955 near the NexGen Rook 1 Project access road intersection also originates in the LSA and extends into the RSA west of the highway. This route is currently avoided by BNDN members. It was previously used to access trap lines; however, was disturbed by industrial activity and, as such, is no longer used by BNDN members. A trail is identified at Broach Lake entirely within the RSA originating at Highway 955 and extending across the lake to the east shore (BNDN 2024).

Hunting and Stewardship

Hunting areas are identified in the summary map as a combination of points and larger areas. A large hunting area that straddles Highway 955 is present within the PDA and it

extends south along the highway through the LSA and to the outer edge of the RSA. One specific hunting site is located within the LSA south of the Rook 1 Project access road and north of Forrest Lake.

Individuals who identified hunting areas shared the importance of moose and caribou hunting in the area and expressed concern about possible contamination and disturbance to animals if the mine is approved. They noted that if BNDN members avoid hunting in this area, this may impact food security for the community (BNDN 2024).

Study participants indicated that the Patterson Lake area is used by moose for mating and birthing grounds, and that caribou also frequent the area. Participants expressed concern about the Project and its potential impact on animals like caribou, which are very sensitive to noise. An increase in noise has the potential to impact caribou habitat long-term, according to participants. Of the habitat that remains for caribou, participants noted Ithingo Lake and Moberly Lake (both of which are located southeast of the RSA) as important contemporary caribou habitat; from these areas caribou often migrate north towards the Project site and beyond (BNDN 2024).

An area identified as "environmental" is located near the Patterson Lake South Arm outlet. In this area a bird species important to BNDN members was observed. Wildfires are currently a threat in the area and have been known to impact wildlife habitat (BNDN 2024).

Fishing

Participants discussed fishing in several lakes surrounding the proposed Project site. Specific fishing locations were identified at Patterson Lake within the LSA, and at Forrest Lake within the RSA. Specific lakes mentioned in the study results included Patterson Lake, Forrest Lake, Lloyd Lake, and Murison Lake. Community members reported fishing these areas both in the past, and as recently as the summer of 2023. Participants noted catching pike and walleye in large numbers in the area. While speaking about harvesting near the Project, many participants pointed out that drilling and other mining activities in the area have eroded their trust in the health of the fish, and other species they harvest. Some participants explained that ongoing mining activities near the Project site would prevent them from returning to harvest there (BNDN 2024).

BNDN members shared that water and aquatic species are also changing. Some individuals observed that water levels are often lower throughout warmer periods of the year and water quality has declined. This has been linked to impacts observed by BNDN members on fish

and fisheries. BNDN noted that this is problematic as fish are an important source of nutritious food (BNDN 2024).

Culture and Occupancy

Cultural sites were not identified within the PDA. Within the LSA, a cultural site is located in proximity to the recreational and camping area south of the PDA. Within the RSA, a cultural site is located on the east shore of Forrest Lake, and one is located on the west shore of Broach Lake near Highway 955. Study participants also noted that land within the BNDN study area was used as a basecamp for BNDN school trips, where various animals were harvested, and survival skills were taught (BNDN 2024).The exact locations of these camps were not disclosed.

BNDN notes that a pervading theme throughout the interviews was the continuous use and knowledge of the lands by BNDN members and the connection between the land and culture of the Dene people. It was explained that participants' connection to the land acts as a cornerstone of their mental and physical wellbeing (BNDN 2024).

Many participants described an important cultural/ceremonial site where their ancestors would gather for three months of dancing, hunting, trading, and other cultural activities. While this site was referenced multiple times, participants were unsure of the exact location, but it is predicted to be located north of Lloyd Lake, and south-east of Preston Lake. This approximate site is located roughly 30 km south of the PDA. Participants felt it was important to note that a ceremonial site of significance is located near the Project site and should require follow-up ground-truthing to narrow down the location (BNDN 2024).

Many participants spoke of extensive historic and contemporary land use and occupancy spanning from Peter Pond Lake to Cree Lake, and beyond the Project site as far north as Tazin Lake. In the past while traveling seasonally, if someone passed away, they would often be buried in that location, owing to the difficulty of transporting their body over land. For this reason, participants noted that burial sites exist across the landscape. While many burial locations are known, many are not yet identified. Consequently, the potential for locating burials throughout the region, including the Project site area exists (BNDN 2024).

4.7.5.5 ACFN

ACFN prepared a Desktop Review of Traditional Land Use and Historical Resources which was provided to Fission on December 20th, 2022. The review identified that the

Project is located within various land use or stewardship areas; however, maps of the areas, information on specific land use types, presence of historical resources, presence of contemporary land users, or predicted effect pathways present in and around the Project site were not provided. It is assumed that traditional land and resource uses have the potential to be practiced by ACFN members in the LSA and RSA, and may include stewardship activities, fishing, hunting (potentially for caribou), and harvesting (which may include trapping). ACFN also noted that caribou is considered a keystones species and is integral to ACFN members' food and cultural systems.

ACFN is a Treaty 8 Signatory with documented traditional territory and use areas overlapping the PDA, land use LSA, and land use RSA. The nearest ACFN reserve is located 160 km northwest of the PDA.

4.7.5.6 YNLR

The Ya' thi Néné Land and Resource Office (YNLR) represents BLDFN and FDLFN which are Treaty 8 Signatories with documented traditional territory and use areas overlapping the PDA, land use LSA, and land use RSA. The nearest BLDFN reserve is located 275 km north-east of the PDA, and the nearest FDLFN reserve is located 230 km north of the PDA.

A Fission Patterson Lake South Engagement Agreement: Summary Report (2022-23) was provided to Fission on May 26th, 2023. The summary report was a community-led study completed by YNLR and funded by Fission through the YNLR Engagement and Capacity Agreement signed in 2022. The study report included high-level information about land uses collected through interviews with 18 Athabasca community members and a summary of engagement activities. Approximately 11% of the 18 community members interviewed reported travelling through the Patterson Lake area and conducting land use activities (YNLR 2023).

The 2022-23 summary report identified that the Project is located within various land use or stewardship areas; however, maps of the areas, information on specific land use types, presence of historical resources, presence of contemporary land users, or predicted effect pathways present in and around the Project site were not provided.

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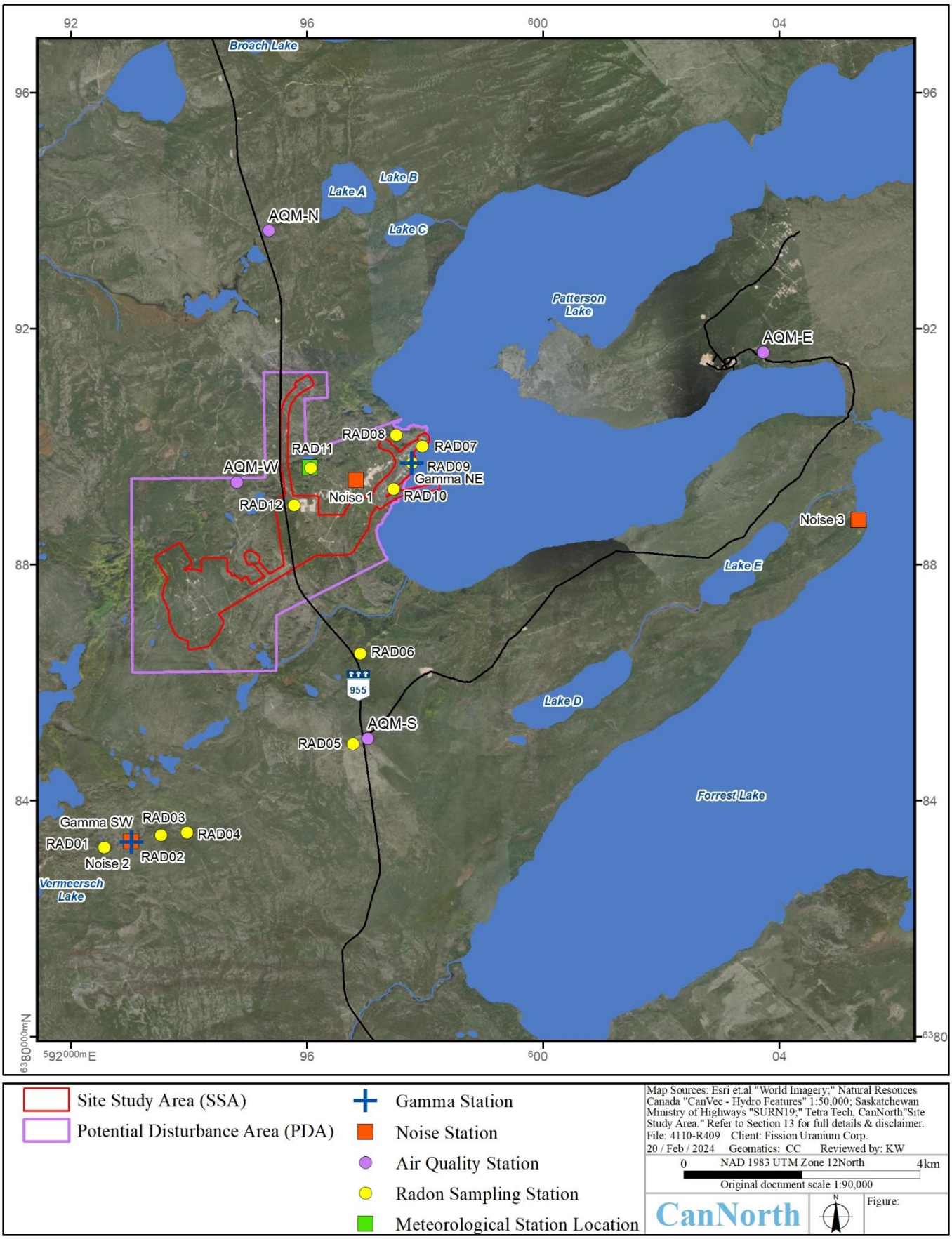


Figure 4-1
Locations of the Project atmospheric and acoustic monitoring stations, 2018, 2019, and 2022.

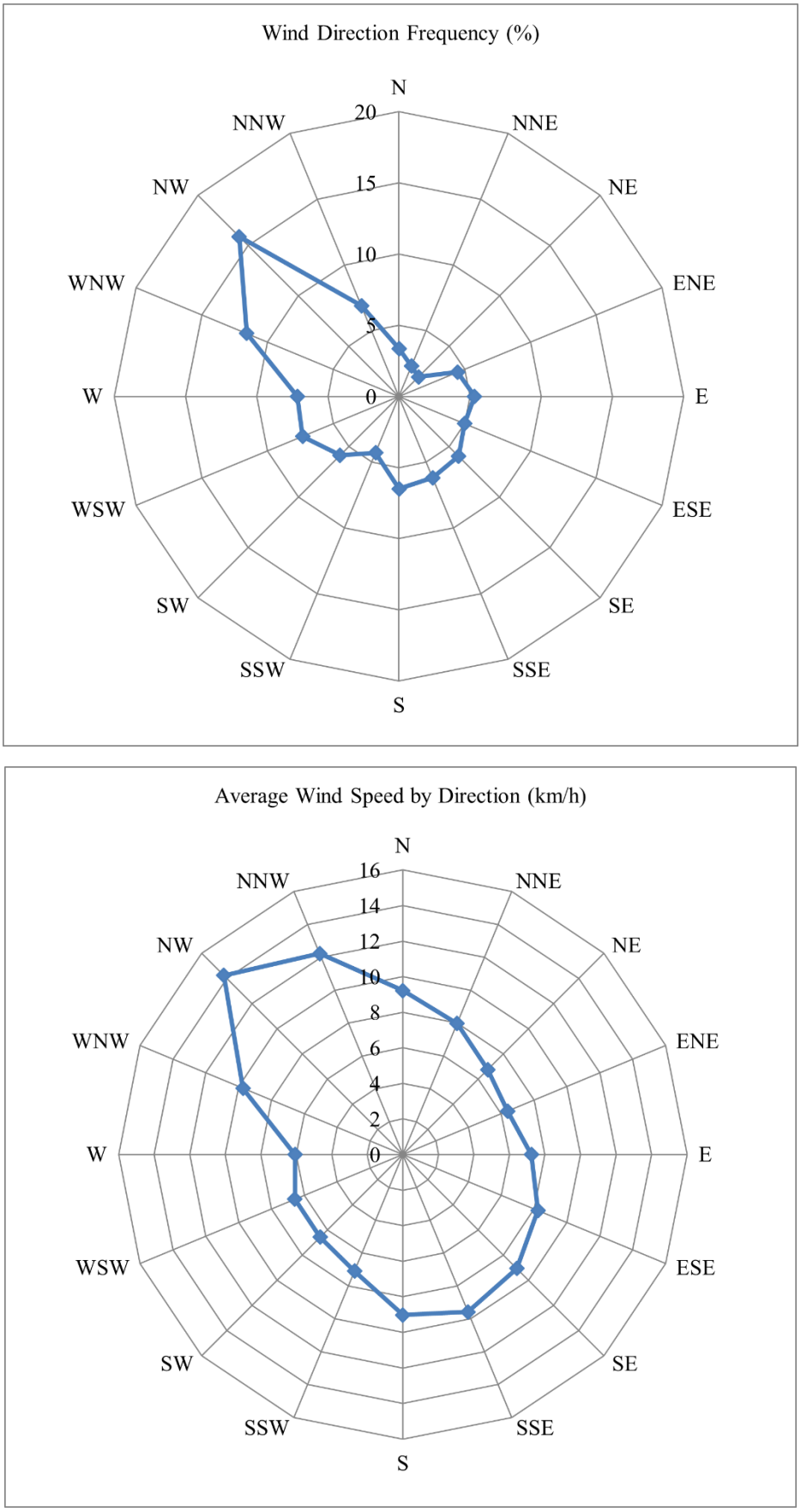


Figure 4-2
Wind rose diagrams indicating wind direction frequency and average wind speed by direction at the Project meteorological monitoring station, August 2014 to September 2022.

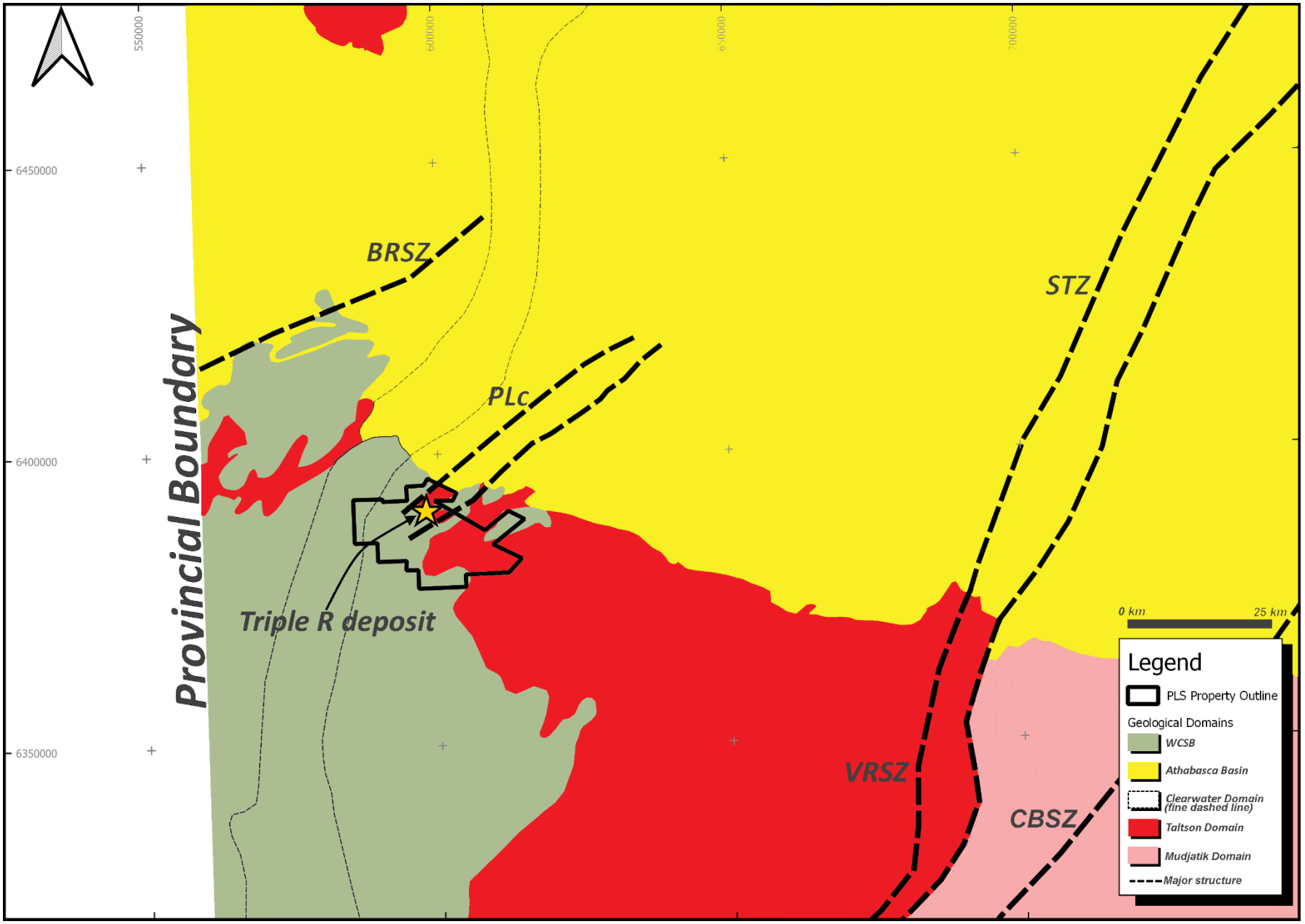


Figure 4-3
1:1M scale regional geology map of the Patterson Lake area in northwestern Saskatchewan showing Project location, major lithological domains and sedimentary basins (WCSB = Western Canadian Sedimentary Basin) (Maxeiner et al. 2021).

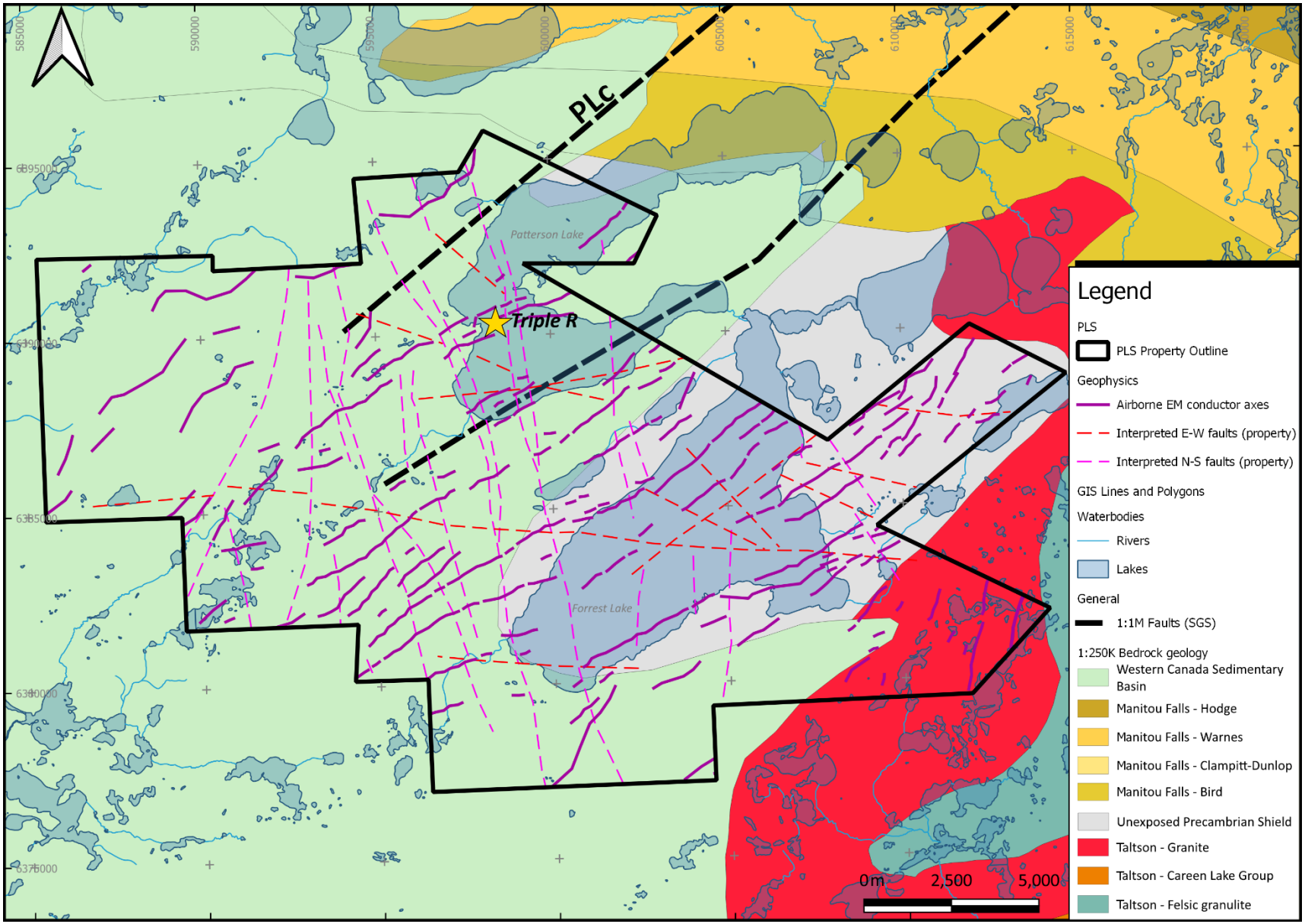


Figure 4-4
1:250k scale local geology map of the Patterson Lake area (modified after Bosman et al., 2017).

Note: Thick purple lines represent airborne electromagnetic conductor axes which highlight the general northeast-southwest trend in the basement rocks. Late cross cutting brittle faults interpreted by Fission from airborne magnetic surveys are shown with dashed pink and red lines and are in-line with the brittle structural interpretations presented by Johnstone et al., 2019.

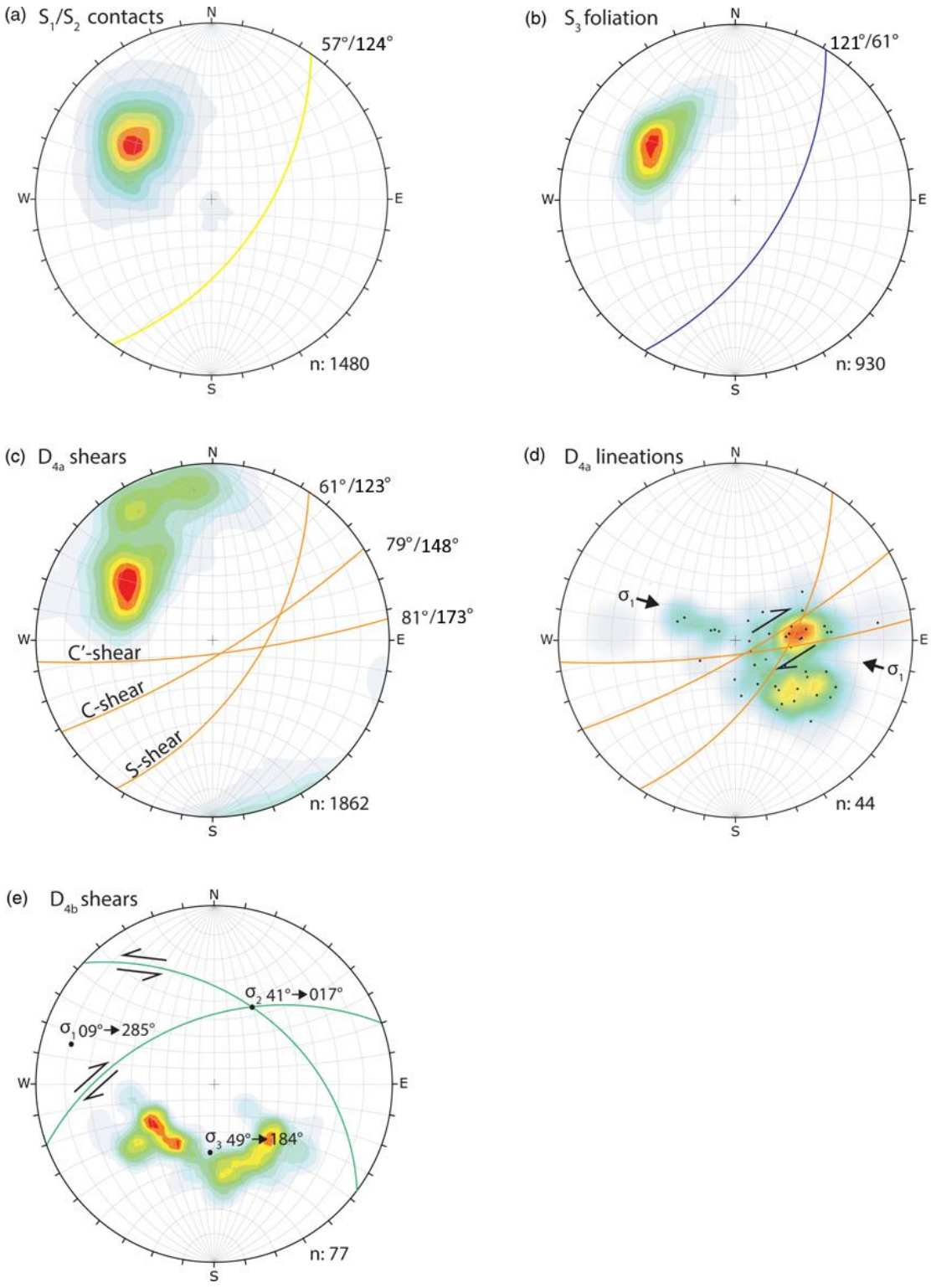


Figure 4-5
Equal area lower hemisphere stereoplots projecting the dip/dip direction attitudes of ductile structural fabric elements in the Patterson Lake area.

Notes: (a) S_1/S_2 gneissosity and parallel unit contacts. (b) S_3 schistosity and cleavage. (c) D_{4a} mylonite and phyllonite shear orientations from across the Patterson Lake locality. General orientations show a typical C–S shear fabric geometry. Note that north-northeast striking S-shears represent the most abundant shear fabric orientation throughout the Patterson Lake locality. (d) D_{4a} C–S shear fabrics with associated ductile stretching lineations indicating a tectonic transport direction and maximum principle stress (σ1) oriented ESE–WNW. (e) D_{4b} semi-brittle shear orientations that cross-cut the main shear fabrics throughout the Patterson Lake locality (modified after Johnstone, et al., 2019).

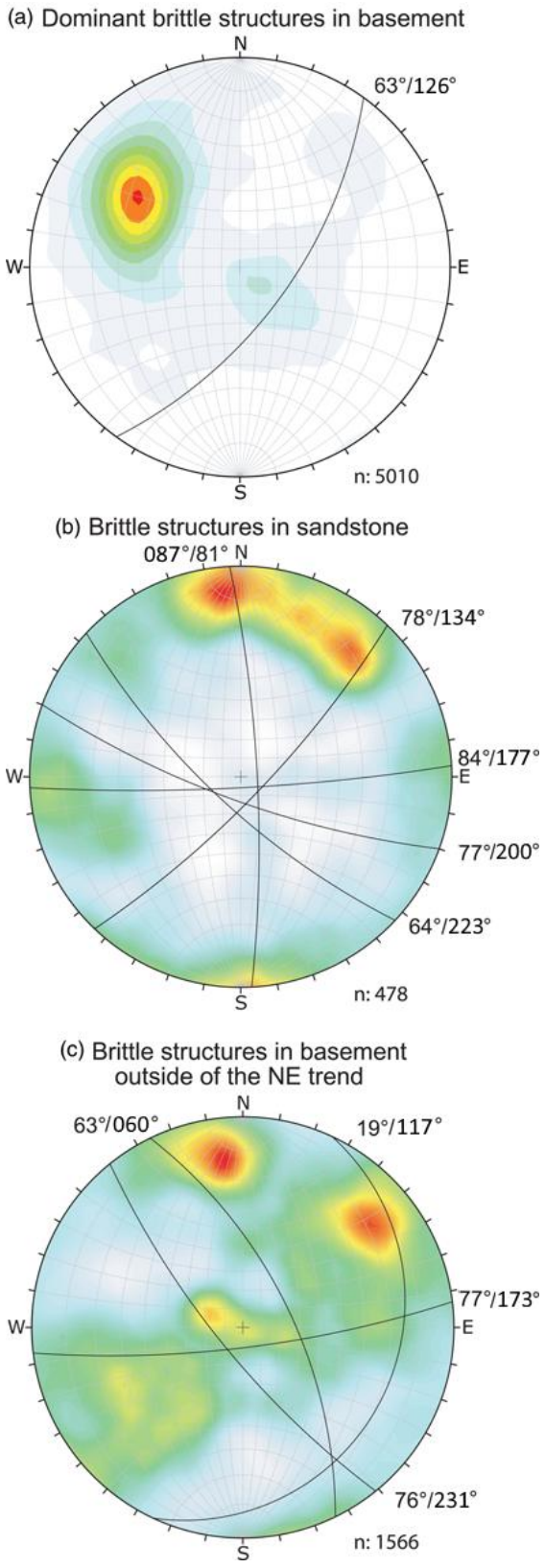


Figure 4-6
Equal area lower hemisphere stereoplots projecting the dip/dip direction attitudes of brittle structural elements in the Patterson Lake area.

Notes: (a) the bulk basement brittle structure dataset, (b) the bulk sandstone brittle structure dataset, and (c) all basement brittle structures that do not strike northeast parallel to the main northeast-striking S_1–S_3 ductile grain and S_{4a} shear fabric that define the Patterson Lake locality (modified after Johnstone, et al., 2019).

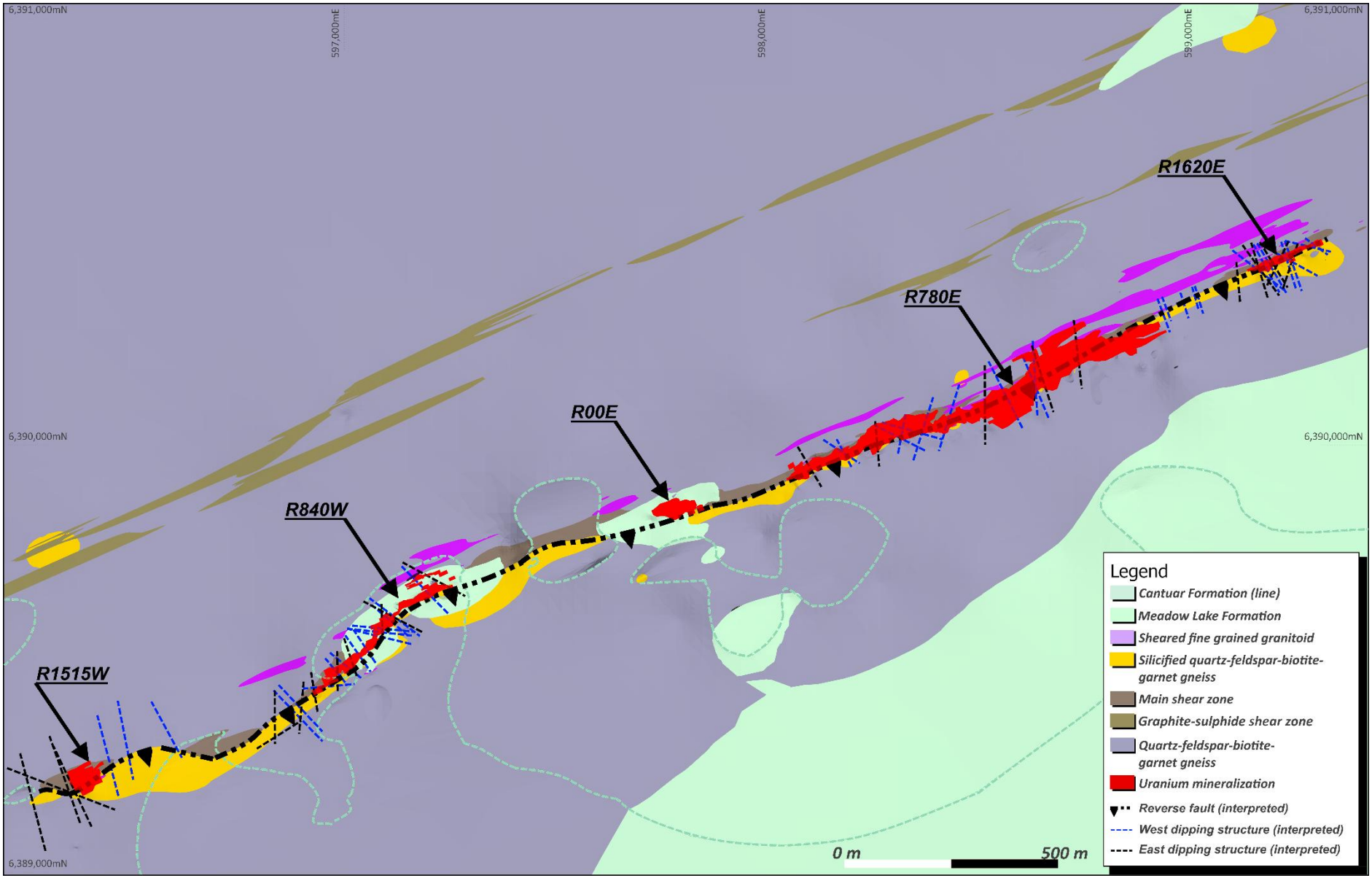


Figure 4-7
Plan map showing the interpreted PLc bedrock geology and location of uranium mineralization.

Note that foliation parallel structures are not shown on this image due to their overabundance relative to the cross faults.

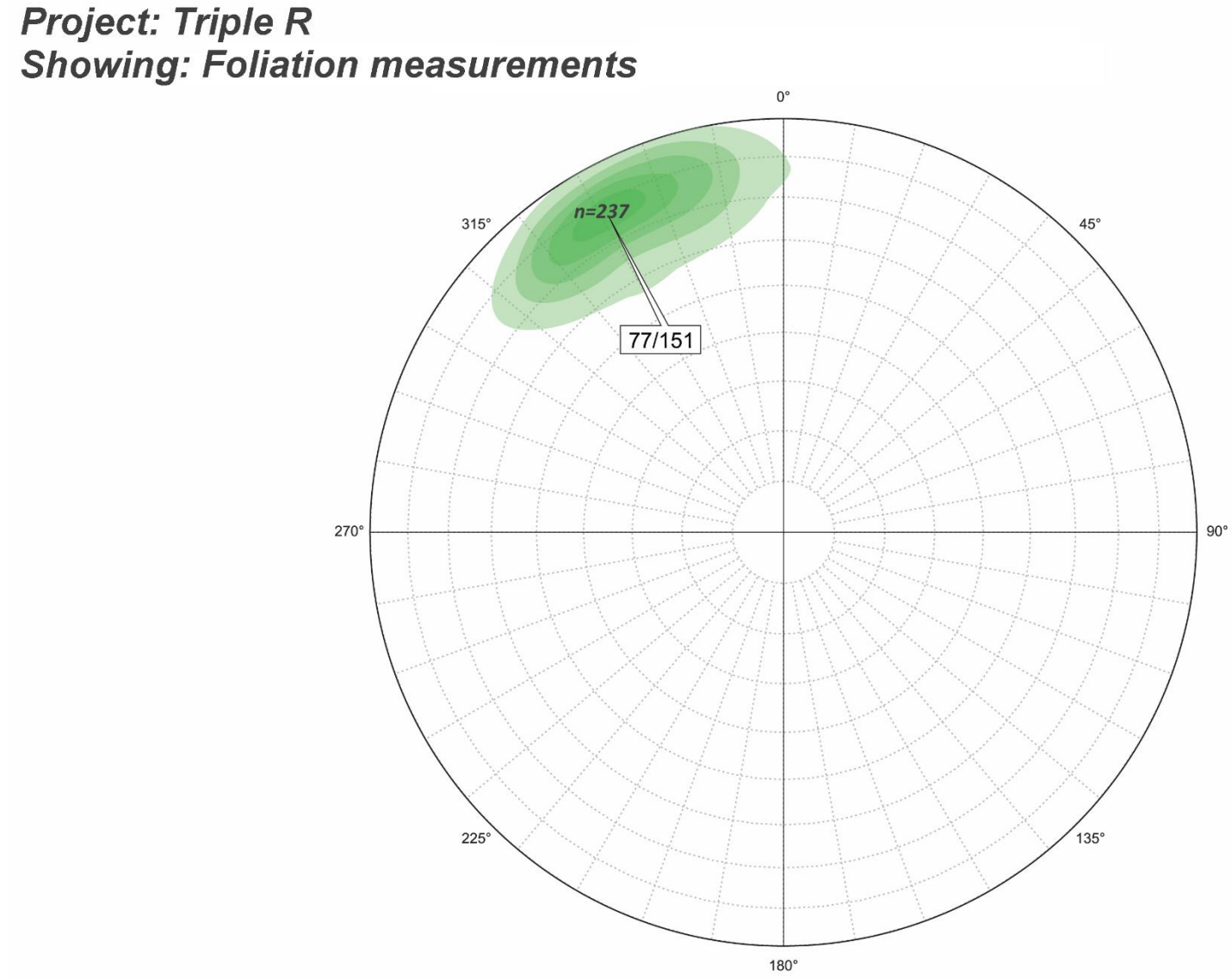


Figure 4-8
Stereonet showing southeast dipping foliation measurements derived from televiewer data in the vicinity of the Triple R deposit. Structural measurements are in dip/dip direction notation.

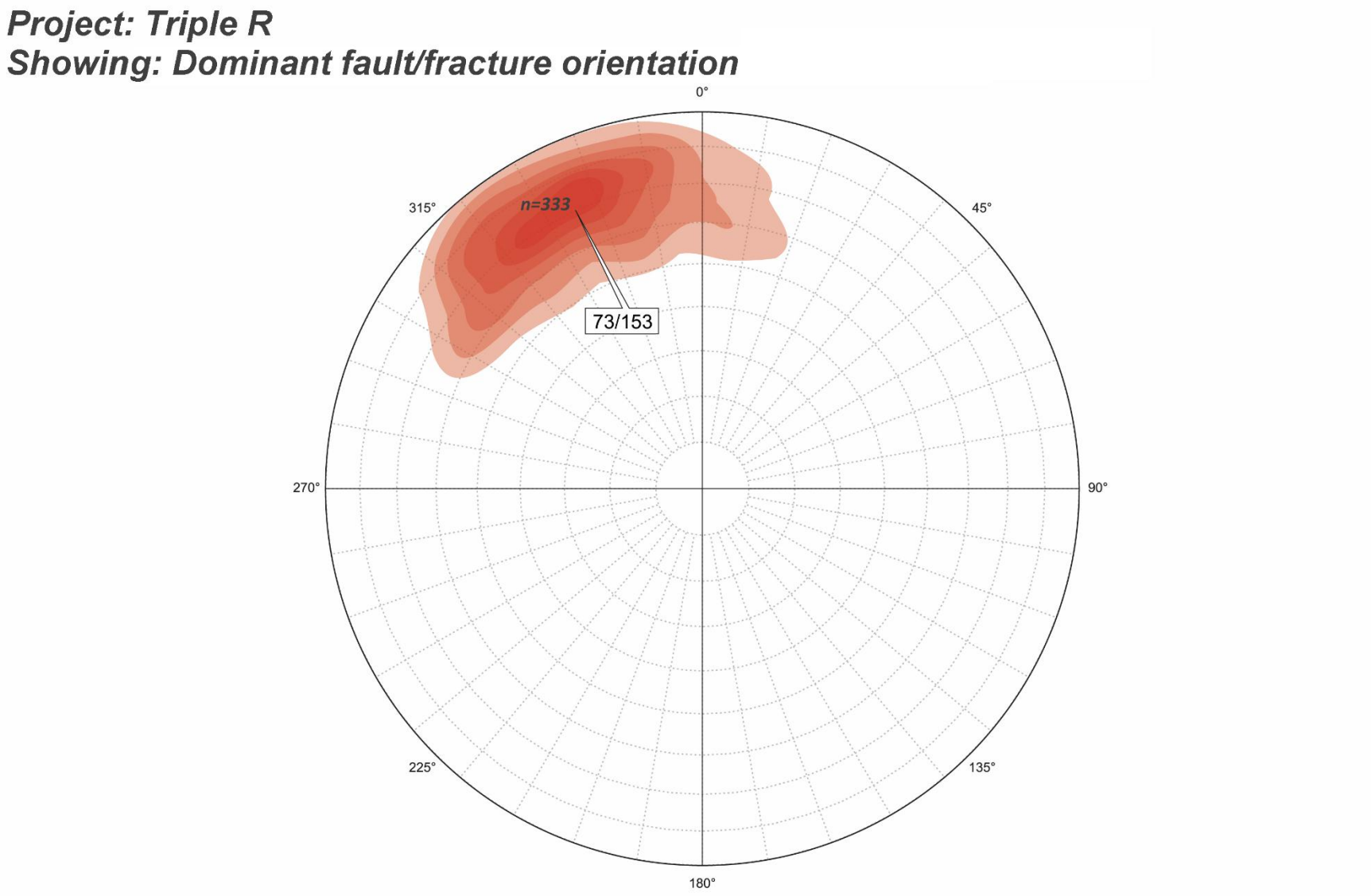


Figure 4-9
Stereonet showing dominant southeast dipping fracture and fault measurements from televiewer data in the vicinity of the Triple R deposit. Structural measurements are in dip/dip direction notation.

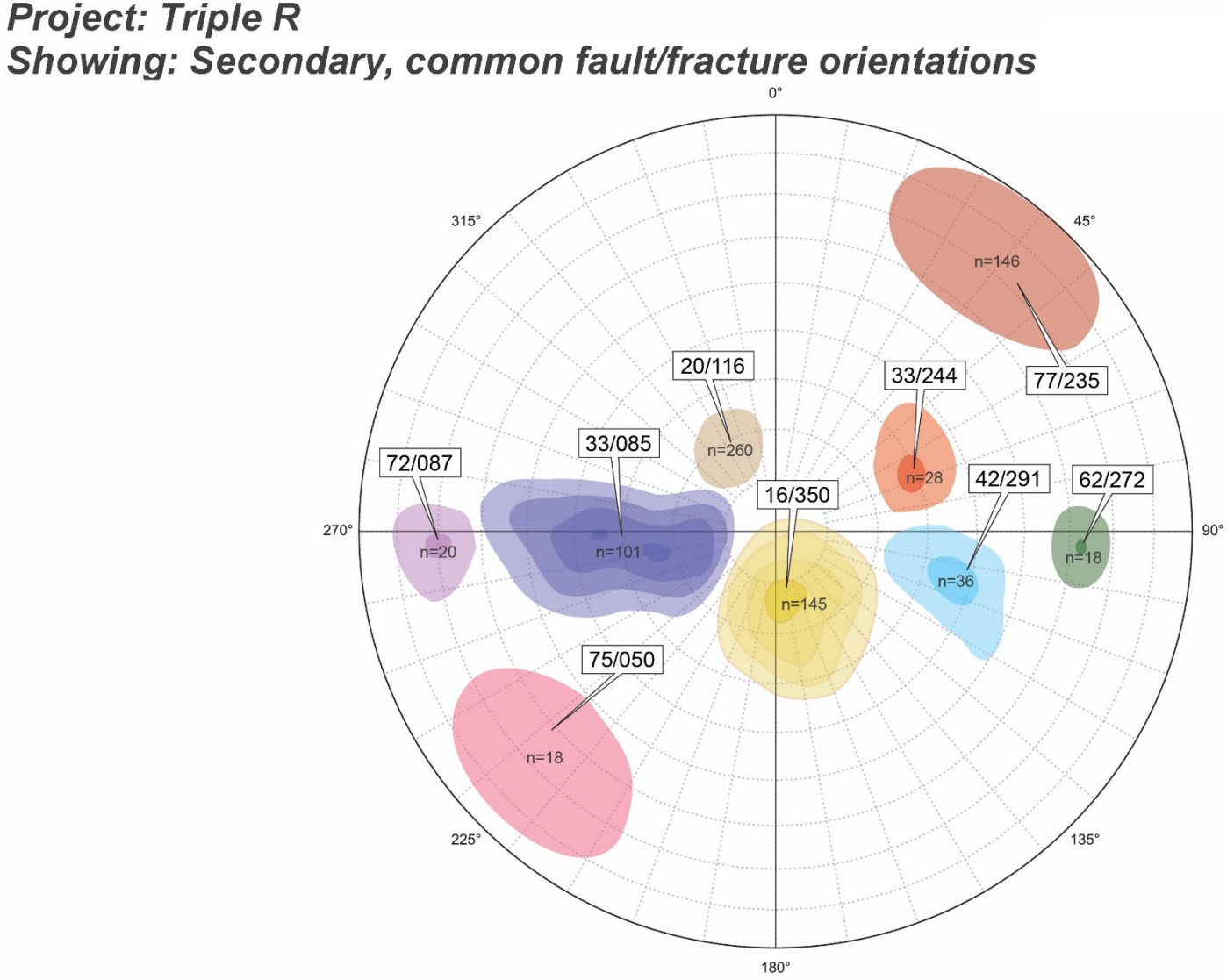


Figure 4-10
Stereonet showing the common secondary fracture/fault orientations from televiewer data in the vicinity of the Triple R deposit. Structural measurements are in dip/dip direction notation.

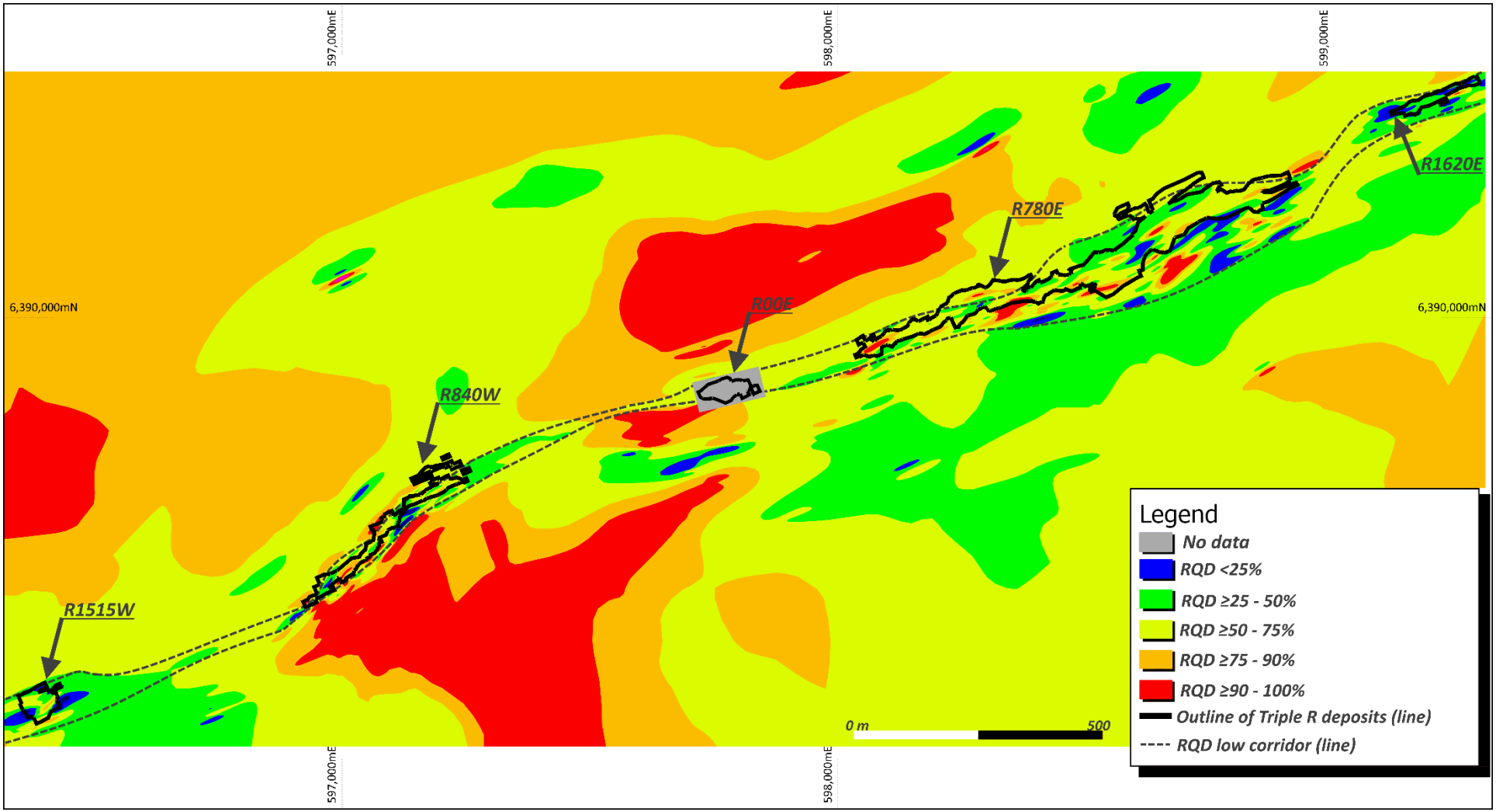


Figure 4-11
Plan view showing Triple R mineralization outlines and rock quality designation (RQD) isoshells contoured from drill data at the top of bedrock. Low RQD corridor associated with fracturing and alteration around the Triple R mineralization is highlighted with dashed grey lines.

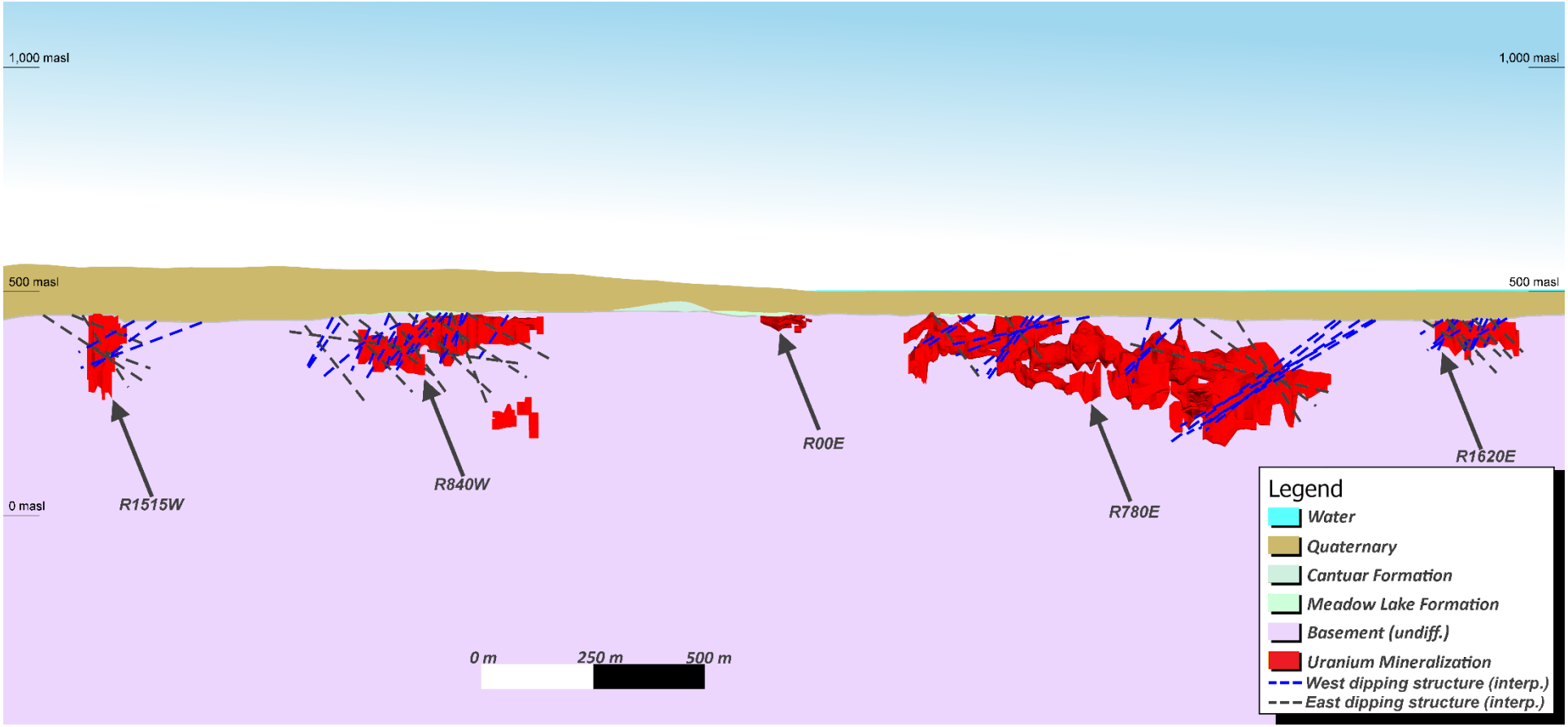


Figure 4-12
Long section looking northwest (azimuth 336º) at the Triple R deposit, showing PLc geology, interpreted secondary fault/fracture sets (dashed lines) and the location of uranium mineralization**.**

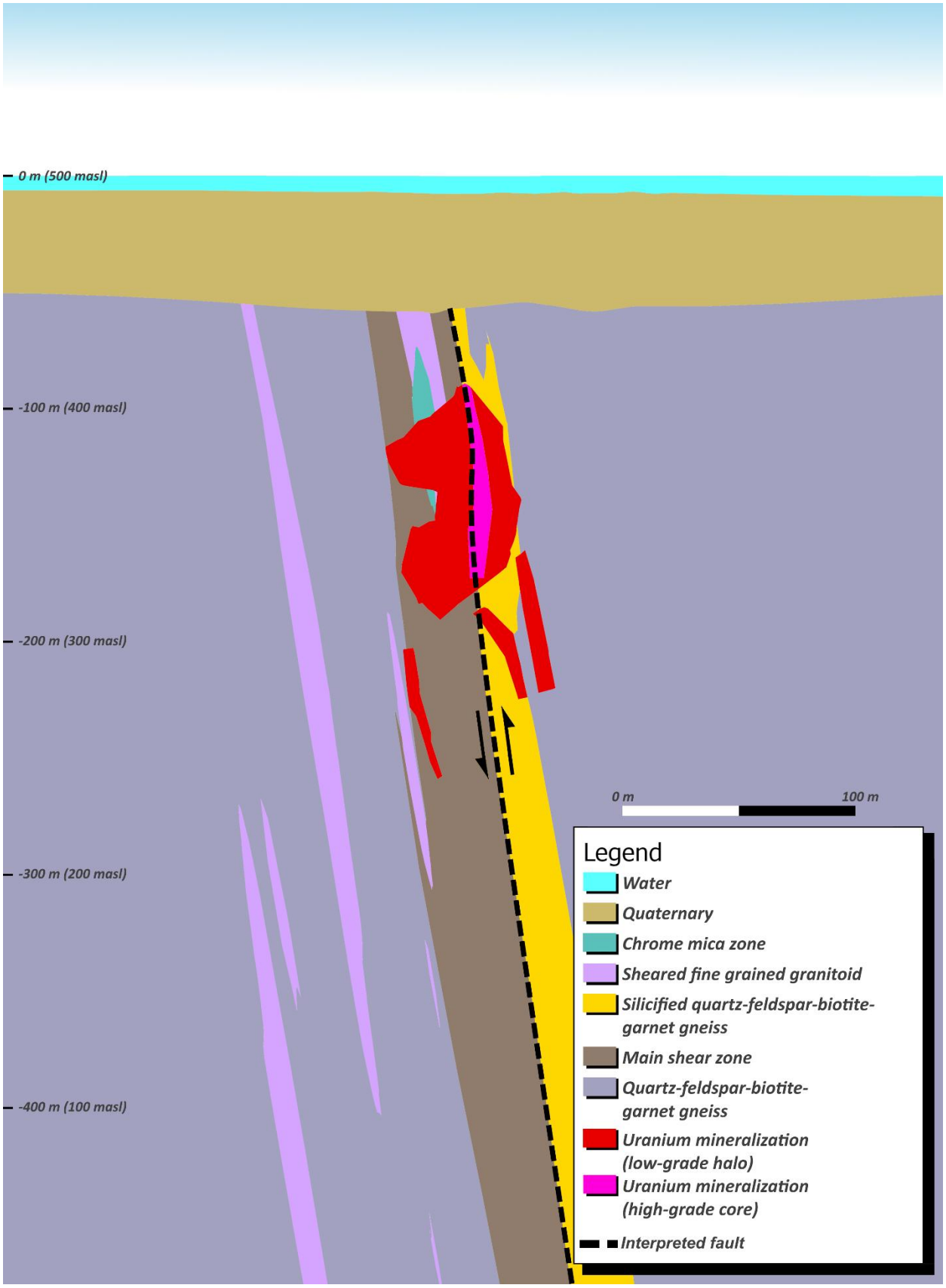


Figure 4-13
Simplified cross section looking northeast (azimuth 066°) at the Triple R deposit, eastern R780E zone, showing PLc geology and the location of uranium mineralization.

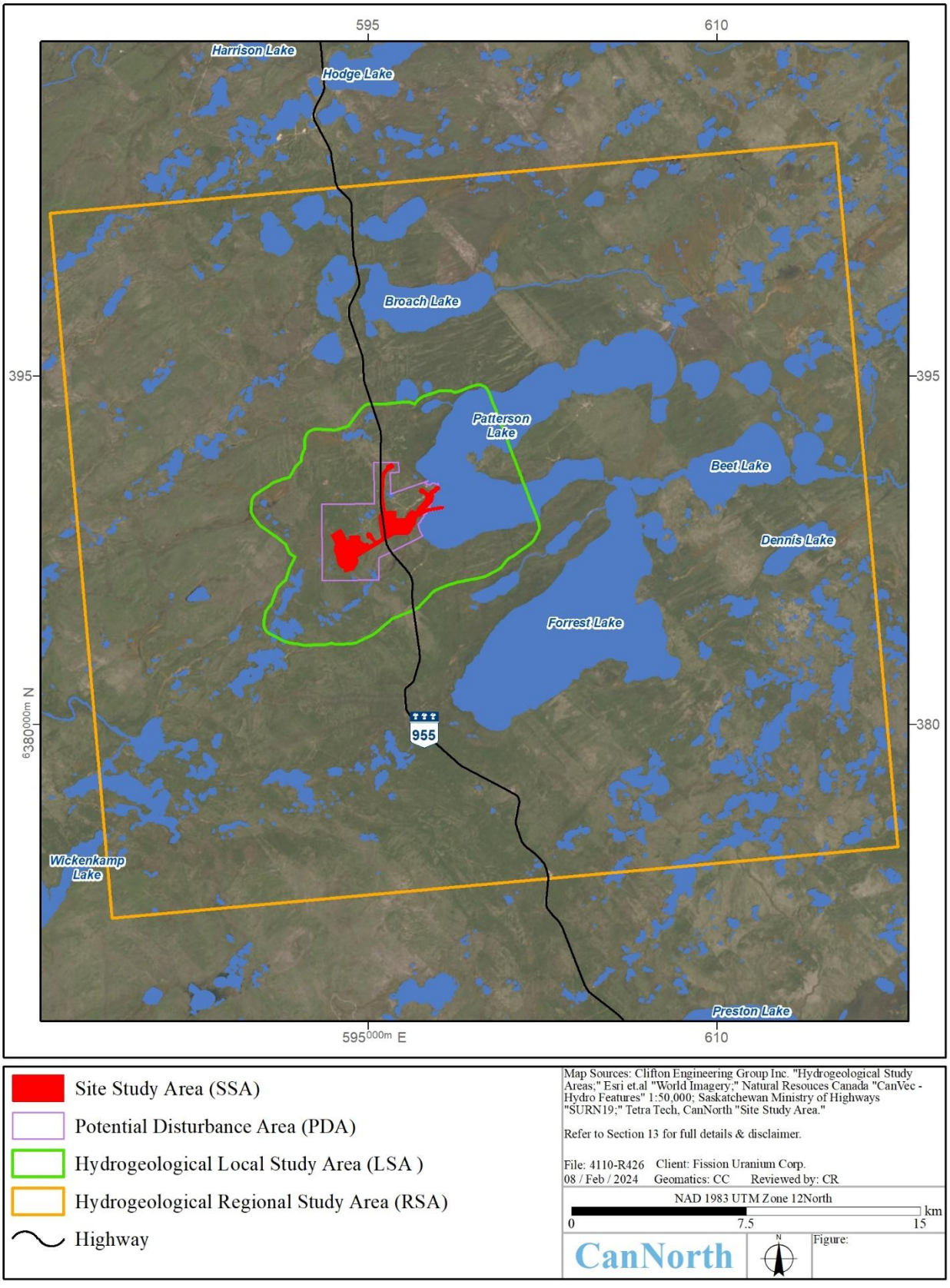


Figure 4-14
Hydrogeological environment regional and local study area for the Project.

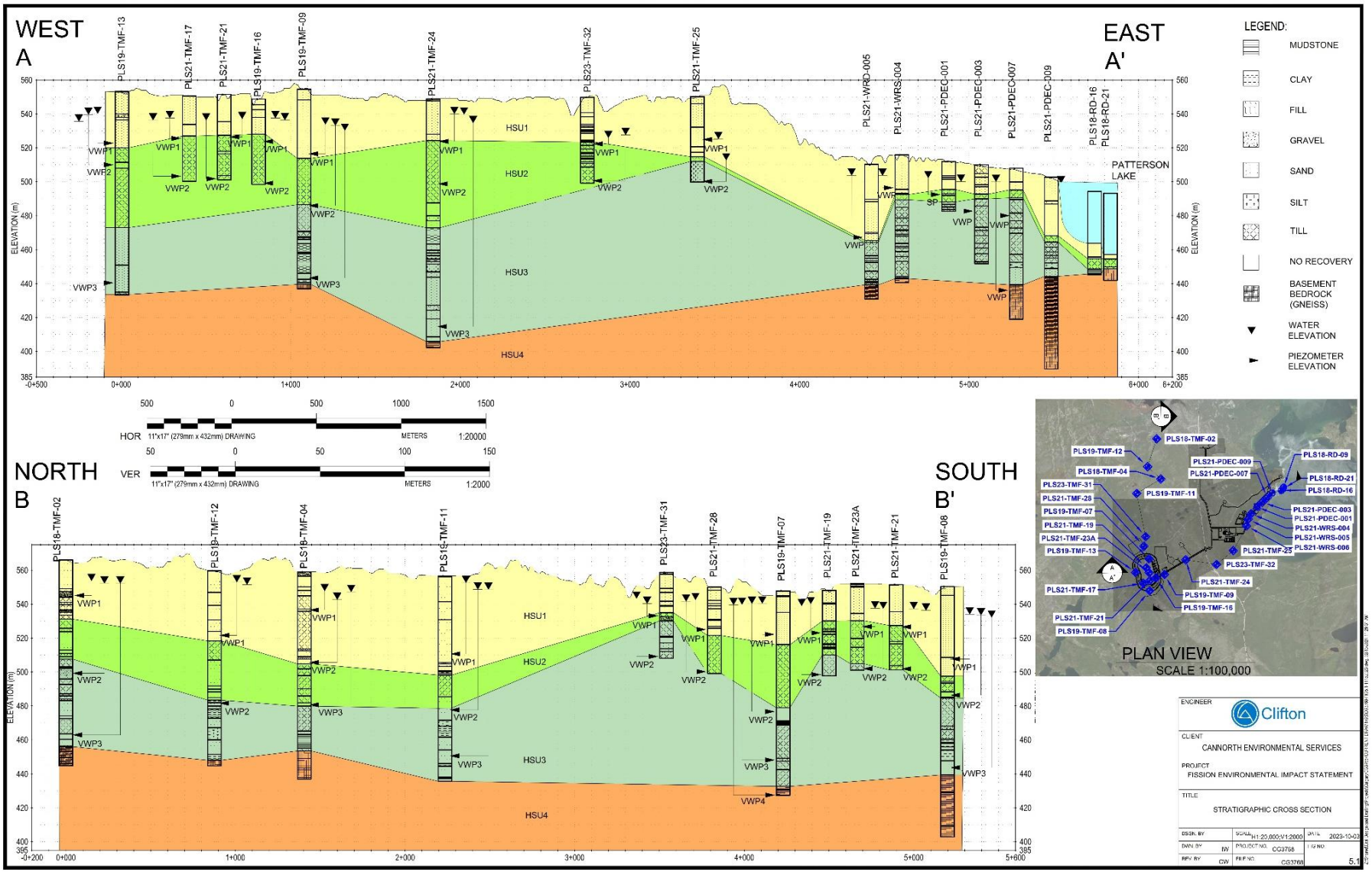
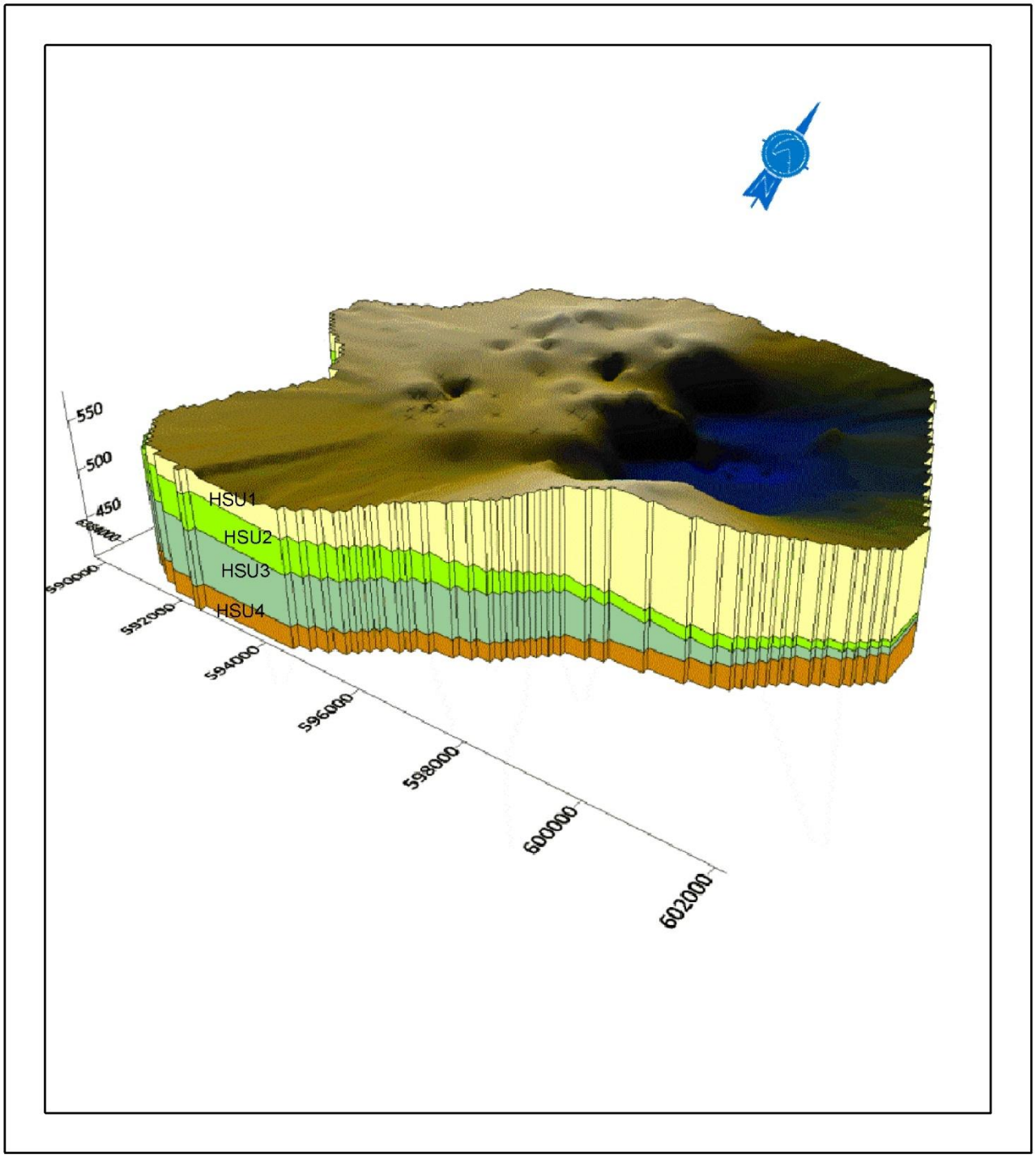


Figure 4-15
Hydrogeology west – east (A-A') and north – south (B-B') stratigraphic cross-sections across the LSA.



Map Sources: Clifton Engineering Group Inc. "3-D BLOCK MODEL OF HSUs ACROSS THE LSA."

Refer to Section 13 for full details & disclaimer.

File: 4110-R430 Client: Fission Uranium Corp.
08 / Feb / 2024 Geomatics: CC Reviewed by: CR

Not to Scale

CanNorth

Figure:

Figure 4-16
3-D block model of the LSA.

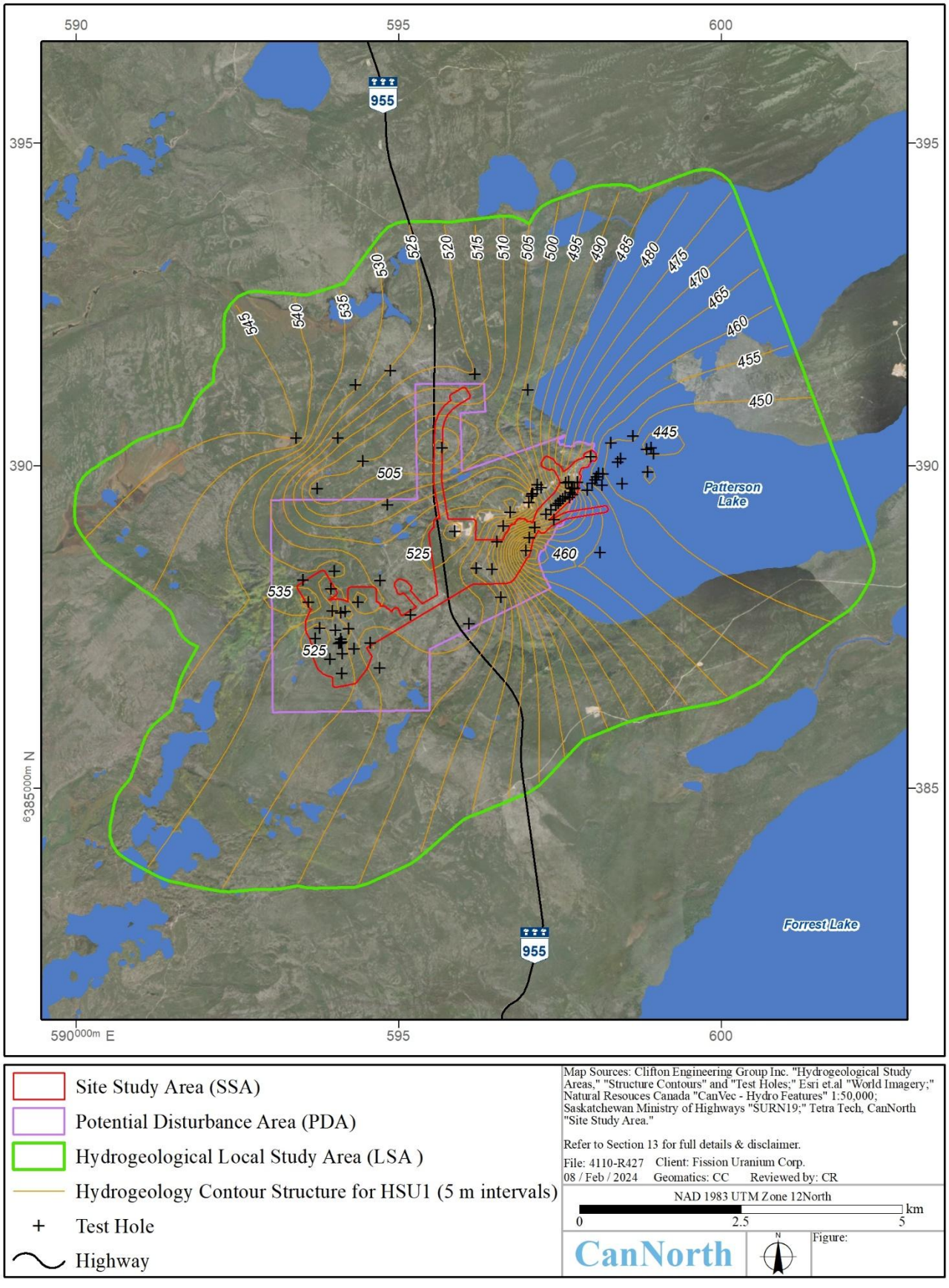


Figure 4-17
Structure contour map of the base of HSU1.

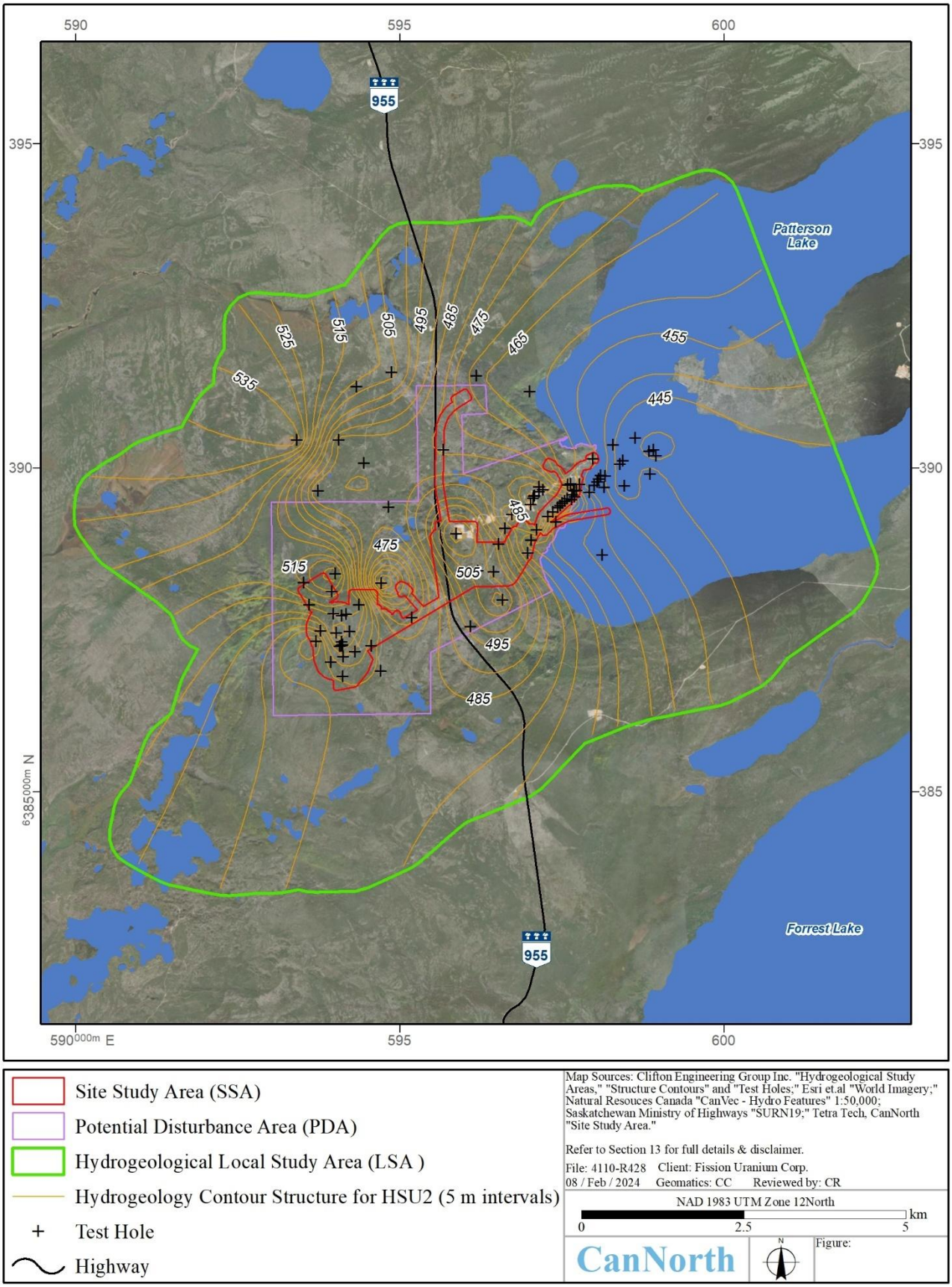


Figure 4-18
Structure contour map of the base of HSU2.

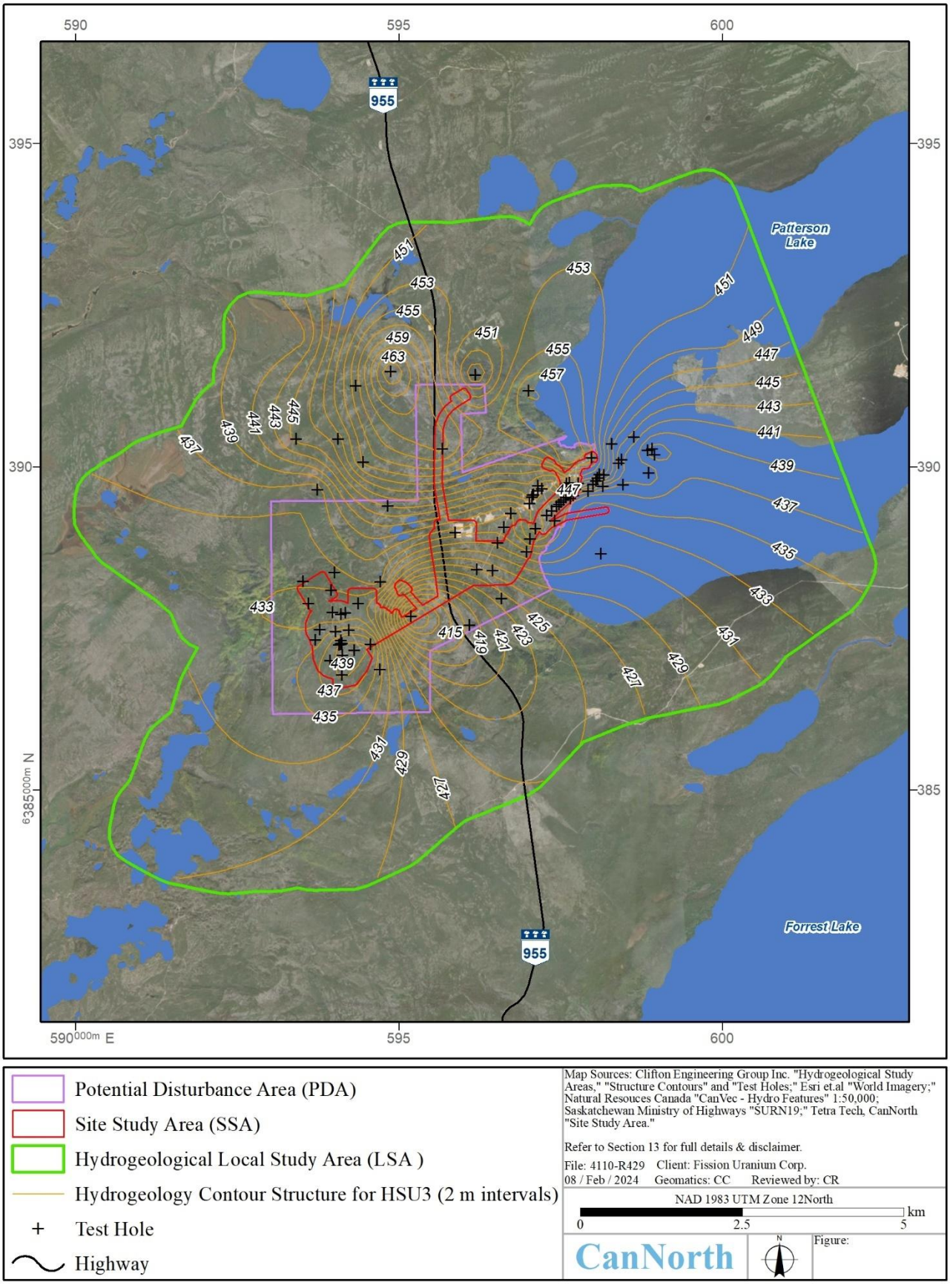


Figure 4-19
Structure contour map of the base of HSU3.

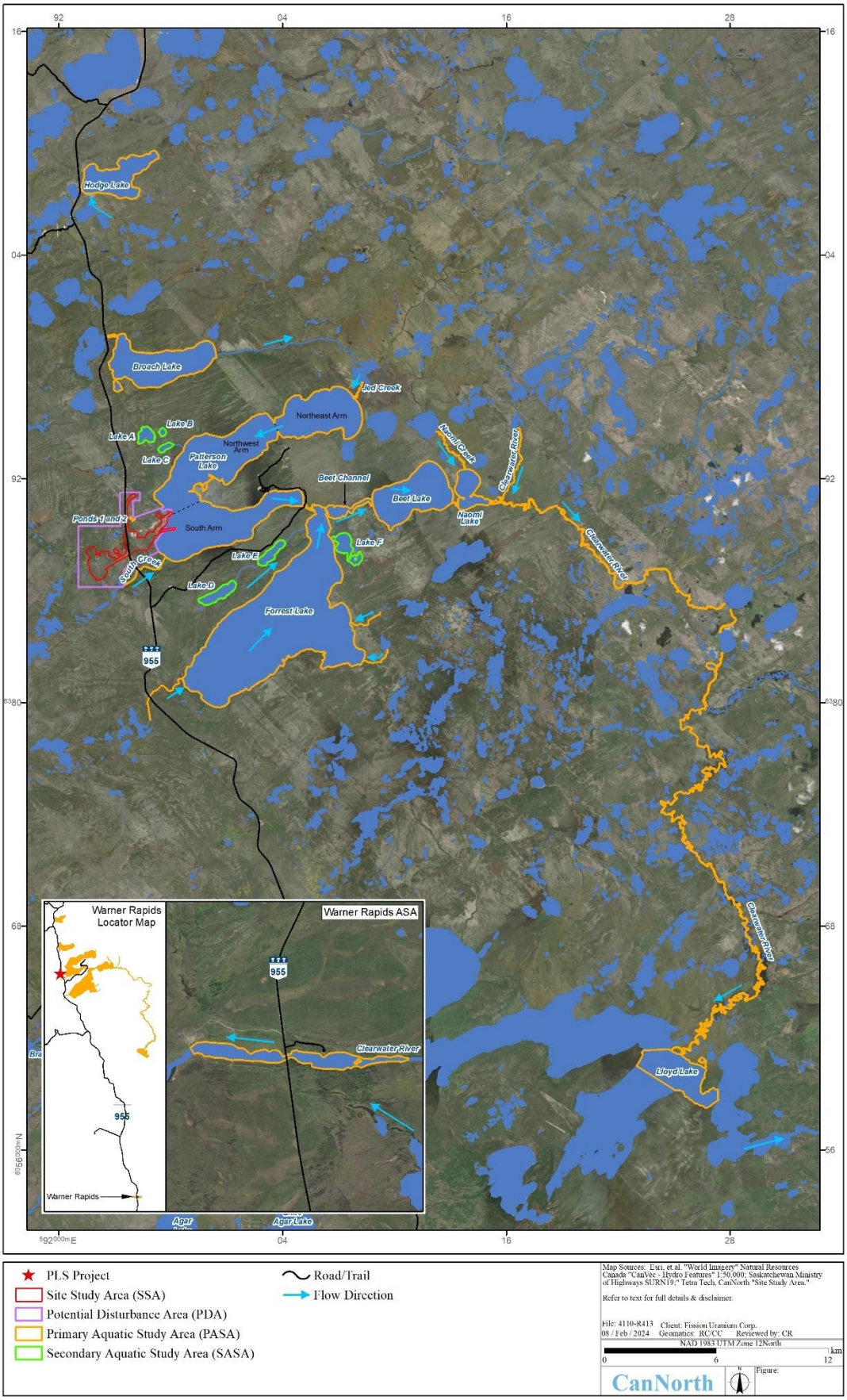


Figure 4-20
Primary and secondary aquatic study areas (ASAs) for the Project.

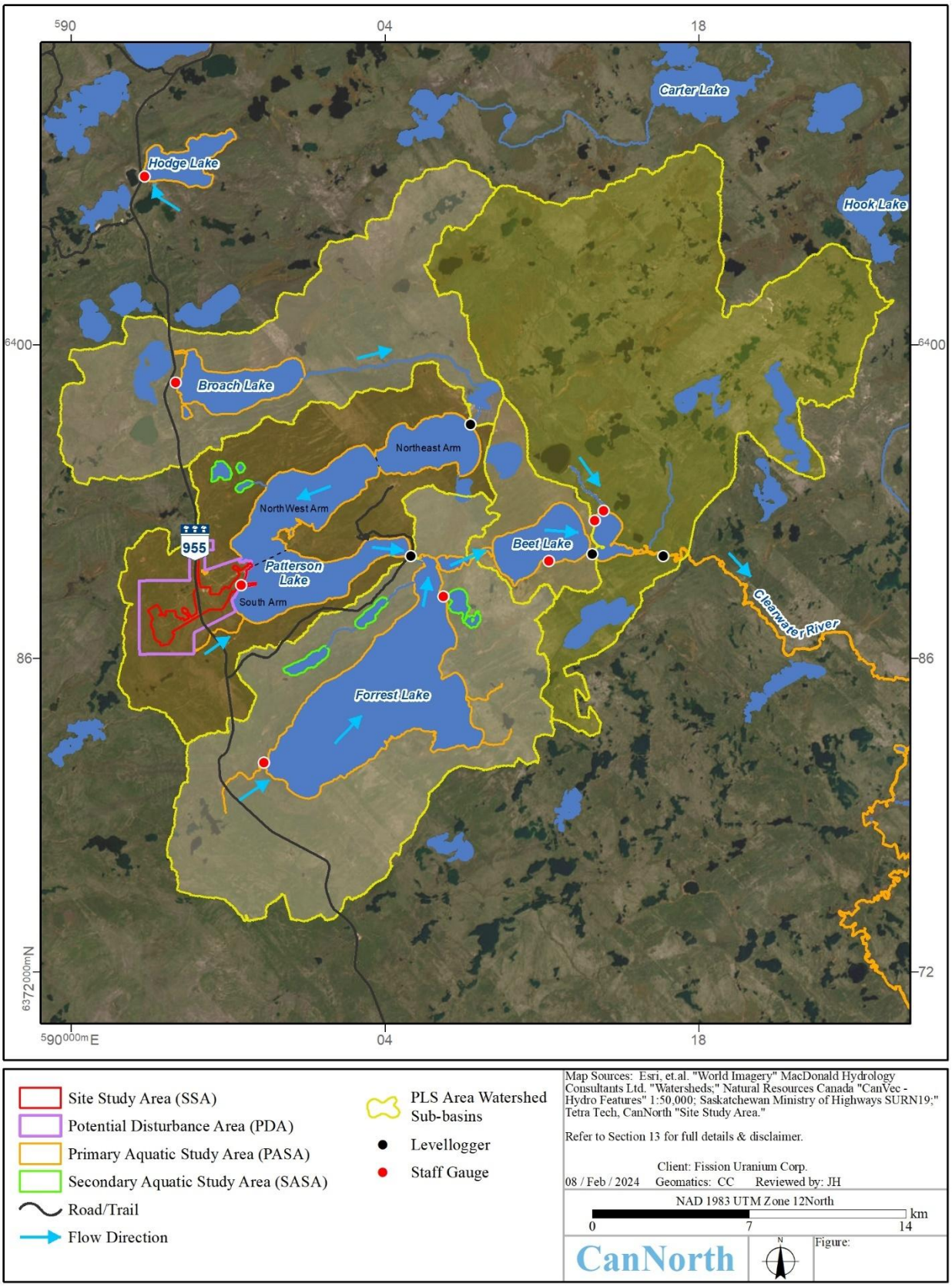


Figure 4-21
Watershed delineation of the RSA and hydrological monitoring locations in the Project ASA, 2014 to 2023.

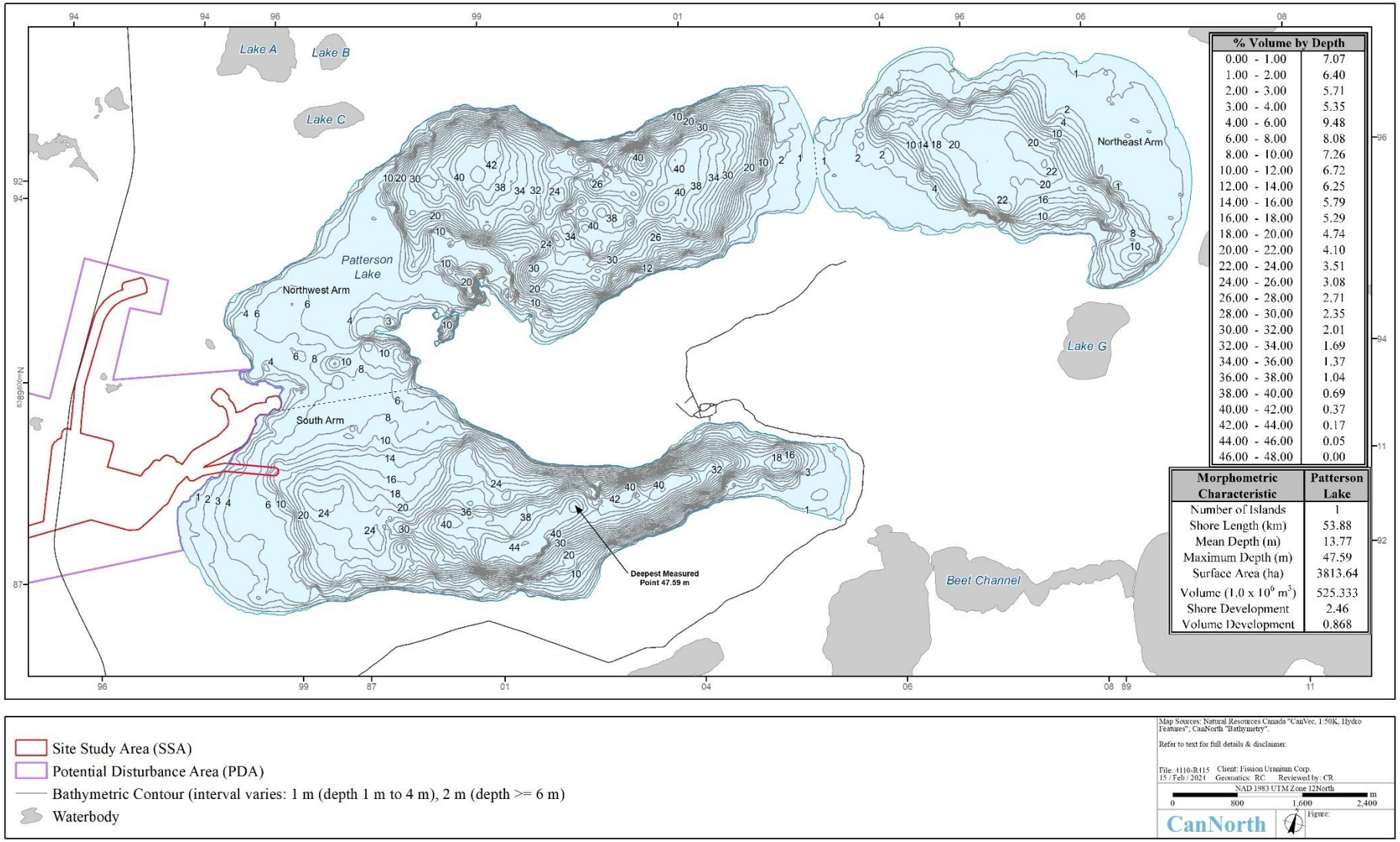
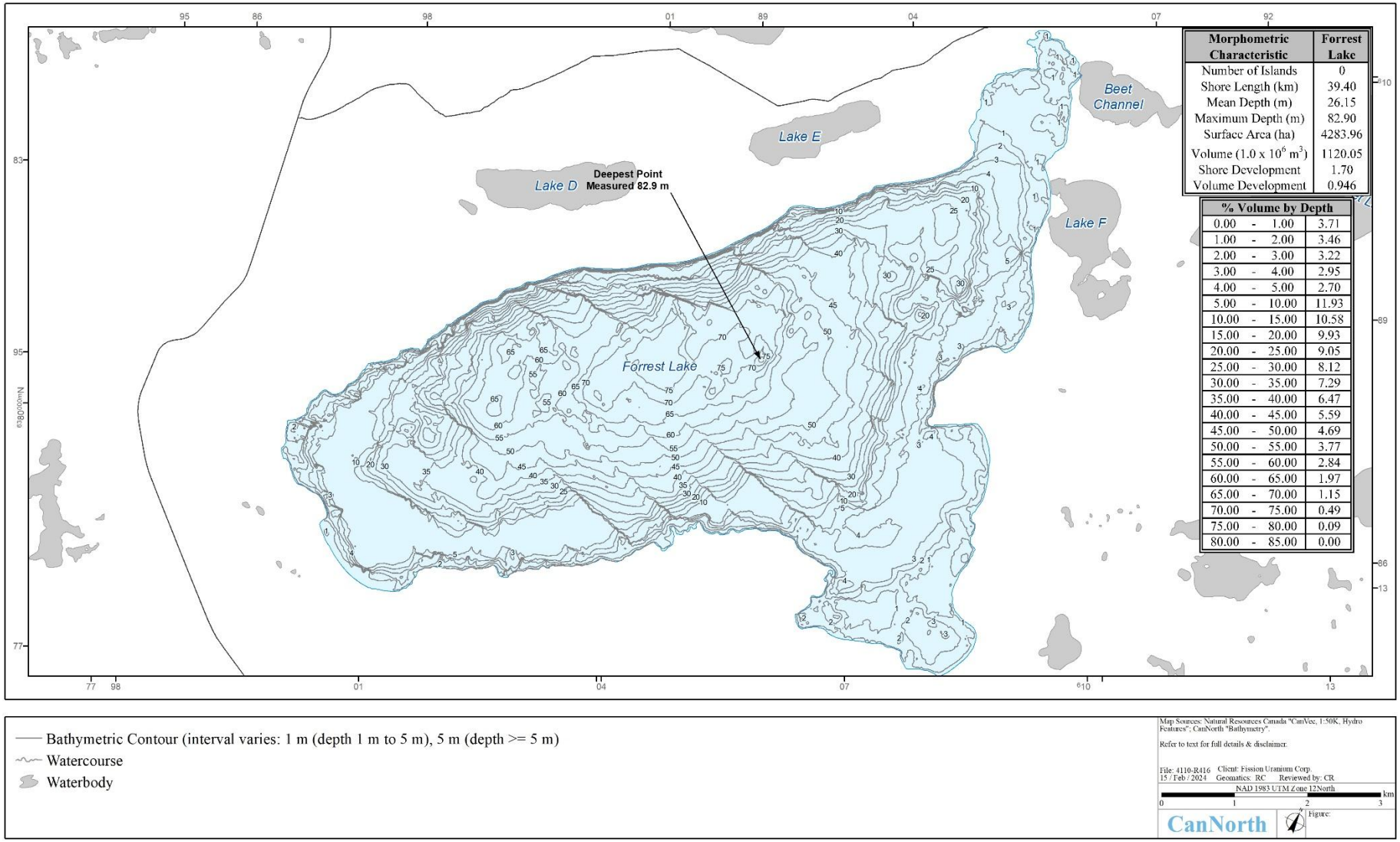


Figure 4-22
Bathymetric map of Patterson Lake.



Morphometric Characteristic	Forrest Lake
Number of Islands	0
Shore Length (km)	39.40
Mean Depth (m)	26.15
Maximum Depth (m)	82.90
Surface Area (ha)	4283.96
Volume (1.0 x 10^6 m^3)	1120.05
Shore Development	1.70
Volume Development	0.946

% Volume by Depth	
0.00 - 1.00	3.71
1.00 - 2.00	3.46
2.00 - 3.00	3.22
3.00 - 4.00	2.95
4.00 - 5.00	2.70
5.00 - 10.00	11.93
10.00 - 15.00	10.58
15.00 - 20.00	9.93
20.00 - 25.00	9.05
25.00 - 30.00	8.12
30.00 - 35.00	7.29
35.00 - 40.00	6.47
40.00 - 45.00	5.59
45.00 - 50.00	4.69
50.00 - 55.00	3.77
55.00 - 60.00	2.84
60.00 - 65.00	1.97
65.00 - 70.00	1.15
70.00 - 75.00	0.49
75.00 - 80.00	0.09
80.00 - 85.00	0.00

Figure 4-23
Bathymetric map of Forrest Lake.

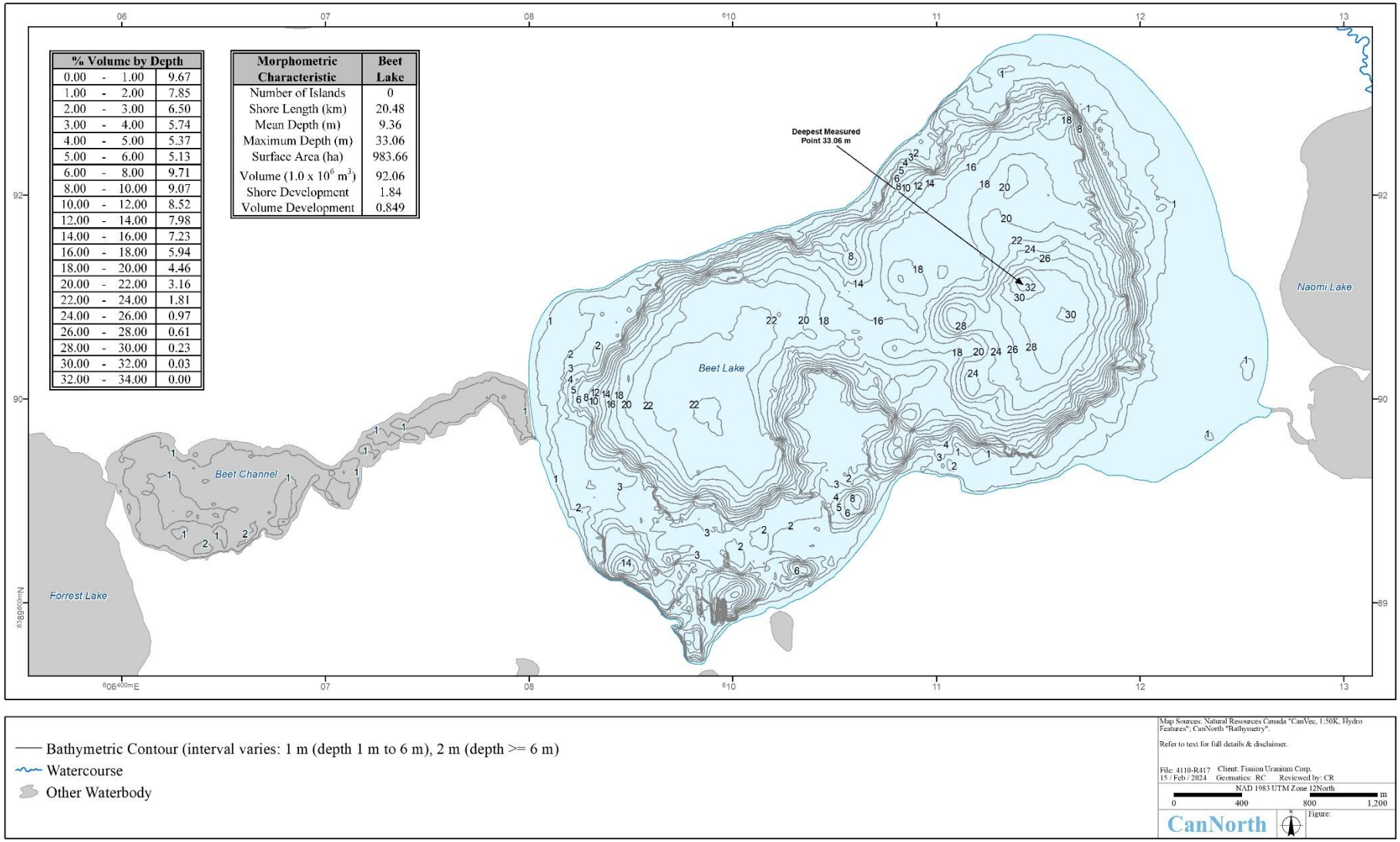
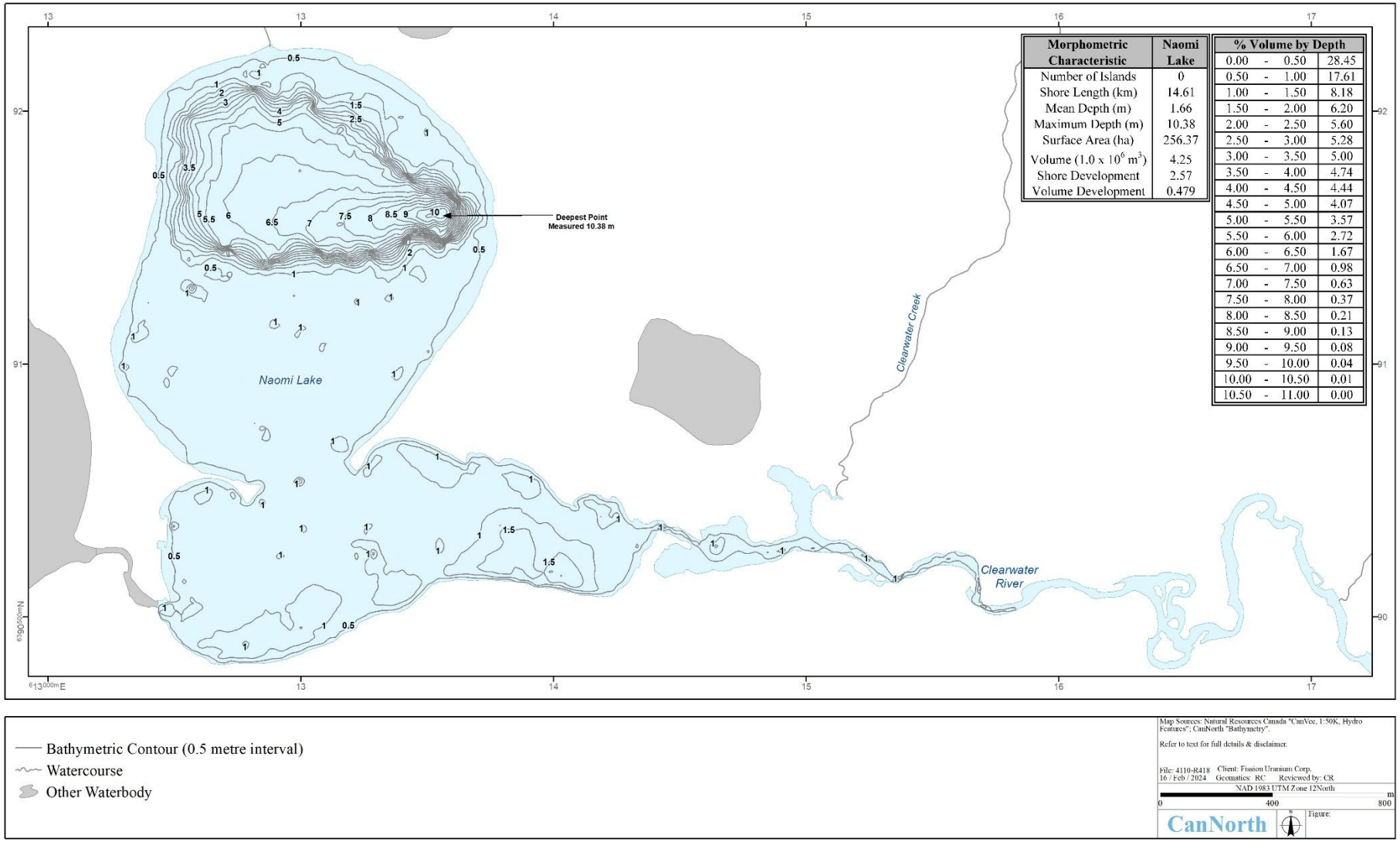


Figure 4-24
Bathymetric map of Beet Lake.



Morphometric Characteristic	Naomi Lake
Number of Islands	0
Shore Length (km)	14.61
Mean Depth (m)	1.66
Maximum Depth (m)	10.38
Surface Area (ha)	256.37
Volume (1.0 x 10^6 m^3)	4.25
Shore Development	2.57
Volume Development	0.479

% Volume by Depth			
0.00	-	0.50	28.45
0.50	-	1.00	17.61
1.00	-	1.50	8.18
1.50	-	2.00	6.20
2.00	-	2.50	5.60
2.50	-	3.00	5.28
3.00	-	3.50	5.00
3.50	-	4.00	4.74
4.00	-	4.50	4.44
4.50	-	5.00	4.07
5.00	-	5.50	3.57
5.50	-	6.00	2.72
6.00	-	6.50	1.67
6.50	-	7.00	0.98
7.00	-	7.50	0.63
7.50	-	8.00	0.37
8.00	-	8.50	0.21
8.50	-	9.00	0.13
9.00	-	9.50	0.08
9.50	-	10.00	0.04
10.00	-	10.50	0.01
10.50	-	11.00	0.00

Figure 4-25
Bathymetric map of Naomi Lake.

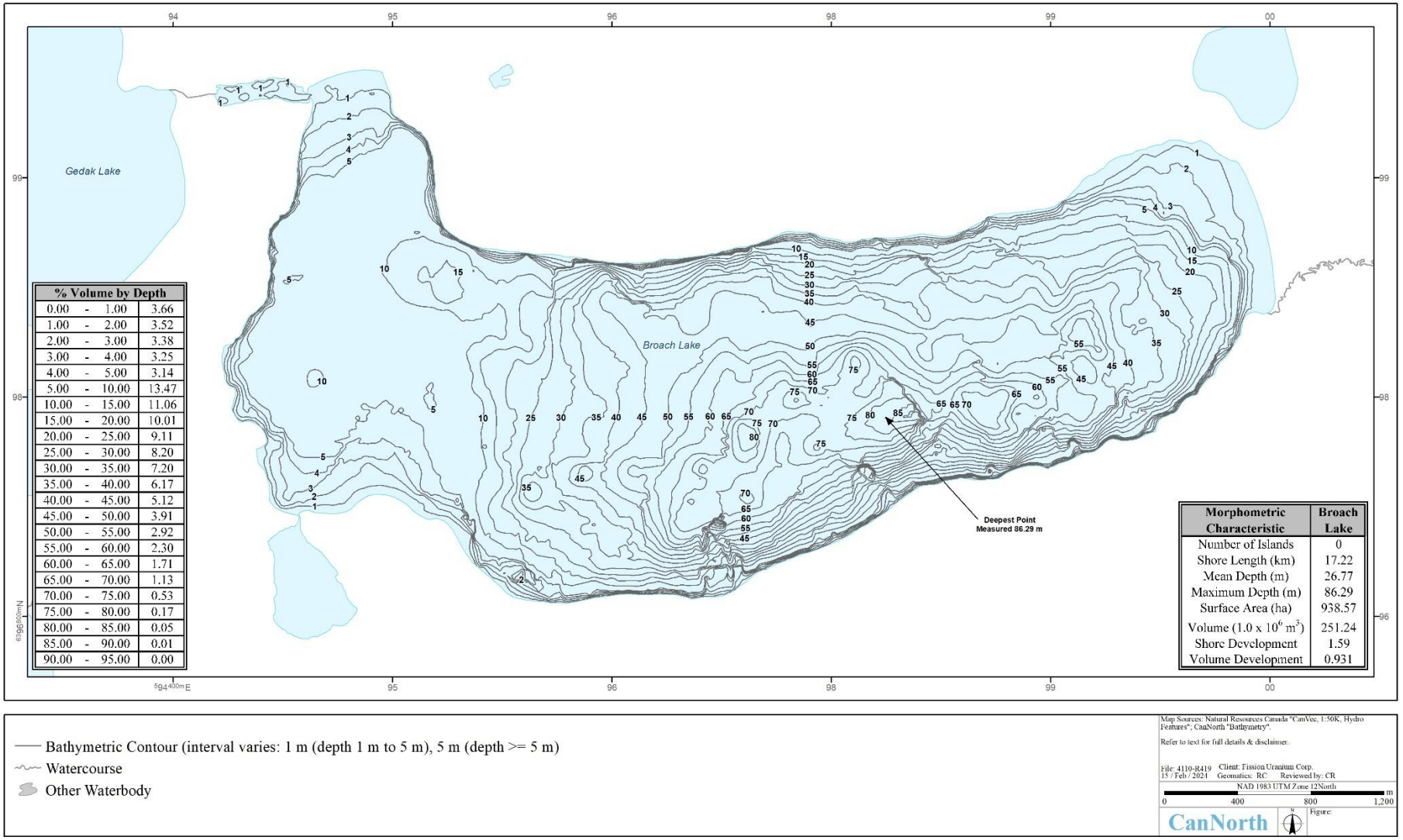
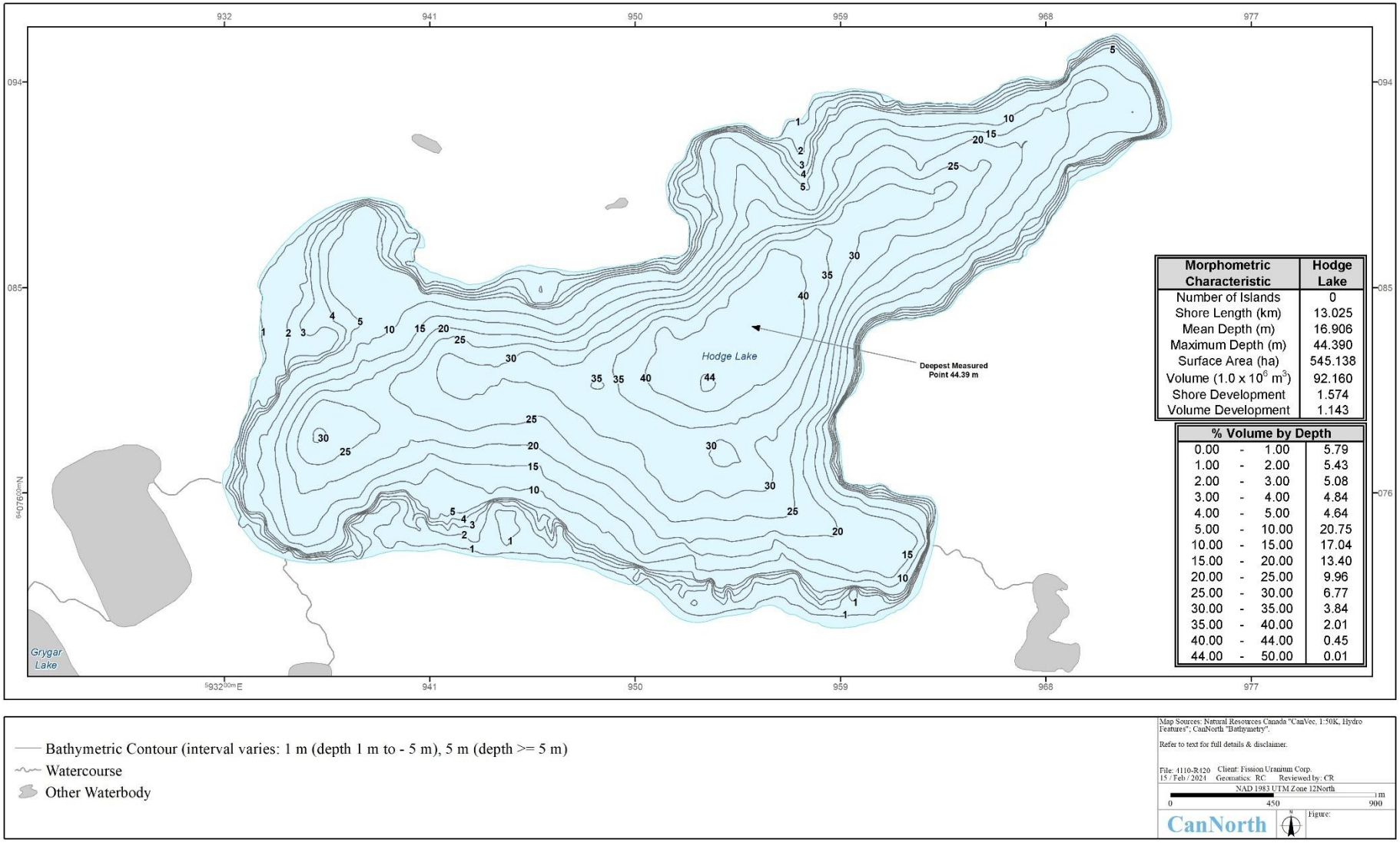


Figure 4-26
Bathymetric map of Broach Lake.



Morphometric Characteristic	Hodge Lake
Number of Islands	0
Shore Length (km)	13.025
Mean Depth (m)	16.906
Maximum Depth (m)	44.390
Surface Area (ha)	545.138
Volume (1.0 x 10^6 m^3)	92.160
Shore Development	1.574
Volume Development	1.143

% Volume by Depth			
0.00	-	1.00	5.79
1.00	-	2.00	5.43
2.00	-	3.00	5.08
3.00	-	4.00	4.84
4.00	-	5.00	4.64
5.00	-	10.00	20.75
10.00	-	15.00	17.04
15.00	-	20.00	13.40
20.00	-	25.00	9.96
25.00	-	30.00	6.77
30.00	-	35.00	3.84
35.00	-	40.00	2.01
40.00	-	44.00	0.45
44.00	-	50.00	0.01

Figure 4-27
Bathymetric map of Hodge Lake.

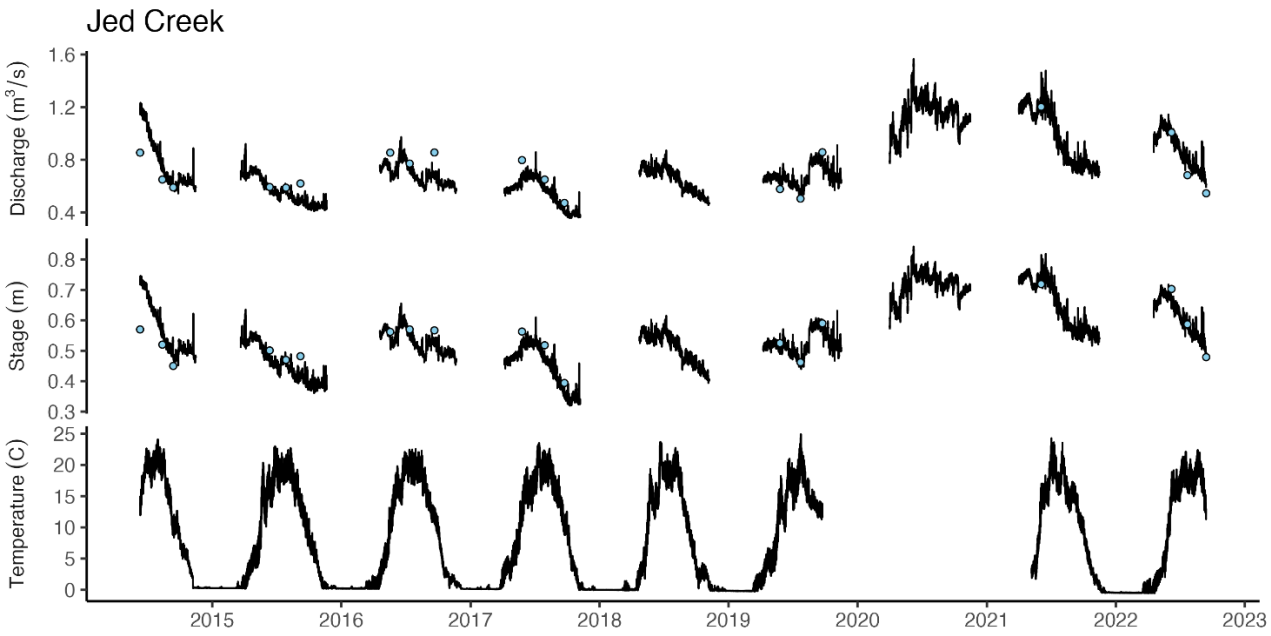


Figure 4-28
Hydrometric record for Jed Creek based on data collected between June 2014 and September 2022.

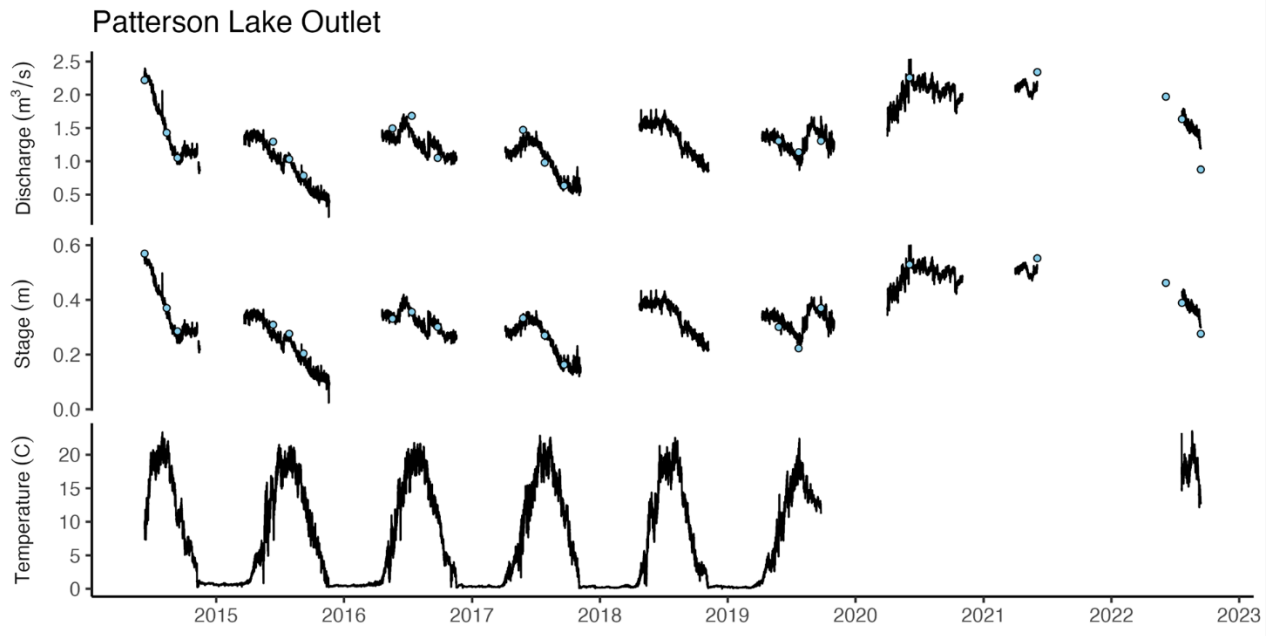


Figure 4-29
Hydrometric record for Patterson Lake Outlet (Patterson Creek) based on data collected between June 2014 to September 2022.

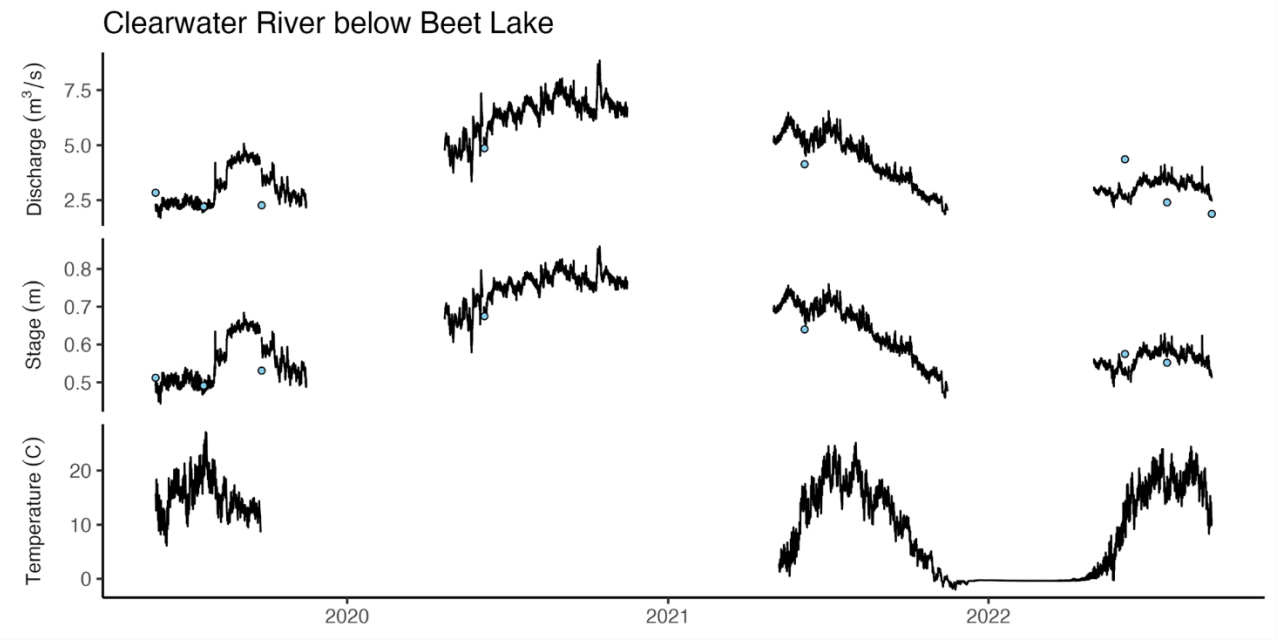


Figure 4-30
Hydrometric record for Beet Lake Outlet (Beet Creek) based on data collected between May 2019 and September 2022.

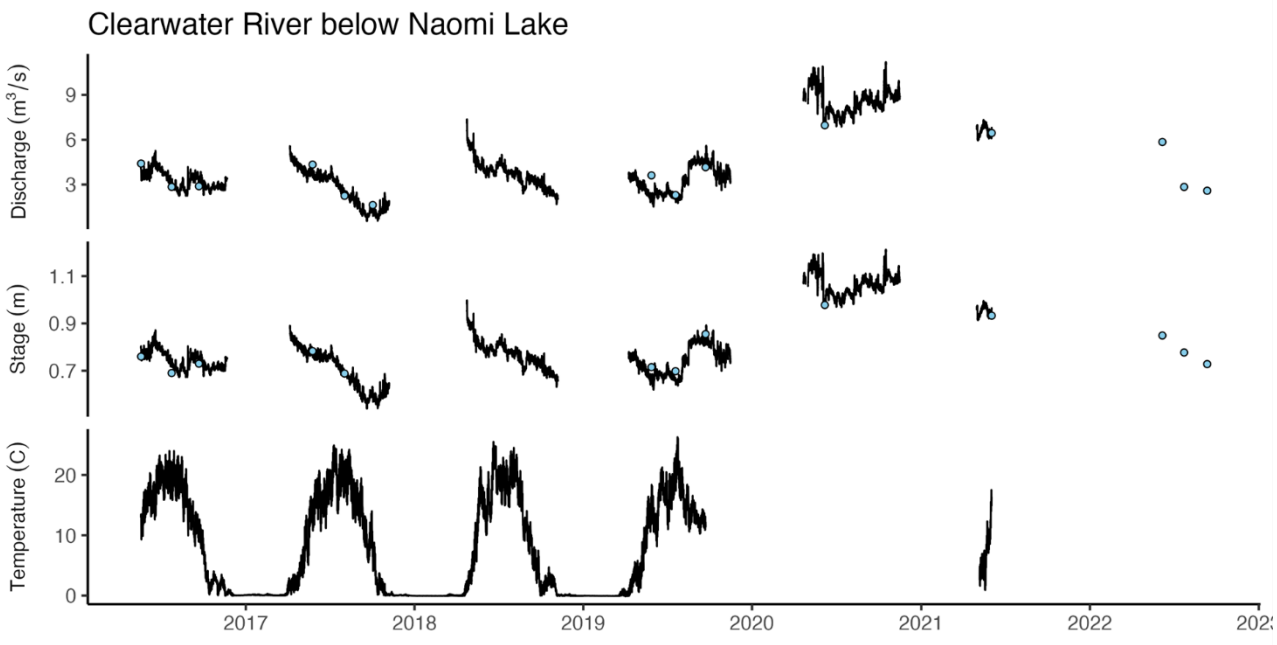


Figure 4-31
Hydrometric record for Clearwater River (near-field; below Naomi Lake) based on data collected between May 2016 to September 2022.

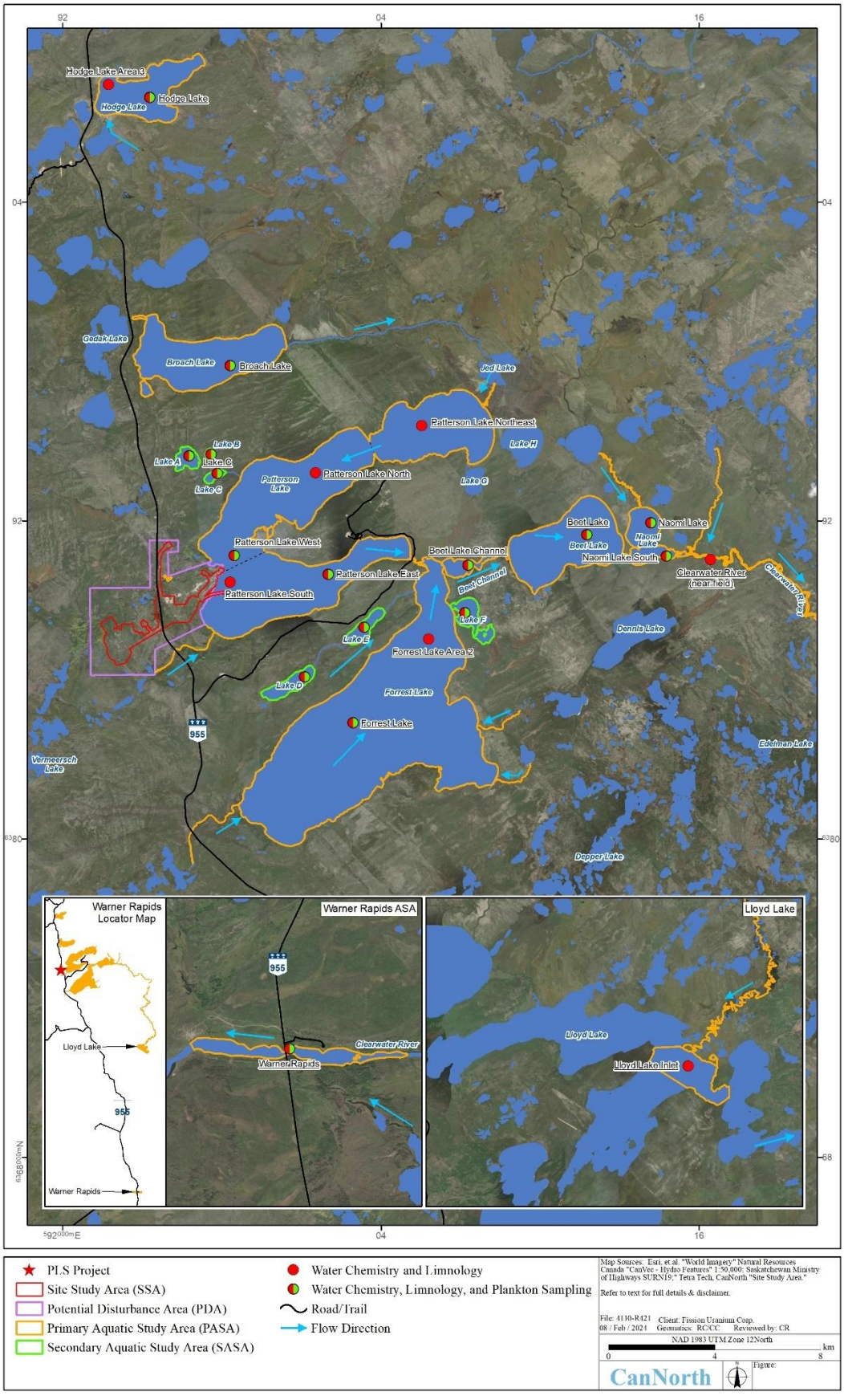


Figure 4-32
Water sampling locations within the primary and secondary ASA, 2016 to 2023.

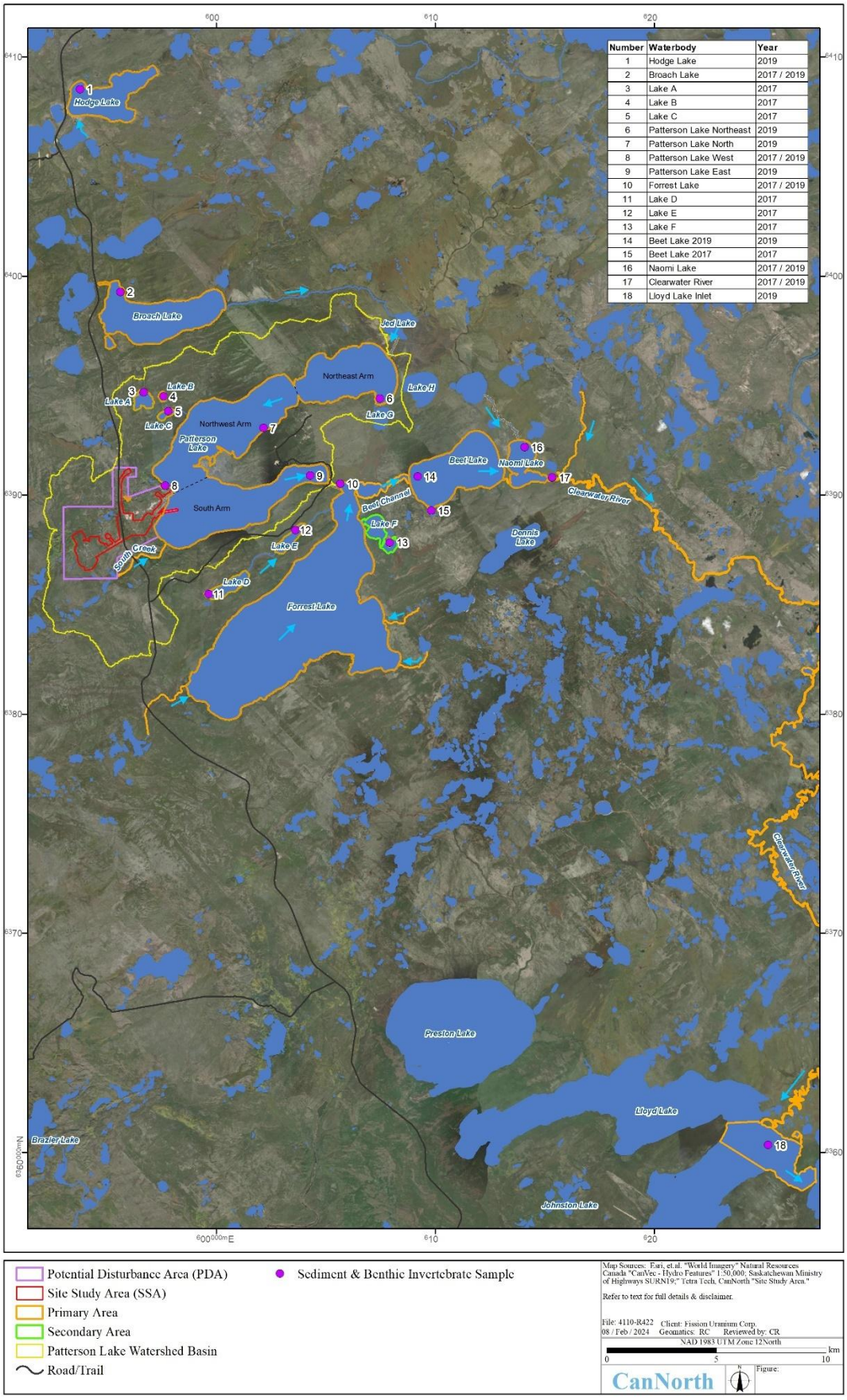


Figure 4-33
Sediment sampling locations within the primary and secondary ASA, 2017 and 2019.

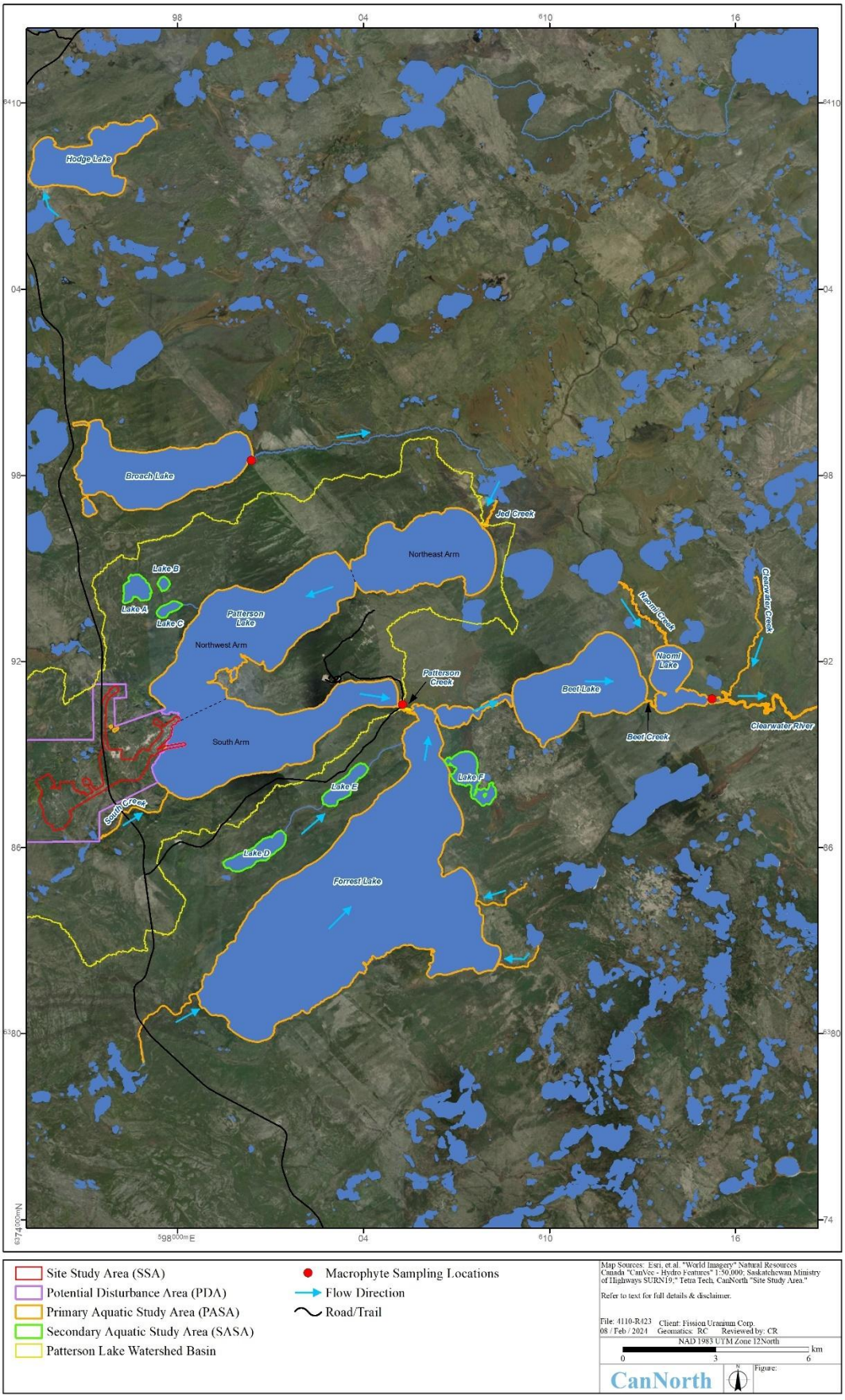


Figure 4-34
Macrophyte sampling locations within the primary ASA, July 2016.

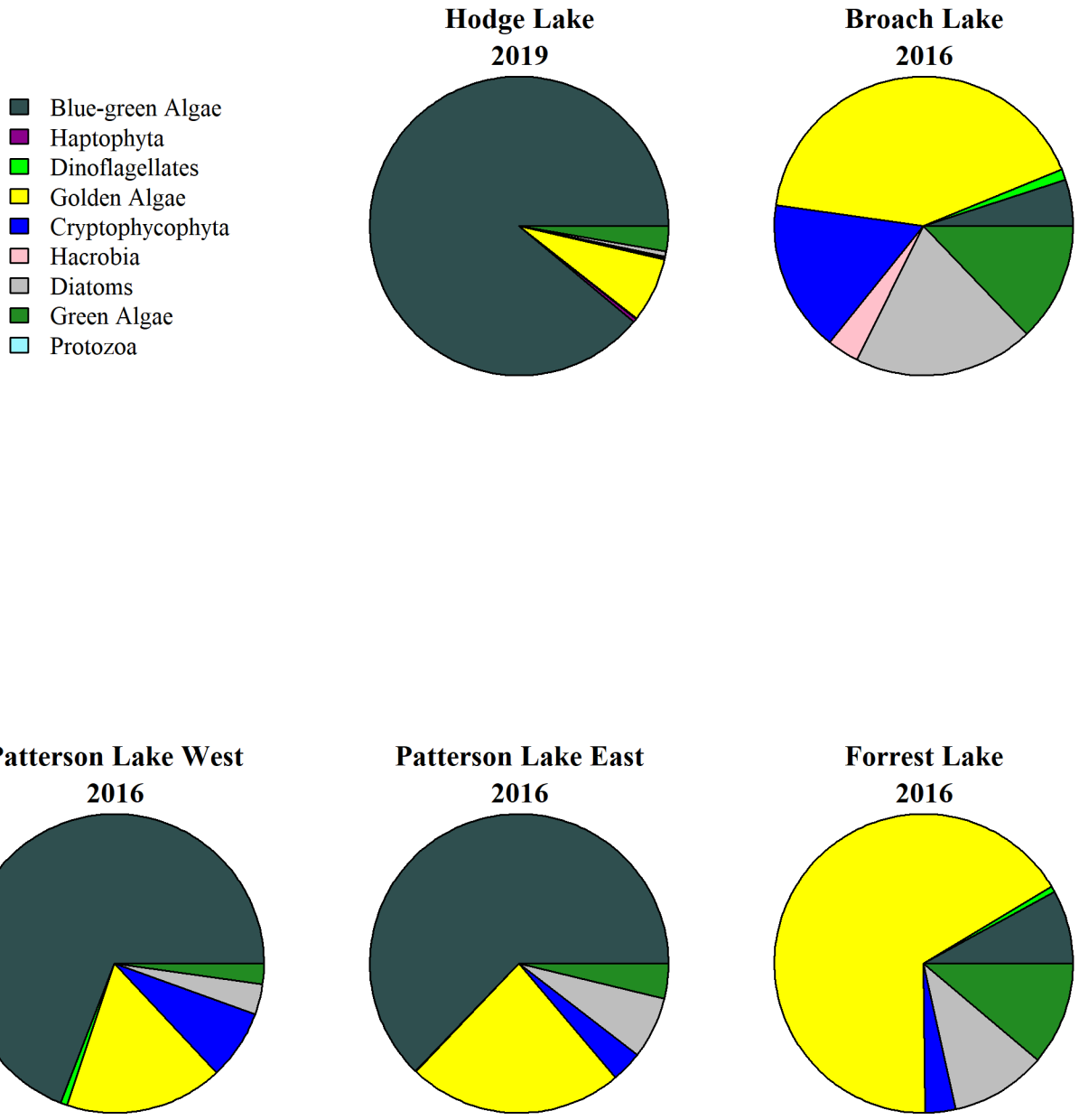


Figure 4-35
Phytoplankton density percent composition in the Project ASA, July 2016 and July 2019.

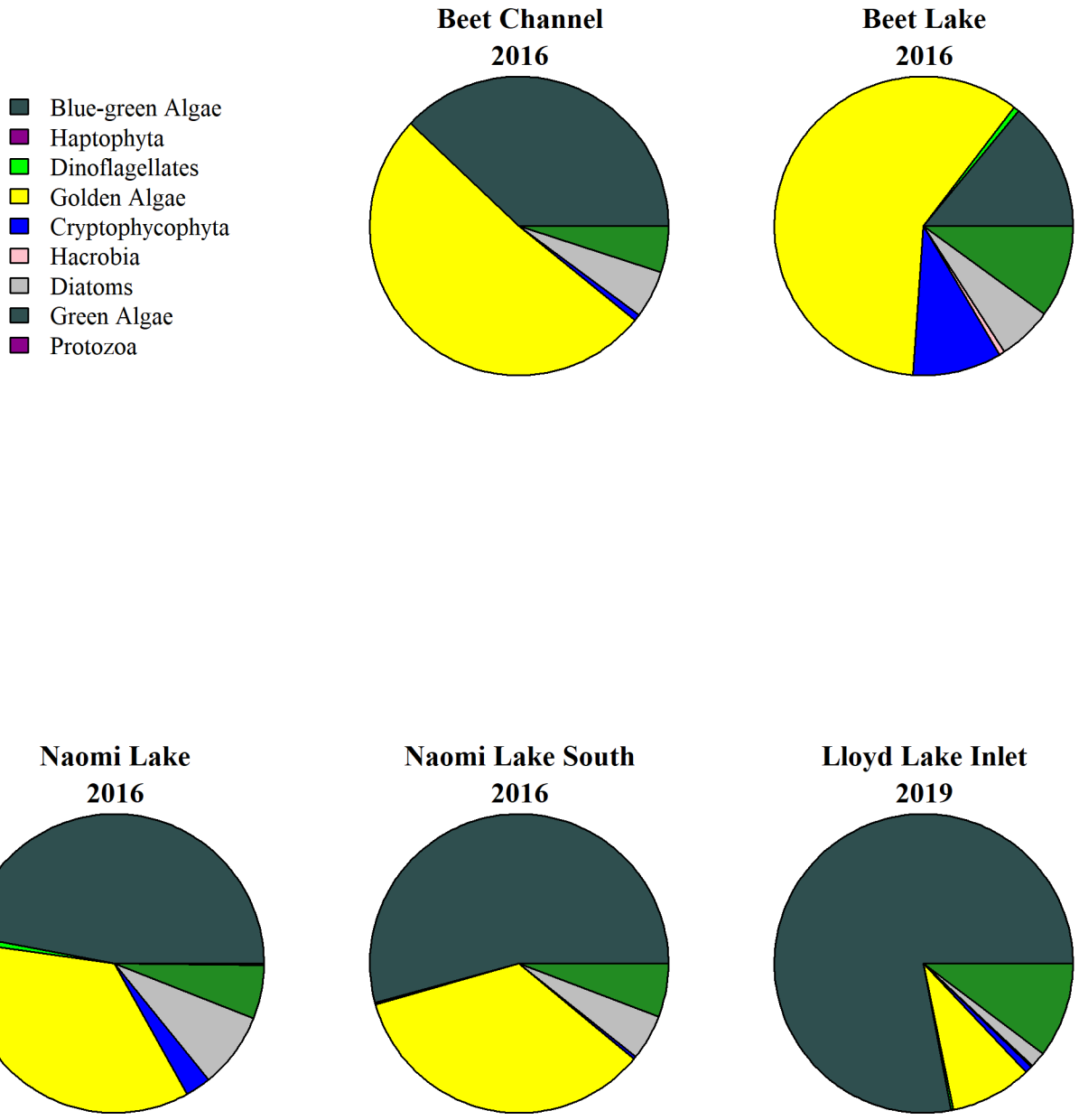


Figure 4-35
Phytoplankton density percent composition in the Project ASA, July 2016 and July 2019.

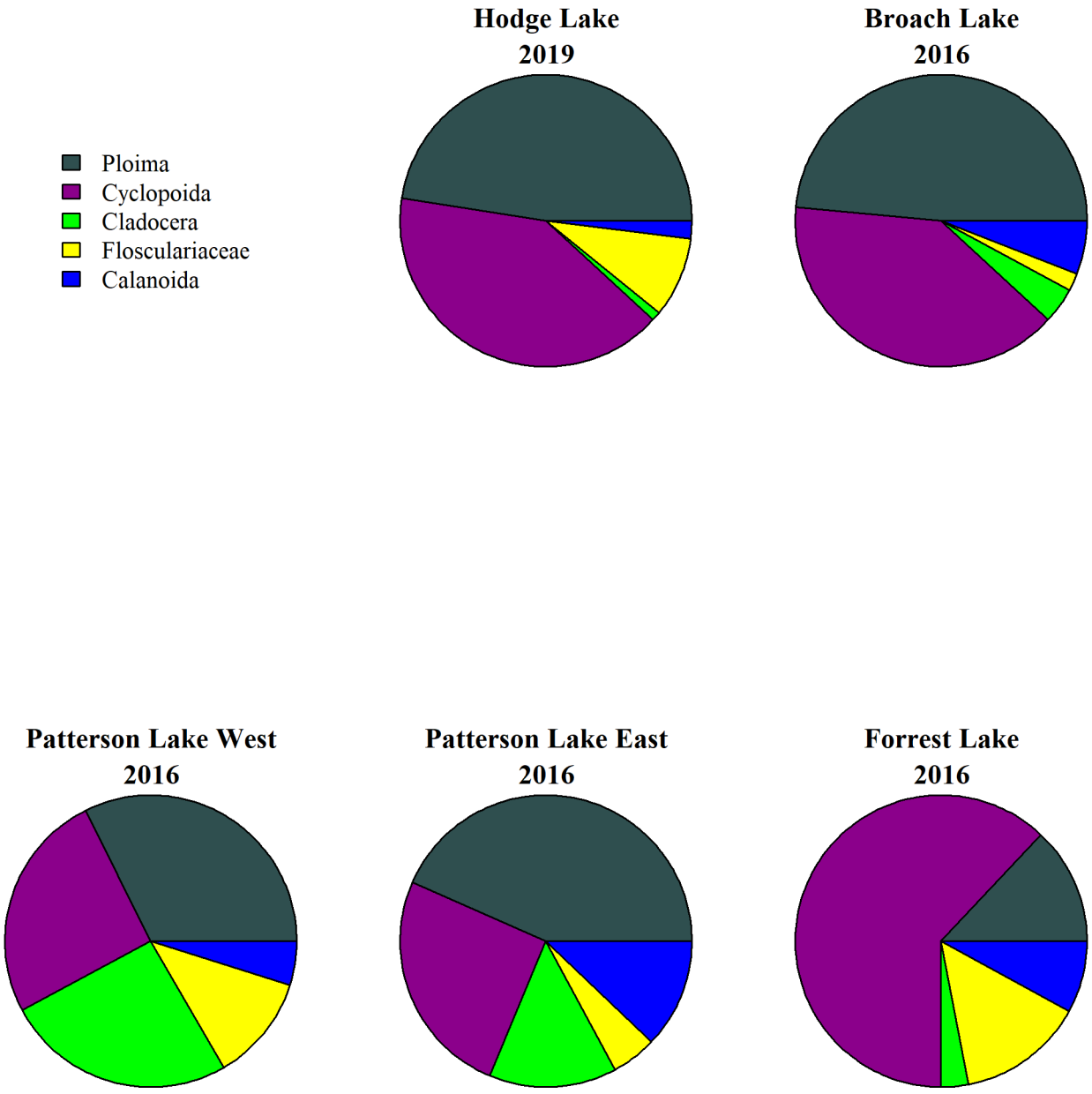


Figure 4-36
Zooplankton density percent composition in the Project ASA, July 2016 and July 2019.

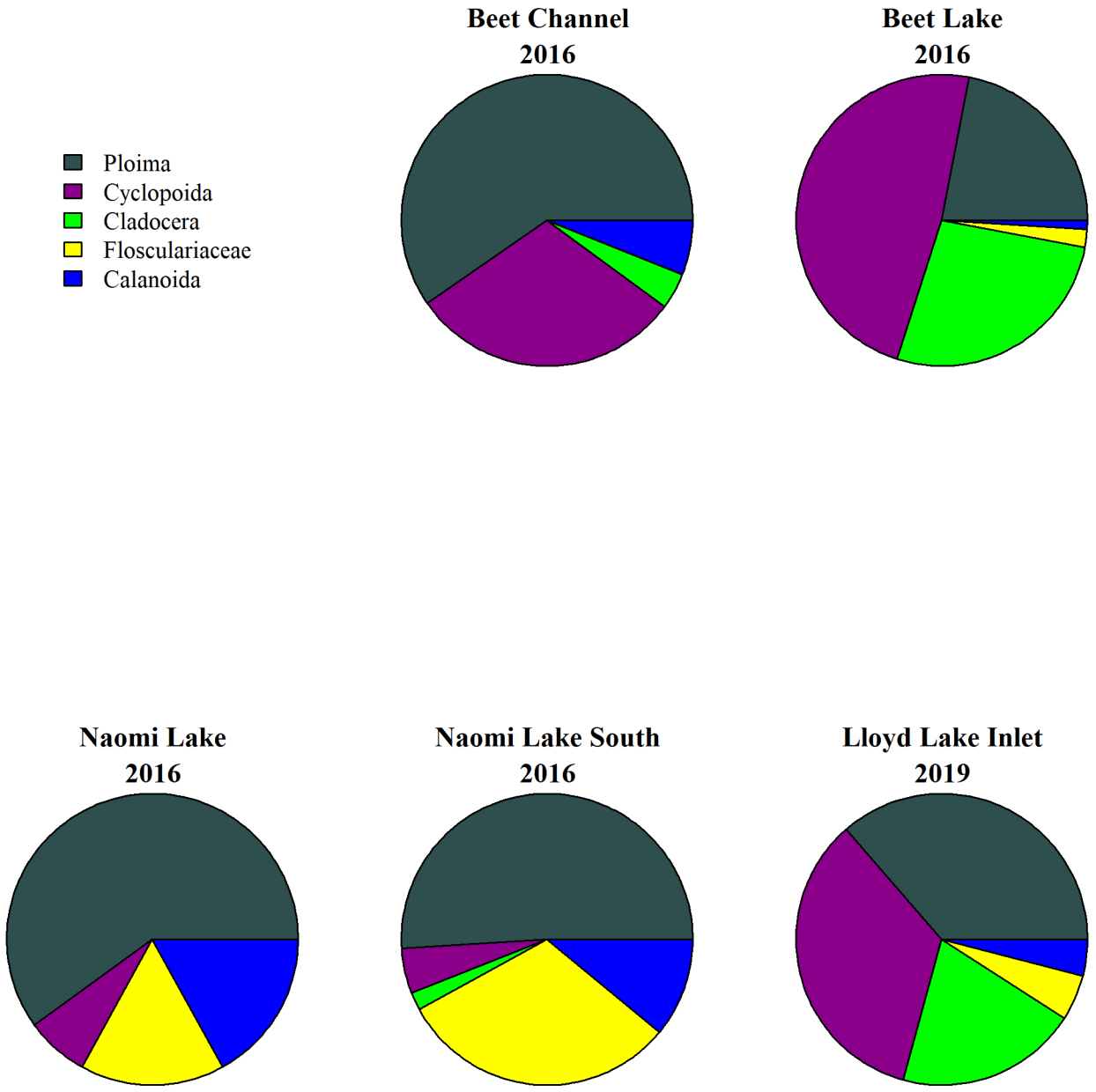


Figure 4-36
Zooplankton density percent composition in the Project ASA, July 2016 and July 2019.

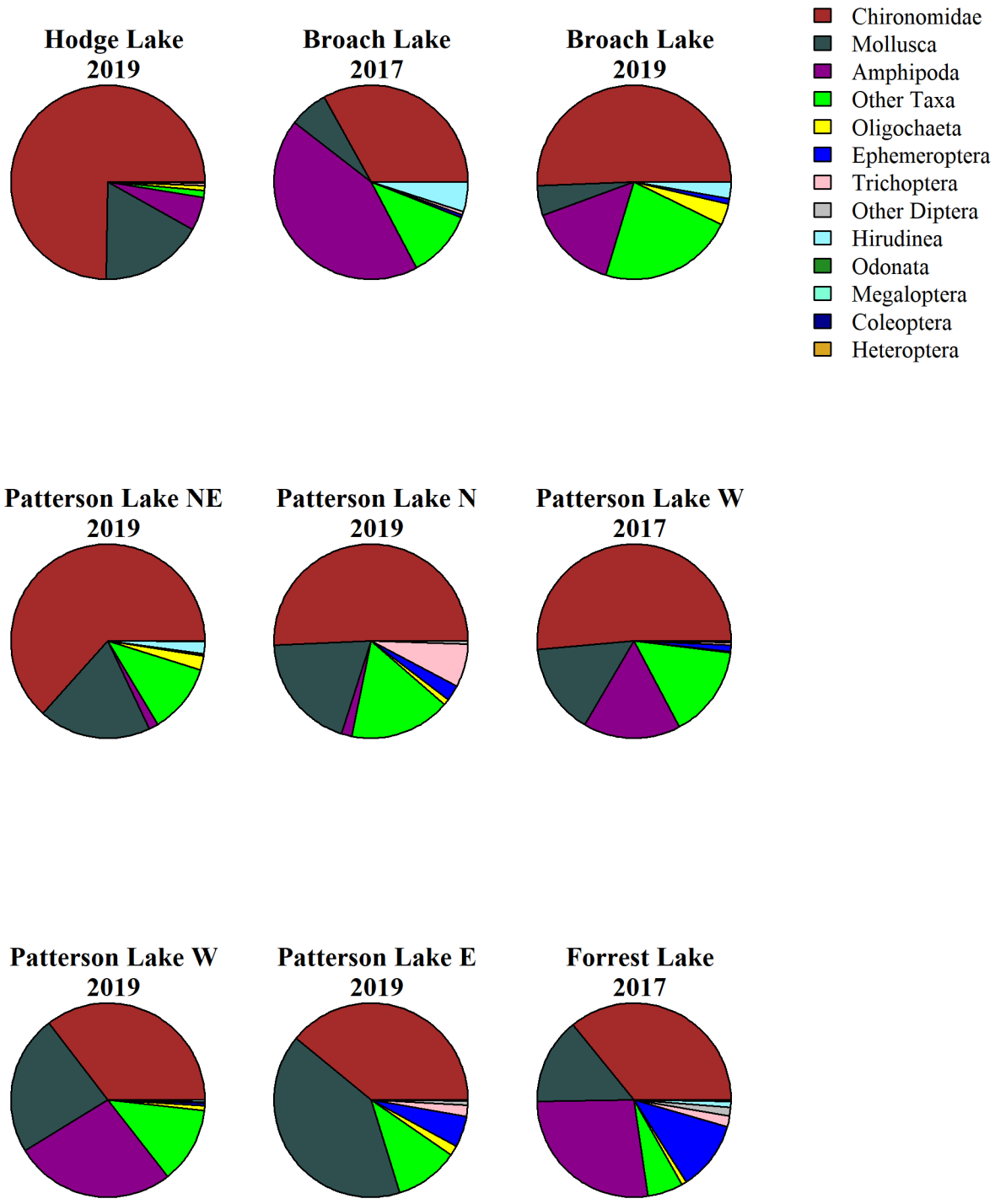


Figure 4-37
Benthic invertebrate density percent composition distribution in sampling areas from the Project ASA, September/October 2017 and September 2019.

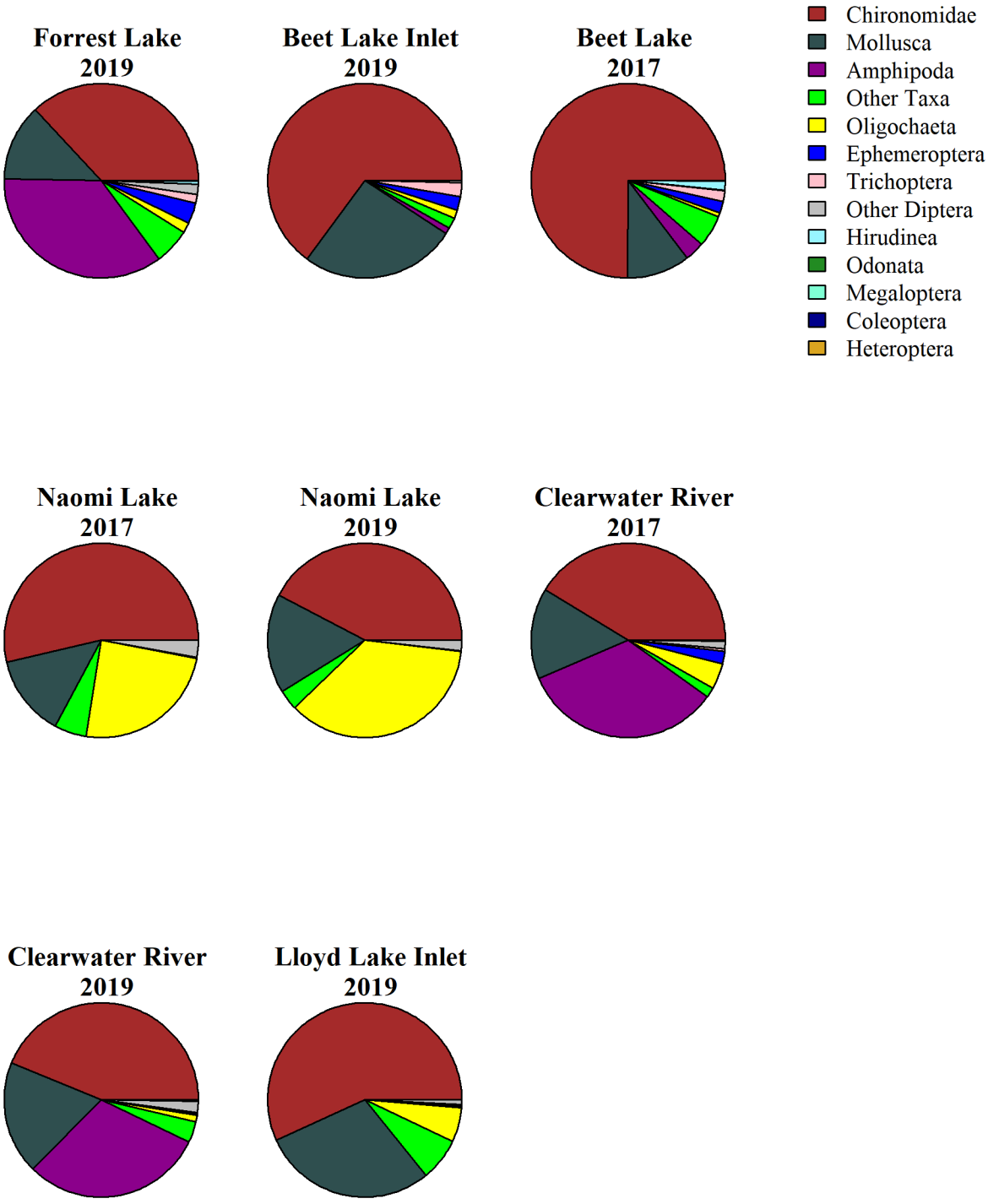


Figure 4-37
Benthic invertebrate density percent composition distribution in sampling areas from the Project ASA, September/October 2017 and September 2019.

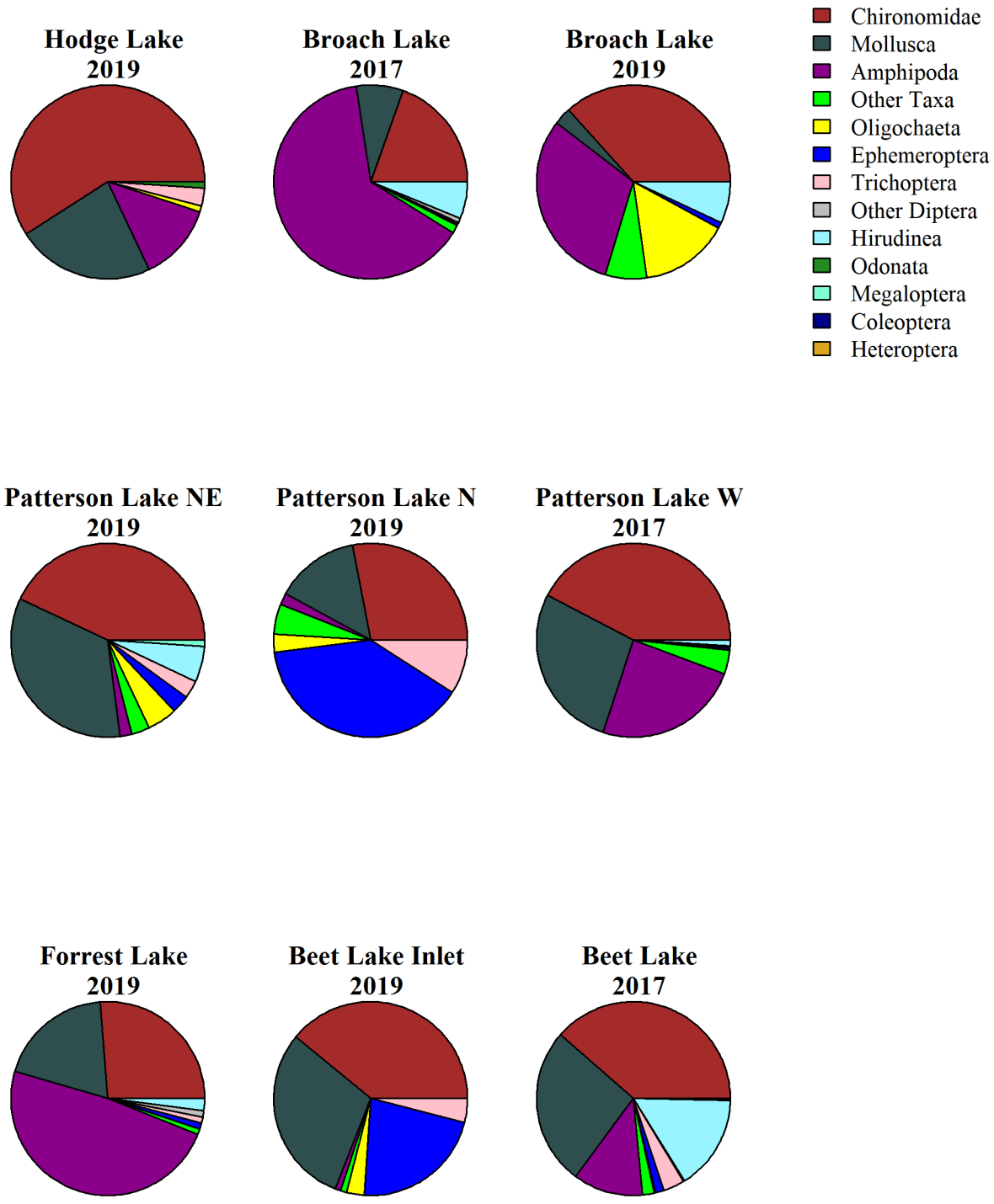


Figure 4-38
Benthic invertebrate biomass percent composition distribution in sampling areas from the Project ASA, September/October 2017 and September 2019.

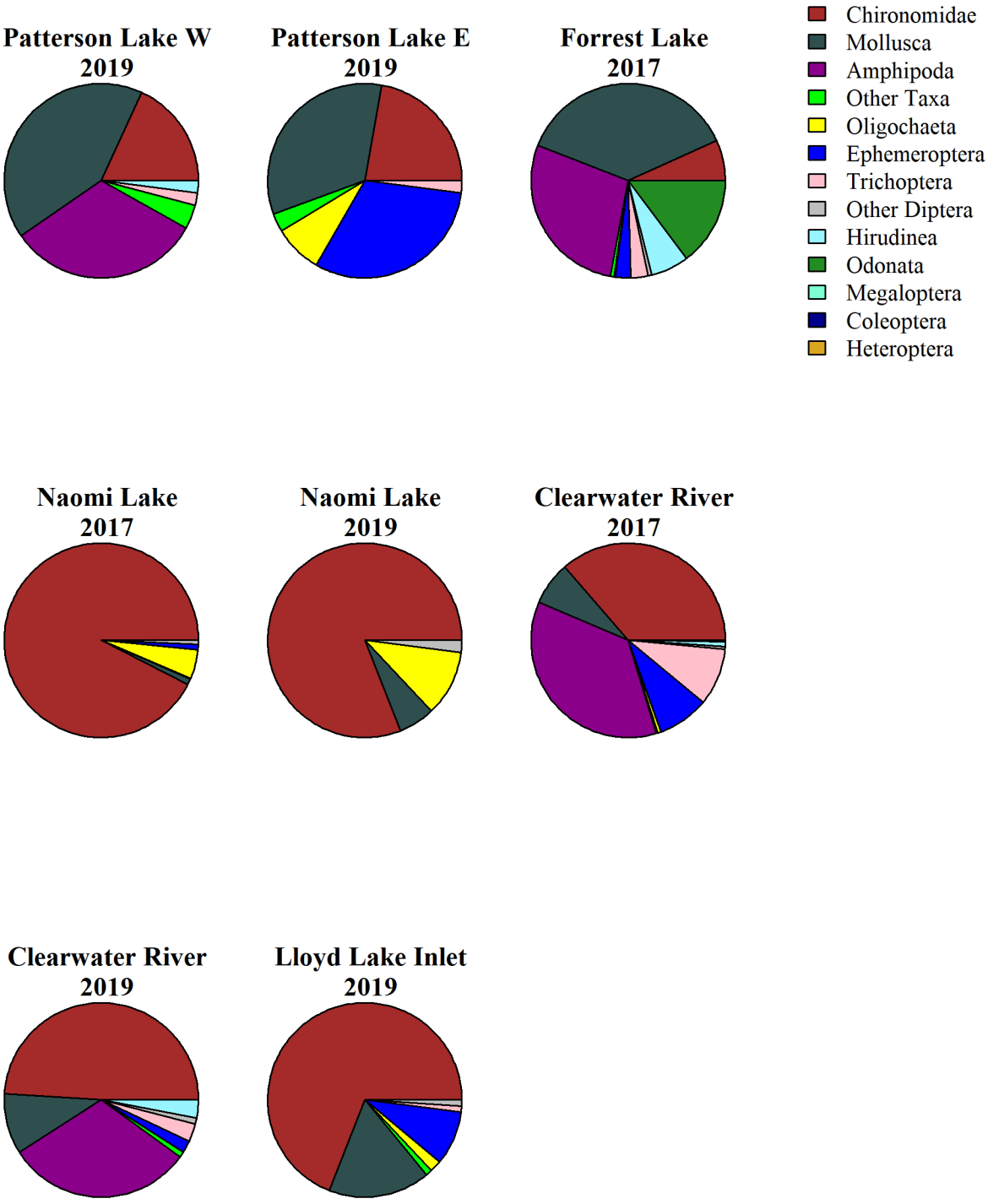


Figure 4-38
Benthic invertebrate biomass percent composition distribution in sampling areas from the Project ASA, September/October 2017 and September 2019.

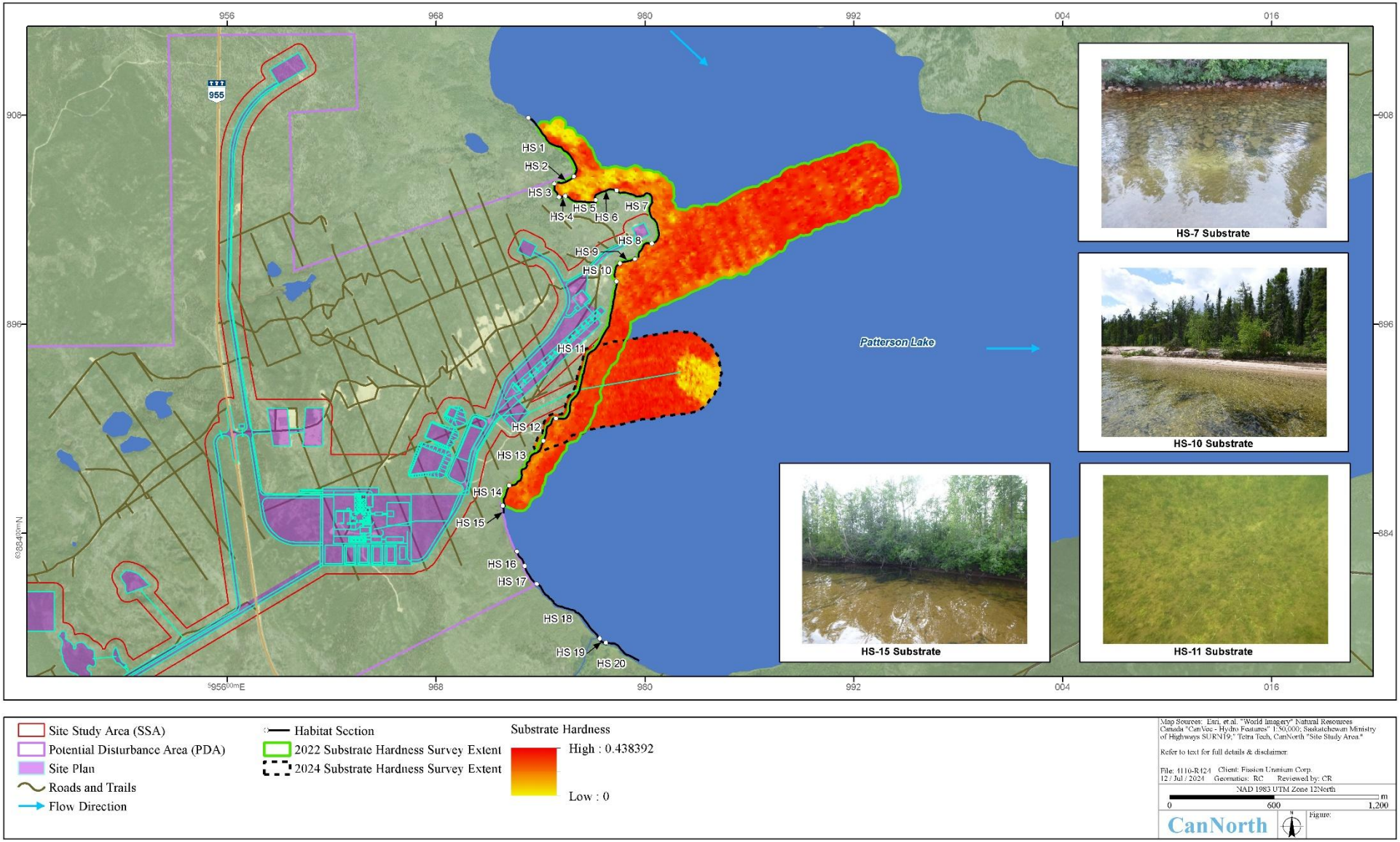


Figure 4-39
Fish habitat mapping around the proposed Patterson Lake treated effluent discharge, September 2022 and June 2024.

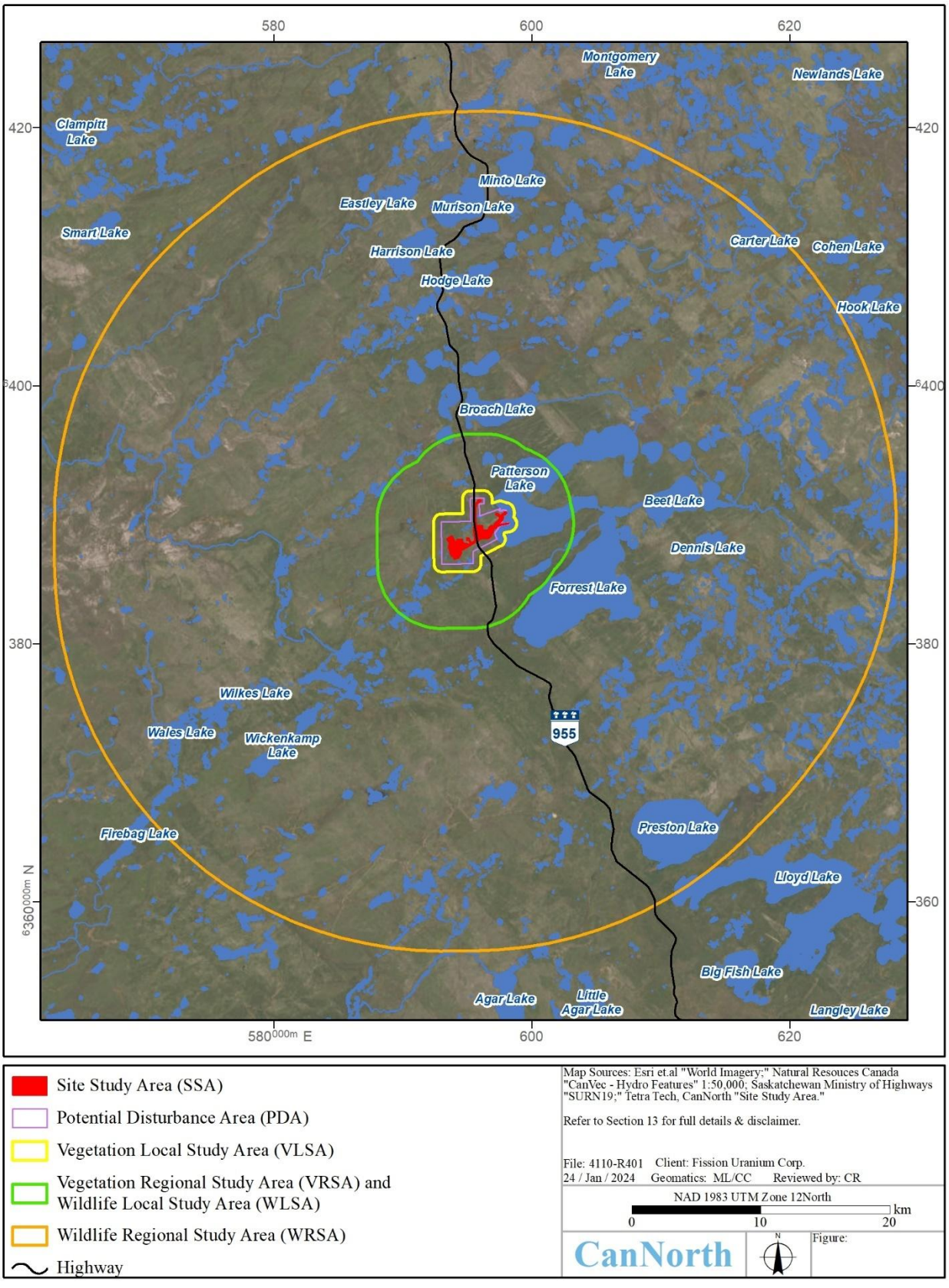


Figure 4-40
Project SSA and PDA, and vegetation and wildlife LSA and RSA.

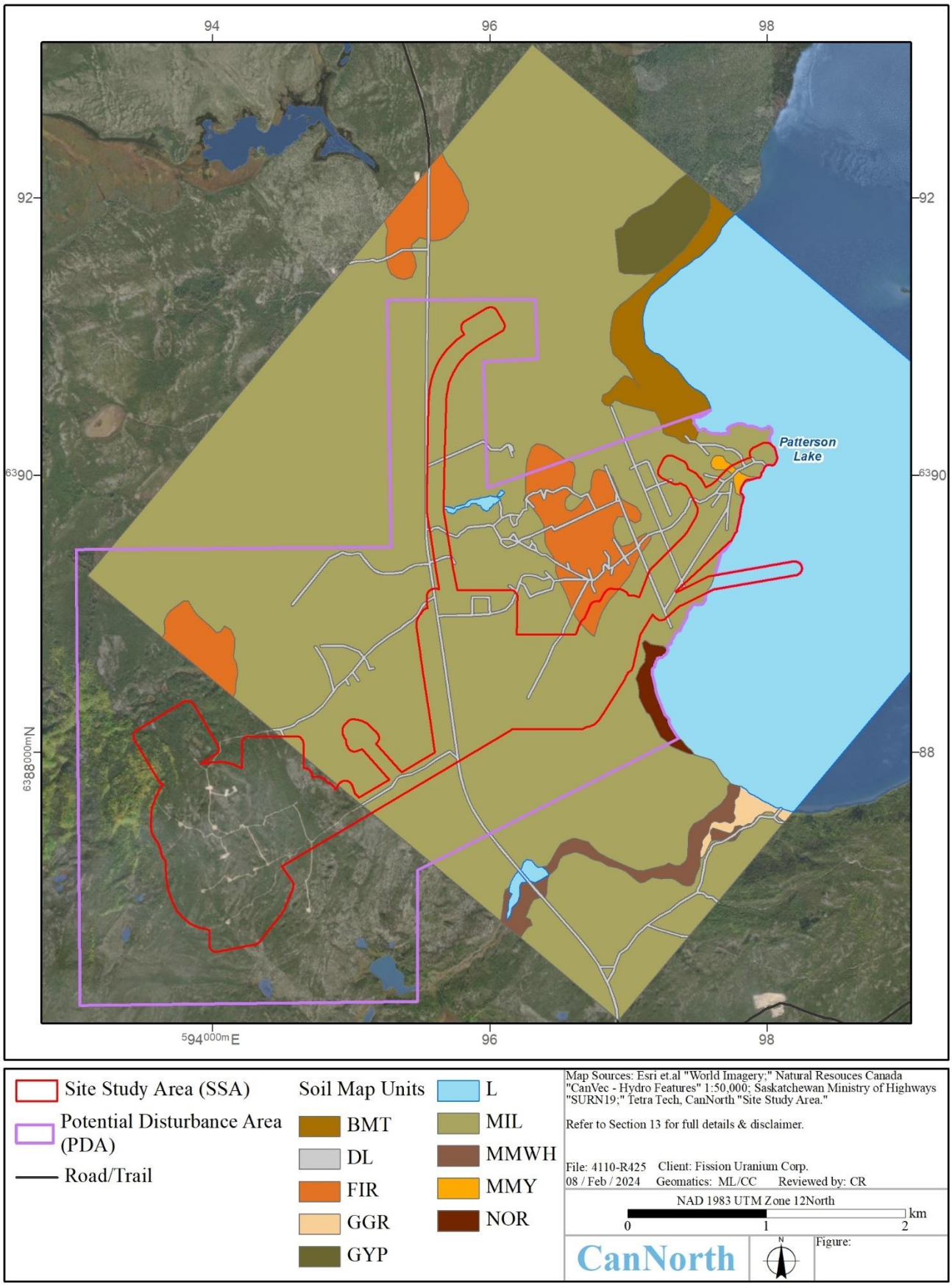


Figure 4-41
Soil map units for the 2018/2019 baseline SSA.

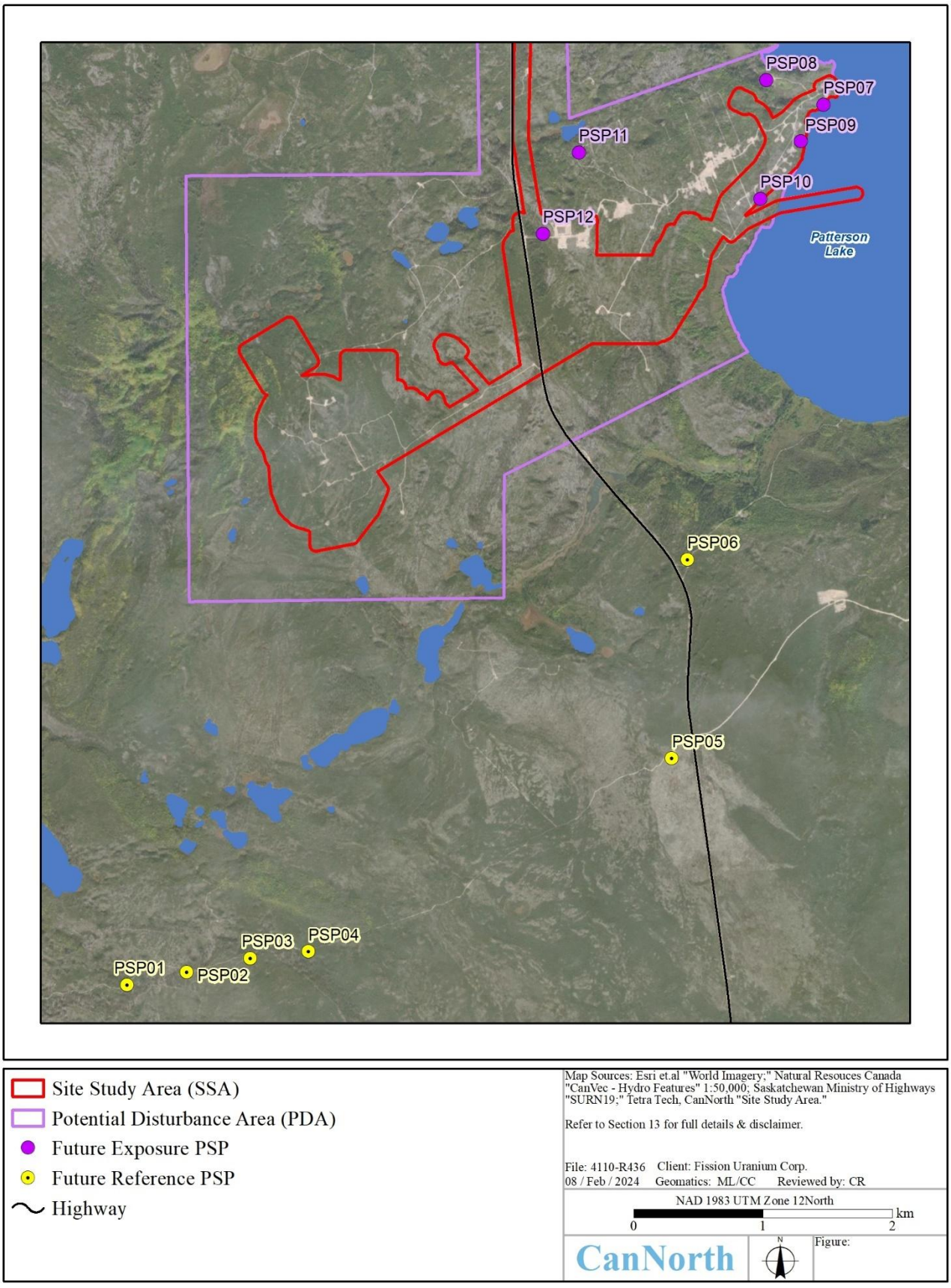


Figure 4-42
Locations of the permanent sampling plots for the PLS Project.

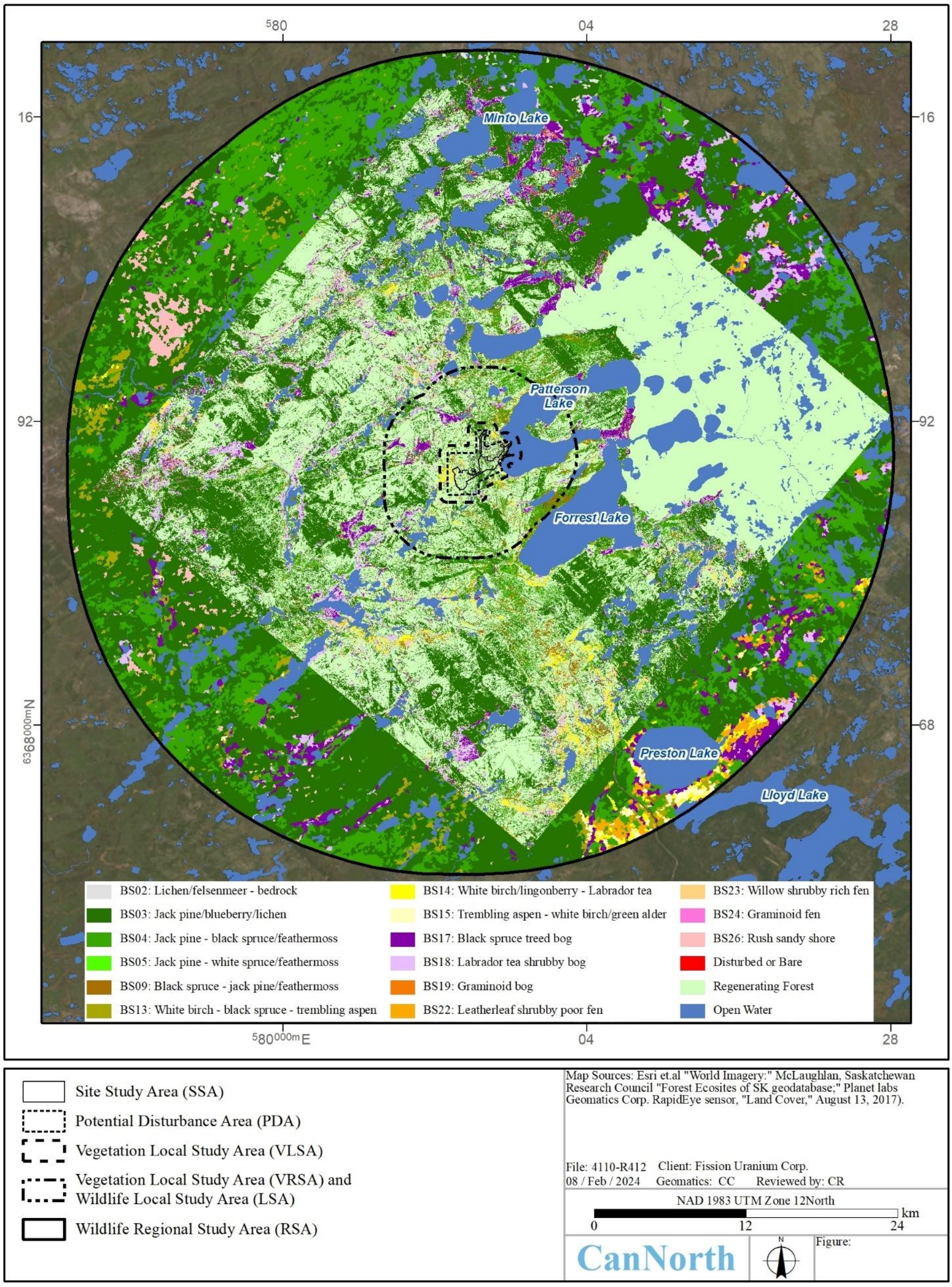


Figure 4-43
Land cover classification of the Project SSA and PDA, and vegetation and wildlife LSA and RSA.

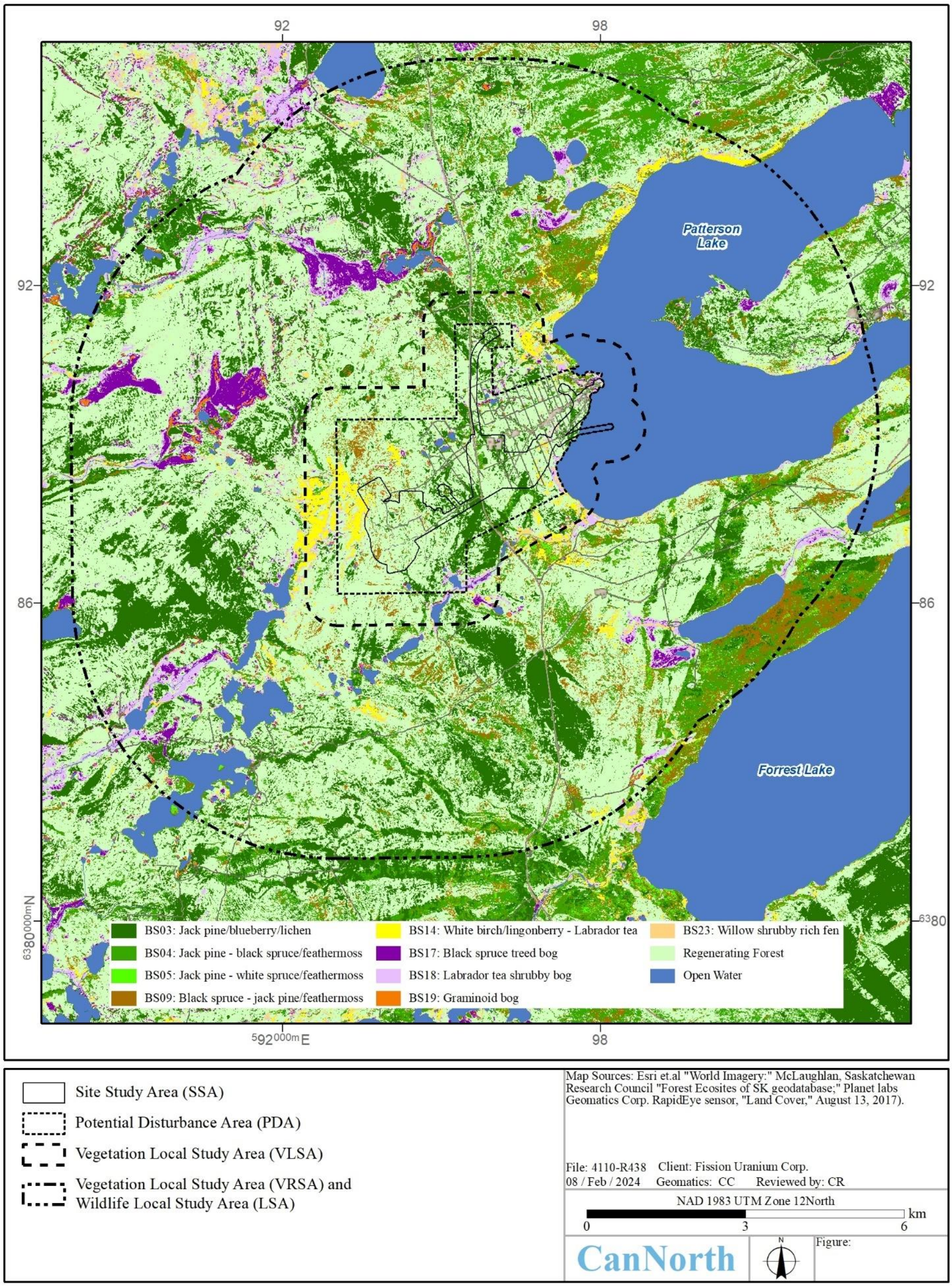


Figure 4-44
Land cover classification of the Project SSA and PDA, vegetation LSA and RSA, and wildlife LSA.

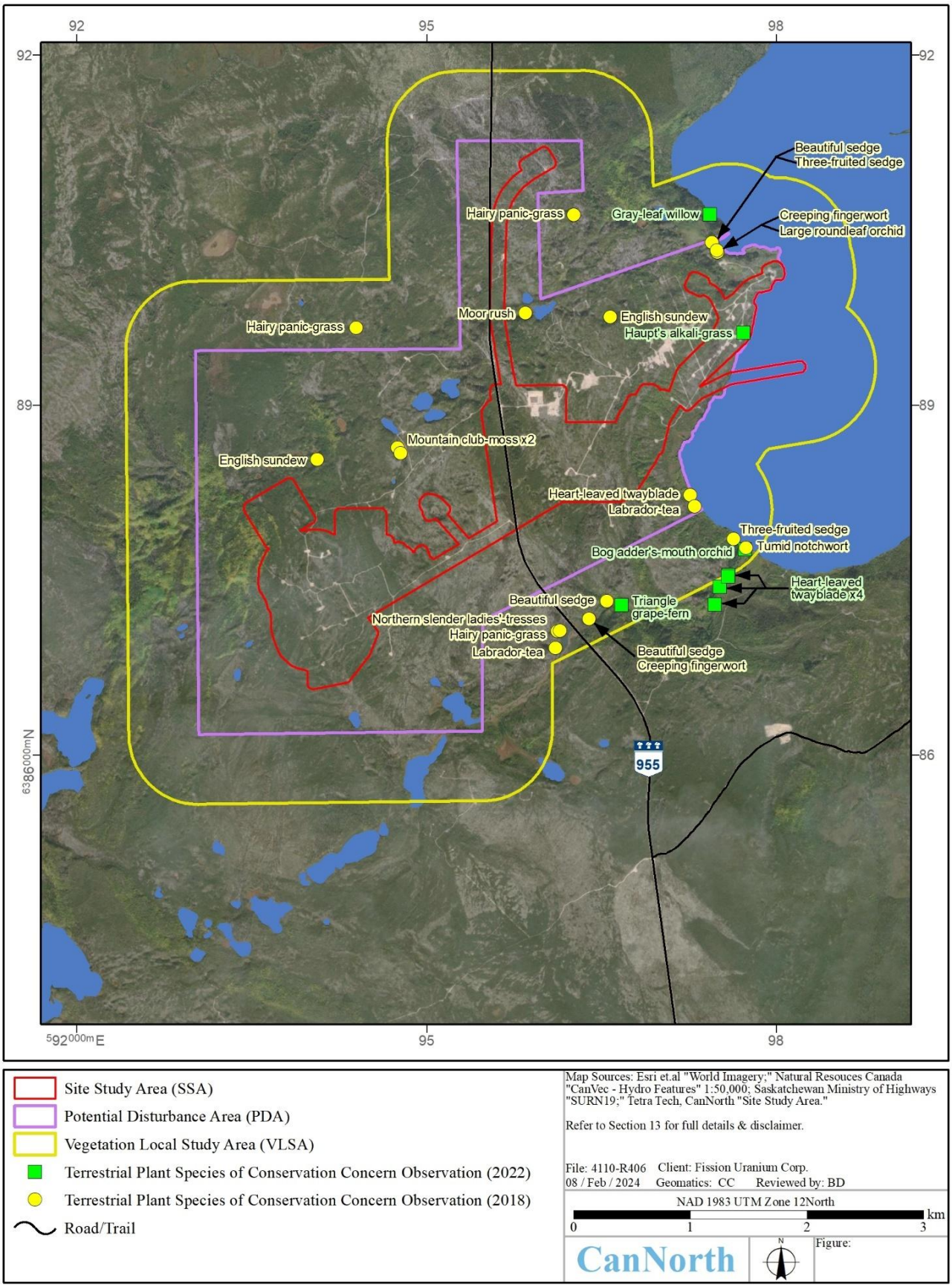


Figure 4-45
Locations of terrestrial plant SOCC detected in the Project PDA and vegetation LSA, 2022.

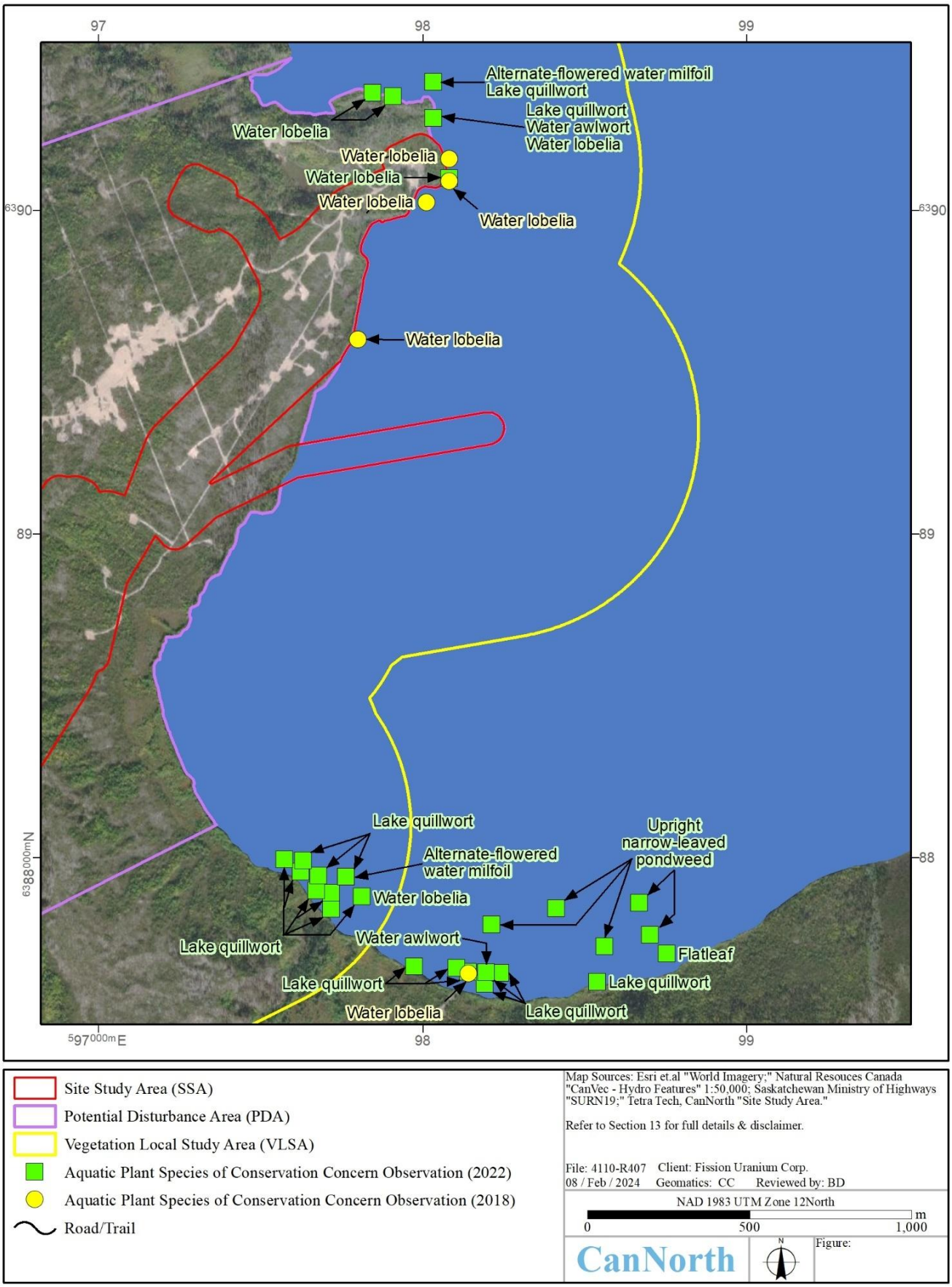


Figure 4-46
Locations of aquatic plant SOCC detected in the Project PDA and vegetation LSA, 2022.

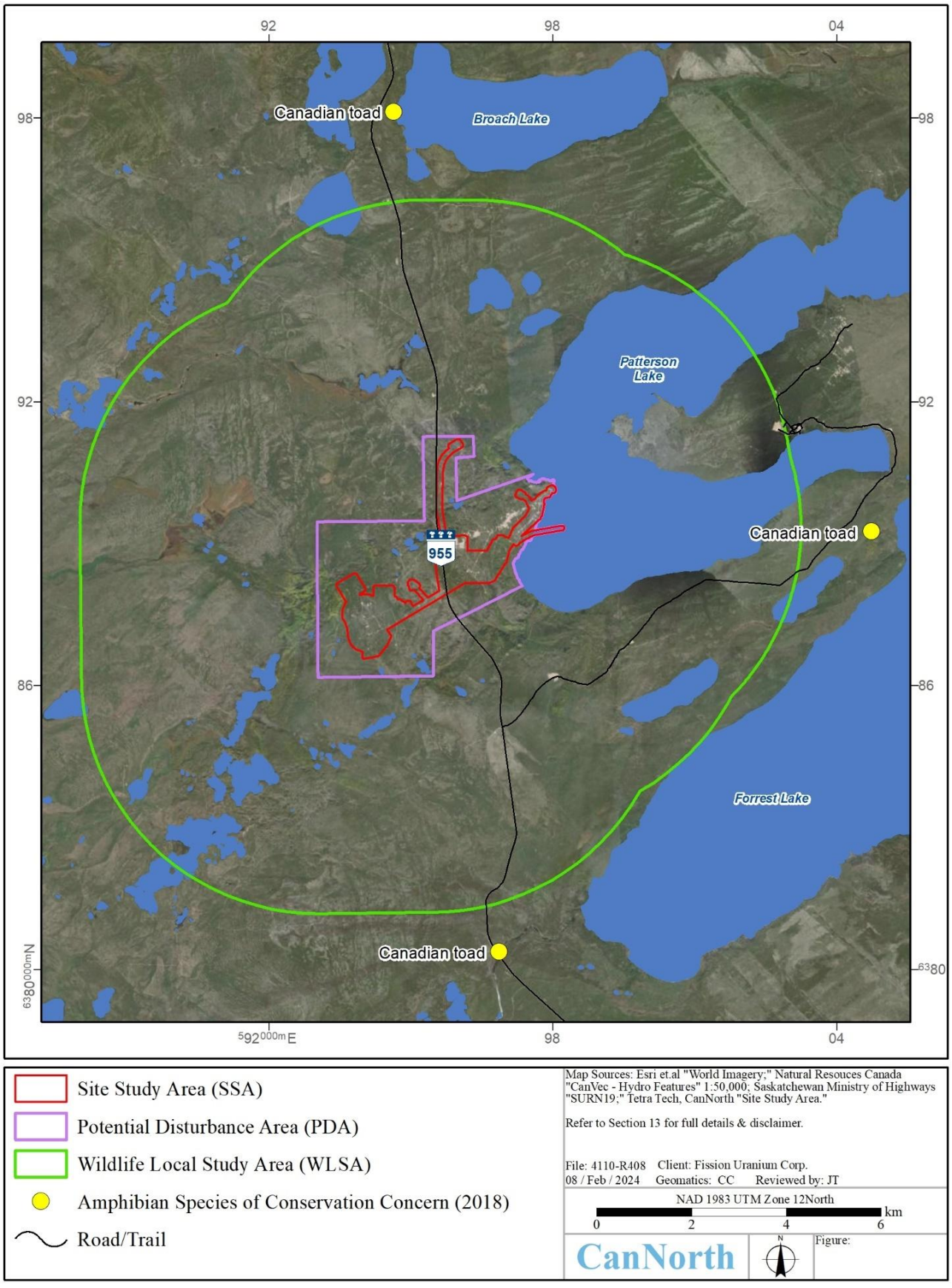


Figure 4-47
Locations of amphibian SOCC detected in the wildlife LSA, 2018.

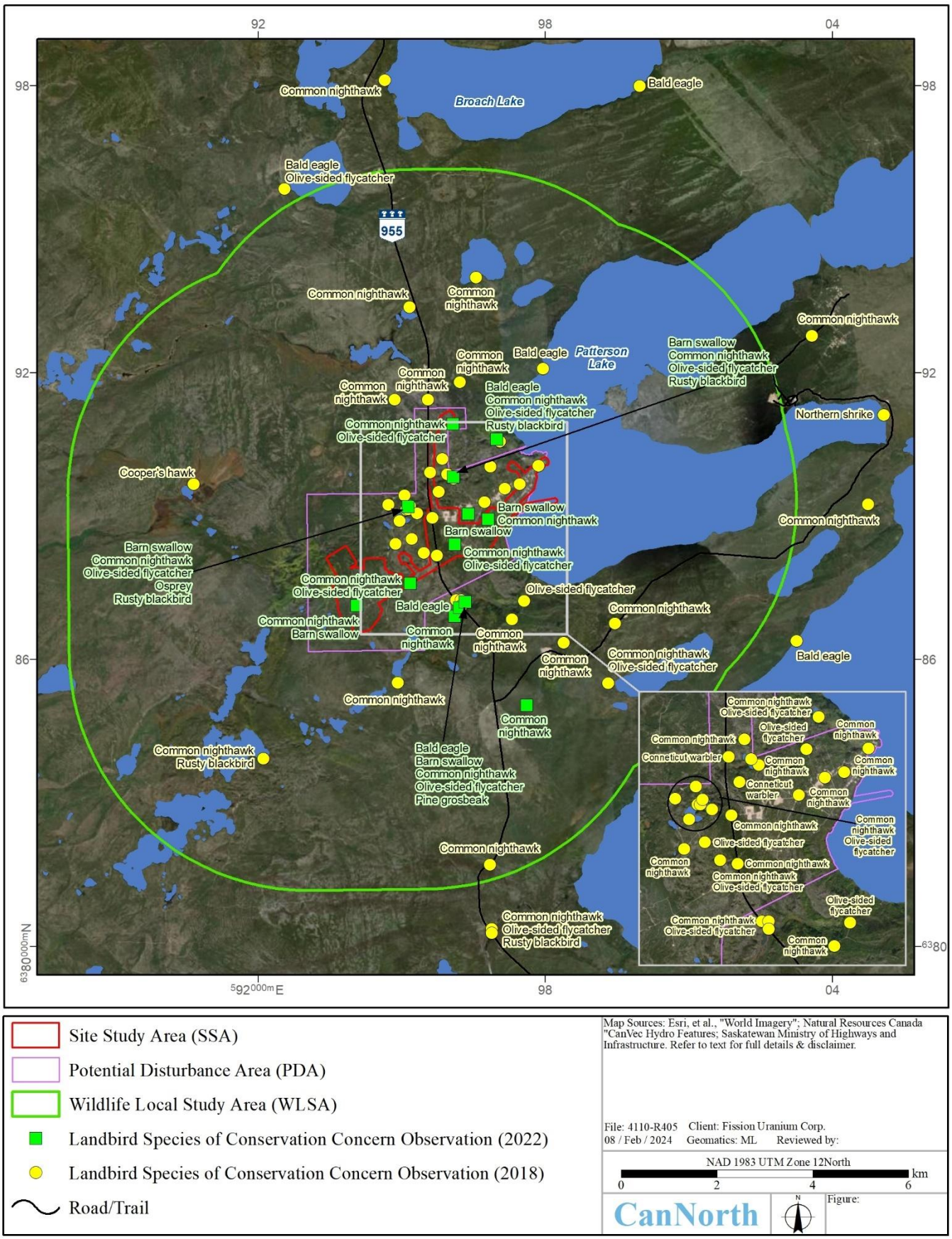


Figure 4-48
Locations of landbird SOCC detected in the Project SSA and wildlife LSA, 2018 and 2022.

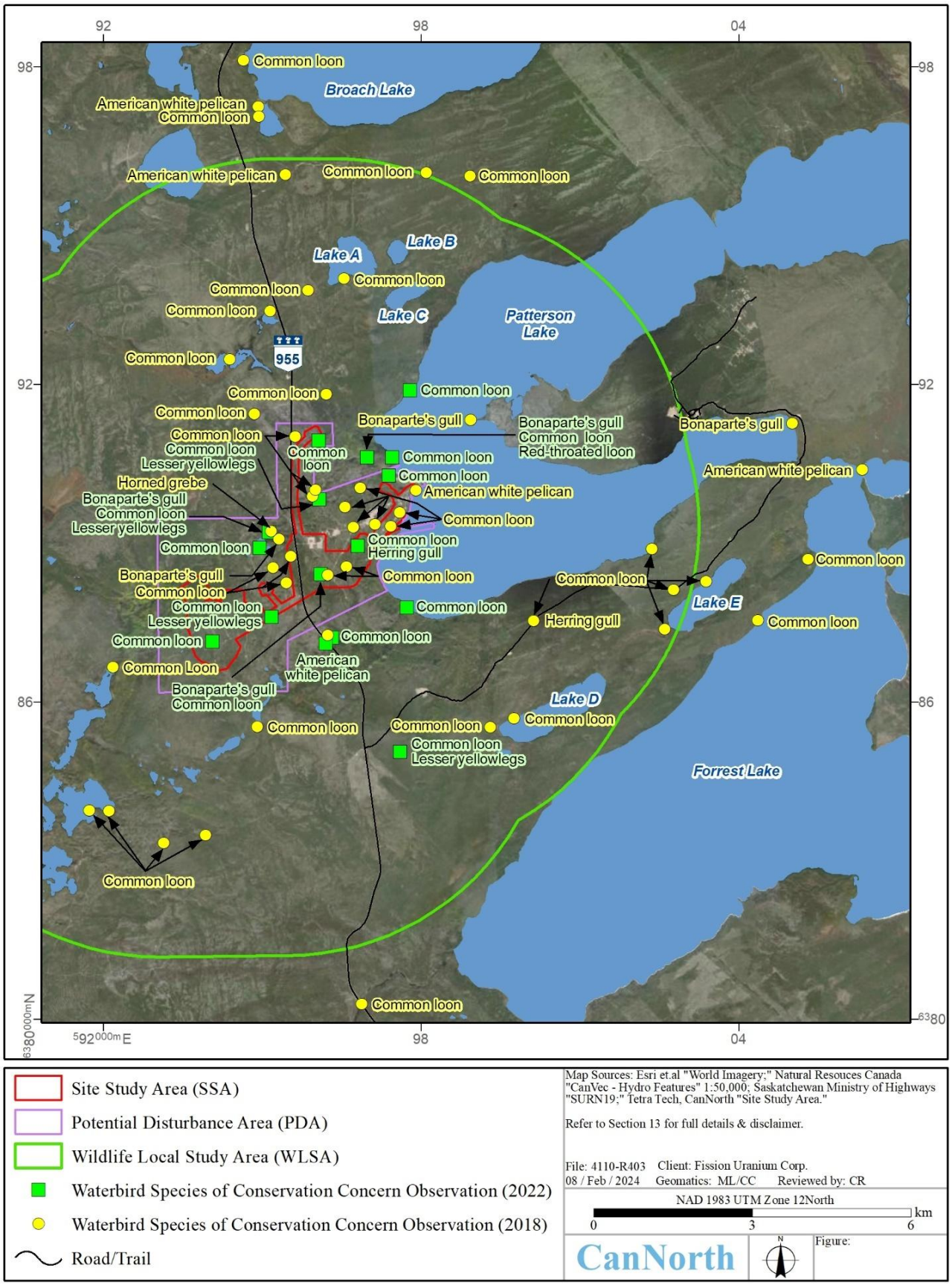


Figure 4-49
Locations of waterbird SOCC detected in the Project SSA and wildlife LSA, 2018 and 2022.

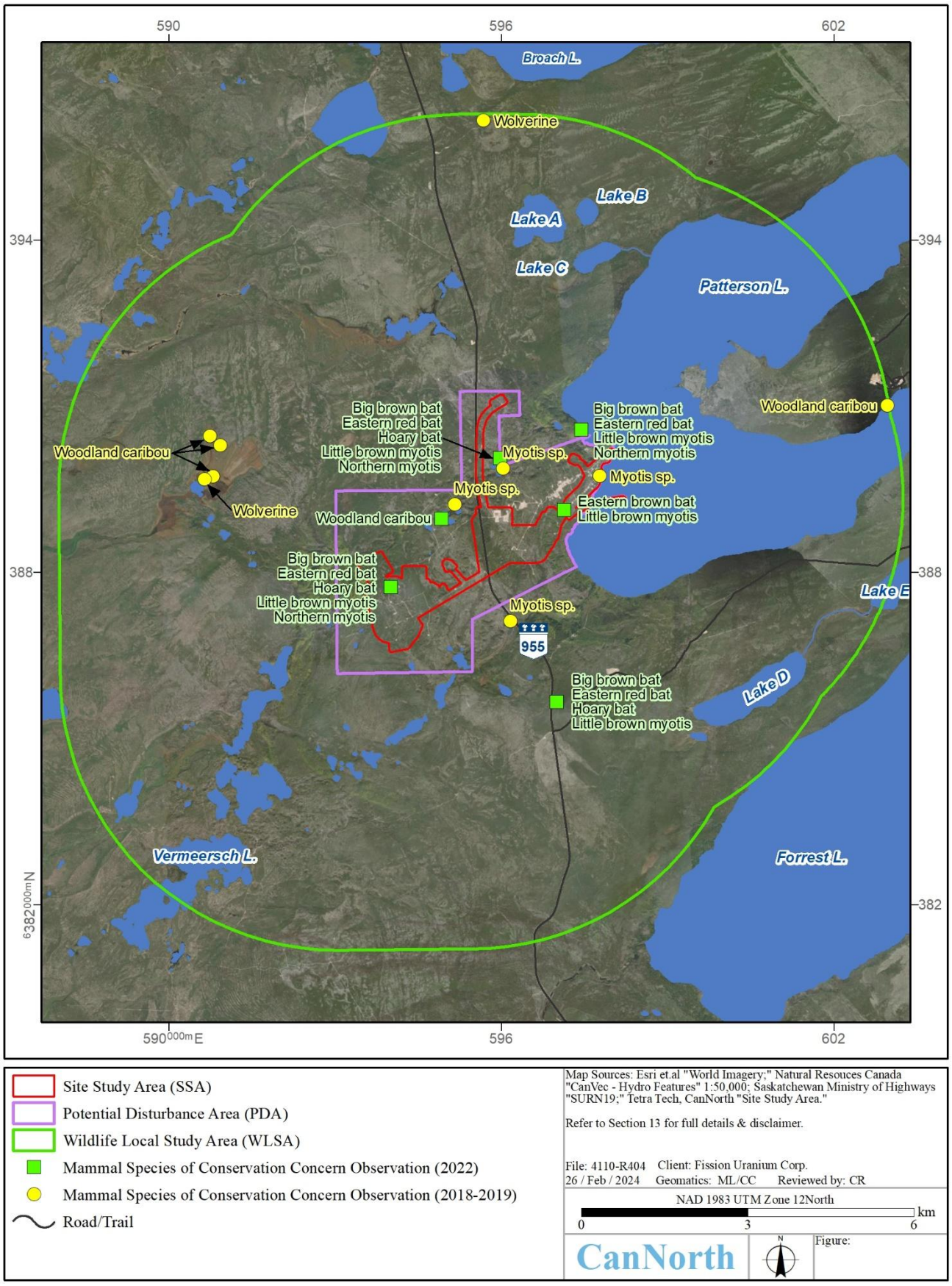


Figure 4-50
Locations of mammal SOCC detected in the Project SSA and wildlife LSA and RSA, 2018 to 2019 and 2022.

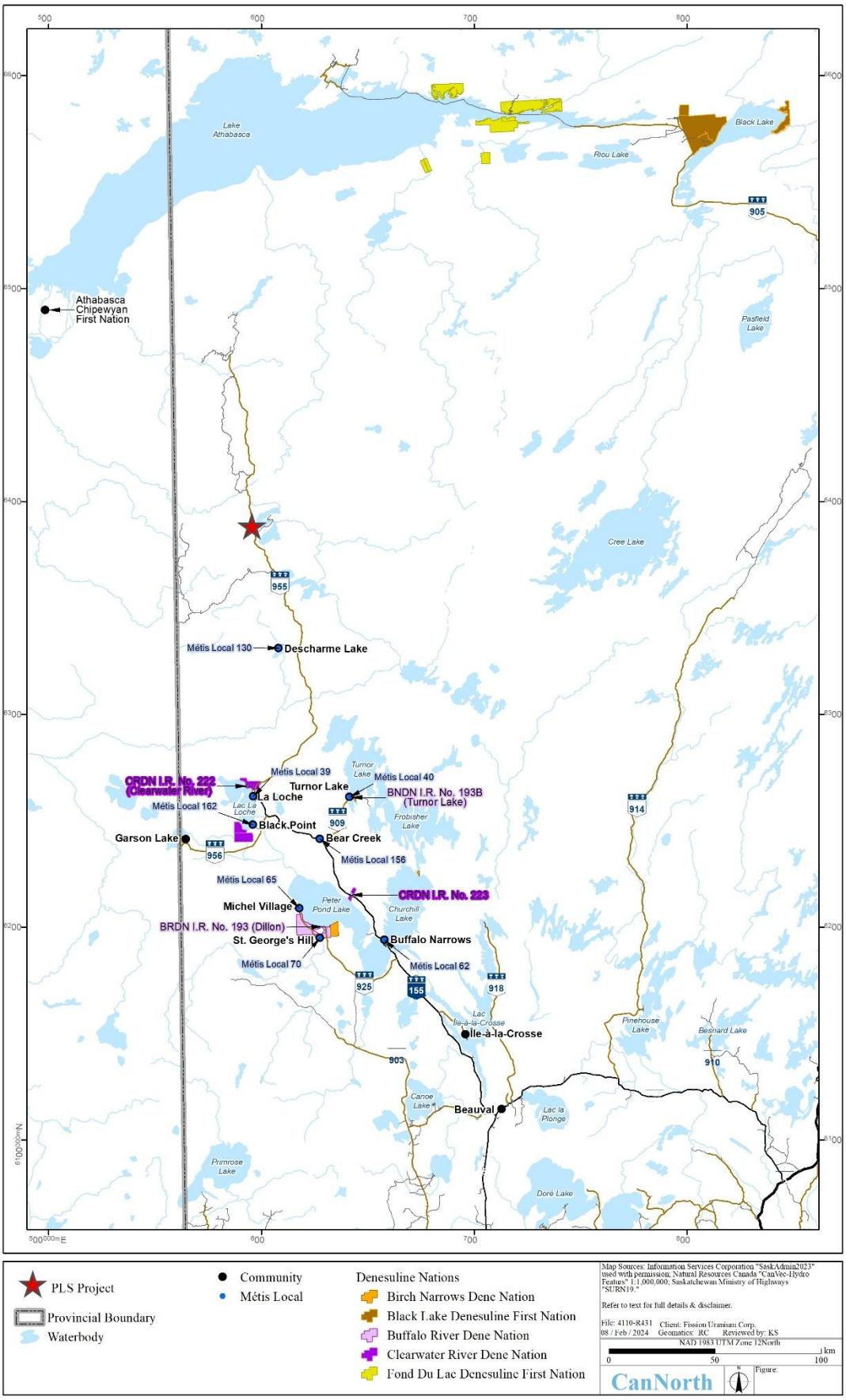


Figure 4-51
Socio-economic LSA and potentially interested communities.

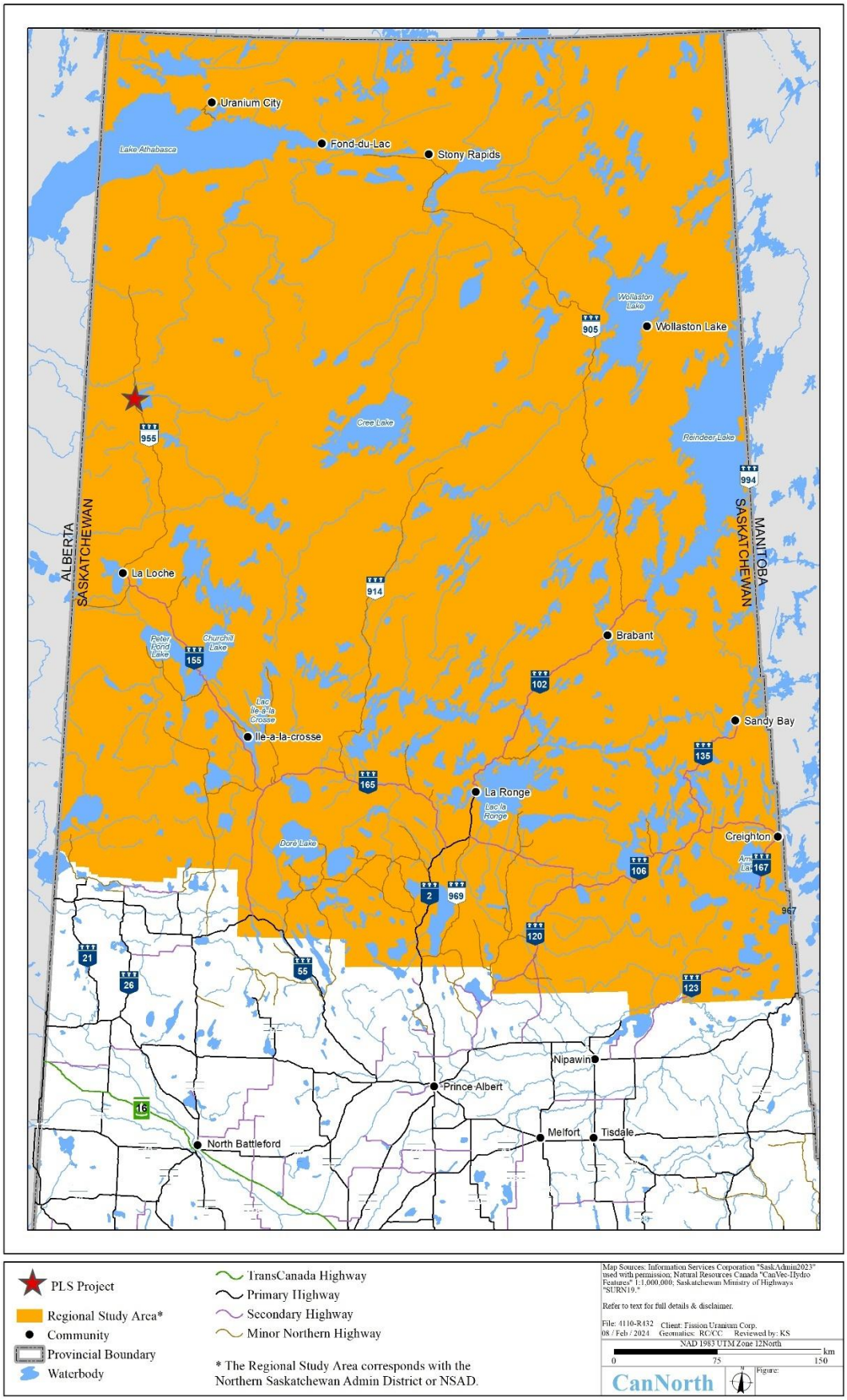


Figure 4-52
Socio-economic RSA.

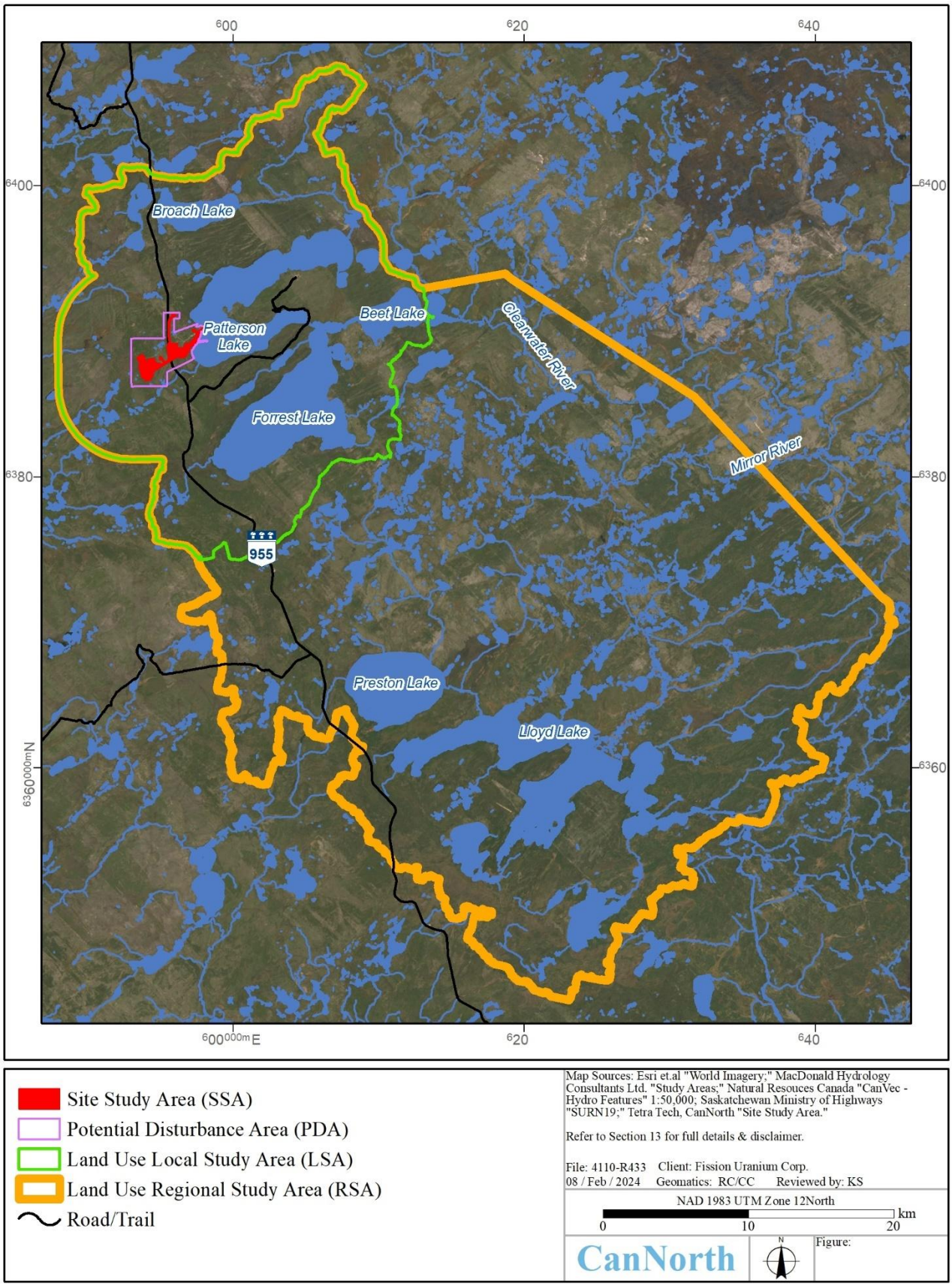


Figure 4-53
Land use LSA and RSA.

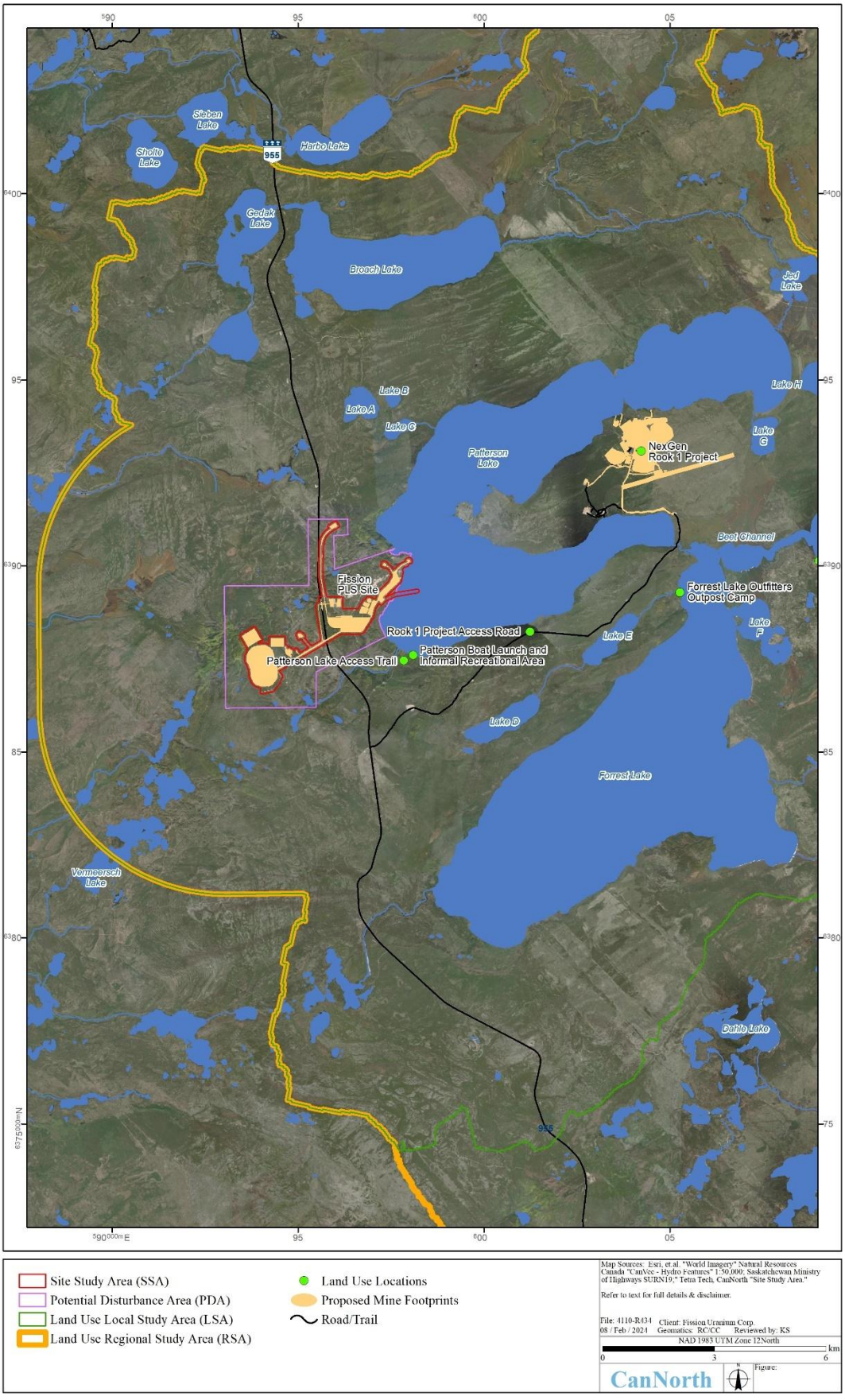


Figure 4-54
Current and reasonably foreseeable land use infrastructure in the land use LSA and RSA.

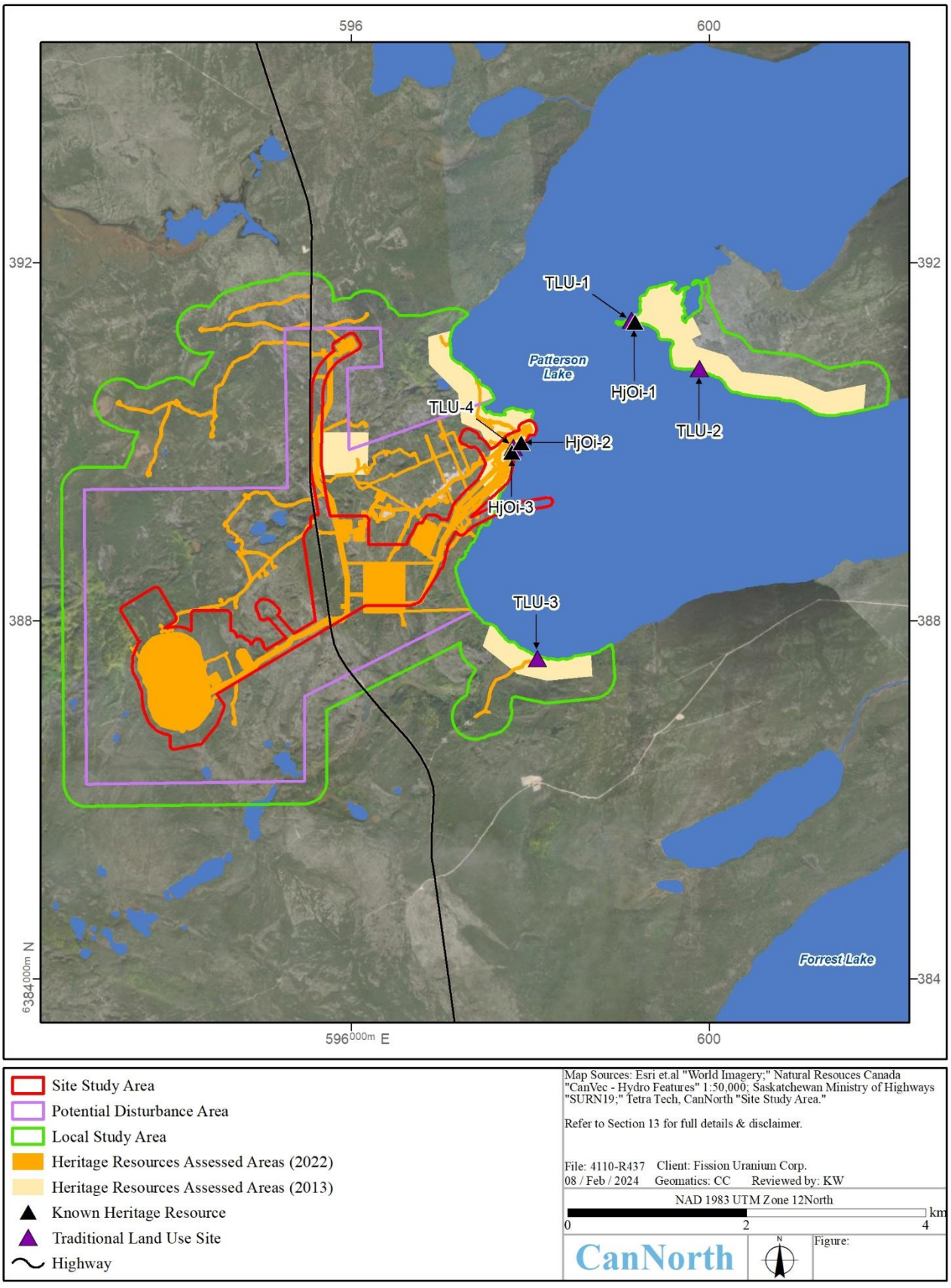


Figure 4-55
Areas assessed for heritage resources in 2013 and 2022, known heritage resources, and traditional land use sites.

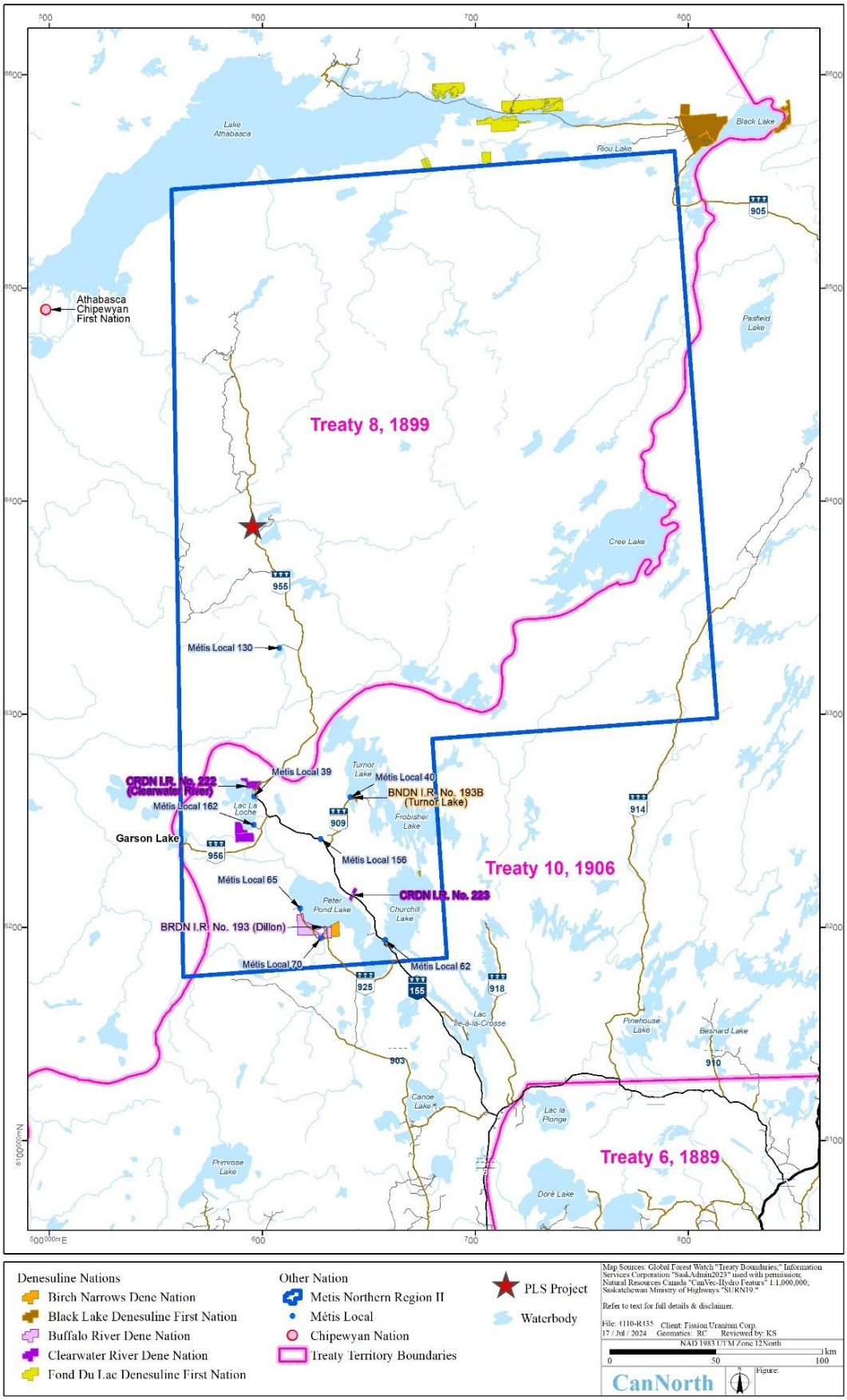


Figure 4-56
Indigenous Nations with documented land use in the Project PDA and land use LSA and RSA.

Table 4-1
Concordance table – existing environment.

EIS Requirement	Section and Page #
General Requirements	
c) concise textual description of baseline conditions and important conclusions	Section 4.0 Existing Environment; 4-1 to 4-113.
d) identification of the government protocols or detailed descriptions of the alternative methodologies used to design and carry out baseline data collection	In each subsection throughout Section 4.0; Appendix C.2, C.3, C.4, and C.5
e) tables or diagrams summarizing key data, as appropriate	Figure 4-1 to Figure 4-56 and Table 4-2 to Table 4-44
Biophysical	
Topography and Soils	
c) description, map and shapefile (or reference to widely available data) of land forms and soil classification in the study area	Topography and Soils (4.6.1), 4-49; Figure 4-43
d) topsoil and overburden depths and characterization relative to salvage and reclamation potential	Available Soil Quantity for Reclamation (4.6.1.3); 4-51; Table 4-39
e) special management and conservation measures required due to specific soils and topography	Available Soil Quantity for Reclamation (4.6.1.3); 4-51
Flora	
c) characterization of each of the distinct aquatic and terrestrial vegetation communities in the development area, providing, at a minimum for each type: - estimate of % visual cover for each of the dominant three native species - estimate of % visual cover for each of the dominant three non-native species - estimate of % visual cover for invasive or noxious species; - list of the most prevalent 5-10 secondary species - list of any unusual or relevant indicator species	Land Cover Classification (4.6.2), 4-53 Vegetation Inventory (4.6.4.1); 4-56
d) list of each SOCC detected and their population sizes, and detected noxious and prohibited weed infestations	Vegetation Inventory (4.6.4.1); 4-56; Table 4-42
e) labelled map and shapefile of each distinct vegetation type	Figure 4-42, Figure 4-45, Figure 4-46
f) list of identified traditional foods or medicinal plants	Vegetation Inventory (4.6.4.1); 4-56

Table 4-1
Concordance table – existing environment.

EIS Requirement	Section and Page #
Fauna	
c) characterization of the aquatic and terrestrial animal populations in the study areas with focus on species likely to be impacted, and considering factors such as: - population sizes and dynamics - habitat requirements - life stage and seasonal requirements - migratory status - species interdependencies - behavioural sensitivities (e.g., human presence, noise, habitat disturbance)	Benthic Invertebrate Communities (4.5.6); 4-39 Fish and Fish Habitat (4.5.7); 4-41 Wildlife (4.6.5), 4-59
d) depending on siting and impacts, species' presence, population size, composition and distribution	Benthic Invertebrate Communities (4.5.6); 4-39 Fish and Fish Habitat (4.5.7); 4-41 Wildlife (4.6.5), 4-59
e) presence of invasive wildlife species, quantified if the development is likely to cause additional spread	N/A
f) importance of wildlife to traditional uses	First Nation and Metis Land Use (4.7.5); 4-94
g) map and shapefile of key findings (e.g., potentially impacted dens, burrows, roosts, dancing grounds, spawning habitat)	Figure 4-39, Figure 4-47, Figure 4-48, Figure 4-49, and Figure 4-50
Species of Conservation Concern	
c) summaries of SOCC detected during field surveys provided in tabular format identifying each species, the scientific name, local population size, federal and provincial status	Tables 4-42 and 4-44
d) labelled map and shapefile with point locations for all observed SOCC individuals or populations overlaid with historic locations of SOCC for HABISask	Figure 4-45 to Figure 4-50
e) identification of critical habitat or habitat avoidance zones (e.g., woodland caribou range, Wildlife Siting Guidelines for Saskatchewan Wind Energy Projects) in the local and regional study areas	Wildlife (4.6.5); 4-59 to 4-68

Table 4-1

Concordance table – existing environment.

EIS Requirement	Section and Page #
Surface Water	
c) delineation and classification of wetlands, streams, rivers and lakes	Aquatic Environment (4.5); 4-24 Land Cover Classification (4.6.2); 4-53
d) identification of surface water users within the regional study area and map and shapefile (or reference to widely available data) of locations	Surface Water Uses (4.5.1.1); 4-26 Land and Resource Use (4.7.2); 4-80; Figure 4-53 to Figure 4-54
e) maps indicating potentially impacted surface waters in the context of the watersheds, drainage basins, water flow direction and type of impact	Figure 4-20 and Figure 4-21; impacts are addressed in Effects Assessment Section 6.0
f) key surface water uses including community, residential, agricultural, industrial, recreational, and commercial fishing	Land and Resource Use (4.7.2); 4-80
g) identification of surface waters potentially directly or indirectly impacted by the development	Aquatic Environment (4.5); 4-24
h) hydrology of surface waters, including key seasonal flow rates and existing water works	Surface Hydrology (4.5.1); 4-25 Figure 4-21, and Figure 4-28 to Figure 4-31
i) total surface area, maximum and mean depths and water level fluctuations for each water body potentially impacted by the development	Surface Hydrology (4.5.1); 4-25 Table 4-14 to Table 4-17 Figure 4-22 to Figure 4-27
j) chemistry of key water bodies potentially impacted by release of run-off, dewatering activities, process water, tailings decant or other by-products of the development	Surface Water Quality (4.5.2); 4-32 Table 4-19 to Table 4-22
k) locations of each baseline water sample	Figure 4-32
Groundwater	
c) identification and mapping of key hydrostratigraphic units, including depth to aquifers and aquitards	Hydrostratigraphic Units (4.4.2); 4-21
d) physical properties of hydrogeological units (e.g., hydraulic conductivity, storativity, transmissivity)	Hydrostratigraphic Units (4.4.2); 4-21
e) historic (where available and relevant) and current groundwater chemistry of all units	Groundwater Chemistry (4.4.3); 4-23
f) horizontal and vertical groundwater flow directions, rates and trends	Hydrostratigraphic Units (4.4.2); 4-21

Table 4-1
Concordance table – existing environment.

EIS Requirement	Section and Page #
Groundwater (continued)	
g) list and map of groundwater receptors potentially impacted by the development	Potential impacts are addressed in Effects Assessment Section 6.0
h) list and map groundwater wells within areas potentially impacted by the development	N/A
i) where risk of groundwater contamination is likely, identify and map areas of groundwater to surface water interactions	Potential impacts are addressed in Effects Assessment Section 6.0
j) identify and map groundwater monitoring wells and test holes, providing relevant construction, hydrostratigraphic and piezometric data	Hydrostratigraphic Units (4.4.2); 4-21; Figure 4-15
Geology and Geochemistry	
c) site lithology including sediment types and thickness of layers	Geology and Geochemistry (4.3); 4-7
d) bedrock and host rock chemistry relevant to the development	Geology of the Patterson Lake Corridor (4.3.3); 4-11
e) discussion of acid-forming and metal-leaching potential of disturbed rock, especially if processed of stored on surface	Geochemistry (4.3.6); 4-19
f) short to long-term potential for fracturing, landslides or subsidence	Stability (4.3.5); 4-17
Atmospheric and Sensory Environment	
c) characterization and distance to site of key receptors for air quality and sensory disruptions	Air Quality (4.2.2); 4-4
d) baseline ambient air constituents within the development area, study areas and airshed likely to be impacted, including particulates, toxic pollutants and greenhouse gas emissions	Air Quality (4.2.2); 4-4
e) current provincial, territorial and federal limits for GHG emission targets and applicability of federal and provincial emission reporting and performance threshold programs	See Project Description Section 2.0
f) ambient daytime and nighttime noise levels and key receptor points	Noise (4.2.4); 4-5
g) visual interferences (e.g., glare, reflections)	N/A
h) ambient nighttime light levels at key receptor points	N/A

Table 4-1
Concordance table – existing environment.

EIS Requirement	Section and Page #
Social, Economic and Health	
c) identification of potentially affected populations and particularly sensitive or vulnerable subsets of populations	Social, Economic, and Health (4.7.1); 4-68
d) current levels of air or water contaminants detrimental to human health	Air Quality (4.2.2); 4-4 Groundwater Chemistry (4.4.3); 4-23 Surface Water Quality (4.5.2); 4-32
e) current status of community services that may be impacted by the development	Social, Economic, and Health (4.7.1); 4-68
f) current levels of employment, income and education that may be altered by the development	Social, Economic, and Health (4.7.1); 4-68
g) current levels of access into the region for local residents and traditional users	Social, Economic, and Health (4.7.1); 4-68 First Nation and Métis Land Use (4.7.5); 4-94
h) current and reasonably near future land use in the study areas	Social, Economic, and Health (4.7.1); 4-68
i) current regional food security	Social, Economic, and Health (4.7.1); 4-68
j) identification and levels of harvesting of traditional foods	Social, Economic, and Health (4.7.1); 4-68 First Nation and Métis Land Use (4.7.5); 4-94
Archaeology and Heritage	
b) results of screening by the Heritage Conservation Branch (HCB) regarding the need for a Heritage Resource Impact Assessment (HRIA)	Heritage (4.7.4); 4-91
c) if an HRIA was required, a description of historical, archaeological, paleontological, cultural or spiritual resources found in the study area, discussion of their significance and any necessary mitigation for impacts	Heritage (4.7.4); 4-91
d) permit numbers and copies of clearance letters from HCB, if applicable	Heritage (4.7.4); 4-91
First Nations and Metis Land Use	
c) confirmation that the activities specified in the letter assigning procedural aspects of the duty to consult to the proponent were conducted	First Nation and Métis Land Use (4.7.5); 4-94
d) map showing the development area, local and regional study areas, extent of the lease area relative to the location of First Nation Reserves and Metis communities (represented by Metis Nation – Saskatchewan or the Metis Locals)	First Nation and Métis Land Use (4.7.5); 4-94

Table 4-1
Concordance table – existing environment.

EIS Requirement	Section and Page #
First Nations and Metis Land Use (continued)	
e) summary of contemporary use of the area for the exercise of rights and traditional uses	First Nation and Métis Land Use (4.7.5); 4-94
f) copies of traditional use studies, or any other maps showing important hunting, fishing, trapping, gathering, spiritual, cultural, burial locations and access routes the community has provided	First Nation and Métis Land Use (4.7.5); 4-94
g) identification of environmental attributes and species important to the exercise of rights and traditional uses	First Nation and Métis Land Use (4.7.5); 4-94
h) timing, duration and frequency of traditional practices	First Nation and Métis Land Use (4.7.5); 4-94
i) access and travel routes use for exercising rights practicing traditional uses	First Nation and Métis Land Use (4.7.5); 4-94
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Section 4.0 Existing Environment; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (4.8); 4-113
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 4.0 Existing Environment; throughout

Table 4-2

Monthly summaries of the meteorological data collected at the Project area, 2014 to 2022.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Daily Mean (°C)	-18.0	-19.6	-10.1	-2.0	8.0	14.3	16.4	14.8	8.2	0.8	-9.6	-17.5	-1.1
Daily Maximum (°C)	-13.4	-13.7	-3.2	4.7	15.3	20.8	23.0	21.1	13.9	4.9	-6.0	-13.2	4.5
Daily Minimum (°C)	-23.2	-26.2	-17.8	-9.9	-0.6	6.8	9.4	8.0	2.4	-3.4	-13.8	-22.7	-7.4
Extreme Maximum (°C)	5.0	11.2	14.0	24.2	32.3	39.0	37.0	33.0	31.5	24.0	11.5	6.5	39.0
Extreme Minimum (°C)	Less than -40.2	Less than -40.2	Less than -40.2	-35.6	-24.6	-3.6	1.4	-1.2	-11.7	-20.2	-35.2	Less than -40.2	Less than -40.2
Precipitation[1,2]													
Average Monthly Precipitation (mm)	16.9	22.7	21.1	21.0	29.5	54.9	39.6	45.7	36.6	27.1	18.2	23.9	357.0
Extreme Daily Precipitation (mm)	10.9	16.3	13.2	15.5	19.8	36.8	26.2	39.9	24.4	19.8	11.7	33.0	39.9
Wind Speed													
Speed (km/h)	7.8	9.6	9.8	9.9	9.6	9.4	9.0	9.2	9.5	10.2	9.4	7.1	9.2
Most Frequent Direction	NW	WNW	NW	NW	E	WNW	NW	WNW	WNW	NW	NW	WNW	NW
Maximum Hourly Speed (km/h)	65.3	63.5	72.8	59.8	71.0	74.2	75.4	72.0	58.9	69.9	55.7	70.8	75.4
Solar Radiation													
Total Radiation (MJ/m^2)	1608.7	3171.8	2051.4	1707.3	3206.4	1456.5	2964.6	3318.8	2100.6	2171.8	3521.1	2519.6	29798.8
Average Daytime Radiation (W/m^2)	75.7	168.4	109.4	94.1	171.0	70.5	138.4	143.9	90.0	90.1	150.9	104.9	116.5
Maximum Hourly Radiation (W/m^2)	402.1	765.0	1024.0	1328.0	1403.0	1392.0	1375.0	1267.0	1094.0	783.6	579.7	258.5	1403.0
Relative Humidity													
Daily Mean (%)	81.4	75.5	68.7	61.4	56.0	63.4	67.8	70.3	76.3	80.1	84.5	81.7	72.9
Daily Maximum (%)	85.4	83.3	86.5	87.6	87.4	91.8	93.4	94.0	95.2	93.6	90.5	86.0	89.8
Daily Minimum (%)	76.3	64.3	47.1	36.2	30.5	35.8	39.5	42.8	49.6	61.9	75.5	76.7	53.9

[1]Total precipitation is the water equivalent of all types of precipitation; the water equivalent of snowfall is computed by dividing the measured amount by ten.

[2]Issues with the precipitation and snow tube sensors throughout 2014 to 2022 meant that multiple data points were not collected.

The meteorological station was removed on February 20, 2022 for calibration and reinstalled on June 1, 2022; therefore, no data were collected during that time period.

E = east, NW = northwest, WNW = west, northwest.

Table 4-3

Summary of suspended particle matter monitoring results from the Project area, 2018 to 2022.

Parameter	AQM-W[1]			AQM-E[1]			HVAS[2]
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP
Sample Efficiency							
Sample Count	16	11	11	20	5	10	16
Samples Attempted	22	11	11	22	11	11	16
Sample Efficiency	73%	100%	100%	91%	45%	91%	100%
Results Summary							
Maximum (µg/m^3)	51.4	24.9	17.9	46.6	25.8	15.5	173.3
Minimum (µg/m^3)	1.4	<1.2	<0.6	1.6	5.4	<0.4	<2.9
Average (µg/m^3)	14.4	6.9	4.2	13.9	13.5	4.1	23.3
Std. Deviation (µg/m^3)	13.7	7.7	5.8	14.3	8.9	5.5	41.3
Geometric Mean (µg/m^3)	9.7	4.3	2.3	8.5	11.3	2	11.7
Results Analysis[3,4]							
24-hr Criteria (µg/m^3)	100	50	27	100	50	27	100
Max. result compared to 24-hr Criteria (%)	51%	50%	66%	47%	52%	57%	173%
Annual Criteria (µg/m^3)	60	20	8.8	60	20	8.8	60
Average result compared to Annual Criteria (%)[5]	16%	21%	48%	14%	56%	46%	19.50%

[1]Particulate data sampled with a PQ200 sampler in 2018 and 2019.

[2]Particulate data sampled with High Volume Air Sampler (HVAS) in 2022. Program only involved sampling Total Suspended Particulate (TSP).

[3]A percent (%) equal to or less than 100 indicates that the result was not over the criteria being compared too.

[4]Criteria for TSP and Particulate Matter equal or less to 10 µm (PM_{10}) comes from the Saskatchewan Ambient Air Quality Standards (SAAQS; ENV 2012); Criteria for Particulate Matter equal or less to 2.5 µm ($PM_{2.5}$) comes from the Canadian Ambient Air Quality Standards (CAAQS; CCME 2012).

[5]The percentages are based on the geometric mean (TSP) and average (PM_{10}, $PM_{2.5}$) concentrations from the data collected, and are therefore not true annual averages. These are provided as an estimate using the available data.

Table 4-4

Summary of high-volume air sampler metals analysis from the Project area, 2022.

Parameter	n	n<DL	AAQC (µg/m^3)[1]	Average (µg/m^3)	Weighted Average (µg/m^3)[2]	Standard Deviation (µg/m^3)	Max. (µg/m^3)	Max. result compared to AAQC (%)[3]
Arsenic	16	15	0.3	0.0009	0.0003	0.0002	0.0009	0.30%
Cadmium	16	2	0.025	0.00076	0.00067	0.0017	0.00698	27.90%
Cobalt	16	15	0.1	0.0008	0.0002	0.0002	0.0008	0.80%
Copper	16	0	50	0.192	0.192	0.098	0.381	0.80%
Lead	16	0	0.5	0.0014	0.0014	0.0019	0.007	1.40%
Nickel	16	3	0.2	0.0007	0.0006	0.0006	0.0024	1.20%
Selenium	16	16	10	N/A	0.00052	0.000003	N/A	N/A
Uranium	16	11	0.3	0.00046	0.00018	0.00037	0.00151	0.50%

[1]Ambient Air Quality Criteria (AAQC) adopted from the Ontario Ministry of the Environment, Conservation, and Parks (MECP 2019).

[2]The "weighted average" is the average that includes the non-detectable results at the concentration associated with the detection limit.

[3]A percent (%) equal to or less than 100 indicates that the result was not over the criteria being compared to.

DL = detection limit; n = number of samples; N/A = no data available.

Table 4-5

Summary of settleable particulate monitoring results from the Project area, 2018 to 2022.

Parameter	Monitoring Location			
	AQM-N	AQM-E	AQM-W	AQM-S
Sample Efficiency				
Sample Count	7	16	14	16
Samples Attempted	7	17	17	17
Sample Efficiency	100%	94%	82%	94%
Results Summary				
Maximum (mg/cm^2/30-day)	0.36	0.83	0.58	0.58
Minimum (mg/cm^2/30-day)	0.03	0.04	0.01	0.07
Average (mg/cm^2/30-day)	0.18	0.22	0.16	0.2
Results Analysis[1]				
Criteria (mg/cm^2/30-day)[2]	2	2	2	2
Max. result compared to Criteria (%)	18%	41%	15%	29%
Average result compared to Criteria (%)	9%	11%	8%	10%

[1]A percent (%) equal to or less than 100 indicates that the result was not over the criteria being compared to.

[2]Criteria based on Saskatchewan Ministry of Environment (ENV) criterion for settleable particulates (ENV 2012).

Table 4-6

Summary of nitrogen dioxide and sulphur dioxide monitoring results from the Project area, 2018 to 2022.

Parameter	Monitoring Location							
	AQM-N		AQM-E		AQM-W		AQM-S	
	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2	NO_2	SO_2
Annual Average								
Results Summary								
Maximum (ppb)	0.2	0.3	0.5	0.3	0.4	0.4	0.4	0.3
Minimum (ppb)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Average (ppb)	0.15	0.27	0.24	0.21	0.17	0.2	0.2	0.22
Results Analysis[1,2,3]								
Annual Criteria (ENV, ppb)	24	8	24	8	24	8	24	8
Average result compared to ENV Criteria (%)	0.6%	3.3%	1.0%	2.7%	0.7%	2.5%	0.8%	2.8%
Annual Criteria (CCME, ppb)	17	5	17	5	17	5	17	5
Average result compared to CCME Criteria (%)	0.9%	5.3%	1.4%	4.3%	1.0%	4.0%	1.2%	4.5%
Adjusted to 24-hr Averaging Period								
Results Summary								
Maximum (ppb)	0.52	0.78	1.3	0.81	1.04	1.04	1.04	1.04
Minimum (ppb)	<0.26	<0.26	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Average (ppb)	0.41	0.72	0.63	0.56	0.45	0.52	0.52	0.59
Results Analysis[1,2]								
24-hr Criteria (ENV, ppb)	106	48	106	48	106	48	106	48
Max. result compared to ENV 24-hr Criteria (%)	0.50%	1.60%	1.20%	1.70%	1.00%	2.20%	1.00%	1.70%
Adjusted to 1-hr Averaging Period								
Results Summary								
Maximum (ppb)	1.26	1.89	3.16	1.98	2.52	2.52	2.52	1.99
Minimum (ppb)	<0.63	<0.63	<0.60	<0.60	<0.60	<0.60	<0.60	<0.60
Average (ppb)	1	1.75	1.53	1.36	1.09	1.27	1.27	1.43
Results Analysis[1,2,3]								
1-hr Criteria (ENV, ppb)	159	170	159	170	159	170	159	170
Max. result compared to ENV 1-hr Criteria (%)	0.80%	1.10%	2.00%	1.10%	1.60%	1.50%	1.60%	1.20%
1-hr Criteria (CCME, ppb)	60	70	60	70	60	70	60	70
Max. result compared to CCME 1-hr Criteria (%)	2.10%	2.70%	5.30%	2.80%	4.20%	3.60%	4.20%	2.80%

[1]A percent (%) equal to or less than 100 indicates that the result was not over the criteria being compared to.

[2]Saskatchewan Ministry of Environment (ENV) criteria based on Saskatchewan Ambient Air Quality Standards (ENV 2012).

[3]Canadian Council of the Ministers of the Environment (CCME) criteria based on Canadian Ambient Air Quality Standards (CCME 2017).

NO_2 = Nitrogen Dioxide; SO_2 = Sulphur Dioxide; ppb = parts per billion.

Table 4-7

Summary of external gamma monitoring results from the Project area, 2018 and 2019.

Campaign	Location	Total Days	Gross (mSv)	Exposure Gross Ambient Dose		Comments
				Daily (µSv/day)	Monthly (µSv/month)	
2018 Round 1 (July)	Gamma-NE	363	N/A	N/A	N/A	Damaged; discarded
	Gamma-SW	94	N/A	N/A	N/A	Suspected contamination; discarded
2018 Round 2 (October)	Gamma-NE	135	0.23	1.73	53.7	
	Gamma-SW	135	0.26	1.9	59	
2019 Round 1 (March)	Gamma-NE	134	0.36	2.66	82.6	
	Gamma-SW	134	0.37	2.76	85.6	
2019 Round 2 (July)	Gamma-NE	98	0.28	2.88	89.2	
	Gamma-SW	98	N/A	N/A	N/A	Damaged; discarded
2019 Round 3 (October)	Gamma-NE	227	0.46	2.01	62.4	
	Gamma-SW	227	0.46	2.04	63.4	

NE = northeast; SW = southwest; N/A = no data available.

Table 4-8

Summary of radon monitoring results from the Project area, 2018 to 2022.

Location	n	n<DL	Weighted Average (Bq/m^3) [1]	Average Detectable (Bq/m^3)	Detectable Range (Bq/m^3)	Detection Limit Range (Bq/m^3)
RAD1	6	5	12.5	**13 ± 8**	**5 to 21**	7 to 15
RAD2	5	5	12.4	N/A	N/A	7 to 15
RAD3	6	6	11.7	N/A	N/A	7 to 15
RAD4	6	6	11.7	N/A	N/A	7 to 15
RAD5	6	6	11.7	N/A	N/A	7 to 15
RAD6	4	4	10.3	N/A	N/A	7 to 15
RAD7	5	4	25.6	**81 ± 14**	**67 to 95**	7 to 15
RAD8	5	4	13.6	**13 ± 6**	**7 to 19**	10 to 15
RAD9	6	6	11.8	N/A	N/A	7 to 15
RAD10	6	6	11.7	N/A	N/A	7 to 15
RAD11	6	6	12	N/A	N/A	7 to 15
RAD12	4	4	10	N/A	N/A	7 to 15

[1]The "weighted average" is the average that includes the non-detectable results at the concentration associated with the detection limit.

n = number of samples; DL = detection limit; N/A = no data available; +/- = uncertainty.

Table 4-9

Baseline noise monitoring results from the Project area, 2018.

Station	Spring			Summer			Fall		
	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	Leq (dBA)	Lmax (dBA)	Lmin (dBA)	Leq (dBA)	Lmax (dBA)	Lmin (dBA)
Station 1	44.1	77.9	16.8	54.9	82.8	17.9	29.4	79.8	17.3
Station 2	36.4	69.7	16.6	43.2	70.5	17.5	42.5	65.1	26
Station 3	34.5	70.1	16.9	44.1	94.8	18.7	45.4	69	18.7

All values calculated using the BZ5503 Utility Software.

Leq: the average sound level that has the same mean square sounds pressure level as the time-varying sound level under consideration.

Lmax: the single highest sound level occurring during the monitoring period.

Lmin: the single lowest sound level occurring during the monitoring period.

dBA = decibels (broadband A-weighted).

Table 4-10

Hydrostratigraphic framework for the hydrogeological Local Study Area.

Eon	Era	Period	Group / Formation	Unit / Domain	Lithology	Hydrostratigraphic Unit
Phanerozoic	Cenozoic	Quaternary	Undifferentiated Glacial Sediments	Stratified Drift	Silt, Sand, Gravel	HSU1
				Undifferentiated Glacial Drift	Sand Till	HSU2
					Silt, Sand and Clay Till	HSU3
	Mesozoic	Cretaceous	Mannville / Cantuar	Transgressive Marine Sediments	Marine Sandstones, Mudstones and Siltstones	
	Paleozoic	Devonian	Elk Point Group	Shallow Elk Point Basin	Dolomitic Siltstones and Shales Interbedded with Limestone	
Proterozoic	Neoptoterozoic to Paleoproterozoic		Athabasca Supergroup	Precambrian Sedimentary Basin	Sandstones	
			Careen Lake	Taltson	Orthogneiss	HSU4

Table 4-11

Summary of Constituents of Potential Concern levels in HSU1, HSU2, and HSU3 groundwater.

Parameters	Units	Geometric Mean	Median	10th Percentile	90th Percentile	Count	SEQG[1]	
							Potable Water	Aquatic Life
Inorganic Ions								
Sulphate	mg/L	2.7	3	1.09	5.42	23	500	100
Metals, Total								
Arsenic	mg/L	0.0007	0.0007	0.0002	0.002	24	0.01	0.005
Cadmium	mg/L	0.000018	0.00001	0.000005	0.00007	27	0.005	0.000017
Copper	mg/L	0.002	0.002	0.0005	0.005	22	1	-
Nickel	mg/L	0.001	0.001	0.0004	0.003	25	-	-
Selenium	mg/L	0.0001	0.0001	0.00005	0.0004	26	0.05	-
Uranium	mg/L	0.0003	0.000305	0.0001	0.0015	26	0.02	0.015
Radionuclides								
Radium-226	Bq/L	0.016	0.02	0.005	0.1	21	0.5	-

[1]Saskatchewan Environmental Quality Guideline (SEQG) - Industrial use for coarse grained soil (GS 2023a).

Bolded values indicate exceedance of SEQG for potable water; underlined values indicate exceedance of SEQG for aquatic life.

Table 4-12

Summary of Constituents of Potential Concern levels in HSU4 groundwater.

Parameters	Units	Geometric Mean	Median	10th Percentile	90th Percentile	Count	SEQG[1]	
							Potable Water	Aquatic Life
Inorganic Ions								
Sulphate	mg/L	2.22	2.67	1.1	3.58	12	500	100
Metals, Total								
Arsenic	mg/L	0.01	0.01	0.001	**0.2**	12	0.01	0.005
Cadmium	mg/L	0.00003	0.00003	0.00001	0.00005	11	0.005	0.000017
Copper	mg/L	0.002	0.003	0.0005	0.005	11	1	-
Nickel	mg/L	0.003	0.004	0.001	0.005	11	-	-
Selenium	mg/L	0.0002	0.0003	0.0001	0.0005	11	0.05	-
Uranium	mg/L	0.001	0.001	0.0001	**0.58**	12	0.02	0.015
Radionuclides								
Radium-226	Bq/L	**1.18**	**1.4**	**0.74**	**2.55**	6	0.5	-

[1]Saskatchewan Environmental Quality Guideline (SEQG) - Industrial use for coarse grained soil (GS 2023a).

Bolded values indicate exceedance of SEQG for potable water; underlined values indicate exceedance of SEQG for aquatic life.

Table 4-13

Aquatic environment baseline data used to describe the existing environment within the Project ASA, 2013 to 2023.

Area	2013	2014 to 2022[1]	2016 to 2017											2019 to 2020							2022			2023
	Fish Community and Habitat	Hydrology	Bathymetry	Seasonal Water Quality	Aquatic Macrophyte Chemistry	Plankton Community	Sediment Quality	Benthic Invertebrate Community	Fish Community	Spring Spawning Survey	Fall Spawning Survey - Lake Trout	Fall Spawning Survey - Lake Whitefish	Fish Chemistry	Habitat Assessment	Bathymetry	Seasonal Water Quality	Plankton Community	Sediment and Benthic Invertebrates	Fish Community	Fish Chemistry	Habitat Assessment	Seasonal Water Quality	Fish Community	Habitat Assessment	Seasonal Water Quality
Primary ASA																									
Jed Creek		✓							✓	✓		✓									✓				
Patterson Lake		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											
Patterson Lake Northeast																✓		✓				✓			
Patterson Lake North																✓		✓				✓			
Patterson Lake West				✓		✓	✓	✓								✓		✓				✓			
Patterson Lake East				✓		✓										✓		✓				✓			
Patterson Lake South																							✓	✓	✓
Patterson Creek		✓							✓	✓		✓									✓				
Forrest Lake		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓				✓			
Forrest Lake - Area 2																						✓			
Beet Channel				✓		✓			✓	✓		✓		✓		✓						✓			
Beet Lake			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓[2]				✓			
Beet Creek		✓							✓	✓				✓											
Naomi Creek									✓	✓		✓									✓				
Naomi Lake		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓							
Naomi Lake South				✓		✓										✓						✓			
Clearwater River (near-field)		✓		✓			✓	✓	✓	✓		✓		✓		✓		✓				✓			

Table 4-13

Aquatic environment baseline data used to describe the existing environment within the Project ASA, 2013 to 2023.

Area	2013	2014 to 2022[1]	2016 to 2017											2019 to 2020							2022			2023
	Fish Community and Habitat	Hydrology	Bathymetry	Seasonal Water Quality	Aquatic Macrophyte Chemistry	Plankton Community	Sediment Quality	Benthic Invertebrate Community	Fish Community	Spring Spawning Survey	Fall Spawning Survey - Lake Trout	Fall Spawning Survey - Lake Whitefish	Fish Chemistry	Habitat Assessment	Bathymetry	Seasonal Water Quality'	Plankton Community	Sediment and Benthic Invertebrates	Fish Community	Fish Chemistry	Habitat Assessment	Seasonal Water Quality	Fish Community	Habitat Assessment	Seasonal Water Quality
Clearwater River (far-field)		✓																			✓				
Lloyd Lake Inlet															✓	✓	✓	✓	✓	✓	✓	✓			
Warner Rapids																✓						✓			
Hodge Lake		✓													✓	✓	✓	✓	✓	✓	✓				
Hodge Lake Area 3																									✓
Broach Lake		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓		✓							
South Creek Downstream																						✓		✓	
South Creek Upstream																						✓		✓	
Pond 1	✓																								
Pond 2	✓																								
Secondary ASA																									
Lake A		✓	✓	✓		✓	✓	✓	✓					✓											
Lake B		✓	✓	✓		✓	✓	✓	✓					✓											
Lake C		✓	✓	✓		✓	✓	✓	✓	✓				✓											
Lake D		✓	✓	✓		✓	✓	✓	✓	✓				✓											
Lake E		✓	✓	✓		✓	✓	✓	✓	✓				✓											
E Creek																					✓			✓	
Lake F		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓											

[1]Sampling initiated at some locations in 2014, with additional locations added in 2016 and 2019; not all locations are continuously monitored.

Table 4-14

Morphometric and hydrological characteristics of waterbodies within the primary Aquatic Study Area.

Morphometric and Hydrological Characteristic	Patterson Lake	Forrest Lake	Beet Lake	Naomi Lake	Broach Lake (Reference)	Hodge Lake (Reference)
Catchment Area (km^2)[1]	263.4	425.5	453.7	585.7	56.7	51.2
Volume (1.0×10^6 m^3)	525.3	1120.1	92.1	4.3	251.2	92.2
Surface Area (km^2)	38.1	42.8	9.84	2.56	9.40	5.45
Mean Depth (m)	13.8	26.2	9.4	1.7	26.8	16.9
Maximum Depth (m)	47.6	82.9	33.1	10.4	86.3	44.4
Number of Islands	1	0	0	0	0	0
Shore Length (km)	53.9	39.4	20.5	14.6	17.2	13.0
Shoreline Development	2.46	1.70	1.84	2.57	1.59	1.57
Volume Development	0.87	0.95	0.85	0.48	0.93	1.14
Number of Inflows	1	3	1	2	1	2
Number of Outflows	1	1	1	1	1	1
Mean Monthly Discharge (m^3/s)	1.04	1.76	1.89	2.51	0.19	0.17
Flushing Rate (Times/Year)	0.06	0.05	0.65	18.6	0.02	0.06

[1]Catchment area was measured at the outflow of each waterbody.

Table 4-15
Physical and flow characteristics of monitoring locations along Clearwater River.

Watercourse	Boundaries	Channel Width (m)	Channel Depth (m)	Mean Annual Open Water Flow (m^3/s)	Min. Daily Open Water Flow (m^3/s)	Date of Min. Daily Open Water Flow	Max. Daily Open Water Flow (m^3/s)	Date of Max. Daily Open Water Flow	Min. Daily Open Water Elevation (m)	Max. Daily Open Water Elevation (m)	Elevation Variability (m)	Stage Discharge Relationship
Jed Creek	Jed Lake to Patterson Lake	10.1	0.42	0.762	0.363	08-Oct-2017	1.42	07-Jun-2020	0.325	0.804	0.479	$\log_{10}(Q) = -1.15 + 4.69\log_{10}(S + 1.09)$
Patterson Lake Outlet	Patterson Lake to Forrest Lake	10.6	0.48	1.36	0.351	18-Nov-2015	2.38	07-Jun-2020	0.082	0.569	0.487	$\log_{10}(Q) = 0.634 + 1.19\log_{10}(S + 0.0397)$
Beet Lake Outlet	Beet Lake to Naomi Lake	22.6	0.64	4.40	1.92	01-Jun-2019	8.33	14-Oct-2020	0.466	0.841	0.375	$\log_{10}(Q) = 1.16 + 2.25\log_{10}(S - 0.0589)$
Clearwater River (Near-Field)	Naomi Lake to Dell Lake	26.7	0.52	4.53	0.706	19-Sep-2017	10.7	12-May-2020	0.553	1.187	0.634	$\log_{10}(Q) = 1.21 + 1.21\log_{10}(S - 0.478)$

Table 4-16

Water level elevation values recorded in the primary ASA, 2014 to 2022.

Station ID	Waterbody	Water Level Elevations									
		Jun-2014	Aug-2014	Sep-2014	Jun-2015	Jul-2015	Sep-2015	May-2016	Jul-2016	Sep-2016	May-2017
14SGPattersonLake	Patterson Lake	97.749	97.579	97.484	97.420	97.465	97.410	97.542	97.557	97.507	97.545
16SGForrestLk	Forrest Lake	-	-	-	-	-	-	98.189	98.132	98.129	98.200
16SGBeetLk	Beet Lake	-	-	-	-	-	-	98.175	98.163	98.135	98.211
16SGNaomiLk	Naomi Lake	-	-	-	-	-	-	97.938	97.893	97.918	97.918
16SGBroachLk	Broach Lake	-	-	-	-	-	-	98.734	98.742	98.681	98.803
19SGHodge Lake	Hodge Lake	-	-	-	-	-	-	-	-	-	-

Station ID	Waterbody	Water Level Elevations										
		Jul-2017	Sep-2017	May-2018	May-2019	Jul-2019	Sep-2019	Jun-2020	Jun-2021	Jun-2022	Jul-2022	Sep-2022
14SGPattersonLake	Patterson Lake	97.487	97.377	97.520	97.517	97.460	97.573	97.737	97.802	97.697	97.604	97.490
16SGForrestLk	Forrest Lake	98.108	98.000	98.211	98.135	98.097	98.214	98.370	98.353	98.310	98.205	98.106
16SGBeetLk	Beet Lake	98.111	98.019	98.312	98.177	98.141	98.275	98.443	98.387	98.387	98.291	98.200
16SGNaomiLk	Naomi Lake	97.865	97.753	97.988	97.902	97.908	98.061	98.130	98.141	98.055	97.993	97.932
16SGBroachLk	Broach Lake	98.695	98.556	98.733	98.677	98.533	98.613	98.767	98.806	-	-	-
19SGHodge Lake	Hodge Lake	-	-	-	97.964	97.936	98.046	98.144	98.205	-	-	-

Staff gauges were not surveyed in May of 2018, so elevation readings may not correspond to previous years. Gauge on Broach Lake were re-installed in May 2018.

Table 4-17

Morphometric and hydrological characteristics of waterbodies within the secondary Aquatic Study Area.

Morphometric Characteristic	Lake A	Lake B	Lake C	Lake D	Lake E	Lake F
Catchment Area (km^2)[1]	3.0	3.0	2.5	8.0	13.6	24.3
Volume (1.0×10^6 m^3)	2.7	0.18	0.39	2.9	6.5	11.5
Surface Area (km^2)	0.59	0.12	0.24	1.06	0.79	1.21
Catchment to Surface Area Ratio	5.1	25	10.4	7.5	17.2	20.1
Mean Depth (m)	4.5	1.4	1.6	2.8	8.2	9.4
Maximum Depth (m)	10.9	2.5	2.4	4.5	20.5	36.4
Number of Islands	0	0	0	0	0	1
Shore Length (km)	3.4	1.3	2.1	5.2	4.4	7.9
Shoreline Development	1.24	1.05	1.23	1.44	1.41	2.00
Volume Development	1.24	1.74	2.03	1.85	1.21	0.77
Number of Inflows	0	0	0	0	1	0
Number of Outflows	0	0	0	1	1	0

[1]Catchment area was measured at the outflow of each waterbody.

Table 4-18

Water quality guideline ranges utilized for comparison to primary and secondary ASA, 2016 to 2022.

Parameter	Units	Guidelines[1]						
		SEQG	CEQG	FEQG	Environmental Factor Used for Guidelines[2]			
					pH	Hardness	DOC	Temperature
Inorganic Ions								
Calcium	mg/L	-	-	-	-	-	-	-
Chloride	mg/L	120	120	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-
Sulphate	mg/L	128 to 218[3]	-	-	-	1 to 34	-	-
Metals								
Aluminum	mg/L	0.028 to 0.05 [4,5]	0.005 to 0.1[6]	0.06 to 2.5[7]	4.48 to ≥6.5 [5,6], ≤6 to ≥8.7[7]	≤10 to 34	1.2 to ≥12.3	-
Arsenic	µg/L	5	5	-	-	-	-	-
Cadmium	mg/L	0.00004 to 0.00006[8]	0.00004 to 0.00006[8]	-	-	≤17 to 34	-	-
Chromium	mg/L	-	-	-	-	-	-	-
Cobalt	mg/L	0.000778[9]		0.000778[9]	-	1 to 34	-	-
Copper	mg/L	0.007	0.002[10]	0.0002 to 0.0035[3,11]	4.48 to 8.87	1 to 34	1.2 to 14	0.2 to 22.2
Iron	mg/L	0.3	-	1.0 to 4.5[12]	≤6 to ≥8.7	-	1.2 to ≥9.9	-
Lead	mg/L	0.001[13]	0.001[13]	0.003 to 0.0072[3,14]	-	≤4.7 to 34	1.2 to 14	-
Manganese	mg/L	0.09 to 0.38[15]	0.09 to 0.38[15]	-	4.48 to 8.87	1 to 34	-	-
Mercury	ng/L	5	26	-	-	-	-	-
Molybdenum	mg/L	0.073	0.073	-	-	-	-	-
Nickel	mg/L	0.025[16]	0.025[16]	-	-	1 to 34	-	-
Selenium	mg/L	0.002	0.001	-	-	-	-	-
Thallium	mg/L	0.0008	0.0008	-	-	-	-	-
Uranium	µg/L	15	15	-	-	-	-	-
Zinc	mg/L	0.03	0.003 to 0.029[3,17]	-	≤6.5 to ≥8.13	≤23.4 to 34	1.2 to 14	-
Nutrients								
Un-Ionized Ammonia	mg/L	0.019	0.019	-	-	-	-	-
Ammonia, N	mg/L	0.119 to 187[18]	0.119 to 187[18]	-	4.48 to 8.87	-	-	0.2 to 22.2
DOC	mg/L	-	-	-	-	-	-	-
Nitrate	mg/L	13	13	-	-	-	-	-
Phosphorus	mg/L	-	Narrative[19]	-	-	-	-	-
Physical Properties								
Hardness, Total	mg/L	-	-	-	-	-	-	-
pH	-	Low 6.5 and High 9.0	Low 6.5 and High 9.0	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	Narrative[20]	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-

Table 4-18

Water quality guideline ranges utilized for comparison to primary and secondary ASA, 2016 to 2022.

Parameter	Units	Guidelines[1]						
		SEQG	CEQG	FEQG	Environmental Factor Used for Guidelines[2]			
					pH	Hardness	DOC	Temperature
Radionuclides								
Lead-210	Bq/L	-	-	-	-	-	-	-
Polonium-210	Bq/L	-	-	-	-	-	-	-
Radium-226	Bq/L	0.11	0.11	-	-	-	-	-
Thorium-230	Bq/L	-	-	-	-	-	-	-

Italicized parameters represent the Constituents of Potential Concern (COPCs) of the Project.

[1]SEQG = Saskatchewan Environmental Quality Guidelines for freshwater aquatic life (GS 2023a), CEQG = Canadian Environmental Quality Guidelines (CCME 2023), FEQG = Federal Environmental Quality Guidelines (ECCC 2021).

[2]Guidelines were calculated individually for each parameter using the specific environmental factors collected at the time of collection. The ranges below represent the range of environmental factors from each sampling location and seasonal event.

[3]Sulphate guideline based on hardness: 128 mg/L at hardness = 0 mg/L to 30 mg/L; 218 mg/L at hardness = 31 mg/L to 75 mg/L.

[4]Guideline for a dissolved parameter concentration has been applied to the total concentration of the parameter.

[5]Aluminum guideline based on field pH measurements: SEQG = 0.05 mg/L if pH ≥6.5, if pH <6.5 the following formula was used:
SEQG=EXP((1.6-3.327*(pH)+0.402*(pH)^2)).

[6]Aluminum guideline is based on field pH measurements: 0.005 mg/L if pH <6.5 or 0.1 mg/L if pH ≥6.5.

[7]Aluminum guideline is based on hardness, pH, and dissolved organic carbon (DOC). Guideline is derived using the formula:
FEQG=EXP((0.645*LN(DOC))+(2.255*ln(Hardness))+(1.995*pH)+(-0.284*(ln(Hardness)*pH))-9.898). Equation valid between hardness 10 mg/L and 430 mg/L, pH 6 and 8.7, and DOC 0.08 mg/L and 12.3 mg/L. Concentrations above/below range were rounded to the upper/lower limits.

[8]Cadmium guideline based on hardness. Guideline is derived using the formula: CEQG= (10^(0.83(log[hardness]) – 2.46))/1000. Equation valid between hardness 17 mg/L and 280 mg/L. Concentrations below range were rounded to the lower limit.

[9]Cobalt guideline is based on hardness. Guideline was derived using the formula: FEQG=EXP(0.414*(LN(Hardness))-1.887). Equation valid between hardness 52 mg/L and 396 mg/L. For hardness below this range, the lowest possible guideline was used.

[10]Copper guideline is based on hardness. Guideline was derived using the formula: CEQG = (0.2*EXP(0.8545(ln(hardness))-1.465))/1000. Equation valid between hardness 82 mg/L and 180 mg/L. For hardness below this range, the lowest possible guideline was used.

[11]Copper guideline modeled using the Biotic Ligand Model using values of temperature, pH, DOC, and hardness.

[12]Iron guideline is based on pH and DOC. Guideline is derived using the formula: FEQG = (EXP(0.671*(LN(DOC)) +0.171*(pH)+5.586)/1000. Equation valid between DOC 0.3 mg/L and 9.9 mg/L and pH 6.1 and 8.1. Concentrations above/below range were rounded to the upper/lower limits.

[13]Lead guideline is based on hardness. Guideline was derived using the formula: CEQG=(EXP(1.273*(LN(Hardness))-4.705))/1000. Equation valid between hardness 60 mg/L and 180 mg/L. For hardness below this range, the lowest possible guideline was used.

[14]Lead guideline is based on DOC and hardness. Guideline is derived using the formula: FEQG = (EXP(0.514*(LN(DOC)) + 0.214*(LN(Hardness)) + 0.4152))/1000.
Equation valid between DOC 0.5 mg/L and 31.5 mg/L and hardness 4.7 mg/L and 511 mg/L. Concentrations above/below range were rounded to the upper/lower limits.

[15]Manganese guideline is based on hardness and pH using a model averaged species sensitivity approach.

[16]Nickel guideline is based on hardness. Guideline is derived using the formula: CEQG = (EXP(0.76*(LN(Hardness)) + 1.06))/1000. Equation valid between hardness 60 mg/L and 180 mg/L. For hardness below this range, the lowest possible guideline was used.

[17]Zinc guideline is based on DOC, pH, and hardness. Guideline is derived using the formula:
FEQG = (EXP(0.947*(LN(Hardness))-0.815*(pH)+0.398*(LN(DOC))+4.625))/1000. Equation valid between DOC 0.3 mg/L and 22.9 mg/L, pH 6.5 and 8.13, and hardness 23.4 mg/L and 399 mg/L. Concentrations above/below range were rounded to the upper/lower limits.

[18]Ammonia guideline based on field measured water temperature and pH and applied to a guideline line table supplied by CCME.

[19]Long-term concentration (µg/L) guidance framework for phosphorus: ultra-oligotrophic = <4 µg/L; oligotrophic = 4-10 µg/L; mesotrophic = 10-20 µg/L; meso-eutrophic = 20-35 µg/L; eutrophic = 35-100 µg/L; and hyper-eutrophic = >100 µg/L.

[20]Clear flows or clear waters: maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
High flows or turbid waters: maximum increase of 25 mg/L from background levels at any time when background levels are between 25 mg/L and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Table 4-19

Field measured water quality parameters within the primary ASA, 2016 to 2023.

Waterbody	Stations	Temperature (°C)				Dissolved Oxygen (mg/L)				Specific Conductivity (µS/cm)				pH			
		n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max
South Creek	Downstream	3	9.3	11.1	14.2	3	8.54	9.22	9.70	3	50.2	59.8	66.7	3	6.95	7.02	7.10
	Upstream	3	6.2	12.5	18.8	3	**6.45**	8.58	11.56	3	53.7	63.2	71.7	3	6.68	7.14	7.84
Patterson Lake	Northeast	178	0	9.2	21.3	178	**0.12**	9.19	15.33	178	10.4	31.6	135.9	178	**6.03**	7.03	7.68
	North	235	0.07	6.8	19.2	235	7.50	10.97	14.90	235	36.1	37.6	44.1	235	**6.37**	7.15	7.72
	West	201	0.04	9.6	21.7	201	**0.21**	8.83	15.62	201	31.1	41.6	215.7	201	**5.83**	7.19	8.15
	East	570	0	6.5	19.0	570	**0**	10.0	15.58	570	0.4	39.5	73.7	570	**6.10**	7.07	7.86
	South	27	8.5	13.8	17.5	27	9.7	11.6	15.80	27	32.3	36.0	37.5	27	7.10	7.45	7.62
Forrest Lake	North (area 2)	96	0	7.5	17.2	96	9.26	11.31	15.15	96	46.6	47.7	58.4	96	6.91	7.38	7.70
	South	607	0.06	5.2	18.2	607	**0.26**	10.54	14.77	607	43.0	48.5	223.7	607	**6.48**	7.29	8.32
Beet Channel	Beet Channel	44	0.08	11.0	22.2	44	6.75	10.28	13.64	44	33.0	44.0	51.6	44	**6.44**	7.37	7.96
Beet Lake	Beet Lake	385	0	7.6	19.5	385	**0.10**	9.20	14.07	385	36.8	44.5	96.7	385	**6.01**	7.17	9.56
Naomi Lake	Naomi Lake	61	0.1	10.9	22.6	61	**0.09**	7.94	10.70	61	22.4	28.5	71.2	61	**6.10**	6.86	7.54
	South	48	0.1	11.0	20.7	48	**3.84**	10.13	13.73	48	34.6	42.4	52.8	48	6.50	7.29	7.77
Clearwater River	Near-field	15	0.5	13.8	19.8	15	6.50	9.39	11.32	15	29.3	36.7	42.1	15	6.58	7.14	7.70
Lloyd Lake Inlet	Lloyd Lake Inlet	37	0.5	11.3	21.6	37	**6.26**	9.15	10.96	37	25.6	30.3	37.6	37	**5.72**	6.57	7.08
Warner Rapids	Warner Rapids	7	0.2	12.7	18.6	7	**5.84**	8.78	11.20	7	26.0	30.7	37.8	7	**5.44**	6.81	7.55
Broach Lake	Broach Lake	600	0.06	5.0	19.2	600	**0.06**	10.06	14.29	600	29.6	39.2	171.9	600	**6.04**	7.03	8.29
Hodge Lake	Hodge Lake	157	0.5	6.4	17.7	157	6.63	10.56	13.20	157	26.8	27.8	31.7	157	**6.00**	6.58	7.37
	Hodge Lake (area 3)	26	0.3	12.0	17.1	26	9.33	10.37	13.67	26	24.3	26.8	33.6	26	6.64	7.27	7.86
Pond 1	-	1	22.4	22.4	22.4	1	8.14	8.14	8.14	1	6.6	6.6	6.6	1	**6.02**	**6.02**	**6.02**
Pond 2	-	1	20.2	20.2	20.2	1	7.70	7.70	7.70	1	12.4	12.4	12.4	1	**6.46**	**6.46**	**6.46**

Table 4-19

Field measured water quality parameters within the primary ASA, 2016 to 2023.

Waterbody	Stations	Depth Total (m)				Secchi Depth (m)				Ice Thickness (m)				Snow Depth (m)			
		n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max
South Creek	Downstream	2	0.2	0.4	0.6	2	0.2	0.4	0.6	-	-	-	-	-	-	-	-
	Upstream	2	0.2	0.4	0.5	2	0.2	0.4	0.5	-	-	-	-	-	-	-	-
Patterson Lake	Northeast	9	20.5	21.2	22.3	7	3.0	3.9	4.8	2	0.51	0.53	0.55	2	0.15	0.25	0.35
	North	8	27.7	28.7	30.2	6	3.7	6.6	8.1	2	0.55	0.60	0.65	2	0.40	0.46	0.51
	West	12	13.6	15.6	16.8	9	4.4	6.5	9.4	3	0.62	0.74	0.85	3	0.12	0.25	0.32
	East	12	46.0	46.8	48.3	9	5.1	6.4	8.0	3	0.50	0.67	0.90	3	0.11	0.25	0.35
	South	3	8	8.0	8.1	3	5.5	6.1	7.20	-	-	-	-	-	-	-	-
Forrest Lake	North (area 2)	4	22.5	23.3	24.1	3	6.8	8.3	9.8	1	0.72	0.72	0.72	1	0.35	0.35	0.35
	South	8	75.1	76.4	79.9	6	7.0	10.0	13.0	2	0.55	0.69	0.83	2	0.20	0.33	0.45
Beet Channel	Beet Channel	11	1.4	1.6	2.0	8	1.4	1.7	2.0	3	0.51	0.61	0.78	3	0.32	0.35	0.40
Beet Lake	Beet Lake	12	29.6	31.3	33.0	10	1.6	5.1	7.9	3	0.45	0.60	0.81	3	0.27	0.34	0.40
Naomi Lake	Naomi Lake	8	5.1	6.9	8.8	6	1.3	2.2	2.6	2	0.42	0.61	0.79	2	0.31	0.38	0.45
	South	12	1.4	1.8	2.1	9	0.8	1.6	1.9	3	0.35	0.56	0.81	3	0.28	0.39	0.50
Clearwater River	Near-field	9	0.5	0.7	1.1	8	0.5	0.7	1.1	1	0.21	0.21	0.21	1	0.05	0.05	0.05
Lloyd Lake Inlet	Lloyd Lake Inlet	6	4.3	5.5	6.7	5	2.2	2.8	4.1	1	0.62	0.62	0.62	1	0.31	0.31	0.31
Warner Rapids	Warner Rapids	6	0.2	0.4	0.6	5	0.2	0.4	0.5	1	0.50	0.50	0.50	1	0.35	0.35	0.35
Broach Lake	Broach Lake	8	51.0	76.4	85.0	6	4.8	7.3	9.0	2	0.49	0.67	0.84	2	0.32	0.37	0.42
Hodge Lake	Hodge Lake	4	37.8	38.6	39.5	3	6.4	8.0	9.0	1	0.48	0.48	0.48	1	0.33	0.33	0.33
	Hodge Lake (area 3)	4	5.4	5.6	6.0	3	5.4	5.6	6.0	1	0.74	0.74	0.74	1	0.67	0.67	0.67
Pond 1	-	1	0.4	0.4	0.4	1	0.4	0.4	0.4	-	-	-	-	-	-	-	-
Pond 2	-	1	0.4	0.4	0.4	1	0.4	0.4	0.4	-	-	-	-	-	-	-	-

n = sample size, min = minimum; max = maximum.

Highlighted values fall outside of the available SEQG range.

Note: summary statistics calculated from all available measurements, including profile measurements; thus, the n varies by location.

Table 4-20

Summary statistics of select water quality parameters within the primary ASA, 2016 to 2023.

Parameter	Units	RDL	South Creek										Patterson Lake														
			Downstream					Upstream					Northeast					North					West				
			n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc
Inorganic Ions																											
Calcium	mg/L	0.1	3	4.9	6.1	6.9	-	3	4.9	6.4	7.7	-	8	2.7	3.0	3.3	-	8	3.4	3.7	4.0	-	12	3.5	3.9	4.5	-
Chloride	mg/L	0.1	3	<0.1	0.1	0.1	0	3	<0.1	0.2	0.3	0	8	0.4	0.4	0.4	0	8	0.5	0.6	0.6	0	12	0.5	0.6	0.7	0
Magnesium[1]	mg/L	0.1	3	2.3	2.8	3.2	-	3	2.4	3.0	3.5	-	8	0.8	1.0	1.1	-	8	1.2	1.3	1.4	-	12	1.2	1.4	1.6	-
Potassium[1]	mg/L	0.1	3	0.6	0.6	0.7	-	3	0.6	0.7	0.8	-	8	0.3	0.5	0.5	-	8	0.4	0.5	0.6	-	12	0.2	0.5	0.7	-
Sodium	mg/L	0.1	3	1.1	1.3	1.5	-	3	1.2	1.3	1.5	-	8	1.1	1.3	1.4	-	8	1.3	1.4	1.6	-	12	0.8	1.4	1.6	-
Sulphate	mg/L	0.2	3	0.7	1.0	1.3	0	3	0.9	1.1	1.2	0	8	1.1	1.2	1.3	0	8	1.4	1.4	1.6	0	12	1.1	1.5	2.2	0
Metals																											
Aluminum	mg/L	0.0005	3	0.0023	0.0053	0.0077	0	3	0.0006	0.0046	0.0075	0	8	0.0005	0.0032	0.0056	0	8	<0.0005	0.0016	0.0042	0	12	<0.0005	0.0017	0.0045	0
Arsenic	µg/L	0.1	3	0.1	0.2	0.3	0	3	0.3	0.3	0.4	0	8	0.1	0.1	0.1	0	8	0.1	0.1	0.2	0	12	<0.1	0.1	0.2	0
Cadmium	mg/L	0.00001	3	<0.00001	0.00001	0.00001	0	3	<0.00001	<0.00001	<0.00001	0	8	<0.00001	<0.00001	<0.00001	0	8	<0.00001	<0.00001	<0.00001	0	12	<0.00001	0.00001	0.00001	0
Chromium	mg/L	0.0005	3	<0.0005	<0.0005	<0.0005	-	3	<0.0005	<0.0005	<0.0005	-	8	<0.0005	<0.0005	<0.0005	-	8	<0.0005	<0.0005	<0.0005	-	12	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	3	<0.0001	0.0001	0.0001	0	3	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	3	<0.0002	0.0002	0.0002	0	3	<0.0002	<0.0002	<0.0002	0	8	<0.0002	0.0002	0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	0.0002	0.0002	0
Iron	mg/L	0.0005	3	0.91	2.01	3.35	3	3	1.2	1.45	1.58	3	8	0.04	0.17	0.47	1	8	0.008	0.012	0.02	0	12	0.015	0.037	0.11	0
Lead	mg/L	0.0001	3	<0.0001	<0.0001	<0.0001	0	3	<0.0001	0.0009	0.0025	1	8	<0.0001	0.0001	0.0001	0	8	<0.0001	0.0003	0.0015	1	12	<0.0001	0.0001	0.0003	0
Manganese	mg/L	0.0005	3	0.081	0.18	0.32	0	3	0.026	0.035	0.052	0	8	0.004	0.028	0.084	0	8	0.002	0.013	0.029	0	12	0.0075	0.051	0.33	1
Mercury	ng/L	1	3	<1	<1	<1	0	3	<1	<1	<1	0	8	<1	2	7	1	8	<1	1.9	5	0	12	<1	1.8	4	0
Molybdenum	mg/L	0.0001	3	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	3	0.0001	0.0001	0.0002	0	3	<0.0001	0.0001	0.0002	0	8	<0.0001	<0.0001	<0.0001	0	8	<0.0001	0.0001	0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Selenium	mg/L	0.0001	3	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	3	<0.0002	<0.0002	<0.0002	0	3	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	3	<0.1	<0.1	<0.1	0	3	<0.1	<0.1	<0.1	0	8	<0.1	<0.1	<0.1	0	8	<0.1	<0.1	<0.1	0	12	<0.1	0.1	0.1	0
Zinc	mg/L	0.0005	3	<0.0005	0.0024	0.0048	0	3	0.0007	0.0034	0.0071	0	8	<0.0005	0.0009	0.0021	0	8	<0.0005	0.0016	0.0056	0	12	<0.0005	0.0014	0.0048	0
Nutrients																											
Un-Ionized Ammonia	mg/L	Variable[2]	3	<0.00002	0.00003	0.00004	0	3	<0.00006	0.00042	0.00113	0	8	<0.00003	0.00009	0.0002	0	8	<0.000005	0.00003	0.00005	0	12	<0.000008	0.00009	0.00036	0
Ammonia, N	mg/L	0.01	3	0.01	0.01	0.01	0	3	0.03	0.05	0.06	0	8	0.01	0.04	0.06	0	8	<0.01	0.01	0.01	0	12	<0.01	0.03	0.11	0
DOC[1]	mg/L	0.2	3	2.3	2.6	3.1	-	3	2.9	3.9	5.0	-	8	2.6	3.2	3.9	-	8	2	2.2	2.7	-	12	1.6	2.1	2.6	-
Nitrate[1]	mg/L	0.04	3	0.26	0.38	0.58	-	3	<0.04	<0.04	<0.04	-	8	<0.04	0.08	0.28	-	8	<0.04	0.06	0.13	-	12	<0.04	0.14	0.53	-
Phosphorus[1]	mg/L	0.01	3	0.01	0.02	0.03	-	3	0.01	0.02	0.02	-	8	<0.01	0.01	0.01	-	8	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-
Physical Properties																											
Hardness, Total	mg/L	1	3	22	27	30	-	3	22	28	34	-	8	10	11	12	-	8	13	15	16	-	12	14	15	18	-
TDS	mg/L	1 to 5[3]	3	43	54	62	-	3	42	47	54	-	8	18	30	40	-	8	26	33	40	-	12	24	34	42	-
TSS[1]	mg/L	1	3	4	9	17	-	3	4	5	7	-	8	<1	2	3	-	8	<1	1	1	-	12	<1	1	2	-
Turbidity[1]	NTU	0.1	3	1.8	4.6	8.2	-	3	2.9	3.4	4.4	-	8	0.4	1.1	1.8	-	8	0.4	0.4	0.5	-	12	0.2	0.6	1.2	-
Radionuclides																											
Lead-210	Bq/L	0.02	3	<0.02	<0.02	<0.02	-	3	<0.02	<0.02	<0.02	-	8	<0.02	<0.02	<0.02	-	8	<0.02	<0.02	<0.02	-	12	<0.02	<0.02	<0.02	-
Polonium-210	Bq/L	0.005	3	<0.005	<0.005	<0.005	-	3	<0.005	<0.005	<0.005	-	8	<0.005	<0.005	<0.005	-	8	<0.005	<0.005	<0.005	-	12	<0.005	<0.005	<0.005	-
Radium-226	Bq/L	0.005	3	<0.005	0.006	0.007	0	3	<0.005	0.005	0.005	0	8	<0.005	0.006	0.008	0	8	<0.005	0.005	0.006	0	12	<0.005	0.005	0.009	0
Thorium-230	Bq/L	0.01	3	<0.01	<0.01	<0.01	-	3	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-	12	<0.01	0.01	0.02	-

Table 4-20

Summary statistics of select water quality parameters within the primary ASA, 2016 to 2023.

Parameter	Units	RDL	Patterson Lake									Forrest Lake										Beet Channel				
			East					South				North (Area 2)					South									
			n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc
Inorganic Ions																										
Calcium	mg/L	0.1	12	3.5	3.9	4.5	-	4	3.7	3.725	3.8	-	4	4.4	4.6	5.0	-	8	3.7	4.4	4.8	-	12	2.7	4.1	5.3	-
Chloride	mg/L	0.1	12	0.5	0.6	0.7	0	4	0.5	0.575	0.6	0	4	0.8	0.9	0.9	0	8	0.7	0.8	1.0	0	12	0.4	0.6	0.9	0
Magnesium[1]	mg/L	0.1	12	1.2	1.4	1.6	-	4	1.3	1.35	1.4	-	4	1.6	1.7	1.8	-	8	1.6	1.7	1.8	-	12	1	1.5	1.9	-
Potassium[1]	mg/L	0.1	12	0.3	0.5	0.8	-	4	0.5	0.525	0.6	-	4	0.8	0.8	0.9	-	8	0.4	0.8	0.9	-	12	0.4	0.6	0.8	-
Sodium	mg/L	0.1	12	1.3	1.4	1.6	-	4	1.4	1.425	1.5	-	4	1.9	2.0	2.1	-	8	1.8	2.0	2.1	-	12	1.2	1.7	1.9	-
Sulphate	mg/L	0.2	12	1.4	1.5	1.8	0	4	1.3	1.4	1.6	0	4	1.4	1.6	1.9	0	8	1.6	1.7	1.9	0	12	1.1	1.6	2.0	0
Metals																										
Aluminum	mg/L	0.0005	12	<0.0005	0.0013	0.0024	0	4	<0.0005	0.00085	0.0018	0	4	<0.0005	0.00073	0.001	0	8	0.0007	0.0016	0.0046	0	12	0.0016	0.0072	0.012	0
Arsenic	µg/L	0.1	12	<0.1	0.1	0.1	0	4	<0.1	0.1	0.1	0	4	0.2	0.2	0.2	0	8	0.1	0.2	0.2	0	12	0.1	0.2	0.2	0
Cadmium	mg/L	0.00001	12	<0.00001	0.00001	0.00001	0	4	<0.00001	<0.00001	<0.00001	0	4	<0.00001	<0.00001	<0.00001	0	8	<0.00001	0.00001	0.00001	0	12	<0.00001	0.00001	0.00001	0
Chromium	mg/L	0.0005	12	<0.0005	<0.0005	<0.0005	-	4	<0.0005	<0.0005	<0.0005	-	4	<0.0005	<0.0005	<0.0005	-	8	<0.0005	<0.0005	<0.0005	-	12	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	12	<0.0002	<0.0002	<0.0002	0	4	<0.0002	<0.0002	<0.0002	0	4	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	0.0007	0.0047	1
Iron	mg/L	0.0005	12	0.0048	0.024	0.067	0	4	0.0014	0.015	0.033	0	4	0.0043	0.014	0.021	0	8	0.0065	0.011	0.017	0	12	0.019	0.045	0.095	0
Lead	mg/L	0.0001	12	<0.0001	0.0001	0.0001	0	4	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Manganese	mg/L	0.0005	12	0.0025	0.13	1.32	1	4	0.0091	0.012	0.015	0	4	0.0011	0.0038	0.0085	0	8	0.0019	0.0053	0.0092	0	12	0.0039	0.0074	0.011	0
Mercury	ng/L	1	12	<1	2	4		4	<1	<1	<1	0	4	<1	1.25	2	0	8	<1	2.13	4	0	12	<1	1.83	6	1
Molybdenum	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	4	<0.0001	0.00053	0.0018	0	4	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	12	<0.0001	0.0001	0.0001	0	4	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	0.0001	0.0001	0
Selenium	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	12	<0.0002	<0.0002	<0.0002	0	4	<0.0002	<0.0002	<0.0002	0	4	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	12	<0.1	0.1	0.1	0	4	<0.1	<0.1	<0.1	0	4	<0.1	<0.1	<0.1	0	8	<0.1	<0.1	<0.1	0	12	<0.1	0.1	0.1	0
Zinc	mg/L	0.0005	12	<0.0005	0.0012	0.0024	0	4	<0.0005	0.00068	0.0012	0	4	<0.0005	0.0012	0.0019	0	8	<0.0005	0.0017	0.0042	0	12	<0.0005	0.0013	0.003	0
Nutrients																										
Un-Ionized Ammonia	mg/L	Variable[2]	12	<0.000011	0.00	0.00064	0	4	<0.000038	<0.000079	<0.00013	0	4	<0.000026	0.000068	0.00011	0	8	<0.00001	0.00006	0.00022	0	12	<0.00001	0.0002	0.0009	0
Ammonia, N	mg/L	0.01	12	<0.01	0.03	0.15	0	4	<0.01	<0.01	<0.01	0	4	<0.01	0.02	0.03	0	8	<0.01	0.02	0.04	0	12	<0.01	0.02	0.05	0
DOC[1]	mg/L	0.2	12	1.7	2.0	2.4	-	4	2.1	2.225	2.4	-	4	1.4	1.6	1.7	-	8	1.2	1.4	1.8	-	12	1.5	2.3	3.1	-
Nitrate[1]	mg/L	0.04	12	<0.04	0.28	2.1	-	4	<0.04	<0.04	<0.04	0	4	<0.04	0.08	0.18	-	8	<0.04	0.05	0.10	-	12	<0.04	0.05	0.13	-
Phosphorus[1]	mg/L	0.01	8	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-
Physical Properties																										
Hardness, Total	mg/L	1	12	14	15	18	-	4	14	14.75	15	-	4	18	19	20	-	8	16	18	19	-	12	11	17	21	-
TDS	mg/L	1 to 5[3]	12	19	35	42	-	4	31	33.5	36	-	4	27	44	53	-	8	32	42	50	-	12	31	39	50	-
TSS[1]	mg/L	1	12	<1	1	2	-	4	<1	1	1	-	4	<1	1	2	-	8	<1	1	1	-	12	<1	2	4	-
Turbidity[1]	NTU	0.1	12	0.2	0.5	1.4	-	4	0.5	0.55	0.6	-	4	0.2	0.3	0.3	-	8	0.1	0.3	0.7	-	12	0.4	0.7	1.4	-
Radionuclides																										
Lead-210	Bq/L	0.02	12	<0.02	<0.02	<0.02	-	4	<0.02	<0.02	<0.02	-	4	<0.02	<0.02	<0.02	-	8	<0.02	<0.02	<0.02	-	12	<0.02	0.02	0.04	-
Polonium-210	Bq/L	0.005	12	<0.005	<0.005	<0.005	-	4	<0.005	<0.005	<0.005	-	4	<0.005	<0.005	<0.005	-	8	<0.005	<0.005	<0.005	-	12	<0.005	<0.005	<0.005	-
Radium-226	Bq/L	0.005	12	<0.005	0.005	0.006	0	4	<0.005	<0.005	<0.005	0	4	<0.005	0.005	0.005	0	8	<0.005	0.005	0.008	0	12	<0.005	0.005	0.007	0
Thorium-230	Bq/L	0.01	12	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-	12	<0.01	<0.01	<0.01	-

Table 4-20

Summary statistics of select water quality parameters within the primary ASA, 2016 to 2023.

Parameter	Units	RDL	Beet Lake					Naomi Lake										Clearwater River (Near-field)				
								Naomi Lake					South									
			n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc
Inorganic Ions																						
Calcium	mg/L	0.1	12	3.6	4.2	4.8	-	8	2.1	2.7	3.4	-	12	3.1	4.0	5.0	-	10	2.8	3.4	4.0	-
Chloride	mg/L	0.1	12	0.5	0.6	0.8	0	8	0.4	0.5	0.6	0	12	0.5	0.7	1.0	0	10	0.5	0.6	0.8	0
Magnesium[1]	mg/L	0.1	12	1.4	1.6	1.8	-	8	0.6	0.8	0.9	-	12	1.1	1.4	1.8	-	10	0.8	1.2	1.4	-
Potassium[1]	mg/L	0.1	12	0.4	0.6	0.7	-	8	0.2	0.4	0.7	-	12	0.3	0.6	0.8	-	10	0.3	0.6	0.7	-
Sodium	mg/L	0.1	12	1.6	1.7	1.8	-	8	0.8	1.1	1.2	-	12	1.4	1.6	1.9	-	10	1.1	1.5	1.8	-
Sulphate	mg/L	0.2	12	1.4	1.5	1.8	0	8	0.6	0.7	1.0	0	12	1	1.4	1.8	0	10	0.7	1.2	1.4	0
Metals																						
Aluminum	mg/L	0.0005	12	0.0007	0.0018	0.0037	0	8	0.0083	0.024	0.059	1	12	0.0016	0.0094	0.018	0	10	0.01	0.021	0.05	0
Arsenic	µg/L	0.1	12	0.1	0.1	0.2	0	8	0.1	0.2	0.2	0	12	0.1	0.1	0.2	0	10	0.1	0.2	0.2	0
Cadmium	mg/L	0.00001	12	<0.00001	0.00001	0.00001	0	8	<0.00001	0.00001	0.00003	0	12	<0.00001	0.00001	0.00001	0	10	<0.00001	0.00001	0.00002	0
Chromium	mg/L	0.0005	12	<0.0005	<0.0005	<0.0005	-	8	<0.0005	<0.0005	<0.0005	-	12	<0.0005	<0.0005	<0.0005	-	10	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	8	<0.0001	0.0001	0.0001	0	12	<0.0001	<0.0001	<0.0001	0	10	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	12	<0.0002	0.0002	0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	0.0002	0.0007	0	10	<0.0002	<0.0002	<0.0002	0
Iron	mg/L	0.0005	12	0.013	0.084	0.21	0	8	0.38	0.92	1.42	8	12	0.028	0.1700	0.54	1	10	0.16	0.36	1.03	4
Lead	mg/L	0.0001	12	<0.0001	0.0002	0.0011	1	8	<0.0001	0.0001	0.0003	0	12	<0.0001	0.0002	0.0008	0	10	<0.0001	<0.0001	<0.0001	0
Manganese	mg/L	0.0005	12	0.0031	0.0330	0.11	1	8	0.019	0.11	0.28	2	12	0.0047	0.015	0.043	0	10	0.012	0.027	0.078	0
Mercury	ng/L	1	12	<1	1.67	3	0	8	<1	1.75	3	0	12	1	1.92	5	0	10	<1	1.3	2	0
Molybdenum	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0	10	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	8	<0.0001	0.0001	0.0001	0	12	<0.0001	0.0001	0.0001	0	10	<0.0001	0.0002	0.0007	0
Selenium	mg/L	0.0001	12	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	12	<0.0001	<0.0001	<0.0001	0	10	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	12	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	12	<0.0002	<0.0002	<0.0002	0	10	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	12	<0.1	<0.1	<0.1	0	8	<0.1	<0.1	<0.1	0	12	<0.1	<0.1	<0.1	0	10	<0.1	<0.1	<0.1	0
Zinc	mg/L	0.0005	12	<0.0005	0.0012	0.0032	0	8	<0.0005	0.0012	0.0024	0	12	<0.0005	0.002	0.012	1	10	<0.0005	0.00083	0.0024	0
Nutrients																						
Un-Ionized Ammonia	mg/L	Variable[2]	12	<0.00001	0.0002	0.0016	0	8	<0.000005	0.00007	0.00014	0	12	<0.00002	0.00012	0.00045	0	10	<0.00001	0.00011	0.00037	0
Ammonia, N	mg/L	0.01	12	<0.01	0.02	0.07	0	8	<0.01	0.03	0.06	0	12	<0.01	0.02	0.06	0	10	<0.01	0.02	0.04	0
DOC[1]	mg/L	0.2	12	1.9	2.2	2.8	-	8	4.6	6.1	7.6	-	12	2.1	3.2	4.3	-	10	3	3.9	7.0	-
Nitrate[1]	mg/L	0.04	12	<0.04	0.10	0.40	-	8	<0.04	0.20	1.00	-	12	<0.04	0.11	0.80	-	10	<0.04	0.06	0.26	-
Phosphorus[1]	mg/L	0.01	8	<0.01	<0.01	<0.01	-	4	<0.01	0.01	0.01	-	8	<0.01	0.01	0.04	-	7	<0.01	<0.01	<0.01	-
Physical Properties																						
Hardness, Total	mg/L	1	12	15	17	19	-	8	8	10	12	-	12	12	16	20	-	10	11	13	16	-
TDS	mg/L	1 to 5[3]	12	30	40	48	-	8	20	34	43	-	12	20	37	48	-	10	32	36	46	-
TSS[1]	mg/L	1	12	<1	2	7	-	8	<1	3	6	-	12	<1	2	10	-	10	<1	4	12	-
Turbidity[1]	NTU	0.1	12	0.4	0.8	1.4	-	8	1.4	3.4	7.9	-	12	0.3	1.3	5.7	-	10	0.8	1.9	4.2	-
Radionuclides																						
Lead-210	Bq/L	0.02	12	<0.02	0.02	0.04	-	8	<0.02	<0.02	<0.02	-	12	<0.02	<0.02	<0.02	-	10	<0.02	0.02	0.02	-
Polonium-210	Bq/L	0.005	12	<0.005	<0.005	<0.005	-	8	<0.005	<0.005	<0.005	-	12	<0.005	<0.005	<0.005	-	10	<0.005	<0.005	<0.005	-
Radium-226	Bq/L	0.005	12	<0.005	0.005	0.008	0	8	<0.005	0.006	0.010	0	12	<0.005	0.005	0.007	0	10	<0.005	0.006	0.010	0
Thorium-230	Bq/L	0.01	12	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-	12	<0.01	<0.01	<0.01	-	10	<0.01	<0.01	<0.01	-

Table 4-20

Summary statistics of select water quality parameters within the primary ASA, 2016 to 2023.

Parameter	Units	RDL	Lloyd Lake Inlet					Warner Rapids					Broach Lake					Hodge Lake									
																		Area 1					Area 3				
			n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc
Inorganic Ions																											
Calcium	mg/L	0.1	6	2.3	3.0	3.3	-	7	2.4	2.9	3.2	-	8	3.1	3.7	4.2	-	4	2.9	3.0	3.0	-	3	2.7	2.8	3.2	-
Chloride	mg/L	0.1	6	0.6	0.7	0.8	0	7	0.4	0.5	0.6	0	8	0.3	0.5	0.8	0	4	1.7	2.0	2.1	0	3	1.8	2.0	2.3	0
Magnesium[1]	mg/L	0.1	6	0.8	1.0	1.1	-	7	0.9	1.0	1.1	-	8	1.2	1.3	1.4	-	4	0.6	0.7	0.7	-	3	0.7	0.7	0.7	-
Potassium[1]	mg/L	0.1	6	0.5	0.5	0.6	-	7	0.5	0.5	0.6	-	8	0.3	0.5	0.6	-	4	0.3	0.3	0.4	-	3	0.3	0.4	0.4	-
Sodium	mg/L	0.1	6	1.2	1.4	1.5	-	7	1.2	1.4	1.6	-	8	1.5	1.6	1.8	-	4	1	1.0	1.0	-	3	0.9	1.0	1.1	-
Sulphate	mg/L	0.2	6	0.8	1.0	1.2	0	7	0.9	1.0	1.2	0	8	1.7	1.9	2.0	0	4	1	1.1	1.1	0	3	0.9	1.0	1.1	0
Metals																											
Aluminum	mg/L	0.0005	6	0.0042	0.0093	0.016	2	7	0.013	0.019	0.029	2	8	0.0006	0.0015	0.0024	0	4	0.0028	0.0029	0.0031	0	3	0.0013	0.0017	0.0021	0
Arsenic	µg/L	0.1	6	0.1	0.1	0.2	0	7	0.1	0.1	0.3	0	8	0.1	0.1	0.2	0	4	<0.1	0.1	0.1	0	3	<0.1	<0.1	<0.1	0
Cadmium	mg/L	0.00001	6	<0.00001	<0.00001	<0.00001	0	7	<0.00001	<0.00001	<0.00001	0	8	<0.00001	0.00001	0.00001	0	4	<0.00001	<0.00001	<0.00001	0	3	<0.00001	<0.00001	<0.00001	0
Chromium	mg/L	0.0005	6	<0.0005	<0.0005	<0.0005	-	7	<0.0005	0.00089	0.0032	-	8	<0.0005	<0.0005	<0.0005	-	4	<0.0005	<0.0005	<0.0005	-	3	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	6	<0.0001	<0.0001	<0.0001	0	7	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	6	<0.0002	<0.0002	<0.0002	-	7	<0.0002	0.0002	0.0004	1	8	<0.0002	0.0002	0.0003	1	4	<0.0002	0.0003	0.0004	1	3	<0.0002	<0.0002	<0.0002	0
Iron	mg/L	0.0005	6	0.12	0.42	0.78	5	7	0.42	0.58	0.93	7	8	0.0055	0.029	0.12	0	4	0.017	0.023	0.028	0	3	0.0062	0.0074	0.0096	0
Lead	mg/L	0.0001	6	<0.0001	0.0002	0.0004	0	7	<0.0001	<0.0001	<0.0001	0	8	<0.0001	0.0001	0.0001	0	4	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0
Manganese	mg/L	0.0005	6	0.017	0.0380	0.066	0	7	0.023	0.031	0.038	0	8	0.0058	0.19	1.42	1	4	0.0074	0.015	0.03	0	3	0.0025	0.0045	0.0079	0
Mercury	ng/L	1	6	<1	1.83	3	0	7	<1	1.29	2	0	8	<1	2.25	3	0	4	<1	1.5	2	0	3	<1	1	1	0
Molybdenum	mg/L	0.0001	6	<0.0001	<0.0001	<0.0001	0	7	<0.0001	<0.0001	<0.0001	0	8	<0.0001	1.1E-05	0.0002	0	4	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	6	<0.0001	0.0001	0.0001	0	7	0.0001	0.0004	0.0015	0	8	<0.0001	<0.0001	<0.0001	0	4	<0.0001	0.0001	0.0002	0	3	<0.0001	0.0001	0.0001	0
Selenium	mg/L	0.0001	6	<0.0001	<0.0001	<0.0001	0	7	<0.0001	<0.0001	<0.0001	0	8	<0.0001	<0.0001	<0.0001	0	4	<0.0001	<0.0001	<0.0001	0	3	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	6	<0.0002	<0.0002	<0.0002	0	7	<0.0002	<0.0002	<0.0002	0	8	<0.0002	<0.0002	<0.0002	0	4	<0.0002	<0.0002	<0.0002	0	3	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	6	<0.1	<0.1	<0.1	0	7	<0.1	<0.1	<0.1	0	8	<0.1	<0.1	<0.1	0	4	<0.1	<0.1	<0.1	0	3	<0.1	<0.1	<0.1	0
Zinc	mg/L	0.0005	6	<0.0005	0.0016	0.0048	0	7	<0.0005	0.0012	0.0028	0	8	<0.0005	0.0013	0.0025	0	4	<0.0005	0.0034	0.0086	0	3	0.0006	0.0008	0.0009	0

Table 4-20

Summary statistics of select water quality parameters within the primary ASA, 2016 to 2023.

Parameter	Units	RDL	Lloyd Lake Inlet					Warner Rapids					Broach Lake					Hodge Lake									
																		Area 1					Area 3				
			n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc	n	Min	Mean	Max	Exc
Nutrients																											
Un-Ionized Ammonia	mg/L	Variable[2]	6	<0.000003	0.00003	0.00007	0	7	<0.000001	0.00008	0.0003	0	8	<0.000007	0.00006	0.00018	0	4	<0.000003	0.00002	0.00004	0	3	<0.00007	0.00016	0.00033	0
Ammonia, N	mg/L	0.01	6	<0.01	0.02	0.06	0	7	<0.01	0.02	0.04	0	8	<0.01	0.04	0.21	0	4	0.01	0.02	0.03	0	3	<0.01	0.02	0.04	0
DOC[1]	mg/L	0.2	6	3.2	4.4	5.8	-	7	4.6	5.6	7.7	-	8	1.5	1.7	1.9	-	4	1.9	2.0	2.2	-	3	2.4	2.8	3.7	-
Nitrate[1]	mg/L	0.04	6	<0.04	0.39	1.90	-	7	<0.04	0.07	0.26	-	8	<0.04	0.08	0.16	-	4	<0.04	0.07	0.14	-	3	<0.04	<0.04	<0.04	0
Phosphorus[1]	mg/L	0.01	6	<0.01	0.05	0.26	-	7	<0.01	0.01	0.02	-	4	<0.01	0.01	0.01	-	4	<0.01	<0.01	<0.01	-	3	<0.01	<0.01	<0.01	-
Physical Properties																											
Hardness, Total	mg/L	1	6	9	12	13	-	7	10	11	12	-	8	13	15	16	-	4	10	10	10	-	3	10	10	11	-
TDS	mg/L	1 to 5[3]	6	28	38	44	-	7	23	33	45	-	8	31	38	44	-	4	19	26	37	-	3	23	25	28	-
TSS[1]	mg/L	1	6	<1	2	3	-	7	<1	2	5	-	8	<1	1	3	-	4	<1	2	2	-	3	<1	<1	<1	-
Turbidity[1]	NTU	0.1	6	1.2	1.7	2.3	-	7	1.2	1.8	3.2	-	8	0.3	0.5	1.4	-	4	0.4	0.5	0.5	-	3	0.2	0.3	0.4	-
Radionuclides																											
Lead-210	Bq/L	0.02	6	<0.02	<0.02	<0.02	-	7	<0.02	<0.02	<0.02	-	8	<0.02	<0.02	<0.02	-	4	<0.02	<0.02	<0.02	-	3	<0.02	0.02	0.02	-
Polonium-210	Bq/L	0.005	6	<0.005	<0.005	<0.005	-	7	<0.005	<0.005	<0.005	-	8	<0.005	<0.005	<0.005	-	4	<0.005	<0.005	<0.005	-	3	<0.005	<0.005	<0.005	-
Radium-226	Bq/L	0.005	6	<0.005	0.005	0.006	0	7	<0.005	0.005	0.006	0	8	<0.005	0.006	0.010	0	4	<0.005	0.007	0.010	0	3	<0.005	<0.005	<0.005	0
Thorium-230	Bq/L	0.01	6	<0.01	<0.01	<0.01	-	7	<0.01	<0.01	<0.01	-	8	<0.01	<0.01	<0.01	-	4	<0.01	<0.01	<0.01	-	3	<0.01	<0.01	<0.01	-

Italicized parameters represent the Constituents of Potential Concern (COPCs) of the Project. Other parameters were included because they are listed in Schedules 4 and 5 of the *Metal and Diamond Mining Effluent Regulations*.

n = sample size; Min = minimum; SD = standard deviation; Max = maximum; RDL = reported detection limit; Exc = number of samples exceeding the guideline, when available; DOC = dissolved organic carbon; TDS = total dissolved solids; TSS = total suspended solids.

[1]Not selected as COPC but included to describe general water quality characteristics.

[2]As un-ionized ammonia is a calculated value using values of ammonia as N, field pH and field temperature, the RDL is based on values of ammonia as N that were undetectable and will vary.

[3]For total dissolved solids, the RDL ranged between 1 mg/L and 5 mg/L depending on sampling period.

Table 4-21

Field measured water quality parameters within the secondary ASA, 2013 and 2016/2017.

Waterbody	Temperature (°C)				Dissolved Oxygen (mg/L)				Specific Conductivity (µS/cm)				pH			
	n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max	n	Min	Mean	Max
Lake A	28	0.1	11.4	20.1	28	**6.34**	8.96	14.13	28	7.5	10.9	24.6	28	**3.98**	**5.57**	6.52
Lake B	19	0.0	9.5	20.6	19	**2.14**	8.40	10.95	19	9.8	18.2	34.5	19	**5.62**	**6.05**	7.22
Lake C	20	0.3	10.7	19.2	20	**0.35**	7.73	11.90	20	0.1	20.8	98.9	20	**5.86**	**6.35**	6.84
Lake D	19	0.1	11.4	20.3	19	**0.43**	8.63	14.06	19	39.3	48.0	70.8	19	6.81	7.66	8.47
Lake E	75	0.2	7.2	20.3	75	**0.15**	7.24	12.39	75	34.5	51.4	374.7	75	**5.85**	6.74	8.08
Lake F	125	0.1	6.3	18.8	125	**0.77**	8.70	12.98	125	18.0	20.6	72.5	125	**5.73**	6.80	9.00
Waterbody	**Depth Total (m)**				**Secchi Depth (m)**				**Ice Thickness (m)**				**Snow Depth (m)**			
	n	**Min**	**Mean**	**Max**	**n**	**Min**	**Mean**	**Max**	**n**	**Min**	**Mean**	**Max**	**n**	**Min**	**Mean**	**Max**
Lake A	4	0.4	6.6	9.3	3	0.4	2.3	3.5	1	0.81	0.81	0.81	1	0.20	0.20	0.20
Lake B	5	0.4	1.7	2.4	4	0.4	1.3	1.8	1	0.82	0.82	0.82	1	0.35	0.35	0.35
Lake C	4	1.9	2.1	2.5	3	0.4	0.7	0.9	1	0.79	0.79	0.79	1	0.25	0.25	0.25
Lake D	4	3.5	4.0	4.3	3	0.8	1.7	2.5	1	0.80	0.80	0.80	1	0.27	0.27	0.27
Lake E	4	18.6	18.8	18.9	3	2.2	2.6	3.3	1	0.80	0.80	0.80	1	0.30	0.30	0.30
Lake F	4	27.8	30.5	32.8	3	3.3	3.5	3.8	1	0.85	0.85	0.85	1	0.19	0.19	0.19

n = sample size, min = minimum; max = maximum.

Highlighted values fall outside of the available SEQG range.

Note: summary statistics calculated from all available measurements, including profile measurements; thus, the n varies by location.

Table 4-22

Summary statistics of select water quality parameters within the secondary ASA, 2016 to 2017.

Parameter	Units	RDL	n	Lake A				Lake B				Lake C			
				Min	Mean	Max	Exc	Min	Mean	Max	Exc	Min	Mean	Max	Exc
Inorganic Ions															
Calcium	mg/L	0.1	4	0.4	0.5	0.6	-	0.6	1.1	2.3	-	0.8	1.5	2.9	-
Chloride	mg/L	0.1	4	0.1	0.1	0.1	0	<0.1	0.1	0.2	0	<0.1	0.1	0.1	0
Magnesium[1]	mg/L	0.1	4	0.1	0.2	0.3	-	0.2	0.4	0.7	-	0.3	0.5	1.0	-
Potassium[1]	mg/L	0.1	4	<0.1	0.2	0.2	-	0.2	0.3	0.3	-	<0.1	0.2	0.3	-
Sodium	mg/L	0.1	4	0.5	0.5	0.6	-	0.7	1.1	1.6	-	0.7	1.0	1.6	-
Sulphate	mg/L	0.2	4	1.6	1.7	1.8	0	0.8	1.0	1.3	0	<0.2	0.3	0.5	0
Metals															
Aluminum	mg/L	0.0005	4	0.0024	0.0048	0.00776	2	0.0048	0.0097	0.016	1	0.02	0.0	0.074	3
Arsenic	µg/L	0.1	4	0.2	0.2	0.2	0	<0.1	0.1	0.1	0	<0.1	0.1	0.2	0
Cadmium	mg/L	0.00001	4	<0.00001	<0.00001	<0.00001	0	<0.00001	0.00001	0.00002	0	<0.00001	0.00001	0.00002	0
Chromium	mg/L	0.0005	4	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	4	<0.0002	<0.0002	<0.0002	0	<0.0002	0.0002	0.0002	0	<0.0002	<0.0002	<0.0002	0
Iron	mg/L	0.0005	4	0.0044	0.012	0.017	0	0.011	0.033	0.055	0	0.6	0.89	1.25	4
Lead	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	0.0001	0.0001	0	<0.0001	<0.0001	<0.0001	0
Manganese	mg/L	0.0005	4	0.0077	0.0084	0.01	0	0.0025	0.013	0.031	0	0.024	0.043	0.088	0
Mercury	ng/L	1	4	<1	2	4	0	<1	2	5	0	<1	3	6	1
Molybdenum	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	0.0001	0.0001	0	<0.0001	<0.0001	<0.0001	0
Selenium	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	4	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	4	<0.1	<0.1	<0.1	0	<0.1	<0.1	<0.1	0	<0.1	<0.1	<0.1	0
Zinc	mg/L	0.0005	4	<0.0005	0.00098	0.0023	0	<0.0005	0.0019	0.0036	0	<0.0005	0.0009	0.0012	0
Nutrients[2]															
Un-Ionized Ammonia	mg/L	Variable[2]	4	<0.0000001	0.000004	0.000011	0	<0.000003	0.000012	0.000034	0	<0.00001	0.000013	0.000016	0
Ammonia, N	mg/L	0.01	4	<0.01	0.02	0.04	0	<0.01	0.03	0.04	0	<0.01	0.05	0.12	0
DOC[1]	mg/L	0.2	4	2.9	3.2	3.5	-	3.4	4.5	5.6	-	6.3	9.7	14.0	-
Nitrate[1]	mg/L	0.04	4	<0.04	0.04	0.04	-	<0.04	0.04	0.04	-	<0.04	0.04	0.04	-
Physical Properties															
Hardness, Total	mg/L	1	4	1	2	3	-	2	4	9	-	4	6	11	-
Total Dissolved Solids	mg/L	1 to 5[3]	4	14	16	17	-	13	21	30	-	29	37	57	-
Total Suspended Solids[1]	mg/L	1	4	<1	2	4	-	<1	3	4	-	2	11	23	-
Turbidity[1]	NTU	0.1	4	0.3	0.6	0.8	-	0.4	0.9	1.6	-	2.4	5.3	9.6	-
Radionuclides															
Lead-210	Bq/L	0.02	4	<0.02	<0.02	<0.02	-	<0.02	<0.02	<0.02	-	<0.02	0.03	0.04	-
Polonium-210	Bq/L	0.005	4	<0.005	0.006	0.007	-	<0.005	0.006	0.010	-	<0.005	0.009	0.010	-
Radium-226	Bq/L	0.005	4	<0.005	<0.005	<0.005	0	<0.005	<0.005	<0.005	0	<0.005	0.006	0.010	0
Thorium-230	Bq/L	0.01	4	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-

Table 4-22

Summary statistics of select water quality parameters within the secondary ASA, 2016 to 2017.

Parameter	Units	RDL	n	Lake D				Lake E				Lake F			
				Min	Mean	Max	Exc	Min	Mean	Max	Exc	Min	Mean	Max	Exc
Inorganic Ions															
Calcium	mg/L	0.1	4	4.2	5.1	7.2	-	4.3	4.6	5.1	-	1.5	1.8	2.2	-
Chloride	mg/L	0.1	4	<0.1	0.1	0.1	0	<0.1	0.1	0.1	0	0.1	0.1	0.1	0
Magnesium[1]	mg/L	0.1	4	1.2	1.5	2.1	-	1.3	1.4	1.6	-	0.5	0.6	0.7	-
Potassium[1]	mg/L	0.1	4	0.3	0.4	0.6	-	0.3	0.5	0.8	-	0.2	0.4	0.6	-
Sodium	mg/L	0.1	4	1.2	1.5	2.1	-	1.5	1.6	1.8	-	0.9	1.0	1.0	-
Sulphate	mg/L	0.2	4	0.9	1.1	1.4	0	1	1.2	1.4	0	0.4	0.6	0.6	0
Metals															
Aluminum	mg/L	0.0005	4	0.0037	0.004	0.0047	0	0.001	0.0018	0.0031	0	0.0014	0.0026	0.0035	0
Arsenic	µg/L	0.1	4	0.1	0.175	0.4	0	0.1	0.125	0.2	0	0.1	0.1	0.1	0
Cadmium	mg/L	0.00001	4	<0.00001	0.000015	0.00002	0	<0.00001	0.00001	0.00001	0	<0.00001	0.00001	0.00001	0
Chromium	mg/L	0.0005	4	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	-
Cobalt	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Copper	mg/L	0.0002	4	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0
Iron	mg/L	0.0005	4	0.055	0.15	0.28	0	0.093	0.38	0.73	2	0.07	0.14	0.26	0
Lead	mg/L	0.0001	4	<0.0001	0.0001	0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	0.000175	0.0004	0
Manganese	mg/L	0.0005	4	0.0076	0.021	0.051	0	0.031	0.27	0.47	2	0.018	0.66	0.18	0
Mercury	ng/L	1	4	<1	3.25	6	1	<1	3.75	6	2	<1	3.5	6	1
Molybdenum	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Nickel	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	0.000125	0.0002	0
Selenium	mg/L	0.0001	4	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	<0.0001	0
Thallium	mg/L	0.0002	4	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0	<0.0002	<0.0002	<0.0002	0
Uranium	µg/L	0.1	4	<0.1	<0.1	<0.1	0	<0.1	<0.1	<0.1	0	<0.1	<0.1	<0.1	0
Zinc	mg/L	0.0005	4	<0.0005	0.001	0.0016	0	<0.0005	0.0016	0.0041	0	<0.0005	0.0013	0.0024	0
Nutrients[2]															
Un-Ionized Ammonia	mg/L	Variable[2]	4	<0.00002	0.00066	0.0013	0	0.000017	0.000066	0.00014	0	<0.000002	0.00012	0.00048	0
Ammonia, N	mg/L	0.01	4	<0.01	0.05	0.13	0	0.02	0.07	0.11	0	<0.01	0.01	0.01	0
DOC[1]	mg/L	0.2	4	6.2	7.3	9	-	3.9	4.1	4.4	-	4.6	4.8	5.2	-
Nitrate[1]	mg/L	0.04	4	<0.04	0.04	0.04	-	<0.04	0.22	0.71	-	<0.04	0.2425	0.66	-
Physical Properties															
Hardness, Total	mg/L	1	4	15	19	26	-	16	17	19	-	6	7	8	-
Total Dissolved Solids	mg/L	1 to 5[1]	4	49	58	74	-	40	43	46	-	27	31	34	-
Total Suspended Solids[1]	mg/L	1	4	<1	3	4	-	<1	3	4	-	<1	1	1	-
Turbidity[1]	NTU	0.1	4	0.9	1.8	3.7	-	0.6	2.0	3.2	-	0.6	0.9	1.3	-
Radionuclides															
Lead-210	Bq/L	0.02	4	<0.02	0.03	0.05	-	<0.02	0.03	0.04	-	<0.02	0.02	0.02	-
Polonium-210	Bq/L	0.005	4	<0.005	0.005	0.005	-	<0.005	<0.005	<0.005	-	<0.005	<0.005	<0.005	-
Radium-226	Bq/L	0.005	4	<0.005	0.006	0.006	0	<0.005	<0.005	<0.005	0	<0.005	0.005	0.006	0
Thorium-230	Bq/L	0.01	4	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-

Italicized parameters represent the Constituents of Potential Concern (COPCs) of the Project. Other parameters were included because they are listed in Schedules 4 and 5 of the *Metal and Diamond Mining Effluent Regulations*.

n = sample size; Min = minimum; SD = standard deviation; Max = maximum; RDL = reported detection limit; Exc = number of samples exceeding the guideline, when available; DOC = dissolved organic carbon; TDS = total dissolved solids; TSS = total suspended solids.

[1]Not selected as COPC but included to describe general water quality characteristics.

[2]As un-ionized ammonia is a calculated value using values of ammonia as N, field pH, and field temperature, the RDL is based on values of ammonia as N that were undetectable and will vary.

[3]For total dissolved solids, the RDL ranged between 1 mg/L and 5 mg/L depending on sampling period.

Table 4-23

Summary statistics of select sediment quality parameters within the primary ASA, 2017 and 2019.

Parameter	Unit	Patterson Lake																				Guidelines				
		Northeast (2019)					North (2019)					West (2017 and 2019)					East (2019)									
		n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	ISQG[1]	PEL[1]	LEL[2]	REF[3]	NE2[3]
Physical Properties																										
Station Depth	m	5	5.0	**5.9**	6.8	0	5	4.9	**5.2**	5.9	0	5	5.0	**5.7**	6.6	0	5	4.9	**5.5**	6.0	0					
Clay	%	5	2.7	**5.0**	8.2	0	5	0.9	**1.2**	1.4	0	10	1.7	**6.2**	11.3	0	5	1.3	**2.0**	3.5	0					
Silt	%	5	20.5	**41.6**	67.9	0	5	2.7	**4.9**	7.1	0	10	21.5	**52.7**	79.4	0	5	6.3	**10.1**	19.0	0					
Fine Sand	%	5	20.7	**31.2**	37.7	0	5	6.5	**9.0**	13.5	0	10	8.5	**29.8**	47.7	0	5	6.9	**10.9**	23.8	0					
Coarse Sand	%	5	3.1	**22.1**	41.3	0	5	78.0	**84.9**	89.8	0	10	0.74	**11.4**	34.3	0	5	53.7	**76.9**	84.5	0					
Gravel	%	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5	10	0.01	**0.01**	0.01	10	5	0.01	**0.01**	0.01	5					
Inorganic Ions																										
Calcium	µg/g	5	1400	**1700**	2100	0	5	230	**268**	300	0	10	1600	**2530**	3100	0	5	200	**298**	440	0					
Metals																										
Aluminum	µg/g	5	2460	**3106**	3600	0	5	580	612	630	0	10	3250	4623	5400	0	5	390	480	550	0					
Arsenic	µg/g	5	2.8	**3.2**	3.8	0	5	0.4	**0.5**	0.5	0	10	10	***17***	***48***	0	5	0.5	**0.6**	0.6	0	5.9	17	*9.8*	20.8	522
Cadmium	µg/g	5	0.1	**0.1**	0.2	1	5	0.1	**0.1**	0.1	5	10	0.1	**0.2**	0.2	0	5	0.1	**0.1**	0.1	5	0.6	3.5			
Chromium	µg/g	5	5.3	**6.7**	7.5	0	5	0.5	**0.6**	0.8	2	10	5.6	**8.4**	10	0	5	0.5	**0.6**	0.7	3	37.3	90			
Cobalt	µg/g	5	2.2	**2.5**	2.8	0	5	0.2	**0.3**	0.4	3	10	3.2	**4.6**	5.6	0	5	0.2	**0.2**	0.2	5					
Copper	µg/g	5	1.6	**2.5**	3.1	0	5	0.5	**0.5**	0.5	5	10	1.9	**3.2**	4.2	0	5	0.5	**0.5**	0.5	5	35.7	197	22.2		
Iron	µg/g	5	55700	**62460**	71800	0	5	570	**724**	870	0	10	99400	**149240**	#####	0	5	700	**986**	1320	0					
Lead	µg/g	5	2.4	**3.6**	4.2	0	5	0.9	**1.0**	1.0	0	10	2.6	**5.1**	6.7	0	5	0.9	**1.0**	1.1	0	35	91.3	36.7		
Manganese	µg/g	5	520	**692**	780	0	5	63	**104**	160	0	10	520	**1363**	2300	0	5	49.0	**83.4**	120	0					
Mercury	µg/g	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	0.17	0.49			
Molybdenum	µg/g	5	0.6	**0.9**	1.1	0	5	0.1	**0.1**	0.1	5	10	1.4	**2.3**	3.9	0	5	0.1	**0.1**	0.1	4			13.8	245	22.6
Nickel	µg/g	5	2.6	**3.6**	4.6	0	5	0.2	**0.4**	0.7	0	10	4.8	**7.5**	9.1	0	5	0.2	**0.3**	0.4	0			23.4	21.4	326
Selenium	µg/g	5	0.1	**0.3**	0.4	0	5	0.1	**0.1**	0.1	5	10	0.4	**0.5**	0.6	0	5	0.1	**0.1**	0.1	5			1.9	3.6	29.7
Thallium	µg/g	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5	10	0.2	**0.2**	0.2	10	5	0.2	**0.2**	0.2	5					
Uranium	µg/g	5	0.4	**0.5**	0.6	0	5	0.1	**0.2**	0.2	0	10	0.5	**3.7**	7.6	0	5	0.2	**0.2**	0.3	0			104	96.7	2296
Zinc	µg/g	5	24.0	**27.0**	30.0	0	5	0.9	**1.0**	1.2	0	10	24.0	**32.1**	36.0	0	5	0.8	**1.1**	1.6	0	123	315			
Nutrients																										
Carbon, Total Organic	%	5	4.51	**6.77**	8.61	0	5	0.36	**0.42**	0.45	0	10	7.15	**12.8**	17.1	0	5	0.41	**0.64**	1.1	0					
Radionuclides																										
Lead-210	Bq/g	5	0.16	**0.26**	0.37	0	5	0.04	**0.04**	0.04	5	10	0.06	**0.44**	0.76	0	5	0.04	**0.04**	0.04	5			0.9		
Polonium-210	Bq/g	5	0.17	**0.26**	0.37	0	5	0.02	**0.02**	0.02	0	10	0.06	**0.41**	0.70	0	5	0.01	**0.02**	0.02	1			0.8		
Radium-226	Bq/g	5	0.01	**0.03**	0.05	0	5	0.01	**0.01**	0.02	2	10	0.01	**0.05**	0.07	1	5	0.01	**0.01**	0.02	3			0.6		
Thorium-230	Bq/g	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.02	5	10	0.02	**0.04**	0.07	4	5	0.02	**0.02**	0.02	5					

Table 4-23

Summary statistics of select sediment quality parameters within the primary ASA, 2017 and 2019.

Parameter	Unit	Forrest Lake (2017 and 2019)					Beet Lake										Naomi Lake (2017 and 2019)					Guidelines				
							Inlet (2019)					Lake (2017)														
		n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	ISQG[1]	PEL[1]	LEL[2]	REF[3]	NE2[3]
Physical Properties																										
Station Depth	m	5	1.0	**1.1**	1.2	0	5	6.5	**7.1**	7.7	0	-	-	**-**	-	-	5	5.2	**5.4**	5.5	0					
Clay	%	10	2.4	**5.5**	9.1	0	5	1.2	**1.8**	2.7	0	5	1.5	**3.5**	4.7	0	10	2.2	**9.6**	16.8	0					
Silt	%	10	21.7	**38.7**	56.4	0	5	3.7	**6.0**	8.6	0	5	12.5	**41.4**	56.3	0	10	29.4	**56.6**	77.0	0					
Fine Sand	%	10	24.4	**34.5**	46.9	0	5	7.5	**11.1**	13.9	0	5	16.0	**30.9**	41.8	0	10	8.6	**23.8**	47.9	0					
Coarse Sand	%	10	9.4	**21.3**	39.3	0	5	74.8	**81.1**	86.0	0	5	7.8	**24.3**	70.1	0	10	0.05	**10.0**	27.9	0					
Gravel	%	10	0.01	**0.01**	0.01	10	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5	10	0.01	**0.01**	0.01	10					
Inorganic Ions																										
Calcium	µg/g	10	2200	**4360**	6400	0	5	200	**210**	240	0	5	310	**2522**	3700	0	10	3300	**3500**	3800	0					
Metals																										
Aluminum	µg/g	10	2100	**2740**	3440	**0**	5	760	**870**	930	**0**	5	1130	**3654**	5300	0	10	7900	**8980**	9700	0					
Arsenic	µg/g	10	1.4	**2.4**	3.6	0	5	0.5	**0.5**	0.6	0	5	0.6	**4.1**	6.4	0	10	8.3	**9.3**	*11.0*	0	5.9	17	*9.8*	20.8	522
Cadmium	µg/g	10	0.1	**0.2**	0.3	1	5	0.1	**0.1**	0.1	5	5	0.1	**0.16**	0.2	1	10	0.3	**0.4**	0.5	0	0.6	3.5			
Chromium	µg/g	10	3.5	**5.6**	7.6	0	5	0.9	**1.1**	1.3	0	5	1.2	**6.1**	9.3	0	10	20.0	**22.1**	24.0	0	37.3	90			
Cobalt	µg/g	10	0.4	**1.1**	1.6	0	5	0.2	**0.2**	0.2	4	5	0.3	**2.7**	5.0	0	10	4.8	**5.7**	6.7	0					
Copper	µg/g	10	1.0	**1.7**	2.8	0	5	0.5	**0.5**	0.5	5	5	0.5	**2.7**	4.0	1	10	4.7	**5.3**	6.4	0	35.7	197	22.2		
Iron	µg/g	10	6600	**9740**	14900	0	5	1720	**1800**	1910	0	5	1990	**35638**	64100	0	10	76100	**89640**	105000	0					
Lead	µg/g	10	1.9	**2.5**	3.8	0	5	1.0	**1.1**	1.1	0	5	1.3	**5.5**	9.3	0	10	4.3	**6.1**	8.4	0	35	91.3	36.7		
Manganese	µg/g	10	120	**265**	420	0	5	51.0	**59.2**	66.0	0	5	37.0	**279.4**	510.0	0	10	640	**788**	1050	0					
Mercury	µg/g	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	0	-	-	-	0	5	0.05	**0.08**	0.1	0	0.17	0.49			
Molybdenum	µg/g	10	0.3	**0.5**	0.9	0	5	0.1	**0.1**	0.1	5	5	0.1	**0.6**	1.0	1	10	2.0	**2.2**	2.5	0			13.8	245	22.6
Nickel	µg/g	10	1.8	**2.6**	3.4	0	5	0.3	**0.3**	0.4	0	5	0.8	**5.5**	8.9	0	10	8.6	**9.6**	11.0	0			23.4	21.4	326
Selenium	µg/g	10	0.2	**0.3**	0.5	0	5	0.1	**0.1**	0.1	5	5	0.1	**0.5**	0.7	1	10	0.6	**0.7**	0.8	0			1.9	3.6	29.7
Thallium	µg/g	10	0.2	**0.2**	0.2	10	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5	10	0.2	**0.2**	0.2	10					
Uranium	µg/g	10	0.5	**1.2**	2.0	0	5	0.1	**0.1**	0.2	0	5	0.3	**0.5**	0.6	0	10	1.2	**1.5**	2.1	0			104	96.7	2296
Zinc	µg/g	10	7.1	**12.2**	17.0	0	5	1.2	**1.3**	1.6	0	5	1.7	**19.5**	30.0	0	10	55.0	**63.3**	68.0	0	123	315			
Nutrients																										
Carbon, Total Organic	%	10	7.1	**12.5**	20.3	0	5	0.3	**0.3**	0.3	0	5	0.8	**12.5**	18.7	0	10	22.6	**23.3**	24.3	0					
Radionuclides																										
Lead-210	Bq/g	10	0.04	**0.11**	0.13	1	5	0.04	**0.04**	0.04	5	5	0.04	**0.49**	0.74	1	10	0.44	**0.62**	0.70	0			0.9		
Polonium-210	Bq/g	10	0.05	**0.11**	0.16	0	5	0.01	**0.01**	0.02	3	5	0.03	**0.34**	0.50	0	10	0.35	**0.54**	0.63	0			0.8		
Radium-226	Bq/g	10	0.01	**0.02**	0.03	1	5	0.01	**0.01**	0.03	4	5	0.01	**0.02**	0.02	1	10	0.05	**0.08**	0.10	0			0.6		
Thorium-230	Bq/g	10	0.02	**0.02**	0.02	10	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.02	5	10	0.02	**0.02**	0.03	6					

Table 4-23

Summary statistics of select sediment quality parameters within the primary ASA, 2017 and 2019.

Parameter	Unit	Clearwater River (Near-field; 2017 and 2019)					Lloyd Lake Inlet (2019)					Broach Lake (2017 and 2019)					Hodge Lake (2019)					Guidelines				
		n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	n	Min	Mean	Max	#<RDL	ISQG[1]	PEL[1]	LEL[2]	REF[3]	NE2[3]
Physical Properties																										
Station Depth	m	5	0.6	**0.8**	0.9	0	5	5.5	**5.7**	5.7	0	5	5.0	**5.3**	5.7	0	5	7.4	**7.5**	7.7	0					
Clay	%	10	2.0	**8.6**	17.1	0	5	8.9	**13.0**	14.6	0	10	2.7	**5.9**	9.6	0	5	1.8	**2.4**	3.4	0					
Silt	%	10	12.3	**45.1**	69.6	0	5	51.4	**69.3**	74.4	0	10	29.0	**50.3**	68.5	0	5	15.8	**18.4**	22.0	0					
Fine Sand	%	10	8.1	**22.7**	36.5	0	5	10.7	**14.4**	27.6	0	10	19.6	**24.4**	30.0	0	5	34.7	**37.1**	40.8	0					
Coarse Sand	%	10	2.5	**23.6**	66.4	0	5	0.6	**3.4**	12.2	0	10	3.2	**19.4**	40.7	0	5	37.5	**42.1**	46.2	0					
Gravel	%	10	0.01	**0.01**	0.01	10	5	0.01	**0.01**	0.01	5	10	0.01	**0.01**	0.01	10	5	0.01	**0.01**	0.01	5					
Inorganic Ions																										
Calcium	µg/g	10	300	**1974**	3600	0	5	2100	**2520**	3600	0	10	1100	**4140**	5100	0	5	790	**1058**	1200	0					
Metals																										
Aluminum	µg/g	10	970	**2627**	4590	**0**	5	7500	**8080**	8400	**0**	10	1380	**3486**	4650	0	5	1710	**2362**	2720	0					
Arsenic	µg/g	10	1.3	**4.2**	7.6	0	5	4.9	**5.7**	7.1	0	10	1.3	**4.3**	5.1	0	5	1.4	**1.9**	2.4	0	5.9	17	9.8	20.8	522
Cadmium	µg/g	10	0.1	**0.12**	0.2	5	5	0.2	**0.2**	0.2	0	10	0.1	**0.2**	0.3	1	5	0.1	**0.2**	0.2	0	0.6	3.5			
Chromium	µg/g	10	3.2	**12.3**	19.0	0	5	13.0	**14.2**	15.0	0	10	2.7	**6.2**	7.7	0	5	3.3	**4.7**	5.6	0	37.3	90			
Cobalt	µg/g	10	0.3	**1.1**	1.9	0	5	2.9	**3.0**	3.1	0	10	0.6	**2.0**	2.3	0	5	1.3	**1.7**	2.1	0					
Copper	µg/g	10	0.5	**1.0**	1.5	2	5	3.7	**4.2**	5.3	0	10	1.1	**3.6**	5.0	0	5	2.7	**5.2**	8.8	0	35.7	197	22.2		
Iron	µg/g	10	5800	**27230**	54900	0	5	45300	**58880**	76400	0	10	2930	**5383**	6500	0	5	3070	**5054**	6600	0					
Lead	µg/g	10	1.3	**1.9**	2.5	0	5	3.6	**3.7**	3.9	0	10	1.4	**4.1**	9.4	0	5	2.2	**2.6**	3.5	0	35	91.3	36.7		
Manganese	µg/g	10	38.0	**160**	420	0	5	330	**516**	800	0	10	130	**226**	320	0	5	100	**190**	290	0					
Mercury	µg/g	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	5	0.05	**0.05**	0.05	5	0.17	0.49			
Molybdenum	µg/g	10	0.1	**0.6**	0.9	0	5	0.5	**0.6**	0.8	0	10	0.4	**1.9**	2.7	0	5	0.5	**0.8**	1.1	0			13.8	245	22.6
Nickel	µg/g	10	0.3	**2.1**	3.8	0	5	7.3	**8.1**	9.0	0	10	2.1	**7.5**	8.7	0	5	3.0	**4.5**	5.9	0			23.4	21.4	326
Selenium	µg/g	10	0.1	**0.2**	0.2	3	5	0.4	**0.48**	0.5	0	10	0.1	**0.6**	0.7	0	5	0.2	**0.2**	0.3	0			1.9	3.6	29.7
Thallium	µg/g	10	0.2	**0.2**	0.2	10	5	0.2	**0.2**	0.2	5	10	0.2	**0.2**	0.2	10	5	0.2	**0.2**	0.2	5					
Uranium	µg/g	10	0.2	**0.6**	0.8	0	5	0.7	**0.8**	0.8	0	10	0.2	**0.3**	0.4	0	5	0.2	**0.3**	0.4	0			104	96.7	2296
Zinc	µg/g	10	4.2	**11.1**	17.0	0	5	25.0	**26.0**	27.0	0	10	7.7	**25.8**	37.0	0	5	16.0	**26.2**	42.0	0	123	315			
Nutrients																										
Carbon, Total Organic	%	10	1.0	**8.7**	14.7	0	5	11.2	**11.8**	12.3	0	10	4.5	**20.2**	23.8	0	5	2.6	**3.7**	4.6	0					
Radionuclides																										
Lead-210	Bq/g	10	0.04	**0.133**	0.25	2	5	0.25	**0.30**	0.36	0	10	0.04	**0.074**	0.20	4	5	0.09	**0.11**	0.16	0			0.9		
Polonium-210	Bq/g	10	0.02	**0.13**	0.24	0	5	0.28	**0.31**	0.36	0	10	0.02	**0.06**	0.16	0	5	0.06	**0.13**	0.17	0			0.8		
Radium-226	Bq/g	10	0.01	**0.02**	0.05	0	5	0.02	**0.03**	0.04	0	10	0.01	**0.02**	0.03	1	5	0.01	**0.02**	0.03	0			0.6		
Thorium-230	Bq/g	10	0.02	**0.02**	0.03	9	5	0.02	**0.02**	0.02	3	10	0.02	**0.02**	0.02	10	5	0.02	**0.02**	0.02	5					

All 0 cm to 2 cm data presented on a dry weight basis (n = 5); SD = standard deviation; Min = Minimum; Max = Maximum; <RDL = number of values less than the reported detection limit (RDL); - = insufficient data to calculate.

All values lower than the RDL were set equal to the RDL for the calculation of mean and SD; means are bolded for ease of data comparison; summary statistics are presented for combined 2017 and 2019 datasets, where available.

Italicized parameters represent the Constituents of Potential Concern (COPCs) of the Project. Other parameters were included because they are listed in Schedules 4 and 5 of the *Metal and Diamond Mining Effluent Regulations*.

Shaded, italicized, bolded, or underlined values denote an exceedance of guideline with matching typographical emphasis.

[1]ISQG = interim sediment quality guideline; PEL = probable effects level (CCME 2019).

[2]LEL = lowest effects level (Thompson et al. 2005).

[3]REF = reference sediment value; NE2 = no-effect value (Burnett-Seidel and Liber 2013). Chromium, copper, and lead were excluded based on the recommendation made in the discussion section of the publication.

Due to the high sand content in Patterson Lake North, the 0-5 cm sediment horizon was sampled using an Ekman dredge (0.052 m^2 sampling area).

Table 4-24

Summary statistics of select sediment quality parameters levels within the secondary ASA, 2017.

Parameter	Unit	Lake A 23-Sep-2017					Lake B 24-Sep-2017					Lake C 25-Sep-2017					Guidelines				
		N	Min	Mean	Max	#<RDL	N	Min	Mean	Max	#<RDL	N	Min	Mean	Max	#<RDL	ISQG[1]	PEL[1]	LEL[2]	REF[3]	NE2[3]
Physical Properties																					
Station Depth	m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Clay	%	5	2.2	**2.5**	3.4	0	5	0.9	**1.8**	2.3	0	5	1.3	**3.7**	5.6	0					
Silt	%	5	38.2	**50.7**	62.9	0	5	13.3	**32.1**	45.1	0	5	17.6	**46.4**	68.9	0					
Fine Sand	%	5	20.8	**29.7**	34.7	0	5	33.5	**40.8**	48.4	0	5	22.2	**32.8**	44.0	0					
Coarse Sand	%	5	8.5	**17.2**	38.7	0	5	8.4	**25.3**	50.8	0	5	3.2	**17.0**	37.1	0					
Gravel	%	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5					
Inorganic Ions																					
Calcium	µg/g	5	4000	**4380**	4800	0	5	4700	**5140**	5800	0	5	2100	**2320**	2500	0					
Metals																					
Aluminum	µg/g	5	5300	**5460**	5700	**0**	5	2840	**3184**	3440	0	5	3630	**4104**	4480	0					
Arsenic	µg/g	5	2.9	**3.2**	3.7	0	5	1.5	**1.8**	2.2	0	5	2.8	**3.3**	3.6	0	5.9	17	9.8	20.8	522
Cadmium	µg/g	5	0.5	**0.6**	0.7	0	5	0.4	**0.4**	0.4	0	5	0.2	**0.2**	0.2	0	0.6	3.5			
Chromium	µg/g	5	8.1	**8.5**	9.4	0	5	4.6	**5.2**	6.2	0	5	6.3	**7.1**	7.8	0	37.3	90			
Cobalt	µg/g	5	1.8	**1.9**	2.0	0	5	1.1	**1.2**	1.4	0	5	1.5	**1.7**	1.9	0					
Copper	µg/g	5	6.7	**7.1**	7.8	0	5	4.4	**5.0**	5.6	0	5	2.6	**3.1**	3.4	0	35.7	197	22.2		
Iron	µg/g	5	2220	**2476**	2690	0	5	1850	**2164**	2960	0	5	18300	**19820**	22200	0					
Lead	µg/g	5	7.5	**14.3**	18.0	0	5	7.4	**8.3**	8.8	0	5	3.7	**4.4**	4.9	0	35	91.3	36.7		
Manganese	µg/g	5	82.0	**85.8**	93.0	0	5	68.0	**81.6**	110.0	0	5	95.0	**100.8**	110.0	0					
Mercury	µg/g	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0.17	0.486			
Molybdenum	µg/g	5	0.6	**0.6**	0.7	0	5	0.8	**0.9**	1.2	0	5	0.4	**0.5**	0.5	0			13.8	245	22.6
Nickel	µg/g	5	6.9	**7.4**	9.0	0	5	5.4	**6.0**	6.7	0	5	4.4	**5.3**	5.8	0			23.4	21.4	326
Selenium	µg/g	5	1.1	**1.2**	1.3	0	5	1.2	**1.4**	1.6	0	5	0.4	**0.4**	0.5	0			1.9	3.6	29.7
Thallium	µg/g	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5					
Uranium	µg/g	5	0.4	**0.4**	0.5	0	5	0.3	**0.7**	2.2	0	5	0.4	**1.1**	3.5	0			104.4	96.7	2296
Zinc	µg/g	5	40.0	**48.4**	54.0	0	5	27.0	**30.0**	35.0	0	5	22.0	**24.8**	27.0	0	123	315			
Nutrients																					
Carbon, Total Organic	%	5	31.0	**31.6**	32.1	0	5	31.2	**32.2**	33.1	0	5	20.8	**22.6**	24.3	0					
Radionuclides																					
Lead-210	Bq/g	5	0.21	**0.72**	*1.20*	0	5	0.37	**0.55**	0.66	0	5	0.37	**0.44**	0.51	0			*0.9*		
Polonium-210	Bq/g	5	0.18	**0.60**	*0.91*	0	5	0.33	**0.44**	0.60	0	5	0.30	**0.35**	0.46	0			*0.8*		
Radium-226	Bq/g	5	0.02	**0.02**	0.02	0	5	0.02	**0.03**	0.03	0	5	0.02	**0.03**	0.04	0			0.6		
Thorium-230	Bq/g	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.03	4					

Table 4-24

Summary statistics of select sediment quality parameters levels within the secondary ASA, 2017.

Parameter	Unit	Lake D 27-Sep-2017					Lake E 21-Sep-2017					Lake F 1-Oct-2017					Guidelines				
		N	Min	Mean	Max	#<RDL	N	Min	Mean	Max	#<RDL	N	Min	Mean	Max	#<RDL	ISQG[1]	PEL[1]	LEL[2]	REF[3]	NE2[3]
Physical Properties																					
Station Depth	m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Clay	%	5	2.7	**3.0**	4.1	0	5	2.1	**3.6**	5.5	0	5	2.6	**3.6**	4.5	0					
Silt	%	5	22.8	**27.4**	35.1	0	5	14.1	**28.3**	44.2	0	5	26.0	**33.5**	50.2	0					
Fine Sand	%	5	29.7	**34.4**	38.9	0	5	31.9	**36.7**	41.0	0	5	30.7	**34.3**	40.1	0					
Coarse Sand	%	5	29.8	**35.1**	44.8	0	5	13.1	**31.4**	47.7	0	5	5.4	**28.7**	38.7	0					
Gravel	%	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5	5	0.01	**0.01**	0.01	5					
Inorganic Ions																					
Calcium	µg/g	5	4300	**5280**	6300	0	5	690	**1018**	1400	0	5	320	**1304**	1700	0					
Metals																					
Aluminum	µg/g	5	3400	**4224**	5200	0	5	1610	**1996**	2660	0	5	1240	**5208**	6700						
Arsenic	µg/g	5	1.8	**2.4**	3.1	0	5	2.3	**3.2**	4.9	0	5	0.9	**3.0**	3.8	0	5.9	17	9.8	20.8	522
Cadmium	µg/g	5	0.2	**0.3**	0.4	0	5	0.1	**0.2**	0.3	0	5	0.4	**0.5**	0.6	0	0.6	3.5			
Chromium	µg/g	5	7	7.7	8.9	0	5	2.8	4.08	7.5	0	5	1.7	8.68	11		37.3	90			
Cobalt	µg/g	5	1.1	**1.4**	1.7	0	5	0.8	**1.1**	1.4	0	5	0.5	**3.5**	5.3	0					
Copper	µg/g	5	2.4	**3.7**	6.3	0	5	0.8	**1.5**	2.4	0	5	0.6	**3.5**	4.6	0	35.7	197	22.2		
Iron	µg/g	5	3010	**3942**	4700	0	5	30100	**40700**	56200	0	5	8000	**28880**	40300						
Lead	µg/g	5	2.6	**4.7**	6.4	0	5	2.4	**3.4**	4.6	0	5	1.9	**4.6**	6.7	0	35	91.3	36.7		
Manganese	µg/g	5	110.0	**148.0**	170.0	0	5	600	**1134**	1530	0	5	100	**302**	400						
Mercury	µg/g	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0.17	0.486			
Molybdenum	µg/g	5	0.4	**0.7**	1.0	0	5	0.4	**0.7**	1.3	0	5	0.1	**0.4**	0.5	1			13.8	245	22.6
Nickel	µg/g	5	3.3	**4.5**	5.5	0	5	1.6	**2.6**	5.0	0	5	1.0	**6.2**	8.6	0			23.4	21.4	326
Selenium	µg/g	5	0.4	**0.5**	0.6	0	5	0.2	**0.3**	0.4	0	5	0.1	**0.6**	0.8	1			1.9	3.6	29.7
Thallium	µg/g	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5	5	0.2	**0.2**	0.2	5					
Uranium	µg/g	5	0.6	**0.7**	0.9	0	5	0.2	**0.4**	0.7	0	5	0.3	**0.4**	0.5	0			104.4	96.7	2296
Zinc	µg/g	5	20.0	**23.8**	27.0	0	5	10.0	**13.2**	18.0	0	5	9.0	**45.8**	62.0	0	123	315			
Nutrients																					
Carbon, Total Organic	%	5	11.8	**16.9**	21.1	0	5	2.7	**4.6**	7.1	0	5	1.8	**11.2**	14.7	0					
Radionuclides																					
Lead-210	Bq/g	5	0.11	**0.24**	0.30	0	5	0.04	**0.15**	0.26	1	5	0.05	**0.24**	0.35	0			0.9		
Polonium-210	Bq/g	5	0.08	**0.19**	0.26	0	5	0.05	**0.12**	0.19	0	5	0.06	**0.18**	0.26	0			0.8		
Radium-226	Bq/g	5	0.01	**0.02**	0.03	0	5	0.02	**0.02**	0.02	0	5	0.01	**0.01**	0.02	2			0.6		
Thorium-230	Bq/g	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.02	5	5	0.02	**0.02**	0.02	5					

All 0 cm to 2 cm data presented on a dry weight basis (n = 5); SD = standard deviation; Min = Minimum; Max = Maximum; <RDL = number of values less than the reported detection limit (RDL); - = insufficient data to calculate.

All values lower than the RDL were set equal to the RDL for the calculation of mean and SD; means are bolded for ease of data comparison.

Italicized parameters represent the Constituents of Potential Concern (COPCs) of the Project. Other parameters were included because they are listed in Schedules 4 and 5 of the *Metal and Diamond Mining Effluent Regulations*.

Shaded, italicized, bolded, or underlined values denote an exceedance of guideline with matching typographical emphasis.

[1]ISQG = interim sediment quality guideline; PEL = probable effects level (CCME 2019).

[2]LEL = lowest effects level (Thompson et al. 2005).

[3]REF = reference sediment value; NE2: no-effect value (Burnett-Seidel and Liber 2013). Chromium, copper, and lead were excluded based on the recommendation made in the discussion section of the publication.

Table 4-25

Summary of available aquatic macrophyte chemistry from the primary ASA, July 2016.

Parameters	Units	Shoots											
		Patterson Lake Outlet				Naomi Lake Outlet				Broach Lake Outlet			
		Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL
Metals													
Arsenic	µg/g	< 0.05	**0.05**	0.08	4	< 0.05	**0.06**	0.08	2	< 0.05	**0.05**	< 0.05	5
Cadmium	µg/g	< 0.01	**0.01**	0.01	4	< 0.01	**0.01**	< 0.01	5	< 0.01	**0.01**	< 0.01	5
Cobalt	µg/g	0.01	**0.02**	0.04		0.02	**0.04**	0.06		0.01	**0.01**	0.02	
Copper	µg/g	0.37	**0.69**	1.2		0.44	**0.93**	1.3		0.44	**2.0**	2.9	
Lead	µg/g	0.08	**0.14**	0.26		0.05	**0.13**	0.26		0.08	**0.09**	0.1	
Nickel	µg/g	0.1	**0.16**	0.24		< 0.05	**0.12**	0.28	1	0.07	**0.10**	0.12	
Selenium	µg/g	< 0.05	**0.05**	< 0.05	5	< 0.05	**0.05**	< 0.05	5	< 0.05	**0.05**	< 0.05	5
Uranium	µg/g	0.04	**0.15**	0.44		< 0.01	**0.01**	0.01	3	< 0.01	**0.01**	< 0.01	5
Physical Properties													
% Moisture	%	74.84	**78.63**	84.5		73.59	**76.66**	79.35		75.2	**77.86**	82.21	
Radionuclides													
Lead-210	Bq/g	0.003	**0.007**	0.01		0.003	**0.005**	0.006		0.004	**0.006**	0.007	
Polonium-210	Bq/g	0.003	**0.006**	0.011		0.002	**0.004**	0.007		0.002	**0.004**	0.005	
Radium-226	Bq/g	0.003	**0.004**	0.005		0.003	**0.005**	0.006		0.002	**0.003**	0.004	
Thorium-230	Bq/g	< 0.001	**0.0016**	< 0.002	5	< 0.001	**0.0014**	< 0.002	5	< 0.001	**0.002**	< 0.003	5

Table 4-25

Summary of available aquatic macrophyte chemistry from the primary ASA, July 2016.

Parameters	Units	Roots											
		Patterson Lake Outlet				Naomi Lake Outlet				Broach Lake Outlet			
		Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL
Metals													
Arsenic	µg/g	0.12	**0.39**	0.91		0.1	**0.75**	1.7		0.12	**0.21**	0.31	
Cadmium	µg/g	0.02	**0.04**	0.06		< 0.01	**0.02**	0.04	1	0.02	**0.04**	0.05	
Cobalt	µg/g	0.13	**0.17**	0.29		0.13	**0.29**	0.66		0.12	**0.20**	0.31	
Copper	µg/g	7.6	**12**	14		6.1	**13**	32		7.3	**21**	40	
Lead	µg/g	0.16	**0.61**	1.2		0.13	**0.31**	0.56		0.26	**0.61**	1.1	
Nickel	µg/g	0.6	**1.1**	1.8		0.58	**12**	56		0.72	**2.1**	3.2	
Selenium	µg/g	< 0.05	**0.06**	0.08	2	< 0.05	**0.05**	0.05	4	0.05	**0.084**	0.17	
Uranium	µg/g	0.24	**0.44**	0.81		0.03	**0.08**	0.12		0.04	**0.10**	0.23	
Physical Properties													
% Moisture	%	88.5	**89.52**	90.49		88.4	**89.70**	91.08		88.26	**89.24**	90.34	
Radionuclides													
Lead-210	Bq/g	0.008	**0.041**	0.056		< 0.004	**0.021**	0.04	1	0.012	**0.036**	0.052	
Polonium-210	Bq/g	0.013	**0.045**	0.065		0.006	**0.022**	0.036		0.020	**0.040**	0.058	
Radium-226	Bq/g	0.003	**0.007**	0.009		0.001	**0.004**	0.006		< 0.001	**0.003**	0.004	1
Thorium-230	Bq/g	< 0.001	**0.002**	0.004	4	< 0.0009	**0.002**	< 0.003	5	< 0.001	**0.0018**	< 0.003	5

Table 4-25

Summary of available aquatic macrophyte chemistry from the primary ASA, July 2016.

Parameters	Units	Sediment											
		Patterson Lake Outlet				Naomi Lake Outlet				Broach Lake Outlet			
		Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL
Metals													
Arsenic	µg/g	0.6	**0.6**	0.7		0.5	**0.6**	0.7		0.5	**0.6**	0.7	
Cadmium	µg/g	0.3	**0.4**	0.6		0.2	**0.3**	0.7		0.2	**0.46**	1.3	
Cobalt	µg/g	< 0.2	**0.2**	< 0.2	5	< 0.2	**0.2**	< 0.2	5	< 0.2	**0.2**	0.3	4
Copper	µg/g	< 0.5	**0.5**	< 0.5	5	< 0.5	**0.5**	< 0.5	5	< 0.5	**0.5**	< 0.5	5
Lead	µg/g	1.4	**1.5**	1.6		1.2	**1.3**	1.6		1.4	**1.6**	1.8	
Nickel	µg/g	0.5	**0.6**	0.6		0.2	**0.3**	0.4		0.1	**0.42**	1.2	
Selenium	µg/g	< 0.1	**0.1**	< 0.1	5	< 0.1	**0.1**	< 0.1	5	< 0.1	**0.1**	< 0.1	5
Uranium	µg/g	0.1	**0.2**	0.5		< 0.1	**0.12**	0.2	2	< 0.1	**0.1**	0.1	2
Physical Properties													
% Moisture	%	58.15	**73.53**	79.84		61.11	**69.47**	73.02		76.15	**77.46**	79.64	
Radionuclides													
Lead-210	Bq/g	< 0.04	**0.04**	< 0.04	5	< 0.04	**0.04**	< 0.04	5	< 0.04	**0.04**	< 0.04	5
Polonium-210	Bq/g	< 0.01	**0.012**	0.02	4	0.01	**0.02**	0.03		< 0.01	**0.012**	0.02	4
Radium-226	Bq/g	< 0.01	**0.01**	0.02	3	< 0.01	**0.01**	0.02	1	< 0.01	**0.01**	0.01	4
Thorium-230	Bq/g	< 0.02	**0.02**	< 0.02	5	< 0.02	**0.02**	< 0.02	5	< 0.02	**0.02**	< 0.02	5

All values lower than a reportable detection limit (RDL) were set equal the RDL for the calculation of mean and standard deviation (SD).

All data presented on a dry weight basis; Min = Minimum; Max = Maximum; #<RDL = number of replicates stations below the RDL.

Means are bolded for ease of data comparison.

Table 4-26

Phytoplankton descriptive statistics from the primary ASA, July 2016 and July 2019.

Area	Density (Cells/L)	Biovolume (µl/L)	Taxon Richness[1]	Simpson's Diversity[1]	Simpson's Evenness[1]
July 2016					
Broach Lake	236578	0.01156	14	0.81	0.38
Patterson Lake West	1635036	0.02040	16	0.61	0.16
Patterson Lake East	576740	0.01489	15	0.62	0.17
Forrest Lake	359846	0.02086	16	0.72	0.22
Beet Channel	585894	0.02803	15	0.61	0.17
Beet Lake	721050	0.05315	15	0.82	0.38
Naomi Lake	6101546	0.43162	22	0.77	0.20
Naomi Lake South	3703829	0.13208	22	0.76	0.19
July 2019					
Hodge Lake	9140768	0.01608	17	0.63	0.16
Lloyd Lake Inlet	13979903	0.17260	21	0.67	0.14

[1]Computed at the Family level.

Table 4-27

Zooplankton descriptive statistics from the primary ASA, July 2016 and July 2019.

Area	Density (Org/L)	Biomass (mg/L)	Taxon Richness[1]	Simpson's Diversity[1]	Simpson's Evenness[1]
July 2016					
Broach Lake	70	0.66036	10	0.51	0.20
Patterson Lake West	107	2.61860	12	0.86	0.59
Patterson Lake East	20	0.47035	13	0.64	0.21
Forrest Lake	93	1.03623	8	0.69	0.41
Beet Channel	25	0.05204	10	0.36	0.16
Beet Lake	299	19.50126	10	0.81	0.52
Naomi Lake	263	0.23747	9	0.37	0.18
Naomi Lake South	63	0.11892	14	0.69	0.23
July 2019					
Hodge Lake	85	1.85558	12	0.37	0.13
Lloyd Lake Inlet	109	4.54832	11	0.63	0.25

[1]Computed at the Family level.

Table 4-28

Benthic invertebrate descriptive statistics for samples collected from the primary ASA, September/October 2017.

Area	Station	Density (Org/m^2)	Taxon Richness[1] (Taxa/m^2)	Biomass (mg/m^2)	Simpson's Diversity[1]	Simpson's Evenness[1]
Broach Lake	1	523	6	1.28	0.72	0.59
	2	1600	9	1.98	0.68	0.35
	3	1354	6	1.75	0.66	0.48
	4	800	4	0.89	0.63	0.68
	5	1969	10	2.26	0.70	0.33
Total		6246	14	8.17	-	-
Mean		**1249**	**7.0**	**1.63**	**0.68**	**0.49**
Standard Deviation		**588**	**2.4**	**0.55**	**0.03**	**0.15**
Minimum		523	4	0.89	0.63	0.33
Maximum		1969	10	2.26	0.72	0.68
Patterson Lake West	1	3250	12	3.1	0.57	0.20
	2	2988	12	2.4	0.72	0.29
	3	1935	14	4.0	0.70	0.24
	4	5304	13	4.3	0.72	0.28
	5	1208	12	1.3	0.51	0.17
Total		14685	21	15.1	-	-
Mean		**2937**	**12.6**	**3.0**	**0.64**	**0.24**
Standard Deviation		**1557**	**0.9**	**1.3**	**0.10**	**0.05**
Minimum		1208	12	1.3	0.51	0.17
Maximum		5304	14	4.3	0.72	0.29
Forrest Lake	1	10892	18	35.9	0.57	0.13
	2	10004	12	12.9	0.79	0.40
	3	19788	27	33.7	0.79	0.17
	4	12081	25	32.2	0.67	0.12
	5	15869	20	30.5	0.71	0.17
Total		68635	32	145.2	-	-
Mean		**13727**	**20.4**	**29.0**	**0.71**	**0.20**
Standard Deviation		**4060**	**5.9**	**9.2**	**0.09**	**0.12**
Minimum		10004	12	12.9	0.57	0.12
Maximum		19788	27	35.9	0.79	0.40
Beet Lake	1	6665	23	4.2	0.45	0.08
	2	4969	14	4.7	0.55	0.16
	3	5665	15	2.6	0.40	0.11
	4	10658	12	6.1	0.39	0.14
	5	12631	19	8.0	0.40	0.09
Total		40588	31	25.6	-	-
Mean		**8118**	**16.6**	**5.1**	**0.44**	**0.11**
Standard Deviation		**3349**	**4.4**	**2.0**	**0.07**	**0.03**
Minimum		4969	12	2.6	0.39	0.08
Maximum		12631	23	8.0	0.55	0.16

Table 4-28

Benthic invertebrate descriptive statistics for samples collected from the primary ASA, September/October 2017.

Area	Station	Density (Org/m^2)	Taxon Richness[1] (Taxa/m^2)	Biomass (mg/m^2)	Simpson's Diversity[1]	Simpson's Evenness[1]
Naomi Lake	1	1108	5	13.1	0.62	0.53
	2	581	6	9.1	0.57	0.39
	3	942	6	17.7	0.59	0.41
	4	673	7	10.5	0.67	0.43
	5	815	5	13.0	0.62	0.52
Total		4119	8	63.4	-	-
Mean		**824**	**5.8**	**12.7**	**0.61**	**0.46**
Standard Deviation		**210**	**0.8**	**3.3**	**0.04**	**0.07**
Minimum		581	5	9.1	0.57	0.39
Maximum		1108	7	17.7	0.67	0.53
Clearwater River (Near-field)	1	10035	10	17.2	0.66	0.29
	2	16681	16	23.1	0.74	0.24
	3	11108	15	35.5	0.71	0.23
	4	16492	12	23.1	0.67	0.25
	5	10035	13	13.6	0.59	0.19
Total		64350	23	112.6	-	-
Mean		**12870**	**13.2**	**22.5**	**0.67**	**0.24**
Standard Deviation		**3422**	**2.4**	**8.3**	**0.06**	**0.04**
Minimum		10035	10	13.6	0.59	0.19
Maximum		16681	16	35.5	0.74	0.29

All data are presented on a 1 m^2 basis, except totals that are on a 5 m^2 basis.

Oligochaete cocoons were excluded because they were not deemed individual specimens.

Crustacean families Daphniidae and Holopedidae as well as crustacean Order Calanoida were deemed non-benthic and were excluded from all analyses.

Unidentified Trombidiformes were included in density but excluded for taxon richness, Simpson's diversity, and Simpson's evenness computations.

[1]Computed at the Family level, except for Cyclopoida, Ostracoda, Nematoda, and Plathyhelminthes that were identified at higher taxonomic levels.

Table 4-29

Benthic invertebrate descriptive statistics for samples collected from the primary ASA, September 2019.

Area	Station	Density (Org/m^2)	Taxon Richness[1] (Taxa/m^2)	Biomass (mg/m^2)	Simpson's Diversity[1]	Simpson's Evenness[1]
Hodge Lake	1	8154	12	12.44	0.65	0.24
	2	7015	12	9.13	0.69	0.27
	3	8369	6	8.80	0.43	0.29
	4	12400	10	14.46	0.30	0.14
	5	31615	8	33.68	0.29	0.18
Total		67554	18	78.51	-	-
Mean		**13511**	**9.6**	**15.70**	**0.47**	**0.22**
Standard Deviation		**10324**	**2.6**	**10.32**	**0.19**	**0.06**
Minimum		7015	6	8.80	0.29	0.14
Maximum		31615	12	33.68	0.69	0.29
Broach Lake	1	4092	13	2.9	0.68	0.24
	2	3477	9	3.0	0.57	0.26
	3	2462	10	3.6	0.84	0.62
	4	4646	12	3.0	0.62	0.22
	5	2431	9	2.2	0.76	0.46
Total		17108	18	14.7	-	-
Mean		**3422**	**10.6**	**2.9**	**0.69**	**0.36**
Standard Deviation		**982**	**1.8**	**0.5**	**0.11**	**0.17**
Minimum		2431	9	2.2	0.57	0.22
Maximum		4646	13	3.6	0.84	0.62
Patterson Lake Northeast	1	14388	19	5.9	0.53	0.11
	2	10219	13	6.8	0.50	0.16
	3	4754	8	3.7	0.66	0.36
	4	6104	13	6.2	0.60	0.19
	5	3300	11	4.0	0.62	0.24
Total		38765	21	26.7	-	-
Mean		**7753**	**12.8**	**5.3**	**0.58**	**0.21**
Standard Deviation		**4518**	**4.0**	**1.4**	**0.06**	**0.10**
Minimum		3300	8	3.7	0.50	0.11
Maximum		14388	19	6.8	0.66	0.36
Patterson Lake North	1	1123	13	1.1	0.74	0.30
	2	2104	14	2.3	0.65	0.21
	3	1692	13	2.5	0.69	0.25
	4	2062	18	2.8	0.71	0.19
	5	1258	13	2.8	0.60	0.19
Total		8238	23	11.5	-	-
Mean		**1648**	**14.2**	**2.3**	**0.68**	**0.23**
Standard Deviation		**450**	**2.2**	**0.7**	**0.06**	**0.05**
Minimum		1123	13	1.1	0.60	0.19
Maximum		2104	18	2.8	0.74	0.30

Table 4-29

Benthic invertebrate descriptive statistics for samples collected from the primary ASA, September 2019.

Area	Station	Density (Org/m^2)	Taxon Richness[1] (Taxa/m^2)	Biomass (mg/m^2)	Simpson's Diversity[1]	Simpson's Evenness[1]
Patterson Lake West	1	4842	14	3.4	0.72	0.25
	2	3869	12	3.2	0.72	0.30
	3	6154	11	7.4	0.74	0.35
	4	2723	12	2.6	0.74	0.32
	5	8962	14	7.6	0.72	0.26
Total		26550	20	24.2	-	-
Mean		**5310**	**12.6**	**4.8**	**0.73**	**0.30**
Standard Deviation		**2400**	**1.3**	**2.5**	**0.01**	**0.04**
Minimum		2723	11	2.6	0.72	0.25
Maximum		8962	14	7.6	0.74	0.35
Patterson Lake East	1	2908	16	2.1	0.68	0.20
	2	6073	17	5.8	0.71	0.21
	3	3358	17	2.5	0.71	0.21
	4	3769	17	2.2	0.67	0.18
	5	5046	14	3.8	0.72	0.26
Total		21154	24	16.4	-	-
Mean		**4231**	**16.2**	**3.3**	**0.70**	**0.21**
Standard Deviation		**1302**	**1.3**	**1.6**	**0.02**	**0.03**
Minimum		2908	14	2.1	0.67	0.18
Maximum		6073	17	5.8	0.72	0.26
Forrest Lake	1	27692	21	36.05	0.65	0.14
	2	24154	7	18.85	0.64	0.40
	3	21231	15	27.28	0.73	0.25
	4	35231	18	40.05	0.69	0.18
	5	19154	12	23.46	0.70	0.27
Total		127462	25	145.70	-	-
Mean		**25492**	**14.6**	**29.14**	**0.68**	**0.25**
Standard Deviation		**6321**	**5.4**	**8.78**	**0.04**	**0.10**
Minimum		19154	7	18.85	0.64	0.14
Maximum		35231	21	40.05	0.73	0.40
Beet Lake Inlet	1	3523	11	2.71	0.54	0.20
	2	3969	13	3.67	0.40	0.13
	3	4473	15	5.96	0.41	0.11
	4	4492	15	4.01	0.53	0.14
	5	4565	14	3.41	0.62	0.19
Total		21023	20	19.76	-	-
Mean		**4205**	**13.6**	**3.95**	**0.50**	**0.15**
Standard Deviation		**449**	**1.7**	**1.22**	**0.09**	**0.04**
Minimum		3523	11	2.71	0.40	0.11
Maximum		4565	15	5.96	0.62	0.20

Table 4-29

Benthic invertebrate descriptive statistics for samples collected from the primary ASA, September 2019.

Area	Station	Density (Org/m^2)	Taxon Richness[1] (Taxa/m^2)	Biomass (mg/m^2)	Simpson's Diversity[1]	Simpson's Evenness[1]
Naomi Lake	1	2000	7	8.06	0.67	0.43
	2	2662	7	6.45	0.70	0.47
	3	2754	6	8.84	0.68	0.52
	4	3862	6	10.85	0.64	0.47
	5	2769	5	9.54	0.63	0.54
Total		14046	10	43.74	-	-
Mean		**2809**	**6.2**	**8.75**	**0.66**	**0.48**
Standard Deviation		**669**	**0.8**	**1.64**	**0.03**	**0.04**
Minimum		2000	5	6.45	0.63	0.43
Maximum		3862	7	10.85	0.70	0.54
Clearwater River	1	10846	10	20.8	0.69	0.32
	2	24692	7	42.2	0.60	0.36
	3	12423	13	14.9	0.74	0.30
	4	21027	15	33.4	0.58	0.16
	5	21077	16	29.3	0.62	0.16
Total		90065	23	140.6	-	-
Mean		**18013**	**12.2**	**28.1**	**0.65**	**0.26**
Standard Deviation		**6035**	**3.7**	**10.6**	**0.07**	**0.09**
Minimum		10846	7	14.9	0.58	0.16
Maximum		24692	16	42.2	0.74	0.36
Lloyd Lake Inlet	1	6773	11	10.2	0.60	0.22
	2	6685	13	9.7	0.61	0.20
	3	5362	11	7.5	0.51	0.19
	4	4723	11	11.4	0.57	0.21
	5	4738	11	7.0	0.60	0.23
Total		28281	21	45.9	-	-
Mean		**5656**	**11.4**	**9.2**	**0.58**	**0.21**
Standard Deviation		**1013**	**0.9**	**1.9**	**0.04**	**0.02**
Minimum		4723	11	7.0	0.51	0.19
Maximum		6773	13	11.4	0.61	0.23

All data are presented on a 1 m^2 basis, except totals that are on a 5 m^2 basis.

Oligochaete cocoons were excluded because they were not deemed individual specimens.

Crustacean families Daphniidae and Holopedidae as well as crustacean Order Calanoida were deemed non-benthic and were excluded from all analyses.

Unidentified Trombidiformes were included in density but excluded for taxon richness, Simpson's diversity, and Simpson's evenness computations.

[1]Computed at the Family level, except for Cyclopoida, Ostracoda, Nematoda, and Plathyhelminthes that were identified at higher taxonomic levels.

Table 4-30
Fish species captured in the primary ASA, 2013 to 2022.

Common Name	Species Name	Primary ASA											Reference	
		Jed Creek	Patterson Lake	Patterson Creek	Forrest Lake	Beet Channel[1]	Beet Lake	Beet Creek[2]	Naomi Lake	Naomi Creek	Clearwater River	Lloyd Lake Inlet	Hodge Lake	Broach Lake
Large-bodied Fish Species														
Arctic Grayling	*Thymallus arcticus*										*			
Burbot	*Lota lota*		o, *, ✓, y		*		*				*	*x*	*x*	*
Longnose Sucker	*Catostomus catostomus*	✓	o, *, ✓	✓	✓	✓	✓	✓			✓			*
Lake Trout	*Salvelinus namaycush*		o, *, ✓		*, ✓		*, ✓						*x*	*
Lake Whitefish	*Coregonus clupeaformis*	✓	o, *, ✓, y	✓	*, ✓	✓	*, ✓	✓	*, ✓	✓	*, ✓	*x*	*x*	*
Northern Pike	*Esox lucius*	✓	o, *, ✓, y	✓	*, ✓	*, ✓	*, ✓	✓	*, ✓	✓	*, ✓	*x*	*x*	*
Walleye	*Sander vitreus*	✓	o, *, ✓, y		*, ✓		*, ✓	✓		✓	✓	*x*		
White Sucker	*Catostomus commersonii*	✓	o, *, ✓, y	✓	*, ✓	*		✓	*	✓	*, ✓	*x*	*x*	*
Yellow Perch	*Perca flavescens*		o; *	✓		*	*		*		*	*x*	*x*	*
Unidentified Sucker Species	*Catostomus* sp.						*							*
Small-bodied Fish Species														
Slimy Sculpin	*Cottus cognatus*		o, *, y		*		*				*	*x*	*x*	*
Lake Chub	*Couesius plumbeus*		o, *, y		*		*				*			*[3]
Ninespine Stickleback	*Pungitius pungitius*		o, *		*		*					*x*	*x*	*
Spottail Shiner	*Notropis hudsonius*		o, *, y		*	*	*		*		*	*x*		*
Trout Perch	*Percopsis omiscomaycus*		o, *, y		*		*						*x*	

o = 2013; * = 2016; ✓ = 2017; *x* = 2019; y = 2022 (Patterson Lake near effluent diffuser); No fish were captured in Ponds 1 and 2.

[1]Beet Lake Channel is located between Forrest Lake and Beet Lake.

[2]Beet Creek is located between Beet Lake and Naomi Lake.

[3]Identification of lake chub was not confirmed.

Table 4-31
Fish species abundance and richness in the primary ASA.

Common Name	Species Name	Primary ASA											Reference		Species Abundance
		Jed Creek	Patterson Lake	Patterson Creek	Forrest Lake	Beet Channel[1]	Beet Lake	Beet Creek[2]	Naomi Lake	Naomi Creek	Clearwater River	Lloyd Lake Inlet	Hodge Lake	Broach Lake	
Large-bodied Fish Species															
Arctic Grayling	*Thymallus arcticus*										1				1
Burbot	*Lota lota*		9		4		15				1	1	9	6	30
Longnose Sucker	*Catostomus catostomus*	16	9	49	33	1	9	278			7			93	402
Lake Trout	*Salvelinus namaycush*		9		45		7						5	9	61
Lake Whitefish	*Coregonus clupeaformis*	289	53	550	31	4	31	8	11	8	2	14	64	33	1001
Northern Pike	*Esox lucius*	4	16	62	55	28	23	58	25	3	9	9	15	12	292
Walleye	*Sander vitreus*	64	18		2		6	35		107	1	33			266
White Sucker	*Catostomus commersonii*	14	289	32	8	5		25	23	2	13	52	3	110	463
Yellow Perch	*Perca flavescens*		10	1		29	65		25		1	20	41	52	151
Unidentified Sucker Species[1]	*Catostomus* sp.						1							9	1
Small-bodied Fish Species															
Slimy Sculpin	*Cottus cognatus*		6		4		5				1	6	1	14	22
Lake Chub	*Couesius plumbeus*		28		90		10				3			106	131
Ninespine Stickleback	*Pungitius pungitius*		1		1		1					19	1	21	22
Spottail Shiner	*Notropis hudsonius*		87		11	35	14		74		22	57		6	300
Trout Perch	*Percopsis omiscomaycus*		153		48		7						42		208
Total Fish per Waterbody		387	688	694	332	102	194	404	158	120	61	211	181	471	3351
Species Richness		5	13	5	12	6	12	5	5	4	11	9	9	11	-

[1]Sucker species captured were young-of-the-year, and could be white sucker, longnose sucker, or both. Note: these individuals were not included in species richness so as not to double count species within the ASA.
Fish species abundance and richness is based on fish catch data from both the 2016 community survey and the 2017 spawning surveys, with the exception of Hodge and Lloyd lakes which were only sampled as part of the fish community survey in 2019.

Table 4-32

Catch-per-unit-effort for electrofishing and half-standard gang gill net sets in the primary ASA.

Waterbody	Boat Electrofishing		Half-standard Gang Gill Net	
	Species	CPUE (# fish/hour)	Species	CPUE (# fish/hour)
Patterson Lake	White Sucker	174.3	Lake Whitefish	1.2
	Trout Perch	105.6	Walleye	0.7
	Spottail Shiner	60.4	Lake Trout	0.4
	Lake Chub	19.4	Northern Pike	0.3
	Burbot	4.9	White Sucker	0.3
	Longnose Sucker	4.9		
	Slimy Sculpin	4.2		
	Yellow Perch	2.1		
	Ninespine Stickleback	0.7		
Patterson Lake (near proposed treated effluent discharge)	Trout Perch	26.9	Walleye	1.6
	Lake Chub	15.4	Lake Whitefish	1.3
	Burbot	7.7	White Sucker	1.1
	Northern Pike	5.8	Northern Pike	0.16
	Spottail Shiner	3.8		
	White Sucker	3.8		
	Slimy Sculpin	1.9		
Forrest Lake	Trout Perch	61.5	Lake Whitefish	0.2
	Lake Chub	56.4	Northern Pike	0.2
	Spottail Shiner	14.1	Lake Trout	0.09
	Northern Pike	10.3	Walleye	0.03
	White Sucker	9.0		
	Slimy Sculpin	5.1		
	Burbot	3.8		
	Ninespine Stickleback	1.3		
Beet Channel	Spottail Shiner	87.5	White Sucker	1.2
	Yellow Perch	72.5	Lake Whitefish	0.3
	Northern Pike	30.0	Northern Pike	0.3
	White Sucker	2.5		
Beet Lake	Yellow Perch	144.4	Lake Whitefish	1.5
	Burbot	33.3	Northern Pike	0.3
	Spottail Shiner	28.9	Walleye	0.3
	Lake Chub	22.2	Lake Trout	0.06
	Trout Perch	15.6		
	Slimy Sculpin	11.1		
	Longnose Sucker	4.4		
	Northern Pike	4.4		
	Ninespine Stickleback	2.2		
	Sucker species	2.2		

Table 4-32

Catch-per-unit-effort for electrofishing and half-standard gang gill net sets in the primary ASA.

Waterbody	Boat Electrofishing		Half-standard Gang Gill Net	
	Species	CPUE (# fish/hour)	Species	CPUE (# fish/hour)
Naomi Lake	Spottail Shiner	137.0	White Sucker	2.0
	Yellow Perch	46.3	Lake Whitefish	0.8
	Northern Pike	14.8	Northern Pike	0.5
	White Sucker	1.9		
Clearwater River	Spottail Shiner	45.8		
	White Sucker	18.8		
	Northern Pike	16.7		
	Lake Chub	6.3		
	Burbot	2.1		
	Slimy Sculpin	2.1		
	Lake Whitefish	2.1		
	Yellow Perch	2.1		
Lloyd Lake Inlet[1]	Spottail Shiner	63.6	Walleye	2.8
	White Sucker	59.1	Lake Whitefish	1.2
	Yellow Perch	22.7	Northern Pike	0.7
	Ninespine Stickleback	21.6		
	Slimy Sculpin	6.8		
	Burbot	1.1		
	Northern Pike	1.1		
	Walleye	1.1		
Hodge Lake[1]	Trout Perch	31.8	Lake Whitefish	0.8
	Yellow Perch	31.1	Northern Pike	0.09
	Burbot	6.1	Lake Trout	0.07
	Northern Pike	3.0	Burbot	0.01
	White Sucker	2.3		
	Slimy Sculpin	0.8		
	Ninespine Stickleback	0.8		
Broach Lake	Lake Chub	79.1	White Sucker	1.2
	Longnose Sucker	64.9	Lake Whitefish	0.7
	White Sucker	58.2	Lake Trout	0.4
	Yellow Perch	38.1	Northern Pike	0.3
	Ninespine Stickleback	15.7	Longnose Sucker	0.2
	Lake Whitefish	11.2		
	Slimy Sculpin	10.4		
	Sucker species	6.7		
	Burbot	4.5		
	Spottail Shiner	4.5		
	Northern Pike	2.2		

= number; CPUE = catch per unit effort.

Table 4-33

Fish species presence in the secondary ASA, 2016 and 2017.

Common Name	Species Name	Secondary ASA					
		Lake A	Lake B	Lake C	Lake D	Lake E	Lake F
Large-bodied Fish Species							
Burbot	*Lota lota*			*			*
Lake Trout	*Salvelinus namaycush*						✓
Lake Whitefish	*Coregonus clupeaformis*						*, ✓
Northern Pike	*Esox lucius*				*, ✓	*, ✓	*, ✓
White Sucker	*Catostomus commersonii*			*, ✓	*, ✓		
Yellow Perch	*Perca flavescens*					*	*
Small-bodied Fish Species							
Lake Chub	*Couesius plumbeus*	*	*	*			
Spottail Shiner	*Notropis hudsonius*					*	*
Trout Perch	*Percopsis omiscomaycus*						*

* = 2016 fish catch data; ✓ = 2017 fish catch data.

Table 4-34

Fish species abundance and richness in the secondary ASA, 2016 and 2017.

Common Name	Species Name	Secondary ASA						Species Abundance
		Lake A	Lake B	Lake C	Lake D	Lake E	Lake F	
Large-bodied Fish Species								
Burbot	*Lota lota*			8			3	11
Lake Trout	*Salvelinus namaycush*						14	14
Lake Whitefish	*Coregonus clupeaformis*						37	37
Northern Pike	*Esox lucius*				63	53	8	124
White Sucker	*Catostomus commersonii*			314	127			441
Yellow Perch	*Perca flavescens*					59	53	112
Small-bodied Fish Species								
Lake Chub	*Couesius plumbeus*	184	366	9				559
Spottail Shiner	*Notropis hudsonius*					204	117	321
Trout Perch	*Percopsis omiscomaycus*						23	23
Total Fish per Waterbody		184	366	331	190	316	255	**1642**
Species Richness		1	1	3	2	3	7	**-**

Table 4-35

Summary of catch-per-unit-effort for the fish community survey completed in the secondary ASA, July 2016.

Waterbody	Method	Effort (hours)	Species	CPUE (# fish/hour)
Lake A	Boat Electrofishing	0.36	Lake Chub	272.2
	Half-standard Gang	10.34	No Fish	0
	Minnow Trap	224.46	Lake Chub	0.4
Lake B	Boat Electrofishing	0.17	Lake Chub	705.9
	Half-standard Gang	7.61	No Fish	0
	Minnow Trap	23.88	Lake Chub	10.3
Lake C	Boat Electrofishing	0.28	White Sucker	389.3
			Burbot	17.9
			Lake Chub	7.1
	Half-standard Gang	9.59	White Sucker	19.4
	Minnow Trap	272.06	Lake Chub	0.03
			White Sucker	0.02
			Burbot	0.01
Lake D	Boat Electrofishing	0.41	White Sucker	278.0
			Northern Pike	51.2
	Half-standard Gang	10.43	Northern Pike	1.0
			White Sucker	0.7
	Minnow Trap	231.83	Northern Pike	0.004
Lake E	Boat Electrofishing	0.17	Spottail Shiner	1188.2
			Yellow Perch	335.3
			Northern Pike	11.8
	Half-standard Gang	10.91	Northern Pike	0.5
			Yellow Perch	0.09
	Minnow Trap	239.00	Spottail Shiner	0.008
			Yellow Perch	0.004
Lake F	Boat Electrofishing	0.21	Spottail Shiner	471.4
			Yellow Perch	166.7
			Trout Perch	109.5
			Burbot	14.3
			Northern Pike	4.8
	Half-standard Gang	5.67	Lake Whitefish	2.5
	Minnow Trap	207.45	Spottail Shiner	0.09
			Yellow Perch	0.09

Table 4-36

Summary of lake whitefish bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Lake Whitefish Bone															
	Primary ASA															
	Patterson Lake				Forrest Lake				Beet Lake				Naomi Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)																
Arsenic	0	0.1	0.20	0.27	0	0.33	0.38	0.44	0	0.2	0.36	0.66	0	0.19	0.28	0.46
Cadmium	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.02	5	<0.02	0.02	<0.02
Cobalt	0	0.1	0.1	0.2	0	0.1	0.1	0.2	0	0.1	0.1	0.2	0	0.1	0.1	0.2
Copper	0	0.34	0.62	0.95	0	0.33	0.48	0.61	0	0.31	0.40	0.59	0	0.23	0.52	0.73
Lead	5	<0.02	0.02	<0.03	1	<0.02	0.06	0.1	5	<0.02	0.02	<0.02	4	<0.02	0.02	0.02
Mercury	1	<0.02	0.04	0.1	0	0.02		0.08	0	0.02	0.05	0.1	0	0.02	0.05	0.1
Nickel	4	<0.04	0.05	0.05	4	<0.04	0.08	0.25	4	<0.04	0.06	0.1	5	<0.04	0.05	<0.05
Selenium	0	0.32	1.2	2.2	0	0.31	0.5	0.86	0	0.19	0.3	0.42	0	0.1	0.2	0.25
Uranium	0	0.02	0.05	0.09	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.02	5	<0.02	0.02	<0.02
Physical Properties																
% Moisture	0	52.39	58.18	63.17	0	48.24	54.27	60.26	0	48.63	52.58	56.39	0	48.14	54.17	58.54
Radionuclides (Bq/g)																
Lead-210	4	<0.004	0.005	0.008	5	<0.004	0.004	<0.005	2	<0.004	0.007	0.01	5	<0.004	0.005	<0.005
Polonium-210	0	0.002	0.008	0.01	0	0.002	0.004	0.005	0	0.001	0.004	0.006	0	0.001	0.003	0.007
Radium-226	5	<0.002	0.002	<0.002	4	<0.002	0.002	0.002	4	<0.002	0.002	0.002	5	<0.002	0.002	<0.002
Thorium-230	5	<0.002	0.004	<0.005	5	<0.002	0.004	<0.005	5	<0.002	0.004	<0.006	5	<0.004	0.005	<0.005

Table 4-36

Summary of lake whitefish bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Lake Whitefish Bone											
	Primary ASA				Reference							
	Lloyd Lake Inlet				Hodge Lake				Broach Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)												
Arsenic	1	<0.1	0.14	0.2	1	<0.1	0.14	0.2	0	0.25	0.32	0.39
Cadmium	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.02	0.02	<0.03
Cobalt	0	0.13	0.2	0.2	0	0.16	0.2	0.2	0	0.1	0.2	0.2
Copper	0	0.2	0.44	0.9	0	0.4	0.56	0.7	0	0.2	0.32	0.39
Lead	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	2	<0.02	0.02	0.03
Mercury	2	<0.05	0.07	0.11	4	<0.05	0.05	0.06	0	0.05	0.05	0.05
Nickel	5	<0.1	0.10	<0.1	5	<0.1	0.10	<0.1	5	<0.05	0.05	<0.05
Selenium	0	0.2	0.2	0.3	0	0.4	0.7	1.1	0	0.6	0.7	0.82
Uranium	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.02	0.02	<0.03
Physical Properties												
% Moisture	0	48.13	51.57	56.85	0	51.02	56.38	61.31	0	56.15	57.97	61.71
Radionuclides (Bq/g)												
Lead-210	5	<0.004	0.004	<0.005	3	<0.004	0.006	0.01	3	<0.002	0.004	0.005
Polonium-210	0	0.002	0.003	0.004	0	0.011	0.013	0.016	0	0.001	0.003	0.005
Radium-226	4	<0.002	0.003	0.006	1	<0.002	0.003	0.004	5	<0.001	0.002	<0.003
Thorium-230	5	<0.003	0.004	<0.007	5	<0.003	0.004	<0.005	5	<0.002	0.004	<0.005

Table 4-36

Summary of lake whitefish bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Lake Whitefish Flesh															
	Primary ASA															
	Patterson Lake				Forrest Lake				Beet Lake				Naomi Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)																
Arsenic	0	0.08	0.1	0.2	0	0.2	0.3	0.5	1	<0.04	0.1	0.3	0	0.1	0.20	0.42
Cadmium	5	<0.008	0.008	<0.009	5	<0.007	0.008	<0.009	5	<0.007	0.008	<0.008	5	<0.007	0.008	<0.009
Cobalt	1	<0.008	0.01	0.02	1	<0.007	0.01	0.02	3	<0.008	0.01	0.01	1	<0.008	0.02	0.02
Copper	1	<0.04	0.39	0.72	0	0.43	0.90	1.6	0	0.3	0.60	0.82	1	<0.04	0.41	0.75
Lead	5	<0.008	0.008	<0.009	4	<0.007	0.008	0.01	4	<0.007	0.008	0.008	5	<0.007	0.008	<0.009
Mercury	0	0.05	0.2	0.46	0	0.072	0.1	0.28	0	0.12	0.46	1.2	0	0.058	0.15	0.26
Mercury[1]	0	-	0.04	-	0	-	0.03	-	0	-	0.1	-	0	-	0.04	-
Nickel	4	<0.04	0.05	0.09	1	<0.04	0.10	0.3	5	<0.04	0.04	<0.04	3	<0.03	0.05	0.1
Selenium	0	0.74	3.2	5.4	0	0.61	1.0	2.0	0	0.4	0.7	1.1	0	0.3	0.4	0.69
Uranium	4	<0.004	0.004	0.005	5	<0.004	0.004	<0.004	5	<0.004	0.004	<0.004	5	<0.003	0.004	<0.004
Physical Properties																
% Moisture	0	74.2	76.15	77.9	0	72.13	73.74	76.84	0	72.32	74.33	76.14	0	70.86	74.06	76.9
Radionuclides (Bq/g)																
Lead-210	5	<0.004	0.004	<0.005	5	<0.004	0.004	<0.004	5	<0.004	0.004	<0.004	5	<0.003	0.004	<0.004
Polonium-210	0	0.002	0.014	0.024	0	0.0043	0.0057	0.0072	1	<0.0007	0.0021	0.004	2	<0.0007	0.0011	0.002
Radium-226	5	<0.0002	0.0003	<0.0003	5	<0.0002	0.0002	<0.0003	5	<0.0002	0.0002	<0.0003	5	<0.0002	0.0002	<0.0002
Thorium-230	5	<0.0004	0.0004	<0.0005	5	<0.0004	0.0004	<0.0004	5	<0.0004	0.0005	<0.001	5	<0.0003	0.0003	<0.0004

Table 4-36

Summary of lake whitefish bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Lake Whitefish Flesh											
	Primary ASA				Reference							
	Lloyd Lake Inlet				Hodge Lake				Broach Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)												
Arsenic	0	0.08	0.18	0.36	0	0.1	0.13	0.21	0	0.05	0.07	0.1
Cadmium	5	<0.01	0.01	<0.01	4	<0.01	0.01	0.02	5	<0.009	0.01	<0.01
Cobalt	2	<0.01	0.02	0.04	0	0.01	0.02	0.03	0	0.01	0.01	0.02
Copper	0	0.36	0.70	0.94	0	0.91	1.2	1.4	0	0.2	0.7	1.5
Lead	5	<0.01	0.01	<0.01	5	<0.01	0.01	<0.01	4	<0.009	0.01	0.02
Mercury	0	0.04	0.3	0.44	0	0.12	0.2	0.2	0	0.22	0.25	0.28
Mercury[1]	0	-	0.07	-	0	-	0.03	-	0	-	0.05	-
Nickel	4	<0.05	0.05	0.07	5	<0.05	0.05	<0.05	5	<0.04	0.05	<0.05
Selenium	0	0.17	0.4	0.58	0	1.2	2.0	3.2	0	1.5	1.7	2.1
Uranium	5	<0.005	0.005	<0.005	5	<0.005	0.005	<0.005	5	<0.004	0.005	<0.005
Physical Properties												
% Moisture	0	66.98	72.97	75.46	0	75.26	77.27	78.72	0	77.26	78.97	80.48
Radionuclides (Bq/g)												
Lead-210	4	<0.004	0.004	0.004	5	<0.004	0.004	<0.005	5	<0.004	0.005	<0.005
Polonium-210	2	<0.0008	0.0011	0.002	0	0.006	0.009	0.012	1	<0.001	0.002	0.003
Radium-226	4	<0.0002	0.0003	4E-04	5	<0.0002	0.0003	<0.0003	4	<0.0002	0.0003	0.0004
Thorium-230	5	<0.0004	0.0005	<0.0007	5	<0.0005	0.0009	<0.002	5	<0.0003	0.0004	<0.0005

Results are presented on a dry weight basis; n = sample size; RDL = reportable detection limit; Min = minimum; Max = maximum.

All values lower than a reportable detection limit (RDL) were set equal the RDL for the calculation of summary statistics.

[1]Mean concentrations were converted to wet weight to aid in guideline comparison using the following equation: wet weight concentration = dry weight concentration*((100-% moisture)/100).

Table 4-37

Summary of northern pike bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Northern Pike Bone															
	Primary ASA															
	Patterson Lake				Forrest Lake				Beet Lake				Naomi Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)																
Arsenic	0	0.28	0.36	0.55	0	0.2	0.27	0.43	0	0.22	0.30	0.37	0	0.2	0.27	0.37
Cadmium	5	<0.02	0.02	<0.02	5	<0.02	0.03	<0.03	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.02
Cobalt	0	0.1	0.1	0.2	0	0.2	0.2	0.2	0	0.1	0.2	0.22	0	0.1	0.1	0.1
Copper	1	<0.05	0.14	0.36	0	0.38	0.60	0.96	0	0.27	0.40	0.48	0	0.2	0.35	0.55
Lead	5	<0.02	0.02	<0.02	5	<0.02	0.03	<0.03	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.02
Mercury	2	<0.02	0.03	0.05	0	0.05	0.06	0.08	0	0.09	0.2	0.2	0	0.07	0.1	0.2
Nickel	2	<0.04	0.07	0.1	5	<0.05	0.05	<0.06	3	<0.04	0.06	0.1	4	<0.04	0.05	0.07
Selenium	0	0.26	0.34	0.55	0	0.24	0.29	0.35	0	0.1	0.19	0.23	0	0.2	0.21	0.24
Uranium	5	<0.02	0.02	<0.02	5	<0.02	0.03	<0.03	5	<0.02	0.02	<0.03	5	<0.02	0.02	<0.02
Physical Properties																
% Moisture	0	55.47	57.28	59.72	0	55.72	60.28	66.19	0	51.34	56.37	62.34	0	55.33	57.94	59.96
Radionuclides (Bq/g)																
Lead-210	5	<0.004	0.006	<0.01	5	<0.005	0.005	<0.006	4	<0.004	0.005	0.006	5	<0.004	0.005	<0.005
Polonium-210	0	0.002	0.003	0.007	0	0.002	0.004	0.006	2	<0.001	0.002	0.003	0	0.002	0.004	0.005
Radium-226	5	<0.002	0.002	<0.002	3	<0.002	0.002	0.003	4	<0.002	0.002	0.002	5	<0.002	0.002	<0.002
Thorium-230	4	<0.002	0.004	0.005	5	<0.003	0.005	<0.005	5	<0.004	0.005	<0.006	5	<0.004	0.005	<0.005

Table 4-37

Summary of northern pike bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Northern Pike Bone											
	Primary ASA				Reference							
	Lloyd Lake Inlet				Hodge Lake				Broach Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)												
Arsenic	5	<0.1	0.1	<0.1	1	<0.1	0.1	0.2	0	0.05	0.2	0.4
Cadmium	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.02	0.02	<0.03
Cobalt	0	0.16	0.20	0.24	0	0.14	0.19	0.29	0	0.1	0.19	0.23
Copper	0	0.4	0.60	0.9	0	0.2	0.5	1.1	0	0.47	0.53	0.68
Lead	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.02	0.02	<0.03
Mercury	0	0.12	0.16	0.22	0	0.05	0.2	0.42	1	<0.02	0.04	0.05
Nickel	4	<0.1	0.1	0.1	5	<0.1	0.1	<0.1	5	<0.05	0.1	<0.05
Selenium	0	0.2	0.3	0.3	0	0.3	0.4	0.6	0	0.1	0.2	0.28
Uranium	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.02	0.02	<0.03
Physical Properties												
% Moisture	0	54.30	58.78	61.61	0	47.59	53.07	59.55	0	55.59	58.27	60.32
Radionuclides (Bq/g)												
Lead-210	4	<0.004	0.005	0.005	4	<0.004	0.005	0.006	5	<0.005	0.005	<0.005
Polonium-210	0	0.001	0.003	0.005	0	0.003	0.003	0.004	2	<0.001	0.003	0.005
Radium-226	5	<0.002	0.002	<0.003	2	<0.002	0.003	0.003	2	<0.002	0.003	0.005
Thorium-230	5	<0.004	0.005	<0.006	5	<0.004	0.004	<0.006	5	<0.005	0.005	<0.005

Table 4-37

Summary of northern pike bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Northern Pike Flesh															
	Primary ASA															
	Patterson Lake				Forrest Lake				Beet Lake				Naomi Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)																
Arsenic	0	0.1	0.1	0.2	0	0.09	0.1	0.1	0	0.05	0.1	0.1	0	0.2	0.2	0.3
Cadmium	5	<0.009	0.009	<0.009	5	<0.008	0.009	<0.009	5	<0.009	0.009	<0.01	5	<0.008	0.009	<0.009
Cobalt	3	<0.009	0.01	0.03	4	<0.008	0.01	0.009	4	<0.009	0.01	0.01	4	<0.008	0.01	0.01
Copper	2	<0.04	0.28	0.56	0	0.47	0.76	0.93	0	0.55	0.75	0.97	3	<0.04	0.08	0.2
Lead	5	<0.009	0.009	<0.009	5	<0.008	0.009	<0.009	3	<0.009	0.02	0.050	5	<0.008	0.009	<0.009
Mercury	0	0.19	0.2	0.3	0	0.2	0.3	0.33	0	1.1	1.4	2.3	0	0.29	0.5	0.8
Mercury[1]	0	-	0.05	-	0	-	0.06	-	0	-	0.29	-	0	-	0.1	-
Nickel	4	<0.04	0.04	0.05	5	<0.04	0.04	<0.04	5	<0.05	0.05	<0.05	4	<0.04	0.08	0.2
Selenium	0	0.85	0.90	1.0	0	0.54	0.62	0.74	0	0.51	0.55	0.63	0	0.48	0.56	0.66
Uranium	5	<0.004	0.004	<0.005	5	<0.004	0.004	<0.004	5	<0.005	0.005	<0.005	5	<0.004	0.005	<0.005
Physical Properties																
% Moisture	0	76.48	77.40	77.97	0	76.33	76.92	77.59	0	77.94	79.12	80.42	0	75.19	77.74	78.88
Radionuclides (Bq/g)																
Lead-210	5	<0.004	0.004	<0.005	5	<0.004	0.004	<0.004	5	<0.005	0.005	<0.005	5	<0.004	0.005	<0.005
Polonium-210	0	0.0045	0.0098	0.017	0	0.0074	0.017	0.026	0	0.004	0.007	0.0082	0	0.003	0.008	0.012
Radium-226	5	<0.0002	0.0003	<0.0004	5	<0.0002	0.0003	<0.0004	5	<0.0002	0.0003	<0.0003	5	<0.0002	0.0003	<0.0003
Thorium-230	5	<0.0002	0.0005	<0.0009	5	<0.0003	0.0005	<0.0009	4	<0.0002	0.0004	0.0005	5	<0.0004	0.0005	<0.0009

Table 4-37

Summary of northern pike bone and flesh chemistry results from the primary ASA, 2016 and 2019.

Parameter	Northern Pike Flesh											
	Primary ASA				Reference							
	Lloyd Lake Inlet				Hodge Lake				Broach Lake			
	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max	n<RDL	Min	Mean	Max
Metals (µg/g)												
Arsenic	0	0.05	0.1	0.07	0	0.11	0.18	0.26	2	<0.04	0.1	0.2
Cadmium	5	<0.01	0.01	<0.01	5	<0.01	0.01	<0.01	5	<0.008	0.01	<0.01
Cobalt	2	<0.01	0.01	0.02	4	<0.01	0.01	0.01	3	<0.008	0.01	0.01
Copper	0	0.8	1.2	1.7	0	0.54	0.72	1.0	0	0.44	0.62	0.89
Lead	4	<0.01	0.01	0.01	4	<0.01	0.01	0.02	5	<0.008	0.01	<0.01
Mercury	0	0.45	0.92	1.3	0	0.48	1.0	3.3	0	0.15	0.3	0.4
Mercury[1]	0	-	0.19	-	0	-	0.33	-	0	-	0.06	-
Nickel	5	<0.05	0.05	<0.05	5	<0.05	0.05	<0.05	5	<0.04	0.04	<0.05
Selenium	0	0.66	0.76	0.85	0	1.2	1.4	1.7	0	0.2	0.47	0.64
Uranium	5	<0.005	0.005	<0.005	5	<0.005	0.005	<0.005	5	<0.004	0.004	<0.005
Physical Properties												
% Moisture	0	78.45	78.80	79.14	0	76.50	77.28	78.11	0	76.46	77.74	79.75
Radionuclides (Bq/g)												
Lead-210	5	<0.005	0.005	<0.005	5	<0.004	0.004	<0.004	4	<0.004	0.004	0.005
Polonium-210	0	0.004	0.006	0.008	0	0.003	0.008	0.014	0	0.002	0.004	0.010
Radium-226	5	<0.0003	0.0003	<0.0003	5	<0.0002	0.0002	<0.0003	5	<0.0002	0.0003	<0.0003
Thorium-230	5	<0.0006	0.0006	<0.0006	5	<0.0004	0.0005	<0.0006	4	<0.0003	0.0005	0.0009

Results are presented on a dry weight basis; n = sample size; RDL = reportable detection limit; Min = minimum; Max = maximum.

All values lower than a reportable detection limit (RDL) were set equal the RDL for the calculation of summary statistics.

[1]Mean concentrations were converted to wet weight to aid in guideline comparison using the following equation: wet weight concentration = dry weight concentration*((100-% moisture)/100).

Table 4-38
Soil map units in the 2018/2019 baseline SSA.

Map Unit	Soil Model[1]				Landscape Model	
	Name	Dominant Soil(s)	Significant Soil(s)	Inclusion Soil(s)	Code	Description
Soil Map Units						
BMT	Bitumount	Gleysols (BMT series and variants)	Organics (ABN and variants)	-	I3l; H1m	Inclined, low relief; Hummocky, moderate relief
FIR	Firebag	Eluviated Dystric Brunisols (FIR series)	-	Eluviated Dystric Brunisols (MIL series)	H1l	Hummocky, low relief
GGR	Gregoire	Organics (GGR and variants)	-	-	O1	Level, flat, horizontal, or plateau peatlands
GYP	Gypsy	Eluviated Dystric Brunisols (GYP series)			H1m	Hummocky, moderate relief
MIL	Mildred	Eluviated Dystric Brunisols (MIL series and variants, FIR series)	Eluviated Sombric Brunisols (MIL variants); Eluviated Dystric Brunisols (FIR series and variants, GYP series)	Eluviated Dystric Brunisols (KEL and GYP series); Gleyed Eluviated Dystric Brunisols (FIR variants); Cumulic Humic Regosols (MMY variants); Orthic Sombric Brunisols (MIL variants); Gleyed Eluviated Dystric Brunisols; Orthic Dystric Brunisols; Eluviated Sombric Brunisols (MIL variants); Rego Gleysols (NOR variants)	H1h; H1l; SC2; I3h; H1m	Hummocky, low, medium, and high relief; Wide Valleys; Inclined, high relief
MMWH	Mamawi/Wanham	Cumulic Rego Gleysols (MMW variants) Humic Luvic Gleysols (WHM variants)	Gleyed Eluviated Sombric Brunisols (MIL variants)	-	FP1	Meander floodplain
MMY	McMurray	Gleyed Cumulic Regosols (MMY variants)	-	-	L2	Level, closed basin
NOR	Norberta	Rego Humic Gleysols (NOR variants)	-	-	L1	Level plain
Non-Soil Map Units						
DL	Disturbed Land	-	-	-	-	-
L	Lake	-	-	-	-	-
ZZZ	Open Water	-	-	-	-	-

[1]Dominant soils are those occupying 60% or more of the soil polygon (for a single soil series) or between 30% and 60% of the soil polygon (for two co-dominant soil series); significant soils are those occupying between 10% and 30% of the soil polygon; inclusions are those occupying less than 10% of the soil polygon.

Table 4-39

Summary characteristics and soil quantity available for reclamation for soil map units in the 2018/2019 baseline SSA.

Soil Map Units	Soil Series	Peat + Topsoil Thickness (cm)[1]				Topsoil Texture	Areal Extent	Quantity of Topsoil[3]
		n	Mean	Min	Max		ha	m3
Mineral Soils								
BMT	Bitumount	3	26	7	51	Sand	46	119,600
FIR	Firebag	48	13	4	45	Sand	99	128,700
GYP	Gypsy	14	15	7	32	Loam	30	45,000
MIL	Mildred	108	15	2	78	Sand	1,547	2,320,500
MMWH	Mamawi/Wanham	2	10	2	18	Silt Loam	24	24,000
MMY	McMurray	2	13	0	25	Sand	3	3,900
NOR	Norberta	2	30	54	30	Sand	9	27,000
							Total Quantity	**2,668,700**
Organic Soils								
GGR	Gregorie	3	114	105	126	-	7	79,800
							Total Quantity	**79,800**
Miscellaneous Soils, Rock Outcrops, and Non-Soils								
DL	Disturbed Land	-	-	-	-	-	60	-
L	Open Water	-	-	-	-	-	670	-

[1]The terminal depth explored for organic soils was 160 cm; however, organic materials may exist at depths beyond 160 cm.

[2]Calculated only for soil investigations where bedrock was encountered within the terminal depth explored (160 cm for organic soils, 120 cm for mineral soils).

[3]Quantity of Topsoil for Mineral Soils is the quantity of A horizon; Quantity of Topsoil for Organic Soils is the cumulative quantity of Om, Of, Oh, and buried A horizons.

Table 4-40

Summary of soil chemistry data from permanent sampling plots.

Parameter	Units	RDL	Reference				Exposure				SEQG[1]	
											Coarse Grained	
			Min	Mean	Max	#<RDL	Min	Mean	Max	#<RDL	Residential/ Parkland	Industrial
Metals												
Arsenic	µg/g	0.1	0.4	**0.75**	1.4	0	0.7	**0.98**	2.1	0	17	26
Cadmium	µg/g	0.1	0.1	**0.1**	0.1	5	0.1	**0.1**	0.1	4	10	22
Cobalt	µg/g	0.2	0.2	**0.583**	1.4	2	0.2	**0.4**	0.7	1	20	300
Copper	µg/g	0.5	0.5	**0.983**	1.8	2	0.8	**1.37**	2.3	0	63	91
Lead	µg/g	0.1	1.2	**2.32**	3.7	0	1.7	**1.98**	2.3	0	140 [2]	600
Nickel	µg/g	0.1	0.2	**1.58**	3.7	0	0.4	**1.68**	3.5	0	45	89
Selenium	µg/g	0.1	0.1	**0.117**	0.2	5	0.1	**0.1**	0.1	6	1	2.9
Uranium	µg/g	0.1	0.1	**0.25**	0.4	0	0.2	**0.38**	0.9	0	23 [2]	510 [2]
Physical Properties												
pH	-	0.07	**4.44**	**4.61**	**4.92**	0	**3.73**	**4.29**	**4.94**	0	6.0 to 8.5	6.0 to 8.5
Radionuclides												
Lead-210	Bq/g	0.04	0.04	**0.04**	0.04	6	0.04	**0.04**	0.04	5	-	-
Polonium-210	Bq/g	0.01	0.01	**0.018**	0.04	3	0.01	**0.018**	0.04	2	-	-
Radium-226	Bq/g	0.01	0.01	**0.015**	0.02	2	0.01	**0.012**	0.02	2	-	-
Thorium-230	Bq/g	0.02	0.02	**0.02**	0.02	6	0.02	**0.02**	0.02	5	-	-

Min = minimum; Max = maximum; RDL = reportable detection limit; #<RDL = number of samples that were under the RDL "-" = no data.

Total sample size (n) of 6 per media per area. All values set equal to RDL for calculation of summary statistics.

[1]Saskatchewan Environmental Quality Guidelines - Tier 2 (GS 2023a); based on ecological contact, unless otherwise noted.

[2]SEQG based on dermal contact.

Shaded cells indicate parameter concentration is outside of the SEQG range.

Means are bolded for ease of data comparison.

Table 4-41
Summary of ecosites present in the Project vegetation and wildlife study areas.

Ecosite Code	Ecosite Description	SSA (ha)	SSA (%)	PDA (ha)	PDA (%)	Vegetation		Vegetation RSA / Wildlife LSA (ha)	Vegetation RSA / Wildlife LSA (%)	Wildlife	
						LSA (ha)	LSA (%)			RSA (ha)	RSA (%)
Anthropogenic	Anthropogenically disturbed	43.7	**10.9**	109.0	**7.6**	118.5	**4.3**	277.9	**1.5**	1182.8	**0.4**
Bare	Bare rock or soil	-	**-**	-	**-**	-	-	0.6	**0.0**	238.3	**0.1**
BS02	Lichen/felsenmeer - bedrock	-	**-**	-	**-**	-	**-**	-	**-**	226.4	**0.1**
BS03	Jack pine/blueberry/lichen	57.7	**14.4**	222.5	**15.4**	373.7	**13.4**	2755.3	**15.2**	114180.9	**34.1**
BS04	Jack pine - black spruce/feathermoss	11.1	**2.8**	44.3	**3.1**	103.6	**3.7**	1355.9	**7.5**	41680.9	**12.4**
BS05	Jack pine - white spruce/feathermoss	0.1	**0.0**	1.2	**0.1**	7.3	**0.3**	83.2	**0.5**	507.6	**0.2**
BS09	Black spruce - jack pine/feathermoss	16.0	**4.0**	62.2	**4.3**	119.6	**4.3**	842.7	**4.6**	4196.5	**1.3**
BS13	White birch - black spruce - trembling aspen	-	**-**	-	**-**	-	**-**	-	**-**	3641.9	**1.1**
BS14	White birch/lingonberry - Labrador tea	4.5	**1.1**	43.2	**3.0**	110.7	**4.0**	232.2	**1.3**	2485.3	**0.7**
BS15	Trembling aspen - white birch/green alder	-	**-**	-	**-**	-	**-**	-	**-**	748.1	**0.2**
BS17	Black spruce treed bog	2.3	**0.6**	12.7	**0.9**	25.8	**0.9**	424.1	**2.3**	11509.7	**3.4**
BS18	Labrador tea shrubby bog	4.4	**1.1**	27.6	**1.9**	62.8	**2.3**	517.4	**2.9**	9757.1	**2.9**
BS19	Graminoid bog	1.6	**0.4**	8.6	**0.6**	14.8	**0.5**	99.0	**0.5**	1369.5	**0.4**
BS22	Leatherleaf shrubby poor fen	-	**-**	-	**-**	-	**-**	-	**-**	1700.7	**0.5**
BS23	Willow shrubby rich fen	2.3	**0.6**	13.8	**1.0**	35.0	**1.3**	110.0	**0.6**	1080.4	**0.3**
BS24	Graminoid fen	-	**-**	-	**-**	-	**-**	-	**-**	85.3	**0.0**
BS26	Rush sandy shore	-	**-**	-	**-**	-	**-**	-	**-**	2518.6	**0.8**
Regenerating forest	Regenerating forest	249.4	**62.3**	876.6	**60.8**	1489.7	**53.6**	8537.2	**47.1**	89900.3	**26.8**
Regenerating wetland	Regenerating forested wetland	-	**-**	-	**-**	-	**-**	-	**-**	5877.2	**12.6**
Water	Water	7.0	**1.8**	20.4	**1.4**	319.8	**11.5**	2916.8	**16.1**	42101.5	**1.8**
Total		**400.1**	**100**	**1442.1**	**100**	**2781.2**	**100**	**18152.4**	**100**	**334989.1**	**100**

SSA = Site Study Area; PDA = Potential Disturbance Area; LSA = Local Study Area; RSA = Regional Study Area.

Table 4-42
Plant species of conservation concern recorded in the Project vegetation study areas, 2018 and 2022.

Scientific Name[1]	Common Name[1]	Number of plants observed (n=)				Provincial Rank and Activity Restriction Guidelines[2]				Habitat
		Site Study Area (SSA)	Potential Disturbance Area (PDA)	Vegetation Local Study Area (LSA)	Vegetation Regional Study Area (RSA)	SKCDC Rank	Protected Aspect	Restricted Activity Dates	Setback Distance (m)[2]	
Carex concinna	Beautiful sedge	-	40	2	-	S3	Occurrence	Year-round	30	Occurs in moist, shady, non-peaty forests such as those composed of white spruce and balsam poplar (Leighton 2012).
Carex trisperma var. *trisperma*	Three-fruited sedge[3]	-	40	50	-	S4	Occurrence	Year-round	30	Occurs in wet black spruce woods, older thickets, muskegs, and open or treed bogs (Leighton 2012).
Botrychium lanceolatum ssp. *lanceolatum*	Triangle grape-fern	-	-	3	-	S2	Occurrence	Year-round	30	Occurs in open woods and grassy slopes (Harms and Leighton 2011a).
Dichanthelium lanuginosum (Syn. *Dichanthelium acuminatum* ssp. *fasciculatum*)	Hairy panic-grass	-	-	53	-	S3	Occurrence	Year-round	30	Occurs in dry-moist, open woods, shrubby areas, exposed rock outcrops, low meadows and forest depressions, and margins of marshes, swamps, bogs, and fens (Leighton and Harms 2014).
Drosera anglica	English sundew	-	501	-	-	S3	Occurrence	Year-round	30	Occurs on marly shores, fens, and drainage tracks in peat bogs (FNA 2019).
Huperzia selago var. *selago*	Mountain club-moss	-	800	-	-	S1	Occurrence	Year-round	30	Occurs in moist peaty places in spruce woods, muskegs, bogs, organic shores, and moist rock-crevices (Harms and Leighton 2011a).
Isoetes lacustris	Lake quillwort	-	-	17	7	S2	Occurrence	Year-round	30	Occurs in cold, nutrient-poor, northern lakes. Submersed (Harms & Leighton 2011a).
Juncus stygius ssp. *americanus*	Moor rush	-	50	-	-	S3	Occurrence	Year-round	30	Occurs in wet mossy woods, peaty lake shores, bogs, bog pools and sometimes calcareous fen margins (Harms et al. 2018).

Table 4-42
Plant species of conservation concern recorded in the Project vegetation study areas, 2018 and 2022.

Scientific Name[1]	Common Name[1]	Number of plants observed (n=)				Provincial Rank and Activity Restriction Guidelines[2]				Habitat
		Site Study Area (SSA)	Potential Disturbance Area (PDA)	Vegetation Local Study Area (LSA)	Vegetation Regional Study Area (RSA)	SKCDC Rank	Protected Aspect	Restricted Activity Dates	Setback Distance (m)[2]	
Lepidozia reptans	Creeping fingerwort[4]	-	-	1	1	S3	Occurrence	Year-round	30	Occurs on rotten logs, stumps, and wood (Vitt et al. 1988).
Lobelia dortmanna	Water lobelia	-	-	280	1	S3	Occurrence	Year-round	30	Occurs in shallow lakes (Looman and Best 1979).
Lophozia ventricosa	Tumid notchwort[4]	-	-	1	-	S3	Occurrence	Year-round	30	Occurs on decaying wood in boreal, montane, and subalpine forests (Vitt et al. 1988).
Malaxis paludosa	Bog adder's-mouth orchid	-	-	2	-	S3	Occurrence	Year-round	30	Occurs in wet, springy, black spruce woods, and sphagnaceous bogs and fens (Harms and Leighton 2011b).
Myriophyllum alterniflorum	Alternate-flowered water milfoil	-	-	2	-	S2	Occurrence	Year-round	30	Occurs in shallow water in boreal forest (Looman & Best 1979).
Listera borealis (Syn. *Neottia cordata*)	Heart-leaved twayblade	-	50	-	67	S3	Occurrence	Year-round	30	Occurs in moist to wet, mossy spruce or mixed-wood forests, swamps, and sphagnaceous bogs and fens (Harms & Leighton 2011b).
Platanthera orbiculata	Large roundleaf orchid	-	-	1	-	S3	Occurrence	Year-round	30	Occurs in mesic to wet, rich, dense coniferous and mixedwood forests with thick moss, and fens (Harms and Leighton 2011b).
Potamogeton robbinsii	Flatleaf	-	-	-	1	S3	Occurrence	Year-round	30	Occurs in ponds, lakes, and slow-flowing rivers (FNA 2020).
Potamogeton strictifolius	Upright narrow-leaved pondweed	-	-	-	5	S3	Occurrence	Year-round	30	Occurs in alkaline waters of lakes and slow-moving streams (FNA 2020).
Puccinellia distans ssp. *hauptiana*	Haupt's alkali-grass	17	-	-	-	S2	Occurrence	Year-round	30	Occurs in saline mud flats in tailings and open, sandy, disturbed sites (Leighton & Harms 2014).

Table 4-42

Plant species of conservation concern recorded in the Project vegetation study areas, 2018 and 2022.

Scientific Name[1]	Common Name[1]	Number of plants observed (n=)				Provincial Rank and Activity Restriction Guidelines[2]				Habitat
		Site Study Area (SSA)	Potential Disturbance Area (PDA)	Vegetation Local Study Area (LSA)	Vegetation Regional Study Area (RSA)	SKCDC Rank	Protected Aspect	Restricted Activity Dates	Setback Distance (m)[2]	
Rhododendron tomentosum	Labrador-tea[3]	-	-	1000	4	S4	Occurrence	Year-round	30	Occurs in bogs, muskeg, tundra, and raised beach ridges (FNA 2019).
Salix glauca var. *villosa*	Gray-leaf willow	-	-	1		S2	Occurrence	Year-round	30	Occurs in mesic-moist riparian forests, forest openings, muskegs, sedge meadows, treed bogs, shores, and talus slopes (Argus et al. 2016).
Spiranthes lacera var. *lacera*	Northern slender ladies'-tresses	-	-	20	-	S3	Occurrence	Year-round	30	Occurs in moist to drying, sandy and peaty, open, spruce woods, barrens, and meadows (Harms and Leighton 2011b).
Subularia aquatica ssp. *americana*	Water awlwort	-	-		2	S3	Occurrence	Year-round	30	Occurs in shallow lake bottoms, submerged (SASK Herbarium 2006)

SKCDC = Saskatchewan Conservation Data Centre.

S1 = Critically imperiled/extremely rare; S2 = Imperiled/very rare; S3 = Vulnerable/rare to uncommon; H = Historical occurrence.

[1]Scientific and common names, and SKCDC ranks adhere to the SKCDC taxa lists for vascular and non-vascular plants (SKCDC 2023a).

[2]Activity restriction guidelines for medium-disturbance activities, as recommended by ENV (2017).

[3]Species ranking was altered and is no longer considered rare.

[4]Species is a non-vascular plant found incidentally.

Table 4-43

Summary of blueberry stems and leaf and lichen chemistry data from permanent sampling plots.

Parameter	Units	Reference										Exposure									
		RDL	Blueberry				RDL	Lichen				RDL	Blueberry				RDL	Lichen			
			Min	Mean	Max	# <RDL		Min	Mean	Max	# <RDL		Min	Mean	Max	# <RDL		Min	Mean	Max	# <RDL
Metals																					
Arsenic	µg/g	0.05	0.05	**0.05**	0.05	6	0.05	0.15	**0.2**	0.26	0	0.05	0.05	**0.05**	0.05	5	0.05	0.11	**0.182**	0.32	0
Cadmium	µg/g	0.01	0.01	**0.012**	0.02	4	0.01	0.06	**0.073**	0.09	0	0.01	0.01	**0.012**	0.02	4	0.01	0.04	**0.06**	0.09	0
Cobalt	µg/g	0.01	0.04	**0.067**	0.09	0	0.01	0.19	**0.345**	0.59	0	0.01	0.05	**0.112**	0.19	0	0.01	0.11	**0.275**	0.56	0
Copper	µg/g	0.05	1.8	**3.68**	4.6	0	0.05	1.2	**1.67**	2.4	0	0.05	2.8	**4.1**	4.8	0	0.05	1.3	**1.65**	2.0	0
Lead	µg/g	0.01	0.01	**0.038**	0.09	0	0.01	0.57	**1.41**	2.5	0	0.01	0.02	**0.107**	0.26	0	0.01	0.59	**1.15**	2.3	0
Nickel	µg/g	0.05	0.69	**1.58**	2.5	0	0.05	3.2	**7.57**	17	0	0.05	1.2	**2.82**	5.9	0	0.05	1.1	**5.82**	14	0
Selenium	µg/g	0.05	0.05	**0.05**	0.05	5	0.05	0.07	**0.088**	0.1	0	0.05	0.05	**0.05**	0.05	6	0.05	0.05	**0.072**	0.1	0
Uranium	µg/g	0.01	0.01	**0.01**	0.01	5	0.01	0.02	**0.042**	0.06	0	0.01	0.01	**0.232**	1.1	1	0.01	0.10	**0.415**	1.4	0
Physical Properties																					
% Moisture	%	0.01	52.46	**54.13**	55.08	0	0.01	4.62	**10.21**	25.60	0	0.01	51.84	**54.44**	56.62	0	0.01	8.91	**12.48**	18.87	0
Radionuclides																					
Lead-210	Bq/g	0.006 to 0.007	0.01	**0.127**	0.41	0	0.001 to 0.004	0.27	**0.447**	0.64	0	0.006 to 0.007	0.02	**0.023**	0.03	0	0.001 to 0.004	0.25	**0.363**	0.5	0
Polonium-210	Bq/g	0.002	0.007	**0.066**	0.2	0	0.0002 to 0.001	0.12	**0.287**	0.46	0	0.002	0.007	**0.012**	0.015	0	0.0002 to 0.001	0.19	**0.293**	0.47	0
Radium-226	Bq/g	0.0003 to 0.0006	0.002	**0.003**	0.0049	0	0.0002 to 0.001	0.001	**0.002**	0.004	0	0.0003 to 0.0006	0.004	**0.019**	0.08	0	0.0002 to 0.001	0.004	**0.024**	0.11	0
Thorium-230	Bq/g	0.0006 to 0.001	0.0006	**0.0007**	0.0009	6	0.0005 to 0.002	0.0006	**0.0012**	0.002	4	0.0006 to 0.001	0.0007	**0.002**	0.009	4	0.0005 to 0.002	0.002	**0.009**	0.039	2

Min = minimum; Max = maximum; RDL = reportable detection limit; #<RDL = number of samples that were below the RDL.

Total sample size (n) of 6 per media per area. All values set equal to RDL for calculation of summary statistics.

Means are bolded for ease of data comparison.

Table 4-44
Wildlife species of conservation concern recorded in the Project wildlife study areas, 2018, 2019, and 2022.

Scientific Name[1]	Common Name[1]	Federal Rank and Activity Restriction Guidelines					Provincial Rank and Activity Restriction Guidelines[3]		
		COSEWIC Status	SARA Status	Protected Aspect	Restricted Activity Dates	Setback Distance (m)[2]	SKCDC Rank	Protected Aspect	Restricted Activity Dates
Amphibians									
Anaxyrus hemiophrys	Canadian toad	-	-	-	-	-	S4	Breeding and overwintering habitat	Year-round
Birds									
Chordeiles minor	Common nighthawk	Special Concern	Special Concern	Nest	May 1 to August 31	200	S4B	Breeding bird	May 1 to August 31
Chroicocephalus philadelphia	Bonaparte's gull	-	-	-	-	-	S4B	Nesting colony	May 1 to July 15
Contopus cooperi	Olive-sided flycatcher	Special Concern	Threatened	Nest	May 1 to August 31	300	S4B	Breeding bird	May 1 to August 31
Euphagus carolinus	Rusty blackbird	Special Concern	Special Concern	Nest	May 1 to July 31	300	S3B,SUN	Breeding bird	May 1 to July 31
Gavia immer	Common loon	-	-	-	-	-	S5B,SUN	Breeding bird	May 15 to July 15
Gavia stellata	Red-throated loon	-	-	-	-	-	S1B	Breeding bird	May 15 to July 15
Haliaeetus leucocephalus	Bald eagle	-	-	-	-	-	S5B,S5N,S4M	Nest site	March 15 to July 15
Hirundo rustica	Barn swallow	Special Concern	Threatened	Nest	May 1 to August 31	100	S4B	-	-
Larus argentatus	Herring gull	-	-	-	-	-	S5B	Nesting colony	May 15 to July 15
Pandion haliaetus	Osprey	-	-	-	-	-	S3B	Nest site	May 1 to August 15
Pelecanus erythrorhynchos	American white pelican	-	-	-	-	-	S5B	Nesting colony	April 1 to July 31
Pinicola enucleator	Pine grosbeak	-	-	-	-	-	S2B,S4N	-	-
Tringa flavipes	Lesser yellowlegs	Threatened	-	-	-	-	S4B	-	-
Mammals									
Eptesicus fuscus	Big brown bat	-	-	-	-	-	S5	Roost/ foraging site	Year round
Gulo gulo	Wolverine	Special Concern	-	-	-	-	S2	-	-
Lasiurus borealis	Eastern red bat	Endangered	-	Den	Year-round	500	S4B	Roost/ foraging site	Year round
Lasionycteris noctivagans	Silver -haired bat[3]	Endangered	-	-	-	-	S5B	Roost/ foraging site	Year round
Lasiurus cinereus	Hoary bat[3]	Endangered	-	-	-	-	S5B	Roost/ foraging site	Year round
Myotis lucifugus	Little brown myotis	Endangered	Endangered	-	-	-	S4B,S4N	Roost/foraging site	Year round
Myotis septentrionalis	Northern myotis	Endangered	Endangered	-	-	-	S3	Roost/foraging site	Year round
Rangifer tarandus caribou	Woodland caribou	Threatened	Threatened	-	-	-	S3	-	-

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = Species at Risk Act; SKCDC = Saskatchewan Conservation Data Centre.

S1 = Critically imperiled/extremely rare; S2 = Imperiled/very rare; S3 = Vulnerable/rare to uncommon; S4 = Apparently secure; S5 = Secure/common; B = Breeding population; M = Migratory population; N = Non-breeding population; SNR = Not ranked; SU = Status uncertain due to limited information.

[1]Scientific names, common names and SKCDC ranks adhere to the SKCDC taxa list for vertebrates (SKCDC 2023b).

[2]Activity restriction guidelines for high-disturbance activities, as recommended by ENV (2017).

[3]Silver-haired and hoary bats could not be distinguished during the 2018/2019 baseline surveys; only hoary bats were identified during 2022 baseline surveys.

SECTION 5

EFFECTS ASSESSMENT APPROACH

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LIST OF ACRONYMS

ACFN	Athabasca Chipewyan First Nation
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
CEA	Cumulative Effects Assessment
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminants of Potential Concern
CRDN	Clearwater River Dene Nation
CSM	Conceptual Site Model
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
HHERA	Human Health and Ecological Risk Assessment
ICP	Institutional Control Program
IPCC	Intergovernmental Panel on Climate Change
LSA	Local Study Area
MN-S	Métis Nation Saskatchewan
NexGen	NexGen Energy Ltd
PDA	Potential Disturbance Area
RCP	Representative Concentration Pathway
REA	Residual Effects Assessment
RSA	Regional Study Area
SEQG	Saskatchewan Environmental Quality Guideline
SSA	Site Study Area
SOCC	Species of Conservation
TMF	Tailings Management Facility
TOR	Terms of Reference
UGTMF	Underground Tailings Management Facility
VC	Valued Component
WRSA	Waste Rock Storage Area

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5.0 EFFECTS ASSESSMENT APPROACH

5.1 Introduction

The effects assessment is the core of the Environmental Impact Assessment (EIA) process and provides a means for stakeholders, Indigenous Nations and communities, and regulatory agencies to be involved during the project planning stage. The EIA process applied to the PLS Project (the Project) was iterative with information received from engagement and technical assessments used to improve Project design and mitigation planning, and to inform effects assessment methodologies and monitoring/management plan development. The objective was to use the EIA process to optimize the Project and reduce uncertainties and impacts to the biophysical and human environments to the extent possible.

The effects assessment stages completed for Project included the following:

1. Identifying environmental components, Valued Components (VCs), key indicators, measurable parameters, spatial and temporal boundaries, and potential positive and negative Project-environment interactions to include in the effects assessment.
2. Identifying design features, best practices, management and monitoring plans, and other measures the Project will use to mitigate predicted adverse effects.
3. Evaluating the significance of key adverse effects predicted to remain after the implementation of mitigation measures (Residual Effects Assessment [REA]).
4. Identifying uncertainties in the REA and follow-up assessments or monitoring to address these uncertainties.
5. Completing a Cumulative Effects Assessment (CEA) to identify and evaluate impacts from other past, present, or reasonably foreseeable projects or activities that may combine with and amplify Project-specific residual effects (ENV 2021).

A schematic illustrating this approach is provided in Figure 5-1. This section of the Environmental Impact Statement (EIS) presents the methodology used to complete the effects assessment for the Project and is divided into four stages: scoping, screening, REA, and CEA. Information provided in the Saskatchewan Ministry of Environment (ENV) Guidelines for the Terms of Reference (TOR) and EIS (ENV 2021), the TOR for the Project (Fission 2022), and reviewer comments on the TOR were incorporated into this approach. Concordance between the components of the effects assessment approach of this EIS and the ENV guidelines (ENV 2021) is provided in Table 5-1.

5.2 Input from Stakeholders and Indigenous Nations and Communities

A comprehensive suite of engagement activities, which are described in detail in Section 3.0, provided a means for stakeholders and Indigenous Nations and communities to provide input on EIS components and Project design and mitigation measures. The comments or input received through engagement was entered into a database, coded by VC or topic area, and provided to the EIS team for consideration at several intervals throughout the EIA process.

Input from stakeholders and Indigenous Nations and communities received following review of the Project Technical Proposal (Clifton Engineering Group Inc. 2021) and TOR (Fission 2022) was utilized early in the scoping stage to inform selection of VCs, key indicators, measurable parameters, and an initial list of Project-environment interactions.

Information received in response to a request by Fission for traditional land use information was used to select receptors, receptor locations, and study areas, and to inform the description of the existing environment and Project-environment interactions.

Input received from leadership meetings, community meetings, and community-led studies was used to inform the description of the existing environment, Project-environment interactions, and identification of mitigation measures. The EIS team discipline leads integrated engagement input into their respective assessments.

A summary of how the engagement input received from Indigenous Nations and communities was used to inform the various processes and sections of the EIS is provided in Appendix B.2, Consultation Report.

5.3 Scoping

The scoping stage was used to define the environmental components and VCs for the effects assessment along with key indicators and measurable parameters for each VC. Spatial and temporal assessment boundaries were delineated for each environmental component and in some cases at the VC level.

5.3.1 Environmental Components and Valued Components

The environmental components assessed in this EIS are broad and encompass potentially affected physical, biological, and human environments. They include the following:

- Atmospheric and acoustic environment
- Visual environment
- Hydrogeological environment
- Aquatic environment
- Terrestrial environment
- Human environment

To concentrate on environmental and social aspects of most relevance to the Project area and activities, VCs were selected within each of the environmental components listed above. VCs refer to a selected list of biophysical and human components that may be affected (positively or negatively) by the Project, and these are the focus of the effects assessment. The selection of VCs was carried out in consideration of:

- potential for spatial and temporal overlap with Project activities;
- input from stakeholders and Indigenous Nations and communities;
- components that are known to be of ecological, human health, cultural, and/or socio-economic importance;
- input from regulatory agencies, including the TOR document (Fission 2022) and reviewer comments;
- Species of Conservation Concern (SOCC) with the potential to utilize the Project area (e.g., boreal woodland caribou [*Rangifer tarandus caribou*]);
- information from baseline studies;
- receptors identified for inclusion in the Human Health and Ecological Risk Assessment (HHERA); and
- best practices as well as precedent for effects assessments from other mining developments located in similar environments in northern Saskatchewan, including projects included in the CEA.

A list of the VCs selected for this EIS and the rationale for their inclusion is provided in Table 5-2.

5.3.2 Key Indicators and Measurable Parameters

Key indicators and measurable parameters were identified for each VC that were used in the effects assessment to provide focus and quantitative criteria for evaluating magnitudes of change (Table 5-2).

Key indicators identify components or species that are the focus of the assessment and were selected using the same methods presented above for selecting VCs. For some VCs, key indicators were physical measures such as groundwater flow or water quality, for other VCs such as furbearers and birds, this included identifying specific species as key indicators.

Measurable parameters represent expressions of change that were used during the effects assessment to determine if an impact (positive or negative) was predicted to occur and a means for evaluating the change, such as comparing to existing conditions or guideline values/benchmarks. These may be quantitative, such as changes in water chemistry, or qualitative such as evaluating potential effects on community well-being. The predicted level of change in a measurable parameter is a key factor in identifying the magnitude of impact that a Project activity may cause on the VC, the significance, and the extent of uncertainty.

5.3.3 Intermediate Valued Components

Select VCs were considered as intermediate VCs because their significance of change was evaluated by considering their effect on another VC or key indicator. The VCs identified as intermediate VCs for this EIS include air quality, noise and vibration, visual landscape, groundwater and surface water quantity and quality, and terrain and soils (Table 5-2). These are physical attributes of the environment upon which other biophysical and human environment VCs rely and interact. A REA and CEA was completed on Project-environment interactions that were deemed as key interactions for intermediate VCs, but a significance determination was not completed. The information used to assess change of intermediate VCs (e.g., results of air quality modelling) was incorporated into the significance determination for relevant VCs/key indicators that interact with and could be affected by the intermediate VC.

5.3.4 Boundaries

5.3.4.1 Spatial

The spatial boundaries for the EIA are of a geographical scale that enables an evaluation of potential Project-related effects on local and regional natural and human environments and considers the potential for cumulative effects.

The following spatial scales were applied to each component.

Site Study Area (SSA): The SSA includes the Project area where construction, operation, and decommissioning activities are planned as described in Section 2, Project Description. The SSA is 400.1 hectares and includes the currently planned locations of site facilities and infrastructure surrounded by a 50 m buffer to allow for small variances as the Project design moves forward (Figure 5-2).

Potential Disturbance Area (PDA): In addition to the SSA, a larger area of approximately 1442.1 hectares was assessed as a PDA to provide flexibility and account for potential expansion of facilities or other design changes that may occur and are currently not foreseen. This conservative approach was undertaken to ensure effects are not underestimated and to encompass potential uncertainties as Project design progresses (Figure 5-2).

Local Study Area (LSA): The LSA is defined as the area adjacent to the SSA and PDA where there is the highest potential for direct and indirect Project-related impacts on VCs. LSAs often differ between components and/or VCs as physical, biological, and human components function within the environment at different spatial scales; thus, VC-specific LSAs are described within the relevant subsections in Section 6, Effects Assessment.

Regional Study Area (RSA): The RSA is defined as a larger area adjacent to the LSA where there is the potential for indirect Project effects and/or cumulative effects on VCs. Like LSAs, RSAs often vary between components and/or VCs and were selected in consideration of factors such as species home ranges, Projects included in the CEA, and broader community use of the region. VC-specific RSAs are described within the relevant subsections in Section 6, Effects Assessment.

The Project design includes continuing to have Highway 955 bisect the site. A preliminary plan to create a highway bypass was discontinued following input from local Indigenous Nations and communities. Site roads will branch off the highway to connect with Project infrastructure and the site roads are included in the SSA (Figure 5-2). The effects assessment LSA or RSA for certain VCs include portions of Highway 955.

5.3.4.2 Temporal

The temporal boundaries used in the effects assessment extend over the life of the Project and are inclusive of all Project stages including construction, operation, decommissioning, and post-decommissioning. For select assessments, such as modelling unintended liner

seepage of Contaminants of Potential Concern (COPC) into groundwater and transport, a long-term time frame of 10,000 years was also applied.

To provide a conservative basis for the EIA and to allow for operational flexibility for the Project, including the identification of additional ore to be mined and processed, it was necessary to bound the EIA beyond the current project design basis. The design schedule for the Project currently consists of 3 years construction, 10 years of operation, 8 years of decommissioning, and 3 years of post-decommissioning monitoring. However, as detailed below, the operational timeline assessed was extended to 15 years to allow for flexibility and to ensure the EIA is providing a conservative assessment over an extended timeline.

Current planned production is 93.7 million pounds of U_3O_8 over a 10-year period with a maximum annual production plan of 14.4 million pounds in Year 6 (Tetra Tech 2023). In this scenario, 1000 tonnes per day of material is fed to the mill. To provide conservatism and flexibility, this EIA assesses production of 15 million pounds of U_3O_8 per year over a 15-year time frame, and 1500 tonnes per day being fed to the mill. Additionally, where applicable, assessments include a peak production year of 20 million pounds U_3O_8 in any single year.

Thus, in summary, the temporal boundaries assessed in this EIA extend for a period of 29 years and include construction (3 years), operations (15 years), decommissioning (8 years), and post-decommissioning (3 years). The same temporal boundaries were applied to all VCs, with long-term timeframes applied where relevant.

5.4 Project Effects Assessment

5.4.1 Screening Assessment

The screening assessment involved completing a thorough examination of potential Project-environment interactions to identify potential negative or positive effect pathways of Project activities on VCs and describing Project design features and mitigation measures that will reduce or eliminate the negative effects. This process resulted in determining the following: 1) whether there were interactions between VCs and Project activities during each phase (i.e., Project-environment interaction), 2) whether the Project-environment interaction resulted in residual effects, and 3) the predicted magnitude of the biophysical or human environment change (i.e., negligible or measurable). Measurable parameters (Table 5-2) were used to assess which Project-environment interactions had magnitudes of

change greater than negligible and were designated as key interactions. Further details on this process are provided in the subsections below.

5.4.1.1 Project-environment Interactions

The first step in the screening assessment involved identifying all pathways by which the Project could potentially affect the environmental components and VCs. For a Project-environment interaction to occur there needs to be a source of impact, a VC that could be affected, and a valid connection from the source to the VC in the environment. This is illustrated in the Conceptual Site Model (CSM) provided in Figure 5-3. The proposed Project inputs, outputs, and activities described in Section 2, the existing environment information described in Section 4, technical expertise, review of literature and other publicly available EISs, consultation with regulators, and input obtained through engagement with stakeholders and Indigenous Nations and communities were collectively used to determine the interactions between the environment and the Project.

Table 5-3 provides an overview of Project activities or components, their Project stage, and anticipated interactions with each VC. This information was used to determine the Project-environment interactions, also referred to as effects pathways, that were evaluated as part of the screening assessment in Section 6, Effects Assessment.

5.4.1.2 Mitigation Measures

During the screening assessment, Project-environment interactions were evaluated to determine if Project design and the mitigation strategies discussed below eliminated the pathway or reduced the effect to a negligible level.

Mitigation measures were developed using a common hierarchy of strategies that included avoid, minimize, restore/reclaim/rehabilitate, and offset (Arlidge et al. 2018). The EIA process enabled an iterative approach whereby mitigations were developed and implemented as a result of engagement input or initial assessment results to further reduce potential effects. Numerous management and monitoring plans are being developed to ensure effective mitigation measure implementation and to monitor their effectiveness throughout the life of the Project (refer to Section 9).

The main mitigation strategy used was avoidance, which was achieved by measures such as modifying the Project layout or methods. An example is the mining method was redesigned to consist of only underground mining instead of a hybrid open pit/underground

mining option because input from Indigenous Nations and communities stated that the underground only option was highly preferred.

Several mitigation strategies aim to minimize the likelihood, magnitude, extent, and duration of potential effects during the Project stages and minimize overall impacts. An example of this strategy was optimization of the treated effluent diffuser design and location to ensure sufficient dispersion of COPC occurs in the receiving environment.

Wherever possible, reclamation strategies will be employed throughout the Project phases prior to extensive reclamation occurring during the decommissioning stage. Reclamation and restoration activities to be completed during closure activities will be detailed in the Decommissioning and Reclamation Plan being developed for the Project. The need for offsetting or compensation will be determined through regulatory processes and will be implemented where required. Fission has committed to a habitat offset to address disturbance to woodland caribou habitat due to development of the Project.

5.4.1.3 Screening Criteria

Each Project-environment interaction was screened to assess the predicted magnitude of change on the VC and to determine if the pathway has the potential to cause residual effects beyond negligible. The extent of measurable change on the VC was evaluated using measurable parameters outlined in Table 5-2. The following criteria were used to determine which Project-environment interactions were evaluated in the REA.

1. No Interaction: If a Project-environment interaction is expected to result in no measurable change to the VC or has no direct effect on a receptor, then no residual effect is predicted, and the pathway was not included in the REA and determination of significance.

2. Minor Interaction: If a Project-environment interaction is expected to result in minor changes to the VC and residual effects are predicted to be negligible, then the pathway was not included in the REA and determination of significance.

3. Key Interaction: If a Project-environment interaction is expected to result in measurable changes to the VC and residual effects beyond negligible are predicted, then the pathway was moved forward into the REA and determination of significance.

This process focuses the REA on the highest risks to the biophysical and human environments and ensures that mitigation measures will be duly implemented in order to avoid residual effects to the extent possible.

5.4.2 Residual Effects Assessment

A REA was completed on the Project-environment interactions determined to have key interactions during the screening assessment described above that are negative in direction. Information obtained from comprehensive assessments conducted to evaluate the measurable parameters (e.g., air quality modelling, HHERA, comparisons to guidelines) was used to complete a weight of evidence approach where the overall significance of each residual effect was rated by collectively considering multiple criteria commonly used in EIAs. Definitions of the criteria used are as follows.

Direction indicates whether the residual effect will result in a negative (i.e., adverse) or positive (i.e., beneficial) change.

Magnitude is the expected scale and/or severity of the residual effect and indicates the degree to which the effect is different from existing conditions, reference criteria, or guideline values.

Geographic extent is the spatial area over which the residual effect is expected to occur; ratings correlate to the SSA, PDA, LSA, or RSA applied to each VC.

Duration is the length of time from when the residual effect begins to the time it is reversed or an effect can no longer be measured.

Reversibility is the likelihood and time required after removal of the stressor to the VC to return to a state that is similar to baseline or to other similar areas in the region at that time.

Timing identifies the Project phase during which the residual effect is expected to occur (i.e., construction, operations, decommissioning, or post-decommissioning).

Frequency is associated with duration and defines how often the residual effect is expected to occur. Occasional residual effects occur only once or a few times while continuous effects occur constantly over a specified duration.

Likelihood is the probability of the residual effect occurring and is a measure of uncertainty.

Table 5-4 summarizes the criteria used for characterizing residual effects that were applied to all VCs. For the criteria of magnitude, VC-specific definitions were developed to enable a more quantitative approach to the evaluation (Table 5-5)[1]. Criteria ratings for direction and timing were not included because direction is simply categorized as a negative or positive change and the focus of the REA and significance determination is on adverse effects. Timing indicates the Project stage in which the effect is anticipated to occur, which is identified as part of the screening effects assessment.

5.4.2.1 Significance Determination

The criteria discussed above were collectively used to rate the significance of each residual effect as not significant or significant, except for VCs identified as intermediate VCs. This rating system uses a weight of evidence approach that considers predicted changes in the measurable endpoints of the VC and assesses the overall level of impact and risk in consideration of the criteria ratings. The most weight was placed on magnitude, geographic extent, and duration, with likelihood, frequency, and reversibility included as secondary factors. This approach places more importance on effects with the highest impact that could affect the biophysical or human environments on a larger and/or longer scale. As much as possible, the magnitude was evaluated using measurable parameters that were quantifiable, which resulted in the creation of VC-specific magnitude rating criteria being developed. Ecological or social context was considered to ensure the objective of focusing the effects assessment on areas of highest importance to the environment, people, and culture was met. A significance determination was not provided for positive effects, but these are important to discuss for consideration of the overall benefits provided to local stakeholders and Indigenous Nations, the economy, and the global need for uranium as a critical mineral.

5.4.2.2 Uncertainty

The EIS acts to predict future conditions of biophysical and human environments, but there is a complexity of factors, interactions, and unknowns that introduce a level of uncertainty. Determination of the level of confidence or uncertainty in predicted effects, the ratings provided for each criterion, and the overall significance determination was identified in the REA and was also broadly captured in the rating criterion of likelihood. Specific follow-up monitoring or other measures designed to reduce or alleviate the uncertainties were identified and included in the commitments register (refer to Section 11). Wherever

[1] Definitions were not provided for the VCs of economic wellbeing and heritage resources as the Project-environment interactions did not proceed to a REA or CEA.

possible, conservative assessment approaches were taken to ensure effects were not underestimated which increases the level of confidence that negative effects will not extend beyond the magnitudes predicted.

Monitoring programs will be used to follow-up on identified uncertainties and will provide an on-going evaluation of the accuracy of the effects assessment, mitigation measure effectiveness, and significance determinations (refer to Section 9). Throughout the life of the Project, information, processes, mitigations, management plans, and monitoring programs will be revisited and updated as needed.

5.5 Cumulative Effects Assessment

Cumulative impacts are residual impacts on the environment combined with the environmental impacts of other past, present, or reasonably near future projects or activities in the area. The objective of this CEA is to identify Project-specific residual effects that may combine with the impacts from other past, present, or reasonably foreseeable future projects or activities to create or amplify adverse impacts on VCs, and to propose additional mitigation measures to avoid, minimize, or offset identified cumulative effects (ENV 2021). Risk evaluation and mitigation measures associated with potential effects on the Project caused by non-anthropogenic events (i.e., hurricanes, forest fires, etc.) are discussed in Section 8.0, Effects of the Environment on the Project, and those associated with Malfunctions and Accidents are discussed in Section 7.0.

For Project-environment interactions to be considered in the CEA for the Project, the following criteria had to be met:

- The Project-environment interaction had to be designated as a key interaction during the screening assessment and evaluated as part of the REA.
- The residual effect from the Project had to have the potential to act cumulatively with residual effects from other projects or activities on the same VC.
- The spatial and temporal scales had to overlap causing potential for the cumulative effect to occur.

The same VCs and spatial study areas assessed for the Project were included in the CEA. The temporal scale used in this assessment considered the impacts of historical, current, and reasonably foreseeable future developments that may occur during the lifespan of the Project assessed in this EIS (29 years). Throughout the Project life, it is anticipated that the region will be subject to continued mineral exploration and other developments, in addition

to unpredictable activities, which may further influence and/or contribute to cumulative effects in the area. Since these are unknowns, the CEA only includes reasonably foreseeable projects or activities that have been publicly announced and have relatively defined locations and timelines. The projects and activities included in the CEA are discussed further in the subsequent section.

5.5.1 Projects Included in the CEA

The Project is in a remote area of northwestern Saskatchewan and the primary activity in the region is mineral exploration. Forestry occurs in the region, but as described in Section 2, Project Description, there are no forestry leases in the vicinity of the Project.

The Project is in the Athabasca Basin where uranium exploration and mining activities have been conducted since the 1940s. The only uranium mining and milling operation that has occurred on the west side of the basin was the Cluff Lake Project located approximately 90 km north of the Project along Highway 955. During its operation between 1979 and 2002, the Cluff Lake Project produced over 62 million pounds of uranium concentrate. The site has been fully decommissioned and open to the public since 2013 and was released to the Province of Saskatchewan under its Institutional Control Program (ICP) in 2023. Since the site is fully reclaimed, has been released to ICP, and is not located in close proximity to the Project, it is not being considered in this CEA.

Several companies are in the early to advanced stages of exploration in close proximity to the Project area, particularly for uranium and oil sands resources. Mineral dispositions issued by the Government of Saskatchewan to numerous companies/groups surround the Project, as illustrated in Figure 5-4. However, the timelines and extent of exploration activity or further development in each mineral disposition is unknown, with the exception of NexGen Energy Ltd's (NexGen) Rook I Project. NexGen's Rook I Project is a new uranium mining and milling operation proposed for development in close proximity to the Project (Figure 5-5) that has received provincial EIA approval and is currently undergoing the federal environmental assessment process under the *Canadian Environmental Assessment Act* (2012). The anticipated lifespan of the Rook I Project would be 43 years and includes construction, operations, and decommissioning and reclamation (i.e., closure) phases. The anticipated physical footprint of the Rook I Project is 228 ha, consisting of the following key facilities to support the extraction and processing of uranium ore:

- underground mine development;

- process plant buildings, including uranium concentrate packaging facilities;
- paste tailings distribution system;
- underground tailings management facility (UGTMF);
- potentially acid generating waste rock storage area (WRSA);
- non-potentially acid generating WRSA;
- special waste rock and ore storage stockpiles;
- surface and underground water management infrastructure, including water management ponds, effluent treatment plant, and sewage treatment plant;
- conventional waste management facilities and fuel storage facilities;
- ancillary infrastructure, including maintenance shop, warehouse, administration building, and camp;
- airstrip and associated infrastructure; and
- access road to the Project and site roads.

The Rook I Project is proposing to discharge treated mine effluent to Patterson Lake through an effluent diffuser located upstream of the Project and their current plan also includes discharging treated sewage to Patterson Lake through a separate discharge (Figure 5-5). Since the Rook I Project has high potential to overlap spatially and temporally with the Project and has the potential to cause cumulative effects, it was the focus of the CEA.

5.5.2 Assessment Methods

Modelling and other assessments undertaken to evaluate the key indicators and measurable parameters for the Project also considered the scenario of the Project and the Rook I Project operating simultaneously. Information used in the assessment was obtained from the publicly available Rook I Project EIS submission to the Canadian Nuclear Safety Commission (CNSC) and ENV in 2022 (NexGen 2022) and the revised Rook I Project EIS submission to the ENV in 2023 (NexGen 2023).

If potential cumulative effects were identified for a Project-environment interaction, the criteria ratings used for the REA described in Table 5-4 were considered, and differences between the REA and the CEA were discussed within each of the cumulative effects sections. The need for additional mitigation measures, follow-up assessments to address uncertainty, and monitoring was evaluated and described. An overall determination of significance for cumulative effects was not included because of uncertainties related to some information presented in the Rook I Project EIS, uncertainties on timelines of the two

developments, and unknown, potential changes that could occur in the Rook I Project since the project is still undergoing regulatory approvals and detailed design.

5.5.3 Climate Change Considerations

Climate change effects were considered in the CEA wherever possible because it is an external force that can influence the potential effects of the Project on the environment that is occurring in the present and reasonably foreseeable future. To complete climate change evaluations, estimations of key climate parameters were compiled based on the representative concentration pathway (RCP) trajectory analysis adopted by the Intergovernmental Panel on Climate Change (IPCC) and outlined in the IPCC Synthesis Report AR5 (IPCC 2014). Further information on the scenarios and climate change predictions used in the effects assessments is provided in Section 8, Effects of the Environment on the Project.

Climate change scenarios were considered during effects assessments completed for the EIS to ensure that Project design measures provide adequate mitigation for the changing climate. The type of assessment varied depending on the VC and residual effect being evaluated; further information is provided in the relevant VC-specific sections included throughout Section 6.0, Effects Assessment and associated appendix reports.

5.6 Literature Cited

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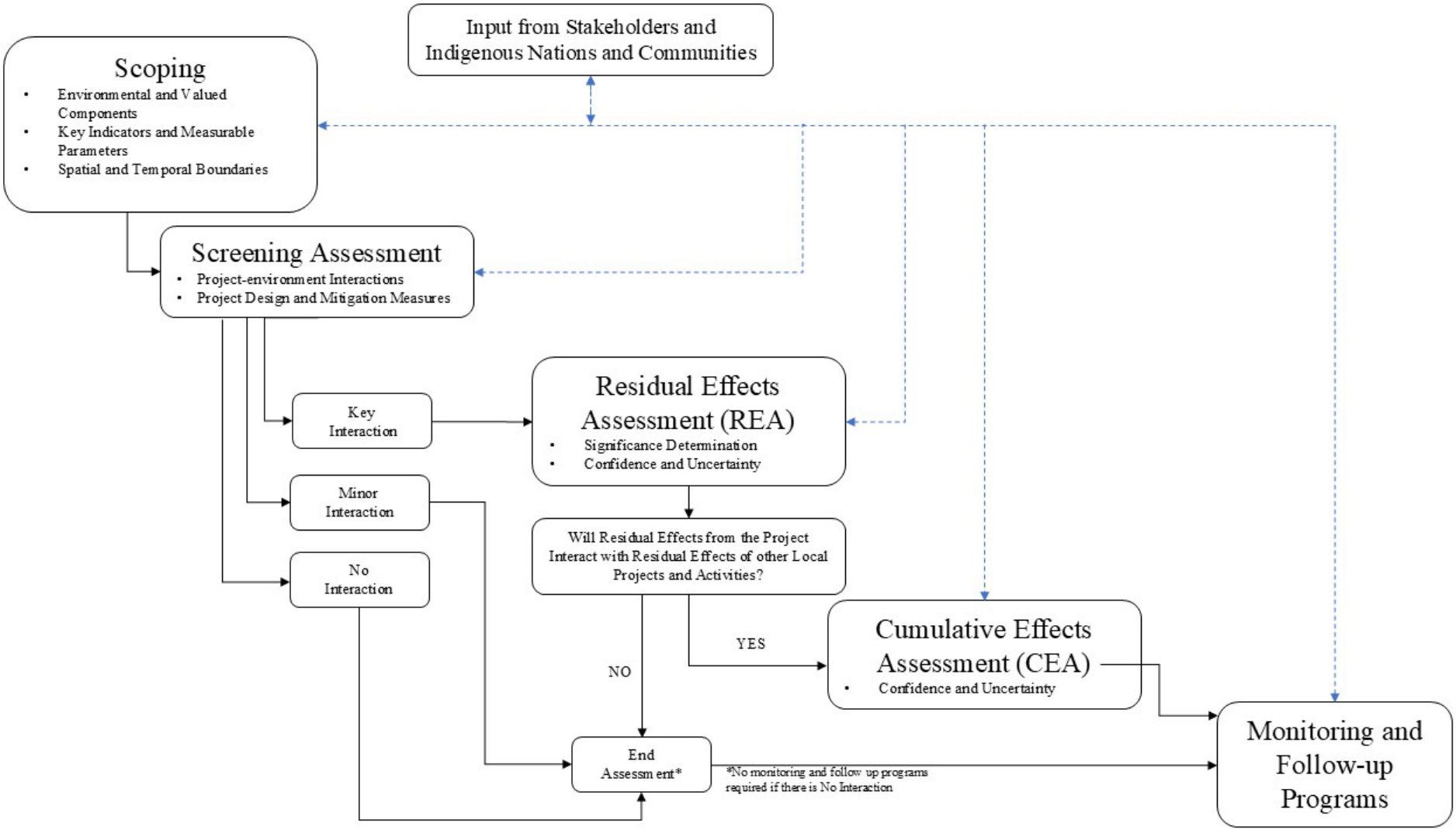

Figure 5-1
Effects assessment general approach.

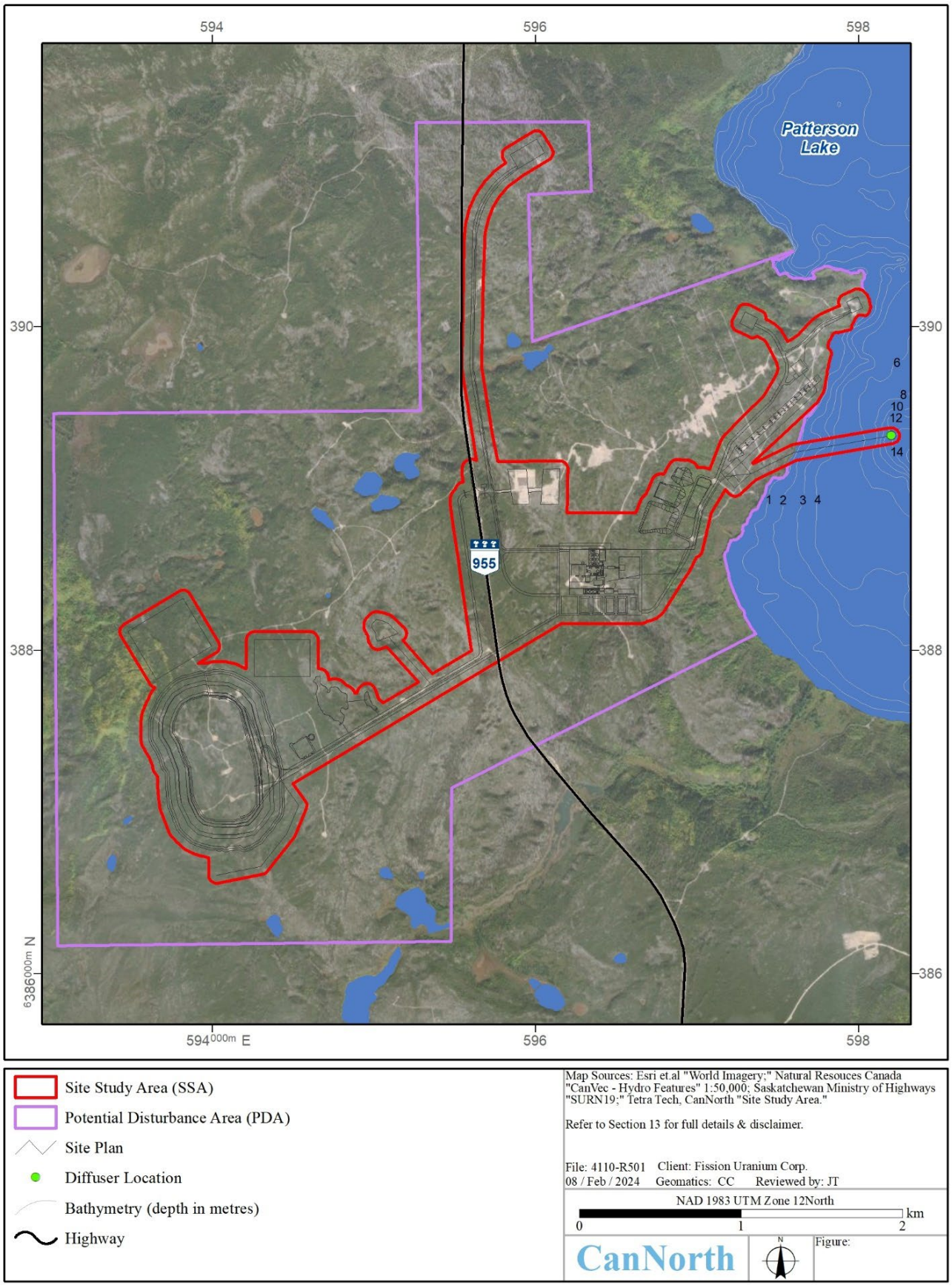

Figure 5-2
PLS Project Site Study Area (SSA) and Potential Disturbance Area (PDA).

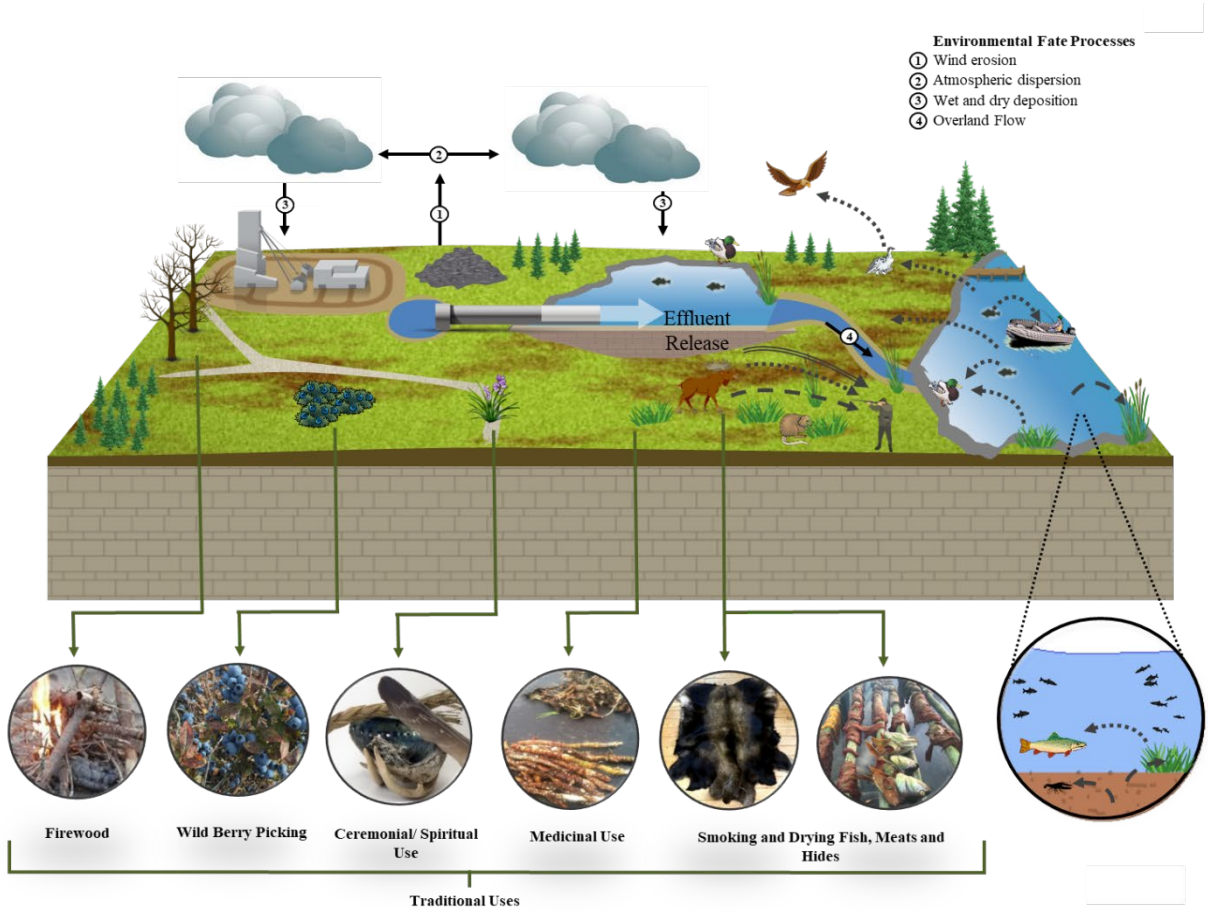

Figure 5-3
Conceptual Site Model for the PLS Project effects assessment.

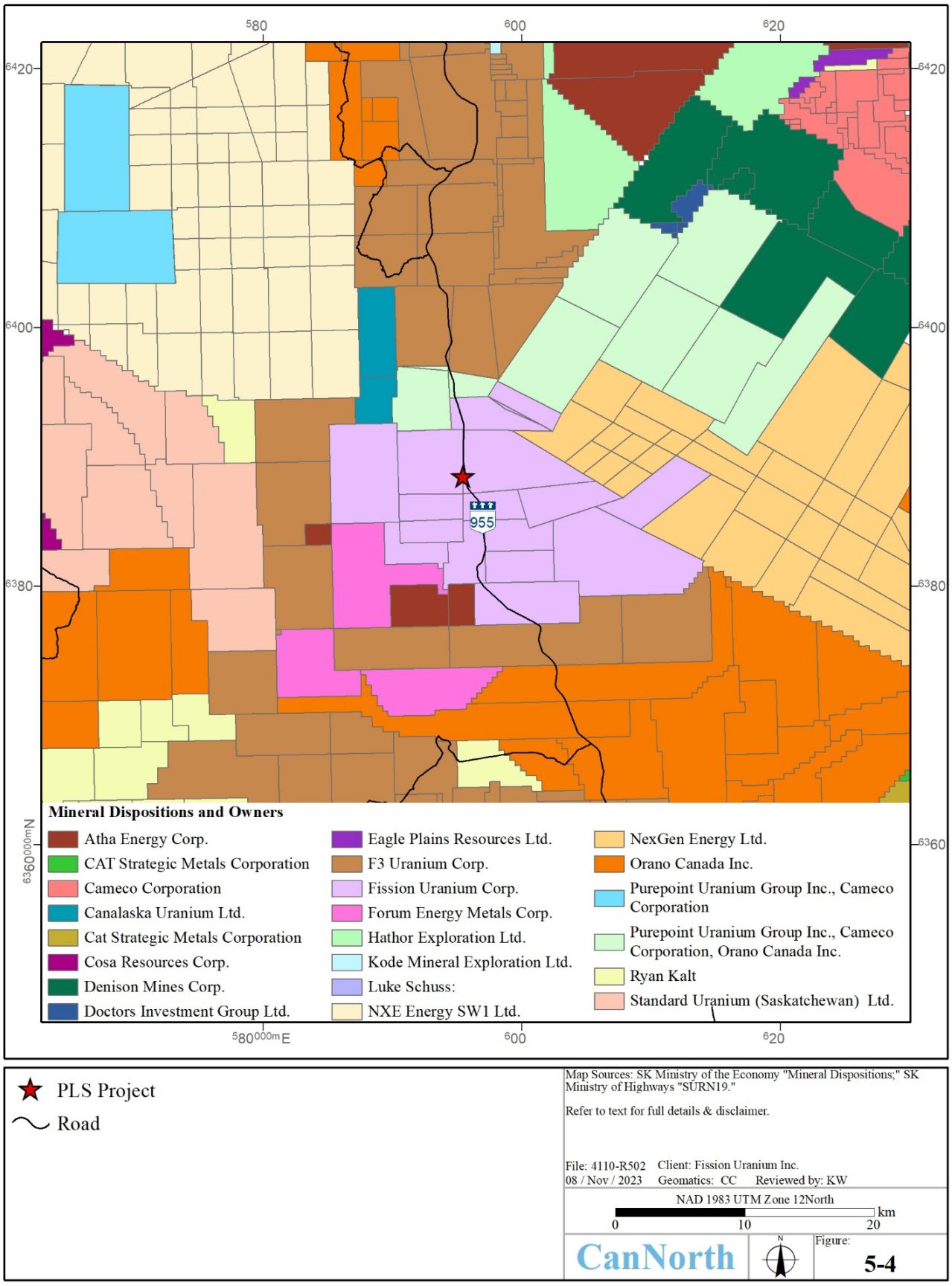

Figure 5-4
Mineral dispositions and owners within approximately 20 km of the PLS Project.

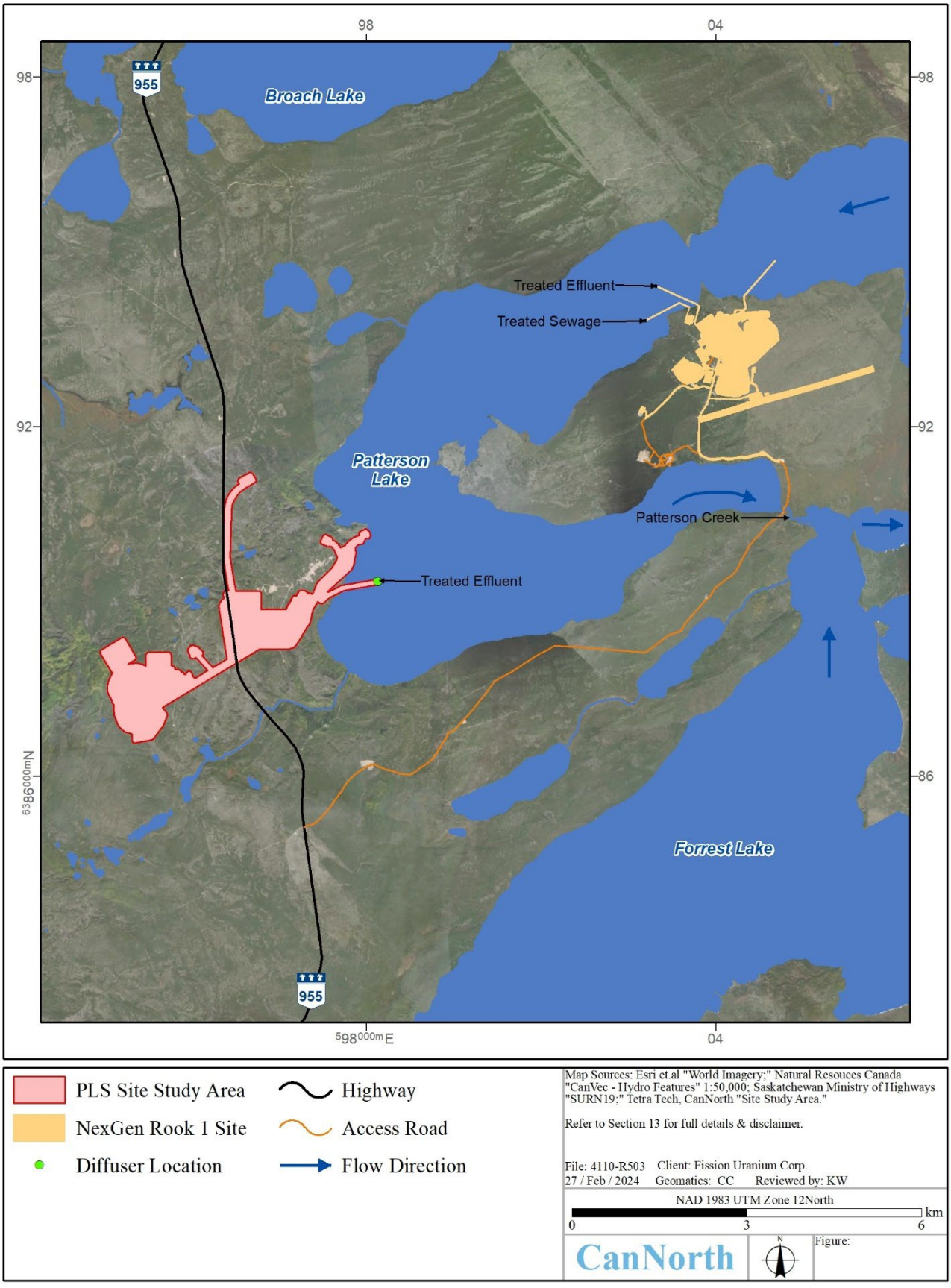

Figure 5-5
Location of the NexGen Rook I Project in relation to the PLS Project.

Table 5-1
Concordance table – effects assessment approach.

EIS Requirement	Section and Page #
EIA Boundaries	
Spatial Boundaries	
c) detailed methodology and rationale used to delineate each study area, including those specific to individual environmental components	Spatial Boundaries (5.3.4.1); 5-4
d) appropriately scaled and clearly labelled maps and GIS shapefile(s) showing the study areas and development area in relation to nearby communities and other existing or planned developments	Figures 5-4 and 5-5
e) areal extent in hectares of the final spatial boundaries used in the Environmental Impact Assessment (EIA)	Spatial Boundaries (5.3.4.1); 5-4
Temporal Boundaries	
b) definitions of the temporal boundaries delineated for the Environmental Risk Assessment (ERA)	Temporal Boundaries (5.3.4.2); 5-5
c) detailed methodology and rationale used to define the temporal boundaries, including those specific to individual environmental components and cumulative effects	Temporal Boundaries (5.3.4.2); 5-5
Valued Component Selection	
c) refined list of valued components (VCs) based on anticipated development impacts and local and traditional knowledge gathered throughout the EIA	Table 5-2; Environmental Components and Valued Components (5.3.1); 5-2
d) final methodology used to select VCs and the rationale for additions or omissions to the list identified in the Terms of Reference (TOR)	Environmental Components and Valued Components (5.3.1); 5-2
e) importance of specific VCs to the public, community, and First Nation and Metis communities	Table 5-2; Input from Stakeholders and Indigenous Nations and Communities (5.2); 5-2
f) link between VCs and potential development effects	Screening Assessment (5.4.1); 5-6 and Residual Effects Assessment (5.4.2); 5-9
Literature Cited	
b) a citation for third-party information source within the text of the Environmental Impact Statement (EIS)	Section 5 Effects Assessment Approach; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (5.6); 5-14
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 5 Effects Assessment Approach; throughout

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Air Quality*	• Changes in air quality could affect human health, aquatic and terrestrial environments, and land and resource use • Through engagement activities, Indigenous groups expressed interest and concern about changes to air quality and the potential effects on the health of the environment and Indigenous peoples	• Air concentrations of constituents of potential concern (COPC)	• Predicted changes in concentrations of dust and adsorbed metals and radionuclides identified as COPC compared to existing environment conditions and air quality standards or criteria • Predicted changes in gaseous emissions compared to existing environment conditions and air quality standards or criteria
Noise and Vibration*	• Changes to noise and vibration could cause human and wildlife avoidance affecting habitat availability and land and resource use • Through engagement activities, an Indigenous group expressed concern that changes in noise levels may affect wildlife and people	• Noise levels • Vibration levels	• Predicted changes in sound pressure levels compared to existing environment conditions and guidelines • Predicted changes in vibration compared to literature
Visual Landscape*	• Visual aesthetics is a concern of stakeholders and Indigenous Nations and communities	• Visibility • Visual contrast	• Predicted visible extent of prominent Project features from sensitive viewpoints • Predicted visual contrast between the Project and the existing landscape from sensitive viewpoints
Terrain*	• Changes in topography could affect terrestrial and aquatic environments	• Terrain morphology and stability	• Predicted changes to topographic contours and drainage patterns compared to existing environment conditions

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Soils*	• Changes in soil quantity and quality could affect terrestrial and aquatic environments • Changes in soil quantity and quality could affect reclamation success • Through engagement activities, Indigenous groups expressed interest and concern with potential contamination of soil	• Soil quantity • Soil quality	• Predicted changes to quantity of organic and mineral soil available for reclamation compared to existing environment conditions • Predicted changes to quality of soil physical and chemical properties compared to existing environment conditions
Groundwater Quantity*	• Changes to groundwater levels could affect the availability of water and could affect surface water levels, habitat, and biota • Through engagement activities, Indigenous groups expressed interest and concern with changes to groundwater levels and the potential effects on the health of the environment	• Groundwater levels	• The horizontal and vertical extent of drawdown from a point of discharge
Groundwater Quality*	• Changes in groundwater COPC concentrations could affect its use by groundwater supply well users and potentially surface water quality • Through engagement activities, Indigenous groups expressed interest and concern with potential contamination of groundwater and the potential effects on the health of the environment and Indigenous peoples	• Groundwater COPC concentrations	• Predicted changes in groundwater COPC concentrations that discharge to surficial receptors compared to Saskatchewan Environmental Quality Guideline (SEQG) groundwater criteria for freshwater aquatic life • Predicted changes in groundwater COPC concentrations compared to SEQG groundwater criteria for potable water

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Surface Water Quantity*	• Changes to surface water levels could affect habitat availability and quality • Changes to surface water levels could affect use of water for recreation, navigation, or land and resource use • Through engagement activities, Indigenous groups expressed interest and concern with changes to surface water levels and flow and the potential effects on the health of the environment and impacts to Indigenous peoples	• Surface water levels and flows	• Predicted changes in surface water levels and flows compared to existing environment conditions • Predicted changes in hydrologic indicators compared to existing environment conditions which capture important hydrologic processes in the watershed, and/or represent an important period of the year for fish and fish habitat
Surface Water Quality*	• Changes in COPC concentrations in surface water and sediment could affect human and biota health, aquatic habitat availability and quality, and consumption of traditional foods • Changes to surface water quality could affect use of water for recreation, navigation, or land and resource use • Cultural importance • Through engagement activities, Indigenous groups expressed interest and concern with potential contamination of surface water and sediments and the potential effects on the health of the environment and Indigenous peoples	• Surface water COPC concentrations • Sediment COPC concentrations	• Predicted changes in surface water and sediment COPC concentrations compared to existing environment conditions and applicable guidelines

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Fish and Fish Habitat	• Changes in COPC concentrations in the environment may affect fish health as well as the health of people and wildlife species who consume them • Changes to the abundance or types of fish or fish habitat could affect the ability of fish populations to be self-sustaining • Avoiding, mitigating, or offsetting loss of fish habitat is a regulatory requirement • Cultural, recreational, and socio-economic importance • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to fish and fish habitat and the potential effects on the health of the environment and Indigenous peoples	• Lake trout • Walleye • Northern pike • Lake whitefish • White sucker • Burbot • Yellow perch • Benthic invertebrates	• Predicted effects to fish and fish habitat due to predicted changes in environmental COPC concentrations • Predicted changes in quantity and quality of fish habitat due to changes in surface water levels and flow as well as sediment transport and deposition compared to existing environment conditions • Direct loss of fish habitat due to in-water works • Potential for injury or mortality to fish
Vegetation	• Changes to the abundance of vegetation species of conservation concern (SOCC) could affect the ability of these populations to be self-sustaining • Changes in COPC concentrations in the environment may affect vegetation health as well as the health of people and wildlife species who consume them • Avoidance or mitigation of SOCC is a regulatory requirement • Control of prohibited and noxious weeds is a regulatory requirement • Cultural, recreational, and socio-economic importance • Through engagement activities, Indigenous groups expressed interest and concern with potential contamination of vegetation and the potential effects on the health of the environment and Indigenous peoples	• Vegetation abundance and diversity • Vegetation COPC concentrations	• Predicted changes in abundance and composition of vegetation communities compared to existing environment conditions • Predicted effects to vegetation due to predicted changes in environmental COPC concentrations

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Woodland Caribou	• Impacts to woodland caribou and their habitat could affect the population and traditional land and resource use • Changes in COPC concentrations in the environment may affect woodland caribou health as well as the health of people and wildlife species who consume them • Woodland caribou are listed as threatened pursuant to the *Species at Risk Act* • Avoiding, mitigating, or offsetting loss of woodland caribou habitat is a regulatory requirement • Cultural importance • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to woodland caribou habitat negatively affecting migration and calving behavior	• Woodland caribou and habitat (SOCC)	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to predicted changes in environmental COPC concentrations • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)
Ungulates	• Impacts to ungulates and their habitat could affect the population and traditional and other land and resource use • Changes in COPC concentrations in the environment may affect ungulate health as well as the health of people and wildlife species who consume them • Cultural, recreational, and socio-economic importance • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to ungulate habitat negatively affecting migration and calving behavior	• Moose and habitat	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to predicted changes in environmental COPC concentrations • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Furbearers	• Impacts to furbearers and their habitat could affect the population and traditional and other land and resource use • Changes in COPC concentrations in the environment may affect furbearer health as well as the health of people and wildlife species who consume them • Changes to furbearer SOCC could affect the ability of these populations to be self-sustaining • Cultural, recreational, and socio-economic importance • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to furbearers habitat negatively affecting behavior	• Grey wolf and habitat • Muskrat and habitat	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to predicted changes in environmental COPC concentrations • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)
Bats	• Impacts to bats and their habitat could affect the population • Changes to bat SOCC could affect the ability of these populations to be self-sustaining • Changes in COPC concentrations in the environment may affect bat health	• Little brown myotis and habitat (SOCC)	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to predicted changes in environmental COPC concentrations • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Amphibians	• Impacts to amphibians and their habitat could affect the population • Changes to amphibian SOCC could affect the ability of these populations to be self-sustaining • Changes in COPC concentrations in the environment may affect amphibian health as well as the health of wildlife species that consume them	• Canadian toad and habitat (SOCC)	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to changes in environmental COPC concentrations identified through the Human Health and Ecological Risk Assessment (HHERA) • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)
Birds	• Impacts to birds and their habitat could affect the population and traditional and other land and resource use • Changes in COPC concentrations in the environment may affect bird health as well as the health of people and wildlife species who consume them • Changes to bird SOCC could affect the ability of these populations to be self-sustaining • Migratory birds are protected under the *Migratory Birds Convention Act* • Cultural, recreational, and socio-economic importance • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to bird habitat negatively affecting behavior	• Osprey and habitat (raptor) • Mallard and habitat (waterfowl) • Common nighthawk and habitat (SOCC; aerial insectivore; nightjar) • Olive-sided flycatcher and habitat (SOCC; aerial insectivore; songbird)	• Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions • Predicted effects due to predicted changes in environmental COPC concentrations • Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Economic Wellbeing	• Potential changes to levels of employment, income, and training opportunities • Potential changes to incomes and revenues both locally and provincially • Economic wellbeing and distribution of economic benefits are important to local priority recruitment communities • Through engagement activities, Indigenous groups expressed interest and concern with potential changes to economic wellbeing of Indigenous peoples	Municipal and provincial economy	• Predicted changes to income levels in local municipality and annual provincial tax revenues • Predicted changes to level of business activity in Saskatchewan (at local and regional levels)
		Traditional economy	• Predicted changes to income received and level of participation in traditional economies compared to existing conditions
		Local employment and income levels and distribution	• Predicted changes to local and regional employment and income levels and distribution compared to existing conditions
Traditional Land and Resource Use	• Patterson Lake is a traditional land use area for Clearwater River Dene Nation (CRDN), Buffalo River Dene Nation (BRDN), Birch Narrows Dene Nation (BNDN), Métis Nation Saskatchewan (MN-S), Athabasca Chipewyan First Nation (ACFN), and the Athabasca communities • Project activities may result in changes to quantity and quality of traditional resources such as wildlife, fish, and vegetation • Project activities may result in changes to availability, accessibility, and quality of lands required for traditional land use • Project activities may result in avoidance of available lands and resources or changes to the land use experience due to perceived or real impacts to the land, resources, or land user • Through engagement activities, Indigenous groups expressed interest and concern with potential changes in exercising Aboriginal and Treaty Rights and quality of resources	Land and resource quantity and accessibility	• Predicted land area that will become inaccessible or avoided for land and resource use compared to current conditions • Predicted changes to availability, abundance, and diversity of vegetation, fish, and wildlife compared to existing conditions • Predicted changes to number and cultural significance of important areas or unique or rare sites which will be disturbed or become inaccessible compared to current conditions
		Land and resource quality and user experience	• Predicted changes to land area where sensory disturbances may be present compared to existing conditions • Predicted changes to availability, abundance, and diversity of vegetation, fish, and wildlife compared to existing conditions • Predicted changes to human health from changes to air, water, and traditional food quality

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Other Land and Resource Use	• Recreational and commercial land uses are present in the Patterson Lake area • Project activities may result in changes to quantity and quality of resources such as wildlife, fish, and vegetation necessary for continued recreational or commercial uses • Project activities may result in changes to availability, accessibility, and quality of lands required for recreational and commercial use • Project activities may result in avoidance of available lands and resources or changes to the land use experience due to perceived or real impacts to the land, resources, or land user • Through engagement activities, groups expressed interest and concern with potential changes in land access and quality of resources	Land and resource quantity and accessibility	• Predicted changes to quantity of land that will become inaccessible for land and resource use compared to current conditions • Predicted changes to availability, abundance, and diversity of vegetation, fish, and wildlife compared to existing conditions
		Land and resource quality	• Predicted changes to land area where sensory disturbances may be present compared to existing conditions • Predicted changes to availability, abundance, and diversity of vegetation, fish, and wildlife compared to existing conditions • Predicted changes to human health from changes to air, water, and traditional food quality
Heritage Resources	• Avoiding or mitigating disturbance of heritage resources is a regulatory requirement • Protection of culturally important areas is important to Indigenous communities • Through engagement activities, Indigenous groups expressed interest in the discovery of Indigenous archaeological sites • Through engagement activities, Indigenous groups expressed concern in disrespecting Indigenous archaeological sites, particularly burial sites	Archaeological sites	• Predicted changes to the number, quality, and significance of known archaeological sites directly or indirectly altered/lost as a result of Project activities

Table 5-2

Valued components, key indicators, and measurable parameters selected for the PLS Project effects assessment.

Valued Component	Rationale	Key Indicator	Measurable Parameters
Community Wellbeing and Human Health	• The demand for infrastructure and services associated with transportation, education and training, accommodation, and protective services will be altered as a result of Project activities • Road conditions on Highway 955 were noted as an area of concern by local communities • Impacts to road conditions and safety on Highway 955 and 155 were identified as areas of concern by regulators • Access to education and training services and facilities were noted as an area of interest by local communities • Changes to employment and income levels and distribution, number of people engaged in fly-in fly-out worker rotations, worker/community interface, and demand for infrastructure and service are key health supports with potential to be affected by Project activities • Project activities could affect the health and safety of employees and contractors • Through engagement activities, Indigenous groups expressed interest and concern with potential changes that could negatively impact community wellbeing and human health	Social and cultural wellbeing	• Predicted changes to the social and cultural environment due to changes in education, employment and income levels and distribution, mobile worker/community interface, and work rotation schedules, which may contribute to increased psychosocial stress • Predicted changes to number of land and resource users, frequency or patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission
		Community health and safety	• Predicted changes to human health due to exposure to COPC concentrations from Project-related air and water releases compared to existing conditions • Predicted changes to mental and physical health due to changes in the natural environment • Predicted changes to community health and safety as a result of increased presence of psychosocial stressors due to changes to social and cultural wellbeing
		Local infrastructure and services	• Predicted changes to road conditions, access, and capacity compared to existing conditions • Predicted changes to demand for air transportation compared to existing conditions • Predicted changes to demand for educational and training facilities and services compared to current levels • Predicted changes to demand for health care and emergency services compared to existing conditions

"*" indicates an intermediate valued component.

Table 5-3
Potential interactions of Project activities with valued components.

Project Activity	Project Phase	Air Quality	Noise and Vibration	Visual Landscape	Groundwater Quantity	Groundwater Quality	Surface Water Quantity	Surface Water Quality	Fish and Fish Habitat	Terrain and Soils	Vegetation	Woodland Caribou	Ungulates	Furbearers	Bats	Amphibians	Birds	Economic Wellbeing	Traditional Land and Resource Use	Other Land and Resource Use	Heritage Resources	Community Well Being and Human Health
Land clearing and construction of surface infrastructure	Construction, Operations	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Operation of mill and processing facilities	Operations	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X		X
Underground decline and mine dewatering, development, operation, and decommissioning	Construction, Operations, and Decommissioning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Tailings Management Facility (TMF) construction, operation, and decommissioning	Construction, Operations, Decommissioning, Post-decommissioning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Waste management (waste rock, domestic, industrial, contaminated, and hazardous)	Construction, Operations, and Decommissioning	X	X	X		X		X	X	X	X	X	X	X	X	X	X		X	X		X

Table 5-3

Potential interactions of Project activities with valued components.

Project Activity	Project Phase	Air Quality	Noise and Vibration	Visual Landscape	Groundwater Quantity	Groundwater Quality	Surface Water Quantity	Surface Water Quality	Fish and Fish Habitat	Terrain and Soils	Vegetation	Woodland Caribou	Ungulates	Furbearers	Bats	Amphibians	Birds	Economic Wellbeing	Traditional Land and Resource Use	Other Land and Resource Use	Heritage Resources	Community Well Being and Human Health
Installation, operation, and removal of in-water infrastructure (treated effluent pipeline and diffuser)	Construction, Operations, and Decommissioning			X				X	X		X			X		X	X		X	X		
Treated effluent and release to Patterson Lake	Construction, Operations, and Decommissioning						X	X	X		X	X	X	X	X	X	X		X	X		X
Site water management	Construction, Operations, and Decommissioning						X	X	X	X	X	X	X	X	X	X	X		X	X		
Potable water supply	Construction, Operations, and Decommissioning				X		X		X										X	X		
Power generation	Construction, Operations, and Decommissioning	X	X	X						X	X	X	X	X	X	X	X		X	X		X
Demolition, salvage, and/or disposal of surface infrastructure	Decommissioning	X	X	X															X	X		X
Reclamation, revegetation, and recontouring of site	Decommissioning	X	X	X			X	X	X	X	X	X	X	X	X	X	X		X	X		X

Table 5-3

Potential interactions of Project activities with valued components

Project Activity/Component	Project Phase	Air Quality	Noise and Vibration	Visual Landscape	Groundwater Quantity	Groundwater Quality	Surface Water Quantity	Surface Water Quality	Fish and Fish Habitat	Terrain and Soils	Vegetation	Woodland Caribou	Ungulates	Furbearers	Bats	Amphibians	Birds	Economic Wellbeing	Traditional Land and Resource Use	Other Land and Resource Use	Heritage Resources	Community Well Being and Human Health
Long-term unintended seepage from the TMF, containment ponds, ore and waste rock stockpiles, and underground mine	Operations, Decommissioning, Post-decommissioning					X		X	X										X	X		X
Vehicle traffic on site roads and Highway 955	Construction, Operations, and Decommissioning	X	X					X	X	X	X	X	X	X	X	X	X		X	X		X
Employment and population changes in area	Construction, Operations, Decommissioning, and Post-decommissioning								X			X	X	X			X	X	X	X		X

Table 5-4

Residual effects assessment criteria ratings.

Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Negligible: effect is highly localized	**Short-term**: effect occurs during construction only (Years 0 to 3)	**Negligible**: effect ceases after a short-term duration	**Negligible**: effect occurs once for a short-term duration	**Negligible**: effect is unlikely to occur
Site: effect is limited to the Site Study Area (SSA) and/or Potential Disturbance Area (PDA)	**Medium-term**: effect happens from construction through to end of post-decommissioning (Years 3 to 26)	**Reversible – short-term**: effect ceases once stressor is removed	**Isolated**: effect is confined to a discrete period	**Low**: effect has the potential to occur
Local: effect is limited to the Local Study Area (LSA)	**Long-term**: effect extends beyond post-decommissioning	**Reversible – long-term**: effect persists after stressor is removed	**Periodic**: effect occurs intermittently, but repeatedly	**Moderate**: effect is expected to occur
Regional: effect extends into the Regional Study Area (RSA)	**Permanent**: effect will remain permanently	**Irreversible**: effect does not reverse after stressor is removed	**Continuous**: effect occurs continuously	**High**: effect is highly likely to occur

Table 5-5
Magnitude definitions applied to each valued component during the residual effects assessment.

Magnitude Rating	Air Quality	Noise and Vibration	Visual Landscape	Groundwater Quantity	Groundwater Quality	Surface Water Quantity	Surface Water Quality	Fish and Fish Habitat	Terrain and Soils	Vegetation
Negligible	Changes from existing environment COPC concentrations are less than 10% and are below standards or criteria	Difference from existing conditions, reference criteria, or guideline values of 0 to 3 dBA	Visual elements of the Project are not discernible or barely discernible	No measurable change from existing conditions	No measurable change from existing conditions	Changes of less than 5% are unlikely to be measurable or detectable	No measurable change from existing conditions	No measurable change from existing conditions	No measurable change from existing conditions	No measurable change from existing conditions
Low	COPC concentrations are predicted to exceed existing environment concentrations by more than10% but are below standards or criteria	Difference from existing conditions, reference criteria, or guideline values of 3 to 5 dBA	Visual elements of the Project are discernible but are affecting a small proportion of the available views and not altering characteristics of the view	Changes are measurable but only affect a highly localized area within the Potential Disturbance Area (PDA); changes are reversible in the short-term	COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Changes of 5% to10% are within the range of natural variability most of the time	COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Changes in habitat, flow, or COPC concentrations are predicted to differ from average existing conditions but remain within the range of natural variability and below guidelines	Changes to terrain and soil can be mitigated and will not require reclamation	Changes to vegetation and vegetation communities can be mitigated and will not require reclamation
Moderate	COPC concentrations are predicted to exceed existing environment concentrations by more than 10% and exceed the standards or criteria by less than 50%	Difference from existing conditions, reference criteria, or guideline values of 5 to 10 dBA	Visual elements of the Project are readily discernible and are affecting a large proportion of the available view and altering its characteristics	Changes are measurable and extend a significant (1/3 or more) distance across the PDA; changes are reversible in the short-term	COPC concentrations are predicted to have minor exceedances above the range of natural variability and guideline levels	Changes of 10% to 15% are likely above the range of natural variability occasionally	COPC concentrations are predicted to have minor exceedances above the range of natural variability and guideline levels	Changes in habitat, flow, or COPC concentrations are predicted to have minor exceedances above the range of natural variability and guidelines	Changes to terrain and soil cannot be fully mitigated and can be remediated/ reclaimed	Changes to vegetation and vegetation communities cannot be fully mitigated and can be reclaimed
High	COPC concentrations are predicted to exceed existing environment concentrations by more than 10% and exceed the standards or criteria by more than 50%	Difference from existing conditions, reference criteria, or guideline values of greater than 10 dBA	Visual elements of the Project dominate the view and define its characteristics	Changes are measurable and extend across the entire PDA; changes are reversible in the long-term	COPC concentrations are predicted to exceed existing conditions, the range of natural variability, and guidelines	Changes of over 15% are likely above the range of natural variability consistently	COPC concentrations are predicted to exceed existing conditions, the range of natural variability, and guidelines	Changes in habitat, flow, or COPC concentrations are predicted to exceed existing conditions, the range of natural variability, and guidelines	Changes to terrain and soil cannot be remediated/ reclaimed and will remain post-decommissioning	Changes to vegetation and vegetation communities cannot be reclaimed and will remain post-decommissioning

Table 5-5

Magnitude definitions applied to each valued component during the residual effects assessment.

Magnitude Rating	Wildlife[1]	Traditional Land and Resource Use	Other Land and Resource Use	Community Well Being and Human Health
Negligible	No measurable change from existing conditions	No measurable change from existing conditions	No measurable change from existing conditions	No measurable change from existing conditions
Low	Changes in quality and quantity of habitat, sensory disturbance, or COPC concentrations differ from average existing conditions, but are unlikely to cause a measurable change to ecosystem function	Measurable change to the ability or preference to continue traditional land and resource use is predicted compared to existing conditions but will remain within the natural range of variability in function	Measurable change is predicted compared to existing conditions but will remain within the natural range of variability in function within the affected land area and population	Measurable change is predicted compared to existing conditions but will remain within the natural range of variability in function on community wellbeing or human health
Moderate	Changes in quality and quantity of habitat, sensory disturbance, or COPC concentrations differ from average existing conditions, which is likely to cause a small measurable change to ecosystem function	Measurable change to the ability or preference to continue traditional land and resource use is predicted compared to existing conditions that are outside of the natural range of variability and will have a limited effect on function	Measurable change is predicted compared to existing conditions that are outside of the natural range of variability and will have a limited effect on function; the ability to continue other land and resource use within the affected land area and population	Measurable change is predicted compared to existing conditions that are outside of the natural range of variability and will have a limited effect on function; the continued community wellbeing and human health of the affected population
High	Changes in quality and quantity of habitat, sensory disturbance, or COPC concentrations differ from average existing conditions, which is likely to cause a measurable change to ecosystem function	Measurable change to the ability or preference to continue traditional land and resource use is predicted compared to existing conditions that are outside of the natural range of variability and will result in a loss of function	Measurable change is predicted compared to existing conditions that are outside of the natural range of variability and will result in a loss of function; the ability to continue other land and resource use within the affected land area and population	Measurable change is predicted compared to existing conditions that are outside of the natural range of variability and will result in a loss of function; the continued community wellbeing and human health of the affected population

[1] Wildlife includes VCs of woodland caribou, ungulates, furbearers, amphibians, bats, and birds.

SECTION 6

EFFECTS ASSESSMENT

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LIST OF ACRONYMS

AAQC	Ambient Air Quality Criteria
ACFN	Athabasca Chipewyan First Nation
AHPP	Aquatic Habitat Protection Permit
ALARA	As Low as Reasonably Achievable
BATEA	Best Available Technology Economically Achievable
BLDFN	Black Lake Denesųłiné First Nation
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
CEA	Cumulative Effects Assessment
CMIP6	Coupled Model Intercomparison Project Phase 6
CNSC	Canadian Nuclear Safety Commission
CO	Carbon Monoxide
COPC	Constituents of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRDN	Clearwater River Dene Nation
DFO	Fisheries and Oceans Canada
DRP	Decommissioning and Reclamation Plan
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EMP	Environmental Management Program
ENV	Saskatchewan Ministry of Environment
FLDFN	Fond Du Lac Denesųłiné First Nation
FIFO	Fly-in/Fly-out
Fission	Fission Uranium Corp.
FTE	Full Time Equivalent
GCM	Global Climate Model
H_2SO_4	Sulphuric Acid
HCB	Heritage Conservation Branch
HDPE	High-Density Polyethylene
HHERA	Human Health and Ecological Risk Assessment
HRIA	Heritage Resource Impact Assessment
IPCC	Intergovernmental Panel on Climate Change
Ldn	24-hour day-night sound level
LFN	Low Frequency Noise
Lmax	Maximum Noise Levels
LSA	Local Study Area
MDL	Method Detection Limits
MDMER	Metal and Diamond Mine Effluent Regulations

MIEPR	Mineral Industry Environmental Protection Regulation
MN-S	Métis Nation – Saskatchewan
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NSAD	Northern Saskatchewan Administration District
PDA	Potential Disturbance Area
PM_{10}	Particulate Matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate Matter 2.5 micrometres or less in diameter
PPV	Peak Particle Velocity
the Project	The PLS Project
RCP	Representative Concentration Pathway
REA	Residual Effects Assessment
Rook I Project	NexGen Energy Ltd.'s Rook I Project
RSA	Regional Study Area
SAAQS	Saskatchewan Ambient Air Quality Standards
SAR	Species at Risk
SARA	Species at Risk Act
SEQG	Saskatchewan Environmental Quality Guidelines
SKCDC	Saskatchewan Conservation Data Centre
SO_2	Sulphur Dioxide
SOCC	Species of Conservation Concern
SSA	Site Study Area
TDS	Total Dissolved Solids
TLU	Traditional Land Use
TMF	Tailings Management Facility
TOR	Terms of Reference
TSM	Tunnel Shield Method
TSP	Total Suspended Particulate
VC	Valued Component
VOC	Volatile Organic Compounds
WCMP	Woodland Caribou Mitigation Plan
WHO	World Health Organization
WMMP	Wildlife Management and Monitoring Procedure
WQG	Water Quality Guidelines
WRMA	Waste Rock Management Area
WSA	Water Security Agency
ZOI	Zone of Influence

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6.0 EFFECTS ASSESSMENT

6.1 Introduction

The effects assessment conducted for the PLS Project (the Project) was completed using the approach and methodology outlined in Section 5 of this Environmental Impact Statement (EIS). The focus of the assessments was on the key indicators and measurable parameters identified for each valued component (VC), as described in Table 5-2. This section of the EIS provides information on 1) study areas and Project-environment interactions assessed for each VC; 2) screening assessment results; and 3) results from the residual effects assessment (REA) and cumulative effects assessment (CEA), including significance determinations and uncertainties.

The screening assessment delineated Project activities that potentially interact with the biophysical and human environments and identified Project-environment interactions that resulted in residual effects that were greater than negligible. For each Project-environment interaction or effect pathway, Project design features and mitigation measures were formulated, a process that incorporated input received from stakeholders and Indigenous Nations and communities through engagement activities. The criteria presented in Section 5.4 was used to determine if an effect pathway was a key interaction that moved forward to the REA and CEA.

The objective of the REA was to use a weight of evidence approach to evaluate the significance of Project-environment interactions with residual effects that were carried forward from the screening effects assessment. For each key interaction, information from the measurable parameter assessment was used to evaluate the magnitude, geographic extent, duration, reversibility, frequency, and likelihood of the residual effect using the criteria described in Section 5.4 and Tables 5-4 and 5-5. These ratings were collectively used to determine the significance of the predicted effect, identify uncertainties, and formulate EIS follow-up and monitoring requirements (refer to Section 9.0). Select VCs were considered as intermediate VCs because their significance of change was evaluated by considering their effect on another VC or key indicator such as wildlife or human health. A REA and CEA was completed on Project-environment interactions that were deemed as key interactions for intermediate VCs, but a significance determination was not completed.

The objective of this CEA was to identify Project-specific residual effects that may combine with the impacts from other past, present, or reasonably foreseeable future projects or activities to create or amplify adverse impacts on VCs, and to propose additional

mitigation measures to avoid, minimize, or offset identified cumulative effects (ENV 2021a). As described in Section 5.5, the CEA was focused on evaluating the potential for cumulative effects to occur if the Project and NexGen Energy Ltd.'s Rook I Project (Rook I Project) are operational at the same time.

Climate change was considered in the effects assessment because it is occurring in the present and reasonably foreseeable future and could potentially influence the key interactions evaluated in the REA and CEA. Further details on the potential for climate change to affect the Project and climate change assessments completed as part of this EIS are provided in Section 8, Effects of the Environment on the Project.

The concordance table for components for the EIS from the Saskatchewan Ministry of Environment (ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021a) for screening effects assessment is provided in Table 6-1.

6.2 Air Quality

6.2.1 Scope of Assessment

Air quality was selected as a VC because of the potential for effects that changes to air quality could have on biophysical and human environment components. During engagement activities, Indigenous groups expressed interest and concern about changes to air quality and the potential effects on the health of the environment and Indigenous peoples.

The VC air quality is designated as an intermediate VC because changes in air quality can affect other VCs such as human health, land and resource use, surface water quality, soil quality, and vegetation through deposition and uptake; thus, the significance of air quality changes was evaluated by assessing the impacts on those VCs. The impact of predicted air quality changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicator for this VC is air concentrations of constituents of potential concern (COPC), and the measurable parameters evaluated in this effects assessment are:

- Predicted changes in concentrations of dust, adsorbed metals and radionuclides identified as COPC compared to existing environment conditions and air quality standards or criteria.
- Predicted changes in gaseous emissions compared existing environment conditions and air quality standards or criteria.

6.2.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the Site Study Area (SSA), the Potential Disturbance Area (PDA), the Local Study Area (LSA), and the Regional Study Area (RSA). The SSA and PDA are defined in Section 5.3.4.1. It is noted that the SSA and PDA utilized for the air quality assessment differs slightly from the current SSA and PDA described in Section 2, Project Description due to minor changes that occurred in the site layout as detailed Project planning progressed. The LSA and RSA vary between VCs, and for air quality are defined as follows (Figure 6-1).

- Local Study Area: The LSA was set to bound the area where measurable changes to the atmospheric environment resulting from Project activities would be anticipated. The LSA covers a 25 km x 25 km (625 km^2) area that is approximately centered on the SSA, plus 5 km on either side of the portion of Highway 955 included in the RSA for a total area of 1,030 km^2 (102,991.2 ha).
- Regional Study Area: The RSA was established for the purpose of identifying any cumulative impacts from other adjacent developments and to capture all measurable endpoints for VC that may be affected by air quality (e.g., human health). The RSA covers a 60 km x 60 km (3,600 km^2 or 360,000 ha) area that is approximately centered on the SSA.

Points of importance to the assessment of human, aquatic, and terrestrial environments were informed by stakeholder and Indigenous Nations' engagement and were aligned with other assessments such as the Human Health and Ecological Risk Assessment (HHERA). For the human health evaluation, these areas included the PLS Camp, NexGen Rook I Project Camp, Patterson Lake South Camping Area, Beet Lake Camp, and Lloyd Lake Lodge. Refer to Figure 6-1 for a map showing these locations as well as locations included for assessing air quality in the terrestrial environment.

6.2.1.2 Potential Effect Pathways

Project-environment interactions for the VC of air quality that were identified as potential effect pathways during each Project stage include the following.

- Generation of dust (and adsorbed metals and radionuclides) from Project activities and traffic could affect ambient air quality during construction, operations, and decommissioning.
- Emissions of gaseous COPC including nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC)[1], and sulphuric acid (H_2SO_4), from Project activities and traffic could affect ambient air quality during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.2.2 Screening Assessment, where relevant.

6.2.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.2.2.1 Dust Emissions

Activities completed during the construction phase are anticipated to cause emissions of dust (and adsorbed metals and radionuclides). A bounding scenario for construction was developed based on the year in which the most activity is expected to occur at the site. The final year of construction (Year –1) was selected for further analysis as this featured the highest amount of truck traffic and the highest amount of waste rock material from the underground mine development being stockpiled on surface. All activities that were evaluated as part of construction are summarized in Section 5.1 of Appendix D.1.

For each of the identified air emission sources, emission rates of dust (total suspended particulate [TSP], particulate matter 10 micrometres or less in diameter [PM_{10}], and particulate matter 2.5 micrometres or less in diameter [$PM_{2.5}$]) and adsorbed metals identified as COPC in Section 2.1 of Appendix D.1 (arsenic, cadmium, cobalt, copper, lead, nickel, and selenium) were estimated using published emission factors, industry standard calculation methods, and Project activity data. The AERMOD model was then used to

[1]Acrolein is used as a surrogate for VOC.

predict air quality concentrations from the simultaneous operation of all the identified sources (including Project traffic along Highway 955) at receptors in the LSA and RSA and the locations shown in Figure 6-1. Radionuclides were not included in the air quality modelling and instead were estimated from predicted uranium concentrations in the HHERA (see Appendix D.7). Similarly, dust deposition was not modelled but estimated for the HHERA using predicted TSP concentrations and an assumed constant settling velocity. The details of the air emissions inventory and air dispersion modelling for the construction phase are provided in Appendix D.1.

Activities completed during the operations phase are also expected to cause emissions of dust (and adsorbed metals and radionuclides). A bounding scenario for the operations phase was developed based on a peak production rate of 20 million pounds of U_3O_8 per year and a maximum mill feed rate of 1,500 tonnes per day. All activities that were evaluated as part of the operations phase are summarized in Section 5.2 of Appendix D.1. For each of the identified air emission sources, emission rates of dust and adsorbed metals identified as COPC were estimated using published emission factors, industry standard calculation methods, and Project activity data. The details of the air emissions inventory and air dispersion modelling for the operations phase are provided in Appendix D.1.

The modelled air quality concentrations were added to background air quality concentrations and compared to Saskatchewan Ambient Air Quality Standards (SAAQS) or ambient air quality criteria from Ontario and/or Alberta to identify whether there were any effects due to the planned construction or operations activities. The air quality criteria and background concentrations used in the assessment of air quality effects are described Sections 3.0 and 4.0, respectively of Appendix D.1. The mitigation measures listed in Table 6-2 were considered as part of this analysis to identify where effects could be reduced or eliminated.

The results of the air dispersion modelling are summarized in Section 8.0 of Appendix D.1. For construction and operations, the modelling predicted a measurable change in air quality concentrations above baseline (i.e., an increase greater than 10% above baseline) for TSP, PM_{10}, $PM_{2.5}$, arsenic, cobalt, nickel, lead, selenium, and uranium. For cadmium and copper, the predicted increase in concentrations above baseline was less than 3% in both construction and operations. The 24-hour concentrations of TSP, PM_{10}, and $PM_{2.5}$ were predicted to be above the SAAQS at some receptors in the LSA and an exceedance of the 24-hour Ontario ambient air quality criteria (AAQC) for uranium (in PM_{10}) was predicted at a receptor along the PDA boundary. An exceedance of the annual $PM_{2.5}$ SAAQS was

also predicted for the operations phase in a small area near the PDA. Since the assessment criteria were exceeded, emissions of dust and uranium from construction and operations were identified as key interactions that were advanced to the assessment of residual effects and are discussed further in Section 6.2.3. For all other metals, modelled concentrations of were predicted to be less than the assessment criteria. As a result, air emissions of arsenic, cadmium, cobalt, copper, lead, nickel, and selenium from construction and operations activities are considered minor interactions that were not carried through the REA.

The decommissioning phase is expected to be similar in nature to the construction phase but is expected to have less equipment and truck traffic and therefore fewer air emissions. As such, the construction phase is expected to bound decommissioning (i.e., have greater potential for air quality effects). As the post-decommissioning phase is effectively a period of monitoring, air emissions are expected to be negligible and are also bounded by the construction and operations phases.

6.2.2.2 Gaseous Emissions

Project activities completed during construction and operations are anticipated to cause emissions of gaseous COPC, including CO, SO_2, NOx, acrolein (a surrogate for VOC), and radon gas. During operations, emissions of H_2SO_4 are also expected from the acid plant and process plant. Similar to the screening assessment for dust discussed in Section 6.2.2.1, the assessments of construction and operations is expected to bound the decommissioning and post-decommissioning phases of the Project.

Following the same methods described in Section 6.2.2.1, emission rates of gaseous COPC were estimated for each of the identified air sources and predictive modelling was used to estimate air quality concentrations within the LSA and RSA and at the sensitive receptor locations. The modelled air quality concentrations, with the exception of radon, were added to background air quality concentrations and compared to SAAQS or ambient air quality criteria from Ontario and/or Alberta to identify whether there were any effects due to the planned operations activities. Modelled radon concentrations (Appendix D.1) were used to calculate radiation dose as part of the HHERA (see Section 6.17 and Appendix D.7). The mitigation measures listed in Table 6-2 were considered as part of this analysis to identify where effects could be reduced or eliminated.

The results of the air dispersion modelling are summarized in Section 8.0 of Appendix D.1. For the construction phase, the modelling predicted a measurable change in air quality concentrations above baseline (i.e., an increase greater than 10% above baseline) for CO,

SO_2, nitrogen dioxide (NO_2), and acrolein; however, there were no predicted exceedances of the assessment criteria for these gaseous COPC. For the operations phase, the modelling predicted a measurable change in concentrations of CO, SO_2, NO_2, acrolein, and H_2SO_4 above baseline. In addition, 1-hour concentrations of CO, SO_2, and NO_2 and 24-hour concentrations of NO_2 and acrolein were predicted to exceed the SAAQS or Ontario AAQC in a small area near the modelled PDA boundary in the vicinity of the mine ventilation exhaust. For H_2SO_4, there were no predicted exceedances of the Ontario AAQC.

Since the assessment criteria of CO, SO_2, NO_2, and acrolein were predicted to be exceeded for the operations phase, emissions of these gaseous COPC from operations activities were identified as key interactions that were advanced to the assessment of residual effects and are discussed further in Section 6.2.3 (REA). H_2SO_4 emissions from operations activities are considered a minor interaction that were not carried through the REA.

6.2.3 Residual Effects Assessment

Since air quality is an intermediate VC, the residual effects classifications summarized below and in Table 6-4 do not have significance determinations; instead, significance is determined for VCs potentially impacted by air quality pathways.

6.2.3.1 Dust Emissions

The Project-environment interaction pertaining to increased levels of dust resulted in residual effects in the LSA. Exceedances of the 24-hour SAAQS for TSP, PM_{10}, and $PM_{2.5}$ were predicted in both assessment scenarios (construction and operations). Annual $PM_{2.5}$ concentrations also exceed the SAAQS in the operations phase. The overall maximum 24-hour TSP, PM_{10}, and $PM_{2.5}$ concentrations during construction were predicted to be 410 µg/m³, 159.7 µg/m³, and 42.9 µg/m³ (or 410.0%, 319.4%, and 153.3% of the SAAQS), respectively. Exceedances of the SAAQS during construction occurred within 5 km of the modelled PDA, and the maximum frequency of exceedances was predicted to be 3.7% of the time for TSP or 14 days per year. For the operations phase, the maximum 24-hour TSP, PM_{10}, and $PM_{2.5}$ concentrations were predicted to be 177.6 µg/m³, 144.3 µg/m³, and 117.8 µg/m³ (or 177.6%, 288.6%, and 420.6% of the SAAQS), respectively. For the operations phase, the maximum annual $PM_{2.5}$ concentration was predicted to exceed the assessment criterion, having a value 13.6 µg/m³ (or 136.1% of the SAAQS). Exceedances of the SAAQS during operations were limited to receptors within 100 m of the modelled PDA and the maximum frequency of exceedances was predicted to be 9.9% of the time for $PM_{2.5}$ or 36 days per year.

Residual Effects Classification

The magnitude of the predicted 24-hour TSP, PM_{10}, and $PM_{2.5}$ concentrations in both scenarios is high, as the predicted levels exceed both baseline levels and the applicable assessment criteria by more than 50%. The magnitude of the predicted annual $PM_{2.5}$ concentration during operations is moderate as it exceeds the applicable assessment criteria by less than 50%. Since exceedances of the applicable criteria are limited to the LSA, the geographic extent of the effect is considered local, while the frequency is considered periodic since exceedances are expected intermittently but repeatedly. The effect is also fully reversible (i.e., the effect will cease once the air emission sources cease to operate).

6.2.3.2 Uranium

The Project-environment interaction pertaining to increased levels of uranium resulted in residual effects in the LSA. Exceedances of the 24-hour Ontario AAQC for uranium (in PM_{10}) were predicted in both assessment scenarios (construction and operations). The overall maximum 24-hour uranium concentration was predicted to be 0.16 µg/m³ or (106.5% of the Ontario AAQC) during construction and 0.22 µg/m³ (or 149.5% of the Ontario AAQC) during operations. Exceedances of the criterion during construction were very limited with only one exceedance predicted at a receptor along the modelled PDA boundary. During the operations phase, exceedances were predicted to occur within a small area near the modelled PDA, with a maximum frequency of 0.2% of the time or about one day per year.

Residual Effects Classification

The magnitude of the predicted 24-hour uranium concentrations is moderate during construction and operations, as the predicted levels exceed the applicable assessment criteria by less than 50%. The geographic extent of the effect for both scenarios is limited to the site as exceedances are limited to a small area near the modelled PDA boundary. The frequency is considered negligible as exceedances are expected to occur only once per year and the effect is fully reversible once the air emission sources cease to operate.

6.2.3.3 Gaseous Emissions

The Project-environment interaction pertaining to increased levels of CO, SO_2, NO_2, acrolein, and radon gas resulted in residual effects in the LSA. In the operations phase, exceedances of the 1-hour SAAQS for CO, SO_2, and NO_2 and of the 24-hour SAAQS for NO_2 and the Ontario AAQC for acrolein were predicted. The overall maximum 1-hour CO,

SO_2, and NO_2 concentrations during operations were predicted to be 19,231 µg/m³, 548.7 µg/m³, and 732.9 µg/m³ (or 128.2%, 121.9%, and 244.3% of the SAAQS), respectively, while the overall 24-hour NO_2 concentration was predicted to be 237.0 µg/m³ (or 118.5% of the SAAQS). The overall maximum 24-hour acrolein concentration was predicted to be 0.5 µg/m³ (or 121% of the Ontario AAQC). Exceedances of the SAAQS and Ontario AAQC during operations occurred within 100 m of the modelled PDA in the vicinity of the mine ventilation exhaust, and the maximum frequency of exceedances for the 1-hour averaging period was predicted to be 0.7% of the time for NO_2, or 61 hours per year. For the 24-hour averaging period, the maximum frequency of exceedances for was predicted to be 0.3% of the time for NO_2 or one day per year.

Residual Effects Classification

The magnitude of the predicted 1-hour CO and SO_2 concentrations and the 24-hour NO_2 and acrolein concentrations during operations are moderate, as the applicable assessment criteria are exceeded by less than 50%. The magnitude of the predicted 1-hour NO_2 concentrations during operations are high, as the predicted levels exceed the applicable assessment criterion by more than 50%. The geographic extent of the effect is limited to the site as exceedances are limited to a small area near the modelled PDA boundary. The frequency of 24-hour exceedances is considered negligible as exceedances are expected to occur only once per year, while the frequency of 1-hour exceedances ranges from negligible (one hour per year) for CO and SO_2 to periodic for NO_2, as exceedances of the 1-hour NO_2 SAAQS may occur intermittently but repeatedly. In addition, and the effect is fully reversible once the air emission sources cease to operate.

6.2.4 Cumulative Effects Assessment

The CEA for the VC of air quality focused on potential interactions with the Rook I Project due to its proximity to the Project. The air quality assessment completed in support of the Rook I Project EIS consisted of a quantitative modelling assessment of the Rook I Project and the PLS Project. The Rook I Project EIS concluded that air quality would be expected to change relative to existing conditions and that short-term 24-hour concentrations of TSP and PM_{10} are predicted to exceed the SAAQS, but frequencies will be low and localized. In addition, NO_2, SO_2, H_2SO_4, CO, and $PM_{2.5}$ were predicted to be compliant with the SAAQS or other relevant criteria. Various metals and radon were also included in the air quality modelling study; however, they were evaluated in the assessments for other VC, such as human health. As such, they are not discussed herein; instead see Section 6.17.

To identify potential cumulative effects to ambient air quality, air quality COPC concentrations predicted at discrete receptor locations common to both air quality modelling studies (Figure 6-1) were summed and evaluated against the applicable assessment criteria. For the purposes of the air quality CEA, it was assumed that Rook I Project and PLS Project construction activities will overlap, and that Rook I Project and PLS Project operations will overlap. As a result, two cumulative effects scenarios were evaluated for air quality: CEA construction and CEA operations. If the total air quality COPC concentrations from both projects were shown to exceed the assessment criteria at a discrete receptor location, emissions from the PLS Project were modelled with emissions from the Rook I Project using available data from Appendix 7A of the Rook I Project EIS (NexGen 2024). As discussed in Appendix D.1, model runs were executed for TSP, PM_{10}, and NO_2 for the CEA construction and CEA operation scenarios. Radon emissions from both projects were also modelled for the CEA operation scenario to generate data inputs for the HHERA (see Section 6.17 and Appendix D.7).

Traffic associated with the Rook I Project and the PLS Project will both use Highway 955. Appendix 7A of the Rook I Project EIS (NexGen 2024) included an analysis of traffic impacts along Highway 955, and so it was possible to estimate emissions of TSP, PM_{10}, and NO_2 from the projected traffic for Rook I Project along Highway 955 in combination with that from the PLS Project. As a result, traffic volumes associated with both projects were included in the CEA modelling along with existing baseline traffic to determine the effect of combined traffic along Highway 955. Traffic volumes are provided in Appendix D.1. As discussed in Section 6.2.3 of Appendix D.1, truck traffic volumes associated with the Rook I Project were approximately five times higher than for the PLS Project during construction, and approximately four times higher during operations.

Except for short-term 24-hour concentrations of TSP and $PM_{10,}$ the CEA assessment showed that cumulative effects are not expected to result in any additional residual effects or to change the residual effects classifications discussed in Section 6.2.3. Based on the CEA modelling, concentrations of 24-hour TSP and PM_{10} are predicted to be above the SAAQS in some areas along Highway 955 within 1 km of the roadway. In these same locations, there were no exceedances predicted for the PLS Project case. Due to the larger traffic counts discussed above, the results indicate that Rook I Project truck traffic is likely to dominate particulate matter concentrations and exceedances of the SAAQS in the vicinity of Highway 955. The results of the CEA modelling are discussed in detail in Section 8.3 of Appendix D.1.

6.2.4.1 Climate Change

Climatological factors such as wind, temperature, and precipitation influence the dispersion of air releases but may also change the nature of Project operations and required mitigations. For instance, if temperatures warm, then less heating (and fuel use required to generate it) may be required, resulting in fewer air emissions from fuel combustion. An increase in precipitation could suppress dust emissions from unpaved surfaces and storage areas, which would decrease the dependency on watering or chemical dust suppressants for dust mitigation. However, an increase in temperature without an increase in precipitation could lead to drier conditions and cause increased emissions of dust.

In terms of dispersion, an increase in ambient temperature could affect the initial buoyancy characteristics of point releases by reducing the difference between the in-stack temperature and the surrounding air temperature. Such a difference may decrease the buoyant flux and therefore dispersion from a point source; however, for most point sources at the Project, dispersion is driven by the momentum flux (i.e., exhaust flow rates) and are unlikely to be sensitive to changes in air temperature. An increase in precipitation could wash out (i.e., remove) particulate matter from the atmosphere, lowering ambient concentrations of dust and adsorbed metals and radionuclides.

The air dispersion modelling was completed using a five-year historical meteorological data set that reasonably captures a range of conditions to predict the most conservative concentrations. The air dispersion modelling was also performed without plume depletion (i.e., removal mechanisms) to predict conservative concentrations.

6.2.5 Uncertainties

The assessment of air quality effects is subject to several technical limitations, including for instance, the use of generalized emission factors and default input variables that may not perfectly describe site-specific conditions. The predictive modelling is also based on empirical or theoretical algorithms that may not perfectly describe real-world conditions. To address these uncertainties and have confidence that the model predictions will bound observed conditions upon Project commencement, several conservative assumptions were implemented in the air quality assessment. For example, all Project activities were assumed to operate concurrently at their individual maximum rates of production. As a result, modelled concentrations of air quality COPC and the number of predicted exceedances of the assessment criteria are likely overestimated. Additional details are provided in Section 2.4 of Appendix D.1.

6.3 Noise and Vibration

6.3.1 Scope of Assessment

Noise and vibration have been included as a VC due to the potential for noise from Project activities to be audible off-site as well as the potential for noise to change use in surrounding lands by humans and wildlife. This VC is designated as an intermediate VC because the significance of changes to noise and vibration caused by Project activities is evaluated as part of the effects assessment for the VCs potentially impacted by these changes, such as wildlife and traditional and other land and resource use. The impact of predicted noise and vibration changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicators for this VC are noise levels and vibration levels, and the measurable parameters evaluated in this effects assessment are:

- Predicted changes in sound pressure levels compared to existing environment conditions and guidelines.
- Predicted changes in vibration compared to literature.

6.3.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for noise and vibration are defined as follows (Figure 6-2).

- Local Study Area: The LSA comprises 181.5 km^2 (18,152.3 ha) and was set to bound the area where measurable changes resulting from the Project activities would be anticipated (i.e., the sound contribution from the Project being equal to the background sound level). Based on the results of noise modelling conducted for the Project, the LSA was set as a 5 km buffer around the PDA and the area of Highway 955 included in the RSA.
- Regional Study Area: Noise is typically a local concern; however, for the purposes of identifying any cumulative impacts from other adjacent developments on sensitive receptors in the assessment, the RSA was set as a 30 km buffer around the PDA (3,349.9 km^2 or 334,989.1 ha).

Points of importance to the assessment of human, aquatic, and terrestrial environments were informed by stakeholder and Indigenous Nations' engagement and were aligned with other assessments such as the HHERA. For the human health evaluation, these areas included the PLS Camp, NexGen Rook I Project Camp, Patterson Lake South Camping Area, Beet Lake Camp, Lloyd Lake Lodge, and traditional land use (TLU) locations. Refer to Figure 6-2 for a map showing these locations as well as locations included for the assessment of ecological receptors.

6.3.1.2 Potential Effect Pathways

Project-environment interactions for the VC of noise and vibration that were identified as potential effect pathways during each Project stage include the following.

- Generation of noise from Project activities could affect noise levels during construction, operations, and decommissioning.
- Generation of vibrations from Project activities could affect vibration levels during construction and operations.
- Generation of noise from increased truck traffic on Highway 955 could affect noise levels during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.3.2 Screening Assessment, where relevant.

6.3.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.3.2.1 Generation of Noise from Project Activities

Activities completed during the construction phase are anticipated to increase sound levels within the LSA. A bounding scenario for construction was developed based on the year in which the most activity is expected to occur at the site. The final year of construction (Year –1) was selected for further analysis, as this featured the highest amount of truck traffic and the highest amount of waste rock material from the underground mine development being stockpiled on the surface. Other activities that were evaluated are summarized in Section 5.1 of Appendix D.2. Each of the identified noise sources were characterized in terms of their sound output using engineering calculations based on their physical operating characteristics (e.g., engine size of mobile construction equipment), or

measurements from similar equipment. Predictive modelling was then used to estimate the sound levels at the sensitive receptor locations from the simultaneous operation of all identified noise sources. The details of the predictive modelling are discussed in Section 7.1 of Appendix D.2.

Similarly, activities completed during the operations phase are anticipated to increase sound levels within the LSA, and a bounding scenario was developed based on Year 4 as this includes the maximum amount of ore to be processed, the maximum amount of site traffic, and full operation of the power plant. The operations assessment scenario is discussed in detail in Section 5.2 of Appendix D.2. Each of the identified noise sources were characterized in terms of their sound output, using engineering calculations that utilized information from the mechanical equipment list (e.g., motor and pump ratings). Measurement data and manufacturer data were also used where available. Predictive modelling was then used to estimate the sound levels at the sensitive receptor locations from the simultaneous operation of all identified noise sources. The details of the predictive modelling are discussed in Section 7.1 of Appendix D.2.

These predicted sound levels at the receptor locations were compared to provincial and federal guideline limits to screen for potential effects due to the planned construction and operations activities. The mitigation measures listed in Table 6-2 were considered as part of this analysis to identify where effects could be reduced or eliminated.

The results of the screening assessment are summarized in Section 8.0 of Appendix D.2. The analysis indicated that predicted sound levels during construction and operations would be less than the adopted criteria at all locations except for one, and that exceedance was limited to night-time hours only. The predicted sound level at TLU_8, located at the south end of Patterson Lake (see Figure 6-2), was 41 dBA during both construction and operations. This prediction is marginally above the provincial night-time criterion of 40 dBA. It should be noted that this location was identified by Clearwater River Dene Nation (CRDN), Buffalo River Dene Nation (BRDN), Birch Narrows Dene Nation (BNDN), and Metis Nation Saskatchewan Northern Region 2 (MN-S NR2) as a location of interest give its previous use as a camp and boat launch. There is no cabin or other accommodation there. As this is a marginal exceedance at an infrequently used site, noise from the construction and operations phases has been identified as a minor interaction; however, since the assessment criteria were exceeded, it has been advanced to an assessment of residual effects and is discussed further in Section 6.3.3.

Sound levels during decommissioning are expected to be less than those predicted during construction, as there will be less equipment on-site and less traffic accessing the site. Furthermore, the dominant noise sources at the site, such as the crushing plant, will not be in operation any longer. Without the crusher operating, there are no predicted exceedances of the provincial or federal guideline limits at any receptor and so noise from decommissioning has been identified as a minor interaction.

6.3.2.2 Generation of Noise from Increased Traffic on Highway 955

The Project will increase truck traffic on Highway 955, due to material deliveries, product shipments, transport of personnel, or other Project needs. Trucks to and from the site will travel on Highway 955. A screening level traffic noise assessment was completed to estimate the noise impact from a generic segment of Highway 955 carrying all of the expected traffic induced by the Project in addition to the existing baseline traffic. Baseline traffic volumes were referenced from the Transportation Impact Assessment completed for the Project (Appendix A.6), and future traffic volumes induced by the Project were estimated by Fission Uranium Corp. (Fission). The traffic volumes were then modelled using the provincial traffic noise model for Ontario, ORNAMENT, as implemented in the software STAMSON. This methodology has reference sound levels for various vehicle types built in. Details of the modelling methodology are provided in Section 7.2 of Appendix D.2 and results are provided in Section 8.3 of Appendix D.2.

Model results predicted that sound levels would increase by approximately 2.1 dBA over baseline conditions during construction, and by 2.4 dBA over baseline conditions during operations. These increments are applicable both in the Project area and in locations further removed from the Project area, such as Buffalo Narrows and Green Lake. Increases of this magnitude are considered to be imperceptible to human hearing and are considered to be negligible. As such, this activity has been considered a minor interaction and was not carried forward to the assessment of residual effects.

6.3.2.3 Generation of Vibration

No significant sources of vibration were identified in the review of equipment and processes associated with the construction, operation, and decommissioning phases. While blasting will be completed for development and mining, the blasts will be underground and so will not result in airblast overpressure. Further, there is not expected to be ground-borne vibration impacts at the distances between the deposits and the human receptor locations

(approximately 2 km). Therefore, this Project-environment interaction has no interaction with human receptors.

Fish health and fish habitat have the potential to be affected by blasting activities in the mine decline and underground mine during construction and operations. An assessment of pressure changes and vibrations caused by explosives on the VC of fish and fish habitat is provided in Section 6.10.2.9. In addition, potential effects of vibration cause by site activities and equipment use on wildlife are discussed in Section 6.12.3.2.

6.3.3 Residual Effects Assessment

The residual effects assessment for the noise and vibration VC is provided below and summarized in Table 6-4.

6.3.3.1 Generation of Noise

Activities completed during the construction and operations phases are predicted to result in measurable changes to the sound environment in the LSA. Predictive modelling completed based on the maximum construction year (Year –1) and maximum operations year (Year 4) with all equipment operating simultaneously indicated that sound levels at each of the receptors included in the assessment would be below the assessment criteria, with the exception of one location during the night-time hours. The predicted sound level at TLU_8 was 41 dBA during both construction and operations, compared to the provincial night-time criterion of 40 dBA. This location is not currently occupied and was identified by local Indigenous Nations as a location of interest that had been used as a camp and boat launch in the past.

For additional context, the results pertaining to the federal criteria adopted for the assessment at this location indicated that there would be no adverse effect during construction and operations. Health Canada requires that the 24-hour day-night sound level (Ldn) be below 75 dBA, and the change in “percent highly annoyed” (%HA, a parameter calculated from the Ldn) between baseline conditions and future conditions with the Project in place be less than 6.5%. The predicted Ldn for construction at TLU_8 was 48 dBA during construction and operations, and the predicted change in %HA was 2.3% for construction and 2.1% for operations. These are each below the required thresholds.

In addition to the federal criteria noted above, Health Canada also recommends an assessment of low frequency noise (LFN) and maximum noise levels (Lmax). The highest

predictions occurred at TLU_8 during each phase but were below the recommended limits. For LFN, the energy sum of sound levels in the 16 Hz, 31.5 Hz, and 63 Hz octave bands predicted at each receptor should not exceed 70 dB (linear), and Lmax levels should not exceed 60 dBA. The maximum LFN values predicted during construction and operations were 57 dB and 58 dB, respectively. The Lmax levels during construction and operations were 47 dBA and 48 dBA, respectively.

Residual Effects Classification

Since noise and vibration is an intermediate VC, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by noise and vibration pathways.

The magnitude of the effect is considered to be low as the exceedance of the provincial night-time criterion is marginal (1 dBA) and each of the other criteria are met. In terms of geographical extent, the most stringent criterion (the provincial night-time criterion of 40 dBA) is met beyond approximately 1.5 km of the PDA and so the effect is considered to be local. The duration of the effect is limited to the construction and operations phases and are fully reversible upon their conclusion. Sound levels are expected to be measurably higher than existing conditions continuously through the construction and operations period; however, it should be noted that the predictions are based on a worst-case scenario with all equipment operating simultaneously and continuously at all times. In practice, sound levels due to construction will vary over time between the existing conditions and the predicted levels.

6.3.4 Cumulative Effects Assessment

The CEA for the VC of noise and vibration focused on potential interactions with the Rook I Project due to its proximity to the Project. The noise assessment completed in support of the Rook I Project EIS consisted of a quantitative modelling assessment. To identify potential cumulative noise effects, the sound level contour plots for the Rook I Project construction and operation phases were digitized and re-gridded with the sound level contour predictions from the PLS Project. This resulted in contour plots for the simultaneous operation of the two projects, as well as the incremental effect associated with the introduction of noise from the PLS Project.

For the purposes of the noise CEA, it was assumed that Rook I Project and PLS Project construction activities will overlap, and that Rook I Project and PLS Project operations will

overlap. As a result, two cumulative effects scenarios were evaluated for noise: CEA construction and CEA operation. Effects were evaluated at the same receptor points as shown in Figure 6-2. The results indicated that the effects of the projects remain local to the respective sites. While there is predicted to be some increase in sound level at locations in between the two sites, these are predicted to be limited to night-time hours and are at levels that would be considered imperceptible (3 dBA increase). Any exceedances of provincial or federal criteria were not the result of cumulative operations but were rather solely influenced by one site or the other. As such, there were determined to be no cumulative effects. The results of the CEA during overlapping construction and operation activities are discussed in detail in Section 9.1 of Appendix D.2.

Traffic associated with the Rook I Project and the PLS Project will both use Highway 955. Appendix 7B of the Rook I EIS (NexGen 2024) included an analysis of traffic impacts along Highway 955, including the traffic volumes considered, and so it was possible to evaluate noise from the projected traffic for the Rook I Project along Highway 955 in combination with that expected from the PLS Project. As such, traffic volumes associated with both projects were included in the CEA modelling along with existing baseline traffic to determine the effect of combined traffic along Highway 955. The Rook I Project is anticipated to have much higher traffic volumes than the PLS Project. The addition of traffic from the PLS Project to the sound levels associated with baseline plus Rook I traffic were predicted to result in incremental increases of 0.1 dBA during the cumulative construction scenario and 0.3 dBA during the cumulative operations scenario, which are considered to be negligible effects. As such, the cumulative effect ratings are predicted to be the same as the residual effect ratings. The results of the CEA pertaining to truck traffic are discussed in detail in Section 9.2 of Appendix D.2.

6.3.4.1 Climate Change

The generation of noise is not generally considered to be a factor that inherently or directly influences climate change. That said, climatological factors may influence the propagation of noise, and may also change the nature of operations. For instance, if temperatures warm, then cooling equipment (and electricity generation required to run it) may run longer and under greater loads, resulting in greater sound levels over longer periods. In terms of propagation, meteorological conditions such as temperature and relative humidity may influence the propagation of sound. The modelling was completed using a combination that generally results in the most conservative predictions (low temperature and high humidity). Temperature inversions are another climate-related occurrence that may affect noise

propagation as temperature inversions act to refract sound waves that would otherwise disperse in the atmosphere back to the ground, resulting in further propagation. If climate change were to increase the frequency of temperature inversions, then sound levels from the site would be expected to travel further; however, it should be noted that the modelling for this assessment accounts for moderate temperature inversions in the predictions and further assumes all receptors are downwind. Lastly, it should also be noted that sources of noise are often associated with sources of air emissions, which may then affect climate change depending on the releases. Climate change considerations related to air quality are discussed in Section 6.2.4.1.

6.3.5 Uncertainties

The assessment of impacts to the acoustic environment is subject to technical limitations pertaining to the quantification of source sound levels, use of general meteorological assumptions, and technical limitations inherent in predictive modelling. Sound propagation models are based on formulae developed either theoretically or empirically and may not perfectly describe real-world conditions, and therefore employ assumptions that tend to result in conservative predictions. Similarly, noise sources are characterized using published research studies, manufacturer data, or historic measurements completed at similar sites and may not perfectly represent the sources that will be installed and operational at the site. To mitigate this uncertainty, conservative assumptions have been applied in the development of the source inventory and are discussed in detail in Section 2.4 of Appendix D.2. As a result, the predictions are expected to be conservatively estimated; however, as there is uncertainty inherent in the process.

6.4 Visual Landscape

6.4.1 Scope of Assessment

Changes to the aesthetics of the area surrounding the Project was a concern expressed by stakeholders and Indigenous nations. The VC visual landscape is designated as an intermediate VC as the extent of changes to the aesthetics of the landscape caused by development of the Project could affect other VCs such as traditional and other land and resource use. The impact of predicted visual landscape changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicators for this VC are visibility and visual contrast, and the measurable parameters evaluated in this effects assessment are:

- Predicted visible extent of prominent Project features from sensitive viewpoints.
- Predicted visual contrast between the Project and the existing landscape from sensitive viewpoints.

6.4.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for visual landscape are defined as follows (Figure 6-3).

- Local Study Area: The visual LSA is defined as the area where measurable changes to the visual environment resulting from the proposed Project activities may be anticipated. The visual LSA was set as a 5 km buffer from each viewpoint, where Project activities or infrastructure would be expected to be visible. The LSA was comprised of 140.6 km^2 (14,055.2 ha).

Since the visual environment is limited to a viewers' ability to visualise the Project, there was no RSA considered in the analysis.

Changes to the visual landscape were assessed at sensitive viewpoints within the LSA, where users/viewers would be expected to interact with the Project. Since there are no permanent settlements or communities located near to the Project, recreational, cultural, and TLU viewpoints were determined based on community engagement activities (Figure 6-3). The most sensitive viewpoints were located on Patterson Lake and were therefore selected for the visual assessment.

6.4.1.2 Potential Effect Pathways

The Project-environment interaction for the VC of visual landscape that was identified as potential effect pathway during each Project stage included the following.

- Project infrastructure could change the visual landscape surrounding the Project during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.4.2 Screening Assessment, where relevant.

6.4.2 Screening Assessment

A summary of the screening assessment results for the Project-environment interaction of changes to the visual landscape is provided in Table 6-3.

6.4.2.1 Changes to the Visual Landscape surrounding the Project

Activities completed during the construction phase are anticipated to change the visual landscape within the LSA. A bounding scenario for construction was developed, which was based on the period where the majority of site preparation activities (i.e., heavy equipment use, earthworks activities like clearing and grubbing, boxcut development) and the internal site roads, facility pads, and access improvements would be completed. The construction assessment scenario is discussed in detail in Section 5.1 of Appendix D.3. A 3D model was used to evaluate visibility and visual contrast associated with the construction scenario at a selection of sensitive viewpoints. The details of the 3D modelling are discussed in Section 7.2 of Appendix D.3.

Similarly, activities completed during the operations phase are anticipated to change the visual landscape within the LSA, and a bounding scenario was developed based on the anticipated full-scale operation of the Project, which included all buildings, infrastructure, and above ground and underground workings (i.e., TMF [Tailings Management Facility], waste rock facilities, etc.). The operations assessment scenario is discussed in detail in Section 5.2 of Appendix D.3. The 3D modelling of the operations scenario is discussed in Section 7.2 of Appendix D.3.

Changes in visibility and visual contrast were evaluated and screened for potential effects due to the planned construction and operations activities. The mitigation measures listed in Table 6-2 were considered as part of this analysis to identify where effects could be reduced or eliminated. The results of the screening assessment are summarized in Section 7.0 of Appendix D.3. The analysis indicated that measurable changes in visual amenity would be expected at sensitive viewpoints on Patterson Lake during construction and operations. Changes to the visual landscape during decommissioning and post-decommissioning are expected to focus on returning the site to a safe, environmentally sound condition as near as possible to pre-development conditions. Therefore, the Project-environment interaction of Project infrastructure changing the visual landscape surrounding the Project was moved to REA for the construction and operations phases.

6.4.3 Residual Effects Assessment

The residual effects assessment for the visual landscape VC is provided below and summarized in Table 6-4.

6.4.3.1 Visibility and Visual Contrast

Activities completed during the construction and operations phases are predicted to result in measurable changes to the visibility and visual contrast due to the Project. The 3D modelling of the construction and operations phases indicated that Project would be highly visible, and of sufficient scale and prominence to negatively affect visual amenities at sensitive viewpoints on Patterson Lake. In addition, changes to the existing landscape character are expected to generate a strong level of contrast that will attract attention from users and will dominate the existing landscape.

Residual Effects Classification

Since visual landscape is an intermediate VC, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by visual landscape pathways.

The magnitude of the effect is considered high since changes to the visual landscape (visibility and visual contrast) as a result of the Project are expected to dominate views and define its characteristics within the LSA. The duration of the effect is limited to the construction and operations phases and is reversible upon their conclusion, through the implementation of a detailed Decommissioning and Reclamation Plan (DRP) and a rehabilitation strategy that is focussed on returning the site to pre-development conditions. The frequency of the effect would be limited to periods where seasonal, recreational, or traditional users would be present at sensitive viewpoints within Patterson Lake.

6.4.4 Cumulative Effects Assessment

The CEA for the VC of the visual environment focused on potential interactions with the Rook I Project due to its proximity to the Project. The EIS for the Rook I Project did not include a detailed quantitative assessment of visual effects, nor did it contain suitable information to determine the broader visual footprint of the facilities and supporting infrastructure. However, it is highly likely that users will be able to visualize elements of the Rook I Project while accessing parts of Patterson Lake and the surrounding areas.

To assess the potential for cumulative effects from the PLS Project and the Rook I Project, a selection of sensitive viewpoints located in Patterson Lake South Arm (Figure 6-3) were evaluated to determine the potential for cumulative visual effects. While the PLS Project is visible from cumulative effects viewpoints, there appeared to be sufficient elevation between the Patterson Lake and the Rook I Project and existing vegetative screening such that the majority of the Project features would not likely be visible from the selected viewpoints.

6.4.5 Uncertainties

The assessment of impacts to the visual environment is subject to several technical limitations. Technical limitations typically associated with visual assessments pertain to the use of general assumptions, and the general limitations inherent in predictive modelling. Visual simulation models were developed based on feasibility-level engineering drawings and data for the proposed Project configuration and available elevation and surface/cover data were used to create 3D models of the study area. To mitigate this uncertainty, conservative assumptions were applied in the development of the visual models, which are described in Section 2.4 of Appendix D.3. For example, maximum height/dimensions of building features, exhaust stacks, stockpiles, and other Project features were assumed and contrasting colours were used for key building envelopes, infrastructure, and Project features. As a result, the analysis is expected to conservative.

6.5 Terrain and Soils

6.5.1 Scope of Assessment

Terrain and soils were identified as intermediate VCs as Project-related changes in terrain morphology, terrain stability, soil quantity, and soil quality have to potential to cause effects on aquatic, terrestrial, and atmospheric environments near the Project. Soil quality could also be affected by the intermediate VC of air quality, which was a concern expressed by Indigenous groups during engagement activities (i.e., the potential for soil contamination by Project activities). The impact of predicted terrain and soil changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicators for these VCs are terrain morphology and stability, soil quantity, and soil quality, and the measurable parameters evaluated in this effects assessment are:

- Predicted changes to topographic contours and drainage patterns compared to existing environment conditions.
- Predicted changes to quantity of organic and mineral soil available for reclamation compared to existing environment conditions.
- Predicted changes to quality of soil physical and chemical properties compared to existing environment conditions.

6.5.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for terrain and soils are defined as follows (Figure 6-4).

- Local Study Area: The LSA was set to bound the area where measurable changes resulting from the Project activities would be anticipated. The terrain and soils LSA is defined as the PDA plus a 600 m buffer (27.8 km^2 or 2,781.2 ha), consistent with the vegetation LSA.
- Regional Study Area: The RSA for terrain and soils is the same as described for the vegetation RSA and the wildlife LSA and included a 5 km buffer around the PDA (181.5 km^2 or 18,152.3 ha). The terrain and soils RSA boundary was chosen to examine the effects of terrain and soil change on vegetation and wildlife habitat in a larger area, and how the effects could contribute to cumulative effects of other VCs within a larger context.

6.5.1.2 Potential Effect Pathways

Project-environment interactions for the VCs of terrain and soils that were identified as potential effect pathways during each Project stage include the following.

- Altered terrain, reduced soil quantity, and reduced soil quality may result from construction, operation, and decommissioning activities.
- Air dispersion of dust and gaseous pollutants could impact soil COPC concentrations and health during construction, operations, and decommissioning.

6.5.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.5.2.1 Altered Terrain

The construction, operation, and decommissioning of Project facilities are predicted to alter the terrain within the SSA. Activities that could alter terrain include grading (clearing of vegetation and soil stripping) and major earthworks (i.e., excavation, hill cuts, backfilling). These earthworks could alter the topographical contours of the site, and subsequently the drainage patterns, which can affect slope stability, water infiltration, and erosion (Duncan et al. 2014; Montgomery 1994; Morbidelli et al. 2018).

To mitigate the effects of Project activities on terrain during the construction, operation, and decommissioning phases, design features and mitigation measures can be used (Table 6-2). These mitigation measures include, but are not limited to:

- using previously disturbed areas for infrastructure and roads;
- identifying areas of terrain sensitivities such as steep slopes (i.e., >15%) and avoiding them where possible, if avoidance is not possible, the use of soil stabilization measures should be considered;
- limiting vegetation removal on steep slopes;
- minimizing the steepness and length of slopes of disturbed areas and stockpiles;
- preserving natural drainage features such as pre-existing areas of natural macro and micro topographic relief; and
- completing progressive reclamation during operations where possible.

A detailed DRP will be developed and implemented that will include altering the terrain to pre-existing conditions to the extent possible during decommissioning. The only Project feature that will continue to affect terrain in the long term is the TMF, as it will remain within the SSA following decommissioning. Since terrain in the SSA will be altered throughout the construction and operations phases, and the TMF will remain as a permanent feature, this Project-environment interaction was classified as a key interaction and was carried forward into the REA.

6.5.2.2 Soil Quantity

Soil quantity within the SSA may be reduced or redistributed by grading (i.e., clearing of vegetation and soil stripping), major earthworks (i.e., excavation, hill cuts, backfilling), aggregate crushing, soil transport, and soil stockpiling. These activities may cause soil loss or redistribution through direct soil handling or through wind and water erosion (Rahman and Esa 2014). The clearing of vegetation during grading can also exacerbate the loss of soil, as vegetation serves as a necessary means of soil stabilization (Jafari et al. 2022). Soils throughout several areas of the LSA have high to moderate wind and water erosion susceptibility (Figure 6-5); thus, mitigation measures should be utilized to reduce soil loss including:

- minimizing earthworks in areas of high erosion susceptibility, where possible;
- avoiding ground disturbance activities during times of high wind and heavy rain;
- placing stockpiles in areas that have a low risk of wind and water erosion and covering stockpiles with temporary or semi permanent materials (e.g., geotextiles and vegetation cover); and
- utilizing and monitoring erosion control measures, where necessary.

As discussed in Section 4.6.1.1, most topsoils (i.e., upper lifts) within the study areas assessed during the 2018/2019 baseline survey were deemed poorly suitable for reclamation use (Appendix C.3). Suitable soil that is temporarily removed by site preparation activities will be stockpiled, covered, and subsequently used for reclamation during future progressive and final closure activities. The only Project feature that will continue to affect soil quantity past the decommissioning phase is the TMF, as it will require large volumes of soil for decommissioning.

Mitigation measures and stockpiling will be employed to prevent soil loss to the extent possible; however, since measurable changes are predicted, this Project-environment interaction was classified as a key interaction and was carried forward into the REA.

6.5.2.3 Soil Quality

Soil Physical Properties

Physical properties of the soil (i.e., structure, texture, and bulk density) may be affected by grading (i.e., clearing of vegetation and soil stripping), major earthworks (i.e., excavation, hill cuts, backfilling), aggregate crushing, and repeated vehicle and equipment travel over

sections of the SSA. These activities can cause admixing, compaction, and pulverization, which can affect soil porosity, therefore affecting water and gas exchange in the soil (Horn and Smucker 2005). Generally, soils throughout the LSA demonstrate low susceptibility to soil compaction (Figure 6-6); however, two areas of increased compaction susceptibility were identified near the fresh air riser and a section of the road that parallels Highway 955.

To mitigate the effects of the Project on soil quality, as it relates to soil physical properties, design features and mitigation measures can be used (Table 6-2). These include minimizing ground disturbances processes in areas of high compaction susceptibility, where possible; using previously disturbed areas for infrastructure and roads; using equipment that reduces effects on soil physical properties (i.e., low ground pressure tires and wide pad tracks); adding soil amendments during reclamation; and planning and implementing a DRP.

The only Project feature that will continue to affect the physical properties of the soil is the TMF as it will remain in the SSA permanently. This Project-environment interaction was classified as a key interaction and was carried forward into the REA.

Soil Chemical Properties

Long-term soil stockpiling and the movement of soil around the site during the various phases of the Project have the potential to degrade soil chemical properties (e.g., pH, electrical conductivity, sodium absorption ratio, organic carbon, and available nitrogen, phosphorous, potassium, and sulphur) within in the SSA. By mixing soils with high reclamation suitability with soils that are unsuitable for reclamation purpose, soil chemistry may be altered (Sheoran 2010). Long-term soil-stockpiling has also been shown to reduce the quantity of plant-available nutrients in the soil, which then makes the soil less suitable for reclamation and vegetation reestablishment (Valliere et al. 2021).

To mitigate the effects of the Project on soil chemical properties, design features and mitigation measures can be used throughout all Project phases (Table 6-2). These include minimizing soil movement from areas of unsuitable or poor suitability for reclamation to areas of good reclamation suitability, minimizing the length of time soil is stockpiled, adding soil amendments during reclamation, completing progressive reclamation where possible, and planning and implementing a detailed DRP.

Air dispersion of dust and gaseous pollutants have the potential to transfer COPCs to the soil. The deposition of air particulates to soil was evaluated in the HHERA (Appendix D.7) using the results of the air dispersion modelling (Appendix D.1). The COPCs considered

in the HHERA included arsenic, cadmium, cobalt, copper, lead, nickel, selenium, uranium, and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210). Uranium concentrations in the soil in the LSA are predicted to increase from baseline concentrations but are expected to remain well below the soil Saskatchewan Environmental Quality Guidelines (SEQG) for the protection of ecological and human health and will decrease with distance from the Project. For the remaining COPCs, little to no change in air quality concentrations in the LSA were modelled (Appendix D.1) and concentrations of COPCs in soils are predicted to be below SEQGs. Therefore, this Project-environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.5.3 Residual Effects Assessment

The residual effects assessment for the terrain and soils VC is provided below and summarized in Table 6-4.

6.5.3.1 Altered Terrain

Residual effects on terrain are mainly related to the alteration of the morphology and stability of the soils from existing environment conditions. Alteration of the slope length, degree, and aspect can have implications for movement of soil and soil process (Duncan et al. 2014). Soil movement either largescale, in the form of mass wasting (i.e., large movement of material downslope) or small scale, in the form of wind and water erosion can directly impact soil process (i.e., water availability and nutrient cycling) (Maja et al. 2021). Some effects to terrain can be mitigated throughout the construction, operations, and decommissioning phases, as outlined in Section 6.5.2 and the site can be reclaimed using industry best practices and formalized processes outlined in the detailed DRP. Therefore, long-term residual effects on terrain from the Project are not anticipated, except for in the area of the TMF. The TMF's footprint is approximately 74.1 ha within the SSA and design currently consists of an excavation 10 m below original ground surface and berm construction 16 m above original ground surface (Clifton 2022); however, optimization studies are ongoing. The TMF will be a permanent feature and will provide secure storage of uranium mill tailing and process fluids during operations and long-term disposal (i.e., approximately 10,000 years; Clifton 2022). As the TMF will remain at the site indefinitely, this will be the only permanent change to terrain.

6.5.3.2 Reduced Soil Quantity

Residual effects on soil quantity are mainly related to the loss of mineral and organic soil through direct soil handling processes, wind and soil erosion, and use during the decommissioning phase. The loss and redistribution of soils affects their moisture and nutrient holding-capacity, through the loss of fine-texture particles (Uo et al. 2015). Additionally, soil loss in the Project area means less bulk soil is available to be used during the decommissioning phase. Some effects to soil quantity can be mitigated throughout the construction and operations phases, as outlined in Section 6.5.2. and the site can be reclaimed using industry best practices and formalized processes outlined in the detailed DRP. Long-term residual effects on soil quantity from the Project are not anticipated, except for in the location of the TMF. The closure of the TMF is currently anticipated to require a cover of approximately 5 m of soil, totally roughly 2.5 million m^3 of soil (Clifton 2022). This soil cover will act to promote further consolidation of the tailings, before it is capped with an engineered cover (Clifton 2022). This redistribution of soil to the TMF will be the only permanent change to soil quantity.

6.5.3.3 Reduced Soil Physical Properties

Residual effects on soil physical properties are mainly related to the alteration of soil texture, structure, and bulk density from Project activities. Admixing, compaction, and pulverization can increase or decrease water infiltration and gas exchange within the soil (Horn and Smucker 2005). Some effects to soil physical properties can be mitigated throughout all three phases of the Project, as outlined in Section 6.5.2 and the site can be reclaimed using industry best practices and formalized processes outlined in the detailed DRP. Therefore, long-term residual effects on soil physical properties from the Project are not anticipated, except for in the location of the TMF. Constructing the TMF will require excavating, crushing, and screening of aggregate that is available within the footprint of the TMF and directly north of the TMF (Clifton 2022). The aggregate will undergo a transformation to fit construction specifications and will no longer be similar to the native material. This will be the only permanent change to soil physical properties.

Residual Effects Classification

Since terrain and soils are intermediate VCs, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by terrain and soils pathways.

The magnitude of the effect pathway of altered terrain and reduced soil quantity and physical properties resulting from Project activities is moderate to high. While much of the site will be remediated and reclaimed progressively through operations and during decommissioning, the TMF will remain as a permanent feature. The geographic extent is local as changes are only predicted to occur within the SSA. Duration is medium-term for the site extending from construction through decommissioning; however, the TMF will be permanently altered and irreversible. The frequency is continuous, and the likelihood is high, as the terrain and soil effects discussed above are required for the development of the Project.

6.5.4 Cumulative Effects Assessment

The CEA for terrain and soils examined potential for future interaction with the NexGen Rook I Project, and found no overlap in study areas, and therefore, no cumulative effects to terrain and soils is predicted.

6.5.5 Uncertainties

Due to a change in the Project footprint following initial baseline investigations, some areas do not have pre-disturbance soil data (e.g., aggregate stockpile, borrow pit, laydown, and TMF). Therefore, no determination of wind and erosion susceptibility, compaction susceptibility, and reclamation suitability can be made for those sections of the SSA. To address this uncertainty, additional pre-disturbance soil data will be collected pre-construction following the same methods discussed in the baseline report (Appendix C.3).

As mentioned previously, design of the TMF is undergoing optimization studies; thus, the size, configuration, and quantities of soil cover required are subject to change.

6.6 Groundwater Quantity

6.6.1 Scope of Assessment

Groundwater quantity was included as a VC because changes to groundwater levels could affect availability of groundwater for future use and groundwater drawdown could alter surface water levels and wetland/aquatic habitat, which could impact biota. This VC was designated as an intermediate VC because the significance of the changes are the potential effects to other VCs such as surface water quantity, vegetation, and fish and fish habitat. The impact of predicted groundwater quantity changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicator for this VC is groundwater levels and the measurable parameters evaluated in this effects assessment are:

- The horizontal and vertical extent of drawdown from a point of discharge.

6.6.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for groundwater quantity are defined as follows (Figure 6-7).

- Local Study Area: The LSA spans the areal extent of drilling investigations conducted at the future Project site and covers the extent of the planned site facilities and the PDA for a total area of 90.8 km^2 (9,080.5 ha). The LSA was selected to be of sufficient size to develop a numerical groundwater model to aid in the assessment of potential impacts associated with the construction, operation, decommissioning, and closure phases of the Project.
- Regional Study Area: The RSA was selected to cover an area of sufficient size to describe key hydrogeological features for the region, provide context for the site geology, and to consider cumulative effects of other activities in the region. The RSA includes a total area of 1,031.5 km^2 (103,146.6 ha).

6.6.1.2 Potential Effect Pathways

Project-environment interactions for the VC of groundwater quantity that were identified as potential effect pathways were separated into activities occurring during construction and activities occurring during operations and decommissioning.

- Groundwater quantity could be affected by the following Project-environment interactions occurring during the construction phase of the Project:
    - Dewatering/depressurization of the mine decline.
    - Dewatering for installation of the TMF underdrain system.
    - Development of the initial water cover for the TMF.
- Groundwater levels could be affected by the following Project-environment interactions occurring during the operations and decommissioning phases of the Project:

- Groundwater use as make-up water for use in the mill.
- Groundwater use as a potable water to supply to the work camp.
- Groundwater inflow to the underground mine.

Receptors with the potential to be affected by changes in groundwater quantity include local surface water receptors (Patterson Lake, South Creek, and wetlands); there are presently no groundwater receptors in the Project area; however, impacts to future potential groundwater users were considered as part of the assessment.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.6.2 Screening Assessment, where relevant.

6.6.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.6.2.1 Dewatering of the TMF Underdrain System

The construction of the TMF underdrain system will require dewatering. The invert of the underdrain system is anticipated to be several meters below the water table. Results of analytical modeling predicted a radius of influence corresponding to 1 m of drawdown that extends an approximate distance of 80 m from the underdrain dewatering system, using a maximum estimated discharge rate of 2,000 m^3/day and a pumping duration of 90 days (Appendix D.4). This interaction takes place over a short time period, is of very limited spatial extent, and is predicted to have negligible impacts on receptors. The period of dewatering is not concurrent to any other groundwater extraction in the area of the TMF. Water levels are expected to recover quickly at the conclusion of dewatering. For these reasons the interaction was considered to be minor and was not moved forward into the REA. Groundwater elevations will be monitored during dewatering of the underdrain system.

6.6.2.2 Development of the TMF Water Cover

It will take approximately 49 days to develop the water cover required for tailings deposition in the TMF using an average discharge rate of 3,500 m^3/day. Analytical modeling predicted a radius of influence corresponding to 1 m of drawdown extending an approximate distance of 115 m (Appendix D.4). This interaction takes place over a short time period, is predicted to have negligible impacts on receptors, and is not concurrent to

any other groundwater extraction in the area of the TMF. Water levels are expected to recover quickly at the conclusion of water cover development. For these reasons the interaction was considered to be minor and was not moved forward into the REA. Groundwater elevations will be monitored while the TMF water cover is developed.

6.6.2.3 Potable Water Supply

Fission estimated 60 m^3/d from groundwater will be required to supply potable water to the site. Analytical modeling predicted a radius of influence corresponding to 1 m of drawdown extending approximately 130 m after 10 years of use (Appendix D.4). Although the time frame for this interaction is significantly longer than discussed in the previous scenarios, the rate of extraction is significantly lower. For these reasons the interaction was considered minor and was not moved forward into the REA. Groundwater elevations will be monitored in the area of the supply well.

6.6.2.4 Groundwater Inflow to the Underground Mine

The majority of the groundwater seepage to the underground is expected to originate as vertical recharge from Patterson Lake and the Upper Overburden with a lesser amount of lateral flow from the basement rocks. Groundwater seeping into the underground mine will be pumped to the surface for process water and eventually discharged into Patterson Lake through the diffuser following treatment. A site wide water balance of inflows and outflows to Patterson Lake (Appendix D.6) was completed in support of the hydrology modeling that projected a net increase in flows to Patterson Lake during the operations phase of the Project (Appendix D.5). Transient modeling using the mitigated scenario of cover grouting and artificial ground freezing as described in BGC (2022), estimated very little change to the existing water table at the end of mine operations (Appendix D.4). As such this Project-environment interaction is predicted to cause minimal changes to groundwater quantity and was not carried forward to the REA. Groundwater elevations in the area of the mine will be monitored for the duration of the Project interaction described above.

6.6.2.5 Decline Dewatering and Make-up Mill Water

The tunnel boring machine method is the preferred method of decline development using an earth pressure boring machine that eliminates the need for dewatering. As the Project is still considering two methods, the alternative tunnel shield method (TSM) was assessed to consider the dewatering needs in advance of construction. Once the decline has been constructed, some of the decline dewatering wells will be repurposed as groundwater

supply wells for make-up water in the mill. The numerical modeling for decline dewatering and mill water supply employed the dewatering well configuration and the half-length barrier wall between the decline and Patterson Lake presented in BGC (2022). The modeled average discharge rate during construction dewatering is 7,250 m^3/day, the estimated discharge rate for mill water supply during operations is between 2,400 m^3/day and 4,800 m^3/day. The groundwater model estimates that approximately 75% of this water comes from Patterson Lake. Steady state models indicate that the maximum extent of the modeled 1 m drawdown radius of influence for these interactions covers an area of approximately 1,000 m by 500 m (Figure E1, Appendix D.4) in the area of the decline.

Since this Project-environment interaction is continuous from construction to the end of operations, takes place adjacent to a receptor (Patterson Lake), and has a predicted drawdown extent that covers an area of approximately 1,000 m x 500 m, it was identified as a key interaction and was carried forward to the REA.

6.6.3 Residual Effects Assessment

The residual effects assessment for the groundwater quantity VC is provided below and summarized in Table 6-4.

6.6.3.1 Decline Dewatering and Make-up Mill Water

Groundwater drawdown in the area of the mine decline will take place continuously throughout the construction and operations phases of the mine life. The 3-D numerical groundwater model used to assess large-scale Project interactions was used to evaluate the impact to groundwater quantity in the area of the mine decline, as described in Appendix D.4.

The groundwater model estimates that approximately 75% of the water coming from the decline wells originates from Patterson Lake. Groundwater discharged during decline dewatering and treated effluent from the mill will be stored in containment ponds onsite for eventual discharge to Patterson Lake. The Patterson Lake Groundwater Balance (Appendix D.6) estimating inflows and outflows to Patterson Lake as a result of Project-environment interactions is near neutral with an overall net positive balance to Patterson Lake over the Project life.

There are presently no groundwater users within the Project area. The drawdown cones produced by the potable water well and the decline wells are not predicted to overlap. Water

levels are predicted to recover relatively quickly at the conclusion of the Project; therefore, no impacts are predicted to potential future groundwater users. The predicted changes to fens from groundwater drawdown in this area is predicted to be negligible (Section 6.11.2.2).

Water levels will be monitored in the area of the decline while the water wells are in use and to monitor recovery of water levels at the conclusion of use.

Residual Effects Classification

Since groundwater quantity is an intermediate VC, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by groundwater quantity pathways.

A low magnitude decrease in groundwater quantity is predicted locally with a 1 m radius of influence extending an approximate area of 1,000 m by 500 m. The duration is medium-term as it is predicted to occur during construction and operations phases of the Project. The effect is reversible in the short-term, the frequency is continuous, and the likelihood is high as the drawdown cone will persist as long as groundwater extraction occurs. Impacts to receptors are predicted to be negligible.

6.6.4 Cumulative Effects Assessment

The CEA for the drawdown of groundwater/impacts to groundwater quantity considered the NexGen Rook I Project, which was identified as it is also located on Patterson Lake and will engage in Project-environment interactions that result in impacts to local groundwater quantity.

The extent and magnitude of drawdown effects for the Rook I Project are shown in Figure A19 in Appendix 9A of the Rook I Project EIS (NexGen 2022). The modeled drawdown cone for the Rook I Project terminates near the eastern shore of Patterson Lake, as such, the drawdown impacts associated with the separate projects are not expected to overlap and no cumulative effects are predicted.

6.6.4.1 Climate Change

The magnitude and extent of the drawdown impacts described are unlikely to change in response to climate change. Changes in climate may potentially increase or decrease the amount of recharge across the site which may in turn impact water levels. Changes in water

levels change the total amount of drawdown available within a geologic unit but have little impact to the amount of drawdown in response to pumping which is primarily governed by the hydraulic properties of the geologic unit.

6.6.5 Uncertainties

This assessment is based on the information available at the time of reporting. Geological formations are heterogeneous, and conditions may be significantly different where information is not present. While conceptual site models and numerical models can be useful in understanding groundwater conditions and facilitate decision making, all models are approximations of natural phenomena and are therefore, inherently inexact. The results of this report should be accepted as approximate. Where uncertainties existed, the most reasonable conservative assumptions were used to assess potential impacts. Uncertainties and limitations to the analytical and numerical models used in the assessment are discussed in further detail in Appendix D.4.

6.7 Groundwater Quality

6.7.1 Scope of Assessment

Groundwater quality is included as a VC because changes in groundwater COPC concentrations could affect its use by downstream groundwater users and potentially affect downstream surface water quality. There are currently no groundwater users in the Project area; however, the potential for effects to future groundwater users located downstream of onsite waste facilities was assessed as well as the potential for effects of changes of COPC concentrations to groundwater that discharges to surface water receptors. Groundwater quality is an intermediate VC because changes could significantly affect other VCs such as surface water quality and human health. The impact of predicted groundwater quality changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicator for this VC is groundwater COPC concentrations, and the measurable parameters evaluated in this effects assessment are:

- Predicted changes in groundwater COPC concentrations that discharges to surficial receptors compared to SEQG groundwater criteria for freshwater aquatic life.
- Predicted changes in groundwater COPC concentrations compared to SEQG groundwater criteria for potable water.

Groundwater discharging into surface waterbodies (South Creek and Patterson Lake) was evaluated against SEQG groundwater criteria for freshwater aquatic life. Groundwater quality with respect to use by future groundwater users was compared to SEQG groundwater criteria for potable water.

6.7.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA for groundwater quality are the same as those used for the VC of groundwater quality described in Section 6.6.1.1 and illustrated in Figure 6-7.

6.7.1.2 Potential Effect Pathways

Project-environment interactions for the VC of groundwater quality that were identified as potential effects pathways were leakage from waste containment facilities located at the site and included:

- Relatively small waste facilities that will be used during construction and operations:
    - Waste rock and overburden stockpiles located in the waste rock management area (WRMA)
    - Effluent ponds located in the WRMA and mill complex
- Relatively large waste facilities that will be used post construction and will remain in place after decommissioning:
    - TMF
    - Mine backfill

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.7.2 Screening Assessment, where relevant.

6.7.2 Screening Assessment

A combination of analytical and numerical groundwater models was used to assess Project interactions with the potential to impact groundwater quality. Analytical models were generally used to assess Project interactions that were short-term and involved assessing

leakage from facilities that were relatively small and will be decommissioned at the end of operations. Numerical models were generally used to assess larger-scale Project interactions. Modeling methodologies are discussed in detail in Appendix D.4. A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.7.2.1 Effluent Ponds and Waste Rock Management Area Stockpiles

Analytical models were developed to predict mass loadings due to leakage from the WRMA stockpiles and the effluent ponds; source term chemistry provided by others is included in Appendix D.4. The following assumptions were used in the assessment:

- The waste facilities will be decommissioned at the end of operations.
- All waste materials will be removed from the sites being evaluated during decommissioning.
- All storage facilities will be double lined, a composite double liner each comprised of two 80 mil high-density polyethylene (HDPE) liners separated by a drainage layer was assumed.
- All leakage from the facilities discharges directly into Patterson Lake.

A leakage rate was determined as described in Appendix D.4 for each facility which was then combined with the source chemistry to estimate mass loadings. Since potential effects are only predicted to occur during the construction and operations phases and there are no groundwater users between the storage facilities and Patterson Lake, the receptor for this pathway is surface water quality in Patterson Lake. The mass loadings were provided to the surface water team for further evaluation (see Section 6.9.2.4) and the Project-environment interaction was screened out as a minor interaction. Groundwater chemistry in proximity to these facilities will be monitored for the duration of the Project.

6.7.2.2 Tailings Management Facility and Mine Backfill

Numerical models were used to assess the long-term impacts of leakage from the TMF and the mine backfill. These facilities are substantially larger and will remain in place at the end of the Project. Long-term transient models set for a period of 10,000 years were used to model potential impacts to groundwater and subsequently surface water. Mitigations used in the assessment included a lined facility for the TMF, a fully grouted underground mine works, and underground mine backfill of a similar hydraulic conductivity as the surrounding bedrock (BGC Engineering 2022).

COPC loadings from the TMF and the backfilled mine were initially evaluated without consideration of attenuation or decay. Only the COPC of radium-226 and cadmium did not pass this initial evaluation (Appendix D.4). As such, radium-226 and cadmium, as well as lead-210 and polonium-210 as the progeny of radium decay, were considered for further transport analyses that considered attenuation and decay. Additional contaminant transport modeling was conducted that included the appropriate inputs to model the attenuation and decay of radium-226, cadmium, lead-210, and polonium-210 (Table 6.10, Section 6.3.2 of Appendix D.4). The updated model substantially decreased the loadings of these COPC.

A memo completed by Knight Piesold showed HDPE geomembrane liners have a minimum of a 400-year service life in a tailings storage facility for a copper mine in Montana, USA (Knight Piesold Consulting 2016). The tailings were placed in a long-term storage facility storing tailings and process waters. The protection of the membrane from ultraviolet radiation and the average site temperature below 20°C suggest that the liner would remain intact longer than the 400-year life span presented. Similar behaviour was outlined in O'Kane (2009) where the service life of an HDPE geomembrane was discussed for use in a municipal solid waste landfill. O'Kane (2009) presented literature sources (Rowe 1998; Sangham 2001; Sangham and Rowe 2001) that stated the anticipated service life of the HDPE geomembranes increases with reduced ultraviolet radiation exposure and lower ambient air temperatures. The service life was anticipated to be between 300 and 400 years and, with the limited exposures noted above, are "expected to remain intact for a very long time."

The life of compacted soil bentonite liners is generally accepted to be very long. The liner design and operating context will control factors which may limit the liner life. Desiccation is not operative as the TMF basal liner is deep and not exposed to drying. The liner is below the depth of freeze thaw.

The numerical modeling consisted of two components: a one-dimensional (1D) consolidation model extending through the tailings and a three-dimensional (3D) flow and transport model. The 1D model (Appendix A.3) considers pore water released from consolidation during operation and through the active and passive periods of decommissioning, with flow occurring through the basal and sideslope liners. An estimated liner leakage rate was used in the 3D flow model (Appendix D.4) for an approximate period of 10 years for the side slope liners and 175 years for the floor liner. These time periods correspond to times in the 1D consolidation model where the rate of tailings pore fluid expulsion is less than the estimated leakage rates through the liners. After 10 years for the

sideslopes and 175 years for the floor, the leakage rates used in the 3D flow model conservatively assume that all pore water fluid expelled from the tailings flows through the liner. The rate of pore water expulsion at a time of 1,000 years (end of the 1D model) was carried forward to the end of the 3D flow model.

The period(s) in the model (10 years and 175) where the liners are used to retain pore water fluids are well within the liner life expectancy timeframes discussed above. The assumption that all pore water fluid passes through the liners once the rate of pore water expulsion is less than the estimated rate of liner leakage is a conservative one that demonstrates the consideration of liner degradation. A final constant leakage rate was used in the 3D model after a period of 1,000 years corresponding to the rate of pore fluid expulsion at 1,000 years. This constant leakage rate corresponds to long term cover performance. COPC monitoring locations were set within the model to evaluate the quality of groundwater prior to discharging into surface waters (Patterson Lake and South Creek) and to evaluate groundwater quality downgradient of waste facilities. South Creek is located southeast of the TMF and discharges into Patterson Lake South Arm (Figure 4-13, Section 4.0).

COPC were selected for groundwater discharging into surface water receptors (Patterson Lake and South Creek) using the SEQG groundwater criteria for freshwater aquatic life. Analytes from the tailings pore fluid that exceeded these criteria as well as additional analytes requested by the surface water team were assessed as COPC (Table 7.1, Appendix D.4).

COPC for the groundwater quality assessment to future downgradient users were developed using SEQG groundwater criteria for potable water. Analytes from the tailings pore fluid that exceeded these criteria were included for assessment as COPC (Table 7.6 Appendix D.4).

The incremental COPC mass loadings to Patterson Lake originating from leakage from the TMF and the mine backfill were estimated and are presented in Table 7.5 in Section 7.2.3 of Appendix D.4. The increase in COPC mass loadings compared to background loadings were used to identify COPC concentrations with the potential to measurably increase from background concentrations. COPCs that showed incremental increases that were considered measurable included arsenic, selenium, sulphate, and uranium. These four COPC were carried forward to the REA for both the groundwater discharge to the surface waters (Patterson Lake and South Creek) and for the potable groundwater.

6.7.3 Residual Effects Assessment

The residual effects assessment for the groundwater quality VC is provided below and summarized in Table 6-4.

6.7.3.1 Groundwater Discharging to Surface Water Receptors

Mass loadings to surface water receptors were provided to the surface water team for further evaluation (see Section 6.9.2.4); residual effects discussed here are for groundwater quality. Monitoring locations were set within the numerical groundwater model to evaluate the change in COPC concentrations prior to discharge into South Creek and Patterson Lake (Appendix D.4, Appendix C, Figure C15,). COPC concentrations in groundwater were reviewed for arsenic, selenium, sulphate, and uranium and compared to SEQG groundwater criteria for the protection of freshwater aquatic life.

Concentrations of the COPC at the point of discharge to South Creek increased in the model between the years of 0 to 200 and they subsequently decreased until around the year 2,000 to what can nominally be assumed to be background. At their peak in year 200, concentrations for arsenic, selenium, uranium, and sulphate are predicted to be: 0.0017 mg/L, 0.0009 mg/L, 0.008 mg/L, and 25 mg/L, all of which are below the SEQG groundwater criteria for freshwater aquatic life of 0.005 mg/L, 0.002 mg/L, 0.015 mg/L, and 100 mg/L, respectively.

COPC concentrations at the point of discharge to Patterson Lake had lower concentrations than those observed for the discharge to South Creek. The COPC concentrations before discharge to Patterson Lake for arsenic, selenium, uranium, and sulphate were estimated to be 0.0008 mg/L, 0.0001 mg/L, 0.0007 mg/L, and 4 mg/L respectively.

Residual Effects Classification

Since groundwater quality is an intermediate VC, the residual effects classification summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by groundwater quality pathways.

The magnitude of the modeled increase in concentrations of arsenic, selenium, uranium, and sulphate is low as the concentrations increase to above existing conditions but are below the groundwater SEQG for freshwater aquatic life. The extent of the effect is highly localized occurring southeast of the TMF at the discharge location to South Creek with further reduced effects closer to Patterson Lake. The duration of the predicted effect can be

considered long-term, peaking around the year 200 and decreasing to background approximately by the year 2,000. The increase is reversible in the long-term, the frequency is rated as continuous, and under the conditions assumed in the model, the likelihood of occurrence is high.

6.7.3.2 Groundwater Quality

Groundwater monitoring locations, in addition to those described in the previous section, were located across the numerical groundwater model domain (Appendix D.4, Appendix C, Figure C15,) to monitor COPC concentrations under the TMF, between the mine and Patterson Lake, halfway between the TMF and Patterson Lake, and across South Creek from the surface water discharge point. Each monitoring location comprised all model layers representing the overburden to evaluate change in peak COPC concentrations over time and across all geologic units in the overburden.

Peak concentrations, in location and time, of arsenic, selenium, sulphate, and uranium occurred in a monitoring location immediately southeast of the TMF, in the model layer corresponding to the top of the groundwater table. The aforementioned COPCs increased in concentration between the years of 0 to 200, where they peak, and then decreased to what can nominally be considered background by the year 2,000. While the modeled COPC concentrations of arsenic, selenium, and sulphate increased above what can be considered background, they did not exceed the SEQG groundwater criteria for potable groundwater. The peak concentrations observed across the entire model domain (space and time) for arsenic, selenium, and sulphate were 0.0036 mg/L, 0.002 mg/L, 0.023 mg/L, and 69 mg/L. The SEQG groundwater criteria for potable water use for the COPCs are 0.01 mg/L, 0.05 mg/L, 0.02 mg/L, and 500 mg/L respectively.

Uranium was the only COPC that exceeded the SEQG criteria for potable groundwater. The modeled results for uranium exceeded potable groundwater criteria between years 150 and 225. The modeled peak concentration of uranium (0.023 mg/L) occurs around year 200 which is marginally above the guideline for potable groundwater of 0.02 mg/L.

Residual Effects Classification

Since groundwater quality is an intermediate VC, the residual effects classification summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by groundwater quality pathways.

The magnitude of the modeled increases in concentrations of arsenic, selenium, and sulphate is low as the concentrations are predicted to be measurable but are below the SEQG groundwater criteria for potable water. The predicted increase in uranium concentrations has a magnitude of medium since the criteria is marginally exceeded between years 150 and 225. The modeled incremental increase in COPC concentrations in groundwater was highest at the location immediately southeast of the proposed TMF, in the model layer corresponding to the top of the groundwater table; thus, the extent of the effect is highly localized. The duration of the pathway is long-term, peaking around the year 200 and decreasing to background around the year 2,000. The predicted increases are reversible in the long-term and the frequency can be considered to be continuous. Under the conditions assumed in the model, the likelihood of this effect occurring is high; however, the likelihood of impacting future receptors is low as the geographic extent of the effect is highly localized. There are currently no groundwater users within the PDA.

6.7.4 Cumulative Effects Assessment

The CEA for Project-environment interactions impacting groundwater quality considered the NexGen Rook I Project, which was identified as it is also located on Patterson Lake and will engage in Project-environment interactions that result in impacts to local groundwater quality.

The interpreted groundwater flow direction in the area of the Rook I Project is towards the northwest where it discharges into Patterson Lake, as such any COPC mass loadings will discharge into Patterson Lake and will not overlap with Project-environment interactions impacting groundwater quality from the PLS project. As such, no cumulative effects to groundwater quality are predicted.

6.7.4.1 Climate Change

Climate change was assessed in the scenarios modeled as a part of the sensitivity analysis. Recharge to the groundwater system was varied by ±25% in consideration of climate change scenario representative concentration pathway (RCP) 8.5 (high-emissions scenario). Neither scenario decreased or increased COPC concentrations for groundwater discharging to surface water or for groundwater quality in any meaningful way. For further information see Appendix D.4.

6.7.5 Uncertainties

This assessment is based on the information available at the time of reporting. Geological formations are heterogeneous, and conditions may be significantly different where information is not present. While conceptual site models and numerical models can be useful in understanding groundwater conditions and facilitate decision making, all models are approximations of natural phenomena and are therefore, inherently inexact. The results of this report should be accepted as approximate. Where uncertainties existed the most reasonable conservative assumptions were used to assess potential impacts. Uncertainties and limitations to the analytical and numerical models used in the assessment are discussed in further detail in Appendix D.4.

6.8 Surface Water Quantity

6.8.1 Scope of Assessment

Surface water quantity was selected as a VC because changes to surface water levels and flows could affect aquatic habitat availability and quality as well as use of water for recreation, navigation, and land and resource use. The VC surface water quantity is designated as an intermediate VC as the extent of changes to surface water quantity could significantly affect other VCs such as surface water quality, fish and fish habitat, select wildlife VCs, and traditional and other land and resource use. The impact of predicted surface water quantity changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicator for this VC is surface water levels and flows, and the measurable parameters evaluated in this effects assessment are:

- Predicted changes in surface water levels and flow compared to existing environment conditions.
- Predicted changes in hydrologic indicators compared to existing environment conditions which capture important hydrologic processes in the watershed, and/or represent an important period of the year for fish and fish habitat.

6.8.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA

are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for surface water quantity are defined as follows (Figure 6-8).

- Local Study Area: The LSA includes waterbodies near to the Project and downstream of the treated effluent release location in Patterson Lake South Arm. Naomi Lake is located downstream of Patterson Lake and the Naomi Lake basin includes the drainage areas above Patterson Lake, Forrest Lake, Beet Lake, and Naomi Lake draining a total area of 695.7 km^2 (69,573.1 ha). This area is considered as the LSA for the purposes of this assessment. The Clearwater River connects the lakes within the LSA which include, from west to east, Broach, Patterson, Forest, Beet, and Naomi.
- Regional Study Area: The Lloyd Lake basin drains an area of 4,387.3 km^2 (438,734.2 ha) and is considered the RSA for the purpose of this assessment. This basin includes all of the lakes in the LSA and the reach of the Clearwater River below Naomi Lake (over 50 km in length) which encompasses flows from the Mirror River. The RSA was included in this assessment to identify far-field downstream effects of the Project and cumulative effects. Lloyd Lake was included as it is an area of importance because there was evidence that traditional uses were taking place in that area (NexGen 2022) and the presence of these uses was confirmed in the Metis Knowledge Study (MN-S NR2 2023).

6.8.1.2 Potential Effect Pathways

Project-environment interactions for the VC of surface water quantity that were identified as potential effect pathways during each Project stage include the following.

- Groundwater drawdown and treated effluent release into Patterson Lake could alter surface water quantities during construction, operations, and decommissioning.
- Construction and operation of the surface facilities could alter site drainage by influencing infiltration capacity and overland flow, which could impact surface water quantity during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.8.2 Screening Assessment, where relevant.

6.8.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.8.2.1 Project Water Use and Return

Changes to surface water quantity based on Project water use and return scenarios produced during the feasibility stage were evaluated in Appendix D.5. A process-based hydrological model was used to evaluate the effect of the Project on the surface water quantity (water levels and flows) within the LSA and RSA during the construction, operation, and decommissioning phases of the Project. This model simulated changes to daily water levels and flows from existing conditions at three different locations (Clearwater River below Patterson Lake, Clearwater River below Naomi Lake, and the Clearwater River below the Outlet of Lloyd Lake) considering climatic variables (precipitation, temperature, relative humidity etc.), land cover, Project water use and return scenarios, cumulative impacts from the NexGen Rook I Project, and climate change. Detailed information on model inputs, methods, assumptions, and results is provided in Appendix D.5.

During the construction phase of the Project, a net decrease in flows was projected compared to existing conditions with percentage changes of -0.5% during high flow conditions and -2.8% during low flow conditions modelled at the Clearwater River below Patterson Lake (Appendix D.5). Downstream, all changes in flow modelled during the construction phase were considerably lower and all changes throughout both the LSA and RSA were considered negligible. Changes in lake levels of Patterson and Naomi lakes during the construction phase were considered to be non-detectable. Therefore, this potential effect pathway was classified as a minor interaction during the construction phase and was not carried forward into the REA. As included in the Commitments Register (Section 11), the model will be updated with detailed design information to support permitting and CNSC licensing.

During the operations phase, conservative assumptions (i.e., higher potential effects) were used to model Project effects. At the Clearwater River below Patterson Lake, increases in streamflow were projected to be 4.5% on average, with low to moderate changes (6% to 13%) projected during low flow conditions and low to negligible changes (2% to 4%) projected during average to high flow conditions (Appendix D.5). The increase in peak flow indicators suggested a negligible impact on flood events and the increase in water levels on Patterson Lake is not projected to be detectable. Given low to moderate changes

were projected to occur during low flow conditions in the operations phase, this potential effect pathway is considered a key interaction and carried forward to the REA.

During the decommissioning phase of the Project, a net increase in flows was predicted relative to existing conditions (Appendix D.5). Predicted changes to surface water quantity ranged from less than 0.6% (during high flow conditions) up to 2.9% (during August under low flow conditions) at the Clearwater River below Patterson Lake while all modelled changes were considerably lower further downstream. Changes in lake levels of Patterson and Naomi lakes during the decommissioning phase were considered to be non-detectable. Therefore, this potential effect pathway was classified as a minor interaction during the decommissioning phase and was not carried forward into the REA.

6.8.2.2 Altered Site Drainage

Landscape changes can affect infiltration rates, natural drainage patterns, and overland flow at the Project, which in turn could affect surface water quantity within Patterson Lake. These landscape changes include the construction, operation, and decommissioning of Project infrastructure altering the site terrain, as described in Section 6.5.2. Mitigations for this potential effect pathway are provided in Table 6-2 and include but are not limited to using previously disturbed areas for infrastructure and roads, implementing a water management strategy to effectively manage site drainage, preserving natural drainage features to the extent possible and constructing others to facilitate drainage and hydrologic continuity, and contouring disturbed areas and re-establishing natural drainage during the decommissioning phase to the extent possible.

In consideration of the mitigative measures and the large size of Patterson Lake relative to the Project footprint area, altered site drainage is not expected to result in detectable changes to water levels in Patterson Lake or streamflow on the Clearwater River. Therefore, this potential effect pathway was considered a minor interaction and not carried forward to a REA.

6.8.3 Residual Effects Assessment

The residual effects assessment for the surface water quantity VC is provided below and summarized in Table 6-4.

6.8.3.1 Project Water Use and Return

Groundwater drawdown and treated effluent release into Patterson Lake will occur year-round through the operations phase of the Project. To understand the potential influence of this Project-interaction, a process-based hydrological model was used to evaluate the effect of the Project on the surface water quantity within the LSA and RSA, as described in Appendix D.5.

Overall, a projected net increase of water into Patterson Lake was modelled. Treated effluent will be released at a rate of 7,656 m^3/day during the operations phase (15 years[2]; refer to Section 2, Project Description) which includes 1,000 m^3/day to 3,000 m^3/day of makeup water from several wells and variable subsurface flow from Patterson Lake into the mine shaft which will be returned to Patterson Lake as effluent. Additionally, a reduction in groundwater recharge (inflows) into Patterson Lake of approximately 1,000 m^3/day was used in the assessment.

During the operations phase, a net increase in streamflow was projected relative to existing conditions. These changes resulted in increases in streamflow to the Clearwater River of approximately 3,888 m^3/day, evenly across the year. At the Clearwater River below Patterson Lake, this change in surface water quantity amounted to a percent change of 4.5% on average, ranging from 2% to 4% during high flow conditions to 6% to 13% under low flow conditions. Further downstream at Clearwater River below Naomi Lake, this percentage change was under 5% in all cases (up to 4.7% under low flow conditions in June). At the Clearwater River at the Outlet of Lloyd Lake, all percentage changes in streamflow are predicted to be below 0.5%.

Surface water quantity, measured by recording water level elevations and flows, will be monitored throughout the life of the Project, as detailed in Section 9.0.

Residual Effects Classification

Since surface water quantity is an intermediate VC, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by surface water quantity pathways.

A low magnitude increase in stream flow is projected locally (at the outlet of Patterson Lake) during low flow conditions, with a negligible impact on flood events and lake levels.

[2] Although the operations period is planned currently for 10 years, a period of 15 years was assessed to be conservative.

The projected effect is reversible in the short-term with the timing of the potential effect expected to occur only during the operations phase. The frequency of the effect is continuous, as it is predicted to occur while groundwater is drawn down and treated effluent is released. The likelihood of the effect is moderate, based on the assumed groundwater volumes and treated effluent quantity for the Project.

6.8.4 Cumulative Effects Assessment

The CEA for the groundwater drawdown and release of treated effluent Project-environment interaction with surface water quantity considered the NexGen Rook I Project, which was identified as it is also located on Patterson Lake and will also be releasing treated effluent into Patterson Lake. The CEA for groundwater drawdown and treated effluent release from the Rook I Project is based on the assessment of the Cumulative Effects Scenario presented in the hydrological modelling report in Appendix D.5.

The Rook I Project effluent is proposed to be released to the Northwest Arm of Patterson Lake, upstream of the PLS Project. The scenario developed for the cumulative effects modelling is based on information provided in Appendix 9A of the Rook I Project EIS (NexGen 2022). Effluent release was assumed to begin with the construction phase in 2025 (NexGen 2022, Appendix G, Table G-2) and included the project phases of construction (4 years), operations (24 years), active closure (5 years), and transition (10 years) (NexGen 2022, Appendix F). The Reasonably Foreseeable Development Case (including the worst-case climate change scenario in the Rook I Project EIS (NexGen 2022) was used to evaluate the cumulative effects of the PLS Project and the Rook I Project on surface water quantity.

In the cumulative effects assessment (Appendix D.5), the combined effects of the PLS Project and the Rook I Project result a net increase in water levels and flow compared to existing conditions. These changes result in an increase in streamflow on the Clearwater River of 0.06 m^3/s to 0.09 m^3/s, with higher increases during the summer months. At the Clearwater River below Patterson Lake, this change in surface water quantity amounts to a percent change of 8% on average, ranging from 4% to 6% during high flow conditions to 9% to 25% under low flow conditions. Further downstream at the Clearwater River below Naomi Lake, the percent change is under 5% in all cases except under low flow conditions in June where the change reaches 8%. At the Clearwater River at the Outlet of Lloyd Lake, all percent changes in streamflow are below 1%. The combination of both projects is modelled to have a low to negligible impact on more extreme peak flow events.

The CEA effects classification for potential effects on surface water quantity from the treated effluent release from both the PLS Project and the Rook I Project mirrors the REA other than the magnitude is predicted to be moderate on average with the greatest increases to flow and water levels to occur during the summer months under low flow conditions.

6.8.4.1 Climate Change

The hydrological model was also run under three future climate change scenarios (SSP2-4.5, SSP3-7.0, and SSP5-8.5 median ensembles) generated from Coupled Model Intercomparison Project Phase 6 (CMIP6) global climate models (GCMs), whose results were used in the latest Intergovernmental Panel on Climate Change (IPCC) Assessment Report (AR6) (Appendix D.5). Each scenario was evaluated over 30-year periods to capture the change in hydrologic variability (1991-2020, 2021-2050, 2051-2080). Under the climate change scenarios, increases in precipitation are projected to lead to substantial increases in streamflow as well as earlier spring snowmelt, and higher peak flows (Appendix D.5). Over the 2021-2050 period, the SSP 5-8.5 scenario (most severe climate change scenario representing a fossil fueled development scenario with minimal greenhouse gas emission mitigation), projects a 19% to 25% increase in mean annual flow and a 24% to 27% increase in the 2-year peak flow at the Clearwater River below Patterson Lake. These increases are projected to moderate later in the century under this climate change scenario, offset by increased rates of evaporation. Comparable increases in lake level are projected. Patterson Lake is projected to see increases of up to 0.09 m (under high flow conditions in May) over the 2021-2050 period while Naomi Lake is projected to see increases of up to 0.09 m (under high flow conditions in May). Under future conditions, low flows are projected to be higher than under the Historical (1991-2020) conditions.

The cumulative effects of the Project and the Rook I Project are much smaller than the changes projected by the climate change scenarios. As a percent change between existing conditions and the Project plus the Rook I Project are approximately the same under the climate change scenario, this suggests that climate change is unlikely to measurably increase the effects of the Project on surface water quantity. Under future climate change scenarios, the magnitude is predicted to be high; however, the large changes predicted stem from the increased precipitation in the area and not from the projects.

6.8.5 Uncertainties

Uncertainties and limitations within the hydrological model originate from several sources which are explained in Appendix D.5. The hydrological model used meteorological and

hydrometric observations gathered from publicly available data sources which was supplemented by local monitoring in the Project area to calibrate and verify the model. Data in this relatively remote region is sparse. As such, climate observations were limited to regional climate stations that were often several hundred kilometers from the Project location. Likewise, no long-term, active hydrometric record was available on the Clearwater River that was representative of conditions close to the Project and flow records from proxy sites in northern Saskatchewan were used to calibrate the hydrological model.

Given the study goals, the hydrological model was purpose-built to examine average conditions and was not specifically calibrated and developed to reproduce extreme high flow events (i.e., large flood events). Modelling uncertainty also exists at the outlet of major lakes. Lake storage and attenuation effects are simulated in the model using simplified flow-area-volume curves. Finally, uncertainty exists in how existing land cover and hydroclimatic conditions may change in the coming decades. The region is prone to frequent forest fires, which may reduce the amount of rain and snow that is intercepted by the forest canopy, which could in turn increase flows. Likewise, a long period of forest regrowth could reduce the amount of precipitation reaching waterways.

Finally, considerable uncertainty exists with regards to what the future climatic conditions will look like in northern Saskatchewan and this study considered a relatively severe future climate change scenario.

6.9 Surface Water Quality

6.9.1 Scope of Assessment

Surface water quality is a VC of high cultural and land use importance. Changes in COPC concentrations in surface water and sediment caused by Project activities could affect human and biota health, aquatic habitat availability and quality, consumption of traditional foods, and use of water for recreation or land and resource use. During engagement activities, Indigenous groups expressed interest and concern about the potential effects on the health of the environment and impacts to Indigenous peoples that could be caused by changes to surface water quality.

The VC surface water quality is designated as an intermediate VC as changes in surface water and sediment could significantly affect numerous other VCs including fish and fish habitat, vegetation, woodland caribou (*Rangifer tarandus caribou*), ungulates, furbearers, birds, amphibians, traditional and other land use, and community wellbeing and human

health. The impact of predicted surface water quality changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicator for this VC is surface water and sediment COPC concentrations, and the measurable parameter evaluated in this effects assessment is:

- Predicted changes in surface water and sediment COPC concentrations compared to existing environment conditions and applicable guidelines.

6.9.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, but for surface water quality are consistent with the study areas defined for surface water quantity (Section 6.8.1.1, Figure 6-8).

6.9.1.2 Potential Effect Pathways

Project-environment interactions for the VC of surface water quality that were identified as potential effect pathways during each Project stage include the following.

- Site clearing and construction activities could cause increased soil erosion, which could affect surface water quality.
- Non-contact water from areas such as roads or camp could affect surface water quality.
- Air dispersion of dust and COPC into aquatic environments could impact surface water quality during construction, operations, and decommissioning.
- Contact water, seepage from the lined Project facilities, and groundwater contact with mine backfill could influence surface water quality during construction, operations, decommissioning, and post-decommissioning.
- Treated effluent release into Patterson Lake could impact surface water quality during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.9.2, Screening Assessment, where relevant.

6.9.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.9.2.1 Soil Erosion and Runoff

Site clearing and construction activities during the construction phase of the Project could result in soil erosion, runoff, and sedimentation occurring in Patterson Lake. As outlined in Table 6-2, there are several mitigation measures aimed to lessen the ability of this Project-environment interaction to affect the VC of surface water quality, including but not limited to the following: minimizing the steepness and slope length of disturbed areas and stockpiles, ensuring a buffer of trees is maintained between the Project and Patterson Lake to curtail runoff, using erosion control measures, placing stockpiles at least 100 m from waterbodies if possible, and implementing an erosion and sediment control plan and monitoring program during construction activities of in-water works.

Given the implementation of design features and mitigation measures (Table 6-2), residual effects related to soil erosion are not anticipated to occur during planned construction activities (see Section 7.0 for potential accidents and malfunctions). Therefore, this Project-environment interaction was considered a minor interaction, screened out, and not moved forward into the REA.

6.9.2.2 Non-Contact Water

Fission has committed to divergence of non-contact water through a water management strategy during all phases of the Project to ensure contact and non-contact water remain segregated. Roads and camp will be maintained as non-contact areas and thus, the only potential effects to surface water quality would be caused by run-off during precipitation events or potential spills. The water management strategy will design site drainage to avoid non-contact water releases into sensitive environments and waterbodies. During operations, Fission will perform maintenance of water containment and conveyance structures to limit the risk of road wash-out and runoff into the environment. As discussed in the accidents and malfunctions section (Section 7.3.1) and the monitoring and follow-up programs section (Section 9.3.6), an Environmental Contingency Plan will be developed to detail spill preparedness, response, reporting, and follow-up.

Given the implementation of design features, mitigation measures, and response plans, residual effects are not anticipated to occur; therefore, this Project-environment interaction was considered a minor interaction, screened out, and not moved forward into the REA.

6.9.2.3 Air Dispersion of Dust and COPC

Particulates in air released from the Project are dispersed through the atmospheric environment and have the potential to transfer from the atmosphere to surface water. The deposition of air particulates to surface water was evaluated in Appendix D.7 using the results of the air dispersion modelling (Appendix D.1). Based on proximity to the Project and community concern, Broach Lake, Lake C, Patterson Lake South Arm, Lake D, Lake E, and the Preston Lake Wildlife Refuge were considered in the evaluation. Based on community concern (ACFN Ltr. November 21 2022), the assessment also included the potential influence of snowmelt on surface water quality. The COPC considered for the deposition from air to surface water were based on COPC selected for the HHERA (Appendix D.7) and included arsenic, cadmium, cobalt, copper, lead, nickel, selenium, uranium, and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210).

The deposition from air results in a small, likely indiscernible change from baseline concentrations (Appendix D.7). For Patterson Lake South Arm, the change in water quality from the deposition of air particulates to surface water is an insignificant transfer pathway compared to direct treated effluent releases to surface water. For Broach Lake, Lake C, Lake D, Lake E, and the Preston Lake Wildlife Refuge, which are not connected to treated effluent releases, the influence of the deposition of particulates in air to surface water and from snowmelt is not discernible from existing environment concentrations. Therefore, this Project-environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.9.2.4 Seepage from Lined Project Facilities and Mine Backfill

During construction and operations, unintended seepage from lined Project facilities has the potential to affect groundwater quality, which may in turn affect surface water quality. In the post-decommissioning period, long-term seepage to groundwater from the TMF and underground mine also has the potential to affect groundwater quality and surface water quality. These Project releases to groundwater were evaluated in Appendix D.4 and are considered further as part of the PLS Scenario for the water and sediment quality modelling in Appendix D.7. The COPC considered for the potential influence of groundwater on

surface water quality were based on the COPC identified for groundwater quality: arsenic, cadmium, copper, nickel, selenium, uranium, radium-226, and sulphate (Appendix D.4).

The potential loads associated with the unintended seepage from lined Project facilities during construction and operation and the long-term post-decommissioning loads from contact with mine backfill and seepage from the TMF were considered for the assessment. The loads were found to be minor compared to effluent loads (Section 3.2.1.1, Appendix D.7), and therefore this Project-interaction was not considered further.

6.9.2.5 Treated Effluent Release

Treated effluent from the Project will be released year-round to the South Arm of Patterson Lake through a multi-port diffuser. The use of diffuser is considered a best management practice since it increases the mixing of treated water in the receiving environment. The diffuser design is provided in Appendix A.5.

Downstream of the diffuser, predicted treated effluent concentrations and flows were used to model predicted COPC concentrations in the water and sediment at select locations as well as to complete a HHERA (Appendix D.7) to evaluate the potential risks of these COPC concentrations on aquatic, terrestrial, and human receptors. Detailed methods and results of the constituent transport and pathways modelling and HHERA are presented in Appendix D.7. The results show that treated effluent release will result in a measurable change in the receiving environment. Therefore, this Project-environment interaction is considered a key interaction and was carried forward to the REA.

6.9.3 Residual Effects Assessment

The residual effects assessment for the surface water quality VC is provided below and summarized in Table 6-4.

6.9.3.1 Treated Effluent Release

Treated effluent from the Project will be discharged year-round through a diffuser into the South Arm of Patterson Lake. To understand the potential influence of this Project-interaction, a predictive contaminant dispersion and transport model was applied, as described in Appendix D.7 based on the process water balance produced for the Project during the feasibility stage. An effluent release quantity of 7,600 m^3/d was used for the assessment. The same effluent quantity and quality was used for all 26 years of effluent release in the assessment; however, the quantity released during construction will depend

on which method is selected for decline dewatering (refer to Section 2.4.1.1). As included in the Commitments Register (Section 11), the model will be updated using detailed design information on effluent quantity and quality that will be released during each Project stage to support permitting and CNSC licensing.

Treated effluent quality was based on significant metallurgical test work (Melis Engineering 2023). The test work resulted in the selection of a three-stage treatment process capable of producing effluent that meets the requirements of the *Metal and Diamond Mine Effluent Regulations* (MDMER). Test ET5 was selected as the basis of the effluent quality for the EIA, since it represents the scenario where 100% of tailings is routed to the TMF and incorporates the use of tailings decant filtrate from tailings testing. Some values from the test ET5 required substitution due to high method detection limits (MDLs). It was determined that these values could be substituted with average values from previous, similar tests. Additional details on the water treatment process are provided in Section 2.3.1.18, Water Treatment Plant. The treated effluent quality defined for the assessment is below the applicable maximum authorized concentrations of prescribed deleterious substances in the MDMERs and the *Mineral Industry Environmental Protection Regulations* (MIEPRs).

For the assessment, COPC were selected based on the predicted effluent quality and included ammonia, arsenic, cadmium, chloride, cobalt, copper, lead, nickel, nitrate, selenium, sulphate, total dissolved solids (TDS), uranium, and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210); calcium was also considered in the modelling as a surrogate for water hardness. Constituents that were not selected as COPC for the assessment are not expected to be a concern related to the Project releases due to the low concentrations in the predicted effluent.

The PLS Effluent Scenario assessed effluent release for 26 years (3 years of construction, 15 years of operation, and 8 years of decommissioning). Constituent transport and pathways modelling was completed within a probabilistic framework and, as part of that, variability was defined for the effluent release to capture natural variations and to acknowledge uncertainty in the releases.

The diffuser consists of five ports designed to create optimal mixing of effluent discharged. Based on predicted effluent quantity and quality data, mixing and plume modelling was conducted using software designed for these purposes to ensure that sufficient dilution was

achieved to meet Water Quality Guidelines (WQG) at a distance 100 m downstream of the discharge location (Appendix A.5).

Predictive modelling for water and sediment quality was completed for the remainder of Patterson Lake South Arm, outside of the mixing zone, for the PLS Effluent Scenario. The modelling also considered the entirety of Patterson Lake, Forrest Lake, and Beet Lake, as part of the LSA, and downstream in the Clearwater River to Lloyd Lake as part of the RSA (Appendix D.7).

The highest concentrations for the PLS Effluent Scenario are predicted for Patterson Lake South Arm. COPC that are predicted to have a measurable change in concentration in the receiving environment include arsenic, cobalt, lead, selenium, uranium, calcium, chloride, sulphate, and TDS. The model results for the PLS Effluent Scenario (Appendix D.7) show that predicted concentrations of arsenic, cadmium, cobalt, copper, lead, nickel, selenium, uranium, uranium decay-chain (thorium-230, radium-226, lead-210, and polonium-210), chloride, ammonia, nitrate, sulphate, and TDS are below the available WQGs in Patterson Lake South Arm throughout the 26 years of effluent release assessed for the Project. Although measurable changes in water quality for some COPC were predicted downstream in the RSA, predicted COPC concentrations remain below WQG downstream of Patterson Lake.

Sediment COPC concentrations are predicted to increase during effluent release as COPC partition onto particulates and are deposited to the sediment. Although small changes in sediment quality are indicated for some COPC, predicted concentrations remain well below the available sediment benchmarks for the PLS Effluent Scenario (Appendix D.7). No discernible changes in sediment quality were predicted in the RSA.

Fission's commitments include that contact water collected during all Project phases will be treated to be below effluent discharge criteria and will be discharged through a multi-port diffuser into Patterson Lake South Arm (Section 11, Commitments Register). Treated effluent, surface water quality, sediment quality, and aquatic biota monitoring will be completed throughout the life of the Project, as detailed in Section 9.0. Data collected through these monitoring programs will be used to verify and update the modelling for the receiving environment and reduce uncertainty associated with the model predictions. Mitigation measures and monitoring will be updated as necessary.

Residual Effects Classification

Since surface water quality is an intermediate VC, the residual effects classifications summarized below do not have significance determinations; instead, significance is determined for VCs potentially impacted by surface water quality pathways.

The magnitude of the predicted residual effect is low, with concentrations of some COPC predicted to exceed existing conditions but remaining below guidelines. The geographic extent is regional, with changes in the concentrations of some COPC extending through the RSA. The duration and reversibility are long-term, with concentrations returning to existing conditions in the post-decommissioning period. The timing of the potential effect is expected to occur in construction, operations, decommissioning, and post-decommissioning. The frequency of the effect is continuous. The likelihood of the effect is high, based on the assumed effluent quality and quantity for the Project.

6.9.4 Cumulative Effects Assessment

The CEA considered NexGen's Rook I Project, which was identified with the potential to interact with the aquatic, terrestrial, and human environments and with sufficient information for including in the water and sediment quality modelling. The CEA for treated effluent release from the Rook I Project is based on the assessment of the Cumulative Scenario presented in the constituent transport and pathways modelling and HHERA in Appendix D.7.

The Rook I Project effluent is proposed to be released to the Northwest Arm of Patterson Lake, upstream of the PLS Project. The scenario developed for the cumulative effects modelling is based on information provided in Appendix F and Appendix G of the Rook I Project EIS TSD XVIII (WSP Golder 2022). Effluent release was assumed to begin with the construction phase in 2025 (NexGen 2022, Appendix G, Table G-2) and included the project phases of construction (4 years), operations (24 years), active closure (5 years), and transition (10 years; NexGen 2022, Appendix F). The Application Case was used to characterize effluent quality for the Cumulative Scenario (NexGen 2022, Appendix G).

Predictive modelling for water and sediment quality for the Cumulative Scenario considered the additional release of effluent from the Rook I Project to the Northwest Arm of Patterson Lake. The modelling considered the entirety of Patterson Lake, Forrest Lake, and Beet Lake, as part of the LSA, and downstream in the Clearwater River to Lloyd Lake as part of the RSA (Appendix D.7).

In the Cumulative Scenario (Appendix D.7), the Rook I Project contributes most significantly to predicted water quality for arsenic, thorium-230, lead-210, and polonium-210. The predicted concentrations in the Cumulative Scenario are below the guideline values for all COPC, except for TDS, which exceeds the available guideline, an aesthetic objective for drinking water for humans of 500 mg/L (Health Canada 2022). TDS provides a representation of the dissolved ions in water. Although measurable changes in water quality for some COPC were predicted downstream in the RSA, predicted COPC concentrations remain below WQG downstream of Patterson Lake in the Cumulative Scenario.

Sediment COPC concentrations are predicted to increase during effluent release as COPC partition onto particulates and are deposited to the sediment. Although small changes in sediment quality are indicated for some COPC, predicted concentrations remain well below the available sediment benchmarks for the Cumulative Scenario (Appendix D.7). No discernible changes in sediment quality were predicted in the RSA.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC. In general, predicted concentrations remain below guidelines protective of the aquatic community, the potential cumulative effect is considered negligible, and no change from the residual effects ratings are predicted. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.9.4.1 Climate Change

The potential effects of climate change were incorporated to the extent possible into the assessment. The effluent quantities released to the environment incorporated water balance information based on the RCP 4.5 climate change scenario (Tetra Tech 2023). The fate and transport of constituents in the environment will be affected by climate change; however, there is uncertainty in how the many aspects of climate change will interact or combine effects within an exposure assessment. Water and sediment quality modelling was completed in a probabilistic framework to capture some of the uncertainties and account for, to an extent, possible future variations under a changed climate.

6.9.5 Uncertainties

The fate and transport modelling completed for the REA and CEA used a probabilistic framework to capture uncertainties on input parameters and assumptions, as well as to

acknowledge realistic ranges in parameter values. Therefore, the probabilistic results provide an accounting of the uncertainty inherent in the assessment through the upper-bound predictions. The 95th percentile predictions were also found to be below the available WQG. The probabilistic assessment also considers possible future variations under changed climate.

6.10 Fish and Fish Habitat

6.10.1 Scope of Assessment

Fish and fish habitat is a VC because engagement activities with Indigenous groups and stakeholders identified fish to be of cultural, recreational, and socio-economic importance and because fish have the potential to be affected by numerous Project-related pathways. There are several intermediate VCs discussed above that could affect fish and fish habitat including groundwater quality, surface water quality, and air quality as changes in COPC concentrations caused by Project activities could impact the chemistry of waterbodies where fish reside. Additionally, changes to the quantity of surface water could alter fish habitat.

In turn, changes to fish and fish habitat could influence other VCs that use fish as a food source including select wildlife VCs and traditional and other land uses. The impact of predicted fish and fish habitat changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicators for this VC are lake trout (*Salvelinus namaycush*), walleye (*Sander vitreus*), northern pike (*Esox lucius*), lake whitefish (*Coregonus clupeaformis*), white sucker (*Catostomus commersonii*), burbot (*Lota lota*), yellow perch (*Perca flavescens*), and benthic invertebrates. These species of fish were chosen because they were commonly found in the LSA during baseline investigations and were identified by local Indigenous community members as important traditional foods (see Section 4.5.7). Benthic invertebrates were selected as a key indicator because benthic invertebrate communities are an important food source for fish and are considered a useful indicator of ecological health due to their sensitivity to contaminants.

The measurable parameters evaluated in this effects assessment are:

- Predicted effects to fish and fish habitat due to predicted changes in environmental COPC concentrations.

- Predicted changes in quantity and quality of fish habitat due to changes in surface water levels and flow compared to existing environment conditions.
- Direct loss of fish habitat due to in-water works.
- Potential for injury or mortality to fish.

6.10.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs; however, for fish and fish habitat they are the same as for surface water quantity and quality previously described (see Section 6.8.1.1 and Figure 6-8).

6.10.1.2 Potential Effect Pathways

Project-environment interactions for the VC of fish and fish habitat that were identified as potential effect pathways include the following.

- Soil erosion and runoff caused by site clearing and construction activities could affect fish habitat.
- Project activities and traffic could cause air dispersion of dust and COPC into aquatic environments and as a result impact fish habitat during construction, operations, and decommissioning.
- Contact water, seepage from the lined waste storage areas, and groundwater contact with mine backfill could influence surface water quality during construction, operations, decommissioning, and post-decommissioning which, in turn, could affect fish habitat.
- Treated effluent release into Patterson Lake could impact surface water quality and thereby affect fish habitat during construction, operations, and decommissioning.
- Groundwater drawdown and treated effluent release into Patterson Lake could impact surface water quantity during construction, operations, and decommissioning and the amount and quality of available fish habitat.
- Predicted changes to stream flow during the operations phase could cause sediment transport and deposition in the Clearwater River downstream of Patterson Lake, which could affect fish habitat.

- Altered site drainage caused by Project infrastructure development and operation could cause changes in surface water quantity compared to existing environment conditions, and thus, affect fish habitat.
- The installation, operation, and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake will directly impact fish habitat.
- Pressure changes and vibrations caused by the use of explosives in the mine decline and underground mine during construction and operations could have adverse health effects on fish.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.10.2 Screening Assessment, where relevant.

6.10.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.10.2.1 Soil Erosion and Runoff

The potential for soil erosion and runoff to affect the VC of surface water quality was discussed previously in Section 6.9.2.1. Soil erosion and runoff are important to consider because site clearing and construction activities at the Project could result in sedimentation occurring in Patterson Lake. In turn, this could affect surface water quality and alter the habitat where fish live. Taking into account the design features and mitigation measures listed in Table 6-2, the Project-environment interaction of soil erosion and runoff was screened out for surface water quality as a minor interaction (Section 6.9.2.1). Given that effects to surface water quality were deemed negligible, it follows that potential effects to fish and fish habitat are also determined to be negligible. Thus, soil erosion and runoff were screened out for the VC of fish and fish habitat and not carried forward to a REA.

6.10.2.2 Air Dispersion of Dust and COPC

The potential for particulates in air released from the Project to disperse through the atmospheric environment and transfer to surface water quality was discussed previously in Section 6.9.2.3. The deposition of air particulates to surface water was evaluated in Appendix D.7 using the results of the air dispersion modelling provided in Appendix D.1. Given that effects to surface water quality were deemed negligible, it follows that potential effects to fish and fish habitat are also determined to be negligible. Thus, this Project-

environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.10.2.3 Seepage from Lined Waste Storage Areas and Mine Backfill

As discussed in Section 6.9.2.4 regarding surface water quality, unintended seepage from lined facilities has the potential to affect groundwater quality during construction and operations, which may in turn alter surface water quality and subsequently affect fish and fish habitat. In the post-decommissioning period, long-term unintended seepage to groundwater from the TMF and underground mine also have the potential to affect groundwater quality, surface water quality, and fish and fish habitat. As described in Section 2.3, the use of engineered barrier/liner systems at the Project are designed to prevent the release of contaminated fluids from all lined facilities on site, such as the waste rock storage areas, effluent monitoring ponds, and the TMF. The HHERA (Appendix D.7) compared the predicted cumulative groundwater loads from liner leakage with the effluent loads during the construction, operation, and post-decommissioning phases of the Project. The leakage from the lined facilities was calculated to be less than 1% of the loads assessed from effluent during construction and operations, and to be less than 5% of the loads assessed from effluent during post-decommissioning; therefore, in both cases, the potential effects were deemed insignificant compared to the assessment for effluent. For this reason, the effect pathway of contact water, seepage from lined waste storage areas, and groundwater contact with mine backfill was screened out and not carried forward to a REA.

6.10.2.4 Treated Effluent Release

The potential for treated effluent released from the Project to affect surface water quality in Patterson Lake and the downstream environment was previously discussed in Section 6.9.2.5. Changes to surface water quality have the potential to influence fish and fish habitat in the receiving environment. Predicted treated effluent concentrations and flows were used to model predicted COPC concentrations in the water and sediment at select locations as well as to complete a HHERA (Appendix D.7) to evaluate the potential risks of these COPC concentrations on aquatic, terrestrial, and human receptors. The results show that treated effluent release will result in a measurable change in the receiving environment and have the potential to affect fish and fish habitat. This Project-environment interaction was carried forward to the REA.

6.10.2.5 Changes to Surface Water Quantity

The predicted potential for groundwater drawdown and treated effluent release to affect the VC of surface water quantity was discussed previously in Section 6.8.2.1. Changes to this VC can also affect the VC of fish and fish habitat. Increased or decreased lake levels can alter the availability of valuable shoreline habitat needed for fish to carry out their life stages and low flows could affect the migrations of fish. Changes to surface water levels and flows within the LSA and RSA were examined using a process-based hydrological model during the construction, operation, and decommissioning phases of the Project. Details on the modelling methods, results, and assumptions are provided in Appendix D.5.

During the construction and decommissioning phases of the Project, modelled changes in surface water flows and lake levels of Patterson and Naomi lakes were predicted to be non-detectable, and as such, effects on fish and fish habitat are inconsequential (Appendix D.5). During operations, water returns are projected to raise water levels in Patterson Lake and Naomi Lake under all flow conditions. In Patterson Lake, projected increases in water level relative to baseline range from 0.005 m under high flow conditions to 0.01 m under low flow conditions. In Naomi Lake, changes in water level relative to baseline under high flow conditions are predicted to increase by 0.001 m to 0.002 m. Overall, changes to water levels in Patterson Lake and Naomi Lake are expected to be negligible and/or non-detectable; thus, these changes to surface water quantity as they relate to fish were categorized as minor interactions and not carried through to the REA.

During the Project's operations phase and specifically under low flow conditions, increases of 4.5% on average in the Clearwater River downstream of Patterson Lake were predicted by modelling (Appendix D.5). Therefore, the potential effect pathway of increased surface water quantity effects on fish habitat during operations and low flow conditions was carried through to the REA.

6.10.2.6 Changes to Sediment Transport and Deposition

Changes to sediment transport and deposition caused by the Project is a potential pathway of effects which could have negative impacts on fish and fish habitat. The treated effluent diffuser location proposed for the Project is situated in Patterson Lake South Arm with the water depth at the diffuser discharge ports spanning from 9 m to 14 m below minimum water level. As described in Appendix A.5, the depth of discharge will be approximately 1 m above the lakebed, when considering the height of the ballast blocks, the pipe thickness, and the riser height. Lakebed sediment resuspension analysis was conducted as part of the

diffuser design study, and it was concluded that lakebed sediment resuspension is not likely to be induced by the effluent diffuser discharge (Appendix A.5).

Hydrology modelling predicted that during the operations phase, there will be an average increase in streamflow of 4.5% at the Clearwater River below Patterson Lake during low flow conditions (Appendix D.5). As described in Section 6.10.3.2, this Project-environment interaction is evaluated as not significant because the predicted effects on fish and fish habitat are minor. The sediment transport model completed as part of the Rook I Project EIS concluded that all assessment cases (Rook I Project, Rook I Project + Fission PLS Project, and climate change) resulted in negligible changes in net transport of sediment for the Clearwater River reach between Patterson Lake and Forrest Lake compared to baseline, which would not be detectable (NexGen 2024).

This Project-environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.10.2.7 Altered Site Drainage

As previously discussed for the VC of surface water quantity (Section 6.8.2.2), altered site drainage, such as changes to infiltration rates, natural drainage patterns, and overland flow can be caused by the construction, operation, and decommissioning of Project infrastructure. In turn, this can affect surface water quantity which can potentially affect the availability and quality of fish habitat. Given the mitigation measures listed in Table 6-2 and size of Patterson Lake, the Project-environment interaction of altered site drainage was screened out for surface water quantity as a minor interaction. Thus, it follows that it is similarly screened out for the VC of fish and fish habitat and not carried forward to a REA.

6.10.2.8 Treated Effluent Pipeline and Diffuser

Treated effluent from the Project will be released via a pipeline and multi-port diffuser into Patterson Lake South Arm. The diffuser design is provided in Appendix A.5 and mitigations for this Project-environment interaction are listed in Table 6-2. During its installation, an erosion and sediment control plan will be implemented, and monitoring will take place during construction/installation activities. The diffuser location was selected based on sufficient water depth, slope of the lakebed, keeping the underwater portion of the pipeline as short as possible, and avoiding sensitive fish habitat. The length of the diffuser covers the 9 m to 14 m depth range. This is a sufficient lake bottom slope to help

the treated effluent plume to flow away from the point of discharge. Sufficient depth ensures mixing can take place during the winter months when approximately 1 m of ice cover is expected. It is noted that the discharge depth is not the lake bottom itself, but rather, typically 1 m to 1.5 m above the lake bottom. Thus, for mixing purposes, the location of the diffuser needed to account for a reduction of 2 m to 2.5 m of available water column due to ice and the actual discharge depth (Appendix A.5).

The treated effluent pipeline and diffuser will result in limited physical habitat loss. The outfall length of the pipeline is planned to be 546 m with an outer diameter of 0.33 m. The attached diffuser will be 63 m in length with five ports spaced 12 m apart. The diameter of each port (0.10 m) is smaller than that of the pipe, allowing for higher exit velocity and improved mixing upon ejection. Within Patterson Lake, the pipe will be attached to 875 kg concrete ballast blocks spaced approximately 10 m apart. Ballast blocks prevent the pipeline from sliding or tipping over due to current and wave action and also prevent the pipe from floating. There will be 60 ballast blocks in total that span the length of the underwater pipeline from the depths of 1.7 m to 14.0 m (Appendix A.5). Only the ballast blocks will contact the substrate, not the entire length of the pipeline. As the footprint of each ballast block is 0.4 m^2, the footprint of all 60 ballast blocks taken together is 24 m^2. Thus, 24 m^2 of aquatic habitat will be occupied and unavailable for use by fish and benthic invertebrate key indicators, a very small percentage (0.00006%) of the sizeable area of Patterson Lake which occupies 38.1 km^2 (Section 4.5.1.1).

At lake entry, TetraTech recommended a trench between the overland and underwater portions of the pipe that would daylight below the ice sheet (2 m below low water level) to prevent the forces of ice from impacting the pipe and to reduce the chance of water/treated effluent freezing if ever it is left unmoving in the pipe (Appendix A.5). It is anticipated that construction of the trench would occupy a small area of shoreline habitat. The aquatic habitat at this location (where the diffuser pipe intersects the Patterson Lake shoreline) was previously described in Section 4.5.7.2 as having substrate containing mainly sand and cobble with smaller amounts of gravel, boulder, and organics. Fish cover at this location included moderate amounts of overhanging vegetation and undercut banks with sparse amounts of rock, large woody debris, and aquatic vegetation observed. The preferred spawning habitat of the key indicators (northern pike, lake trout, walleye, lake whitefish, white sucker, and yellow perch)[3] are based on known spawning habitat characteristics

[3] Spawning habitat was not specifically assessed for burbot; however, burbot prefer spawning habitat with sand or gravel bottom <1.5 m deep (Scott and Crossman 1973); thus, their spawning habitat ratings would be similar to lake whitefish, white sucker, and walleye.

described in literature and habitat suitability models (Appendix C.4). The spawning habitat at this location was assessed as not suitable for northern pike and lake trout and marginally suitable for walleye, lake whitefish, white sucker, and yellow perch. As noted in Section 4.5.7.2, other areas assessed in the larger general area surrounding the treated effluent pipeline and diffuser were identified as higher quality spawning habitat; thus, the loss of the relatively small amount of shoreline habitat where the treated effluent pipeline and diffuser will be installed is considered minor compared to the extent of higher-quality spawning habitat available nearby and in other areas of Patterson Lake.

Substrate mapping of the area surrounding the treated effluent discharge location was presented and discussed in Section 4, including both the original proposed location and the final treated effluent diffuser location mapped in June 2024. In addition, a sediment characterization survey (particle size, total organic carbon, etc.) will be conducted downstream of the treated effluent release point and as close as possible to the diffuser location itself prior to treated effluent release. The substrate where the treated effluent pipeline and diffuser will be located is composed of mainly sand and silt/clay with little to no aquatic macrophytes (Section 4.5.7.2). The small footprint of the ballasts is a minor disturbance that will not impact the overall habitat in Patterson Lake that supports critical life stages of fish. Therefore, potential effects on abundance and composition of fish populations in Patterson Lake are not expected to occur. Benthic invertebrate communities are anticipated to be impacted only where the ballasts are situated which is considered a minor interaction compared to the vast amount of similar substrate available in Patterson Lake.

The installation and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake are the only planned in-water activities for the Project. Any work that has the potential to impact fish habitat or cause fish mortality may require an Authorization under the *Fisheries Act* from Fisheries and Oceans Canada (DFO). Fission will submit a Request for Review and follow the best practices stated in DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat during in-water works. Any other mitigations, conditions, or offsetting measures prescribed by DFO will also be implemented or followed, as applicable. In-water work will be scheduled to avoid DFO's Saskatchewan Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat and all requirements stipulated in the Aquatic Habitat Protection Permit (AHPP) issued by the Water Security Agency (WSA) will be fulfilled.

During the operation of the diffuser, turbulence caused by the ejection of treated effluent from the diffuser ports could affect fish habitat availability (as fish avoid the area) and affect habitat quality (if sediment is disturbed and stirred up into the water column). This potential is localized to the diffuser area and mitigated by the five diffuser ports being spaced out (12 m between each) and by the ports pointing upwards at depths ranging from 9 m to 14 m. The installation and decommissioning of the treated effluent pipeline and diffuser will be short-term and during the decommissioning phase of the Project the entire pipeline and diffuser will be removed from Patterson Lake.

Overall, the Project-environment interaction of the installation, operation, and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake results in a temporary, minor measurable change to existing environment conditions and residual effects are classified as negligible. Therefore, this potential effect pathway was screened out and not carried forward to the REA.

6.10.2.9 Pressure Changes and Vibrations

Explosives are planned to be used during the Project's construction and mining operations in the vicinity of Patterson Lake. The detonation of explosives may cause injury or mortality to fish and/or disruption of fish habitat. The degree of potential negative outcomes to fish depends on many factors such as the size and pattern of explosive charges, setback distance from the detonation, water depth, as well as the fish species, size, and life stage according to the DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998). The upper extent of the longhole stopes of the underground mine is proposed to be approximately 74 m below the lake bottom of Patterson Lake. The upper longhole stopes are the areas of potential concern due to their proximity to Patterson Lake, whereas the use of explosives in the deeper zones of the mine will not impact Patterson Lake (Pers. Comm. Chambers 2024). There are mitigative measures to prevent any detonation at the Project from exceeding an overpressure of 100 kPa and a peak particle velocity (PPV) of 13 mm/s as prohibited in Wright and Hopky (1998). These include setting up each blast hole on its own delay and utilizing decked charges and stemming in order to reduce the charge mass per delay, thus limiting the overpressure and PPV to within acceptable levels. In addition, special equipment (geophones and hydrophones) will be used initially when mining of the upper longhole stopes commences to measure the transfer of vibrations through Patterson Lake and the surrounding rock and to determine more precisely what the true maximum charge mass per delay would be. It is noted that mining of the upper longhole stopes, and therefore the use

of hydrophones, is not scheduled until later in the life of the mine (2035 and beyond; Pers. Comm. Chambers 2024)

As recommended in Wright and Hopky (1998), Fission will notify DFO about their intent to use explosives at the Project and provide detailed information (plans, specifications, etc.), discuss potential issues and further mitigative measures, and if necessary, submit a Request for Review to seek an Authorization under the *Fisheries Act*. All actions and measures mandated by DFO to avoid harm to fish and fish habitat at the Project will be followed by Fission. With consideration to the mitigation measures listed in Table 6-2 and Fission's commitment to follow DFO requirements in ensuring the overpressure and PPV are within acceptable limits, the Project-environment interaction of pressure changes and vibrations was screened out for the VC of fish and fish habitat as a minor interaction and not carried forward to the REA.

6.10.3 Residual Effects Assessment

The residual effects assessment for the fish and fish habitat VC is provided below and summarized in Table 6-4.

6.10.3.1 Treated Effluent Release

Treated effluent from the Project will be discharged year-round through a diffuser into Patterson Lake South Arm. Near-field plume modelling performed with CORMIX and Visual Plumes was used to predict the discharged plume behaviors and dilutions in the near-field area (Appendix A.5). A target dilution was calculated as 30:1 at a 100 m distance from the diffuser to comply with the SEQG for the most restrictive constituent, sulfate. A total of 20 scenarios were assessed with variations in ambient profile structure, ambient current speed, seasonal ambient stratification, various discharge depths, and single vs multi-port configuration. Dilution at 100 m is confidently expected to exceed 30:1 for all scenarios.

To understand the potential influence of treated effluent release on water and sediment quality and biota in the receiving environment, a predictive contaminant dispersion and transport model and HHERA were applied, as described in Appendix D.7. Based on the results of the predictive modelling, there are negligible negative effects for fish and other aquatic biota, such as aquatic vegetation and benthic invertebrates, expected in the receiving environment of the Project treated effluent release. The WQG for the protection of aquatic life were used as a screening for the identification of potential effects on fish and

other aquatic biota; there were no predicted exceedances of the WQG in Patterson Lake South Arm and downstream in the LSA and RSA (Appendix D.7).

The potential for nutrient loading into Patterson Lake due to treated effluent release was identified as a concern by BNDN, particularly considering the low phosphorus concentrations measured during the baseline program illustrating the oligotrophic status of the lake (CCME 2004). Phosphorus was screened out as a COPC for the HHERA based on the effluent quality test scenario used; however, there was uncertainty in the potential phosphorus loadings (Appendix D.7). A commitment made in this EIS includes conducting a Best Available Technology Economically Achievable (BATEA) study to optimize effluent quality during the detailed design phase, which will provide more certainty and minimize phosphorus loadings to the extent possible. The results of the BATEA study will be communicated to the BNDN in response to their concerns. Nutrient concentrations in surface water will be measured in Patterson Lake and downstream waterbodies throughout the life of the Project (refer to Section 9).

Selenium is known to bioaccumulate in fish; therefore, further consideration was given to exposure to selenium. Fish concentrations for selenium are estimated using a trophic transfer model that considers the accumulation over time in the receiving environment and transfer through the biological food web. Predicted concentrations of selenium in fish flesh were compared to the U.S. EPA (2016) fish muscle tissue guideline of 11.3 µg/g (dw). The concentrations of selenium in fish tissue are not predicted to exceed these guidelines during any Project phase and no change to selenium fish tissue concentrations from the PLS Effluent Scenario is predicted. It is also noted that there are no predicted exceedances of the British Columbia Ministry of Environment safe selenium fish tissue concentrations for human consumption, which are available for moderate (14.5 µg/g (dw)) and subsistence fish (7.3 µg/g (dw)) diets (BC MOE 2014).

For radionuclides, the internal and external doses to aquatic biota, calculated based on the predicted water and sediment quality, were compared to benchmarks for aquatic radiation doses (Appendix D.7). The estimated radiological doses to fish exposed to water and sediments influenced by uranium and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210) in PLS effluent were shown to remain below the benchmark for aquatic radiation doses considered to be protective of aquatic biota.

Residual Effects Classification

The magnitude is low for potential effects on fish and fish habitat from the treated effluent release, with concentrations of some COPC in surface water predicted to exceed existing conditions but remaining below guidelines protective of the aquatic community in general. The geographic extent is regional, with changes in the concentrations of some COPC in surface water extending through the RSA. The duration is long-term and reversible, with concentrations in surface water returning to existing conditions in the post-decommissioning period. The timing of the potential effects is expected to occur in construction, operations, decommissioning, and post-decommissioning. The frequency of the effect is continuous. The likelihood of the effect is high, based on the assumed effluent quality and quantity for the Project.

Overall, the Project-environment interaction is rated as not significant since predicted surface water quality is expected to remain below the available WQG, which are established to be protective of the receiving environment and the aquatic community, including fish. Monitoring of the treated effluent release and receiving environment, including fish and fish habitat, will be completed throughout the life of the Project, as detailed in Section 9.0.

6.10.3.2 Changes to Surface Water Quantity

The basis of this residual effects assessment is the hydrological model provided in Appendix D.5. Groundwater drawdown and treated effluent release into Patterson Lake will occur year-round through the operations phase of the Project. Numerous mitigations are noted in Table 6-2 to limit the changes to surface water quantity, such as recycling and reusing process water in the mill to the extent possible, which will reduce the volumes released to Patterson Lake via the treated effluent diffuser, and restricting the ability of groundwater to enter the underground workings through freezing and other methods, which supersedes the need for more extensive dewatering activities. Nevertheless, it was predicted that during the operations phase, there will be an average increase in streamflow of 4.5% at the Clearwater River below Patterson Lake during low flow conditions (Section 6.8.2.1), which could have an effect on fish and fish habitat in the near-field environment. It is noted that further downstream the effects are predicted to be negligible.

The predicted increase in flows during low flow periods is likely to improve the access fish have to shoreline habitat, which is often where fish spawning, nursery, and rearing habitat is situated. Minor increases to water levels that occur at times when they would otherwise

be low (August to September) could also increase the ability of fish to migrate (e.g., to spawning grounds) through creeks and streams, such as the Clearwater River below Patterson Lake. The Clearwater River below Patterson Lake[4] was observed as providing suitable spawning habitat during baseline investigations. In July 2019, its fish habitat underwent a detailed assessment and of the 13 habitat sections delineated, the majority were rated as highly suitable for northern pike spawning due to dense amounts of aquatic vegetation and relatively slow flow (Appendix C.3). In 2017, northern pike eggs were found in the Clearwater River below Patterson Lake during the spring spawning survey (Section 4.5.7.2). Two of the habitat sections assessed contained faster flow with substrates of cobble, boulder, and sand making them moderately suitable for walleye, lake whitefish, white sucker, and lake trout spawning. Eight of the habitat sections were assessed as either moderately or highly suitable for yellow perch spawning (Appendix C.3). Therefore, this section of the Clearwater River contains critical habitat for utilization by the key indicator fish species. This Project-environment interaction could result in positive effects; however, there is also the potential for negative effects if increased migration results in increased predation or competition.

Residual Effects Classification

The magnitude of this effect pathway is determined to be low because the percentage increase was modelled at 4.5% on average. The geographic extent is local, with changes in surface water quantity predicted in the LSA. The duration is medium-term, with water levels and flows returning to existing conditions during the decommissioning period. The effect is regarded as reversible in the short-term with the potential effect expected to cease following the operations phase of the Project. The frequency of the effect is continuous because groundwater drawdown and treated effluent release will be continuous during mining and milling operations. The likelihood of the effect is moderate based on the assumed groundwater volumes and treated effluent quantity for the Project. As a result of the aforementioned ratings, this Project-environment interaction is evaluated as not significant because the predicted effects on fish and fish habitat are minor.

[4]Section 4.0 and Appendix C reports refer to the Clearwater River below Patterson Lake as Patterson Creek.

6.10.4 Cumulative Effects Assessment

6.10.4.1 Treated Effluent Release

The CEA for the release of treated effluent Project-environment interaction with fish and fish habitat considered the Rook I Project, which was identified with the potential to interact with the aquatic, terrestrial, and human environments and with sufficient information for including in the water and sediment quality modelling. The CEA for treated effluent release from the Rook I Project is based on the assessment of the Cumulative Scenario presented in the constituent transport and pathways modelling and HHERA in Appendix D.7.

Predicted water concentrations were compared to WQG for the protection of aquatic life and no exceedances were identified in Patterson Lake or downstream waterbodies (Appendix D.7). However, an exceedance was indicated for TDS in the Cumulative Scenario; this exceedance was related to an aesthetic objective for drinking water (human health) and does not provide an indication of the potential for negative effects on the aquatic community. The toxicity of TDS is from an ion imbalance affecting the body fluids of aquatic organisms. A review of the available toxicity values from literature (Appendix D.7) indicated that the concentrations predicted for TDS in the Cumulative Scenario are below levels associated with negative effects on aquatic species. In fish species, the life stage most sensitive to TDS exposure is during fertilization to egg hardening, with the lowest effect concentration of 750 mg/L. After egg hardening, fish do not appear to be affected by elevated concentrations of TDS up to 2000 mg/L (Weber-Scannell and Jacobs 2001).

Based on the effluent assumptions, the Rook I Project contribution for selenium in effluent is insignificant (<1%) of the PLS Project effluent; therefore, there is no change to selenium fish tissue concentrations predicted for the Cumulative Scenario and concentrations of selenium in fish tissue remain below the fish muscle tissue guideline.

For radionuclides, the internal and external doses to fish, calculated based on the predicted water and sediment quality, increase in the Cumulative Scenario (Appendix D.7). However, the predicted radiological doses are unlikely to cause adverse effects on aquatic biota, including fish, in the receiving environment of the PLS and Rook I projects.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC, which increases the potential for negative effects on fish and fish habitat. However, predicted concentrations remain below guidelines

protective of the aquatic community in general and the potential effect is considered to be negligible with cumulative effect ratings that mirror the residual effect ratings. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.10.4.2 Changes to Surface Water Quantity

The CEA for groundwater drawdown and release of treated effluent as a Project-environment interaction with surface water quantity was previously discussed in Section 6.8.4. It was based on the assessment of the cumulative effects scenario presented in the hydrological modelling report (Appendix D.5). The scenario considered the combination of the PLS Project and the NexGen Rook I Project (including the worst-case climate change scenario in the Rook I Project EIS). The largest effect on surface water quantity, and thus on fish and fish habitat, was an increase at the Clearwater River below Patterson Lake of 9% to 25% under low flow conditions. Similar to the REA, this predicted increase in flow could potentially enhance the ability of fish to access shoreline habitat and migrate through streams during times when water levels would otherwise be lower. Climate change effects were also evaluated and the cumulative effects of the PLS Project and the Rook I Project were predicted to be much smaller than the changes projected by the climate change scenarios (see Section 6.8.4).

The only difference in the effects assessment ratings between the REA and CEA is the magnitude, which for the REA was low and for the CEA is determined to be moderate on account of the predicted 9% to 25% increase in surface water in the summer months (i.e., during low flow conditions).

6.10.5 Uncertainties

For treated effluent release into Patterson Lake and its potential effect on fish and fish habitat, the uncertainties associated with the input parameters and assumptions of the model are summarized in Section 6.9.5 and detailed in Appendix D.7.

For changes to surface water quantity and associated potential effects on fish and fish habitat, the uncertainties and limitations of the model are presented in Section 4.1 of Appendix D.5. They were also summarized previously in Section 6.8.5.

6.11 Vegetation

6.11.1 Scope of Assessment

Vegetation was selected as a VC because Project activities could affect vegetation communities, species of conservation concern (SOCC), and vegetation health; avoidance or mitigation of SOCC and control of prohibited and noxious weeds are regulatory requirements; and vegetation has high cultural, recreational, and socio-economic importance. Through engagement activities, Indigenous groups expressed interest and concern with potential contamination of vegetation and the potential effects on the health of the environment and Indigenous peoples. 6.14

There are several intermediate VC's which may cause impacts to vegetation including groundwater quantity, surface water quality and quantity, air quality, terrain, and soils. In turn, changes to vegetation will affect VCs that rely on vegetation communities as a food source, including select wildlife VCs (Section 6.12) and traditional and other land uses (Sections 6.14 and 6.15). The impact of predicted vegetation changes on key interactions for other VCs are discussed in each relevant VC section.

As described in Table 5-2, the key indicators for this VC are vegetation abundance and diversity and vegetation COPC concentrations, and the measurable parameters evaluated in this effects assessment are:

- Predicted changes in abundance and composition of vegetation communities compared to existing environment conditions.
- Predicted effects to vegetation due to predicted changes in environmental COPC concentrations.

6.11.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for vegetation are defined as follows (Figure 6-4).

- Local Study Area: The LSA was set to bound the area where measurable changes resulting from the Project activities would be anticipated. The vegetation LSA is defined as the PDA plus a 600 m buffer for a total area of 27.8 km^2 (2,781.2 ha). Considerations for establishing the buffer were disturbance edge effects

(Bannerman and Branch 1998) and maximum buffer distances for SOCC (300 m for federally-listed species (ENV 2017)).

- Regional Study Area: The vegetation RSA is the same as described for soil and terrain RSA and the wildlife LSA and included a 5 km buffer of the PDA (181.5 km^2 or 18,152.3 ha). The vegetation RSA boundary was chosen to examine the effects of vegetation changes on wildlife habitat in a larger area, and cumulative effects of vegetation with other VCs within a larger ecological context.

6.11.1.2 Potential Effect Pathways

Project-environment interactions for the VC of vegetation that were identified as potential effect pathways during each Project stage include the following.

- Loss or alteration of vegetation and vegetation communities may result from land clearing during construction, operation, and decommissioning.
- Water quantity changes (groundwater and surface) could affect vegetation in wetlands during construction, operations, and decommissioning.
- Air dispersion of dust and gaseous pollutants could impact vegetation COPC concentrations and health during construction, operations, and decommissioning.
- Treated effluent release into Patterson Lake could impact vegetation COPC concentrations and health during construction, operations, and decommissioning.
- Aquatic vegetation species could be affected by the installation and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake.
- Introduction of invasive and/or noxious weed species could affect vegetation community composition and SOCC during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.11.2 Screening Assessment, where relevant.

6.11.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.11.2.1 Loss or Alteration of Vegetation

Measurable loss or alteration of vegetation and vegetation communities (ecosites) will occur during construction and operation of the Project. Loss of vegetation and ecosites can increase edge effects; affect local populations of SOCC, unique ecosites, and traditionally used plants/culturally important areas; and alter soil quantity and quality, nutrient cycling, reclamation success, biodiversity, and alter wildlife habitat. Land clearing and disturbance are limited to the Project footprint and occur primarily during construction; however, there is potential for limited disturbance to occur within the SSA during operations if facilities are expanded or altered. As such, the entire SSA was used as a conservative estimate of vegetation loss and to capture effects of edge effects. Mitigations for this Project-environment interaction are listed in Table 6-2.

Clearing of vegetation communities may result in habitat alteration and fragmentation through creation of edge effects, such as changes in light levels, local humidity and precipitation, dust deposition, soil erosion, wind, etc. where the cleared areas and existing ecosites interact. These changes can result in growth of early seral stage and potentially invasive plant species, which in turn can reduce the quality of habitat for wildlife and change ecosite types over time (AEP 2016; Bannerman and Branch 1998; McLaughlan et al. 2010). Progressive reclamation and weed management (Section 6.11.2.7) will mitigate these effects during operations, and reclamation will be completed during decommissioning.

During construction and operations, the terrain will be altered, and soil quantity and quality will be affected as land is cleared, which may increase the risk of soil erosion and compaction to both terrestrial and aquatic vegetation habitats and decrease reclamation effectiveness (Section 6.5). Increased erosion effects can influence vegetation regrowth success through the loss of topsoil and associated nutrients and local seedbanks, possible habitat loss through slumping/slope failure, and decreased carbon storage and nutrient cycling. Soil compaction may decrease porosity of soil and thus reduce available moisture and habitat for regrowth of species. However, progressive reclamation and soil management mitigations (Table 6-2) will be implemented, reducing the risk to vegetation from terrain alteration and changes to soil quality and quantity.

During operations and decommissioning, cleared and disturbed areas will be progressively reclaimed and revegetated to as close to current conditions as possible. However, there will be a permanent landscape alteration as the TMF will not be reclaimed to previous habitat

and instead will remain as a feature and be capped with shallow rooted species (i.e., grasses, shrubs) as approved by regulators. While progressive reclamation will mitigate loss and alteration of vegetation communities during operations and decommissioning, the TMF will cause permanent alteration of vegetation communities post-decommissioning.

Since loss and alteration of vegetation communities in the SSA will occur as part of Project development and operation, this Project-environment interaction is a key interaction and has been carried forward to the REA.

6.11.2.2 Wetland Vegetation Alterations

As discussed in sections 6.6 and 6.8, changes to water quantity are predicted for the Project area. Changes to both groundwater and surface water quantities may cause potential impacts to the chemical and biological processes in wetlands and wetland vegetation, including carbon storage, vegetation community structure, long-term water storage in peat soils, and vegetation and wildlife SOCC which rely on stable water levels to maintain wetland functionality (Ahmad et al. 2021; Jukaine et al. 1995; Leclair 2015; Liu et al. 2019; McLaughlan et al. 2010; Mrotzek et al. 2020; Tiemeyer et al. 2016).

Direct habitat loss (4 ha) will occur for wetland ecosites under the Project footprint (Section 6.11.2.1). Outside of the footprint, the LSA contains four wetland ecosites which may be affected by long term water quantity changes: black spruce treed bog (25.8 ha, 0.9% of LSA), Labrador tea shrubby bog (62.8 ha, 2.3%), graminoid bog (14.8 ha, 0.5%), and willow rich shrubby fens (35 ha, 1.3%) and water habitats (shoreline and shallow open water; 319.8 ha, 11.5%). Bog ecosites are largely reliant on precipitation (snowmelt, fog, and rain) to maintain functionality while fen ecosites rely on both precipitation and groundwater to remain stable ecosites (Warner and Rubec 1997). Groundwater dewatering is largely expected to affect fen ecosites, while changes to surface water quantities may alter both bog and fen ecosites found close to site, and wetland habitats further downstream of site.

Groundwater dewatering is predicted to occur due to the construction and operations of the decline and underground mine, construction of the TMF and development of initial water cover and providing make-up water for the mill and potable water for camp (Section 6.6, Appendix D.4). Limited effects to wetland habitat are anticipated at the camp and TMF locations due to the lack of wetland habitat in the predicted drawdown area (camp and TMF) and limited drawdown period (TMF) (Appendix D.4). The extent of predicted groundwater drawdown in the vicinity the decline and underground mine due to

construction (1 year for decline development) and operations (15 years assessed) was slightly larger and is further discussed below.

Groundwater drawdown predicted in the vicinity of the decline and mine during construction and operations was conservatively modeled (Section 6.6.2, Appendix D.4) and predicted to produce drawdowns of approximately 5 m to 10 m within 100 m of the mine decline/entrance, 1 m to 5 m drawdown within 700 m, and 0 m to 1 m drawdown depths extending up to 1.8 km away (Figure 6-9 and Figure 6-10). Groundwater fed wetlands are naturally acclimatized to changes in water level from factors such as wetland connectivity and climate (precipitation), and fen wetlands have been shown to withstand water level changes of up to 1 m (Ahmad et al. 2021). Therefore, groundwater dewatering levels between 1 m to 10 m were deemed those most likely to be affected. Under the decline model (construction phase), 0.3 ha of fen ecosite was predicted to be affected, while under the most conservative operations drawdown model (200 m^3/hr make-up water for the mill; Appendix D.4), 0.2 ha of fen was predicted to be affected by groundwater drawdowns between 1 m to 10 m during operations. The predicted changes to fens from drawdown would affect less that 1% of all available fen habitat within the LSA, which is considered negligible.

As previously discussed for the VC of surface water quantity (Section 6.8.2.2) altered site drainage, such as changes to infiltration rates, natural drainage patterns, and overland flow, can be caused by the construction, operation, and decommissioning of Project infrastructure. Mitigations for this potential effect pathway are provided in Table 6-2 and are discussed in Section 6.8.2.2. Mitigations are expected to reduce effects on surface water quantity such that long-term changes to wetland habitat within the vegetation LSA are not predicted to be measurable.

Given the limited number of affected groundwater fed ecosites in the area (less than 1% of available fen habitat within the LSA) and the mitigation measures for altered site drainage listed in Table 6-2, the Project-environment interaction of changes to groundwater quantity and surface water quantity affecting wetland vegetation was screened out as a minor interaction and not carried forward to the REA.

6.11.2.3 Air Dispersion of Dust and COPC

Particulates in air released from the Project are dispersed through the atmospheric environment and have the potential to transfer from the atmosphere to soil and affect vegetation health and concentrations. The deposition of air particulates to soil was

evaluated in Appendix D.7 using the results of the air dispersion modelling (Appendix D.1). The COPC considered for the deposition from air to soil and air to lichen were based on COPC selected for the HHERA (Appendix D.7) and included arsenic, cadmium, cobalt, copper, lead, nickel, selenium, uranium, and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210). The deposition from air results in soil concentrations that are below the soil SEQG for the protection of ecological health and therefore no negative effects are expected on vegetation health.

The predicted concentrations of foliage were compared to concentrations that are associated with phytotoxicity. No exceedances were identified associated with Project releases and therefore negative effects on foliage as a result of the Project releases to air are not indicated.

Therefore, this Project-environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.11.2.4 Gaseous Emissions

Gaseous emissions to air also have the potential to impact vegetation health. Potential interactions related to exposure to air gases (NO_x and SO_2) are predicted to have negligible effects on vegetation relative to existing conditions (Appendix D.7). Therefore, this Project-environment interaction, classified as minor, was screened out and not carried forward into the REA.

6.11.2.5 Treated Effluent Release

The potential for treated effluent released from the Project to affect surface water quality in Patterson Lake and the downstream environment was previously discussed in Section 6.9.2.5. Changes to surface water quality have the potential to influence vegetation in the aquatic environment. Predicted treated effluent concentrations and flows were used to model predicted COPC concentrations in the water and sediment at select locations as well as to complete a HHERA (Appendix D.7) to evaluate the potential risks of these COPC concentrations on aquatic, terrestrial, and human receptors. Detailed methods and results of the constituent transport and pathways modelling and HHERA are presented in Appendix D.7. The results show that treated effluent release will result in a measurable change in the receiving environment and therefore this Project-environment interaction was carried forward to the REA.

6.11.2.6 Loss or Alteration of Aquatic Vegetation in Patterson Lake

A pipeline and diffuser will be installed into Patterson Lake South Arm for the duration of the Project to release treated effluent (Appendix A.5). Alteration and/or loss of aquatic vegetation including SOCC in Patterson Lake will occur during the installation and decommissioning of the infrastructure but will be limited to the shoreline where the pipeline is installed (approximately 10 m by 20 m), and areas under the ballasts (approximately 24 m^2; see Section 6.10.2.7 for further discussion).

Previous aquatic vegetation studies of the LSA and RSA in Patterson Lake have shown that aquatic plants, including SOCC are locally abundant, including around existing shoreline infrastructure such as docks/boat launches (Section 4.6.4.1; Figure 4-37). A detailed aquatic vegetation survey under the proposed footprint of the pipeline and diffuser will be completed in 2024 to ascertain exact species distribution under the proposed footprint and in the area. As shown by SOCC abundance around existing shoreline infrastructure, aquatic vegetation communities disturbed by the construction and decommissioning of the diffuser will likely recover quickly after disturbance due to the availability of local populations to repopulate the area. Erosion control and mitigation measures for in-water construction will be implemented during construction and decommissioning to limit effects (Table 6-2).

Due to the limited footprint and duration of the infrastructure, local abundance of SOCC in Patterson Lake, evidence of natural repopulation after disturbance, and mitigation measures that will be employed during in-water construction, this Project-environment interaction is considered minor, was screened out, and was not carried forward to the REA.

6.11.2.7 Introduction of Invasive Weeds

The Weed Control Act is provincial legislation that enforces the control of prohibited, noxious, and nuisance weeds (GS 2010). The Project area currently has no listed nuisance, noxious or prohibited weeds observed (Section 4.6.4.1). To continue to prevent and control any future spread of non-native species including invasive plants and noxious weeds, as part of the Environmental Management Program (EMP), a weed management and monitoring plan will be established during all stages of the Project. In addition, progressive reclamation will be completed in exposed areas where practical during operations utilizing suitable and appropriate native species as approved by ENV to minimize colonization by invasive listed species. With mitigation planned for each stage of the Project, this effect pathway was considered minor, was screened out, and was not brought forward to a REA.

6.11.3 Residual Effects Assessment

The residual effects assessment for the vegetation VC is provided below and summarized in Table 6-4.

6.11.3.1 Loss or Alteration of Vegetation

Habitat loss and alteration was analyzed conservatively by using the SSA (400.1 ha) as the total area to be disturbed, rather than the proposed Project footprint (197.9 ha), as this accounted for indirect effects from habitat loss such as edge effects on vegetation (Table 4-41). Loss was calculated by excluding existing anthropogenic disturbance within the SSA (43.7 ha) from the total SSA (400.1 ha), for a total of 356.5 ha. Of this habitat loss, the majority (95%) is upland forest habitat, with the largest upland habitat regenerating forest (249.4 ha; 70%). It should be noted that the previously burned forested areas will continue to mature during the lifespan of the Project (approximately 29 years), and some areas will no longer be considered disturbed by ECCC. The period to maturation for regenerating forest habitat will be extended for areas under the Project footprint compared to the areas outside of the footprint. The second most prevalent upland habitat was mature coniferous forest (84.8 ha; 23.8%), with small areas of deciduous habitat (4.5 ha; 1.3%). Open water and wetland habitat was calculated at 17.7 ha (5%) of the total SSA (Table 4-41). When assessing the SSA in context of the local and regional areas, locally the loss of the SSA would result in the loss of 15% upland habitat and 4% wetland habitat in the LSA, and regionally would result in a loss of 2.5% upland and 0.4% wetland habitat of the RSA.

Ecosites within the SSA were assessed for their potential for loss of vegetation SOCC, for any unique ecosites when compared to the LSA and RSA, and for traditionally important plants. Previously completed vegetation inventory surveys in the area (Section 4.6.2.1) show that all SOCC observations (n=21) were found outside of the SSA, apart from one SOCC, Haupt's alkali-grass (*Puccinellia distans* ssp. *hauptiana*) (Table 4-42; Figures 4-38 and 4-39). Haupt's alkali-grass was observed in disturbed habitat in the Project footprint near the mine decline. This SOCC is a disturbance specialist, preferring saline mudflats in uranium mine tailings and sandy disturbed areas (Leighton and Harms 2014); thus, it is anticipated that populations may increase within the Project area as these habitats are created during the Project. None of the observed SOCC outside of the Project footprint are provincially or federally listed species. Ecosites found within the SSA are regionally abundant, with no unique ecosites noted in the SSA that were not found within the RSA (Table 4-41). The plant communities and species identified by local communities as

traditionally important included muskeg (wetland ecosites) and edible and medicinal plants, all of which are found on habitats or are habitats which were also regionally abundant (Section 4.6.4.1).

As discussed in the initial screening assessment, the long-term effects of vegetation loss are largely considered reversible through reclamation (approximately 40 years to a functional forest ecosite; McLaughlin 2010). Final decommissioning of the site will involve reclaiming the site to a state as similar to the baseline condition as possible, except for the TMF, which will be remediated with shallow-rooted species appropriate for the structure and as approved by ENV. This feature left on the landscape will result in the permanent alteration of 73.7 ha of upland habitat and 0.4 ha of wetland habitat, for a total loss of 74.1 ha. Considered on the local scale, this is a 2.6% loss of habitat in the LSA, while on a regional scale, this is a 0.4% loss of habitat in the RSA.

Residual Effects Classification

The magnitude of the residual effect of vegetation habitat loss or alteration is moderate, as temporary changes to vegetation communities will happen during construction and operation of the Project. The vegetation community on the TMF will remain permanently altered; however, the footprint is small (74.1 ha) and only results in a loss of 0.4% of habitat available regionally. The geographic extent is the site, with vegetation clearing only occurring in the Project footprint. The duration is long-term, with reclamation taking place during operations and decommissioning, and follow-up monitoring occurring during post-decommissioning. The reversibility rating for the majority of the Project is reversible in the long-term with the exception of the small footprint of the TMF. Although the long-term vegetation community on the TMF will differ from the baseline condition, the area will provide habitat post-decommissioning. The frequency of the effect is continuous, as habitat in most areas will be cleared and remain cleared until decommissioning with progressive reclamation occurring in select areas during operations to the extent possible. The likelihood of the effect is high, as vegetation clearing will be required to construct the Project.

Overall, the Project-environment interaction was rated as not significant considering vegetation clearing will be limited to the Project footprint with progressive reclamation occurring throughout operations to the extent possible, and the effect is reversible with the exception of the small footprint of the TMF which will remain altered. Monitoring will

occur during post-decommissioning to ensure decommissioning and reclamation objectives are met.

6.11.3.2 Treated Effluent Release

The basis of the detailed assessment for the potential effects from treated effluent release on vegetation in the aquatic environment is the HHERA (Appendix D.7). Based on the results of the predictive modelling, there are negligible negative effects for aquatic vegetation expected in the receiving environment of the Project treated effluent release. The WQG for the protection of aquatic life were used as a screening for the identification of potential effects on aquatic vegetation; there were no predicted exceedances of the WQG in Patterson Lake South Arm and downstream in the LSA and RSA (Appendix D.7).

For radionuclides, the internal and external doses to aquatic biota, calculated based on the predicted water and sediment quality, were compared to benchmarks for aquatic radiation doses (Appendix D.7). The estimated radiological doses to aquatic vegetation exposed to water and sediments influenced by uranium and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210) in PLS effluent were shown to remain below the benchmark for aquatic radiation doses considered to be protective of aquatic vegetation.

Residual Effects Classification

The magnitude is low for potential effects on aquatic vegetation from the treated effluent release, with concentrations of some COPC in surface water predicted to exceed existing conditions but remaining below guidelines protective of the aquatic community in general. The geographic extent is regional, with changes in the concentrations of some COPC in surface water extending through the RSA. The duration is long-term, with concentrations in surface water returning to existing conditions in the post-decommissioning period. The reversibility is considered to be reversible in the long-term with the timing of the potential effect expected to occur in operations, decommissioning, and post-decommissioning. The frequency of the effect is continuous. The likelihood of the effect is high, based on the assumed effluent quality and quantity for the Project.

Overall, the Project-environment interaction is rated as not significant since predicted surface water quality is expected to remain below the available WQG, which are established to be protective of the receiving environment and the aquatic community,

including aquatic vegetation. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.11.4 Cumulative Effects Assessment

6.11.4.1 Loss or Alteration of Vegetation

The CEA for loss or alteration of vegetation examined potential for future interaction with the NexGen Rook I Project VRSA. While the Project VRSA and NexGen VRSA do overlap, the Project VRSA was included for the potential interactions of vegetation with other VCs (wildlife habitat, soils and terrain, etc.) but through assessment it was determined the loss of vegetation and associated habitats are highly localized and regional cumulative effects are not anticipated.

6.11.4.2 Treated Effluent Release

The CEA for the release of treated effluent Project-environment interaction with vegetation in the aquatic environment considered the Rook I Project, which was identified with the potential to interact with the aquatic, terrestrial, and human environments and with sufficient information for including in the water and sediment quality modelling. The CEA for treated effluent release from the Rook I Project is based on the assessment of the Cumulative Scenario presented in the constituent transport and pathways modelling and HHERA in Appendix D.7.

For the assessment of aquatic biota and habitat potentially influenced by effluent released from the PLS and Rook I projects, the Cumulative Scenario considered the results of the predictive modelling for water and sediment quality. Predicted water concentrations were compared to WQG for the protection of aquatic life and no exceedances were identified in Patterson Lake or downstream waterbodies (Appendix D.7). However, an exceedance was indicated for TDS in the Cumulative Scenario; this exceedance was related to an aesthetic objective for drinking water (human health) and does not provide an indication of the potential for negative effects on the aquatic community. A review of the available toxicity values from literature (Appendix D.7) indicated that the concentrations predicted for TDS in the Cumulative Scenario are below levels associated with negative effects on aquatic plant species.

For radionuclides, the internal and external doses to aquatic vegetation, calculated based on the predicted water and sediment quality, increase in the Cumulative Scenario

(Appendix D.7). However, the predicted radiological doses are unlikely to cause adverse effects on aquatic biota, including aquatic vegetation, in the receiving environment of the Project and the Rook I Project.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC, which increases the potential for negative effects on vegetation in the aquatic environment. However, predicted concentrations remain below guidelines protective of the aquatic community in general and the potential cumulative effect is therefore considered to be negligible with ratings that mirror the residual effect ratings. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.11.5 Uncertainties

Changes to the Project footprint may occur with finalization of detailed design, and uncertainties exist regarding those vegetation communities and potential SOCC which may be impacted by changes to the footprint. If these changes occur, follow-up vegetation inventory surveys will be completed to document all vegetation communities, including any species with regulatory requirements (SOCC or weed species) in these new areas. Site-specific mitigation and monitoring plans will be implemented as per the Environmental Monitoring Program as necessary.

The fate and transport modelling completed for the REA and CEA used a probabilistic framework to capture uncertainties on input parameters and assumptions, as well as to acknowledge realistic ranges in parameter values. Therefore, the probabilistic results provide an accounting of the uncertainty inherent in the assessment through the upper-bound predictions. The 95th percentile predictions were also found to be below the available WQG, which are established to be protective of the receiving environment and the aquatic community, including aquatic vegetation. The probabilistic assessment also considers possible future variations under changed climate.

6.12 Wildlife

6.12.1 Scope of Assessment

The wildlife VCs were selected to represent functional groups that reside in the region and are important for ecosystem health, cultural, recreational, and/or socio-economic use. Baseline studies identified a wide variety of wildlife using a diversity of habitat types in

the SSA, PDA, LSA, and RSA (refer to Section 4.0). To ensure a comprehensive assessment was completed, several wildlife VCs were included in the effects assessment including amphibians, birds, furbearers, bats, woodland caribou, and ungulates. Woodland caribou were included as a VC because of their high importance to Indigenous Nations, as identified through engagement, and their conservation status. Woodland caribou are currently listed as threatened under Schedule 1 of the *Species at Risk Act* (SARA; GC 2022), are rated as threatened by The Committee on the Status of Endangered Wildlife in Canada (COSEWIC),and are provincially ranked as Vulnerable/Rare to Uncommon (S3) by the Saskatchewan Conservation Data Centre (SKCDC).

To focus the assessment, key indicator species were selected within each VC, as described in Table 5-2. The key indicator species were selected because they occur or have the potential to occur in the study areas, in some cases are SOCC, and they utilize various habitat types that could be influenced by Project activities. A description of habitat types used by each key indicator species during various life stages is provided in Appendix D.8. Species selection was aligned with the ecological risk assessment to ensure potential impacts of COPCs from Project releases were evaluated on the key indicators.

The same measurable parameters were applied to all wildlife VCs and include the following.

- Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions.
- Predicted effects due to predicted changes in environmental COPC concentrations.
- Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions).

6.12.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The same LSA and RSA were applied to all wildlife VCs and are defined below (Figure 6-11).

- Local Study Area: The LSA was set to bound the area where measurable changes (direct and/or indirect changes) resulting from the Project activities would be anticipated. The wildlife LSA is defined as the PDA plus a 5-km buffer for a total area of 181.5 km^2 (18,152.3 ha) Considerations for establishing the buffer were

maximum setback distances for wildlife SOCC (maximum 1 km from sensitive features; ENV 2017) plus additional distance to compensate for species that have a large home range and lack provincial or federal guidance on setback requirements (e.g., woodland caribou).

- Regional Study Area: The wildlife RSA is bounded within a radius of 25 km of the wildlife LSA for a total of 3,349.9 km^2 (334,989.1 ha). The RSA boundary was chosen to examine indirect effects of the Project on a landscape scale, including cumulative effects within a larger ecological context.

6.12.1.2 Potential Effect Pathways

Project-environment interactions for the wildlife VCs that were identified as potential effect pathways during each Project stage include the following.

- Construction, operation, and decommissioning of Project facilities will cause direct loss or alteration of wildlife habitat in the SSA.
- Potential for change in wildlife habitat quality and in the behaviours and movement patterns of wildlife due to sensory disturbances caused by Project activities during construction, operations, and decommissioning.
- A change in wildlife mortality and/or health may occur due to several factors, including injury during vegetation clearing, vehicle collisions, attraction or habituation, and increased access to hunters during construction, operations, and decommissioning.
- Air dispersion of dust and COPC, gaseous emissions, and treated effluent release could affect wildlife during construction, operations, and decommissioning.
- Wildlife movements may be altered by barriers to movement (i.e., treated effluent pipeline and roads) during construction, operations, and decommissioning.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.12.2 Screening Assessment, where relevant.

6.12.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.12.2.1 Habitat Loss or Alteration

Habitat loss will occur during construction, operation, and decommissioning Project phases in the SSA. Baseline studies illustrate that wildlife species utilize a variety of habitat types in the SSA, PDA, LSA, and RSA ranging from forested habitats to wetlands (refer to Section 4.0; Appendix D.8), and these habitats can be used by mammals, birds, and amphibians for breeding, foraging, shelter, and travel corridors. Wildlife SOCC may be more sensitive to habitat loss due to multiple factors impacting population dynamics such as reduced adult survival or recruitment (Williams et al. 2002). Clearing of habitat can also result in habitat alteration and/or fragmentation through creation of edge effects; the habitat edge in proximity to cleared areas can result in growth of early seral stage vegetation and potentially invasive plant species, which in turn can reduce the quality of habitat and ultimately alter wildlife species richness and predation rates (AEP 2016).

The Project is currently planned to be primarily located on anthropogenically pre-disturbed or recently burned land in the SSA (Appendix D.8). Although these habitat types still have potential to support wildlife and must be included when considering habitat loss and relevant mitigations, they often hold lower habitat value than mature forest to many wildlife SOCC (e.g., woodland caribou).

The extent of direct habitat loss or alteration has been minimized to the extent possible through design features Progressive reclamation will occur to the extent possible during operations and a comprehensive Decommissioning and Reclamation Plan will be implemented during closure. Best practice mitigations and Project planning are anticipated to reduce potential habitat loss of wildlife, particularly for SOCC, in the area. Several mitigation measures including wildlife pre-clearance sweeps will be completed before construction begins, when necessary; also, a Woodland Caribou Mitigation Plan (WCMP) and Wildlife Management and Monitoring Procedure (WMMP) will be implemented to further reduce risk (Table 6-2, Section 9). Any caves or rock outcrops discovered during construction will be assessed for bat usage and habitat potential prior to being impacted (i.e., roosting sites or hibernacula); however, these habitats are not known to occur, and their presence is considered unlikely due to flat, sandy terrain. During decommissioning, when access to the underground workings is no longer required, openings will be sealed; however, prior to closure bat surveys will be completed to identify use. Depending on presence of bats, mitigation measures will be discussed with ENV (i.e., when to close, use of bat gates or cupolas). Since development of the Project will result in measurable change in abundance and composition of wildlife habitat, including habitat for wildlife SOCC,

compared to existing environment conditions; thus, this effect pathway was carried forward to the REA.

Project activities such as alterations of site drainage, changes to surface water and groundwater quality, impacts to terrain and soils, introduction of invasive or noxious weed species, or loss of vegetation communities, could result in wildlife habitat alterations within the SSA. The screening effects assessments for these activities are included in other subsections since their primary Project-environment interactions are with other VCs. Of these, the pathways that were carried to REA included reduction in soil quality and altered terrain (Section 6.5.3), changes in surface and ground water quality (Sections 6.7.3 and 6.9.3), and loss of vegetation communities (Section 6.11.3). The potential for these residual effects to affect wildlife and wildlife habitat is captured by the Project-environment interactions of habitat loss and potential effects of environmental COPC concentrations.

6.12.2.2 Sensory Disturbance

Sensory disturbance to wildlife during construction, operation, and decommissioning activities could result in impacts to wildlife by creating functional habitat loss (indirect loss or reduced habitat effectiveness) and/or by altering movement and behavior of wildlife such as predators (Lewis et al. 2015; Paquet and Darimont 2010), ungulates and woodland caribou (Leblond et al. 2013; Polfus et al. 2011), bats (Luo et al. 2014), amphibians (Annich 2017), waterfowl and waterbirds (Black et al. 1984; Conomy et al. 1998), and forest breeding birds (Bayne et al. 2008). Ambient light and noise from roads can disrupt wildlife populations and alter behaviors like vocalization (more frequently, louder, and/or at different times) and foraging bouts (Beier 2006; Cartwright et al. 2014; Fure 2012; Luo et al. 2014; Parris 2015; RCEP 2009; Shannon et al. 2015). Responses to disturbance can change seasonally and align with important time periods for breeding birds, bats, and woodland caribou. For example, woodland caribou are the most sensitive during their life cycle in late-winter and the calving/post-calving period (i.e., April 1 to July 31) (ECCC 2020; ENV 2021b).

Best practice mitigations and Project planning are anticipated to reduce potential sensory disturbance (see Table 6-2). Several mitigation measures are planned including strategies to reduce noise in buildings and vehicles, ensuring vehicles remain on designated roads and trails, and implementing a Waste Management Plan, among others. Furthermore, the WCMP (Appendix D.9) describes an employee education program, monitoring, and adaptive management that will be used to plan reductions in potential sensory disturbances.

Despite best practices, residual effects are anticipated, and this interaction was carried forward into the REA.

6.12.2.3 Risks to Wildlife Mortality and Health

Injury or Mortality from Vegetation Clearing

The potential for wildlife injury or mortality during construction from the vegetation clearing process would be focused within the Project footprint in the SSA. Mortality risk would be related to mobility of different wildlife groups and life cycle stages. For example, migratory breeding birds are mobile; however, nests, eggs, and young offspring would be unable to move out of harms' way. Thus, clearing during certain time periods such as the migratory bird breeding season (April to August) could increase risk of mortality or incidental take (nesting calendar; ECCC 2022). Additionally, construction may also pose a risk to amphibian and small mammal species that tend to have lower mobility (i.e., avoidance ability) and experience mortality due to heavy equipment traffic (Fahrig and Rytwinski 2009). Prey species such as grouse/ptarmigan, snowshoe hare (*Lepus americanus*), and red squirrel (*Sciurus vulgaris*) have a higher mobility and would be at lower risk of mortality due to construction, except during reproductive phases. Potential for wildlife mortality during construction is lowest in highly disturbed areas (e.g., areas previously stripped of vegetation during anthropogenic disturbance) and highest in areas with native cover types such as forest and wetlands. This is because there is generally higher wildlife species abundance in native cover types, as opposed to areas that have been developed or stripped of vegetation. However, mitigations and best practices will apply to all habitat types, including previously disturbed areas, as wildlife may be present.

Best practice mitigations to avoid wildlife mortality during vegetation clearing are expected to greatly reduce potential impacts to wildlife. Key mitigations include avoiding situating Project infrastructure in high quality wildlife habitat where possible, placing site features and infrastructure in previously disturbed areas or corridors to the extent possible, or using existing infrastructure (i.e., roads). Clearing activities during the peak breeding bird season and the period when bats are likely to occupy maternal roosts (April to August) would be avoided to the extent possible. The majority of vegetation clearing (i.e., large areas) will be scheduled to avoid this timing window. When vegetation clearing is deemed necessary within the sensitive timing window, the services of a qualified professional will be engaged to identify sensitive features and implement activity restriction guidelines or setbacks for any active nest sites or wildlife trees (cavities for nesting or bat roost sites).

Potential interactions are expected to be infrequent and localized within the SSA. Consultation with ENV will be completed as required. The effect pathway of injury or mortality from clearing is therefore not anticipated to affect wildlife survival or populations and was screened out as a minor interaction and not carried forward into the REA.

Vehicle Collisions

Injury or mortality by vehicle or equipment collisions during the construction, operation, and decommissioning phases could occur in the SSA, PDA, LSA, and RSA. Impacts may occur along site roads and access trails, within the SSA, or along the existing Highway 955. It is possible that an increase in traffic due to the Project may cause higher potential for wildlife mortality along existing roads or within new areas developed within the Project site. Roads can be a persistent mortality threat (Trombulak and Frissell 2000). In general, wildlife collisions are related to road type (paved/unpaved), traffic volumes, speed limits, road location (different habitat areas providing cover, forage, etc.), and road shape (i.e., straight, curvilinear) (Forman and Alexander 1998; Jalkotzy et al. 1997). Speed limits can directly influence collisions; in a study of white-tailed deer (*Odocoileus virginianus*), Christie and Nason (2003) analyzed data from deer vehicular collisions and discovered most occur on roads with ≥90 km/hr speed limits (82%). Traffic volume (vehicles per day) can also increase collision rates by creating a barrier effect (Forman and Alexander 1998).

Based on the above factors, anticipated road mortality risks to woodland caribou and other wildlife species are unlikely to be high within the Project areas, as all roads in the RSA are unpaved, reducing speed of travel. Additionally, no changes are being made to the existing Highway 955; thus, the only new roads are site roads that will have a low speed limit.

A transportation impact assessment was completed for the Project, considering traffic generated by all Project phases from construction to decommissioning. Based on this assessment, traffic is expected to increase by approximately 22 two-way (inbound and outbound) vehicle trips per day during peak usage (years 3 and 4), primarily consisting of heavy vehicle traffic (Appendix A.6). This increase in traffic volume is unlikely to cause a significant increase in collision mortality, especially considering road type and speed of travel. Based on the assessment of accidents and malfunctions completed for the Project, the probability of wildlife-vehicle interactions over the entire travel route to site is equivalent to 0.47 per year (Appendix D.10). Although this may result in occasional wildlife mortality, there is not expected to be any effect at the population level (Section 7.6.1.4). Note that these estimates are based on SGI collision data, and therefore do not

include small-bodied wildlife species; however, no major increases in road mortality for small-bodied wildlife (e.g., amphibians, rodents, etc.) are expected, as the Project will not necessitate any modifications to the existing Highway 955 (Appendix A.6).

Best practice mitigations are outlined in Table 6-2. Key mitigations will include providing wildlife, particularly SOCC such as woodland caribou, the right-of-way when they are observed on roads or access trails. Where relevant, plowed access roads will have gaps in any berms and snowbanks to facilitate wildlife crossing, signage will identify high-use areas, and speed limits will be adjusted in accordance with conditions. Furthermore, the WCMP describes an employee education program, monitoring, and adaptive management that will be used to plan additional ways to reduce the risk of vehicle collisions. Potential interactions are predicted to have negligible effects on wildlife survival relative to existing conditions, including woodland caribou. This effect was therefore screened out as a minor interaction and not carried forward into the REA.

Attraction or Habituation

Wildlife may become habituated or drawn to mine sites due to attractants such as dust suppressant chemicals, food stuffs (smells), waste sites, and site infrastructure (Beckmann and Lackey 2008; CWS 2007). Best management practices such as implementing a Waste Management Plan and a no feeding wildlife policy will minimize the risk of attraction and habituation of wildlife. Measures to prevent attraction of potentially dangerous wildlife will be addressed in the Waste Management Plan and will include design features to prevent access to food or food wastes by wildlife. These will include secure waste containers and potential installation of electric fences around landfills or other attractants, as required. Food conditioning will be avoided through these measures; however, any nuisance animals will be reported to ENV for guidance. Additional mitigations in the WCMP will focus on an employee education program and environmental monitoring program (e.g., incidental wildlife sightings and site compliance monitoring).

Measures will also be taken to prevent site infrastructure from attracting wildlife to artificial habitat that may have associated mortality risks or increase human-wildlife interactions during construction and operation. For example, some bird species may nest on or near site infrastructure (including buildings or equipment) and waterbirds may land or attempt to rear young on the TMF. Bats may also attempt to roost in buildings or other site infrastructure. Mitigations to prevent injury or incidental take will include deterrents and/or exclusion measures, primarily to prevent nesting of migratory birds in high-risk

areas or entry of bats into buildings or other infrastructure. Measures to prevent birds from entering or nesting near the TMF will include vegetation control to reduce adjacent habitat potential for nesting waterfowl, as well as deterrents as required (e.g., scare cannons or predator calls) and regular patrols. To prevent entry of bats or birds into buildings, measures will include applying screening on vents and entrances to rafters/attics or other openings that may permit entry by wildlife. In the event that bats are observed roosting or hibernating on site infrastructure or in the mine decline/shaft, they will not be disturbed and ENV will be contacted to discuss mitigations. All actions taken will conform to the provincial bat exclusion policy (ENV 2022). Any dead or injured/sick bats observed near site infrastructure will be collected by trained staff using appropriate personal protective equipment and will be submitted for testing of white-nose syndrome and/or rabies, based on communications with the ENV and ECCC.

Potential interactions are predicted to have negligible effects on wildlife survival relative to existing conditions. This effect was therefore screened out as a minor interaction and not carried forward into the REA.

Increased Access to Hunters

As the Project is located along an existing road (Highway 955) and mine site access will be controlled by a security gate, increased public use or access is not expected to occur. Exploration trails exist and could increase in the PDA and LSA in the future; however, the extent remains uncertain. Hunting or trapping will not be permitted on site property, site access roads, or exploration routes by site personnel. Hunting and trapping will not be prohibited for members of the public outside of the PDA, however, members of the workforce will not have access to personal vehicles, personal firearms, or food storage facilities while on shift, therefore increased harvest of wildlife by the workforce is not expected (Table 6-2). Since current site access will not change with Project development, there is no Project-environment interaction from this potential effect and no linkage to carry this effect forward into the REA.

Air Dispersion of Dust and COPC

Particulates in air released from the Project are dispersed through the atmospheric environment and have the potential to transfer from the atmosphere to soil and affect vegetation concentrations and transfer to wildlife via food pathways. The deposition of air particulates to soil and subsequent transfer to vegetation was discussed previously in Section 6.11.2.3. The deposition of air particulates to soil and lichen was evaluated in

Appendix D.7 (HHERA) using the results of the air dispersion modelling (Appendix D.1). Given that effects to vegetation were deemed negligible, it follows that potential effects to wildlife are also determined to be negligible. Thus, this Project-environment interaction, classified as minor, was screened out and not carried forward into the REA. The potential influence of COPC in air on wildlife via food pathways was considered in the HHERA through vegetation ingestion by wildlife and was found to have a negligible potential for negative effects.

Treated Effluent Release

The potential for treated effluent released from the Project to affect surface water quality in Patterson Lake and the downstream environment was previously discussed in Section 6.9.2.5. Changes to surface water quality have the potential to influence wildlife in the receiving environment. Predicted treated effluent concentrations and flows were used to model predicted COPC concentrations in the water and sediment at select locations as well as to complete a HHERA (Appendix D.7) to evaluate the potential risks of these COPC concentrations on aquatic, terrestrial, and human receptors. The results show that treated effluent release will result in a measurable change in the receiving environment and have the potential to affect wildlife. This Project-environment interaction was carried forward to the REA.

Changes in Movement

Linear features with the potential to impede wildlife movement include the treated effluent pipeline and roads. Linear features, such as roads and pipelines, can fragment habitat (Jacobson 2005) resulting in reduced habitat connectivity (Bager and Da Rosa 2011), altered wildlife behaviour and movements (Parris 2015; Reijnen and Foppen 2006), and ultimately, densities of wildlife (Bayne et al. 2005; Develey and Stouffer 2000; Huijser and Bergers 2000). Project work will include construction of some new access roads or trails, as well as the treated effluent pipeline in the SSA.

The treated effluent pipeline is proposed as a single walled HDPE line within the SSA, extending into Patterson Lake. Project design includes placement of the pipeline at-grade in a ditch using a small-diameter pipe (33 cm outside diameter). The planned treated effluent pipe traverses existing disturbed areas, and borders planned infrastructure and site roads. Based on the diameter of the pipe and location within the pre-disturbed site footprint, it is unlikely to constitute a barrier to wildlife, as large-bodied species will be able to easily transverse the pipe, and the area contains low habitat potential for most small-bodied

species (e.g., amphibians), thus impacts to movement within the SSA is expected to be little to none.

Access roads and trails are also unlikely to cause significant changes in wildlife movement, as they will mostly be constructed in areas that are already impacted and/or fragmented by existing operations and roads (Highway 955). For this reason, new access trails are also not expected to significantly increase ease of access to predators (e.g., wolves); predation pressure on ungulates is therefore not expected to significantly change. Mitigation measures to prevent road mortality (Section 6.12.2.3) will also be used to prevent roads from presenting a barrier to wildlife, including woodland caribou. Relevant mitigations will adhere to the measures, monitoring, and adaptive management outlined in the WCMP and WMMP. With the implementation of the above mitigations, potential interactions are predicted to have negligible effects on wildlife movement relative to existing conditions. This effect was screened out as a minor interaction and not carried forward into the REA.

6.12.3 Residual Effects Assessment

The residual effects assessment for the wildlife VC is provided below and summarized in Table 6-4.

6.12.3.1 Habitat Loss and Alteration

To evaluate the quantity and type of habitat loss or alteration predicted to be caused by Project development, the baseline case (i.e., existing conditions) and Project case (i.e., areas that could be lost or altered by Project development) were compared to identify potential habitat loss in the SSA and in the PDA, which is inclusive of the SSA. This approach is very conservative as it assumes 100% loss of critical habitat types for key indicators in the SSA and PDA. The SSA (400.1 ha) contains buffer and the proposed Project footprint as currently designed only covers 197.9 ha of the SSA. Project development in the PDA (1442.1 ha) is currently not foreseen or planned and if development occurs in the PDA in the future, it will not occupy the entire area or cause complete loss.

For each VC, suitable habitat was identified (Appendix D.8) and this information was used in assessing Project case habitat loss (SSA and PDA scenarios) in context to habitat available in the LSA and RSA. Note that habitat type is often variable over time, even in the absence of human disturbance. Fire regimes, in particular, drive changes in habitat type and wildlife habitat potential on the landscape over time. The previously burned habitat quantified in the following sections will partially or fully regenerate during the lifespan of

the Project (approximately 29 years), and some areas will no longer be considered disturbed by ECCC. Thus, even in previously disturbed areas, the Project will result in prolonged regeneration periods following reclamation.

The approach taken in this detailed assessment was to focus on habitat preferences of wildlife key indicator species chosen for the Project to highlight species of importance in terms of conservation or traditional use, as well as addressing a variety of ecological niches (see Appendix D.8). To focus the assessment, wildlife VCs were grouped (amphibians, birds, and mammals), and considered habitat preferences (suitable habitat such as wetlands, treed uplands, etc.) within each species group. However, habitat loss calculations provided herein can be generalized to apply to all wildlife species that use these habitat types.

Amphibians

Habitat loss may affect amphibians by reducing the amount of available breeding, feeding, or over-wintering habitat present on the landscape, or by influencing connectivity among these habitat types. As most amphibians have requirements for two or more habitat types throughout their life cycles and have limited capacity to travel among them, multiple habitats and their distribution on the landscape must be examined when considering impacts related to amphibian habitat loss. Here, the focus of predicted impacts of habitat loss is for the key indicator species, the Canadian toad (*Anaxyrus hemiophrys*) (see Appendix D.8). Canadian toads were detected in the LSA in 2018 but were not recorded in areas with potential to be directly impacted within the SSA, nor were they detected in the PDA (see Section 4.0).

Canadian toads typically breed in shallow wetlands with emergent or floating vegetation cover (NatureServe 2024). The SSA contains 17.7 ha (4.4%) of wetland habitat, while the PDA contains 83.0 ha (5.8%) of wetland habitat (Appendix D.8, Tables 4 and 5). However, the specific microhabitat of shallow open water required for egg laying and tadpole development (Annich 2017) is likely lacking in most of the wetland types present, including treed bog and fen, or the open water of lakes. Within the SSA, wetland habitats would account for a total of 0.4% of the LSA and 0.02% of the RSA (Appendix D.8, Table 4). Within the PDA, wetland habitats account for a total of 2.0% of the LSA and 0.1% of the RSA (Appendix D.8, Table 5). The potential for impacts to groundwater fed fens from Project dewatering activities was assessed in Section 6.11.2 and is considered negligible.

Canadian toads prefer upland habitats with sandy soils for overwintering, which may include all the forest types. The SSA is comprised of 89.4 ha (22.3%) of forest cover that

may have sandy soils, and the PDA is comprised of 373.4 ha (25.9%) of such habitat (see Section 4; Table 4-41). Within the SSA, these account for a total of 0.5% of the LSA and 0.03% of the RSA. Within the PDA, these habitats account for 2.1% in the LSA and 0.1% of the RSA. However, it should be noted that even where sandy soils are available, Canadian toads are thought to use overwintering sites within 100 m but up to 1,500 m of open water habitats, which are limited in the SSA and PDA (Annich 2017). Thus, habitat metrics relevant to wetland habitats may be more representative of Canadian toad distributions on the landscape.

The lack of detection of this species in the SSA and PDA may indicate that the combination of habitat types required for all life processes is not present in these areas. Overall, the magnitude of habitat loss predicted to occur for critical life stages of amphibian SOCC in the PDA and SLA is low compared to the extent of similar habitat types available in the LSA and RSA.

Birds

Thirteen bird SOCC were detected within in the Project RSA during baseline studies (see Section 4.0). Most of these are expected to breed in the RSA, although some species (such as pine grosbeak [*Pinicola enucleator*]) are only likely to occupy the region during migration or over-wintering. Key indicator species selected for the EIA included four of the SOCC: osprey (*Pandion haliaetus*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus cooperi*), and rusty blackbird (*Euphagus carolinus*); as well as one waterbird species selected for traditional use value: mallard (*Anas platyrhynchos*). Of the aforementioned species, all are dependent on forest and/or wetland habitat types for breeding and foraging habitat as are birds in general, although other habitats such as disturbed areas or regenerating forest may be used or even preferred by some species, such as common nighthawk (Billerman et al. 2024; ECCC 2013, 2014). Detailed metrics regarding habitat cover within the SSA and PDA specific to each avian key indicator species are presented in Appendix D.8 (Tables 6 to 15) and are summarized below.

Osprey are large raptors that were recorded in the Project area during baseline studies. Osprey nest in habitats near fish-bearing rivers, lakes, and reservoirs, where they construct large, conspicuous stick nests on live and dead trees or man-made structures such as utility poles (Poole 1989; Smith et al. 2019; Toschik et al. 2006). The SSA contains 96.3 ha (24.1%) of forested and open water habitat suitable for nesting and foraging osprey (Appendix D.8, Table 6), and the PDA contains 392.6 ha (31.7%) of such habitats

(Appendix D.8, Table 7). Suitable habitat types for osprey in the SSA account for 1.2% of the LSA and 0.05% of the RSA (Appendix D.8, Table 6). Such habitats within the PDA account for a total of 4.8% of the LSA and 0.2% of the RSA (Appendix D.8, Table 7).

Mallards are a common and widely distributed species of dabbling duck that were selected as a key indicator species due to traditional use value. Mallards breed in habitats adjacent to shallow water features located near or among vegetated areas (Ringelman et al. 2011), and may nest in areas of anthropogenic disturbance. The SSA contains 61.4 ha (15.4%) of wetland and disturbed habitat with suitability for nesting mallards, while the PDA contains 192.0 ha (11.9%) of such habitats (Appendix D.8, Tables 8 and 9). These habitat types within the SSA account for 1.4% of the LSA and 0.1% of the RSA (Appendix D.8, Table 8). Considering the PDA, these habitat types account for a total 4.4% of the LSA and a 0.3% of the RSA (Appendix D.8, Table 9).

Common nighthawks typically nest in various open and semi-open habitats; in northern Saskatchewan, these include intact and modified forests, areas cleared by anthropogenic disturbance, and other open habitat types (Brigham et al. 2020; COSEWIC 2018a). The SSA contains 293.1 ha (73.3%) of disturbed or bare ground habitat with suitability for nesting common nighthawks, while the PDA contains 985.6 ha (68.4%) of such habitats (Appendix D.8, Tables 10 and 11). These habitat types within the SSA account for 18.6% of the LSA and 0.3% of the RSA (Appendix D.8, Table 10). Within the PDA, these habitat types account for a total of 11.2% of the LSA and 1.1% of the RSA (Appendix D.8, Table 11).

Olive-sided flycatchers typically prefer coniferous and mixed-wood forest openings and edges with dead standing trees for breeding habitat (Altman 1999; COSEWIC 2018b). Broad habitat categories with high suitability for olive-sided flycatchers within the Project areas consist of forested or vegetated wetland ecosites and disturbed areas; however, as edge habitats are not easily quantifiable using broad land cover categories, overall area of suitable habitat for this species are likely lower than the calculated values presented herein. The SSA contains 343.4 ha (23.5%) of broad habitat types with suitability for nesting olive-sided flycatchers while the PDA contains 1275.4 ha (92.9%) of such habitats (Appendix D.8, Tables 12 and 13). Within the SSA, these habitat types account for a total of 2.4% of the LSA and 0.1% of the RSA (Appendix D.8, Table 12). Within the PDA, these habitat types account for a total 8.9% of the LSA and 0.5% of the RSA (Appendix D.8, Table 13).

Rusty blackbirds breed in moist coniferous woodlands, bogs, fens, and wooded margins situated along water features, often in coniferous trees or shrubs adjacent to water (COSEWIC 2017; Matsuoka et al. 2010). The SSA contains 10.7 ha (2.7%) of wetland habitat types with suitability for nesting rusty blackbirds, while the PDA contains 62.6 ha (4.3%) of such habitats (Appendix D.8, Tables 14 and 15). Considering the SSA, these habitats account for 0.9% of the LSA and 0.04% of the RSA (Appendix D.8, Table 14). Within the PDA, they account for a total of 5.4% of the LSA and 0.2% of the RSA (Appendix D.8, Table 15).

Overall, few impacts are expected for forest and wetland breeding birds in the SSA and PDA, as these areas already have a high level of pre-disturbance due to development and fairly recent burns. The total loss of habitat is low to moderate relative to availability at the local and regional scales.

Mammals

During baseline studies, eight mammal SOCC were detected in the LSA and RSA including wolverine (*Gulo gulo*), woodland caribou, and six bat species. These include two of the mammalian VCs and key indicator species selected for the Project: little brown myotis (*Myotis lucifugus*) and woodland caribou. Additional VCs and key indicator species selected for the EIA due to traditional use value included furbearers (northern grey wolf [*Canis lupus occidentalis*] and muskrat [*Ondatra zibethicus*]), and ungulates (moose [*Alces alces*]).

Furbearers

Northern grey wolf are predators that require large home ranges (100 to >1,000 km^2) (NatureServe 2024); northern grey wolves also usually occur at low population densities and are highly dependent on the abundance of prey species, particularly ungulates (NatureServe 2024). Northern grey wolves occur in a variety of boreal forested habitats (NatureServe 2024) and tend to avoid human disturbance (NatureServe 2024; Appendix D.8). Based on pre-disturbance and habitat composition of recent burn, this species is unlikely to den in the SSA or PDA, but they may occasionally occur in the area during foraging or dispersal. Forested habitat with potential to support this species comprises approximately 349.4 ha within the SSA and 1312.7 ha within the PDA (Appendix D.8, Tables 18 and 19). Within the SSA, these habitat types account for 2.3% of the LSA, and 0.1% of the RSA. Within the PDA, these habitat types account for 8.8% of the LSA, and 0.5% of the RSA. Overall, habitat loss in the SSA and PDA is unlikely to significantly

affect this species due to it occurring at low densities and its adaptable nature to human disturbance (Appendix D.8).

Muskrat sign was recorded at low density in the RSA, including within the PDA (see Section 4). Muskrat occur in aquatic habitats, primarily inhabiting shallow areas of lakes, and slow-moving watercourses (NatureServe 2024). Wetland habitat with suitability for muskrat comprises approximately 15.4 ha (3.9%) within the SSA and 70.3 ha (4.9%) within the PDA (Appendix D.8, Tables 20 and 21). These habitat types within the SSA account for 0.4% of the LSA, and 0.03% of the RSA. Within the PDA, these habitat types would account for 1.9% of total muskrat habitat within the LSA, and 0.1% in the RSA. As muskrat are widely distributed and common (S5) provincially and have high reproductive rates (NatureServe 2024; SKCDC 2023), minor habitat loss in the SSA and PDA is unlikely to significantly affect this species.

Bats

All of the bat species recorded in the Project area were detected in the PDA (see Section 4). Of the six bat species detected, three over-winter in hibernacula (big brown bat, little brown myotis, and northern myotis), and three migrate south for the winter (silver-haired bat, eastern red bat, and hoary bat). Hibernacula may consist of caves, mine openings, or buildings; however, sites with suitable features (e.g., temperature, humidity etc.) are rare (ASRD 2006). Bats may travel up to several hundred kilometres from summer foraging or breeding areas to hibernacula (ASRD 2006). The likelihood of hibernacula existing within the SSA or PDA is low due to a lack of caves, rock outcrops, buildings, or other suitable structures. The region is notably flat and sandy and has low potential to contain caves and rock outcrops. Summer habitat selection by bats is likely determined by the availability of roosting structures; physical structures for summer roosting including deeply furrowed tree bark, tree cavities, moderately decomposed snags, rock crevices, buildings, bridges, and other human-made structures (COSEWIC 2013). Due to the presence of bats throughout the breeding season, there is reasonable likelihood that maternal bat roosts are present in areas of mature forest and/or anthropogenic structures. There is the potential that Project construction may create roost sites in the form of buildings, attics, crawl-spaces, or even within the mine itself to include the mine decline/shaft. In general, the bat species prefer to forage over water features and along forest edges, but some species may avoid large clearings or disturbed areas such as burn-overs and clear cuts (Agosta 2002; COSEWIC 2013).

Forested habitat with potential to support the key indicator species, the little brown myotis comprises approximately 91.6 ha (22.9%) within the SSA and 386.1 ha (28.6%) within the PDA (Appendix D.8, Tables 16 and 17). These habitat types within the SSA would account for a total of 1.6% of the LSA and 0.8% of the RSA. Within the PDA, these habitat types would account for a total of 6.8% of the LSA and 3.4% of the RSA. As foraging habitats are expected to be abundant in the area, impacts related to foraging success are expected to be low.

Ungulates

Due to their importance in local traditional use, a detailed assessment on habitat loss pertaining to moose (*Alces alces*) was completed. Moose inhabit a variety of forest types and may forage in disturbed or early seral stage habitats with an abundance of shrub cover for browsing (Appendix D.8). The forage range of moose varies considerably from 4.6 km^2 to 262 km^2 (EC 2012). Overall, the SSA contains 347.8 ha (86.9%) of habitat types that may be used by moose, while the PDA contains 1304.2 ha (22.4%) of such habitat types. These habitat types within the SSA would account for a 13.3% loss in the LSA and a 1.2% loss in the RSA. Within the PDA, these habitat types would account for a 70.0% loss in the LSA and a 6.4% loss in the RSA. However, some of this area may not be regularly used by moose due to existing human presence and the Project site being adjacent to Highway 955, which could result in avoidance behaviour. Studies have demonstrated annual avoidance behaviour of moose in response to roads; avoidance was documented from 100 m to 1,000 m (Laurian et al. 2010, 2012). Finally, moose are expected to be capable of using habitat within the SSA during early stages of reclamation (during early seral stages, or re-vegetation of shrub cover; similar to revegetation after wildfire). Impacts to moose are therefore not expected to be significant or permanent based on the small area to be impacted and shorter time frame of exclusion for this species.

Woodland Caribou

Due to their high priority conservation status, a detailed assessment on habitat loss pertaining to woodland caribou was completed to understand relevant habitat metrics in the Project study areas at the baseline case and Project case. Baseline surveys completed for the Project indicated that woodland caribou are uncommon in the Project areas; observations were only recorded in 13 locations within the RSA during surveys for the 2020 environmental baseline program (mostly including sign such as tracks or pellets) despite targeted survey effort (ungulate aerial surveys, pellet/browse surveys, and winter track count surveys) (Appendix C.3). Surveys completed for the 2022 environmental

baseline report only detected one observation of woodland caribou, consisting of a single pellet group found in the PDA (Appendix C.4). Although uncommon, there is demonstrated habitat use and presence of woodland caribou within the Project areas.

At baseline case, the SSA and PDA are considered to be completely disturbed habitats following guidance from Environment and Climate Change Canada (ECCC; 2012) as both areas are comprised primarily of regenerating burn and human-caused disturbance habitat (Appendix D.8 see Figures 5 to 7). Total human-caused disturbance habitat includes direct disturbance footprints including linear and polygonal areas where habitat is cleared, and habitat located within a 500-m buffer of a direct disturbance area (ECCC 2012). Additionally, habitat that is altered due to wildfires is also considered to be disturbed and functionally unavailable to woodland caribou for 40 years after the burn (temporary disturbance). Within the SSA and PDA, wildfire habitat (62.3%; 249.4 ha and 60.8% or 876.6 ha) characterizes the majority of the area, respectively. However, some of these previously burned areas will have regenerated for 40 years (the threshold for removal from ECCC's disturbed classification) within the 29-year lifespan of the Project. Detailed habitat metrics outlining woodland caribou habitat loss are presented in Appendix D.8.

Direct habitat loss will still occur in the Project case for both the SSA and PDA as habitat in the 500 m buffer of human disturbance is still intact and available for use and regenerating habitat from wildfire is only a temporary disturbance and portions of it can also be used as habitat. For example, a study in the boreal shield of Saskatchewan indicated woodland caribou preferred non-burned (>40 year) over burned (≤40 years) areas but that within burned areas, residual patches dominated by bogs-fens were preferred and suggested that these unburned residuals may provide important calving habitat (Skatter et al. 2017). Overall, in the Project case, 400.1 ha of habitat in the SSA could be developed (direct disturbance), including 71.1 ha with high habitat potential for woodland caribou (based on ecosite type), 24.4 ha with moderate habitat potential, 4.4 ha with low habitat potential, 7.0 ha water, 249.4 ha of regenerating habitat, and 43.7 ha anthropogenic disturbance (Appendix D.8, Table 24). Of the total 400.1 ha, 349.3 ha would be considered woodland caribou habitat (caribou potential habitat and regenerating habitat). In the PDA, 1442.1 ha could be developed, including 279.5 ha of high habitat potential for woodland caribou, 113.4 ha with moderate habitat potential, 43.2 ha with low habitat potential, 20.4 ha water, 876.6 ha of regenerating habitat, and 109.0 ha anthropogenic disturbance (Appendix D.8, Table 25). Of the total 1442.1 ha, 1312.7 ha would be considered woodland caribou habitat.

To put the Project case disturbance metrics into context, the maximum percent loss in the SSA and PDA of high, moderate, and low potential habitat were compared to availability in the LSA, RSA, and SK2 West caribou administration unit. Overall, direct disturbance resulting from development of the SSA will constitute 5.0% of the LSA and 0.2% of the RSA. Direct loss of areas with high habitat potential for woodland caribou constitutes only 1.6% of the LSA and 0.04% of the RSA. Overall, this represents only a small increase in human-caused disturbance predicted to occur in the LSA and RSA as a result of Project development of the SSA. Development of the PDA considering high, moderate, and low potential habitat would constitute 31.6% of similar habitats in the LSA and 1.2% of the RSA.

Within the SK2 West caribou administration unit, an approximate 0.008% and 0.04% loss of Tier 1 habitat occurs in the Project case of the SSA and PDA respectively when considering low, moderate, and high-potential habitat. Tier levels are based on their relative importance to woodland caribou and Tier 1 habitat areas are areas of high importance (ENV 2021). However, when considering only high-quality woodland caribou habitat, total percent of Tier 1 habitat loss is 0.006% considering development of the SSA, and 0.02% when considering development of the PDA. Although the total loss of habitat constitutes a small proportion of the SK2 West caribou administration unit, the magnitude of the effect for habitat loss is considered to be high. Woodland caribou populations within the SK2 West caribou administration unit are currently not considered to be self-sustaining and any loss of suitable habitat is therefore considered significant as the Project creates excess disturbance above the 35% threshold value for disturbed habitat (ENV 2021b).

Residual Effects Classification

The residual effects classification for habitat loss and alteration varies depending on the VC. The magnitude was rated as low for moose, furbearers, bats, amphibians, and birds. However, the magnitude is considered high for woodland caribou, as it will constitute a 0.008% to 0.04% habitat loss within the SK2 West Caribou administration unit under development scenarios of the SSA or PDA.

The geographic extent for all VCs is classified as site since current plans include only areas of the SSA being cleared and developed. Development of the Project will result in features remaining on the landscape in the long-term, with some areas potentially requiring decades to regenerate post-reclamation. It is expected that over time, the surface area of the SSA and any developed parts of the PDA will eventually approximate existing habitat (ecosites)

in the area with the exception of the TMF, which will remain as a permanent land feature vegetated in shallow-rooted species such as grasses and shrubs. The long-term effects of habitat loss throughout most of the developed areas could last for ~70 years (the Project duration plus 40 years or more for habitat to reach mature forest conditions (functional habitat) (EC 2011; ENV 2021b), but this varies between preferred habitat types and VCs (Table 6-4). Effects of habitat loss or alteration are considered long-term reversible, with the exception of the TMF, which is considered irreversible as it will remain altered. The frequency of the effect will be continuous for all wildlife VCs, and the likelihood of habitat loss is high, as it is an unavoidable outcome of Project development.

The criteria above were used to rate the significance of the potential effects on wildlife due to habitat loss or alteration. Overall, the Project-environment interaction for habitat loss is rated as not significant except for woodland caribou; habitat loss for woodland caribou is rated as significant because of their importance to Indigenous Nations and their regulatory status. The Project has committed to a habitat offset program in the WCMP to mitigate risk of habitat loss on woodland caribou (Appendix D.9).

6.12.3.2 Sensory Disturbance

Sensory disturbance has potential to affect a variety of wildlife species in the Project area. Effects are anticipated in the SSA, PDA, and potentially the LSA due to the increased presence of people, equipment, infrastructure, buildings, light, and noise. Effects on wildlife are expected to vary by species due to each species sensitivity to disturbance (Appendix D.8); effects on woodland caribou are considered separately from all other wildlife VCs and key indicator species (below) because of their conservation importance.

Sensory disturbance may impact wildlife by causing habitat avoidance or by masking auditory signals, such as those necessary for reproduction, communication, or echolocation in bats. For noise levels exceeding 50 dBA, habitat suitability is expected to decrease, and wildlife may move out of the area. Noise levels of 48 to 50 dBA have been shown to reduce bird abundance (Bayne et al. 2008; ECCC 2019). Further, studies on waterbirds have documented effects at sound levels of 63 dBA, while other studies indicate tolerance of noise levels by waterbirds and some mammals up to 90 and 100 dBA (Black et al. 1984; Conomy et al. 1998; Manci et al. 1988). Noise levels (68 to 80 dBA; simulated) may impact bats through reduced foraging efficiency (Siemers and Schaub 2011). Prey populations (snowshoe hare, grouse/ptarmigan, and red squirrel) are resilient and can tolerate sensory disturbance expected from construction and operational activities.

Increased sensory disturbance would potentially be most impactful to birds, bats, and amphibians during their breeding periods, which are encompassed by the spring/summer season (April to August). Project noise levels are expected to attenuate in the LSA, where the majority of the areas are predicted to experience noise ranges similar to observed background noise levels (approximately 35 to 45 dBA; Appendix D.2). Noise levels in the SSA during construction and operations are expected to range up to approximately 75 dBA (Appendix D.2; see Section 6.3). Overall, wildlife habitat avoidance is likely to occur in direct disturbance areas of the Project.

There is also the potential for vibrations to cause sensory disturbance to wildlife. While background ground vibration levels tend to be well below the threshold of perception in humans, it is possible that existing vibration may be perceptible to terrestrial wildlife. Generally, background vibrations in areas with no existing vibration sources are estimated to be in the order of 50 VdB (equivalent to 0.008 mm/s), compared to the human threshold of perception of approximately 65 VdB (or 0.045 mm/s) (U.S. FTA 2012). Empirical equations for estimating the propagation of vibration from heavy machinery are typically used to calculate the vibration level at a known distance from the operation, for comparison to a regulatory limit for human response or building damage (U.S. FTA 2012; Wiss 1981). By substituting the estimated background level of 0.008 mm/s for the predicted level, the equations may be used instead to estimate the distance beyond which the vibration level induced by the equipment will be below background conditions. Of the equipment assessed in the EIS, the range of distances to return to background is 14 m to 223 m. The equipment will generally be operating at distances greater than 300 m from the site boundary, and so ground vibrations are not expected to be greater than background conditions outside of the site boundary. There are currently no applicable provincial or federal regulatory guidelines applicable to mining operations that outline vibration limits for terrestrial wildlife.

In addition to modelled noise levels, indirect habitat disturbance was also considered based on species-specific responses to industrial activities (see Appendix D.8). Here, Project effects on wildlife were evaluated using species-specific zones of influence (ZOIs) around the SSA and PDA in their respective development scenarios. The habitat within the ZOIs is still available, but is considered to be not fully functional and is equivalent to low potential habitat for the relevant species. The resulting altered habitat values (in hectares) are considered additional to the estimated direct habitat loss (See Appendix D.8). Overall, for wildlife VCs/key indicators, the area of altered habitat increased from 0 to 12.6% of species-suitable habitat in the LSA and 0 to 0.5% in the RSA when the ZOIs were considered (Appendix D.8). Within the PDA, altered habitat value increases ranged from

0 to 13.6% of species-suitable habitat in the LSA, and 0 to 0.5% in the RSA when the ZOIs were considered (Appendix D.8). ZOIs may be more conservative than using modelled noise levels from construction and operations activities. Collective results suggest changes to wildlife use and movement in the LSA and RSA are not expected.

Best practice mitigations, Project planning, employee education about wildlife, and implementation on of a WMMP are anticipated to reduce potential sensory disturbance. See Section 6.12.2.2 and Table 6-2 for additional relevant mitigations to reduce sensory disturbance to wildlife.

Woodland Caribou

Sensory disturbance effects are anticipated to occur if woodland caribou are present in the SSA and PDA, as there will be buildings, light, and noise resulting from Project construction, operations, and decommissioning. Direct habitat loss and sensory disturbance are inter-related as habitat within 500 m of developments are considered functionally lost habitat due to the influence of sensory disturbance (EC 2011; ECCC 2020). Portions of the SSA (293.1 ha; 73.3%) and PDA (985.6 ha; 68.4%) are currently considered directly disturbed habitat due to previous disturbance areas (human-caused and wildfire disturbance). Including the associated 500 m buffer to account for sensory disturbance, all of the SSA and PDA are considered indirectly disturbed; however, construction and operations will contribute additional disturbance.

In the SSA and PDA, noise levels are expected to increase compared to existing conditions during construction and operations of the Project. Noise levels are anticipated to reach 75 dBA in the SSA during operations; however, noise levels attenuate in the LSA, where the majority of the areas are predicted to experience noise similar to background levels (40 to 45 dBA; Appendix D.2). Notably, levels of 35 to 45 dBA are commonly cited as values observed for background sound levels in rural/remote areas; thus, noise effects are not expected in the LSA and RSA.

Direct impacts of noise on woodland caribou are difficult to assess. For areas within the SSA/PDA where noise levels were modeled to range from 40 to 75 dBA during construction and operations, those areas would already be considered impacted as part of the disturbance calculations provided above (500 m buffer around human-caused disturbance). Loud sensory disturbances (90 to 110 dBA) have been shown to increase woodland caribou movement and/or alter activity patterns (Bradshaw et al. 1997; MacNearney et al. 2021). Increases in sensory disturbance would potentially be most

impactful from April 1 to July 31 (late winter to post-calving) since this is a sensitive life stage (ENV 2021b). However, it should be noted that few woodland caribou are present in the Project area based on environmental baseline studies (see Section 4). To date, no young calves have been observed incidentally or during baseline surveys in the Project area; calving areas in Saskatchewan are currently unknown, although some traditionally identified areas have been identified provincially (ENV 2021b).

In addition to modelled noise levels, indirect habitat disturbance was also modeled based on woodland caribou responses to industrial activities (500 m buffer around the SSA and PDA; see Appendix D.8). The habitat (high, moderate, and low potential woodland caribou habitat) is still available but is not considered to be fully functional. These altered habitat values (in hectares) are considered additional to the estimated direct habitat loss (See Appendix D.8). Overall, the area of altered habitat increased by 25.7% of the suitable habitat in the LSA and 0.9% in the RSA (Appendix D.8). Within the PDA, the area of altered habitat increased by 33.0% of the suitable habitat in the LSA and 1.2% in the RSA (Appendix D.8). Here, ZOIs may be more conservative than using modelled noise levels from construction and operations activities. Modelled noise contours were generally less than background noise values and attenuated within 500 m of the SSA. Additionally, noise contours were pronounced in the east/southeast portion of the SSA and not surrounding the whole SSA or PDA, which the 500 m buffer assumes. Collective results suggest changes to woodland caribou use and movement in the LSA and RSA are not expected.

Best practice mitigations, Project planning, and employee education are anticipated to reduce potential sensory disturbance. The WCMP describes measures to reduce sensory disturbance by describing an employee education program and monitoring and adaptive management that will include information on avoidance of causing sensory disturbance to woodland caribou. Vegetation clearing, which is expected to be one of the most impactful sources of noise and disturbance, will occur outside the late winter and calving period for woodland caribou (April 1 to July 31) when feasible. Further mitigations to reduce disturbance to woodland caribou are also described in the WCMP and Table 6-2.

Residual Effects Classification

The residual effects classification for sensory disturbance varies depending on the VC. The magnitude of potential effects is low for noise (see description of noise in Section 6.3.3.1), light, and other sources of anthropogenic disturbance for most VCs, including moose, furbearers, bats, and amphibians. Although an effect may occur, it is expected to have a

limited effect on function as habitat in the area is considered disturbed (anthropogenically and by fire). Further, while individuals of these species may be affected in close proximity to sources of disturbance, impacts at a population level are unlikely. The magnitude of sensory disturbance is expected to be moderate in the case of woodland caribou and birds, as these species may be more sensitive and could show avoidance.

The geographic extent is considered site for furbearers, but is local for all other VCs; although most noise and disturbance will be generated within the SSA and PDA, all other VCs have a provincial or federal disturbance setback (ECCC 2009; ENV 2017) or were assigned a zone of influence (ZOI) for the Project ranging from 90 to 500 m (Appendix D.8) based on literature on disturbance effects. The duration is medium-term, as an increase in sensory disturbance from background levels is expected throughout the life of the Project and decommissioning. The effect is considered to be reversible in the short-term for most species with the effect expected to be reduced after construction and cease after decommissioning; however, the effect was considered long-term reversible for woodland caribou as they are anticipated to be more sensitive to disturbance than most other wildlife species and have large home ranges. Avoidance behavior may have long-term effects due to caloric wastage, altered movements, or changes to inter-species interactions. The frequency of the effect is continuous, as it is expected to occur throughout all Project phases up until completion of decommissioning. The likelihood of the effect is highly dependent on characteristics of each VC; for woodland caribou, the likelihood of sensory disturbance is high, for amphibians and birds it was rated as moderate, and for moose, furbearers, and bats it was rated as low (Table 6-4). These ratings were assigned based on sensitivity to disturbance, species composition, and density of wildlife recorded in the vicinity of the PDA during environmental baseline surveys. Overall, potential for effects of sensory disturbance on the wildlife VCs is rated as not significant.

6.12.3.3 Treated Effluent Release

Treated effluent from the Project will be discharged year-round through a diffuser into Patterson Lake South Arm. To understand the potential influence of this Project-interaction, a predictive contaminant dispersion and transport model was applied, as described in Appendix D.7. The results of the predictive modelling completed for water and sediment quality were used with the inputs from the air quality modeling (Appendix D.1) to predict concentrations in other environmental components, such as fish, aquatic vegetation, soil, and lichen, for the consideration of potential exposures to wildlife. The details on the pathways modelling completed for wildlife is provided Appendix D.7.

Based on the results of the predictive modelling and pathways assessment, there are negligible effects for wildlife expected in the receiving environment of the PLS effluent release (Appendix D.7). Wildlife considered for the assessment included bats, black bear (*Ursus americanus*), North American beaver (*Castor canadensis*), rusty blackbird, woodland caribou, white-tailed deer, red fox (*Vulpes vulpes*), Canada goose (*Branta canadensis*), spruce grouse (*Canachites canadensis*), snowshoe hare, mallard, moose, muskrat, river otter (*Lontra canadensis*), American white pelican (*Pelecanus erythrorhynchos*), lesser scaup (*Aythya affinis*), Gapper's red-backed vole (*Clethrionomys gapperi*), northern grey wolf, and lesser yellowlegs (*Tringa flavipes*). Species at Risk (SAR) considered for the protection of individuals included little brown myotis, rusty blackbird, woodland caribou, olive-sided flycatcher, horned grebe (*Podiceps auratus*), pine grosbeak, red-throated loon (*Gavia stellata*), common nighthawk, osprey, piping plover (*Charadrius melodus circumcinctus*), American white pelican, barn swallow (*Hirundo rustica*), bank swallow (*Riparia riparia*), Canada warbler (*Cardellina canadensis*), wolverine, and lesser yellowlegs.

Predicted concentrations in surface water in Patterson Lake South Arm remain well below drinking water criteria for livestock watering. The assessment also considered exposure to wildlife from food pathways, such as fish, vegetation, and other animals. The release of treated effluent from the PLS Project is not expected to negatively affect wildlife via food pathways for non-radionuclide intakes and radiological doses.

Residual Effects Classification

The REA for potential effects on wildlife from the treated effluent release rated the magnitude as low, with concentrations of some COPC in surface water predicted to exceed existing conditions but remaining below guidelines protective of livestock. The geographic extent is regional, with changes in the concentrations of some COPC in surface water extending through the RSA. The duration is long-term, with COPC concentrations in surface water returning to existing conditions in the post-decommissioning period. The reversibility is considered to be reversible in the long-term with the timing of the potential effect expected to occur in operations, decommissioning, and post-decommissioning. The frequency of the effect is continuous. The likelihood of the effect is high, based on the assumed effluent quality and quantity for the Project.

Overall, the Project-environment interaction is rated as not significant since intakes of COPC by wildlife are indiscernible or low compared with background exposures. Predicted

surface water quality is also expected to remain below the available drinking water guidelines for livestock watering. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.12.4 Cumulative Effects Assessment

6.12.4.1 Habitat Loss and Alteration

The CEA for wildlife habitat loss/alteration considered Project interactions with the NexGen's Rook I Project (Reasonably Foreseeable Development case; RFD). Although there is no overlap in Project disturbance areas, habitat loss on a regional scale has potential to affect species with large home ranges or sensitivity to fragmentation, such as woodland caribou. Here we focus on woodland caribou, as cumulative effects of habitat loss are not expected to be considerable for species such as amphibians or birds due to nonoverlapping project areas, previous disturbance impacts (anthropogenic and wildfire disturbance) to both the PLS project and Rook I project sites, and an overall small percentage of habitat impacted on a regional scale.

For the RFD case, a comparison of the amount of change between the baseline case (existing) and RFD case in woodland caribou habitat types relative to the amount of these habitat types available in the RSA and SK2 West Caribou Administration Units was completed. The RFD calculated habitat loss considering development of the SSA and PDA for the PLS project and the maximum disturbance area (MDA) for the Rook I Project (NexGen 2023). It is noted that forest harvest has the potential to cumulatively impact both wildlife and woodland caribou and continued forest harvest will contribute to cumulative habitat loss for woodland caribou in the SK2 West caribou administration unit, as well as wildlife in the RSA. Forestry impacts were not considered in the RFD case as magnitude and potential impact will vary depending on the scale of forest harvest occurring in the area. Notably, forestry companies are required to develop and implement management strategies to mitigate potential impacts to woodland caribou habitat (ENV 2021b).

Woodland caribou direct habitat loss displayed an increase of 0.7% (498.1 ha) in the RSA when considering the RFD case of PLS SSA and the Rook I MDA (Appendix D.8; Table 26). This habitat was comprised of 415.4 ha (0.2%) of high potential, 76.3 ha (0.4%) moderate potential, and 6.4 ha (0.1%) low potential woodland caribou habitat in the RSA (Appendix D.8; Table 26). In context of the SK2 West caribou administration unit, this is a decrease of 0.1% of high potential, 0.003% moderate potential, and 0.001% low potential woodland caribou habitat or a total of 0.03% loss of woodland caribou habitat (Appendix

D.8; Table 26). In this RFD case, a total of 1380.8 ha of habitat could be developed, which is comprised of 133.4 ha of anthropogenic disturbance, 740.5 ha of fire disturbance, and 507.0 ha of undisturbed habitat types (Appendix D.8; Table 26); development increases disturbance by 0.02% in the SK2 West caribou administration unit.

In the conservative RFD case of the PLS PDA and the Rook I MDA, direct habitat loss displayed an increase of 1.8% (856.4 ha) in the RSA (Appendix D.8; Table 27). This habitat was comprised of 623.8 ha (0.4%) of high potential, 165.3 ha (0.9%) moderate potential, and 45.1 ha (0.5%) low potential woodland caribou habitat in the RSA (Appendix D.8; Table 27). In context of the SK2 West caribou administration unit, this is a decrease of 0.1% of high potential, 0.006% moderate potential, and 0.006% low potential woodland caribou habitat or a total of 0.05% loss of woodland caribou habitat (Appendix D.8; Table 27). In this RFD case, a total of 2422.8 ha of habitat could be developed, which is comprised of 198.7 ha of anthropogenic disturbance, 1367.7 ha of fire disturbance, and 856.4 ha of undisturbed habitat types (Appendix D.8; Table 27); development increases disturbance by 0.03% in the SK2 West caribou administration unit.

Overall, changes in woodland caribou abundance and distribution could occur in the area with the RFD case. However, the area is considered disturbed from direct disturbances such as existing roads, exploration, past mining activities, and fire disturbance footprints (ENV 2021b) and indirectly disturbed due to habitat being within the 500-m disturbance buffer described for woodland caribou by ECCC (2012). Finally, development could impact habitat connectivity in the area; however, woodland caribou habitat is available in the RSA allowing for movement in the area. Here, the results of the CEA are predicted to mirror the REA effect ratings, except for the geographic extent criterion where effects would be regional due to the location of the Rook I Project Maximum Disturbance Area.

Additional mitigations are not expected to be required as the implementation of a Project-specific WCMP and adaptive management will likely reduce potential cumulative impacts. Ultimately, enhanced reclamation and habitat offset commitments in the WCMP for both projects in addition to regenerating wildfire habitat in the RSA being considered functional woodland caribou habitat at 40 years of age will increase local functional habitat for woodland caribou in the area over the long term.

6.12.4.2 Sensory Disturbance

The CEA for sensory disturbance also considered interactions with NexGen's Rook I Project. Sensory disturbance could be expected to increase cumulative impacts to wildlife

in the area for species with large home ranges (e.g., woodland caribou); however, both project areas are considered primarily disturbed due to existing disturbance in the area (direct and indirect disturbances). Cumulative impacts to wildlife and woodland caribou could be expected for a maximum of 29 years (PLS proposed lifespan is 29 years and Rook I proposed lifespan is 43 years; thus, 29 years of temporal overlap); however, given current levels of disturbance, Project plans, and mitigations, any negative cumulative effects are predicted to mirror the residual effect ratings. The WCMP includes mitigations on reducing sensory disturbance to woodland caribou. Therefore, no further mitigation measures are recommended.

6.12.4.3 Treated Effluent Release

The CEA for the release of treated effluent Project-environment interaction with wildlife considered NexGen's Rook I Project, which was identified with the potential to interact with the aquatic, terrestrial, and human environments and with sufficient information for including in the water and sediment quality modelling. The CEA for treated effluent release from the Rook I Project is based on the assessment of the Cumulative Scenario presented in the constituent transport and pathways modelling and HHERA in Appendix D.7.

The Cumulative Scenario considered the potential effects on wildlife from the additional Rook I Project effluent release. The details on the pathways modelling completed for wildlife in the Cumulative Scenario is provided Appendix D.7. Based on the results of the predictive modelling and pathways assessment, there are negligible negative effects for wildlife expected in the receiving environment for the Cumulative Scenario.

Predicted concentrations in surface water in Patterson Lake remain well below drinking water criteria for livestock watering. The assessment also considered exposure to wildlife from food pathways, such as fish, vegetation, and other animals. The release of treated effluent from the PLS and Rook I projects is not expected to negatively affect wildlife via food pathways for non-radionuclide intakes and radiological doses.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC, which increases the potential for negative effects on wildlife. However, intakes of COPC by wildlife are indiscernible or low compared with background exposures. Predicted surface water quality is also expected to remain below the available drinking water guidelines for livestock watering. Therefore, the potential effect is considered to be negligible and the cumulative effect ratings mirror the

residual effect ratings Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.12.5 Uncertainties

Habitat modeling for the Project was completed using desktop methods with field verification of ecosites (see Section 4.0). Some uncertainty exists in the accuracy and boundaries of land cover types identified for the Project, particularly for fine-scale ecosite classification. Therefore, some imprecision exists regarding the amount of land cover available for key indicator species or wildlife SOCC. Further, some wildlife species require specific microhabitats or landscape features that are not easily detectable or quantifiable using aerial imagery (e.g., cliff or rock ledges, abundant tree snags, specific plant communities or undergrowth characteristics). The amount of available habitat described for each wildlife species in the baseline case is therefore likely to be less than land cover metrics would suggest. As described above, habitat loss metrics are also highly conservative, and the exact area of habitat loss is not currently known but is likely to be lower than the values presented herein.

The fate and transport modelling completed for the REA and CEA used a probabilistic framework to capture uncertainties on input parameters and assumptions, as well as to acknowledge realistic ranges in parameter values. Therefore, the probabilistic results provide an accounting of the uncertainty inherent in the assessment through the upper-bound predictions. The 95th percentile predictions were also found to be below the available drinking water guidelines for livestock watering and intakes and doses associated with negative effects. The probabilistic assessment also considers possible future variations under changed climate.

6.13 Economic Wellbeing

6.13.1 Scope of Assessment

Economic wellbeing was selected as a VC for several reasons. The Project is anticipated to cause changes to levels of employment and income both locally and provincially, which will be especially beneficial and important to local priority recruitment communities as it will influence their economic wellbeing. As discussed in Section 3.0 Engagement, during engagement activities, local priority communities and Nations expressed an interest in ensuring that their residents, citizens, and members were prioritized for economic opportunities, and that economic benefits were distributed amongst all local communities

with potential to be affected by Project activities. Additionally, local priority recruitment communities and Nations expressed frustration that, in their experience, Provincial taxes and royalties have not been used to improve infrastructure in northern communities, and they expressed concern that local communities would not benefit from increased Provincial income levels. Indigenous Nations also expressed concern about impacts to continued participation in traditional economies.

As described in Table 5-2, the key indicators for this VC are municipal and provincial economy, traditional economy, and local employment and income levels and distribution; the measurable parameters evaluated in this effects assessment are specific to each key indicator, as described below.

- Municipal and provincial economy:
  - Predicted changes to income levels in local municipality and annual provincial tax revenues.
  - Predicted changes to level of business activity in Saskatchewan (at local and regional levels).
- Traditional economy:
  - Predicted changes to income received and level of participation in traditional economies compared to existing conditions.
- Local employment and income levels and distribution:
  - Predicted changes to local and regional employment and income levels and distribution compared to existing conditions.

6.13.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs and in some cases, between measurable parameters within VCs. For economic wellbeing, the socio-economic study areas were used to assess increased economic opportunities and are defined as follows (Figure 6-12 and Figure 6-13).

- Socio-economic Local Study Area: The LSA includes communities of interest with population data available (see Section 4.7.1) who have lands overlapping, or adjacent to, the SSA and PDA, or populated centers that are primarily accessed using the Project transportation route (Highway 955 and Highway 155). The communities selected to be part of this study area are those with the greatest

potential to experience Project effects given their proximity to Project activities, and as such, are those who will be prioritized to receive Project related economic benefits and are referred to as "priority recruitment communities."

- Socio-economic Regional Study Area: The RSA is comprised of all populated centers within the Northern Saskatchewan Administration District (NSAD). The NSAD was selected for this study area because the Government of Saskatchewan requires as part of the mine surface lease agreement that mining companies prioritize hiring residents of Saskatchewan's North (people residing in the NSAD) for employment and contract opportunities. As such, qualified residents and companies from the NSAD will be targeted to receive economic opportunities.

The land-use study areas were used to assess changes to land and resource quantity, quality, and accessibility as it relates to traditional economies, and are defined as follows (Figure 6-14).

- Land-use Local Study Area: The LSA includes a 5 km radius from the boundaries of the PDA for a total area of 181.5 km^2 or 18,152.3 ha. This study area was selected because it mirrors the traditional land and resource use spatial scales, and it encompasses the area where measurable changes were predicted to occur to for select pathways related to terrestrial environment, air quality, noise and vibration, and visual landscape VCs, which have the potential to affect land and resource use including those associated with traditional economies.
- Land-use Regional Study Area: The RSA includes the Clearwater River watershed boundary north of Broach Lake to Naomi Lake for a total area of 758.0 km^2 and 75,786.0 ha. This study area was selected to include the land use LSA and the surface water and fish and fish habitat LSA. It encompassed the area where direct effects to aquatic environment VCs were predicted with potential to effect land and resource use including those associated with traditional economies.

The assessment of economic wellbeing, specifically effects to traditional economies considered predicted effects to traditional land and resource use. The results of the assessment of economic wellbeing were used to inform assessment of effect pathways related to community wellbeing and human health.

6.13.1.2 Potential Effect Pathways

Project-environment interactions for the VC of economic wellbeing that were identified as potential effect pathways during each Project stage include the following.

- Increased economic opportunities due to employment, contract, and training opportunities and payment of taxes and royalties during construction and operations.
- Predicted changes to land and resource quantity, quality, and accessibility during all Project phases.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.13.2 Screening Assessment, where relevant.

6.13.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.13.2.1 Increased Economic Opportunities

Increased economic opportunities due to employment, contract, and training opportunities and payment of taxes and royalties will result in measurable changes to income levels due to increased employment income, municipal and annual provincial tax revenues, the level of business activity in Saskatchewan (at local and regional levels), and income received and level of participation in traditional economies compared to existing conditions.

Economic benefits, which include employment and government revenues, will be realized at the federal, provincial, and local levels during construction and operations, and to a lesser extent, decommissioning of the Project. A thorough economic benefits assessment (included in Appendix C.5) was completed for the Project in 2023 and details the predicted economic benefits of the Project.

During construction, capital expenditures are predicted to result in almost 11,300 direct, indirect, and induced full time equivalent (FTE) employment positions across Canada, 7,400 of which will be in Saskatchewan. This is expected to result in $981 million in labour income in Canada, $677 million of which will remain in Saskatchewan.

During operations, direct, indirect, and induced FTEs range from 551 in Saskatchewan to 688 across Canada. Labor income during operations is estimated to be $59 million in Saskatchewan, and $66 million across Canada. Of the predicted FTEs, direct employment is expected to result in approximately 325 positions in Saskatchewan, creating more than $40 million in direct labour income in Saskatchewan.

Residents of the LSA and RSA will be prioritized for direct employment and contract opportunities. Fission is currently working with several economic development organizations from the LSA and RSA to identify services already available and to support local companies or Nations to grow, diversify, and/or form partnerships with the goal of building local capacity so they can increase potential to experience economic benefits. Employment opportunities will also result in increased on-the-job, transferable training opportunities for direct and indirect employees so that positive changes to economic wellbeing may continue to be experienced after the operations phase is complete.

If people engaged in traditional economies choose to pursue employment opportunities with the Project, it may result in changes to the number of people engaged in traditional economies and the level of participation in these economies. Residents of the LSA communities are currently engaged in several traditional economies including commercial fishing, trapping, and wild rice harvesting. Most employees will work shifts that are two-weeks on and two-weeks off which will allow time and opportunity for people engaged in traditional economies to also be employed at the Project. Should people engaged in traditional economies choose to leave their current industry to take a position at the Project, it would represent a shift in industry sectors, and it is not predicted to result in adverse effects to economic wellbeing overall.

The Government of Saskatchewan receives revenues from the mining industry in the form of revenue royalties, profit royalties, corporate income tax, and personal income tax. The Government of Canada receives revenues in the form of corporate income tax and personal income tax. The Project is predicted to contribute $571 million in Provincial revenue royalties, $728 million in Provincial profit royalties, $1 million in Provincial personal income tax revenues, $1.9 million in Federal personal income tax, and $992 million in corporate income tax.

With consideration of the above discussion, increased employment, income, and training opportunities, and payment of taxes and royalties will occur and are predicted to have a

predominately positive effect on economic wellbeing in the LSA and RSA. Therefore, this potential Project-effect pathway has not been moved forward for REA.

6.13.2.2 Changes to Land and Resource Quantity, Quality, and Accessibility

Changes to land and resource quantity, quality, and accessibility has potential to contribute to measurable changes in income received and level of participation in traditional and land-based economies compared to existing conditions.

As noted in Section 4.7, traditional economies including trapping and commercial fishing are known to occur in the SSA, PDA, land-use LSA, and land-use RSA. While there is no record of commercial fishing and trapping taking place in the study areas in the last five years, these uses are permitted and have potential to occur in the future. Similarly, land based commercial activities in the LSA and RSA include an outfitting and lodge operation which offers access to recreational fishing.

Land and resource quantity, quality, and accessibility will be adversely affected by Project activities (see Section 6.14 and 6.15 for additional details) and these measurable changes have potential to affect future use of the SSA, PDA, and land use LSA for trapping and fishing. Prior to construction, Fission will be required to sign a Mine Surface Lease Agreement with the Province of Saskatchewan, and as part of that agreement Fission will commit to compensate traditional land users for any lost income that directly results from Project activities. Because people engaged in traditional economies will be compensated for any lost income they experience, no adverse impacts to economic wellbeing are expected to occur as a result of changes to land and resource quantity, quality, and accessibility.

Increased accessibility due to improved road conditions in the LSA and RSA has the potential to affect the economic wellbeing of commercial outfitters and lodges by increasing the risk of property damage and theft. Roadways will be developed and maintained within the PDA, but these roadways will not be publicly accessible due to the presence of a security gates. No other roadway improvements associated with the Project are proposed. As such, no pathway for changes in accessibility to affect the economic wellbeing of outfitters and lodges are present.

6.14 Traditional Land and Resource Use

6.14.1 Scope of Assessment

Traditional land and resource use was selected as a VC because Patterson Lake is a traditional land use area for several Nations with overlapping ancestral lands or current use areas including CRDN, Buffalo River Dene Nation (BRDN), Birch Narrows Dene Nation (BNDN), Métis Nation – Saskatchewan (MN-S), Athabasca Chipewyan First Nation (ACFN), Black Lake Denesųłiné First Nation (BLDFN), and Fond Du Lac Denesųłiné First Nation (FLDFN), and Project activities may result in changes to traditional land and resource quality and quantity. Through engagement activities, all Indigenous groups noted above expressed concern regarding the potential for Project activities to affect Aboriginal and Treaty Rights and the quality of land and resources, and three Nations provided detailed information about historical, contemporary, and foreseeable future uses in the Patterson Lake area.

As described in Table 5-2, the key indicators for this VC are land and resource quantity and accessibility and land and resource quality and user experience; the measurable parameters evaluated in this effects assessment are described below.

- Predicted land area that will become inaccessible for land and resource use compared to current conditions.
- Predicted change to number and social significance of geographically fixed features or unique or rare sites or resources which will be disturbed or become in accessible compared to current conditions.
- Predicted changes to land area where sensory disturbances may be present compared to existing conditions.
- Predicted changes to vegetation, fish, and wildlife compared to existing conditions.
- Predicted changes to human health from changes to air, water, and traditional food quality.

6.14.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and the land and resource use LSA and RSA (defined in Section 6.13.1.1 and shown in Figure 6-14) were used for assessment of traditional land and resource.

6.14.1.2 Potential Effect Pathways

Project-environment interactions for the VC of traditional land and resource use were identified as potential effect pathways during each Project stage and are as follows.

- Land cleared and disturbed for Project infrastructure and changes to land accessibility due to presence of barriers may cause changes to the quantity of land available for continued traditional land and resource use compared to current conditions.
- Measurable changes to the natural environment may cause changes to quantity and quality of resources important for continued traditional land and resource use compared to current conditions.
- Voluntary avoidance may alter the quantity of land that is considered suitable for traditional land and resource use compared to current conditions.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.14.2 Screening Assessment, where relevant.

6.14.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.14.2.1 Land Cleared and Disturbed and Presence of Barriers

Land cleared and disturbed for Project infrastructure and the presence of barriers may cause changes to the quantity of land available and accessible for continued traditional land and resource use compared to current conditions.

Land cleared and disturbed for Project infrastructure was calculated in Section 6.11.3.1 to determine vegetation loss and alteration and was conservative in using the SSA (400.1 ha) as the total area to be disturbed, rather than the proposed Project footprint (197.9 ha). Loss was calculated by excluding existing anthropogenic disturbance within the SSA (43.7 ha) from the total SSA, for a total area of 356.5 ha. This total area also represents the quantity of land that will no longer be suitable for traditional land and resource use.

During construction, security gates will be installed at the intersections of the site access road and Highway 955 and used to restrict access to the SSA by unauthorized personnel. A security gate is currently in use in the SSA to manage access to the existing exploration

camp. It is assumed that the total area that is currently restricted to unauthorized personnel mirrors the land base where existing infrastructure is present (6.6 ha). The use of security gates during construction, operations, and a portion of decommissioning is predicted to result in a measurable increase of 393.5 ha that will no longer be accessible for traditional land and resource use.

The impacted area is currently or has previously been used for hunting, trapping, gathering, and ground transportation. One geographically fixed land use feature, an access trail, is present in proximity to the SSA and has potential to be impacted by clearing and disturbance (MN-S NR2 2023).

Measurable changes to the quantity of land available and accessible for use are predicted to occur as a result of land clearing and disturbance, and the presence of barriers to movement. As such, this Project-effect pathway is considered a key interaction and has been moved forward for REA.

6.14.2.2 Measurable Changes to the Natural Environment

Measurable changes to the natural environment have the potential to contribute to measurable changes to the quality and quantity of resources available and suitable for continued traditional land and resource use compared to existing conditions.

Measurable changes to the natural environment included consideration of residual effects to the VCs of fish and fish habitat (Section 6.10.3), vegetation (Section 6.11.3), and wildlife (Section 6.12.3), and the results of the HHERA (Appendix D.7).

Measurable changes to fish and fish habitat were predicted to occur as a result of changes to surface water quality and quantity; however, these changes were not predicted to have significant effects on fish habitat and fish health. Similarly, the HHERA results predicted that consumption of fish by land and resource users would not result in human health impacts as a result of the PLS Project. Changes to fish quantity and quality as a result of increased recreational land use by members of the workforce was also considered but given that Fission will employ a catch and release policy, no changes to the quality and quantity of fish are predicted.

As noted in Section 6.14.2, changes to vegetation quantity are predicted to occur in the SSA due to the clearing and disturbance of land. Changes to the quantity of vegetation resources available for continued traditional use will be measurable in the SSA; however,

the affected area is not known to contain any unique or rare species or habitats that are not abundantly available within the LSA or RSA. As noted in the HHERA, effects to human health are not predicted to occur from consuming vegetation that has been exposed to changes in air and water quality. While this change in vegetation resource quantity is predicted to be measurable, it is considered to have a minor interaction with the ability to continue traditional land and resource use.

Measurable changes to the presence and abundance of wildlife species important for traditional land and resource use are predicted to occur in the LSA as a result of habitat loss and sensory disturbances and are discussed in Section 6.12.3. For the most part, effects to wildlife are predicted to be low in magnitude. The exceptions include moderate impact to function for birds as a result of sensory disturbances, and moderate to high impact on woodland caribou due to sensory disturbance and loss of habitat because of their conservation status. The results of the HHERA predicted that consuming wildlife would not result in effects to human health for traditional land users. In the context of traditional land and resource use, these changes have potential to result in negligible to minor changes in the quantity and quality of resources important and suitable for continued traditional land and resource use.

Overall, measurable changes to the natural environment are predicted to occur, but these changes are predicted to have a negligible to minor interaction with availability and accessibility of resources required and suitable continued traditional land and resource use. As such, this Project-effect pathway has not been moved forward for REA.

6.14.2.3 Voluntary Avoidance

Voluntary avoidance may alter the quantity of land that is considered suitable for traditional land and resource use compared to current conditions. Voluntary avoidance can result from the presence and anticipation of sensory disturbances and changes or perceived changes to the safety of the land and resources. Avoidance areas are selected by individual land users based on the personal sensitivities and preferences, but it is assumed that avoidance may occur on any land where sensory disturbances and changes to safety occur. BNDN members explained that ongoing mining activities near the Project site would prevent them from returning to harvest there.

Sensory disturbances considered in this assessment include changes to noise and vibration, and visual landscape. The potential for changes to odors and lighting to be present were also considered.

Measurable changes to noise and vibration levels are predicted to occur within the land use LSA and are discussed in Section 6.3. Measurable changes were compared to existing limits and criteria, and for the most part, noise levels are predicted to remain within applicable limits. Modeling predicted that one location on the south side of Patterson Lake within the land use LSA may have noise levels that are marginally above the provincial nighttime limit during construction and operations. The location of this exceedance overlaps a known camping and recreational area south of the PDA. The potential for traditional land and resource users to experience adverse impacts as a result of changes to noise levels is dependent on several factors including personal preferences, sensitivities, and the type of land uses they are engaged in. As such, land and resource users have potential to experience noise disturbances both in areas where noise levels exceed guidelines and in areas where levels are elevated, but still within the applicable guidelines. For a conservative assessment, it is assumed that sensory disturbances as a result of increased noise and vibration have potential to be experienced across the LSA.

Measurable changes to visual landscape are also predicted to occur during construction and operations and are described in Section 6.4. Project infrastructure will be visible from key locations and viewpoints on Patterson Lake in areas within the LSA and may affect land use experience for land users on Patterson Lake.

Consideration of the presence of odors and changes to lighting was qualitative as predictive modelling or assessment related to odor and lighting was not available. Pathways are present where Project activities may result in changes to odor; however, the ability for odors to create a sensory disturbance depends on the preferences and sensitivities of the land user interacting with the change in odor. Similarly, changes to light outputs from the Project are predicted to occur, but the potential for these changes to result in avoidance of land and resource use depends on the types of uses, if uses are occurring at night, and the preference and sensitivity of the land user. Given the uncertainty around odor generation and light outputs, the size of the potentially affected area, and the sensitivity of land and resource users, it is assumed for this assessment that disturbances from odor and light may be present in the SSA and PDA. When conditions are present for increased visibility, light from the Project may also be visible in areas of the land-use LSA.

Real or anticipated changes to the safety of the land and resources was assessed by considering the total land area within the land use study areas where interactions between workers and land users may occur and where there are conditions present for impacts to human health as a result of air, water, or traditional food consumption. Approximately 200

people are estimated to be working and residing in the SSA at a time during peak operation. Given the presence of security gates which will limit access for traditional land users, interactions with members of the workforce in the SSA are not predicted to occur. Within the PDA, where access will not be restricted, there is potential for interactions to occur between workers and land users which may result in voluntary avoidance of the PDA. Additionally, workers will be permitted to use the PDA and LSA (e.g., Patterson Lake) for recreational purposes when their shift is over each day, and interactions with traditional land users may occur when workers are engaged in recreational activities.

Changes to the safety of resources include consideration of changes to human health effects caused by changes to air quality, water quality, and the quality of traditional foods were considered. The HHERA predicted that changes to the quality of air, water, and traditional foods from the PLS Project would not result in negative impacts to human health. While no negative impacts to human health are predicted to occur, some traditional land and resource users may choose to voluntarily avoid the SSA, PDA, and land use LSA as a precaution.

Measurable changes to the presence of sensory disturbances will occur mostly in the SSA and PDA but have potential to occur in the LSA. For a conservative assessment, it is assumed that some land and resource users may voluntarily avoid land in the LSA which would result in avoidance of 7,854 ha of land. This change in the total area of land where land and resource use is avoided is considered a key interaction and has been moved forward for further assessment in Section 6.14.3.

6.14.3 Residual Effects Assessment

The residual effects assessment for the traditional land and resource use VC is provided below and summarized in Table 6-4.

6.14.3.1 Land Cleared and Disturbed and Presence of Barriers

Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for traditional uses in the SSA. One geographically fixed traditional use site, a trail, is present within the affected area. Evidence provided in the community-led studies received by Fission suggests that current uses in the SSA are similar to those in the PDA and include ground transportation, hunting, trapping, and gathering (detailed in Section 4.7.3). Continuance of these traditional land and resource

activities will be restricted on a continuous basis during construction, operations, and a portion of decommissioning, and will be restored prior to the post decommissioning phase.

Residual Effects Classification

The magnitude of the effect was determined based on consideration of function. Function in this case refers to the ability for traditional land and resource users to continue partaking in traditional land and resource use activities. The ability to continue use was assessed qualitatively and considered loss of function from a site, local, and regional perspective to predict the magnitude of change to specific subsets of affected traditional land and resource users.

Geographically, the land area that is predicted to lose function (the SSA) comprises approximately 28.0% of the total area of the PDA, 5.0% of the total LSA, and 1.0% of the total RSA. Given that the percentage of area lost comprises a small percentage of the land base available and compatible for continued use for traditional land users, it is predicted that the magnitude of the effect on traditional land use for traditional land users from affected Nations will be moderate in that loss of function is present but limited to a small geographic area.

The affected area will be located in the SSA and potentially portions of the PDA should expansion occur in the future and is considered to be local in geographical extent. The effect is considered to be medium-term in duration. Land clearing and disturbance and access restrictions due to the security gates will be present during construction and operations, and possibly portions of decommissioning, but access and function will be restored during the decommissioning process. The amount of land available and accessible for traditional use will be restored after stressors like barriers and restrictions are removed and land has been reclaimed or revegetated. While land within the TMF will not be restored to existing conditions, it will be revegetated and will become accessible for use. As such, this effect is predicted to be reversible in the short-term.

Throughout the construction and operations phases and a portion of decommissioning, effects to the amount of land available and accessible for traditional use will be continuous in frequency. Land clearing and disturbance, and presence of security gates that restrict access to the SSA are highly likely to occur; however, the likelihood that these changes will affect contemporary traditional land and resource use in the study areas is considered low given the presence of avoidance of the area due to existing industrial land uses.

Overall, the reduced land area available and accessible for traditional land and resource use is predicted to be not significant. The magnitude of the effects will be monitored through the Social Monitoring Program, and ongoing and open engagement with local traditional land users including the N-19 Trappers Association. A grievance mechanism will also be implemented which can be used to report impacts to traditional land use and users.

6.14.3.2 Voluntary Avoidance

Measurable changes to the amount of land that has potential to be avoided by traditional land and resource users are predicted to occur within the LSA. These measurable changes have potential to affect current and foreseeable future land users, their families, and the larger community or Nation.

Residual Effects Classification

The magnitude of the effect was determined based on consideration of function. Function in this case refers to the preference of traditional land and resource users to continue partaking in traditional land and resource use activities. The preference to continue use was assessed qualitatively and considered loss of function from a site, local, and regional perspective to predict the magnitude of change to specific subsets of affected traditional land and resource users.

The potential is present for land users to avoid continued and future use of land in the LSA. While the number of people who are currently using the land in the LSA is predicted to be low, the number of people with the potential to use the land during the life of the Project is not known but may span two generations of land and resource users. Several camping and harvesting sites have been identified in the LSA and continued use of these geographically fixed sites may be affected if the LSA is voluntarily avoided. As such, is predicted that this interaction will have a limited effect on the continuance of traditional land and resource use, and the magnitude is predicted to be moderate. The effect is predicted to occur in the LSA, so the geographic extent is predicted to be local.

Stressors with potential to cause avoidance of the LSA will be removed during the decommissioning phase; however, avoidance may persist to the end of post decommissioning. As such, this effect is predicted to be long-term in duration. Avoidance of the LSA is predicted to be reversible, but avoidance of the area by some land users has potential to persist after the stressors that cause avoidance are removed, meaning the effect will be reversible long-term. Throughout construction, operation, decommissioning, and

possibly into the post-decommissioning phase, avoidance of the LSA is predicted to occur continuously. Given that avoidance of land proximate to existing industrial activities has already been reported as a common practice by affected Nations, the likelihood that areas within the LSA will be avoided is considered moderate and is expected to occur.

With consideration of these ratings, this effect is predicted to be not significant; however, given uncertainty regarding the number of land users who are actively using the LSA, this effect will be monitored throughout the life of the Project. Monitoring activities include the Social Monitoring Program, Regional Traditional Food Study, and ongoing engagement with Indigenous Nations and local land users such as the N-19 Trappers Association to identify and address concerns as they arise. A grievance mechanism will also be developed which land users can access to report any concerns or issues to Fission as they arise. Fission is currently engaging with each affected Nation to identify accommodation opportunities to help offset impacts to Aboriginal and Treaty Rights that may occur as a result of increased voluntary avoidance.

6.14.4 Cumulative Effects Assessment

6.14.4.1 Land Cleared and Disturbed and Presence of Barriers

The CEA for this residual effect considered reported changes to quantity of land available and accessible for traditional land and resource uses as a result of NexGen's Rook I Project. The REA for the Rook I Project estimated that changes to land access as a result of project activities may result in a reduction of 981 ha of land available and accessible for continued traditional land and resource use (their designated maximum disturbance area; NexGen 2024). The land area occupied by the Rook I Project will not overlap the land affected by the PLS Project directly, but it has potential to affect the total amount of land available and accessible for use within the land use RSA. The total amount of land with potential to be affected by both projects is approximately 1,381.1 ha, which comprises approximately 2.6% of the land use RSA.

Similar to Fission, as part of the Project design, NexGen made efforts to reduce their Project footprint by optimizing the use of cleared areas for Project activities, using existing access road infrastructure, and designing an efficient infrastructure footprint. Additionally, both Projects are actively engaging with affected Nations to establish suitable accommodations to offset the magnitude of this effect.

Potential accommodation measures suggested by CRDN during engagement to offset the magnitude of this effect included offering unfettered access rights to CRDN members, providing support for culture camps or other similar initiatives, and providing support for Dene language initiatives for CRDN youth. While provision of unfettered access is not possible for safety reasons, Fission made a contribution to the 2024 CRDN Hodge Lake Family Camp Days which took place in August 2024. In February 2024, Fission and CRDN signed a mutual benefit agreement which will provide the Nation with economic and social benefits from the Project which can be used at CRDN's discretion. BNDN also raised concerns about this effect and recommended that monitoring include ongoing and open engagement with BNDN. Fission has committed to developing a Nation-specific Communication and Information Sharing Plans which will be developed in collaboration with each Nation and will formalize plans for ongoing and open engagement. MN-S suggested that Fission work collaboratively with NexGen to define opportunities to share infrastructure and minimize footprint and adverse impacts to the airshed, waterways, aquatic species, birds, and wildlife, and Métis land and resources use. While the regulatory process requires that the Project is presented as a stand-alone facility, Fission has previously invited NexGen to discuss opportunities for infrastructure sharing and will remain open to having these discussions whenever NexGen is ready. MN-S also recommended that Fission work collaboratively with the Métis to ensure continued access to Métis cabins, campsites, trails, and harvesting areas. Fission has committed to work collaboratively with MN-S to identify and aim to resolve impacts to access that result from the Project.

While the Rook I Project is considered a reasonably foreseeable future development, the project is still in the midst of the approvals process. If it is approved, the increase land area that will no longer be accessible or available for use is expected to have a limited effect on the function of traditional land and resource use in a regional context. Indigenous land users who took part in community-led studies have noted that in addition to the total land area that will be affected by the PLS and Rook I projects, the total area previously available and accessible for land and resource use is slowly being reduced by a combination of government policies, industrial developments, and natural occurrences such as wildfire (BRDN 2023; MN-S NR2 2023). The amount of land that has already been affected through these mechanisms in each traditional territory is unknown, but from a social context, the magnitude of the effect has potential to be increased. With consideration of this context and the potential effects to function in the RSA, this effect is predicted to be moderate in magnitude.

The affected land areas for both projects are located in the RSA, so the effect is predicted to be regional in extent. For the purpose of the assessment, it is assumed that the PLS Project and Rook I Project will have temporal overlap, and that the PLS Project construction and operations phases will occur within the same overall window as the Rook I construction and operations phases, where land quantity will be affected. Given that the effects will occur within the construction, operations, and a portion of the decommissioning phase, the duration is predicted to be medium in term. This cumulative effect will be reversible and is predicted to cease once the stressors are removed, and the land is restored or revegetated. While the effect is taking place, it will be continuous in frequency. If both projects proceed, the potential for the reduction of land area available and accessible for use to affect the continuance of traditional land and resource use in the RSA is predicted to be moderately likely to occur.

6.14.4.2 Voluntary Avoidance

Residual effects to the quantity of land that will be avoided by traditional land and resource users were assessed cumulatively with the total avoidance area predicted at the Rook I Project. In the Rook I Project effects assessment, a total land area comprising 19% of the Rook I LSA (which equates to approximately 23,687 ha) was predicted to be the area with potential to be avoided by traditional land and resource users (NexGen 2024).The Rook I Project affected area has considerable overlap with the PLS Project land use LSA, but to ensure a conservative assessment, and allow for uncertainty, the total sum of affected areas for both projects (31,541 ha) was selected to represent the total land area with potential to be avoided if both projects proceed with temporal overlap. The total potentially affected area comprises approximately 59.5% of the PLS Project land use RSA.

Land use is predicted to occur in the RSA but the number of land and resource users who are currently using land in the RSA has not been determined. The choice to avoid land and resource uses in the affected area will be a personal decision for each affected land user based on their preferences and sensitivities to the stressors present or perceived to be present. The amount of avoidance that may occur in the RSA may be mitigated through information sharing and participation in environmental monitoring programs (Section 9). While these measures may help reduce the level of avoidance, avoidance is still predicted to occur for some, but not all land users in the RSA.

With consideration of this information, avoidance of the affected areas for both projects is predicted to have a limited effect on function (the ability to continue traditional land and

resource use), resulting in a moderate magnitude. This cumulative effect will occur in the RSA and is considered regional. It is predicted to be medium-term in duration as it will occur from construction to the end of post decommissioning for the PLS Project. Given the individuality of avoidance preferences and timelines, the effect is predicted to be reversible long-term as avoidance may persist after stressors have been removed. The effect is predicted to occur continuously and given the presence of two industrial facilities operating in proximity to one another, it is assumed that avoidance is likely to occur, but is only moderately likely to affect the continuance of traditional land and resource use in the region.

The magnitude of the effect will be monitored over the life of both projects through ongoing engagement and information sharing with affected Nations and land users. Additionally, environmental monitoring programs for both projects are expected to include involvement of members of the affected Nations. Details of these programs have been or will be determined in consultation with affected Nations.

6.14.5 Uncertainties

Assessment of traditional land and resource use considered the existing environment, REA, and CEA results for the VCs of air, noise and vibration, visual landscape, surface water quality, surface water quantity, fish and fish habitat, vegetation, wildlife, other land and resource use, heritage resources, and community wellbeing and human health. Uncertainties related to these VCs are also considered uncertainties for assessment of impacts to traditional land and resources.

Traditional land and resource use information was shared by four of the affected Nations and was based on interview programs conducted with samples of the population from each Nation. While access to this information helped to build confidence in the assumptions used for the assessment, there is still uncertainty regarding the number of traditional land and resource users who are actively using the study area, the frequency and patterns of use, and how many of the geographically fixed sites of cultural significance located in the study areas are still in use.

Uncertainties are also present regarding the application of avoidance behaviors including how many people may engage in avoidance of affected areas, how long avoidance may occur, and the avoidance buffers that may be applied.

To reduce the level of uncertainty, Fission has committed to develop and implement a Social Monitoring Program which will include completion of a social impact assessment and social management plan every three to five years during construction and operation of the Project. The program will monitor changes to land and resource use as a result of Project activities and will aim to mitigate any impacts to land and resource use as they arise using adaptive management. Fission has also committed to conduct a Regional Traditional Food Study prior to operation which may also help to assess any unexpected changes to harvesting and accessibility.

6.15 Other Land and Resource Use

6.15.1 Scope of Assessment

Recreational and commercial land uses are present within the Patterson Lake area. Project activities have the potential to result in changes to the quantity or quality of resources important for continued land and resource use such as wildlife, fish, and vegetation. The availability, accessibility, quantity, and quality of lands and resources required for recreational and commercial use may also be affected by Project activities. Project activities may result in avoidance of available lands and resources or changes to the land use experience due to perceived or real impacts to the land, resources, or land user.

As described in Table 5-2, the key indicators for this VC are land and resource quantity and accessibility and land and resource quality and user experience; the measurable parameters evaluated in this effects assessment are described below.

- Predicted land area that will become inaccessible for land and resource use compared to current conditions.
- Predicted change to number and social significance of geographically fixed features or unique or rare sites or resources which will be disturbed or become in accessible compared to current conditions.
- Predicted changes to land area where sensory disturbances may be present compared to existing conditions.
- Predicted changes to vegetation, fish, and wildlife compared to existing conditions.
- Predicted changes to human health from changes to air, water, and traditional food quality.

6.15.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, but the study areas used to describe other land and resource use match those used to describe economic wellbeing and traditional land and resource use and are defined in Section 6.13.1.16.14.1.1 (Figure 6-14).

6.15.1.2 Potential Effect Pathways

Project-environment interactions for the VC of other land and resource use that were identified as potential effect pathways during each Project stage include the following.

- Land cleared and disturbed for Project infrastructure and changes to land accessibility due to presence of barriers may cause changes to the quantity of land available for continued recreational and commercial land and resource use compared to current conditions.
- Measurable changes to the natural environment may cause changes to quantity and quality of resources important for continued recreational and commercial land and resource use compared to current conditions.
- Voluntary avoidance may alter the quantity of land that is considered suitable for recreational and commercial land and resource use compared to current conditions.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.15.2 Screening Assessment, where relevant.

6.15.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.15.2.1 Land Cleared and Disturbed and Presence of Barriers

Recreational and commercial land uses have the potential to take place in the study areas, are described in Section 4.7.1.4, and may include fishing, hunting, trapping, gathering, and transportation by land. Land cleared and disturbed for Project infrastructure and changes to land accessibility due to the presence of barriers may cause changes to the quantity of

land available for continued recreational and commercial land and resource use compared to current conditions.

The total area of land that will be affected by clearing and disturbance and presence of barriers was assessed in Section 6.14.2.1 and is predicted include an area in the SSA containing upwards of 393.5 ha, as a conservative estimate.

The amount of land that will be disturbed or become inaccessible is measurable and given the potential for the presence of current commercial and recreation land uses, this effect pathway is considered a key interaction and moved forward to a REA.

6.15.2.2 Measurable Changes to the Natural Environment

Measurable changes to the natural environment have the potential to contribute to measurable changes to the quality and quantity of resources available and suitable for continued recreational and commercial land and resource use compared to existing conditions.

Measurable changes to the natural environment included consideration of residual effects to the VCs of fish and fish habitat (Section 6.10.3), vegetation (Section 6.11.3), and wildlife (Section 6.12.3), and the results of the HHERA (Appendix D.7).

The potential for these measurable changes to affect land and resource use was assessed and detailed in Section 6.14.2.2. Overall, measurable changes to the natural environment are predicted to occur, but these changes are predicted to have a negligible to minor interaction with availability and accessibility of resources required and suitable for continued other land and resource use. As such, this Project-effect pathway has not been moved forward for REA.

6.15.2.3 Voluntary Avoidance

Voluntary avoidance may alter the quantity of land that is considered suitable for recreational and commercial land and resource use compared to current conditions. Voluntary avoidance can result from the presence and anticipation of sensory disturbances and changes or perceived changes to the safety of the land and resources. Avoidance areas are selected by individual land users based on the personal sensitivities and preferences, but it is assumed that avoidance may occur on any land where sensory disturbances and changes to safety occur or have potential to occur.

Sensory disturbances considered in this assessment include changes to noise and vibration, visual landscape, odors, and light and the potential for changes to these VCs to effect land and resource use was assessed in Section 6.14.2.3. Real or anticipated changes to the safety of the land and resources were also assessed in Section 6.14.2.3 by considering the total land area where interactions between workers and land users may occur and where there are conditions present for impacts to human health as a result of traditional food consumption.

The results of the assessment on land use showed that measurable changes to noise and vibration, visual landscape, odor, and light may affect the recreational and commercial land user experience and are predicted to occur within the LSA. Interactions between members of the workforce and land users have potential to occur in the PDA and LSA and may result in avoidance of these study areas by other land and resource users. The HHERA predicted that changes to the quality of air, water, and traditional foods would not result in impacts to human health.

Measurable changes to the presence of sensory disturbances will occur mostly in the SSA and PDA but have potential to occur in the LSA. For a conservative assessment, it is assumed that some land and resource users may voluntarily avoid land in the LSA which would result in avoidance of 7,854 ha of land. This change in the total area of land where land and resource use is avoided is considered a key interaction and has been moved forward for further assessment in the REA.

6.15.3 Residual Effects Assessment

The residual effects assessment for the other land and resource use VC is provided below and summarized in Table 6-4.

6.15.3.1 Land Cleared and Disturbed and Presence of Barriers

Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for recreational and commercial uses in the SSA. One geographically-fixed site, a trail, is present within the affected area with potential to be used to support recreational or commercial purposes. The presence and frequency of current recreational and commercial land use in the SSA has not been confirmed but conditions are present that could support uses such as hunting, trapping, gathering, and ground transportation. If these uses take place in the SSA, their continuance

will be restricted on a continuous basis during construction, operations, and a portion of decommissioning, and will be restored prior to the post decommissioning phase.

While there are no current plans for land clearing and disturbance to occur outside of the SSA, should these activities occur in the PDA it could result in additional land area that is no longer accessible or available for use. Land within the PDA is similar to land in the SSA and does not include any additional unique or rare features important for recreational or commercial land and resource use.

Residual Effects Classification

The results of the REA for other land and resource use mirror those described in Section 6.14.3 for traditional land and resource use. In summary, given that the percentage of area lost comprises a small percentage of the land base available and compatible for continued recreational and commercial use, it is predicted that the magnitude of the effect will be moderate in that loss of function is present, but limited to a small geographic area. The affected area is predicted to be local in geographical extent and medium-term in duration. The amount of land available and accessible for use will be restored or revegetated after stressors like barriers and restrictions are removed so the effect is predicted to be reversible in the short-term. The effect is predicted to occur continuously if it occurs, but the likelihood that this effect pathway will affect recreation and commercial land uses regionally is predicted to be low.

Overall, the reduced land area available and accessible for other land and resource use is predicted to be not significant. The magnitude of the effects will be monitored through ongoing and open engagement with local land users including the N-19 Trappers Association. A grievance mechanism will also be implemented which can be used to report impacts to land use and users.

6.15.3.2 Voluntary Avoidance

Measurable changes to the amount of land that has potential to be avoided by commercial and recreational land and resource users are predicted to occur within the LSA. Commercial and recreational land use is known to occur in the LSA and has potential to occur in the SSA and PDA as well though levels of use have not been confirmed.

Residual Effects Classification

The results of the REA for other land and resource use mirror those described in Section 6.14.3 for traditional land and resource use. In summary, the number of land users who are currently using land in the LSA and may start avoiding this area is predicted to be low and all resources in the LSA are considered to be abundant in the RSA and broader area, so the magnitude of this effect is predicted to be moderate. The effect is predicted to occur in the LSA so the geographic extent is predicted to be local. If the effect occurs, it is predicted to be long-term in duration and reversible in the long-term. Throughout construction, operation, decommissioning, and possibly into the post-decommissioning phase, avoidance of the LSA is predicted to occur continuously, and is predicted to be moderately likely to occur.

With consideration of these ratings, this effect is predicted to be not significant; however, given uncertainty regarding the number of land users who are actively using the LSA, this effect will be monitored throughout the life of the Project. Monitoring activities include the Social Management Program and ongoing engagement with local land users and establishment of a grievance mechanism which land users can access to report any concerns or issues to Fission as they arise.

6.15.4 Cumulative Effects Assessment

6.15.4.1 Land Cleared and Disturbed and Presence of Barriers

The CEA for this residual effect considered reported changes to quantity of land available and accessible for other land and resource uses as a result of NexGen's Rook I Project. The REA for the Rook I Project estimated that changes to land access as a result of project activities may result in a reduction of 981 ha of land available and accessible for continued other land and resource use. Should the Rook I Project proceed to development, the amount of land area that will no longer be accessible or available for use as a result of both projects is predicted to be 1,381 ha (2.6% of the RSA) and expected to have a limited effect on the function of other land and resource use in a regional context.

The affected land areas for both projects are located in the RSA, so the effect is predicted to regional in extent. For the purpose of the assessment, it is assumed that the projects will have temporal overlap, and the effect will occur within the construction, operations, and a portion of the decommissioning phase, so the duration is predicted to be medium in term. This effect will be reversible short-term and is predicted to cease once the stressors are

removed. While the effect is taking place, it will be continuous in frequency and is predicted to be moderately likely to occur.

6.15.4.2 Voluntary Avoidance

Residual effects to the quantity of land that will be avoided by recreational and commercial land and resource users were assessed cumulatively with the total avoidance area predicted at the Rook I Project. In the Rook I Project effects assessment for other land and resource use, the maximum disturbance area (981 ha) was used to predict where effects to the land user experience may occur. To ensure a conservative assessment, and allow for uncertainty, the PLS Project LSA was considered as the area of potential avoidance; thus, the total sum of affected areas for both projects is 8,835 ha. The total potentially affected area comprises approximately 16.7% of the PLS Project land use RSA.

The amount of avoidance that may occur in the RSA may be mitigated through information sharing and participation in environmental monitoring programs (Section 9.0). While these measures may help reduce the level of avoidance, avoidance is still predicted to occur.

With consideration of this information, avoidance of the affected areas for both projects is predicted to have a limited affect on function (the ability to continue other land and resource use), resulting in a moderate magnitude. This cumulative effect will occur in the LSA and is considered local in extent. It is predicted to be medium-term in duration as it will occur from construction to the end of post decommissioning for the PLS Project. Given the individuality of avoidance preferences and timelines, the effect is predicted to be reversible long-term as avoidance may persist after stressors have been removed. The effect is predicted to occur continuously and if it occurs, is predicted to be moderately likely to affect the continuance of recreational and commercial land and resource use in the region.

The magnitude of the effect will be monitored over the life of both projects through the Social Monitoring Program and ongoing engagement and information sharing with affected land users.

6.15.5 Uncertainties

Assessment of other land and resource use considered the existing environment, REA, and CEA results for the VCs of air, noise and vibration, visual landscape, surface water quality, surface water quantity, fish and fish habitat, vegetation, wildlife, traditional land and resource use, heritage resources, and community wellbeing and human health.

Uncertainties related to these VCs are also considered uncertainties for assessment of impacts to traditional land and resources.

Collection of the other land and resource use information was collected primarily through publicly available sources. There is uncertainty regarding the number of recreational and commercial land and resource users who are actively using the study areas and their frequency and patterns of use.

Uncertainties are also present regarding the application of avoidance behaviors including how many people may engage in avoidance of affected areas, how long avoidance may occur, and the avoidance buffers that may be applied.

6.16 Heritage Resources

6.16.1 Scope of Assessment

Heritage Resources were included as a VC because of their high importance to Indigenous Nations, as identified through engagement, and their protection by *The Heritage Property Act* (GS 1980). Specifically, Indigenous Nations have shared concerns about Indigenous archaeological sites (i.e., burial sites) being disrespected.

As described in Table 5-2, the key indicator for this VC is archaeological sites and the measurable parameter evaluated in this effects assessment:

- Predicted changes to the number, quality, and significance of known archaeological sites as a result of Project activities.

6.16.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for heritage resources are defined as follows (Figure 6-15).

- Local Study Area: The LSA is a 250 m buffer around the PDA and the areas included in the 2013 and 2022 Heritage Resource Impact Assessments (HRIAs), thus encompassing all known heritage sites identified during the HRIAs for the PLS Project. This study area is approximately 25 km^2 and 2,495.5 ha.

Since the Project-environment interaction for this VC is local, there is no regional study area defined.

6.16.1.2 Potential Effect Pathways

The Project-environment interaction for the VC of heritage resources that was identified as a potential effect pathway during each Project stage includes the following.

- The construction, operation, and decommissioning of Project facilities has the potential to cause physical disturbance of archaeological sites.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.16.2 Screening Assessment, where relevant.

6.16.2 Screening Assessment

A summary of the screening assessment results for the Project-environment interaction of ground disturbance is provided in Table 6-3.

6.16.2.1 Ground Disturbance

Project activities that cause ground disturbance (e.g., clearing, grading, excavating, etc.) have the potential to impact archaeological sites. Land clearing and disturbance will occur primarily during construction but has the potential to occur during operations as well if facilities are expanded or altered. Construction activities involving ground disturbance can impact heritage resources in a variety of ways including crushing/and or displacing surface features and moving buried cultural materials (i.e., artifacts and features) resulting in the loss of archaeological context.

Two HRIAs have been completed for the Project and two known heritage sites are in the SSA. A third site is located in the LSA and will not be impacted by PLS Project activities. Mitigation for the known heritage sites will be detailed in the Heritage Management Plan and will include the establishment of a 30 m buffer around the sites in which disturbance will be avoided where possible. If the sites cannot be avoided, the Heritage Conservation Branch (HCB) will be consulted and additional testing or excavations may be completed as per Section 5(63)(1) of *The Heritage Property Act* (GS 1980).

As two archaeological sites were identified in the SSA, it suggests that there is the potential to find additional heritage resources during Project development. As part of the Heritage

Management Plan, a Chance Finds Procedure will be developed with input from Indigenous Nations and communities and a professional archaeologist. The procedure will be implemented throughout all Project phases and will be updated as needed. The procedure will outline steps that will be taken by Fission should an archaeological site be identified during Project activities. This will allow for any archaeological site that is incidentally encountered to be either avoided or tested to ensure that the archaeological data is not lost.

Following detailed Project design, additional HRIAs will be completed, as required, to survey areas not previously assessed. Residual effects are anticipated to be negligible with the implementation of mitigations detailed in the Heritage Management Plan and the Chance Finds Procedure. Therefore, this interaction is considered a minor interaction and was not carried forward to the REA and CEA.

6.17 Community Wellbeing and Human Health

6.17.1 Scope of Assessment

Community wellbeing and human health was selected as a VC for several reasons. The demand for infrastructure and services associated with transportation, education and training, accommodation, and protective services has potential to be altered as a result of Project activities. Changes to employment and income levels and distribution, number of people engaged in fly-in fly-out worker rotations, worker/community interface, and demand for infrastructure and services are key health supports with potential to be affected by Project activities. Concerns about affects to community wellbeing and human health were raised by local communities and regulators. Current road conditions on Highway 955 were noted as an area of concern by local communities, and further impacts to conditions on Highway 955 and Highway 155 were identified as an area of concern by regulators. Local communities also identified access to education and training services and facilities as an area of interest.

Changes to community wellbeing and human health were assessed with consideration of residual effects to the VCs of air quality, surface water quality and quantity, fish and fish habitat, vegetation, wildlife, economic wellbeing, traditional land and resources use, other land and resource use, heritage resources, and the results of the HHERA (Appendix D.7). Residual effects to community wellbeing and human health (specifically human health considerations) were used to inform assessment of traditional land and resource use (Section 6.14) and other land and resource use (Section 6.15).

As described in Table 5-2, the key indicators for this VC are social and cultural wellbeing, community health and safety, and local infrastructure and services; the measurable parameters evaluated in this effects assessment are described below.

- Predicted changes to the social and cultural environment due to changes in education, employment and income levels and distribution, mobile worker/community interface, and work rotation schedules.
- Predicted changes to number of land and resource users, frequency or patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission.
- Predicted changes to human health due to exposure to COPC concentrations from Project-related air and water releases compared to existing conditions.
- Predicted changes to mental and physical health due to changes in the natural environment.
- Predicted changes to community health and safety as a result of increased presence of psychosocial stressors due to changes to social and cultural wellbeing.
- Predicted changes to road conditions, access, capacity, and collision rates compared to existing conditions.
- Predicted changes to demand for air transportation compared to existing conditions.
- Predicted changes to demand for educational and training facilities and services compared to current levels.
- Predicted changes to demand for health care and emergency services compared to existing conditions.

6.17.1.1 Study Areas

The study areas delineated for this effects assessment are bounded in terms of increasing distance from the Project and include the SSA, PDA, LSA, and RSA. The SSA and PDA are defined in Section 5.3.4.1. The LSA and RSA vary between VCs, and for community wellbeing and human health they also vary between measurable parameters. The majority of measurable parameters are described using the socio-economic study areas (Figure 6-12 and Figure 6-13), which are defined in Section 6.13.1.1.

Within the socio-economic study areas, land and resource users who currently use land and resources near the Project have the potential to experience disproportionate effects to their wellbeing and health. Where pathways are present for land users to experience disproportionate effects, the land use LSA and RSA were used to assess effects in addition

to the larger socio-economic LSA and RSA. The land use study areas (Figure 6-14) are defined in Section 6.13.1.1.

6.17.1.2 Potential Effect Pathways

Project-environment interactions for the VC of community wellbeing and human health that were identified as potential effect pathways during each Project stage include the following.

- Measurable changes to traditional land and resource use have potential to affect the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission.
- Employment has the potential to result in changes to employment, income, and training levels and distribution, mobile worker/community interface and worker rotations schedules; the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission; and demand for air transportation and education infrastructure.
- Increased vehicle traffic on Highway 955 and 155 has potential to result in changes to road conditions, access, and capacity.
- Measurable changes to community health and safety parameters have the potential to change the demand for health care and emergency services compared to existing conditions.
- Measurable changes to COPC concentrations have the potential to affect human health.
- Measurable changes to VCs representing the natural environment have the potential to cause changes to mental and physical health.

Mitigation measures developed for each potential effect pathway are presented in Table 6-2 and are briefly discussed in Section 6.17.2 Screening Assessment, where relevant.

6.17.2 Screening Assessment

A summary of the screening assessment results for each of the following Project-environment interactions is provided in Table 6-3.

6.17.2.1 Changes to Traditional and Other Land and Resource Use

Measurable changes to traditional and other land and resource use in the land use study areas have potential to contribute to measurable changes to the number of land and resource users, frequency and patterns of use, country food-based diet and access to medicines, and pathways for generational knowledge transmission compared to existing conditions. BNDN noted that if BNDN members avoid hunting in the area, it may impact food security for the community. Increased employment opportunities also have potential to affect these pathways and are discussed in Section 6.13.2.1.

This assessment considered residual effects to the VCs of traditional land and resource use (Section 6.14.3) and other land and resource use (Section 6.15.3).

Effects to the ability to continue land and resource use are predicted to occur during all Project phases, but only within specific geographic extents. Avoidance of land within the land use LSA will result in measurable changes to frequency and patterns of use within that geographic extent; however, land users who are displaced from the land use LSA are predicted to continue their land uses in areas where conditions are more favorable. As such, measurable changes to the total number of people engaged in land and resource uses are not predicted. Changes to frequency or patterns of use of land users are predicted in the land use LSA, but the level of change is predicted to have a negligible to minor effect on the continuance of land uses in the socio-economic LSA. Since land and resource use is expected to continue similar to current conditions outside of affected areas, no measurable changes to the country food-based diet, access to medicines, and pathways for generational knowledge transmission are predicted to occur.

Design features and mitigation measures have been applied to reduce the Project footprint; however, some change to land and resource use is unavoidable and cannot be fully mitigated. Fission is currently working with affected Nations and land use groups to identify actions and opportunities that may help offset effects that result from changes to land and resource use.

Considering that the total number people in the LSA with potential to be affected is predicted to be low, and that efforts are underway to offset or accommodate for impacts to land users, this effect pathway is predicted to have a negligible to minor effect on social and cultural wellbeing and has not been moved forward for REA.

6.17.2.2 Employment

Employment has the potential to result in changes to employment, income, and training levels and distribution, mobile worker/community interface, and worker rotations schedules. Changes to employment, income, and worker rotation schedules have potential to contribute to changes in the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission. Increased levels of employment and worker rotation schedules have the potential to change demand for local infrastructure and services related to air transportation and education.

Direct employment of approximately 325 workers is predicted to occur during construction and operations. An additional 7,000 indirect employment opportunities also have potential to occur across Saskatchewan as a result of the Project. As per the requirements of the future mine surface lease agreement, Fission will prioritize qualified residents in the socio-economic LSA and RSA for direct employment opportunities and will encourage contractors to prioritize hiring and award of subcontracts to residents and businesses of the LSA and RSA. For the purpose of this assessment, and to support a conservative prediction of effects, it is assumed that all 325 direct-hire positions will be awarded to residents in the LSA and RSA. It is also assumed that employment for the 7,000 indirect positions will be distributed evenly across the labour force population of Saskatchewan meaning that 140 indirect jobs will be available in the RSA, with 70 of those available in the LSA.

The total population aged 15+ who reported participating in the labour force in the 2020 census was 3,255 in the LSA and 11,140 in the RSA. If the entire Project workforce (both direct and indirect positions) was recruited from the population of the LSA who participated in the labour force in 2020, it would constitute approximately 12.0% of the total eligible population of workers in priority recruitment communities, and 4.0% of the eligible RSA population. Of those in the LSA and RSA who are part of the labour force, workers who already possess experience in the mining sector will be further prioritized for employment. It is assumed that those who possess experience in the mining sector are currently, or have previously, been employed in roles with similar income levels to those offered at the Project which further reduces the risk of changes to the distribution of employment and income levels in the LSA and RSA. With consideration of this information, it is predicted that changes to the level and distribution of employment and income will be measurable, but in the context of the labour force population in the LSA and RSA, is predicted to be minor.

Due to the fly-in fly-out nature of the Project, the populations of the LSA and RSA communities are not predicted to increase as a result of Project employment and contracts, so changes to distribution of income and employment levels are not predicted to occur as a result of in-migration to communities in the LSA and RSA.

While the potential for changes to level and distribution of employment and income in the LSA and RSA is predicted to affect a small portion of the population, the change is predicted to be measurable and may be experienced with greater magnitude by some subsets of the population. Members of the labour force who do not have experience in mining or similar industries and those who are new to the labour force may experience substantial increases in their level of employment and income should they become employed by the Project and may experience changes to their social and cultural wellbeing as a result. For the most part, it is assumed that these changes will have an overall positive effect on social and cultural wellbeing, but the change in distribution of employment and income within this subset of the workforce does have potential to result in changes to family and social dynamics and support systems. Similarly, members of this subset of the population who are land and resource users may experience changes to frequency and patterns of use. In some cases, increased income levels may result in increased access to store-bought food, and a decrease in subsistence harvesting. In other cases, increased income levels may help land users afford fuel and supplies required for land use leading to increased participation in land use activities.

Specific levels of educational attainment will be required for each direct position available. Residents of the LSA and RSA who do not have the level of education required for specific positions of interest may choose to upgrade their education to meet the qualifications for positions with the Project. If there are a large number of people seeking to further their education, it may result in changes to the level of education in the LSA and RSA and the demand for educational and training facilities and services. To assess this effect pathway, direct-employment opportunities requiring specific levels of education were compared to the current educational attainment levels in the LSA and RSA. Educational requirements for indirect-employment opportunities are unknown and were not considered as part of this assessment of change.

Approximately 50% (163) of the direct-employment positions required during operations do not require post-secondary training, but a high school diploma or certificate is preferred. Based on educational attainment levels (discussed in Section 4.7.7), 13,245 people in the RSA would meet the educational requirements to apply for these positions, 3,460 of whom

are LSA residents. On-the-job training will be provided to new employees to support their future growth and success in the mining field.

Approximately 39% (137) direct-employment positions will require education in a trade or certificate program. Within the RSA, 4,740 people may be eligible for these positions, 1,310 of whom are located in the LSA. The remaining 11% (24) of direct-employment positions are those requiring a bachelor's degree or higher. In the RSA, approximately 2,025 people may be eligible for these roles, 425 of whom are located in the LSA communities. It is recognized that there are several additional factors such as existing employment status, personal preference, applicability of education obtained, and career aspirations to consider that would reduce the amount of LSA and RSA residents eligible or interested in seeking employment at the Project. However, based on current educational attainment levels, the amount of change to the levels of education, and demand for education and training facilities and services in the LSA and RSA may occur as a result of employment opportunities, but are predicted to be within the range of natural variability.

While changes to the demand for education and training facilities and services are not predicted to increase as a result of the Project, the education and training institutes who provide services in the LSA and RSA also provide training services for several other industries, and some of them serve the entire province of Saskatchewan. To monitor changes to demand for education and training facilities and services in the LSA, Fission participates in a Training Working Group with NexGen, representatives from select priority communities that are also part of NexGen's Local Priority Area, and representatives from several northern training institutes. To monitor changes to demand in the RSA, Fission also attends Saskatchewan Indian Institute of Technologies (SIIT) Mining Sector Steering Committee meetings. The focus of these groups/meetings is to identify training needs and gaps in each respective service area and opportunities for industry partners to support delivery of training programs to residents in the LSA and RSA. In addition to monitoring and responding to labour and employment training needs, the groups also discuss barriers to employment, employment readiness, and potential training solutions to help prepare prospective employees for work on mining projects.

Employment of the workforce has the potential to result in increased interactions between the mobile workforce and local residents in LSA communities. Interactions that are adverse have the potential to result in changes to social and cultural wellbeing, and human health and safety. While on shift, employees will live at the camp within the SSA and most of

their work will occur in the SSA. Some members of the workforce may also utilize the PDA and LSA for work and recreational activities.

During construction and operations, members of the direct-employed workforce will travel to site primarily using air transportation services at existing airports in the LSA and RSA. During decommissioning, it is assumed that a combination of road and air transportation will occur. There is potential during all Project phases for increased interactions between the workforce and local residents to occur when workers are commuting to site. Depending on how each two-week shift is overlapped, approximately 100 workers may be travelling to or from the site each week during peak periods of operations, a portion of whom will travel through airports located in LSA communities. Workers from communities in the LSA and RSA that do not have an airport may be required to travel to communities with airports as part of their commute to work each shift. This may result in increased potential for interactions to occur between members of the workforce who do not reside in the airport community and the residents of that community. Because the distribution of employment positions among each LSA community depends on a number of factors and personal decisions that cannot be predicted, the number of non-local workers with potential to interact with residents of airport communities is unknown. Given that airport communities in the LSA and RSA are located in the larger service centres which are regularly visited by residents from neighbouring communities for various purposes, the increase in presence of residents of neighbouring communities in airport communities may increase slightly when workers are commuting for work. The level of change from existing conditions is predicted to be minor, and the risk of adverse interactions occurring as a result of the increased presence of workers in airport communities is predicted to be negligible.

An increase in people employed in fly-in/fly-out (FIFO) worker rotation schedule has potential to contribute to measurable changes to the social and cultural environment. At the peak of employment, approximately 325 direct employees are predicted to be needed to support operations. For a conservative estimate, it is assumed that all 325 workers will be engaged in FIFO work rotations. The on-site camp can accommodate up to 200 members of the workforce at a time. In general, shifts for most employees will last for 2 weeks, and workers will have two weeks off in between shifts. The current number of people who are employed in or have experience with FIFO worker rotations is unknown. Based on analysis of commute-to-work data from the 2021 census for the LSA and RSA populations (Section 4.7.1), it is assumed that 425 people in the RSA, 155 of which reside in the LSA, have potential to be currently employed in FIFO work arrangements. It cannot be assumed that all 325 workers will have experience with FIFO rotations, so for a conservative estimate,

it is assumed that approximately half of the workforce (167 workers) have this experience, and half do not. With consideration of these assumptions, an increase of 167 workers engaged in FIFO worker arrangements is predicted compared to current conditions. If all affected workers were recruited from within the LSA, potentially affected workers would comprise 1.6% of the total population. The more likely scenario is that affected workers would be recruited from within the RSA and would comprise less than 0.5% of the total population.

While the potentially affected population is predicted to be negligible, changes to worker rotation schedule for those affected can result in changes to family and social dynamics and support systems. Similarly, those affected may also experience changes to their ability to participate in time-sensitive cultural events and land and resource uses, which can result in changes to the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission.

To support workers and their families who are affected by changes to their level of employment and income, Fission will provide access for employees to counselling services related to financial planning, mental health wellness, and additional services, and will enforce a Drug and Alcohol Policy to help maintain a safe and healthy workplace. Mental health and cultural supports will be available at the on-site camp including access to an occupational health nurse, elder support, and a cultural space. Fission will develop a Human Resource Development Plan and affected Nations will be provided the opportunity to review it and provide feedback. To monitor the accuracy of these predictions and the effectiveness of the selected mitigation measures, and to identify opportunities for adaptive mitigation approaches, Fission will implement a Social Monitoring Program. The Social Monitoring Program includes completion of a social impact assessment and social management plan every three to five years throughout construction and operation of the Project. In the event that gaps or disparities are identified through the social impact assessment updates, then action items and mitigations will be identified in the social management plan to help address issues raised. The social impact assessment and social management plan development and updates will be informed through engagement with leadership and residents/members/citizens from each of the priority communities and other key local subject matter experts.

Overall, the total number of people with potential to be affected by effect pathways related to Project employment is predicted to be a small percentage of the total population of the

LSA and RSA. Of those with potential to be affected, the magnitude of the effect on the individual worker and their family will be variable. In some cases, the effect may be positive. In other cases, adverse effects may be felt and may be greater for some workers than for others. With these mitigations and adaptive management/monitoring plans in place, it is predicted that, overall, employment will have a negligible to minor effect on the social and cultural wellbeing and human health and safety parameters assessed. As such, these effect pathways have not been moved forward for REA.

6.17.2.3 Vehicle Traffic

Vehicle traffic on Highway 955 and 155 has potential to result in changes to road conditions, access, capacity, and collision rates. No physical changes such as barriers or changes to highway alignment are predicted to occur on Highway 955 and 155 as a result of Project activities.

Transportation of people, goods, and services will occur during construction, operations, and decommissioning of the Project. Traffic predictions accounted for supply delivery, concentrate shipping, and transportation of the workforce from an airport located offsite. Traffic levels are expected to peak at 22 vehicle trips per day during operations and will be comprised of mostly heavy vehicles, some of which have the potential to exceed the allowable weights and dimension for the roadway. Overweight, over-size, and/or over-dimension vehicles will be subject to additional permits and cost-sharing requirements from the Ministry of Highways. Fission commits to work with the Ministry of Highways to enter into road-maintenance and upgrade cost-sharing agreements to mitigate any potential for impacts to roadway conditions that may result from over limit vehicle use. For the purpose of this assessment, it is assumed that all 22 vehicles/day will be heavy vehicles but within the allowable weight and dimension limits for the roadways within the transportation route.

To assess potential impacts to road conditions, access via intersections, and roadway capacity, a Transportation Impact Assessment (Appendix A.6) was completed for the Project which included a sight distance assessment, intersection analysis, roadway analysis, and consideration of warrants for intersection treatments and illumination. The results of the study indicated that all study intersections meet the minimum sight distance requirements, and all intersections currently operate acceptably and will continue to operate acceptably through all Project phases. The roadway analysis found that all roadways within the study area are currently within their daily volume guidelines and will continue to remain

within their daily volume guidelines after development. While Project-related trips will not add enough traffic to exceed a warrant threshold as a new condition, some warrants for intersection treatments were recommended at the intersection of Highway 955 and Highway 155, and the intersection of Highway 908 and Highway 155 based on existing traffic volumes. No new street illumination was recommended for study intersections. In summary, no measurable changes to road conditions, access, and capacity are predicted to occur as a result of Project-related traffic.

While impacts to roadways are not predicted to occur, the increase in traffic may be noticed by area residents and commuters. To provide context, the percentage of change in daily traffic levels compared to existing conditions (Section 4.7.1) was calculated along sections of Highway 155 and 955, and at key intersections in or near the communities of La Loche and Buffalo Narrows. The estimated change to the percentage of daily traffic volume comprised of heavy vehicles was also assessed.

On Highway 955 north of the PDA, a 22% increase in traffic is predicted, and may be noticeable for commuters who frequent the area. No existing heavy vehicle traffic was recorded in the TIA in this section of Highway 955, so the presence of 22 heavy vehicle trips may be noticeable compared to existing conditions. This section of the transportation route is located more than 50 km from the nearest populated centre (Descharme Lake).

At the intersection of Highway 955 and 155 near La Loche, the addition of 22 heavy vehicles would account for less than a 1% increase in total traffic volume and heavy vehicle traffic volume. On Highway 155, between La Loche and Buffalo Narrows, the addition of 22 vehicles per day would account for an 11% increase in overall traffic in the area with lowest traffic volumes. This section of Highway 155 provides access to the communities of Bear Creek, Turnor Lake, Garson Lake, and Black Point. No heavy vehicle traffic data were available for this section of the Highway, but based on counts predicted on adjacent sections, it is assumed that heavy vehicle traffic may increase by 1% to 6% on this section. At the intersection of Highway 155 and Johnson Street in Buffalo Narrows, the increase of 22 heavy vehicles per day would result in a 1% increase in overall traffic volume, and a 6% increase in heavy vehicle traffic. Between Buffalo Narrows and the Highway 55 intersection, a 6.1% increase in traffic is predicted to result from overall Project-related traffic in the areas with the lowest current traffic volumes. In these low volume areas, the predicted change in heavy vehicle traffic is estimated to increase by 8%. At the Highway 165 intersection, the amount of change would be less noticeable at 1.8%, for all traffic types, and 1% for heavy vehicles.

As detailed in Section 4.7.1.3, historical SGI Collision Data was reviewed, and no direct correlation was observed between increased collision rates and an 11% increase in annual traffic volumes. The overall change to traffic volumes in Highway 955 and Highway 155 is predicted to be less than 11% with the exception of the section of Highway 955 located near the PDA that is more than 50 km from the nearest community. As such, measurable changes to collision rates as a result of increased traffic levels are not predicted to occur.

To help further reduce the potential for measurable changes to road conditions, access, capacity, and collision rates to occur, Fission will implement and enforce speed limits to the extent possible, will implement a Travel and Traffic Management Plan to manage and monitor traffic that will be accessing or departing the Project site, and will complete incident reporting on an ongoing basis to track and monitor changes to accident levels. The Travel and Traffic Management Plan will be provided to local communities for review and comment. Fission will continue to engage with the Northern Village of Buffalo Narrows and Northern Village of La Loche about the possibility of installing additional signage on Highway 155 and within village limits. Finally, changes to traffic levels and accident rates will be monitored, re-assessed, and where required, mitigated, as part of the Social Monitoring Program (described in Section 6.17.2.2).

While changes to traffic levels may be noticeable to residents and commuters along the transportation route, as noted above, no measurable changes to road conditions, access, capacity, and collision rates are predicted to occur, and Fission has mitigation measures in place to manage and monitor Project traffic. As such, this Project-environment interaction has not been moved forward for REA.

6.17.2.4 Measurable Changes to Community Health and Safety Parameters

Predicted changes to health and safety parameters have potential to result in changes to human health and emergency services. Parameters and pathways considered in this assessment to predict the level of change to human health and capacity of emergency services include measurable changes to human health as a result of COPC concentrations (Section 6.17.2.5), and changes to the natural environment (Section 6.17.2.6). Changes to social and cultural wellbeing as a result of adverse mobile worker/local resident interactions (Section 6.17.2.2) and changes to land and resource use, including traditional food diet and access to medicines (Section 6.17.2.1) were also considered. Finally, changes to local infrastructure and services including changes to road conditions (Section 6.17.2.3) were assessed.

The results of the screening assessments for most of these pathways predicted negligible to minor measurable changes. Project-effect pathways related to increased COPC concentrations in the air and water potentially affecting human health were moved forward to REA for detailed assessment (Section 6.17.3). The REA results consider the magnitude of this pathway to be low, with COPC concentrations predicted to exceed existing conditions but remain below guidelines protective of human health.

Fission will aim to further mitigate the potential for changes to demand for health and emergency services in the LSA as a result of Project activities by applying additional design features and mitigations. A first aid room will be located on-site and a nurse or medic will be available on-site 24 hours a day to tend to minor injuries. Mental health and cultural supports will be available at the on-site camp including access to healthy food, food that is considerate of worker allergies, restrictions or intolerances, an occupational health nurse, elder support, a cultural space, an on-site gym, and high-speed internet. The site will be equipped with a mine rescue and safety office and emergency response vehicles will be stationed on-site to support site emergency response including wildfire response. Medi-vac service providers will provide air ambulance services as part of the emergency response services through agreements maintained with STARS or equivalent. Medi-vac service providers will transport patients to medical centers located in large service centers outside of the LSA. At this time, no plans are currently in place for Project activities to utilize medical services in the LSA communities.

With consideration of this information, and the mitigation measures that will be applied, impacts to human health are not predicted, and measurable changes to demand for health care and emergency services are not anticipated compared to existing conditions.

6.17.2.5 Measurable Changes to COPC Concentrations

Measurable changes to COPC concentrations in the air and water resulting from Project activities have the potential to affect human health. This assessment considers COPC concentrations and exposure from air dispersion and dust, air gases, and treated effluent release. The air dispersion modelling (Appendix D.1) showed that releases to air from the Project will result in a measurable change in the receiving environment; therefore, the potential to affect human health through deposition from air to soil and vegetation, and exposure to dust and air gases was evaluated (Section 6.2).

The potential for treated effluent released from the Project to affect surface water quality in Patterson Lake and the downstream environment was previously discussed in Section

6.9.2.5. Changes to surface water quality have the potential to influence humans drinking water and eating food from the receiving environment. Predicted treated effluent concentrations and flows were used to model predicted COPC concentrations in the water and sediment at select locations as well as to complete a HHERA (Appendix D.7) to evaluate the potential risks of these COPC concentrations on aquatic, terrestrial, and human receptors. The results show that treated effluent release will result in a measurable change in the receiving environment. As such, the potential to affect human health was evaluated.

Measurable changes to the receiving environment from releases to air and treated effluent release are present. These changes have the potential to cause effects to human health. As such this effect pathway has been moved forward for REA.

6.17.2.6 Changes to the Natural Environment

Measurable changes to VCs representing the natural environment have the potential to cause changes to mental and physical health of land users. Measurable changes to the natural environment and mitigation measures identified to reduce the level of change are discussed in sections 6.2 to 6.12. Measurable changes to the natural environment are predicted to occur within the land use LSA but will occur primarily within the SSA and portions of the PDA. The majority of the change predicted is expected to be minor in magnitude; however, some residual effects for select effect pathways related to the aquatic and terrestrial environment are predicted to occur. No residual effects to heritage resources (Section 6.16.2) were predicted to occur. No residual effects on the continuance of traditional land and resource use (Section 6.14.2.2) and other land and resource use (Section 6.15.2.2) in the land-use LSA were predicted to occur as a result of changes to the natural environment.

Changes to the natural environment also have potential to affect land users within the socio-economic LSA who are not currently using the land in the land use LSA. During engagement activities, it was shared that even the awareness that impacts to lands are occurring can cause mental and physical distress for people who feel a spiritual connection to the land (BNDN Leadership Mtg. December 2023). The number of people present in the socio-economic LSA with potential to experience measurable changes to mental and physical health as a result of this pathway is unknown but is expected be a low.

Design features and mitigation measures have been applied to reduce the size of Project footprint and sensory disturbance area; however, some change to the natural environment is unavoidable and cannot be mitigated. Fission is currently working with affected Nations

to identify actions and opportunities that may help offset effects that result from changes to traditional land and resource use and changes to the natural environment.

Given that the number people with potential to experience changes to mental and physical health due to Project-related changes in the natural environment is predicted to be low, and that efforts are underway to identify opportunities to offset or accommodate for impacts, the level of change that this effect pathway is predicted to have on mental and physical health compared to current conditions is predicted to be minor in magnitude, and has not been moved forward for REA.

6.17.3 Residual Effects Assessment

The residual effects assessment for the community wellbeing and human health VC is provided below and summarized in Table 6-4.

6.17.3.1 Measurable Changes to COPC Concentrations

Dust Emissions

Particulates in air released from the Project are dispersed through the atmospheric environment and have the potential to transfer from the atmosphere to surface water, soil, and vegetation, as well as influence the air quality. The deposition of air particulates to surface water, soil, and vegetation was evaluated in Appendix D.7 using the results of the air dispersion modelling presented in Appendix D.1. Predicted air quality was also considered in HHERA (Appendix D.7) assessment for human health.

The evaluation of air quality for dust (Section 6.2.2.1) identified exceedances of 24-hour SAAQS for TSP, PM_{10}, and $PM_{2.5}$ in both assessment scenarios (construction and operations). Annual $PM_{2.5}$ concentrations also exceed the SAAQS in the operations phase. Exceedances of the SAAQS during construction occurred within 5 km of the modelled PDA, and the maximum frequency of exceedances was predicted to be 3.7% of the time for TSP or 14 days per year. Exceedances of the SAAQS during operations were limited to receptors within 100 m of the modelled PDA and the maximum frequency of exceedances was predicted to be 9.9% of the time for $PM_{2.5}$ or 36 days per year. The HHERA (Appendix D.7) considered specific exposure scenarios for human receptors, including at the PLS Camp. The likelihood that people would be present in the areas of the short-term exceedances on the rare occurrence of the exceedance is considered negligible. Similarly,

people are unlikely to spend a full year within 100 m of the modelled PDA and this exceedance is also considered negligible.

The maximum incremental 24-hr concentrations of particulate matter (PM_{10} and $PM_{2.5}$) are well below the health-based criteria at the human receptor locations, with the exception of the PLS Camp location during construction. Although no one will be living at the PLS Camp during construction, this location represents potential exposures to people on site during the construction phase. The exceedance for the PLS Camp during the construction phase is associated with the construction of the TMF and the exceedances are expected to occur rarely, or 1 day per year. Furthermore, with people living off-site during construction, a 24-hr exposure is unlikely. It is noted that the maximum predicted concentration of PM_{10} is about 100 times lower than the occupational exposure limit of 3,000 $\mu g/m^3$, based on 8-hour exposure. The frequency of exceedances indicated includes consideration of background concentrations, which are conservative and account for 50% of the criteria on their own.

The COPC considered for the deposition from air were based on COPC selected for the HHERA (Appendix D.7) and included arsenic, cadmium, cobalt, copper, lead, nickel, selenium, uranium, and the uranium decay chain radionuclides (thorium-230, radium-226, lead-210, and polonium-210). The deposition from air results in soil concentrations that are below the soil SEQG for the protection of human health and no negative effects are expected on people exposed to soil influenced by Project air releases. The potential influence on soil and vegetation concentrations, including lichen, from air dispersion was considered in the HHERA, through soil and vegetation ingestion by animals and humans (Appendix D.7). The deposition from air to surface water also results in a small, likely indiscernible change from baseline concentrations (Appendix D.7) and concentrations remain well below guidelines protective of human health.

Residual Effects Classification

The pathway of potential effects on human health from dust has a low magnitude, with concentrations of particulate matter rarely (3 days in 5 years) exceeding guidelines protective of human health. The deposition of dust on surface water, soil, and vegetation was found to also be of low magnitude. The geographic extent of the effect is limited to the site, the frequency is considered negligible, and the effect is fully reversible. The frequency is periodic as the exceedance for the PLS Camp during the construction phase is predicted

to occur rarely, or 3 days in 5 years. The likelihood of the residual effect occurring is considered low.

Overall, the Project-environment interaction is rated as not significant since predicted concentrations of dust and COPC concentrations in surface water, soil, and vegetation influenced by dust deposition are below levels considered protective of human health. Air quality monitoring will be completed during all Project phases, as detailed in Section 9.0.

Gaseous Emissions

Potential interactions related to exposure to air gases (NO_x and SO_2) was evaluated in Appendix D.7 using the results of the air dispersion modelling presented in Appendix D.1. The evaluation of air quality for gases (Section 6.2.2.2) found exceedances of the 1-hour SAAQS for CO, SO_2, and NO_2 and of the 24-hour SAAQS for NO_2 and the Ontario AAQC for acrolein during the operations phase. Exceedances of the SAAQS and Ontario AAQC during operations occurred within 100 m of the modelled PDA in the vicinity of the mine ventilation exhaust. The HHERA (Appendix D.7) considered specific exposure scenarios for human receptors, including at the PLS Camp, for SO_2 and NO_2 exposures. The likelihood that people would be present in the areas of the short-term exceedances for CO, SO_2, NO_2, and acrolein on the rare occurrence of the exceedance is considered negligible.

The HHERA (Appendix D.7) considered specific exposure scenarios for human receptors, including at the PLS Camp, for radon dose and found levels to be below those considered protective of human health.

The maximum incremental 1-hr, 24-hr, and annual concentrations of NO_2 are predicted to remain below the short-term or long-term health-based criteria provided by the World Health Organization (WHO) at the human receptor locations for the PLS Project (Appendix D.7). The maximum incremental 1-hr and 24-hr concentrations of SO_2 are also predicted to remain below the short-term health-based criteria from the WHO.

Residual Effects Classification

The pathway of potential effects on human health from air gases (NO_x and SO_2) has a low magnitude, with concentrations of air gases predicted to exceed existing conditions but remain below guidelines protective of human health. The geographic extent of the effect is limited to the site, the frequency is considered negligible, the frequency periodic, and the effect is fully reversible. The likelihood of the residual effect occurring is considered low.

Overall, the Project-environment interaction is rated as not significant since predicted concentrations of air gases (NO_x and SO_2) are below levels considered protective of human health. Air quality monitoring will be completed during all Project phases, as detailed in Section 9.0.

Treated Effluent Release

Based on the results of the predictive modelling and pathways assessment associated with treated effluent release, there are negligible negative effects for people exposed to the receiving environment of the PLS effluent release (Appendix D.7). The Project area is relied on for traditional cultural practices and for harvesting of animals and plants for people's consumption (CRDN 2023). Community members share food harvested from the land extensively and, therefore, food harvested at or near Patterson Lake is spread widely between communities in the region (BRDN 2023). The assessment considered a range of traditional food consumption (average and high consumers). A range of human exposures were included in the HHERA, from workers to recreational users and subsistence hunter/gatherers (Appendix D.7).

The assessment considered the predicted exposures of people to COPC in treated effluent via drinking water and country food pathways, including fish, moose, caribou, rabbit/hare, beaver, mallard, deer, grouse, and goose. Although COPC concentrations in soil, berries, and medicinal plants were not affected by treated effluent release from the Project to Patterson Lake, these exposure pathways, which may be influenced by air releases, were also considered in the HHERA (Appendix D.7). Estimated radon doses were also considered.

Predicted concentrations in surface water in Patterson Lake remain below drinking water criteria for human health and the release of treated effluent and atmospheric releases from the PLS Project are not expected to negatively affect people exposed from country food pathways. Exposures to non-radiological COPC, doses from radionuclides (including radon), and carcinogenic risks were evaluated in the assessment of human health and found to be below levels considered protective of human health (Appendix D.7).

Residual Effects Classification

For potential effects on human health from the treated effluent release, the magnitude is low, with concentrations of some COPC in surface water predicted to exceed existing conditions but remaining below guidelines protective of human health. The geographic

extent is regional, with changes in the concentrations of some COPC in surface water extending through the RSA. The duration is long-term, with concentrations in surface water returning to existing conditions in the post-decommissioning period. The effect is considered to be reversible in the long-term with the timing of the potential effect expected to occur in operations, decommissioning, and post-decommissioning. The frequency of the effect is continuous. The likelihood of the effect is high, based on the assumed effluent quality and quantity for the Project.

Overall, the Project-environment interaction is rated as not significant since intakes and exposures to COPC are below levels considered protective of human health. Predicted surface water quality is also expected to remain below the available drinking water guidelines for human health. Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0.

6.17.4 Cumulative Effects Assessment

6.17.4.1 Measurable Changes to COPC Concentrations

Dust Emissions

The CEA considered the additional dust emissions from NexGen's Rook I Project and the potential to impact human health. Based on the CEA modelling for dust emission (Appendix D.1), concentrations of 24-hour TSP and PM_{10} are predicted to be above the SAAQS in some areas along Highway 955 within 1 km of the roadway. In these same locations, there were no exceedances predicted for the PLS Project case. Due to the larger traffic counts associated with the Rook I Project, the results indicate that Rook I Project truck traffic is likely to dominate particulate matter concentrations and exceedances of the SAAQS in the vicinity of Highway 955.

The consideration of the Rook I Project in the CEA construction and CEA operation scenarios increased concentrations of dust and particulate matter, which increases the potential for negative effects on human health. In the CEA, the release of uranium to air from the Rook I Project was found to potentially increase concentrations in berries at the Rook I Camp and result in potential exceedances of no effects levels for people hypothetically living at the Rook I Camp in the post-decommissioning period. This result is due to the Rook I Project air emissions, which are responsible for 94% of the uranium concentration in air at the Rook I Camp (Section 5.7, Appendix D.7). Otherwise, the potential for negative effects from particulate matter in air and deposition of dust to surface

water, soil, and vegetation was found to be negligible for human health. The likelihood of the cumulative effect from the PLS Project is considered low but nonetheless uncertain and will be followed up with an air quality monitoring program.

Gaseous Emissions

The CEA considered the additional gaseous emissions to air from the Rook I Project and the potential to impact human health. The CEA assessment for air quality (Appendix D.1) showed that cumulative effects from the additional gaseous emissions from the Rook I Project is not expected to result in additional residual effects to human health from those identified in the REA. The HHERA (Appendix D.7) considered specific exposure scenarios for human receptors, including at the PLS Camp, for SO_2 and NO_2 exposures. These potential interactions were evaluated using the results of two cumulative effects scenarios evaluated for air quality: CEA construction and CEA operations in Appendix D.1.

For the CEA construction, exceedances of the 1-hr criterion for NO_2 are indicated at the Rook I Camp and the Patterson Lake Camping Area (an informal recreational area located south of the PDA). The 24-hr criterion for NO_2 is also exceeded at the Rook I Camp in the CEA construction and CEA operation scenarios. The exceedances indicated for NO_2 at the Rook I Camp are mostly related to emissions from the Rook I Project, with a small additional contribution from the PLS Project; the exceedances of the health-based criteria for NO_2 indicated for the Rook I Project are exceedances without the PLS Project. The Rook I Project EIS TSD XXI (Ecometrix 2023) discussed the 1-hr exceedance of NO_2 identified for the Rook I Camp.

The exceedance of NO_2 for the Patterson Lake South Camping Area in the CEA construction is due to both projects. Based on the results of the air dispersion modelling, the health-based criteria for NO_2 would be exceeded on an occasional 1-hr period if both projects were completing construction activities at the same time and under the worst-case meteorological conditions; this is a low probability. There are no predicted exceedances of the health-based criteria for SO_2 at the human receptor locations in the CEA construction and CEA operation scenarios.

The consideration of the Rook I Project in the CEA construction and CEA operation scenarios increased concentrations of gaseous pollutants, which increases the potential for negative effects on human health. The likelihood of the cumulative effect is considered low but nonetheless uncertain and will be followed up with an air quality monitoring program.

Treated Effluent Release

The Cumulative Scenario considered the potential effects on human health from the additional Rook I Project effluent release. The details on the pathways modelling completed for human health in the Cumulative Scenario are provided Appendix D.7. The Project area is relied on for traditional cultural practices and for harvesting of animals and plants for people's consumption (CRDN 2023). Community members share food harvested from the land extensively and, therefore, food harvested at or near Patterson Lake is spread widely between communities in the region (BRDN 2023).

The assessment considered the predicted exposures of people to COPC in treated effluent via drinking water and country food pathways, including fish, moose, caribou, rabbit/hare, beaver, mallard, deer, grouse, and goose. Although COPC concentrations in soil, berries, and medicinal plants were not affected by treated effluent release from the Project to Patterson Lake, these exposure pathways, which may be influenced by air releases from both the PLS and Rook I projects, were also considered in the HHERA (Appendix D.7) based on air modelling for the CEA construction and CEA operation scenarios provided in Appendix D.1.

Potential exposures to humans increase with consideration of the additional effluent and atmospheric releases from the Rook I Project in the CEA. For the most part, the high-level conclusions of the CEA are consistent with the Rook I EIS (NexGen 2024). However, differences in the predicted water quality were noted in the validation of the Rook I Project EIS HHRA (TSD XXI, Ecometrix 2023); details are provided in Section 5.6 of Appendix D.7. These differences result in some of the conclusions of the CEA, as discussed below.

The HHERA for the CEA (Appendix D.7) was completed within a probabilistic framework to account for the various uncertainties in the model assumptions. The focus of this discussion is on the results for the average predictions, as these have the highest level of certainty.

An exceedance of the TDS drinking water guideline for human health is indicated in Patterson Lake South Arm water for the Cumulative Scenario; this is based on an aesthetic objective since high levels of TDS can make water unpalatable.

The results from the pathways assessment indicate that the planned operations for PLS and Rook I projects have the potential to negatively affect human health from radiological dose to high resource users (via fish) in the area immediately downstream of the project sites;

this was not identified in the Rook I Project Reasonably Foreseeable Development scenario. A significant portion of the incremental dose to this receptor is from the ingestion of fish, and specifically polonium-210 in fish, which is estimated using the predicted water concentrations. Differences in the predicted water quality for polonium-210 were noted in the validation of the Rook I Project EIS HHRA (TSD XXI, Ecometrix 2023); details are provided in Section 5.6 of Appendix D.7. The modelling used for these assessments have inherent uncertainty and are based on many assumptions about future conditions and interactions. In acknowledgment of differences in modelling, the CEA also considered the results for the Rook I Project HHRA as presented (TSD XXI, Ecometrix 2023) rather than as remodelled (Appendix D.7). The PLS Project dose to the Patterson Lake Hunter/Gatherer toddler combined with the Rook I Project dose to the Subsistence Harvester – Patterson Lake South Arm (103 µSv/yr, Table 5-20, TSD XXI, Ecometrix 2023) results in a total dose that remains below the radiological dose limit of 1,000 µSv/yr. This indicates that there is additional uncertainty associated with the conclusion of the CEA.

The cancer risks for high resource users immediately downstream of the project sites were found to be very low; although this level of risk is comparable to the risk from many health care interventions (e.g., dental x-rays, chest x-rays, mammograms), it is above the accepted risk level considered to be negligible. Potential cancer risks for the Rook I Camp worker and the Patterson Lake Hunter/Gatherer are above 1 in 100,000 in the Cumulative Scenario; this is consistent with the Rook I EIS (NexGen 2024) conclusions, which found cancer risk levels above 1 in 100,000 in both the Rook I Project Application Case and Reasonably Foreseeable Development scenarios.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC, which increases the potential for negative effects on human health. A comparison of the relative contributions of the PLS Project releases and the Rook I Project releases, based on the assumptions for the Cumulative Assessment, showed that the PLS Project effluent of TDS contributes slightly more (58%) to the overall load than the Rook I Project effluent (42%). It is recommended based on the contribution to TDS that the PLS Project follow the as low as reasonably achievable (ALARA) principle for reducing anions and cations in their effluent.

For other COPC and pathways identified as potential issues (arsenic and polonium-210 in water, uranium in air, and radon), exposures are dominated (77% to 99%) by the Rook I Project contributions.

The consideration of the Rook I Project in the Cumulative Scenario increased concentrations in surface water for some COPC, which increases the potential for negative effects on human health. The potential for effects is considered uncertain, based on the conservative approach to the assessment and issues validating the Rook I Project EIS HHRA (TSD XXI, Ecometrix 2023). Monitoring of the treated effluent release and receiving environment will be completed throughout the life of the Project, as detailed in Section 9.0. Fission intends to collaborate with NexGen to sign an agreement to share project-related data from both Projects relevant to cumulative assessment components of reporting requirements for both the PLS Project and the Rook I Project.

6.17.5 Uncertainties

The fate and transport modelling completed for the REA and CEA used a probabilistic framework to capture uncertainties on input parameters and assumptions, as well as to acknowledge realistic ranges in parameter values. Therefore, the probabilistic results provide an accounting of the uncertainty inherent in the assessment through the upper-bound predictions. The probabilistic assessment also considers possible future variations under changed climate. The 95th percentile predictions in the REA were also found to be below the available drinking water guidelines for human health, intakes associated with negative effects, radiological dose limits, and cancer risk levels, which increases the level of certainty in the results for the REA.

Differences in the predicted water quality were noted in the validation of the Rook I Project EIS HHRA (TSD XXI, Ecometrix 2023) for use in the CEA; details are provided in Section 5.6 of Appendix D.7. These differences increase the uncertainty in the CEA. Potential cancer risks in exceedance of the negligible risk level of 1 in 100,000 were identified for the Beet Lake Hunter/Gatherer with the consideration of the Rook I Project effluent release; this exceedance was not identified in the Rook I Project EIS HHRA. A significant portion of the incremental cancer risk to this receptor is from the ingestion of arsenic in water, and the Rook I Project accounts for 77% of the arsenic released to water in the CEA. However, it is noted that the predicted arsenic concentrations in Patterson Lake and Beet Lake in the CEA are below the drinking water guideline of 10 µg/L for human health and therefore, the risk levels associated with the drinking water pathway are considered acceptable by Health Canada. Overall, this indicates that there is additional uncertainty and conservatism associated with the conclusion of the CEA.

The assessment of air quality effects is subject to several technical limitations, including for example, the use of generalized emission factors and default input variables that may not perfectly describe site-specific conditions. To have confidence that the model predictions will bound the actual observed conditions upon Project commencement, several conservative assumptions were implemented in the assessment (see Appendix D.1 for additional detail). As a result, concentrations of dust and gaseous pollutants are likely overestimated.

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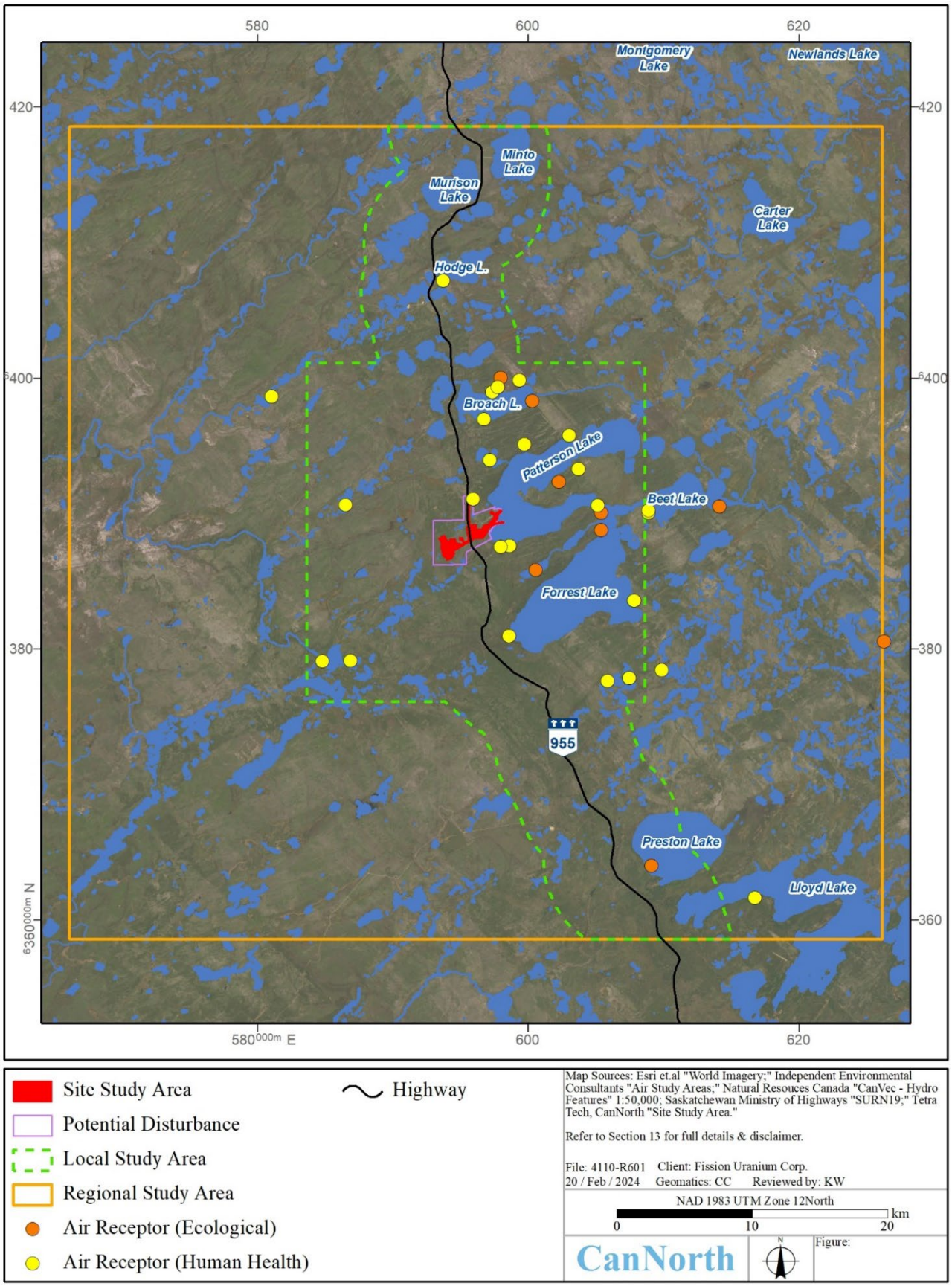

Figure 6-1
PLS Project effects assessment local and regional study areas for air quality.

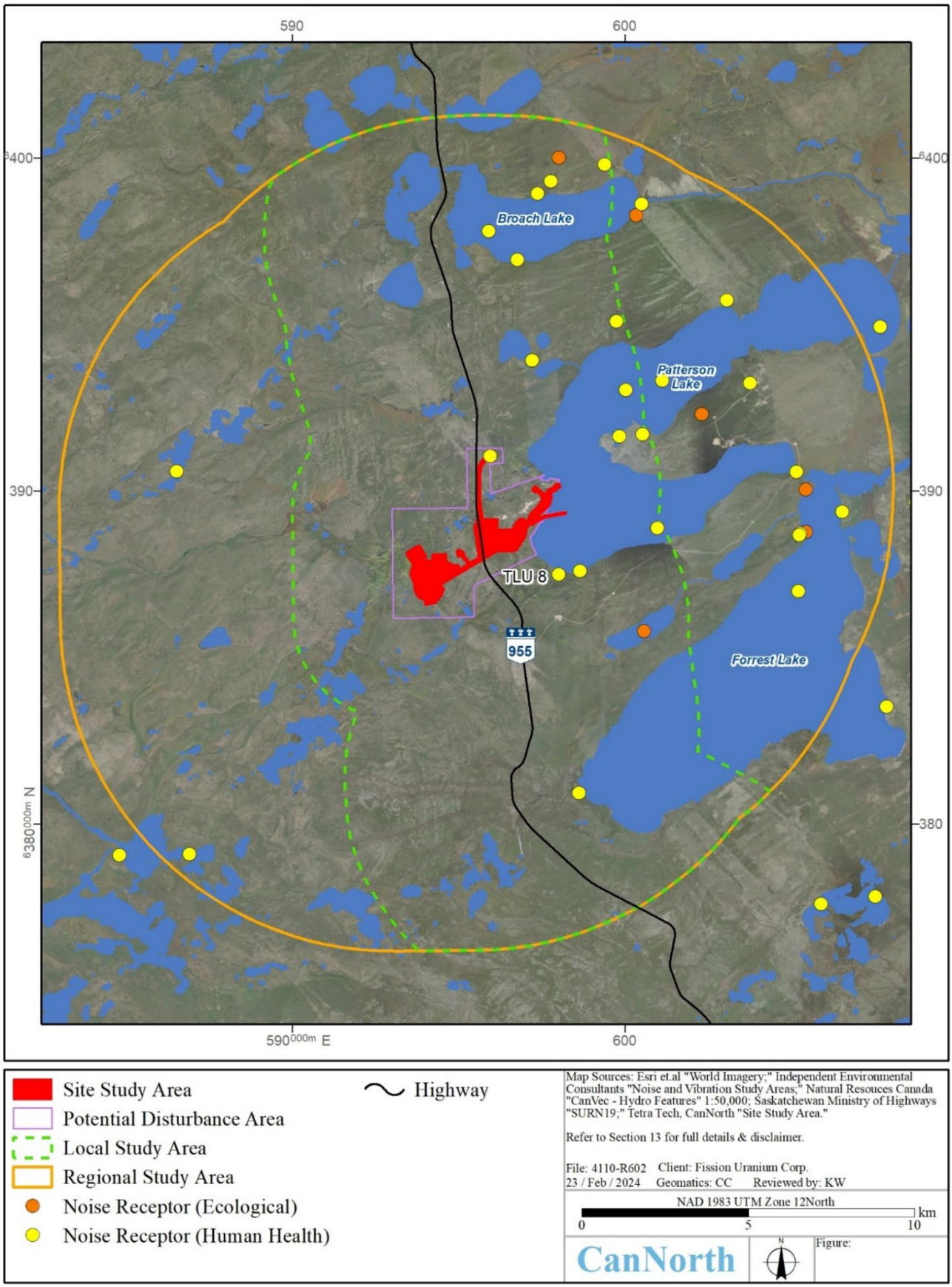

Figure 6-2
PLS Project effects assessment local and regional study areas for noise and vibration.

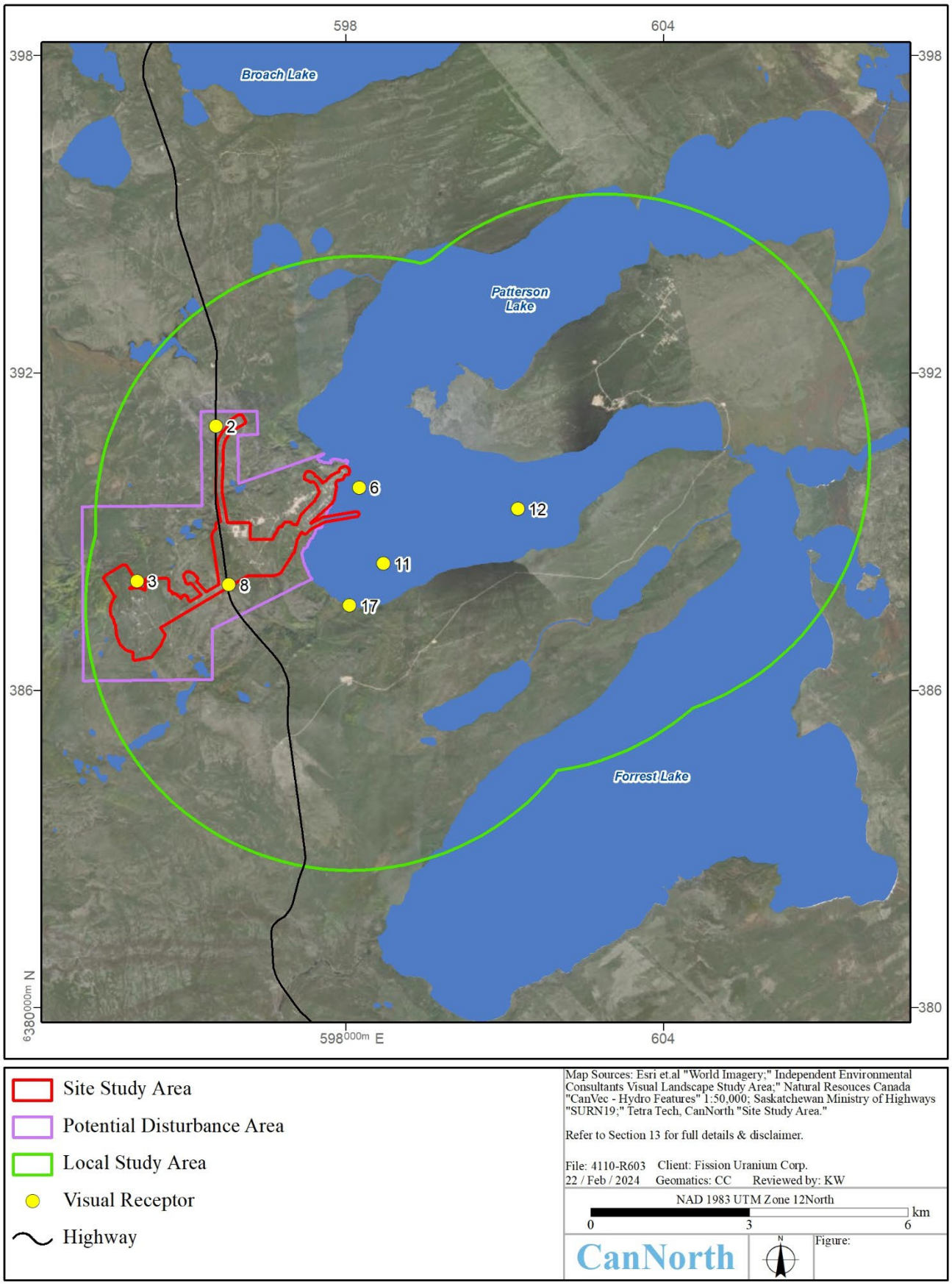

Figure 6-3
PLS Project effects assessment local study area for visual landscape.

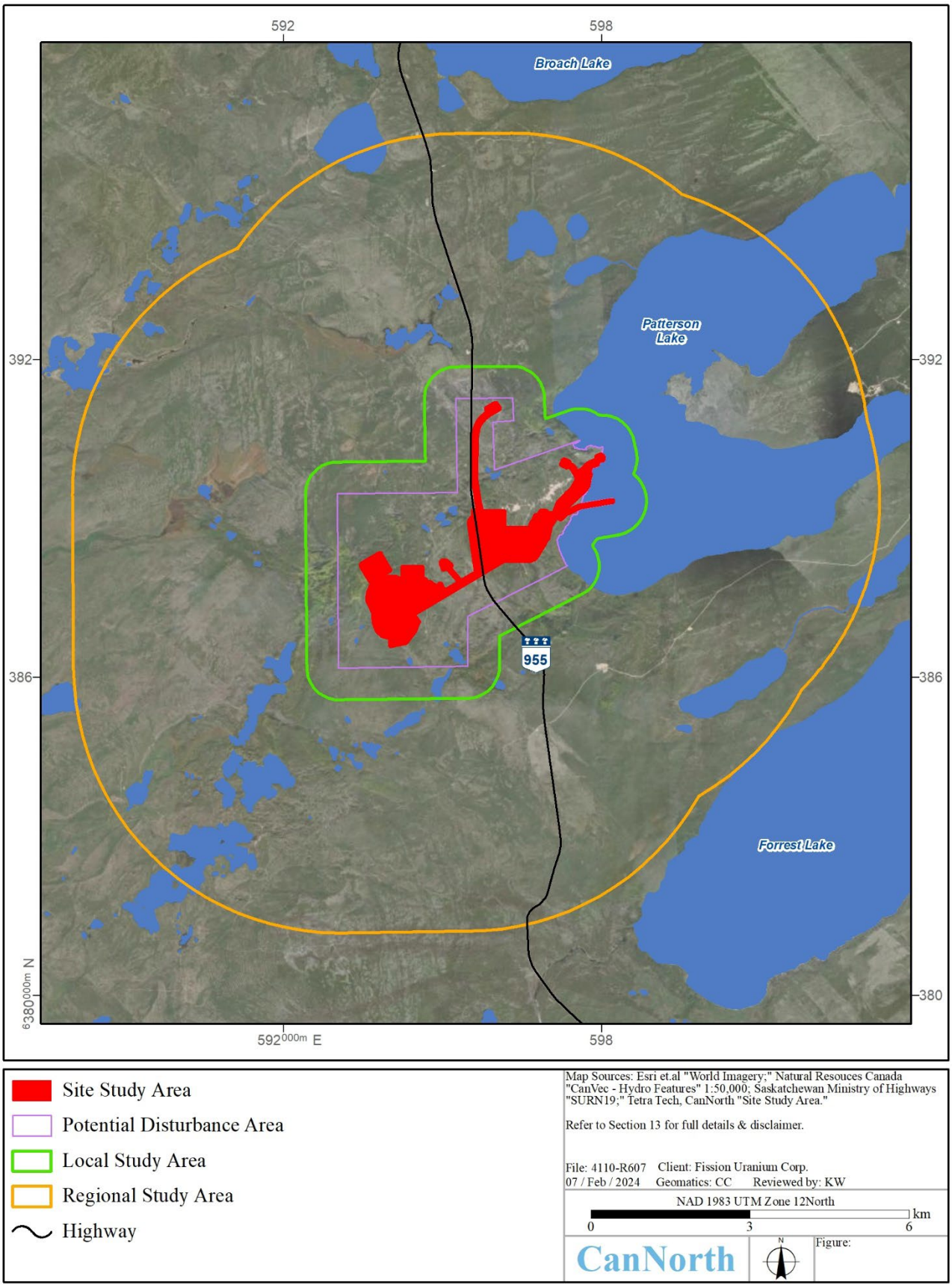

Figure 6-4
PLS Project effects assessment local and regional study areas for terrain and soils and vegetation.

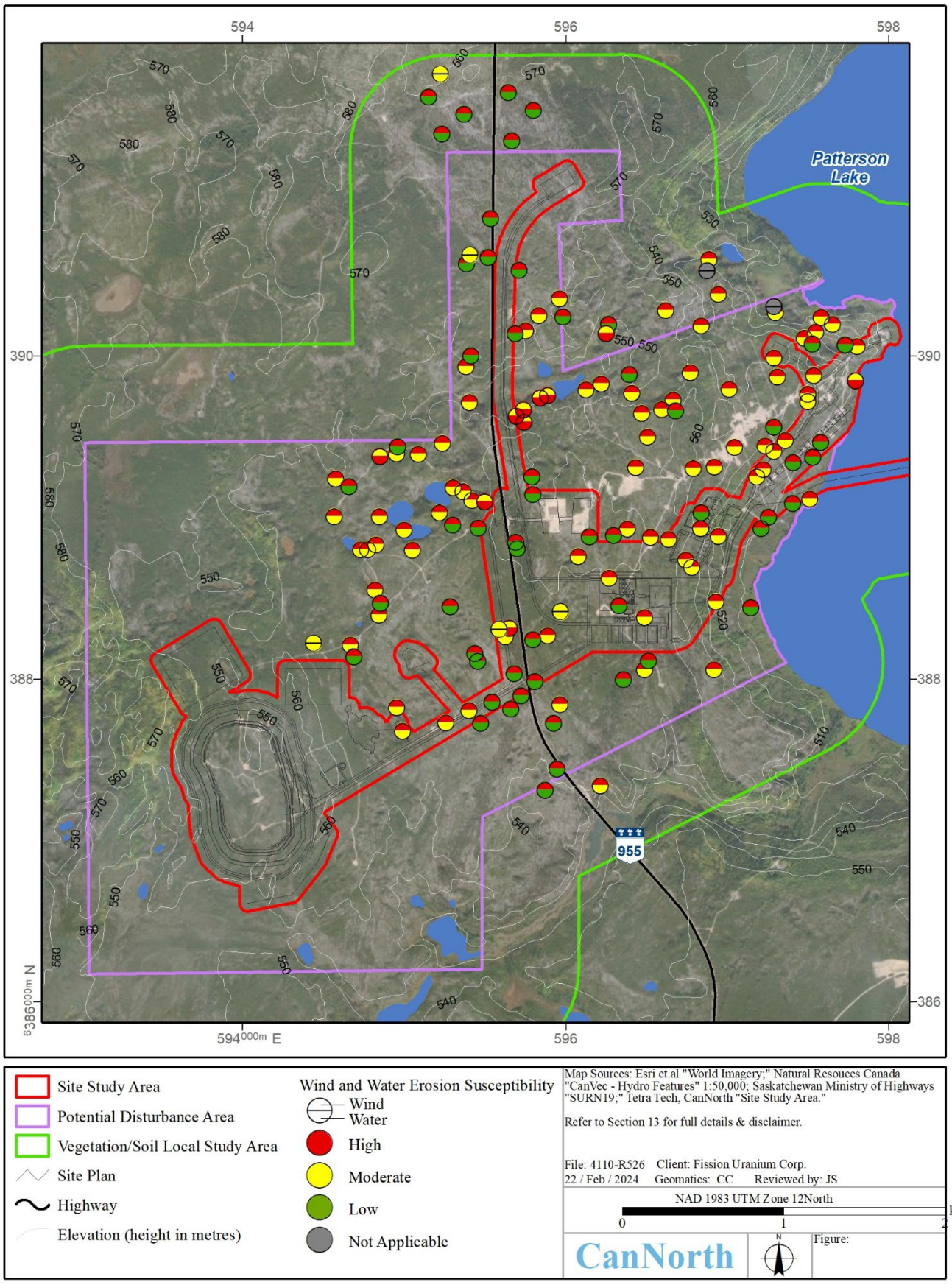

Figure 6-5
Erosion susceptibility of baseline soils within the PLS Project LSA.

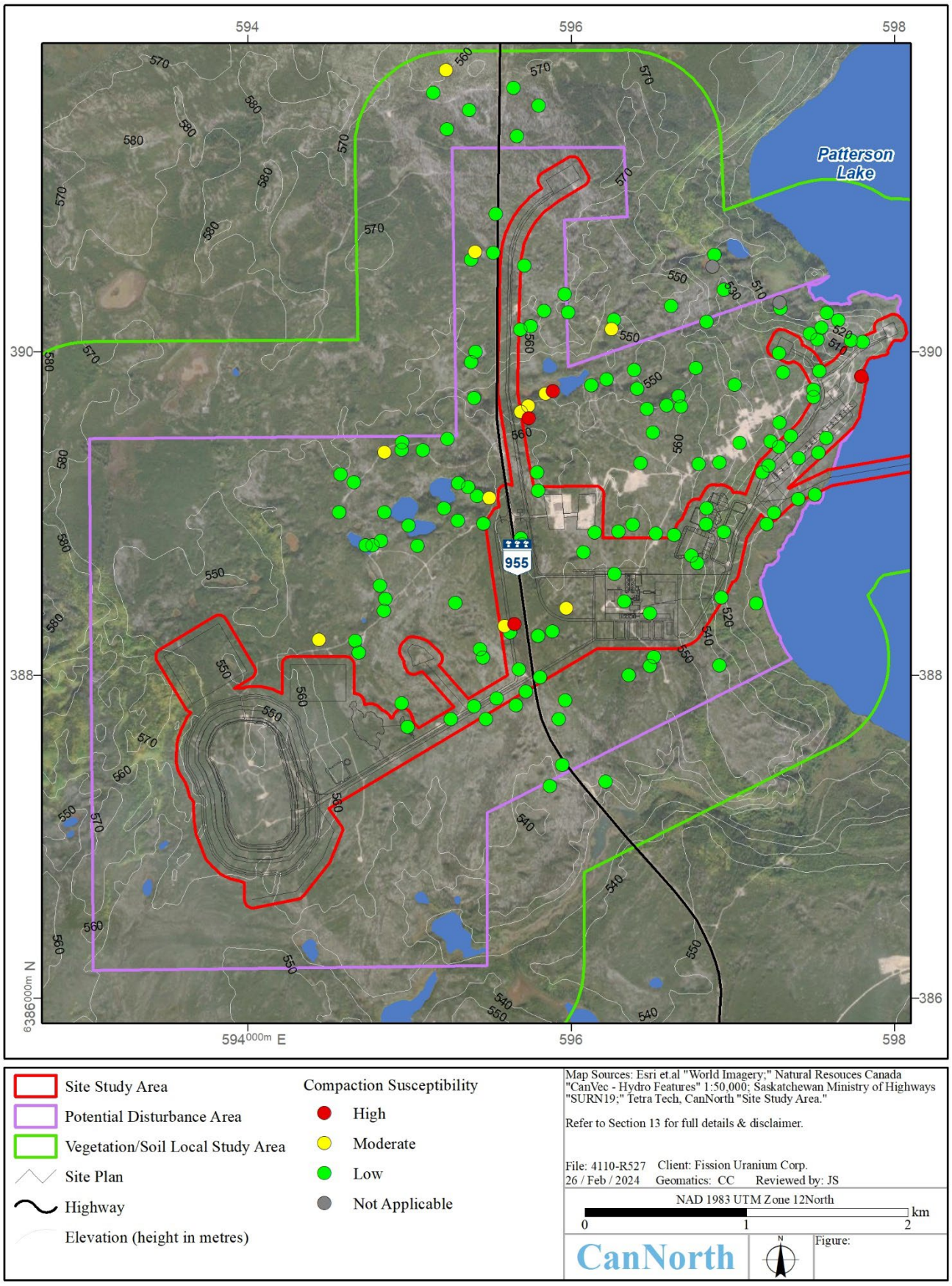

Figure 6-6
Compaction susceptibility of baseline soils within the PLS Project LSA.

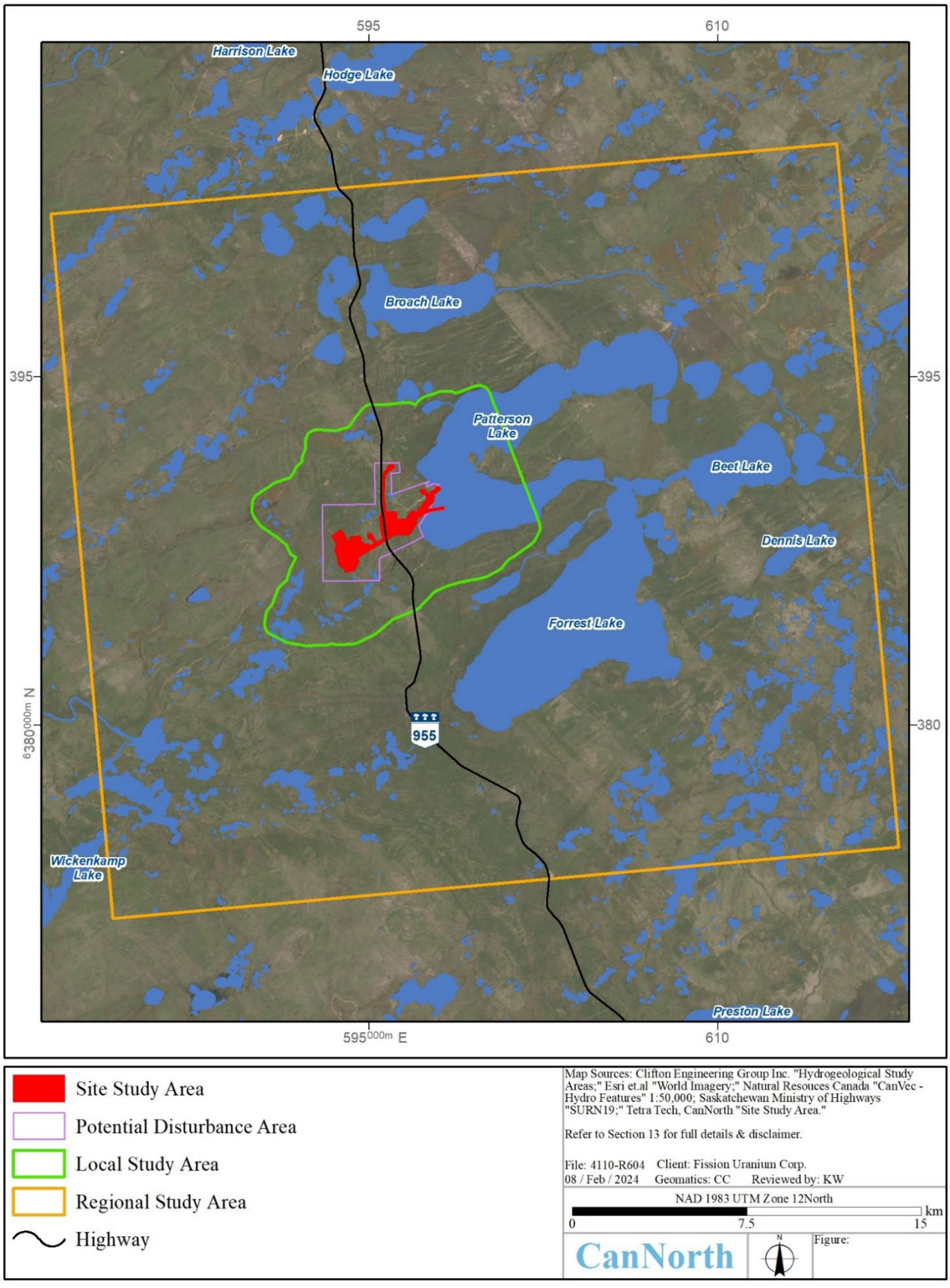

Figure 6-7
PLS Project effects assessment local and regional study areas for groundwater quantity and groundwater quality.

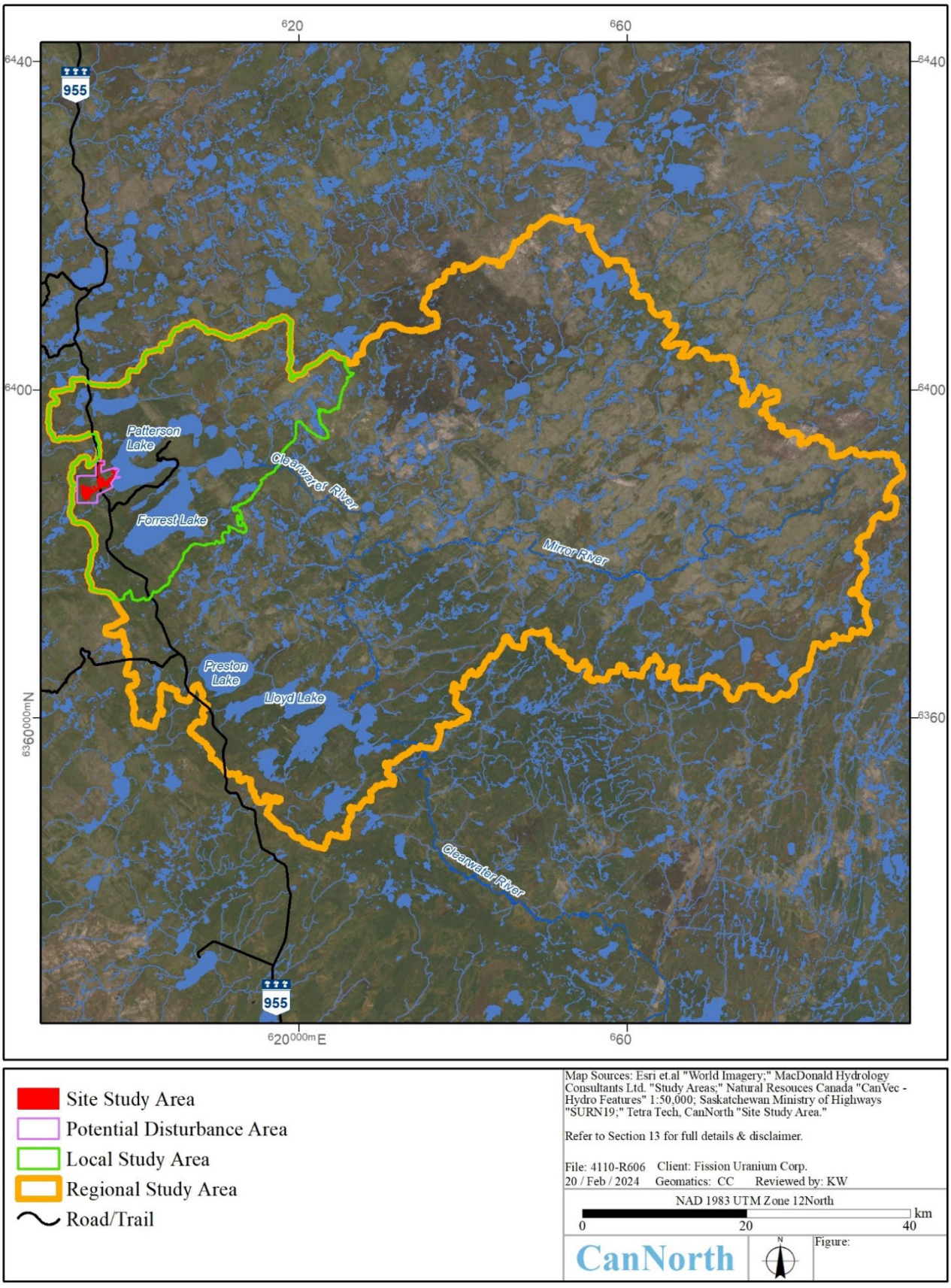

Figure 6-8
PLS Project effects assessment local and regional study areas for surface water quantity, surface water quality, and fish and fish habitat.

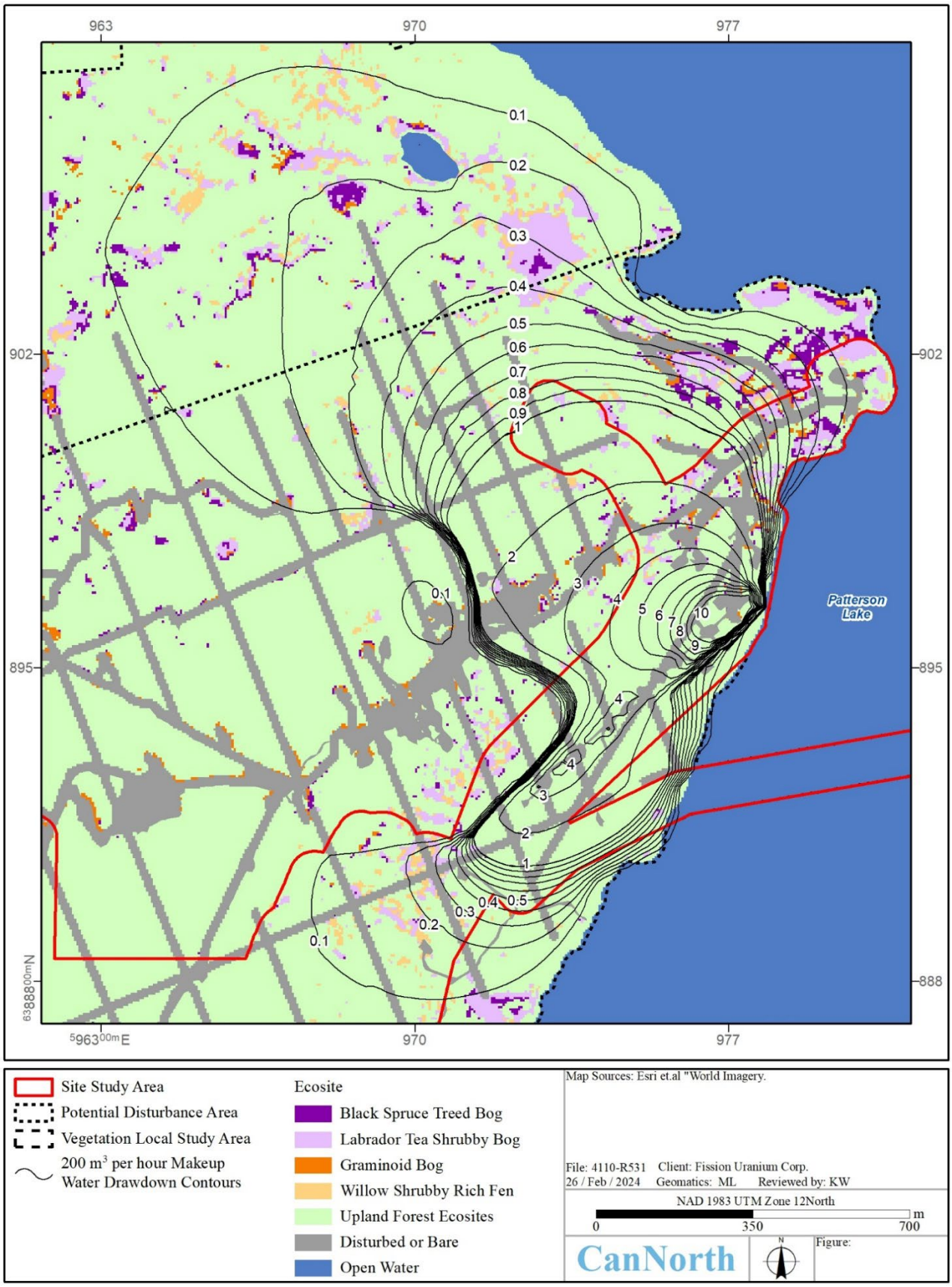

Figure 6-9
PLS Project predicted groundwater drawdown contours from taking make-up water for mill processing overlaid on wetland ecosites.

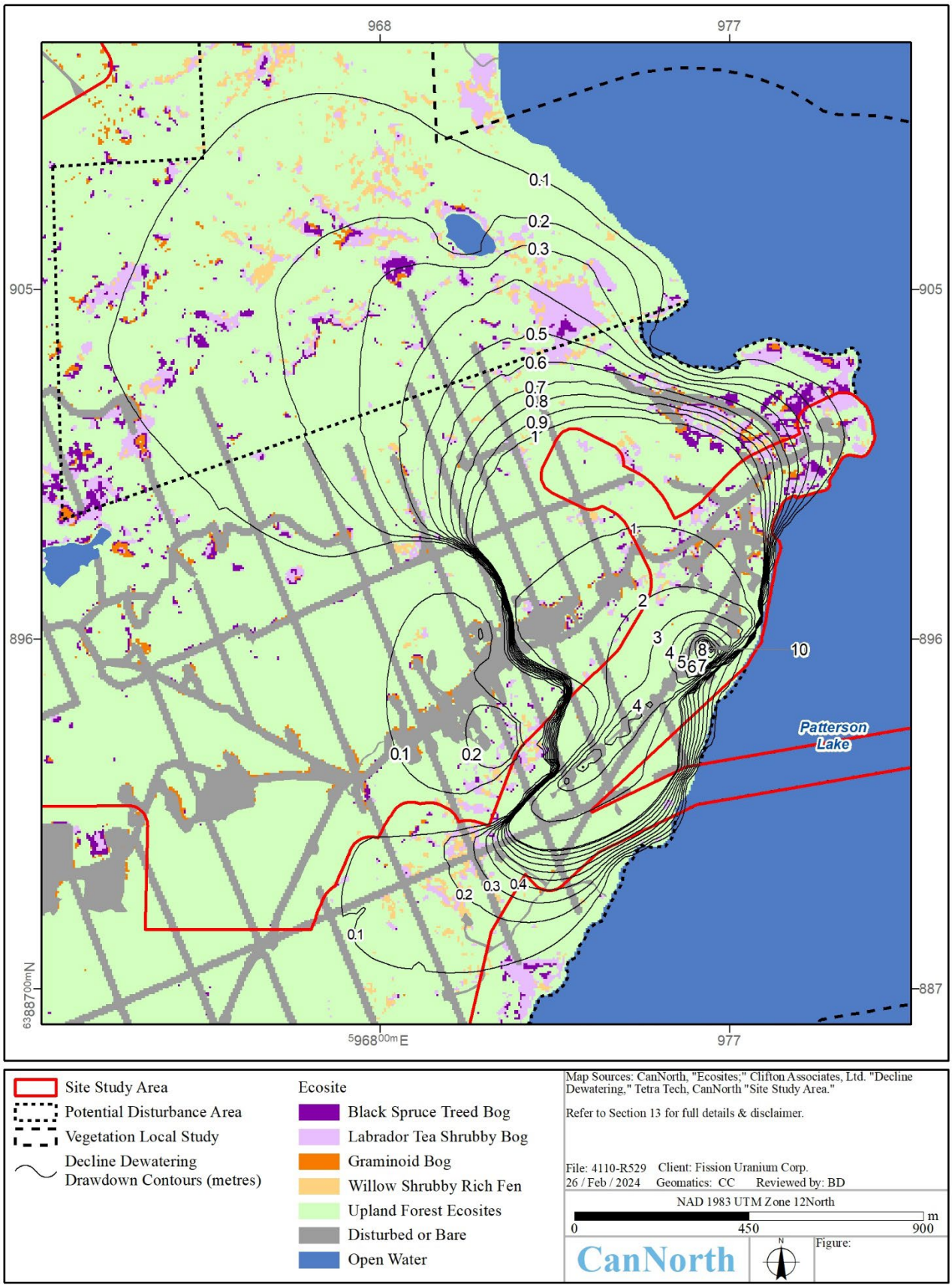

Figure 6-10
PLS Project predicted groundwater drawdown contours at the mine decline overlaid on wetland ecosites.

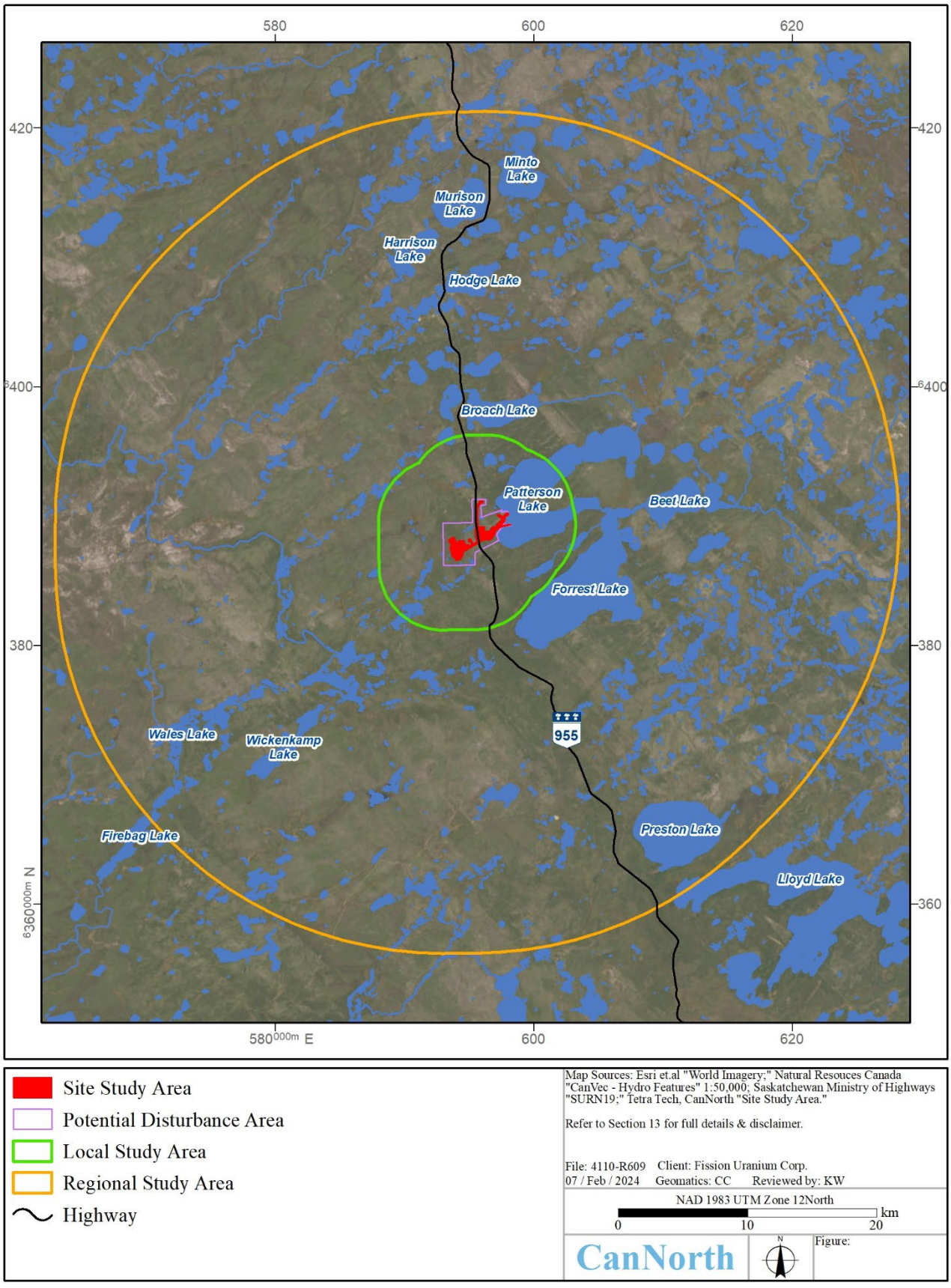

Figure 6-11
PLS Project effects assessment local and regional study areas for wildlife valued components.

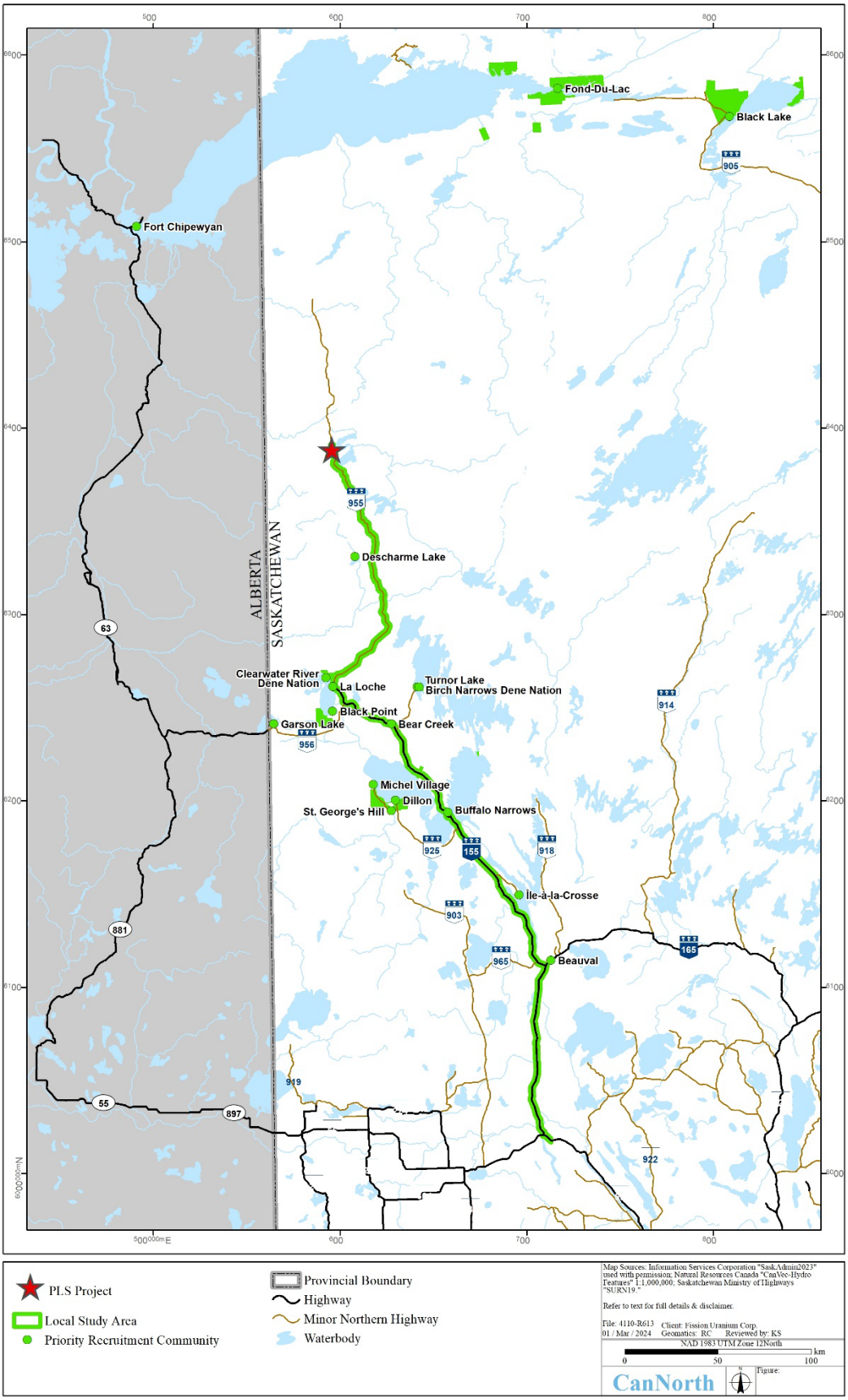

Figure 6-12
PLS Project effects assessment local study area for economic wellbeing and community wellbeing and human health.

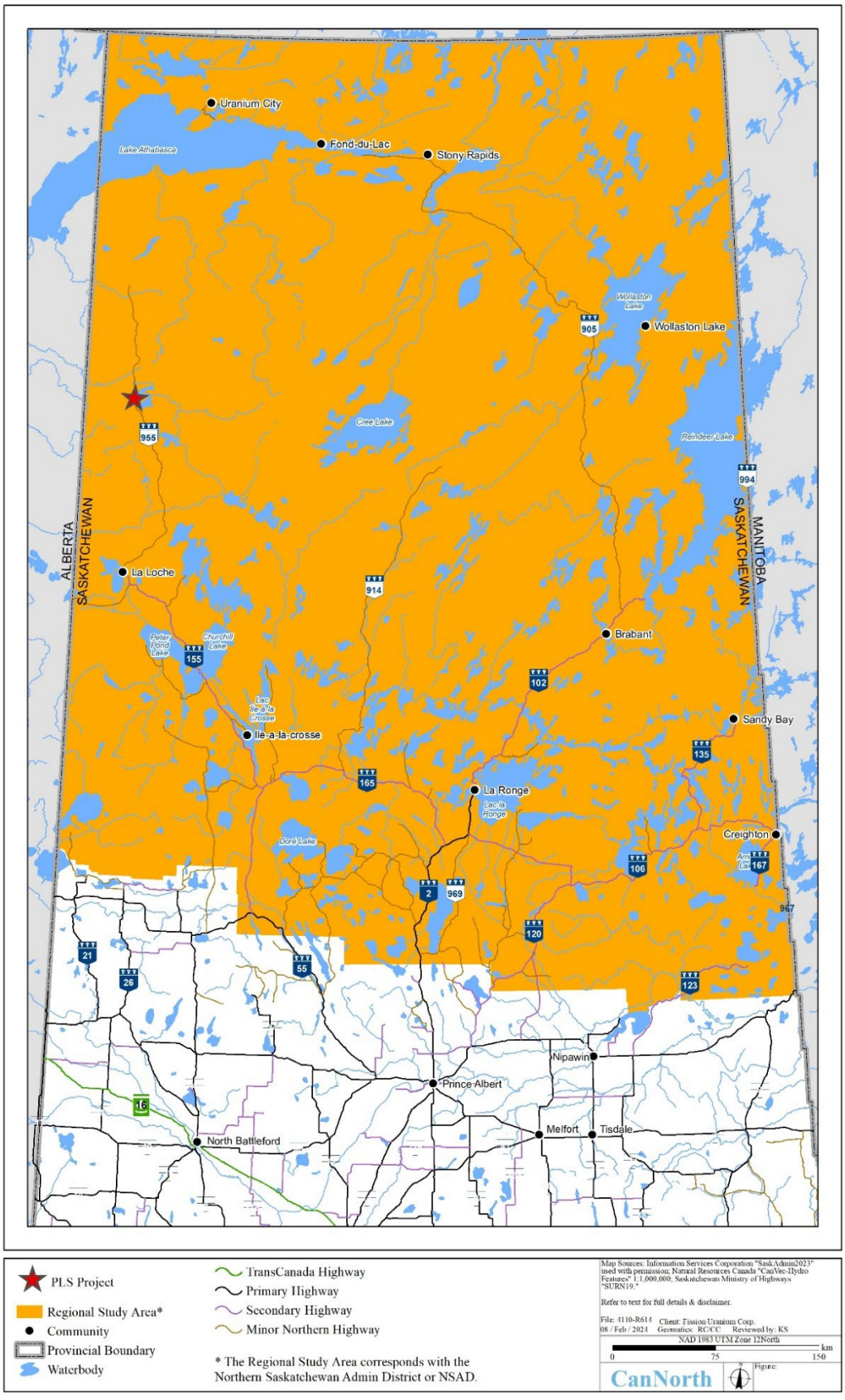

Figure 6-13
PLS Project effects assessment regional study area for economic wellbeing and community wellbeing and human health.

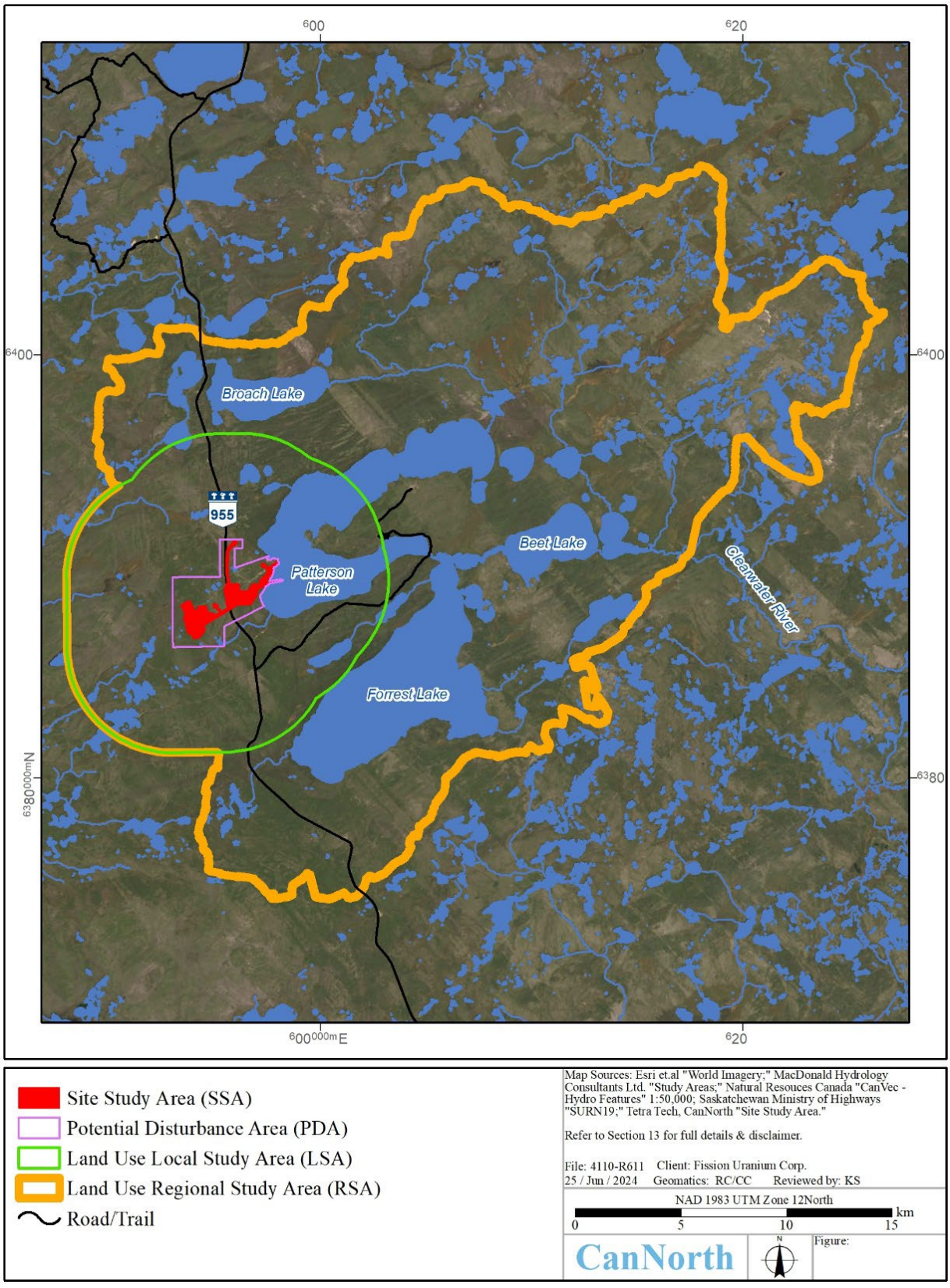

Figure 6-14
PLS Project effects assessment local and regional study areas for traditional land and resource use and other land and resource use.

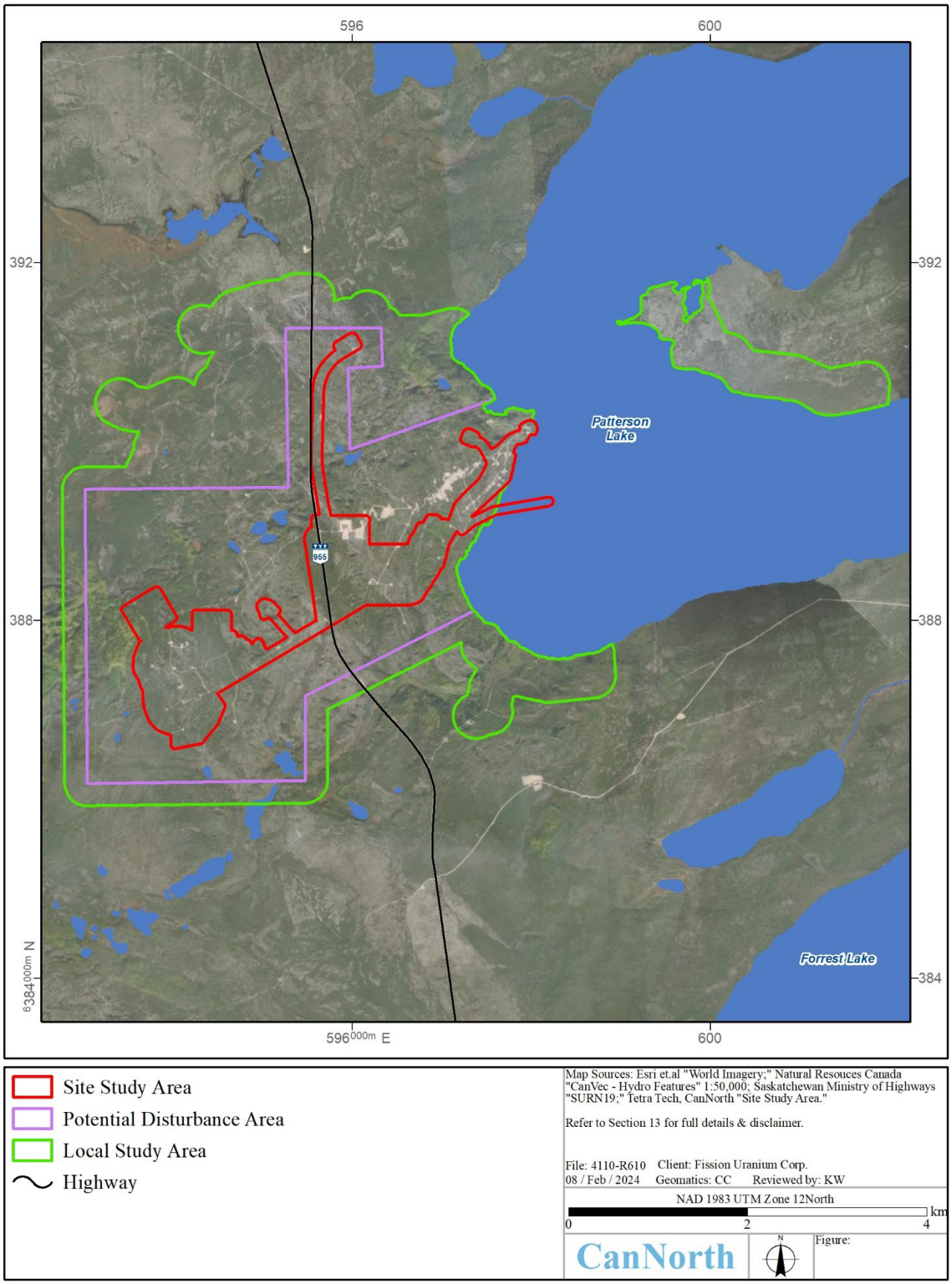

Figure 6-15
PLS Project effects assessment local study area for heritage resources.

Table 6-1
Concordance table – effects assessment.

EIS Requirement	Section and Page #
Predicted Changes to the Environment	
b) For each environmental component, identify the change from baseline condition that could potentially occur and predict the likelihood, magnitude, frequency, duration and reversibility of the change after different possible scenarios	Effects Assessment (6.0), throughout section, Table 6-4
c) Comparison of expected future conditions of each component with and without the development	Effects Assessment (6.0), throughout section, Table 6-3
d) Clearly defined methodology, assumptions and rationale for the predicted changes, including reference to standards and thresholds, where they exist	Effects Assessment (6.0), throughout section, Table 6-3
Assessment of Effects on the Valued Components	
Development Impact	
d) For each VC or group of related VCs, description of the methodology that was used to assess the potential impacts of development related changes explaining any deviations from the methods proposed in the TOR	Effects Assessment (6.0), throughout section
e) Identification and analysis of the direct and indirect impacts on each VC for each phase of the proposed development	Effects Assessment (6.0), throughout section, Table 6-2
f) Evaluation of the significance of development-specific impacts on each VC in terms of the magnitude, geographic extent, timing, duration, frequency, reversibility and likelihood of occurrence	Effects Assessment (6.0), throughout section, Table 6-4
g) Discussion of the ability of the local environment to accept the predicted changes (i.e., the resiliency of the environment)	Effects Assessment (6.0), throughout section
h) Discussion of the proponent's understanding of the potential adverse impacts to VCs important to local communities, First Nations and Metis communities	Effects Assessment (6.13 to 6.17), 6-114
i) The significance of predicted changes to different communities or groups	Effects Assessment (6.13 to 6.17), 6-114
Proposed Mitigation	
d) Proposed mitigation and rationale for those VCs determined to be at risk from potential impacts	Effects Assessment (6.0), throughout section, Table 6-2
e) Justification for when non-standard mitigation is proposed	Effects Assessment (6.0), throughout section, Table 6-2
f) The objective or desired outcome of specific mitigation for each VC	Effects Assessment (6.0), throughout section
g) Discussion of level of acceptance by local communities for proposed mitigation measures	Appendix B.2
h) Methodologies for implementing mitigation measures	Effects Assessment (6.0), throughout section, Table 6-2
i) Plan for monitoring mitigation outcomes	Monitoring and Follow-up Programs (9.0), throughout section
j) Contingency actions if mitigation does not achieve expected outcomes	Conditions Management (11.0), throughout section

Table 6-1
Concordance table – effects assessment.

Residual Effects	
e) For each VC, detailed explanation of the methodologies used to identify and assess the significance of residual effects	Effects Assessment (6.0), throughout section, Table 6-3
f) Identification of the residual effects remaining after proposed mitigation is implemented	Effects Assessment (6.0), throughout section, Table 6-3
g) Significance of development-specific residual impacts on each VC in terms of the magnitude, geographic extent, timing, duration, frequency, reversibility and likelihood of occurrence	Effects Assessment (6.0), throughout section, Table 6-4
h) Detailed proposed offsetting plan(s) for VCs where residual impacts cannot be avoided or sufficiently minimized, or justification as to why offsets are not required. A detailed offset plan for impacts to SOCC or ecosystems may include: - offset objectives - options and preferred method for calculating offsets (e.g., credit/debit, defined ratio) - offset options - offset methodology - monitoring program - contingency actions if offset does not achieve objectives	Fish and Fish Habitat (6.10.2.8), 6-65 Wildlife (6.12.3.1), 6-96 Appendix D.9
Cumulative Effects Assessment (CEA)	
c) Detailed explanation of the approach to assessing cumulative impacts of the development on VCs	Effects Assessment (6.0), throughout section
d) Definition and rationale for spatial and temporal boundaries used in the CEA	Effects Assessment Approach (5.5), 5-5, 5-11
e) Identification and rationale for the VCs that will be the subject of the CEA	Effects Assessment Approach (5.5), 5-11
f) Sources of potential cumulative effects including those from the current development and other past or possible future projects	Effects Assessment Approach (5.5), 5-11
g) Proposed mitigation measures to avoid, minimize or offset cumulative effects of the development	Effects Assessment (6.0), throughout section
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Throughout Section
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (6.18), 6-164
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Appendix A.2, A.3, A.4, A.5, A.6, A,7, B.1, B.2, C.1, C.2, C.3, C.4, C.5, C.6, D.1, D.2, D.3, D.4, D.5, D.6, D.7, D.8, D.10

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Land cleared and disturbed for Project infrastructure	Land clearing and ground disturbance will cause loss or alteration of vegetation and habitat in the Site Study Area (SSA), may cause a physical disturbance to heritage resources, and there is the potential for injury or mortality to wildlife from clearing activities	Visual landscape Terrain and soils Vegetation Wildlife VCs Traditional land and resource use Other land and resource use Heritage resources	• Use previously disturbed areas to the extent possible to situate infrastructure and roads, and design an efficient site layout to minimize the extent of native habitat cleared •Identify areas of terrain sensitivities such as steep slopes (i.e., >15%) and avoid them where possible. If avoidance is not possible, the use of soil stabilization measures (e.g., geotextiles, swamp mats, rig mats, erosion blankets, silt fences, check damns, or surface mulches, etc.) should be considered. • Limit vegetation removal on steep slopes and minimize the steepness and length of slopes of disturbed areas and stockpiles •Preserve natural drainage features such as pre-existing areas of natural macro and micro topographic relief • Access the site via the existing Highway 955 • A 20 m setback from the SSA was established to maximize the buffer of trees along property boundaries to act as visual screens, particularly along the lake-side portion of the SSA • Use topsoil removed during the site preparation process for reclamation during future progressive and final closure activities • Use clearing equipment that minimizes surface disturbance, soil compaction, and topsoil loss, where feasible • Complete progressive reclamation during operations on disturbed areas to promote revegetation as early as possible using native species or non-aggressive, non-native species appropriate for the conditions • Implement an Environmental Management Program that will outline the requirements for pre-clearance surveys prior to clearing activities during sensitive timing windows for breeding birds, bats, and other wildlife, as needed • Assess any caves or rock outcrops discovered during construction for bat usage and habitat potential (i.e., roosting sites or hibernacula) prior to being impacted • Prior to decommissioning, complete bat surveys of site infrastructure and the mine decline/shaft openings and implement procedures to avoid or mitigate as needed • Implement measures, monitoring, and adaptive management outlined in the Woodland Caribou Mitigation Plan and the Wildlife Management and Monitoring Procedure • Implement a detailed Decommissioning and Reclamation Plan and conduct decommissioning and post-decommissioning monitoring to measure revegetation success • Conduct heritage resource impact assessments in previously unassessed areas that will be disturbed and implement procedures to avoid or mitigate as needed • Develop, with the input of the local communities and a professional archaeologist, a Chance Finds Procedure and documentation that guides handling the discovery of heritage resources and culturally important sites
Construction activities and run-off from non-contact areas could cause soil erosion and runoff	Site clearing and construction activities as well as run-off from non-contact areas (i.e., roads and camp) could cause increased soil erosion and runoff, which could cause effects on other VCs	Surface water quality Fish and fish habitat Terrain and soils Vegetation	• Minimize steepness and length of slopes of disturbed areas and stockpiles to the extent possible • Minimize earthworks in areas of high erosion susceptibility, where possible • Avoid ground disturbance activities during times of high wind and heavy rain • Place stockpiles in areas that have a low risk of wind and water erosion and cover stockpiles with temporary or semi permanent materials (e.g., geotextiles and vegetation cover) • Use and monitor erosion control measures (e.g., geotextiles, swamp mats, rig mats, erosion blankets, silt fences, check damns, or surface mulches, etc.) where necessary • Ensure there is a buffer of trees maintained between the Project and Patterson Lake to minimize the potential for soil runoff into the lake • Avoid placing soil stockpiles near waterbodies (i.e., maintaining a 100 m buffer from waterbodies), unless required for temporary storage • Design and perform maintenance of water containment and conveyance structures to limit the risk of road wash-out and runoff into sensitive environments and waterbodies • Avoid introduction of soil/sediment into water and implement an erosion and sediment control plan and monitoring program during construction activities of in-water works • Avoid contamination caused by spills using measures that will be detailed in the Environmental Contingency Plan

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Altered site drainage caused by Project infrastructure development, operations, and decommissioning	Changes to natural drainage patterns could affect local surface water quantity, which could have effects on other VCs	Surface water quantity Fish and fish habitat Terrain and soils Vegetation Wildlife VCs	• Use previously disturbed areas where possible to situate infrastructure and roads, and design an efficient site layout to minimize changes to the terrain • Implement a water management strategy to ensure contact and non-contact water remain separate and site drainage is effectively managed • Preserve natural drainage features to minimize alteration to drainage conditions in the area to the extent possible • Construct surface water management features as needed to facilitate surface drainage continuity and hydrologic connectivity • Contour disturbed areas and re-establish natural drainage during decommissioning to the extent possible
Construction and operation of decline and underground mine	Groundwater levels could be affected by dewatering activities completed during construction and operation of the decline and underground workings, which could have effects on other VCs	Groundwater quantity Surface water quantity Vegetation	• Limit the infrastructure footprint to the extent possible to reduce the potential for reductions in groundwater quantity • Mitigate, where possible, ingress of groundwater into underground workings via grouting, freezing, or other water ingress control measures • Implement an Environmental Monitoring and Measurement Procedure that includes monitoring groundwater and surface water levels
Construction of the TMF and development of the initial water cover	Groundwater levels could be affected by construction of the TMF and development of the initial water cover, which could have effects on other VCs	Groundwater quantity Surface water quantity Vegetation	• Limit the infrastructure footprint to the extent possible to reduce the potential for reductions in groundwater quantity • Implement an Environmental Monitoring and Measurement Procedure that includes monitoring groundwater and surface water levels
Make-up water for mill processing supplied by groundwater	Groundwater levels could be affected by pumping of wells to provide makeup groundwater for use in mill processing during operations, which could have effects on other VCs	Groundwater quantity Surface water quantity Vegetation	• Recycle and reuse process water in the mill to reduce the need for make-up water • Implement an Environmental Monitoring and Measurement Procedure that includes monitoring groundwater and surface water levels
Potable water supplied by groundwater	Groundwater levels could be affected by pumping of groundwater for potable water supply, which could have effects on other VCs	Groundwater quantity Surface water quantity Vegetation	• Minimize water use to the extent possible to limit taking groundwater for potable water • Implement an Environmental Monitoring and Measurement Procedure that includes monitoring groundwater and surface water levels
Long-term unintended seepage from the TMF, containment ponds, ore and waste rock stockpiles, and underground mine	Unintended seepage from lined Project facilities has the potential to affect groundwater quality, which could have effects on other VCs	Groundwater quality Surface water quality Fish and fish habitat	• Design lined surface facilities to mitigate unintended seepage • Install sentinel style monitoring well systems for monitoring, contaminant capture in the event of a release from the TMF, and adaptive management • Implement an Environmental Monitoring and Measurement Procedure that includes monitoring groundwater and surface water quality

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Noise generation and other sensory disturbance caused by Project activities and traffic	Sensory disturbance (e.g., noise, lights, smells, presence of buildings) may cause indirect habitat loss and alter wildlife movement and behaviour, cause changes to the environmental conditions required for the continuance of land and resource use, impact the frequency and pattern of land and resource use, and affect human health	Noise and vibration Visual landscape Wildlife VCs Traditional land and resource use Other land and resource use Community well being and human health	• Employ noise abatement measures on equipment when practical including noise suppression on vehicles • Outfit LNG generators with enclosures and exhaust silencers • Use fan silencers on the surface mine ventilation infrastructure and direct the vents away from Patterson Lake to reduce noise travelling to the lake • Maintain roads to minimize ruts to reduce noise emissions from vehicles • Vehicles, equipment, and ATV/UTVs will remain on designated roads/trails • Limit light pollution to the extent practical by strategically planning lighting locations, brightness, and frequency/duration of use • Implement an Environmental Management Program that will outline the requirements for pre-clearance surveys prior to clearing activities during sensitive timing windows for breeding birds, bats, and other wildlife as needed • Implement a Waste Management Plan to ensure the proper segregation, storage, and disposal of non-hazardous and hazardous wastes; non-hazardous waste storage facilities will be enclosed and fenced to reduce the potential for wildlife interactions • Implement measures, monitoring, and adaptive management outlined in the Woodland Caribou Mitigation Plan and the Wildlife Management and Monitoring Procedure
Pressure changes and vibrations caused by the use of explosives at the Project	Blasting activities in the mine decline and underground mine could cause shock waves through Patterson Lake that could cause injury or mortality to fish and fish eggs	Fish and fish habitat	• The DFO guidelines for the use of explosives in or near fish-bearing waters will be followed; Fission will notify DFO of their intent to use explosives at the Project and seek an Authorization under the *Fisheries Act* if deemed necessary • Each blast hole will be on its own delay; decked charges will be used to divide the charge into several components along the borehole using stemming in order to limit the charge mass per delay, and thus, limit the overpressure and peak particle velocity
Dust generation caused by Project activities and traffic	Generation of dust (TSP, PM_{10}, and $PM_{2.5}$ and their adsorbed metals and radionuclides) can affect ambient air quality, which could have effects on other VCs	Air quality Surface water quality Fish and fish habitat Terrain and soils Vegetation Wildlife VCs Traditional land use Other land use Community well being and human health	• Limit vehicle speed and enforce speed limits on site roads to reduce generation of dust during all Project phases • Use suppressants to minimize dust generation along roads and active work areas, when required • Use suppressants to minimize dust generation from ore, waste rock, and aggregate storage areas, when required • Equip crushing and screening with wet suppression • Equip concrete batching plant with a dust suppression system • Prevent dust emissions from the TMF by implementing subaqueous tailings disposal • Implement an ambient air quality monitoring program
Gaseous emissions caused by Project activities and traffic	Emissions of nitrogen oxides (NOx), sulphur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC), and sulphuric acid (H_2SO_4) can affect ambient air quality, which could have effects on other VCs	Air quality Surface water quality Fish and fish habitat Terrain and soils Vegetation Wildlife VCs Traditional land use Other land use Community well being and human health	• Evaluate opportunities to reduce fuel combustion requirements of infrastructure and equipment during detailed design to the extent possible • Maintain mobile mining equipment and vehicles and operate the equipment within parameters for engine exhaust system design • Primarily use LNG for power generation • Use pollution control technology on acid plant and process plant exhaust stacks with preventative maintenance and stack testing • Use good engineering practices for exhaust stack design to the extent possible to enhance dispersion • Implement an ambient air quality monitoring program

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Radon emissions caused by Project activities	Radon gas has the potential to affect human health through radiation exposure and dose	Community well being and human health	• Cover the TMF with a water cover to minimize releases of radon gas • Implement a radon monitoring program
Project development causing introduction of invasive/noxious weed species	Invasive plant and/or noxious weed species can alter the composition of vegetation communities	Vegetation	• Implement an Environmental Management Program, which will include measures to prevent, detect, and control areas with prohibited, noxious, and nuisance weed/invasive species, following best practices • Keep topsoil that will be used for reclamation during closure activities free of invasive plant and weed species to the extent possible through isolation and use of cover • Complete progressive reclamation utilizing suitable and appropriate native species where practical during operations to minimize colonization by invasive and noxious weed species
Project activities could increase wildlife-human interactions	Project activities could attract wildlife to the site (e.g., smells, attractive infrastructure) which could increase human-wildlife interactions (habituation)	Wildlife VCs	• Implement an Environmental Management Program that includes a prohibition against members of the workforce harassing, feeding, approaching, or killing wildlife and measures for deterring wildlife from site where needed for human and wildlife protection • Implement mandatory training for members of the workforce that details procedures for safety around wildlife, reporting wildlife sightings, and how presence of dangerous wildlife will be handled • Implement a Waste Management Plan to ensure the proper segregation, storage, and disposal of non-hazardous and hazardous wastes; non-hazardous waste storage facilities will be enclosed and fenced to reduce the potential for wildlife interactions • The Waste Management Plan will include design features to prevent access to food or food wastes by wildlife, including secure waste containers, installation of electric fences or other measures; any nuisance animals will be reported to ENV for guidance • Implement measures, monitoring, and adaptive management outlined in the Woodland Caribou Mitigation Plan and the Wildlife Management and Monitoring Procedure • Install deterrents and/or exclusion measures to prevent migratory birds or bats from entering/nesting/roosting on buildings or other infrastructure, including applying screening on vents and entrances to rafters/attics • Measures to prevent birds from entering or nesting near the TMF will include vegetation control to reduce adjacent habitat potential for nesting waterfowl, as well as deterrents as required (e.g., scare cannons or predator calls), and regular patrols • Roosting bats will not be disturbed; ENV will be contacted to discuss any necessary mitigations and the provincial bat exclusion policy will be followed • Any dead or injured/sick bats observed near site infrastructure will be collected by trained staff using appropriate personal protective equipment and will be submitted for testing of white-nose syndrome and/or rabies, based on communications with the ENV and ECCC
Project infrastructure and changes to terrain could change wildlife movement	Project infrastructure including roads and the treated effluent pipeline could change wildlife movement patterns	Wildlife VCs	• Ensure ROW contain line-of-site breaks to provide woodland caribou and other wildlife with adequate visual and winter escape cover • Minimize snowbank height along ploughed roads to the extent practical and have breaks to facilitate wildlife movements across and out of the transportation corridors • Provide woodland caribou and wildlife the right-of-way • Treated effluent pipeline will use small diameter pipe (0.33 m) and to be installed at grade • Implement measures, monitoring, and adaptive management outlined in the Woodland Caribou Management Plan and the Wildlife Management and Monitoring Procedure

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
In-water construction, decommissioning, and operation of treated effluent pipeline and diffuser	In-water construction, operation, and decommissioning of treated effluent pipeline and diffuser could temporarily affect surface water quality and fish and fish habitat and vegetation	Surface water quality Vegetation Fish and fish habitat	• Treated effluent diffuser was situated in an area that avoids sensitive or unique fish habitat • The structure was designed to minimize adverse effects on fish and fish habitat and avoid harmful alteration, disruption, or destruction of fish habitat • Follow permit requirements in the provincial AHPP and apply best practices stated in DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat during in-water works • Schedule in-water work to avoid DFO's Saskatchewan Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat • Properly maintain equipment operating near waters so it is free of any fuel, oil, hydraulic fluid, or coolant leaks and refuel equipment at least 100 m away from Patterson Lake • Mitigate impacts on riparian vegetation during in-water works by accessing the bay perpendicular to the watercourse, limiting activities, and revegetating disturbed areas • Avoid introduction of soil/sediment into water and implement an erosion and sediment control plan and monitoring program during construction activities
Treated mine effluent release into Patterson Lake	The discharge of treated mine effluent into Patterson Lake could affect surface water levels and quality and cause sediment transport and deposition downstream, which could have effects on other VCs	Surface water quantity Surface water quality Fish and fish habitat Vegetation Wildlife VCs Traditional land and resource use Other land and resource use Community wellbeing and human health	• Recycle and reuse process water in the mill to the extent practical to reduce the quantities released to Patterson Lake and dispose of solid sewage waste in the TMF • Treat all contact water in an effluent treatment plant to reduce concentrations of constituents of potential concern to Patterson Lake • Monitor treated effluent quality prior to release to ensure regulatory water quality criteria and Project targets are met • Design treated effluent diffuser structure and depth to provide effective mixing and dilution • Conduct effluent toxicity testing as per the *Metal and Diamond Mining Effluent Regulations* • Management of effluent release volumes to maintain as steady a rate as possible; in case of maintenance or operational upset, larger daily releases may be offset by nil release on adjacent days • Implement Environmental Monitoring and Measurement Procedure that includes monitoring surface water quality, sediment quality, and aquatic biota downstream of treated effluent release and in reference areas
Increased traffic/changes to traffic patterns	Increased traffic on Highway 955 and site roads may result in increased risk of accidents with wildlife and people	Wildlife VCS Community wellbeing and human health	• Implement an Environmental Management Program, which includes the following mitigation measures to minimize the risk of injury or mortality to wildlife: providing wildlife with the right-of-way, providing appropriate signage in high wildlife use areas, maintaining gaps in the road berms and snowbanks to facilitate wildlife crossing and escape routes, adjusting speed limit in accordance with conditions, and reporting wildlife observations adjacent to roads • Fission will implement and enforce speed limits to the extent possible • Prohibit use of personal recreational vehicles on the Project site • Control access to the Project site (i.e., gate, signage, security) with one main entry point from the existing Highway 955 • Implement a Travel and Traffic Management Plan to manage traffic that will be accessing or departing the Project site • Complete incident reporting on an ongoing basis to track and monitor changes to accident levels

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Changes to land accessibility	The clearing and disturbance of land for Project infrastructure and presence of barriers to access such as security gates may result in changes to land accessibility and the amount of land area available for use.	Economic wellbeing Traditional land and resource use Other land and resource use Community wellbeing and human health	• Fission will consider alternatives to provide alternate trail access around the Project site for land users rather than through the Project access gate • Negotiate and execute a Mine Surface Lease Agreement with the Government of Saskatchewan that would include terms and conditions related to the use of lands, compensation for loss of commercial income, and public involvement • Implement a Public Information Program that will outline how Fission will maintain two-way dialogue with land users, CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities over the life of the mine
Changes to employment, income, and education levels and distribution	Changes to levels and distribution of employment, income, and education has the potential to affect family and community dynamics and support systems for members of the workforce, and may lead to changes in land and resource use, traditional food diet, access to medicines, and cultural continuity.	Community wellbeing and human health	• Fission enforces a Drug and Alcohol Policy to help maintain a safe and healthy workplace • Mental health and cultural supports will be available at the on-site camp including access to an occupational health nurse, elder support, and a cultural space • Fission will develop a Human Resource Management Plan and CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities will be provided the opportunity to review and provide comments on socio-economic components (including Site Employee Wellness)
Increase in people employed in fly-in/fly-out worker rotation schedules	A transition from a worker rotation model where workers reside at home to a model where workers reside at camp for 14-day rotations may result in changes to family dynamics, psychosocial stress, reliance on community support systems, and frequency and patterns of land and resource use	Community wellbeing and human health	• Mental health and cultural supports will be available at the on-site camp including access to healthy food, food that is considerate of worker allergies, restrictions or intolerances, an occupational health nurse, elder support, a cultural space, an on-site gym, and high-speed internet • Fission will develop a Human Resource Management Plan and CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities will be provided the opportunity to review and provide comments on socio-economic components (including Site Employee Wellness)
Changes to demand and capacity of local infrastructure and services	Health care infrastructure and services may be affected by increased demand as a result of changes to the safety and health of communities	Community wellbeing and human health	• A first aid room will be located on-site • A nurse or medic will be available on-site 24 hours a day to tend to minor injuries • Mental health and cultural supports will be available at the on-site camp including access to healthy food, food that is considerate of worker allergies, restrictions or intolerances, an occupational health nurse, elder support, a cultural space, an on-site gym, and high-speed internet • Fission will develop a Human Resource Management Plan and CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities will be provided the opportunity to review and provide comments on socio-economic components (including Site Employee Wellness) • The site will be equipped with a mine rescue and safety office • Emergency response vehicles will be stationed on-site to support site emergency response including wild fire response • Medi-vac service providers to provide air ambulance services as part of the emergency response services; agreements with STARS or equivalent will be maintained to retain air ambulance services

Table 6-2
Summary of effect pathways and design features and mitigations.

Effect Pathway	Pathway Description	Key Valued Components Potentially Affected[1]	Design Features and Mitigation
Increased land and resource use by workers residing at camp	Increased land and resource by workers residing at camp may alter the quantity of land and resources available and may result in changes to patterns and frequency of use by traditional and other users	Economic wellbeing Traditional land and resource use Other land and resource use Community wellbeing and human health	• Employees and contractors will not be permitted to use, transport, or store personal recreational vehicles on the Project site • Fishing will be restricted to catch and release only for the PLS Project workforce • Hunting or trapping will not be permitted on site property, site access roads, or exploration routes by site personnel, therefore increased harvest of wildlife is not expected
Increased interactions between workforce and local residents	Presence and use of the on-site camp and local public airports may result in interactions between workforce and land users, vulnerable groups, and service providers	Community wellbeing and human health	• A public facing grievance mechanism will be in place where land users and other members of the public can express their concerns about potential impacts to land and resource use; Fission is also supportive of and encourages open dialogue and communication to identify and address issues as they arise • Fission is currently and proactively working with local commercial land users to monitor existing conditions and identify risk of impacts to commercial operations • Members of the workforce will be transported to and from the site using shuttles which will limit the ability for members of the workforce to leave the site during their shifts • A security gate will be used to monitor who is coming and going from the site, which may also help limit interactions between members of the workforce and residents from local communities, including members of vulnerable groups • Fission will develop a Human Resource Management Plan and CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities will be provided the opportunity to review and provide comments on socio-economic components (including Site Employee Wellness)

VC = valued component; SSA = site study area; TMF = tailings management facility; LNG = liquified natural gas; ATV/UTV = all-terrain vehicle/utility terrain vehicle; ENV = Ministry of the Environment; ECCC = Environment and Climate Change Canada; DFO = Fisheries and Oceans Canada; TSP = total suspended particulate; PM = particulate matter; VOC = volatile organic compounds; ROW = rights-of-way; AHPP = Aquatic Habitat Protection Permit; CRDN = Clearwater River Dene Nation; BRDN = Buffalo River Dene Nation; BNDN = Birch Narrows Dene Nation; MN-S = Métis Nation of Saskatchewan; ACFN = Athabasca Chipewyan First Nation; STARS = Shock Trauma Air Rescue Service; SLA = surface lease area.

[1]The key VCs most likely to be directly affected by the Project-environment interaction are identified.

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Air quality	Air concentrations of COPC	Generation of dust (and adsorbed metals and radionuclides) from Project activities and traffic could affect ambient air quality	Predicted changes in concentrations of dust compared to existing environment conditions and air quality standards or criteria	Construction Operations Decommissioning	Key interaction	Modelled concentrations of 24-hour TSP, PM_{10}, and $PM_{2.5}$ are predicted to have measurable increases and be above the assessment criteria in the LSA during construction and operations; annual $PM_{2.5}$ concentrations are predicted to have measurable increases and be above the assessment criteria during operations in the vicinity of the PDA
			Predicted changes in concentrations of uranium adsorbed in dust compared to existing environment conditions and air quality standards or criteria	Construction Operations Decommissioning	Key interaction	Modelled concentrations of 24-hour uranium are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA for construction and operations
			Predicted changes in concentrations of arsenic, cadmium, cobalt, copper, nickel, and selenium adsorbed in dust compared to existing environment conditions and air quality standards or criteria	Construction Operations Decommissioning	Minor interaction	N/A
		Emissions of gaseous COPC including nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOC), and sulphuric acid (H_2SO_4) from Project activities and traffic could affect ambient air quality	Predicted changes in gaseous concentrations of CO, SO_2, NO_2, and acrolein compared to existing environment conditions and air quality standards or criteria	Construction Operations Decommissioning	Key interaction	Modelled concentrations of 1-hour carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and 24-hour NO_2 and acrolein are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA during operations
			Predicted changes in H_2SO_4 emissions compared to existing environment conditions and air quality criteria	Operations	Minor interaction	N/A
Noise and vibration	Noise and vibration levels	Generation of noise from Project activities	Predicted changes in sound pressure levels compared to existing environment conditions and guidelines	Construction Operations Decommissioning	Key interaction	A measurable increase in sound levels was predicted by the modelling and an exceedance of one of the assessment criteria was predicted at one receptor
		Generation of noise from increased truck traffic on Highway 955		Construction Operations Decommissioning	Minor interaction	N/A
		Generation of vibrations from Project activities on human receptors	Predicted changes in vibration compared to literature	Construction Operations	No interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Visual landscape	Visibility and visual contrast	Project infrastructure could change the visual landscape surrounding the Project	Predicted visible extent of prominent Project features and visual contrast between the Project and existing landscape from sensitive viewpoints	Construction Operations	Key interaction	A measurable change in landscape character is expected to generate a strong level of contrast and high visibility of sufficient scale and prominence to negatively affect visual amenities at sensitive viewpoints
Terrain	Terrain morphology and stability	Altered terrain may result from construction, operation, and decommissioning activities	Predicted changes in topographic contours and drainage patterns compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Altered terrain will result from Project activities; the TMF will remain post-decommissioning
Soils	Soil quantity	Reduced soil quantity may result from construction, operation, and decommissioning activities	Predicted changes to quantity of organic and mineral soil available for reclamation compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Reduced soil quantity will result from Project activities; the TMF will remain post-decommissioning
	Soil quality	Reduced soil quality may result from construction, operation, and decommissioning activities	Predicted changes to quality of soil physical and chemical properties compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Reduced soil physical properties will result from Project activities; the TMF will remain post-decommissioning
		Air dispersion of dust and gaseous pollutants could impact soil COPC concentrations and health	Predicted changes to quality of soil physical and chemical properties compared to existing environment conditions	Construction Operations Decommissioning	Minor interaction	N/A
Groundwater quantity	Groundwater levels	The horizontal and vertical extent of drawdown from a point of discharge	Dewatering/depressurization of the mine decline/groundwater use as make-up water in the mill	Construction Operations	Key interaction	A measurable decrease in water levels is predicted in the area of the decline during construction and operations
			Dewatering for installation of the TMF underdrain system	Construction	Minor interaction	N/A
			Development of the initial water cover for the TMF	Construction	Minor interaction	N/A
			Groundwater inflow to the underground mine	Construction Operations	Minor interaction	N/A
			Groundwater use as a potable water to supply to the work camp	Operations	Minor interaction	N/A
Groundwater quality	Groundwater COPC concentrations	Potential leakage from waste rock stockpiles and effluent ponds could impact groundwater COPC concentrations	Predicted changes in groundwater COPC concentrations that discharges to surficial receptors compared to SEQG groundwater criteria for freshwater aquatic life	Construction Operations	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Groundwater quality	Groundwater COPC concentrations	Long-term potential leakage from the TMF and mine backfill could impact groundwater COPC concentrations	Predicted changes in groundwater COPC concentrations that discharges to surficial receptors compared to SEQG groundwater criteria for freshwater aquatic life	Post-decommissioning	Key interaction	A measurable change in groundwater COPC concentrations is predicted that discharge to South Creek
			Predicted changes in groundwater COPC concentrations compared to SEQG groundwater criteria for potable water	Post-decommissioning	Key interaction	A measurable change in groundwater COPC concentrations is predicted immediately downgradient of the TMF
Surface water quantity	Surface water levels and flows	Groundwater drawdown and treated effluent release into Patterson Lake could alter surface water quantities	Predicted changes in surface water levels and flows compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Groundwater drawdown and treated effluent release into Patterson Lake is predicted to change surface water quantities in the LSA during operations
		Construction and operation of the surface facilities could alter site drainage by influencing infiltration capacity and overland flow, which could impact surface water quantity		Construction Operations Decommissioning	Minor interaction	N/A
Surface water quality	Surface water and sediment COPC concentrations	Site clearing and construction activities could cause increased soil erosion, which could affect surface water quality	Predicted changes in surface water and sediment COPC concentrations compared to existing environment conditions and applicable guidelines	Construction	Minor interaction	N/A
		Non-contact water from areas such as roads or camp could affect surface water quality		Construction Operations Decommissioning	Minor interaction	N/A
		Air dispersion of dust and COPC into aquatic environments could impact surface water quality		Construction Operations Decommissioning	Minor interaction	N/A
		Contact water, seepage from lined Project facilities, and groundwater contact with mine backfill could influence surface water quality		Construction Operations Decommissioning Post-decommissioning	Minor interaction	N/A
		Treated effluent release into Patterson Lake could impact surface water quality		Construction Operations Decommissioning	Key interaction	Treated effluent release into Patterson Lake is predicted to change surface water quality
		Project activities and traffic could cause air dispersion of dust and COPC into aquatic environments and as a result impact fish habitat		Construction Operations Decommissioning	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Fish and fish habitat	Lake trout, walleye, northern pike, lake whitefish, white sucker, burbot, yellow perch, and benthic invertebrates	Soil erosion and runoff caused by site clearing and construction activities could affect fish habitat	Predicted effects to fish and fish habitat due to predicted changes in environmental COPC concentrations	Construction	Minor interaction	N/A
		Contact water, seepage from the lined waste storage areas, and groundwater contact with mine backfill could influence surface water quality which, in turn, could affect fish habitat	Predicted effects to fish and fish habitat due to predicted changes in environmental COPC concentrations	Construction Operations Decommissioning Post-decommissioning	Minor interaction	N/A
		Treated effluent release into Patterson Lake could impact surface water quality and thereby affect fish habitat		Construction Operations Decommissioning	Key interaction	Treated effluent release into Patterson Lake is predicted to change surface water quality
		Groundwater drawdown and treated effluent release into Patterson Lake could impact surface water quantity and the amount and quality of available fish habitat	Predicted changes in quantity and quality of fish habitat due to changes in surface water levels and flow compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Changes in surface water quantity under low flow conditions are predicted during operations
		Altered site drainage caused by Project infrastructure development and operation could cause changes in surface water quantity compared to existing environment conditions, and thus, affect fish habitat.		Construction Operations Decommissioning	Minor interaction	N/A
		Predicted changes to stream flow during the operations phase could cause sediment transport and deposition in the Clearwater River downstream of Patterson Lake, which could affect fish habitat.		Operations	Minor interaction	N/A
		The installation, operation, and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake will directly impact fish habitat	Direct loss of fish habitat due to in-water works	Construction Operations Decommissioning	Minor interaction	N/A
		Pressure changes and vibrations caused by the use of explosives in the mine decline and underground mine could have adverse health effects on fish	Potential for injury or mortality to fish	Construction Operations	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Vegetation	Loss of vegetation abundance and diversity	Loss or alteration of vegetation and vegetation communities may result from land clearing	Predicted changes in abundance and composition of vegetation communities compared to existing environment conditions	Construction Operation Decommissioning Post-decommissioning	Key interaction	Loss or alteration of vegetation from land clearing will occur during all Project stages; TMF will remain permanently altered
		Water quantity changes (groundwater and surface) could affect vegetation in wetlands		Construction Operations Decommissioning	Minor interaction	N/A
		Aquatic vegetation species could be affected by the installation and decommissioning of the treated effluent pipeline and diffuser in Patterson Lake		Construction Decommissioning	Minor interaction	N/A
		Introduction of invasive and/or noxious weed species could affect vegetation community composition and SOCC		Construction Operation Decommissioning Post-decommissioning	Minor interaction	N/A
	Vegetation COPC concentrations	Air dispersion of dust and gaseous pollutants could impact vegetation COPC concentrations and health	Predicted effects to vegetation due to predicted changes in environmental COPC concentrations	Construction Operations Decommissioning	Minor interaction	N/A
		Treated effluent release into Patterson Lake could impact vegetation COPC concentrations and health		Construction Operations Decommissioning	Key interaction	Treated effluent release into Patterson Lake is predicted to change surface water quality
Wildlife VCs	Wildlife key indicators	Construction, operation, and decommissioning of Project facilities will cause direct loss or alteration of wildlife habitat in the SSA	Predicted changes in quantity and quality of suitable habitat compared to existing environment conditions	Construction Operations Decommissioning	Key interaction	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered
		Potential for change in wildlife habitat quality and in the behaviours and movement patterns of wildlife due to sensory disturbances caused by Project activities		Construction Operations Decommissioning	Key interaction	Project activities are predicted to cause sensory disturbances to wildlife
		Wildlife movements may be altered by linear features (i.e., treated effluent pipeline and roads)		Construction Operations Decommissioning	Minor interaction	N/A
		A change in wildlife mortality and/or health may occur due to several factors, including injury during vegetation clearing, vehicle collisions, attraction or habituation, increased access to hunters	Predicted mortalities directly or indirectly related to the Project activities (e.g., traffic collisions)	Construction Operations Decommissioning	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Wildlife VCs	Wildlife key indicators	Dust generation caused by Project activities and traffic	Predicted effects due to predicted changes in environmental COPC concentrations	Construction Operations Decommissioning	Minor interaction	N/A
		Gaseous emissions caused by Project activities and traffic		Construction Operations Decommissioning	Minor interaction	N/A
		Treated effluent release into Patterson Lake		Construction Operations Decommissioning	Key interaction	Treated effluent release into Patterson Lake is predicted to change surface water quality
Economic wellbeing	Municipal and provincial economy	Increased economic opportunities due to employment, contract, and training opportunities and payment of taxes and royalties	Predicted changes to income levels in local municipal and annual provincial tax revenues	Construction Operations Decommissioning	Key interaction - positive	N/A
			Predicted changes to level of business activity in Saskatchewan (at local and regional levels)	Construction Operations Decommissioning	Key interaction - positive	N/A
	Traditional economy		Predicted changes to income received and level of participation in traditional economies compared to existing conditions	Construction Operations Decommissioning	Key interaction - positive	N/A
		Changes to land and resource quantity, quality, and accessibility (see Traditional Land and Resource Use)		Construction Operations Decommissioning Post-decommissioning	Minor interaction	N/A
	Local employment and income levels and distribution	Increased economic opportunities due to employment, contract, and training opportunities and payment of taxes and royalties.	Predicted changes to local and regional employment and income levels and distribution compared to existing conditions	Construction Operations Decommissioning	Key interaction - positive	N/A
Traditional land and resource use	Land and resource quantity and accessibility, and land and resource quality and user experience	Land cleared and disturbed for Project infrastructure and changes to land accessibility due to presence of barriers may cause changes to the quantity of land available for continued traditional land and resource use compared to current conditions	Predicted land area that will become inaccessible for land and resource use compared to current conditions	Construction Operations Decommissioning	Key interaction	Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for traditional uses in the SSA
			Predicted change to number and cultural significance of important areas or unique or rare sites which will be disturbed or become in accessible compared to current conditions			
		Measurable changes to the natural environment may cause changes to quantity and quality of resources important for continued traditional land and resource use compared to current conditions	Predicted changes to vegetation, fish, and wildlife compared to existing conditions	Construction Operations Decommissioning	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Traditional land and resource use	Land and resource quantity and accessibility, and land and resource quality and user experience	Voluntary avoidance may alter the quantity of land that is considered suitable for traditional land and resource use compared to current conditions	Predicted changes to land area where sensory disturbances and members of the workforce may be present compared to existing conditions	Construction Operations Decommissioning	Key interaction	Measurable changes to the amount of land that has potential to be avoided by traditional land and resource users are predicted to occur within the LSA
			Predicted changes to human health from changes to air, water, and traditional food quality			
Other land and resource use	Land and resource quantity and accessibility, and land and resource quality and user experience	Land cleared and disturbed for Project infrastructure and changes to land accessibility due to presence of barriers may cause changes to the quantity of land available for continued recreational and commercial land and resource use compared to current conditions	Predicted land area that will become inaccessible for land and resource use compared to current conditions	Construction Operations Decommissioning	Key interaction	Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for recreational and commercial uses in the SSA
			Predicted change to number and social significance of geographically fixed features or unique or rare sites or resources which will be disturbed or become in accessible compared to current conditions			
		Measurable changes to the natural environment may cause changes to quantity and quality of resources important for continued recreational and commercial land and resource use compared to existing conditions	Predicted changes to vegetation, fish, and wildlife compared to existing conditions	Construction Operations Decommissioning	Minor interaction	N/A
		Voluntary avoidance may alter the quantity of land that is considered suitable for recreational and commercial land and resource use compared to current conditions	Predicted changes to land area where sensory disturbances and members of the workforce may be present compared to existing conditions	Construction Operations Decommissioning	Key interaction	Measurable changes to the amount of land that has potential to be avoided by commercial and recreational land and resource users are predicted to occur within the LSA
			Predicted changes to human health from changes to air, water, and traditional food quality			
Heritage resources	Archaeological sites	Land cleared and disturbed for Project infrastructure	Predicted changes to the number, quality, and significance of known archaeological sites directly or indirectly altered/lost as a result of Project activities	Construction Operations Decommissioning	Minor interaction	N/A
Community wellbeing and human health	Social and cultural wellbeing	Measurable changes to traditional land and resource use have potential to affect the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission	Predicted changes to number of land and resource users, frequency or patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission	Construction Operations Decommissioning	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Community wellbeing and human health	Social and cultural wellbeing	Employment has the potential to result in changes to employment, income, and training levels and distribution, mobile worker/community interface, and worker rotations schedules, the number of land and resource users, frequency and patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission, and demand for air transportation and education infrastructure	Predicted changes to number of land and resource users, frequency or patterns of use, country-food based diet and access to medicines, and presence of pathways for generational knowledge transmission	Construction Operations Decommissioning	Minor interaction	N/A
			Predicted changes to the social and cultural environment due to changes in education, employment and income levels and distribution, mobile worker/community interface, and work rotation schedules	Construction Operations Decommissioning	Minor interaction	N/A
	Local infrastructure and services		Predicted changes to demand for air transportation compared to existing conditions	Construction Operations Decommissioning	Minor interaction	N/A
			Predicted changes to demand for educational and training facilities and services compared to current levels	Construction Operations Decommissioning	Minor interaction	N/A
		Vehicle traffic on Highway 955 and 155 has potential to result in changes to road conditions, access, capacity, and collision rates	Predicted changes to road conditions, access, capacity, and collision rates compared to existing conditions	Construction Operations	No interaction	N/A
		Measurable changes to community health and safety parameters have potential to change the demand for health care and emergency services compared to existing conditions	Predicted changes to demand for health care and emergency services compared to existing conditions	Construction Operations Decommissioning	Minor interaction	N/A

Table 6-3
Summary of screening assessment results.

Valued Component	Key Indicators	Project-Environment Interaction	Measurable Parameter	Project Stage	Screening Assessment Result	Residual Effect
Community wellbeing and human health	Community health and safety	Measurable changes to COPC concentrations have potential to affect human health	Predicted changes to human health due to exposure to COPC concentrations from Project-related air and water releases compared to existing conditions	Construction Operations Decommissioning	Key interaction	Changes to human health have potential to occur due to exposure to COPC concentrations from Project-related air and water releases
		Measurable changes to VCs representing the natural environment have potential to cause changes to mental and physical health	Predicted changes to mental and physical health due to changes in the natural environment	Construction Operations Decommissioning	Minor interaction	N/A
		Measurable changes to social and cultural wellbeing have potential to cause increased presence of psychosocial stressors	Predicted changes to community health and safety as a result of increased presence of psychosocial stressors due to changes to social and cultural wellbeing.	Construction Operations Decommissioning	Minor interaction	N/A

COPC = constituents of potential concern; TSP = total suspended particulate; PM = particulate matter; LSA = local study area; PDA = potential disturbance area; N/A = not applicable; VOC = volatile organic compounds; TMF = tailings management facility; SEQG = Saskatchewan Environmental Quality Guidelines; SOCC = species of conservation concern; SSA = site study area; VC = valued component.

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Air quality	Modelled concentrations of 24-hour TSP, PM_{10}, and $PM_{2.5}$ are predicted to have measurable increases and be above the assessment criteria in the LSA during construction and operations; annual $PM_{2.5}$ concentrations are predicted to have measurable increases and be above the assessment criteria during operations in the vicinity of the PDA	Moderate-high - the predicted $PM_{2.5}$ concentrations exceed the annual assessment criteria by less than 50%; the 24-hour assessment criteria were exceeded by more than 50%	Local - increased dust levels and exceedances of the assessment criteria are predicted to occur at receptors within the LSA	Medium-term - increased dust levels are limited to the construction, operations, and decommissioning phases	Reversible - short-term - increased dust concentrations will cease once decommissioning is concluded	Periodic - exceedances of the assessment criteria for dust are expected intermittently, but repeatedly	Moderate - increased levels of dust and exceedances of the assessment criteria are expected to occur
	Modelled concentrations of 24-hour uranium are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA for construction and operations	Moderate - predicted concentrations exceed the applicable assessment criteria for 24-hour uranium by less than 50%	Site - the area where exceedances of the assessment criteria are predicted is limited to receptors near the modelled PDA	Medium-term - increased concentrations of uranium are limited to the construction, operation, and decommissioning phases	Reversible - short-term - increased uranium concentrations will cease once decommissioning is concluded	Low - exceedances of the 24-hour uranium criteria are predicted to occur at a maximum frequency of one day per year	Low - increased uranium concentrations and exceedances of the assessment criteria has the potential to occur
	Modelled concentrations of 1-hour carbon monoxide (CO), sulphur dioxide (SO2), nitrogen dioxide (NO2), and 24-hour NO2 and acrolein are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA during operations	Moderate-high - the applicable assessment criteria for CO, SO_2 and acrolein are exceeded by less than 50%; the applicable assessment criteria for 1-hour NO_2 is exceeded by more than 50%	Site - the area where exceedances of the assessment criteria are predicted is limited to receptors near the modelled PDA	Medium-term - exceedances of the assessment criteria for gases is limited to the operations phase	Reversible - short-term - increased gaseous concentrations will cease once decommissioning is concluded	Periodic - exceedances of the assessment criteria for gases are expected intermittently, but repeatedly during operations	Low - increased levels of gaseous COPC and exceedances of assessment criteria have the potential to occur
Noise and vibration	A measurable increase in sound levels were predicted by the modelling and an exceedance of one of the assessment criteria was predicted at one receptor	Low - the federal criteria are met at all receptor locations and provincial guideline limits are met at all receptors during the day, and at all but one during the night (marginal 1 dBA exceedance)	Local - detectable sound levels above existing conditions are predicted to be limited to the LSA	Medium-term - sound level increases are limited to the construction and operation phases	Reversible - short-term - increased sound levels will cease once operations are concluded	Continuous - sound levels are expected to remain increased throughout the construction and operations phases	Moderate - increased sound levels during these phases will occur

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Visual landscape	A measurable change in landscape character is expected to generate a strong level of contrast and high visibility of sufficient scale and prominence to negatively affect visual amenities at sensitive viewpoint	High - changes to the visual landscape (visibility and visual contrast) as a result of the Project are expected to dominate views and define its characteristics	Local - changes are limited to the LSA	Medium-term - changes are limited to the construction and operation phases	Reversible - short-term - residual effect will cease once operations are concluded and the site is rehabilitated	Continuous - changes to the visual landscape are expected to continue throughout the construction and operations phases during daylight hours	High - highly likely to occur during construction and operations phases
Terrain and soils	Altered terrain and reduced soil quantity and physical properties will result from Project activities; the TMF will remain post-decommissioning	Moderate-high - changes to terrain and soil cannot be fully mitigated and can be remediated/reclaimed; TMF will remain a permanent landform	Site - disturbance is limited to the SSA	Medium-term - alterations to terrain and soil will occur in all Project stages prior to reclamation activities Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible short-term - the site will be remediated and reclaimed during decommissioning Irreversible - TMF will be a permanent land form	Continuous - alterations to terrain and soil are constant until reclamation	High - alterations to terrain and soils are highly likely to occur
Groundwater quantity	A measurable decrease in water levels is predicted in the area of the decline during construction and operations	Low - no impacts to receptors are predicted	Local - the geographic extent covers an approximate area of 1,000 m x 500 m in the area of the mine decline	Medium-term - limited to the construction and operations phases of the Project	Reversible - short-term - residual effect will cease once the stressor is removed	Continuous - changes are expected to continue through construction and operations	High - highly likely to occur although no impacts to receptors are predicted
Groundwater quality	A measurable change in groundwater COPC concentrations is predicted that discharge to South Creek	Low - predicted increases in arsenic, selenium, uranium, and sulphate concentrations are measurable but below SEQG groundwater criteria for freshwater aquatic life	Local - the geographic extent is highly localized to the South Creek discharge location immediately southeast of the TMF	Long-term - extending into post-decommissioning	Reversible - long-term - extending into post-decommissioning	Continuous - effect is predicted to occur continuously	High - highly likely to occur although no impacts to receptors are predicted
	A measurable change in groundwater COPC concentrations is predicted immediately downgradient of the TMF	Low - predicted increases in arsenic, selenium, and sulphate concentrations are measurable but below the SEQG groundwater criteria for potable water Medium - predicted uranium concentrations marginally exceed the criteria	Local - the geographic extent is highly localized to the area immediately southeast of the TMF	Long-term - extending into post-decommissioning	Reversible - long-term - extending into post-decommissioning	Continuous - effect is predicted to occur continuously	High - highly likely to occur although no impacts to receptors are predicted

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Surface water quantity	Groundwater drawdown and treated effluent release into Patterson Lake is predicted to change surface water quantities in the LSA during operations	Low - on average, increases in streamflow below Patterson Lake during operations are predicted to be <5%	Local - predicted measurable changes are limited to the Clearwater River downstream of Patterson Lake	Medium-term - increases in flow are projected to cease post-decommissioning	Reversible - short term - increases in flow are predicted to cease once stressors are removed	Continuous - expected to occur during groundwater drawdown and treated effluent release	Moderate - effect is expected to occur during operations and low flow periods
Surface water quality	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - COPC concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
Fish and fish habitat	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Changes in surface water quantity under low flow conditions are predicted during operations	Low - on average, increases in streamflow below Patterson Lake during operations are predicted to be <5%	Local - predicted measurable changes are limited to the Clearwater River downstream of Patterson Lake	Medium-term - increases in flow are projected to cease post-decommissioning	Reversible - short term: Increases in flow are predicted to cease once stressors are removed	Continuous - expected to occur during groundwater drawdown and treated effluent release	Moderate - effect is expected to occur during operations and low flow periods
Vegetation	Loss or alteration of vegetation from land clearing will occur during all Project stages; TMF will remain permanently altered	Moderate - habitat will be reclaimed, and regionally there will be less than 1% permanent habitat alteration (vegetation communities on the TMF)	Site - disturbance is limited to the SSA	Long-term - revegetation of forest ecosites will take 40+ years Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible long-term - revegetation of forest ecosites will take 40+ years Irreversible - The TMF will remain with shallow rooted species (grass, shrubs), which represent a permanent habitat alteration	Continuous - habitat loss is constant until reclamation	High - Project footprint will be cleared for construction and remain cleared for operations
	Treated effluent release into Patterson Lake will change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Woodland caribou	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	High - habitat will be lost under the Project footprint (SSA); regionally will cause less than a 0.1% change; overall, habitat loss exceeds disturbance threshold in SK2 West Caribou administration unit	Site - disturbance is limited to the SSA	Long-term - Project phases plus revegetation of forest ecosites will take 40+ years Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur
	Project activities are predicted to cause sensory disturbances to wildlife	Moderate - effect will likely exceed existing conditions and may have a small effect on function	Local - SSA plus 500 m buffer for sensory disturbance (some sensory disturbance will occur in LSA)	Medium-term - effect may occur during all Project phases	Reversible – long-term - effect will taper off once stressor is removed	Continuous - effect occurs continuously	High - likely to occur
Ungulates	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Low - habitat will be lost under the Project footprint (SSA) but regionally, will cause less than a 0.1% change	Site - disturbance is limited to the SSA	Long-term - Project phases plus ~10 years for foraging habitat revegetation Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur
	Project activities are predicted to cause sensory disturbances to wildlife	Low - effect will likely exceed existing conditions but is predicted to have a limited effect on function	Local - SSA plus 500 m buffer for sensory disturbance (some sensory disturbance will occur in LSA)	Medium-term - effect may occur during all Project phases	Reversible – short-term - effect ceases once stressor is removed	Continuous - effect occurs continuously	Low - effect has potential to occur

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Furbearers	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Low - habitat will be lost under the Project footprint (SSA) but regionally, will cause less than a 0.1 (northern grey wolf) or 0.03% (muskrat) change	Site - disturbance is limited to the SSA	Long-term - Project phases plus ~5 years for foraging habitat revegetation Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur
	Project activities are predicted to cause sensory disturbances to wildlife	Low - effect will likely exceed existing conditions but is predicted to have a limited effect on function	Site: SSA	Medium-term - effect may occur during all project phases	Reversible – short-term: effect ceases once stressor is removed	Continuous - effect occurs continuously	Low: effect has potential to occur
Bats	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Low - habitat will be lost under the Project footprint (SSA) but regionally, will cause less than a 0.8% change	Site - disturbance is limited to the SSA	Long-term - Project phases plus revegetation of forest ecosites will take 60 to 80 years to provide roosting habitat Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur
	Project activities are predicted to cause sensory disturbances to wildlife	Low - effect will likely exceed existing conditions but is predicted to have a limited effect on function	Local - SSA plus 100 m buffer for sensory disturbance (some sensory disturbance will occur in LSA)	Medium-term - effect may occur during all Project phases	Reversible – short-term - effect ceases once stressor is removed	Continuous - effect occurs continuously	Low - effect has potential to occur

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Amphibians	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Low - habitat will be lost under the Project footprint (SSA) but regionally, will cause less than a 0.02% change	Site - disturbance is limited to the SSA	Long-term - Project phases plus ~10 years for foraging, breeding habitat to regenerate Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur
	Project activities are predicted to cause sensory disturbances to wildlife	Low - effect will likely exceed existing conditions but is predicted to have a limited effect on function	Local: SSA plus 90 m buffer for sensory disturbance (some sensory disturbance will occur in LSA)	Medium-term - effect may occur during all Project phases	Reversible – short-term - effect ceases once stressor is removed	Continuous - effect occurs continuously	Moderate - effect is expected to occur
Birds	Treated effluent release into Patterson Lake is predicted to change surface water quality	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Regional - change in the concentration of some COPC are predicted to extend through the RSA	Long-term - concentrations return to baseline in the post-decommissioning period	Reversible - long-term - COPC concentrations return to baseline in the post-decommissioning period	Continuous - expected to occur while treated effluent is released	High - based on assumed effluent quality and quantity
	Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Low - habitat will be lost under the Project footprint (SSA); regionally will cause less than a 0.04 to 0.3% change for key indicators	Site - disturbance is limited to the SSA	Long-term - Project phases plus revegetation of forest ecosites will take 5 to 40+ years to provide foraging to breeding habitat depending on species Permanent - TMF will support long-term disposal on landscape for 10,000+ years	Reversible - long-term Irreversible - TMF will remain with shallow rooted species (grass, shrubs)	Continuous - effect occurs continuously	High - habitat loss will occur

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Birds	Project activities are predicted to cause sensory disturbances to wildlife	Moderate - effect will likely exceed existing conditions and may have a small effect on function	Local - SSA plus 100 to 1000 m buffer for sensory disturbance (some sensory disturbance will occur in LSA)	Medium-term - effect may occur during all Project phases	Reversible – short-term - effect ceases once stressor is removed	Continuous - effect occurs continuously	Moderate to High - effect is expected or likely to occur
Traditional land and resource use	Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for traditional uses in the SSA	Moderate - land in the SSA will become inaccessible for traditional land use and resource use; users are known to occasionally use the area	Site - area that will become inaccessible is restricted to within SSA	Medium-term - access will be restored after decommissioning	Reversible - short-term - access and land use can be restored after stressors like barriers and restrictions are removed	Continuous - barriers and restrictions will be in place continuously until decommissioning	Low - loss of access to land will occur; however, due to the presence of current and proposed exploration and mining activities in the area, the number of people using the land currently and in the future is predicted to be low
	Measurable changes to the amount of land that has potential to be avoided by traditional land and resource users are predicted to occur within the LSA	Moderate - land within the LSA has the potential to be avoided by current land users, but these land users are predicted to continue use of areas outside of the LSA	Local - some avoidance is predicted to occur on land in the LSA	Long-term - stressors will be removed during decommissioning but avoidance may continue for some land users beyond post-decommissioning.	Reversible - long-term - avoidance of the area by some land users may persist after the stressors have been removed	Continuous - avoidance of the area is predicted to occur continuously	Moderate - given uncertainty around the number of land users currently using the area who will begin avoiding the area, the likelihood that this effect will occur is predicted to be moderate
Other land and resource use	Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for commercial and recreational uses in the SSA	Moderate - land in the SSA will become inaccessible for other land use and resource use; users are known to occasionally use the area	Site - area that will become inaccessible is restricted to within SSA	Medium-term - access will be restored after decommissioning	Reversible - short-term - access and land use can be restored after stressors like barriers and restrictions are removed	Continuous - barriers and restrictions will be in place continuously until decommissioning	Low - loss of access to land will occur, however this land may already be avoided for use by many land users due to the presence of exploration activities
	Measurable changes to the amount of land that has potential to be avoided by commercial and recreational land and resource users are predicted to occur within the LSA	Moderate - land within the LSA has the potential to be avoided by current land users, but these land users are predicted to continue use of areas outside of the LSA	Local - avoidance is predicted to occur on land in the LSA	Long-term - stressors will be removed during decommissioning but avoidance may continue for some land users beyond post-decommissioning	Reversible - long-term - avoidance of the area by some land users may persist after the stressors have been removed	Continuous - avoidance of the area is predicted to occur continuously	Moderate - given uncertainty around the number of land users currently using the area who will begin avoiding the area, the likelihood that this effect will occur is predicted to be moderate

Table 6-4
Summary of the residual effects assessment.

Valued Component	Residual Effect	Magnitude	Geographic Extent	Duration	Reversibility	Frequency	Likelihood
Community wellbeing and human health	Predicted changes to human health have potential to occur due to exposure to COPC concentrations from Project-related air and water releases	Low - COPC concentrations are predicted to exceed average existing conditions but remain within the range of natural variability and below guidelines	Dust and gas emissions - site - change in COPC concentrations are predicted to remain within the site Treated effluent release - Regional - change in the concentrations of some COPCs are predicted to extend through the RSA	Dust and gas emissions - negligible Treated effluent release - long-term - concentrations return to baseline in the post-decommissioning period	Dust and gas emissions - reversible - short-term Treated effluent release - reversible - long-term	Dust and gas emissions - periodic Treated effluent release - continuous	Dust and gas emissions - low Treated effluent release - high based on assumed effluent quality and quantity

PM = particulate matter; LSA = local study area; PDA = potential disturbance area; COPC = constituents of potential concern; SEQG = Saskatchewan Environmental Quality Guidelines; FAL = freshwater aquatic life; TMF = tailings management facility; RSA = regional study area; SSA = site study area.

SECTION 7

POTENTIAL ACCIDENTS AND MALFUNCTIONS

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LIST OF ACRONYMS

A&M	Accidents and Malfunctions
ACGIH	American Conference of Governmental Industrial Hygienists
AEGL	Acute Exposure Guideline Level
ALARP	As Low As Reasonably Practicable
ALOHA	Areal Locations of Hazardous Atmospheres
CNSC	Canadian Nuclear Safety Commission
EIS	Environmental Impact Statement
EIA	Environmental Impact Assessment
EASB	Environmental Assessment and Sustainability Branch
ENV	Saskatchewan Ministry of Environment
ERPG	Emergency Response Planning Guideline
HI	Hazard Identification
HSEC	Health, Safety, Environment and Community
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life or Health
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
PMP	Probable Maximum Precipitation
PPE	Personal Protective Equipment
RCMP	Royal Canadian Mounted Police
STEL	Short-Term Exposure Limit
TMF	Tailings Management Facility
TSD	Technical Support Document

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7.0 POTENTIAL ACCIDENTS AND MALFUNCTIONS

7.1 Introduction

Accidents and malfunctions (A&M) refer to events or conditions that are not part of any activity or normal operation of the Fission Uranium Corp. (Fission) PLS Project (the Project). Despite rigorous planning and the implementation of best practices and preventative measures, the potential exists for A&M to occur during any Project phase. The purpose of the assessment of A&M is to provide a clear identification of the potential Project-associated hazards that may adversely affect human health and the biophysical environment and determine the extent of these effects. A summary is provided below, and complete details of the A&M assessment are presented in Appendix D.10.

As the Environmental Impact Assessment (EIA) for the Project is a provincial EIA, only the provincial requirements for A&M are referred to in this section (ENV 2021). The concordance table for components for the Environmental Impact Statement (EIS) from the Saskatchewan Ministry of Environment (ENV) Guidelines for the terms of reference and environmental impact statement (ENV 2021) for A&M is provided in Table 7-1.

7.1.1 Spatial Scope of the Assessment

The spatial extent of the assessment includes the Project site, including the associated site access roads, as well as the offsite transportation routes along Highway 955 and Highway 155. The considered off-site scenarios involve potential releases to water and the ground, with the potential to affect a community of interest along the transportation routes. The spatial extent along Highway 955 spans from the intersection of the Project site access roads and Highway 955 to the intersection of Highway 955 and Highway 155 at La Loche. The spatial extent along Highway 155 spans from the intersection of Highway 955 and Highway 155 to the intersection of Highway 155 and Highway 55 at Green Lake (Figure 7-1). The spatial extent was based on existing traffic volumes, identification of incremental increases in traffic associated with the proposed Project, and understanding transportation emergency response times.

7.2 Assessment Methodology

In the A&M assessment process, a crucial initial phase involves the precise identification of potential hazards associated with the Project, especially those that extend beyond routine

daily occurrences. This step serves as the foundation for quantifying the risks connected to these hazards. The risk assessment for A&M includes five essential stages:

1. **Hazard identification (HI)**
2. **Initial screening and identification of bounding scenarios** includes the identification of physical situations with the potential to cause harm to individuals, property, or the environment, such as fire, explosions, chemical releases, or radiation exposure. In this study, "Hazards" and "Accidents and Malfunctions" are used interchangeably. Identified hazard scenarios were screened qualitatively for the perceived effects and probability of occurrence, as well, the potential risk was determined using a risk matrix approach (Section 7.4). Among the high or moderate-risk scenarios, bounding scenarios were selected. The bounding scenarios encompass the effects of other scenarios screened for each Project component and activity.
3. **Assessment of probabilities** includes the estimation of the probability of occurrence of the selected bounding scenario occurring within a specific time period or in specified circumstances.
4. **Assessment of potential consequences** includes the quantitative evaluation of the potential effects of a selected bounding scenario to the human health or biophysical environment.
5. **Risk estimation** includes the estimation of the combination of the effects of a scenario and the probability with which it is likely to occur; that is, risk is the product of consequence and probability (risk = consequence × probability of occurrence).

7.2.1 Assessment Benchmark

The A&M assessment Technical Supporting Document (TSD) (Appendix D.10) describes the applicable benchmarks used for evaluating the potential consequences of the hypothetical A&M scenarios. These benchmarks were tailored to the bounding scenarios identified in Section 7.4 and are provided separately for both the atmospheric and aquatic environments. The selection of these benchmarks considered the anticipated interactions of the bounding scenarios with the environment in the following contexts:

- Uranium
    - atmospheric environment
    - aquatic and terrestrial environment

- Radioactivity
  - aquatic and terrestrial environment
  - atmospheric and terrestrial environment
- Sulphuric acid and sodium hydroxide
  - aquatic environment (pH)
  - sulphur dioxide
  - atmospheric environment
- Smoke and its toxic compounds
  - atmospheric environment

7.3 Emergency Response, Mitigative Measures, and Safety Considerations

Fission is committed to developing and operating the Project activities in a manner that minimizes potential adverse effects on both human health and the environment to the best of their ability. Fission will ensure that all Project work meets or exceeds the regulatory requirements outlined by all regulatory authorities. Fission will set high standards for various aspects of its operations to mitigate potential Project-related effects, including those linked to A&M scenarios. These standards will be upheld through adherence to Fission's and the Project's management systems including:

- Health, Safety, Environment and Community (HSEC) policies
- Planning, implementation, and operation
- Occupational health and hygiene
- Radiation protection
- Incident prevention
- Emergencies and spill response plans and contingencies
- Verification and corrective actions
- Environmental monitoring
- Review by management

Fission's corporate HSEC commitment is evident in a variety of Project-related programs, plans, and procedures. These together with work instructions that will be put into practice throughout the Project's lifespan, collectively contribute to reducing the likelihood and severity of consequences of A&Ms. In addition, experience from uranium mining in Saskatchewan and lessons learned from past and existing operations and responses to emergency situations were utilized in planning for the Project.

The initial defense line in this context is the Project's design features and considerations. At Fission, ensuring process safety and preventing incidents takes precedence during Project design. The proposed design includes various features and considerations, such as robust primary containment, secondary containment provisions, the elimination of exposure pathways, equipment redundancies, and the assurance of equipment and safety function reliability, to name a few. These features and considerations were taken into account when evaluating the postulated A&M scenarios.

7.3.1 Environmental Contingency Procedure

An Environmental Contingency Procedure will be developed that will include methods for quick detection, control, and management of any emergency including spills, fire, etc. during all phases of the Project. Additional information is provided in Section 9.0, Monitoring and Follow-up Programs.

A key component of emergency response and preparedness will be spill response and management to control the release of contaminants into the aquatic and terrestrial environments. The plan will have four major components:

- Containment of the affected area to prevent exposure.
- Cleanup and recovery to remove the source and return the area to the background level (or below the hazardous level).
- Restoration to original state.
- Follow-up monitoring to ensure the effectiveness of the plan.

The first two components are easier to implement for a terrestrial release whereas for a surface water release, the response time is crucial for containment and recovery.

Another part of spill response management will include reporting and notification requirements and procedures. The A&Ms, including the discharges that exceed reportable limits as defined by legislation, will be reported to the regulators at federal and provincial levels.

Relevant sections of the Environmental Contingency Procedure will be shared with community emergency response organizations. The communication of emergencies with other first responders and communities will be done through the procedures established in the emergency response plan. An updated contact list of both internal resources and

external contacts including community liaison person(s) will be put in place for emergency response communication.

Fission will reach out to the communities along the haulage route to ensure awareness of the chemicals and the final product that will be moving through their communities to and from the mine-site once the transportation plan is developed.

7.4 Hazard Identification and Bounding Scenarios

A comprehensive list of potential Project-related A&M scenarios was identified for various process components and activities of the Project based on the project description provided in Section 2.0. Each scenario underwent a screening evaluation in which the severity and probability of consequences were qualitatively assessed to determine a risk level using a risk matrix. The risk matrix approach is based on the concept that risk is the result of multiplying the consequences by the probability of those consequences occurring. The resulting risk levels are defined according to the matrix shown in Table 7-2.

Risks were identified as being low (i.e., coloured green in the matrix) where the screening evaluation considered the risk as generally being acceptable, as the likelihood of these scenarios can be effectively managed through application of planned controls and/or the consequence of the effect would be low.

Risks are identified as being moderate (i.e., coloured yellow in the matrix) where the screening evaluation considers the risk as generally being tolerable. In many cases, risk-reduction activities would reduce the risk associated with these scenarios to As Low as Reasonably Practicable (ALARP). Under this condition, the risk may be characterized as tolerable.

Risks were identified as being high (i.e., coloured red in the matrix) where the screening evaluation considered the risk as generally being unacceptable. As the evaluation of the risk at this hazard identification stage was qualitative and subject to some uncertainty, the hazard scenarios identified as high risk were advanced for further detailed assessment so that a more detailed evaluation of risk and potential management activities could be considered.

A total of 100 scenarios were identified. Out of these, 7 were categorized as high risk, 39 were characterized as moderate-risk, and 54 were characterized as low risk.

Out of the seven high risk scenarios,

- four were identified as requiring further detailed assessment for a more accurate risk characterization, and
- three were conventional occupational scenarios, taking into account the proposed safeguards and design features that mitigate the risk to the ALARP level.

Of the 39 moderate-risk scenarios,

- 32 were considered to represent a tolerable level of risk, taking into account the proposed safeguards and design features that mitigate the risk to the ALARP level.
- 4 were identified as requiring further detailed assessment for a more accurate risk characterization involving contaminant releases into the environment. Since the potential impacts may be more far-reaching than what could be adequately assessed through the screening process additional quantitative evaluation was deemed appropriate.
- 3 were bounded by other scenarios.

The remaining 54 scenarios were considered low risk because of their low likelihood of occurrence and/or limited consequences, in consideration of the planned existing safeguards and design features. These scenarios do not require further detailed analysis, as they are adequately characterized by the screening process.

Overall, the following eight hazard scenarios have been selected as bounding scenarios for more detailed risk analysis:

1. Transportation Accidents
2. Solvent Extraction Fire and Explosion
3. Tailings Pipeline Failure
4. Failure of the Tailings Management Facility (TMF) Pit Berms
5. Failure of the Engineered Barrier System
6. Failure of the Ground Freeze
7. Accidental Atmospheric Sulphur Dioxide Release
8. Failure of Calciner Scrubber or Packaging Baghouse

7.5 Probability Assessment of Bounding Scenarios

The A&M Assessment TSD outlined the detailed assessment of the probability of each bounding scenario (Appendix D.10). The annual probabilities are summarized in Table 7-3. These probabilities were used to evaluate the risk of the A&M scenarios as described in Section 7.4.

7.6 Effects Assessment

The following subsections provide the summary results of the effect assessment of the bounding scenarios; detailed results are presented in Appendix D.10.

7.6.1 Bounding Scenario 1: Transportation Accidents

A transportation accident along the Project's transportation routes may result in the release of hazardous materials to ground, water, and/or the atmosphere. In addition to the hazardous material release, the accident may involve physical impact to members of the public and wildlife along the transportation route. The detailed assessment evaluated the following specific cases:

- aquatic release of yellowcake;
- aquatic release of fuel and reagents;
- atmospheric release of yellowcake and combustion pollutants;
- vehicle-human interaction; and
- vehicle-wildlife interaction.

7.6.1.1 Aquatic Release of Yellowcake, Fuel, and Reagents

The A&M Assessment TSD, citing other similar studies for transportation along the same transportation corridor (NexGen 2022) and yellowcake transportation across Canada (Searcy and Benson 2018), concluded that the consequences of transportation activities associated with the Project are minor to moderate and given the probability of such scenario, the risk posed to the aquatic environment is low. The assessment considered the release of yellowcake as well as different types of fuel, such as diesel fuel, and reagents, such as strong acids, transported to the site. The assessment considered various traffic control measures implemented by Fission, including driver training, speed control, and appropriate signage, as well as emergency response planning to reduce the risk to as low as reasonably practicable.

7.6.1.2 Atmospheric Release of Yellowcake and Combustion Pollutants

In the event of a transportation truck catching fire due to a traffic accident, which might result from factors such as running off the road, rollovers, or collisions with other vehicles, there is a possibility that the yellowcake drums could breach and could be exposed to fire. This situation could lead to the potential atmospheric release of yellowcake particles. Moreover, if the fire involves the combustion of hydrocarbons like diesel, gasoline, or solvents, it could result in the emission of smoke, containing toxic components, into the atmosphere. Consequently, the driver of the truck, first responders, and residents of communities along the transportation route could potentially face risks of exposure.

The assessment results indicated that the Emergency Response Planning Guidelines (ERPG) and Acute Exposure Guideline Level (AEGL) 2 concentrations (0.75 ppm) would be exceeded within a 238 m distance from the release location for uranium concentrate particles and within 124 m for carbon monoxide in the downgradient wind direction (Appendix D.10). It should be noted that the truck drivers and first responders are much closer to the fire compared to members of the public. It is expected that the first responders would be equipped with personal protective equipment (PPE) including self-contained breathing apparatus' that will protect them from exposure to the atmospheric release of yellowcake and smoke.

In the event of an incident involving chemicals going to the mine site or final product being transported from the mine site, Fission would respond to the scene, establish control, and ensure scene management with the assistance of the Royal Canadian Mounted Police (RCMP). First responders from communities may respond to the scene to assist with preliminary scene management. Fission will provide training to the community first response teams for basic scene management; however, a professional HAZMAT response team that is available 24/7 would be deployed immediately to perform the remedial action required for the specific chemical or product involved in the transport incident. Detailed emergency response plans will be developed as the Project continues through towards the operating phase.

Given the transient nature of the effects, and the emergency response provisions implemented by Fission, the consequence of this scenario is judged to be minor, and the risk would be low.

7.6.1.3 Vehicle-Human Interaction

A vehicular collision between a Project-related vehicle and a member of the public in one of the communities situated along the transportation route was analyzed. The annual probability of these types of accidents was calculated as 0.012 (Table 7-3). However, the probability of fatal accidents is much less than the probability of all accidents and is judged to be very unlikely.

Considering all traffic control measures, such as driver training, speed control, and signage, this risk is managed to ALARP level. Since the transportation route is mainly beyond the Project's jurisdiction, Fission can promote these practices within their organization, but the ultimate responsibility for enforcement lies with the Province of Saskatchewan.

7.6.1.4 Vehicle-Wildlife Interaction

Although this accident may result in fatality of individual animals, population-level effects are not expected from vehicle-wildlife interactions; thus, the consequence of this scenario is judged to be minor.

7.6.2 Bounding Scenario 2: Solvent Extraction Fire and Explosion

This bounding scenario involves incidents where equipment or vessels containing uranium-bearing solvents may suffer damage due to either human error or equipment failure. This damage could result in the release of uranium-bearing solvents, potentially leading to fires and exposing workers or the public to airborne uranium. The selected fire scenario was assessed through two separate scenarios:

- confined indoor fire in the solvent extraction building; this scenario assumes that the fire is confined inside the building and that the building envelope remains intact; and
- unconfined fire; this scenario assumes that the building envelope has been breached.

To estimate the consequence of the potential effects associated with Bounding Scenario 2, the Areal Locations of Hazardous Atmospheres (ALOHA)[1] model was used. The air

[1] ALOHA is a standalone software application developed and supported by the Emergency Response Division, a division within the National Oceanic and Atmospheric Administration (NOAA) in collaboration with the Office of Emergency Management of the Environmental Protection Agency. The primary purpose of ALOHA is to provide estimates of the spatial extent of some common hazards associated with chemical spills or releases to emergency response personnel (NOAA 2013).

concentration versus distance was calculated and compared with the benchmarks for two weather conditions, W1[2] and W2[3]. The probability of W2 is less than 5% of the probability of weather condition W1.

For the confined indoor fire, the source term calculated in Appendix D.10 was 4.7 g/s yellowcake. The results of the modelling of yellowcake concentration in air down-wind of the fire are summarized in Table 7-4. The most frequently used benchmark for emergency release scenarios is ERPG-2. The results indicate that the ERPG-2 benchmark of 10 mg/m^3 would be reached (i.e., the yellowcake levels would be below the threshold beyond this distance) at 105 m from the assumed source of the release (i.e., the solvent extraction building) under W1 weather condition and at 282 m under W2 weather conditions.

ALOHA does not account for certain processes that affect the dispersion of particulates, such as wet and dry deposition. Additionally, it does not consider the initial buoyant rise from a fire. As a result, ALOHA tends to overestimate concentrations, especially near the release source, making estimations conservative. It should be noted that the release during a fire is short-term (i.e., less than a few hours in duration); therefore, surface accumulation, and extended exposure to vegetation and wildlife is not expected.

For the unconfined fire, the source term calculated in Appendix D.10 was 14.2 g/s yellowcake. The results of the modelling of yellowcake concentration in air down-wind of the fire are summarized in Table 7-5. The results indicate that the ERPG-2 benchmark will be reached 500 m from the source of the release for weather condition W2 and at 185 m for weather condition W1, which represents the more likely weather condition.

Members of the public present within the mentioned distances may be exposed to concentrations above the ERPG-2 level. However, because the release during a fire is short-term (i.e., less than a few hours in duration), surface accumulation and extended exposure to vegetation and wildlife are not expected. Professional HAZMAT response team that is available 24/7 would be deployed immediately to perform the action required for the

[2] W1: typical weather conditions: average wind speed and Pasquill stability class D. Stability class D is a neutral atmospheric condition that occurs during slight to moderate daytime solar intensity and thin nighttime overcast conditions, with a wind speed of around 5.0 m/s or slightly higher. This represents the average condition for dispersion of released materials (NOAA 2019). The wind rose in the area of the Project indicates that the most frequent wind speed is approximately 5 m/s. Thus, 5 m/s was selected as the typical wind speed.

[3] W2: worst-case weather conditions: 95th percentile wind speed and Pasquill stability class F. Stability class F is a stable atmospheric condition that occurs during nighttime, overcast conditions, with a wind speed of less than 2 m/s, typically 1.5 m/s. Thus, wind speed of 1.5 m/s and stability class F were selected as the worst-case condition for dispersion of released materials (NOAA 2019).

specific chemical or product involved in the fire. Detailed emergency response plans will be developed as the Project continues through towards the operating phase. Provisions in the emergency response plan will ensure that exposed individuals are removed from the affected area. Workers and emergency response personnel will be equipped with respiratory protection equipment.

Based on the above, and in consideration of the effect scale described in Section 7.4, the consequence of the potential effects of this scenario on the environment and the public is rated minor to moderate within a relatively short distance from the release.

7.6.2.1 Worker Exposure

The workers will require time to put on proper protective equipment once the fire begins and during this period they can be potentially exposed to the radioactivity. This duration is conservatively assumed to be five minutes. The concentration of yellowcake particles in the air exiting the building is conservatively assumed to be the same as the average concentration inside the building, which has been calculated as 69 mg of yellowcake/m^3.

It is expected that the workers or first responders are equipped with respiratory protection for a longer period. The primary exposure pathway is assumed to be the inhalation of yellowcake particles. Using the International Commission on Radiological Protection (ICRP) specific activities and dose coefficients for various uranium isotopes (1996), the total inhalation dose was calculated as 2.03 mSv, which is significantly lower than the regulatory dose limit of 20 mSv per year. Based on these results, it was concluded that the overall consequence to the workers is minor.

The estimated total kidney burden of 1 µg uranium per g of kidney for exposure to the released yellowcake for the 5-minute exposure is much less than the generally accepted nephrotoxic threshold level of 3 µg (ATSDR 2013) uranium per g of kidney.

No adverse health effects are expected for the plant operator exposed to the released uranium following an accidental fire for five minutes The details of these calculations are provided in Appendix D.10.

7.6.3 Bounding Scenario 3: Tailings Pipeline Failure

After processing and generating precipitates, a total of 1,120 metric tons of tailings solids will be produced daily. Factoring in a 25% provision for an increase in daily tailings production over the planned 10-year mine life, this will amount to 1,400 metric tons of

tailings per day. The flow of tailings slurry inside the pipeline transporting the tailings to the TMF is projected to be 88 m^3/h. Any full-bore pipe rupture would result in the release of tailings, causing a sudden loss of pressure in the tailings transfer pipe. Loss of pressure can be automatically sensed, triggering the shutdown of the transfer operation. In this scenario, the maximum volume of tailings available for release is the volume of the entire pipe (approximately 2 km of 8" pipe), which is approximately 60 m^3 of tailings. Analyzing the fate and transport of this volume of released tailings requires a detailed analysis of the flow path and infiltration of tailings.

The amount of tailings released if a pipe failure were to occur would be relatively small based on the pipe's flow and size. In a worst-case scenario, a full-bore rupture of the tailings pipeline, approximately 60 m^3 of tailings material could be released onto the surrounding soil. Even with this volume, the spill wouldn't be enough to significantly contaminate the surface soil between the TMF and South Creek, and any spill would be promptly addressed through emergency response efforts. The likelihood of a substantial amount of tailings reaching South Creek is very low, making any potential impact on South Creek negligible. Additionally, the creek's intermittent flow and natural blockages make the likelihood of the spill reaching Patterson Lake or having effects in the creek low.

The tailings pipeline is designed with several protective features. It's located above ground within a utility pipe corridor and includes heat tracing technology to prevent freezing during cold weather. Additionally, the pipe supports are designed to handle freeze-thaw cycles in the ground, ensuring structural stability in varying conditions.

In the unlikely event of a spill, a robust emergency response plan will be in place. This plan will outline procedures for spill containment, material recovery, and site cleanup. The emergency response equipment will include:

- Booms and Socks: designed to contain and absorb spills on land.
- Spill Containment Berms: to create a barrier to contain spills.
- Portable Pumps and Tanks: to remove and temporary storage for recovered liquids.
- Vacuum Systems: Industrial vacuums for liquid material recovery.

Considering the minor potential impact on South Creek and Patterson Lake and completion of the appropriate spill response activities, the severity of the consequences of this scenario is expected to be minor.

7.6.4 Bounding Scenario 4: Failure of the TMF Pit Berms

Two critical accidental release mechanisms have been identified:

- global stability failure of the TMF pit berms; and
- failure of the engineered barrier system.

Overflowing of the TMF pit is an unlikely scenario as a minimum of 2 meters of freeboard is designed to accommodate the probable maximum precipitation (PMP).

The two critical accidental release mechanisms could potentially result in significant adverse environmental impacts. Global instability of the TMF confining berms could release tailings to the southeast to the South Creek and potentially into Patterson Lake (Figure 7-2). Failure of the engineered barrier system may release retained pore water to the groundwater system, eventually discharging to Patterson Lake. TMF design processes have focused on mitigating the risks of these critical failure modes.

The global stability of the TMF confining berms failure modes include:

- piping or internal erosion;
- slumping or sliding;
- seismic activity;
- piping/erosion or toe seepage;
- liquefaction; and
- aging/degradation.

A conservative estimate of the potential release is the total storage capacity available in the TMF which is approximately 8,200,000 m^3. The analysis of a tailings containment breach is a complex process that requires a large volume of information about the tailings characteristics, containment geometry, failure modes, surrounding area topography, and soil characteristics. Many tailings dam failure modes involve a significant breach of the containment's structural integrity, potentially resulting in the release of a large volume of tailings.

The sequence of release typically begins with the water covering the consolidated tailings, followed by the tailings slurry at the water-solid interface, and finally, some of the consolidated tailings may be released. In a likely scenario, the released tailings would flow

towards the southeast of the Project site and reach the South Creek, potentially leading to Patterson Lake.

Due to the potentially large volume of released tailings, it is expected that a significant amount would reach the lake. The contaminants associated with the tailings could cause environmental effects in the lake, and widespread soil contamination is also expected, necessitating major site cleanup. The extent of cleanup required depends on a thorough understanding of the fate and transport of the released tailings from this scenario.

Considering the potential for significant impacts on the lake and the potential for widespread soil and groundwater contamination, the consequences of this scenario are expected to be severe. Fission intends to conduct a dam breach and inundation analysis as part of final design for the TMF.

7.6.5 Bounding Scenario 5: Failure of the TMF Engineered Barrier System

One of the mechanisms of release of contaminants from the TMF is the migration of solutes through the engineered double barrier system. The failure of the engineering barrier may not immediately result in a large volume release of tailings, which defines it as an Abnormal Operating Occurrence (AOO) event. Nevertheless, it was included in this assessment for thoroughness. The design of this double barrier system aims to significantly reduce the potential for solute release from the TMF. Numerical models were used to assess the long-term impacts of leakage from the TMF over a period of 10,000 years to predict potential impacts to groundwater. These results are presented in Section 6.7 and Appendix D.4. Based on these results, the consequence of the potential effects of this event is rated minor within a relatively short distance from the release. For well-designed and maintained liner systems in stable and controlled environments, the annual probability of liner failure can be very low, possibly in the range of $1x10^{-2}$ (1 in 100) or even lower (1 in 1,000 years).

7.6.6 Bounding Scenario 6: Failure of the Ground Freeze

A partial recovery of the mineralized material, approaching the contact between the overburden and bedrock, is accomplished by employing artificial ground freezing to create a bulk freeze. This process involves freezing the ground by drilling holes into the overburden and shallow bedrock, utilizing underground drilling from a dedicated freeze drift below the crown area. In this particular scenario, the structural stability and hydraulic sealing of the ground freeze wall could be compromised entirely. Such a situation may

occur due to earth movements during significant events like earthquakes and major landslides.

In such cases, groundwater within the mining area may potentially migrate into the mine resulting in flooding. The low temperatures in the vicinity of the compromised frozen ground section are likely to induce the freezing of fluids, partially sealing the opening and further reducing the rate of water inflow. However, accurately predicting the scale of migration and the resulting mine flooding is challenging, given the substantial uncertainties regarding factors such as the volume of migrating groundwater, the hydraulic conductivity of the thawed frozen ground, the static head, and other hydrogeological and geological variables.

Nevertheless, it is acknowledged that in the highly improbable event of mine flooding, water management may prove challenging, although this scenario is very unlikely.

7.6.7 Bounding Scenario 7: Accidental Atmospheric Sulphur Dioxide Release

Sulphur will be burned in the presence of dry air in the acid plant, to generate sulphur dioxide gas. This gas is continuously used to produce sulphuric acid under steady-state conditions. There is no storage of sulphur dioxide; the amount in the process is limited to what is contained within the pipelines and reactors. Any process disruptions or equipment, instrumentation, or piping failures, within the burner and converter, absorber, or tail gas scrubbers, have the potential to lead to the release of sulphur dioxide. While the catastrophic failure of the piping system in the acid plant is highly unlikely, a more probable scenario is the failure of the tail gas scrubber, which would result in the release of tail gas containing sulphur dioxide into the atmosphere through the stack before undergoing scrubbing.

Any leak that might occur from other points is detected by gas detectors and pressure sensors within the pipeline. Such incidents trigger an immediate shutdown of flow and operations. A 15-minute release time was selected for the assessment, which is a highly conservative estimate, and moreover, there isn't enough inventory to sustain a release beyond this timeframe.

The sulphur dioxide content of the tail gas in a typical acid plant is approximately 15 kg/t of acid produced. This would be 15 kg/t × 250 t acid produced = 3,750 kg/d. Under this scenario, the total amount released during a 15-minute event would be 39 kg.

The air concentration versus distance was computed using the ALOHA model and then compared to the benchmarks for the W1 and W2 weather conditions, specifically AEGL-2. The AEGL-2 and AEGL-3 values for human exposure to atmospheric releases of sulphur dioxide are 0.75 ppm and 9.6 ppm, respectively. The modeling results are summarized in Table 7-6. The findings indicate that the AEGL-2 benchmark, signifying that sulphur dioxide levels will be below the threshold beyond this distance, will be achieved at 362 meters from the source of the release, which is the acid plant, for more probable weather conditions (W1). For the worst-case weather condition, W2, this benchmark will be reached at a distance of 1,040 meters.

Members of the public present within the mentioned distances may be exposed to concentrations above the AEGL-2 level. However, because the release is short-term (i.e., less than an hour in duration), extended exposure to vegetation and wildlife are not expected. Professional HAZMAT response team that is available 24/7 would be deployed immediately to perform the action required for the specific chemical or product involved in the release. Detailed emergency response plans will be developed as the Project continues through towards the operating phase. Provisions in the emergency response plan will ensure that exposed individuals and members of the public that may be present are removed from the affected area. Workers and emergency response personnel will be equipped with respiratory protection equipment.

This scenario has a likelihood of occurring at a rate of 3×10^{-2} per year, approximately once every 33 years (Table 7-3), with a duration of around one hour. The conditional probability of a rain event coinciding with this scenario reduces the likelihood of surface deposition. Furthermore, due to the brief duration of this event, any surface accumulation of deposition was deemed to be negligible, and consequently, the impact on wildlife or vegetation was assessed as minor.

Based on the above, and in consideration of the effect scale described in Section 7.4, the consequence of the potential effects of this scenario is rated minor within a relatively short distance from the release.

7.6.7.1 Worker Exposure

The workers are assumed to be exposed to sulphur dioxide following an uncontrolled release for a period of less than 15 minutes while they are putting on proper protective equipment. It is expected that the workers or first responders are equipped with respiratory protection for a longer period.

The American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) recommend a Short-Term Exposure Limit (STEL) (15-minute exposure) for sulphur dioxide of 5 ppm[4].

The modeling results for this concentration level are summarized in Table 7-6. The findings indicate that the STEL, signifying that sulphur dioxide levels will be below the threshold beyond this distance, will be achieved at 133 meters from the source of the release, which is the acid plant, for more probable weather conditions (W1). For the worst-case weather condition, W2, this benchmark will be reached at a distance of 357 meters. Based on these results, the occupational health and safety measures ensures that the workers within these distances are equipped with proper respiration protection. The details of these calculations are provided in Appendix D.10.

7.6.8 Bounding Scenario 8: Failure of Calciner Scrubber or Packaging Baghouse

During this process, the precipitated yellowcake will be fed into a rotary dryer, where it will be exposed to a nominal peak operating temperature of 475°C. This temperature is needed to achieve a chemically stable yellowcake with a U_3O_8 content of 95%.

One of the gas streams produced by the dryer is the contaminated process gas which will be drawn through a wet scrubber before being released through a 42 m tall stack. After drying, the yellowcake will be discharged into a storage bin. The bin feed and product transfer points are maintained under negative pressure. This negative pressure is achieved by an induced draft fan, which draws air and dust through to a dust capture baghouse. The cleaned gas is then released through the stack. In the event of a failure in either the wet scrubber or the baghouse, there is a risk of uncontrolled release of yellowcake into the atmosphere through the gas streams.

The controlled release rates of yellowcake from the calciner scrubber stack and packaging baghouse stack are 3.64 mg/s and 8.20 mg/s, respectively (Appendix D.1). Both dust collection systems are assumed to have a collection efficiency of 90%. In the event of a failure of the scrubbers and baghouse, the collection efficiency is reduced to 0%. In this worst-case scenario, the release rates from the calciner scrubber stack and packaging baghouse stack would be 36.4 mg/s and 82.0 mg/s, respectively.

[4] Immediately Dangerous to Life or Health Concentrations (IDLH) values for Sulphur Dioxide, https://www.cdc.gov/niosh/idlh/7446095.html

The air concentration of yellowcake versus distance was calculated using the ALOHA model and compared with the benchmarks for W1 and W2 weather conditions (Table 7-7). ERPG levels 2 and 3 were not exceeded beyond 28 m from the stack under W2 weather conditions. For W1 weather conditions, the ERPG levels 2 and 3 were never reached.

Members of the public present within 28 m may be exposed to concentrations above the AEGL-2 level. However, because the release is short-term (i.e., less than an hour in duration), extended exposure to vegetation and wildlife are not expected. Professional HAZMAT response team that is available 24/7 would be deployed immediately to perform the action required for the specific chemical or product involved in the release. Detailed emergency response plans will be developed as the Project continues through towards the operating phase. Provisions in the emergency response plan will ensure that exposed individuals and members of the public that may be present are removed from the affected area. Workers and emergency response personnel will be equipped with respiratory protection equipment.

Based on the above, and in consideration of the consequence scale described in Section 7.4, the consequence of the potential effects of this scenario is rated insignificant to minor.

7.6.8.1 Worker Exposure

The workers could be exposed to radioactivity following an uncontrolled release of yellowcake for five minutes while they are putting on proper protective equipment. The atmospheric yellowcake concentrations at 28 meters and less than 11 meters, corresponding to ERPG levels 2 and 3 (Table 7-7), were used to estimate the radiological dose to the exposed workers and first responders.

It is expected that the workers or first responders are equipped with respiratory protection for a longer period. The primary exposure pathway is likely to be the inhalation of yellowcake particles. Using the ICRP specific activities and dose coefficients for various uranium isotopes (1996), the total inhalation dose was calculated to be 0.25 mSv at 28 meters and 1.25 mSv at less than 11 meters. Both of these values are significantly lower than the regulatory dose limit of 20 mSv per year.

Based on these results, it was concluded that the overall consequence to the workers is minor. The details of these calculations are provided in Appendix D.10.

7.7 Cumulative Assessment

This cumulative assessment takes into account the operation of NexGen's Rook 1 Project, which is located near the PLS Project, adjacent to Patterson Lake. For all A&M scenarios, except for transportation accidents, there are no cumulative effects. This is because the likelihood of similar accidents and malfunctions related to the operation of both plants occurring simultaneously is exceedingly low. For instance, the probability of solvent extraction fire and explosion scenarios happening simultaneously in both plants is calculated as $1.02x10^{-3}$ x $1.02x10^{-3}$ = $1x10^{-6}$ per year (1 in 1,000,000 years). If such an accident were to occur independently at these two neighboring plants, their respective health and environmental impacts are not superimposable.

However, when it comes to transportation accidents, where both plants share the same transportation highway routes, the estimated probabilities of transportation accidents are superimposable. Table 7-8 shows the cumulative annual probabilities of the transportation accident scenarios.

When assessing the cumulative probability of transportation-related release, it is observed that the probability increases from "very unlikely" to "unlikely," which consequently shifts the risk from "low" to "low to moderate." This highlights the importance of collaboration and cooperation between Fission and NexGen regarding transportation emergency management to ensure that the risk is managed to the ALARP level.

7.8 Summary and Conclusion

The results of the risk assessment of the bounding accident scenarios are summarized in Table 7-9. The results combined the analysis of both likelihood and consequence of effect for each A&M bounding scenario to identify the overall risk rating according to the risk ranking framework presented in Section 7.4.

The overall risk ratings indicate that the traffic accident scenarios involving the release of yellowcake as well as terrestrial and atmospheric releases (Bounding Scenarios 1.a, 1.c, and 1.d), as well as the tailings pipeline failure (Bounding Scenario 3), failure of the TMF engineered barrier system (Bounding Scenario 5), failure of the ground freeze (Bounding Scenario 6), and failure of the calciner scrubber or packaging baghouse (Bounding Scenario 8) were associated with a low level of risk. Similarly, the overall risk related to aquatic release of fuel and reagents (Bounding Scenario 1.b), solvent extraction fire and explosion (Bounding Scenario 2), and accidental atmospheric sulphur dioxide release (Bounding

Scenario 7) were assessed as low to moderate. The overall risk related to vehicle-human and vehicle-wildlife interactions (Bounding Scenarios 1.e and 1.f) were assessed as moderate. The overall risk associated with the failure of the TMF pit berms (Bounding Scenario 4) was assessed as high.

Bounding scenarios with a low to moderate risk were considered to represent a tolerable level of risk, especially when considering the proposed safeguards and design features that mitigate the risk to the ALARP level. The vehicle-human fatal accident was considered moderate risk with ALARP level.

The failure of the TMF pit berms is assessed as a high-risk scenario because of its potentially severe effects on surface water, groundwater, and soil. One factor contributing to uncertainty in determining the consequence level is the limited understanding of the fate and transport of the released tailings under this postulated scenario. Fission intends to conduct a dam breach and inundation analysis as part of final design for the TMF.

The results of the occupational radiological exposure for Scenarios 2 and 8 indicated that estimated values are significantly lower than the regulatory dose limit of 20 mSv per year. For Scenario 7, the findings show distances where STEL benchmark for occupational exposure to sulphur dioxide might be exceeded. Occupational health and safety measures ensure that workers within these distances have appropriate respiratory protection.

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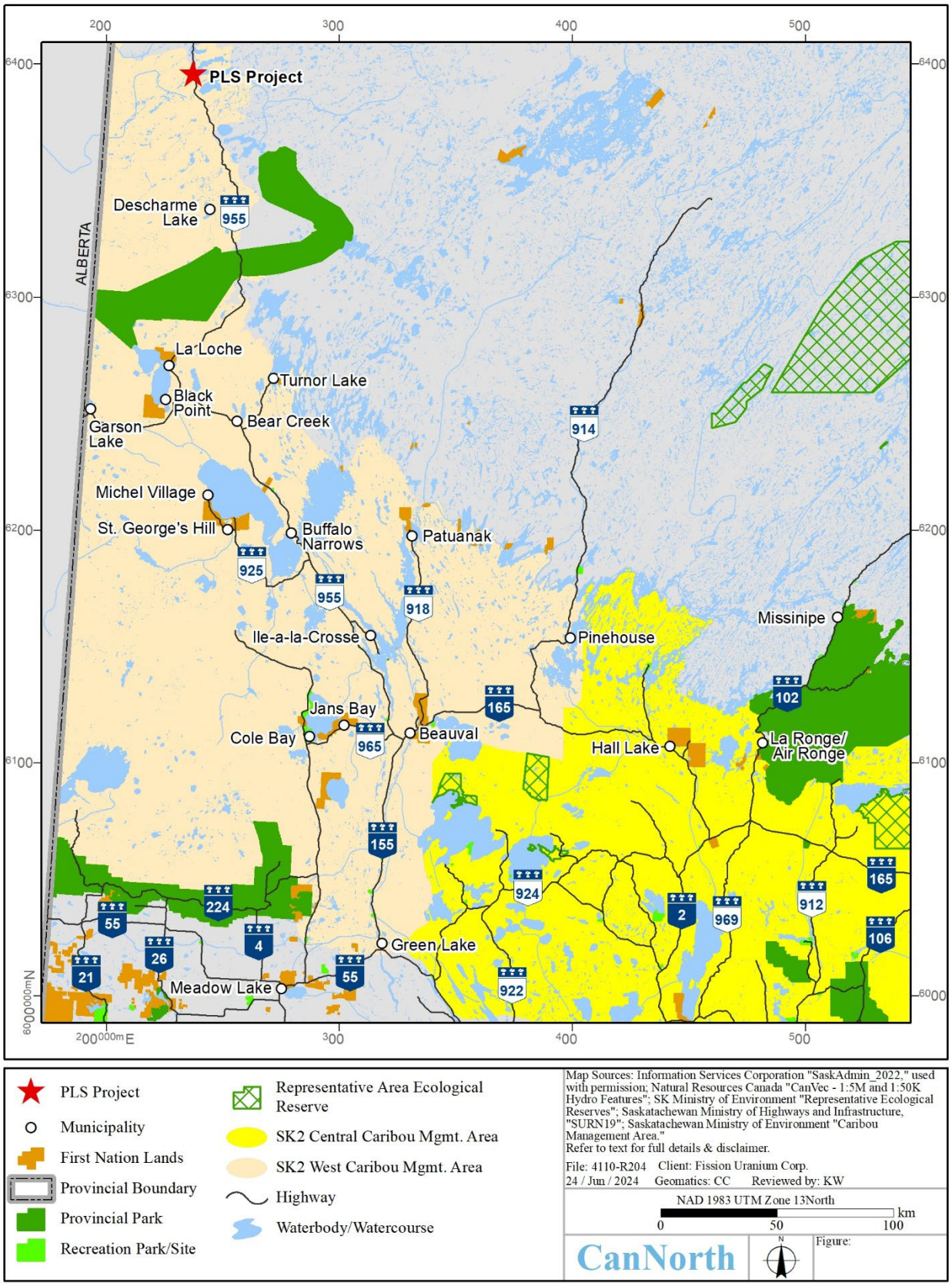

Figure 7-1
PLS Project location and spatial extent of the accidents and malfunctions assessment.

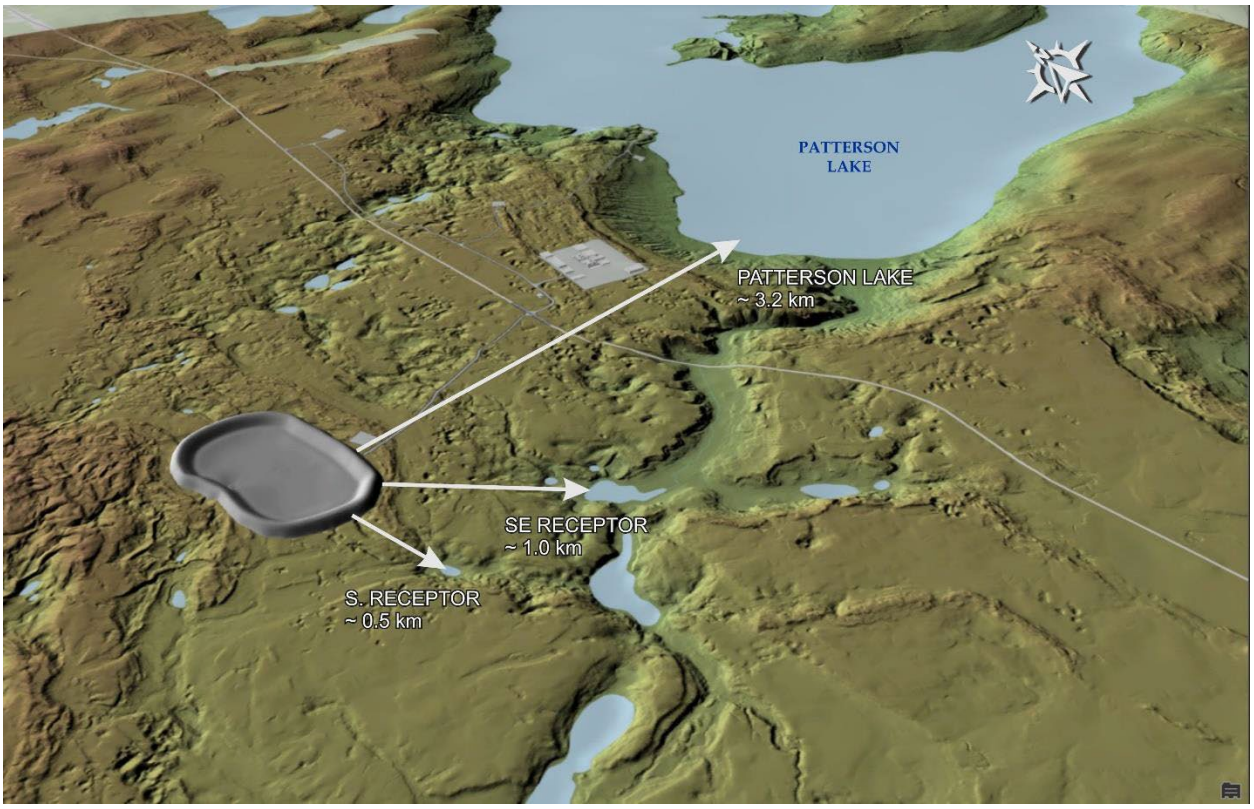

Figure 7-2
Anticipated tailings management facility tailings release path.

Table 7-1
Concordance table – accidents and malfunctions.

EIS Requirement	Section and Page #
b) detailed assessment of the possible major accidents and malfunctions, the resulting impacts on the environment, particularly on VCs, and the level of significance of those effects	Effects Assessment (7.5); 7-6
c) safeguards in place to avoid, minimize and mitigate for impacts due to accidents and malfunctions	Emergency Response, Mitigative, Measures, and Safety Considerations (7.3), 7-3
d) conceptual emergency response plan, including methods for notification of and reporting to potentially impacted communities and authorities	Environmental Contingency Procedure (7.3.1), 7-4
Literature Cited	**Section and Page #**
b) a citation for third-party information source within the text of the EIS	Section 7 Potential Accidents and Malfunctions; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (7.9); 7-20
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 7 Potential Accidents and Malfunctions; throughout

Table 7-2
Risk matrix for accident and malfunctions evaluation.

		Consequence				
Likelihood		**Insignificant**	**Minor**	**Moderate**	**Major**	**Severe**
	Expected to Occur (More Than Once Per Year) (5)	**Low**	**Moderate**	**Moderate**	**High**	**High**
	Likely to Occur (Every 1 to 10 Years) (4)	**Low**	**Moderate**	**Moderate**	**High**	**High**
	May Occur (Every 10 to 100 years) (3)	**Low**	**Low**	**Moderate**	**Moderate**	**High**
	Unlikely to Occur (Every 100 to 1000 Years) (2)	**Low**	**Low**	**Moderate**	**Moderate**	**High**
	Very Unlikely to Occur (Less Than Once per 1000 years) (1)	**Low**	**Low**	**Low**	**Moderate**	**Moderate**

	Consequence Category		
Consequence Level	**Safety and Health**	**Environmental Protection**	**Radiation Protection**
Insignificant	An event that results in a first aid injury or the potential for such an injury to occur.	An event resulting in negligible, reversible environmental damage with clean-up costs <$10,000 or a non-reportable discharge or incident.	A non-conformance to the radiation protection program that does not result in an action or administrative level exceedance.
Minor	An event that results in a medical treatment injury, restricted work injury, or the potential for such an event to occur.	An event resulting in minor, reversible environmental damage with clean-up costs <$50,000 or a reportable incident.	Event that occurs from a minor deviation in the radiation protection program or an Administrative Level exceedance.
Moderate	An event that results in a lost time injury or the potential for such an event to occur.	An event resulting in moderate, reversible environmental damage with clean-up costs <$250,000 or a reportable discharge.	Event that may indicate a potential loss of control of the radiation protection program or an action level exceedance.
Major	An event that results in a fatality or the potential for such an event to occur.	An event resulting in major, reversible or minor irreversible environmental damage with clean-up costs <$500,000.	Event that results in individual(s) exceeding short term (quarterly) dose limits.
Severe	An event that results in multiple fatalities or the potential for such an event to occur.	An event resulting in severe, reversible or major irreversible environmental damage with clean-up costs >$500,000.	Event that results in individual(s) exceeding long term (annual) dose limits.

Table 7-3
Annual probability of bounding scenarios.

SC. No	Bounding Scenarios	Annual Probability
1	Transportation accidents	-
1.a	Aquatic release (yellowcake)	8.91E-05 (1 in 11,223 years)
1.b	Aquatic release (other hazardous materials)	1.15E-03 (1 in 871 years)
1.c	Terrestrial release	1.21E-01 (1 in 8.3 years)
1.d	Vehicle fire and atmospheric release	9.27E-04 (1 in (1,078 years)
1.e	Vehicle-human accident	1.20E-02 (1 in 84 years)
1.f	Vehicle-wildlife accident	4.70E-01 (1 in 2.1 years)
2	Solvent extraction fire and explosion	1.004E-03 (1 in 1,000 years)
3	Tailings pipeline failure	1.00E-03 (1 in 1,000 years)
4	Failure of the TMF pit berms	2.00E-03 (1 in 500 years)
5	Failure of the TMF Engineered Barrier System	1.0E-02 (1 in 100 years)
6	Failure of the ground freeze	1.00E-04 (1 in 10,000 years)
7	Accidental atmospheric sulphur dioxide release	3.00E-02 (1 in 33 years)
8	Failure of calciner scrubber or packaging baghouse	7.14E-02 (1 in 14 years)

Table 7-4
Results of yellowcake fire release modelling for the contained, indoor fire.

Weather Condition	Distance to ERPG-3 (m)	Distance to ERPG-2 (m)
W1	<10	105
W2	95	282

ERPG = Emergency Response Planning Guideline; W1 = worst-case weather conditions; W2 = typical weather conditions.

Table 7-5
Results of yellowcake fire release modelling for unconfined fire.

Weather Condition	Distance to ERPG-3 (m)	Distance to ERPG-2 (m)
W1	80	185
W2	172	500

ERPG = Emergency Response Planning Guideline; W1 = worst-case weather conditions; W2 = typical weather conditions.

Table 7-6
Results of sulphur dioxide release modelling.

Weather Condition	Distance to AEGL-3 (m)	Distance to AEGL-2 (m)	Distance to STEL (15 min) (m)
W1	53	362	133
W2	114	1040	357

AEGL-3 = Acute Exposure Guideline Level 9.6 ppm; AEGL-2 = Acute Exposure Guideline Level 0.75 ppm; W1 = worst-case weather conditions; W2 = typical weather conditions.

STEL = Short Term Exposure Limit (15 min) is 5 ppm.

Table 7-7
Results of yellowcake baghouse stack release.

Weather Condition	Distance to ERPG-3 (m)	Distance to ERPG-2 (m)
W1	Never Reached	Never Reached
W2	<11 m	28 m

ERPG = Emergency Response Planning Guideline; W1 = worst-case weather conditions; W2 = typical weather conditions.

Table 7-8
Summary of annual accident probabilities for PLS and Rook I projects.

Accident Scenario	PLS Annual Probability	Rook 1 Annual Probability	Cumulative Scenario Probability
Aquatic release (yellowcake)	8.91E-05	2.85e-04	3.74E-04 (1 in 2,673 years)
Aquatic release (other hazardous materials)	1.15E-03	8.55e-04	2.00E-03 (1 in 499 years)
Terrestrial release	1.21E-01	1.11e-01	2.32E-01 (1 in 4.3 years)
Vehicle fire and atmospheric release	9.27E-04	2.94e-03	1.22E-03 (1 in 819 years)
Vehicle-human accident	1.20E-02	1.64e-02	2.84E-02 (1 in 35 years)
Vehicle-wildlife accident	3.75E-01	4.63e-01	8.38E-01 (1 in 1.2 years)

Table 7-9
Summary of assessment results for bounding scenarios.

Sc. No.	Accident or Malfunction Scenario	Likelihood	Estimated Effects Consequence	Overall Risk Rating[(a)]
1.a	**Transportation Accidents (Aquatic Release of Yellowcake)**	**Very Unlikely**	**Minor to Moderate**	**Low**
1.b	**Transportation Accidents (Aquatic Release of Fuel and Reagents)**	**Unlikely***	**Minor to Moderate**	**Low to Moderate / ALARP ***
1.c	**Transportation Accidents (Terrestrial release)**	**Likely**	**Insignificant**	**Low**
1.d	**Transportation Accidents (Atmospheric Release)**	**Very Unlikely**	**Minor**	**Low**
1.e	**Transportation Accidents (Vehicle-Human Interaction)**	**May Occur**	**Moderate**	**Moderate / ALARP**
1.f	**Transportation Accidents (Vehicle-Wildlife Interaction)**	**Likely**	**Minor**	**Moderate / ALARP**
2	**Solvent Extraction Fire and Explosion**	**Unlikely**	**Minor to Moderate**	**Low to Moderate / ALARP**
3	**Tailings Pipeline Failure**	**Very Unlikely**	**Minor**	**Low**
4	**Failure of the TMF Pit Berms**	**Unlikely**	**Severe**	**High**
5	**Failure of the TMF Engineered Barrier System**	**May Occur**	**Minor**	**Low**
6	**Failure of the Ground Freeze**	**Very Unlikely**	**Minor**	**Low**
7	**Accidental Atmospheric Sulphur Dioxide Release**	**May Occur**	**Minor to Moderate**	**Low to Moderate**
8	**Failure of Calciner Scrubber or Packaging Baghouse**	**May Occur**	**Insignificant to Minor**	**Low**

*The likelihood rating is for the entire fuel and reagent transportation frequency. For individual goods such as fuel, the likelihood is rated as very unlikely, and the risk is rated as Low.

SECTION 8

EFFECTS OF THE ENVIRONMENT ON THE PROJECT

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LIST OF ACRONYMS

CDA	Canadian Dam Association
COPC	Constituent of Potential Concern
ECCC	Environment and Climate Change Canada
EF-scale	Enhanced Fujita Scale
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
ERT	Emergency Response Team
F-scale	Fujita Scale
Fission	Fission Uranium Corp.
HHERA	Human Health and Ecological Risk Assessment
HVAC	Heating, Ventilation, and Air Conditioning
IPCC	Intergovernmental Panel on Climate Change
LNG	Liquid Natural Gas
NBCC	National Building Code of Canada
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide
OHS	Occupational Health and Safety
PDA	Potential Disturbance Area
the Project	The PLS Project
RCP	Representative Concentration Pathway
RSA	Regional Study Area
SAAQS	Saskatchewan Ambient Air Quality Standards
SO_2	Sulphur Dioxide
SSA	Site Study Area
TMF	Tailings Management Facility
TOR	Terms of Reference
VC	Valued Component

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8.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

8.1 Introduction

Effects of the environment on the PLS Project (the Project) refer to the forces of nature that could adversely affect the Project physically or interfere with the normal activities of the Project and the workforce. The forces of nature considered in this section of the Environmental Impact Statement (EIS) include environmental events with the possibility of occurring in the Project area (e.g., seismic events, forest fires, and climatic events). These events may disrupt Project construction, operations, or decommissioning activities, and could negatively impact Project infrastructure, underground workings, the workforce, or the local environment. This section evaluates the likelihood of these events occurring in the Project area, how the Project may be impacted, and mitigation measures and contingency plans to reduce the risk of adverse effects from these environmental events (ENV 2021).

The term climate change describes a change in the average conditions of environmental parameters, such as temperature and rainfall, in a region over a long period of time. Over the past 100 to 200 years, human activities have caused climate change to occur at an accelerated rate and it is predicted that this trend will continue in the reasonably foreseeable future. Climate change could influence the predictions made during the effects assessment for certain Project-environment interactions, although the extent and timing of the effects of climate change are uncertain. Information on the climate predictions compiled for the Project area that were used in the effects assessment as well as descriptions of potential impacts of climate change on the environmental events are discussed below.

The concordance table for components for the EIS from the Saskatchewan Ministry of Environment (ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021) for effects of the environment on the Project is provided in Table 8-1.

8.2 Seismic Events

Seismic events, or earthquakes, can cause landslides and ground vibrations which could negatively affect Project infrastructure, the workforce, and the local environment and could result in Project delays. Earthquakes are classified based on their magnitude (GC 2021a) and those with magnitudes less than 3.5 are recorded on local seismographs, but are generally not felt (Table 8-2).

The Project is located in northwestern Saskatchewan, approximately 160 km north of the village of La Loche in an area that has a low level of seismicity (Figure 8-1**;** GC 2021a). No earthquake of a magnitude 3 or greater has been recorded in northern Saskatchewan between 1627 and 2022 (Figure 8-2; GC 2021c).

8.2.1 Potential for a Project Effect

Seismic events could affect the Project during construction, operations, and decommissioning by potentially disturbing infrastructure and underground workings, which could cause harm to the workforce and environment. Based on available earthquake data, it is estimated that the frequency of an earthquake occurring with magnitude of 3 or higher in northern Saskatchewan is approximately less than 1% in 50 years (GC 2021c). Therefore, it is considered a low likelihood for an effect on the Project from an earthquake occurring in northern Saskatchewan.

8.2.2 Mitigation Measures

In consideration of the low seismicity of the area and the low likelihood of an earthquake occurring in northern Saskatchewan with a magnitude over 3, the risk of earthquake-related effects on the Project is low. Project infrastructure will be built to meet the requirements of the National Building Code of Canada (NBCC; NRCC 2020), with no additional mitigation measures or design considerations being required. Additionally, the Tailings Management Facility (TMF) is being constructed according to Canadian Dam Association (CDA) guidelines, which contain guidance on analysis and assessment of facilities as they relate to risk from seismic activity.

8.3 Forest Fires

Wildfire is a normal occurrence in northern Saskatchewan, particularly in the boreal forest which is a fire-prone ecosystem. A characteristic feature of the Project area is the prevalence of natural forest fire activity and the related influence of this frequent fire regime on the vegetative communities. Figure 8-3 shows the wildfire history for the province from 1945 to 2020 (GS 2021).

Climate change has the potential to extend the fire season and to increase fire intensity and frequency due to predicted increases in temperatures; however, there is also the potential these impacts could be offset by predicted increases in precipitation (Section 8.4.7).

8.3.1 Potential for a Project Effect

There have been several major fires in this region in the last few years, including a significant fire near Ile-a-la-Crosse in 2023. Figure 8-4 illustrates the extent of wildfire activity that has occurred in the last 40 years in the region surrounding the Project. The Site Study Area (SSA) has experienced fires within the past 30 years and the Wildlife Regional Study Area (RSA) has experienced fires within the last 10 years.

Post-fire regenerating forest constitutes 62% ha in the SSA and 61% ha in the Potential Disturbance Area (PDA) (Appendix C.3). Post-fire boreal forest stands that are <30 years old are less likely to burn than mature forests because of biomass depletion that occurs after fire and the slow regrowth of vegetation (i.e., low productivity) of high-latitude forests (Heon et al. 2014). These conditions yield reduced potential for fire ignition and spread and have been documented throughout the boreal forest biome (Beverly 2017; Heon et al. 2014; Marchal et al. 2020).

A wildfire could damage Project infrastructure during construction, operations, and decommissioning phases, which could in turn result in negative impacts or disruption to Project schedules. A wildfire could also affect workforce safety and access, either blocking or restricting access to the Project, and threatening building structures. Forest fires have caused road closures in northern Saskatchewan. Furthermore, fire activities could cause temporary impacts on employment either negatively or positively depending on resulting Project needs. Negative impacts on air quality are also possible from wildfires; these air quality impacts have the potential to affect worker health and visibility. Wildfires may also negatively impact wildlife through air quality degradation, limiting movement, and direct harm to animals and their habitat. The consequences of a wildfire impacting the Project could be high if unmitigated or uncontrolled.

8.3.2 Mitigation Measures

Fission Uranium Corp. (Fission) has planned Project design features and mitigation measures to limit the potential of fire occurring in the Project area, and to enact emergency protocols if a fire occurs in the region.

Fission will adhere to *The Wildfire Regulations*, which includes the preparation and submission of a Wildfire Prevention and Preparedness Plan pursuant to Section 20 of *The Wildfire Act*. Fire breaks will be installed around the Project site to create a buffer zone. Additionally, anthropogenically disturbed areas around the Project footprint will act as

extra fire breaks (Figure 8-5). On-site emergency response plans for the Project will include wildfire management operating procedures, wildfire fighting training for the Emergency Response Teams (ERTs), and fire suppression and resistance capabilities for the mine facilities. As the Project is being planned as a primarily fly in – fly out operation (see Section 2.4.3), alternate means of transporting supplies will be available in the event of road closures. Fire water storage and a fire truck will be on site should the need for mobile fire fighting be necessary. In addition, forest fire management is the responsibility of the provincial government, and it is expected that Fission will receive fire fighting support from the province should a fire develop near the Project.

Although the potential exists for forest fires to occur near to the Project, fire is not expected to have a detrimental effect on the Project given the recent burns that have occurred in the area and the design features and mitigation measures that Fission will have in place for the Project.

8.4 Climatic Effects

Extreme weather events, caused by climatic effects, have the possibility of damaging infrastructure and the surrounding environment. Although normally short-lived, extreme weather may cause the temporary suspension of specific construction, operations, and decommissioning activities until the events subside. The effects can generally be mitigated through adjustments to the timing of construction and maintenance activities. The potential effects from climatic events such as tornadoes, acid rain and deposition, extended drought, extreme temperatures, major precipitation and flooding, and severe snowstorms are discussed in the following sections. The severity of climatic effects could be affected by climate change; thus, climate predictions for a range of climate change scenarios for the Project area are provided below along with a description of how climate change was considered in the effects assessment.

8.4.1 Tornadoes, Severe Thunderstorms, and Plough Winds

Tornadoes are classified using the Fujita, or F-scale, which was originally developed in the midwestern United States. In 2013, Environment Canada[1] introduced the Enhanced Fujita Scale (EF-Scale) to measure the intensity of wind damage (SRC 2018). On average, approximately 80 tornadoes occur in Canada each year, with the highest tornado risks being in southern Saskatchewan, southern Manitoba, and southwestern Ontario (SRC 2018). The

[1] Environment Canada, as it was known in 2013, was renamed Environment and Climate Change Canada in 2015.

most common tornadoes are characterized as EF0 to EF2 (F0 to F2 on the Fujita scale) and typically result in minor structural damage to barns, wood fences, roof shingles, and chimneys, the uprooting or snapping of trees, and the downing of power lines. Less than 5% of tornadoes in Canada are rated EF3 or higher in intensity, for which wind speeds are greater than 265 km/h. The wind speed and expected damage from tornadoes are shown in Table 8-3.

Severe thunderstorms are often associated with tornadoes. To be classified as 'severe,' thunderstorms need to have one or more of the following features: produce one inch or larger hail, have wind gusts (e.g., plough winds) greater than 90 km/h, or be in combination with a tornado. During hot and humid months in the spring and summer, the intensity of the features and frequency of storms can increase (NSSL 2023). Thus, climate change could potentially increase the frequency and severity of thunderstorms since temperatures and precipitation are predicted to increase (Section 8.4.7).

Plough winds move horizontally along the ground away from thunderstorms and can cause trees or buildings to be blown down (GC 2019). Plough winds can be as strong as tornadoes but usually cover a much larger area.

8.4.1.1 Potential for a Project Effect

The Project is located within the F0-F1 zone, where the occurrence of tornadoes of magnitudes greater than F1 is very rare (ArcGIS 2022). Within 200 km of the Project area, one F0 tornado occurred between 1980 and 2009 (GC 2020), touching down in 1993 at a distance of 147 km from the Project (Figure 8-6). Therefore, it is considered a low potential for an effect on the Project from a tornado occurring in the region surrounding the Project.

Based on historical weather data, plough winds are not common in the Project area. The maximum hourly wind speed recorded at the meteorological station at the Project site between 2014 to 2022 was 74.2 km/hr (refer to Section 4).

While extreme precipitation events do occur in northern Saskatchewan (Section 8.4.5), severe hail events are more uncommon. Between 1978 and 2007, there were zero severe hail events recorded in the area of the Project (SRC 2018).

These extreme weather events could damage Project infrastructure, affect access and communications, and endanger workers during all Project phases depending on their severity. In addition, lightning strikes could cause forest fires.

8.4.1.2 Mitigation Measures

As the Project lies within the F0-F1 zone, the risk of a tornado happening in the Project area is low, and any tornado that may occur would be expected to be localized and of low magnitude, such that it would not be expected to cause any significant measurable damage to mine infrastructure during construction, operations, or decommissioning. Therefore, the risk of a tornado-related incident at the Project is low and no specific mitigation measures or additional design considerations beyond standard building codes are required.

Project infrastructure will be built to meet the requirements of the NBCC (NRCC 2020). Weather forecasts will be monitored daily on the Project site for extreme weather events including thunderstorms. If thunderstorms or high winds are forecast, Fission can prepare by ensuring that materials, equipment, structures, and any other objects are secured to mitigate excess damage as well as issuing warnings for personnel to take shelter when deemed necessary. An emergency preparedness and response program will be implemented during all phases on the Project and will include emergency prevention and response procedures during thunderstorms or high wind events. The likelihood of occurrence of thunderstorms or wind events is high, but the consequences are low and mitigable.

To protect workers, Fission will implement an appropriate Occupational Health and Safety (OHS) program to implement guidelines and procedures for protection from lightning strikes.

8.4.2 Acid Rain

Acid rain, or acid deposition, encompasses any form of wet or dry precipitation such as rain, snow, fog, hail, or dust, that causes atmospheric sulfur dioxide (SO_2) and nitrogen oxides (NO_x) to fall to the ground. The ambient air pollutants SO_2 and NO_x created by vehicles and heavy equipment (i.e., burning of fossil fuels), manufacturing, oil refineries, and mines are emitted into the atmosphere (U.S. EPA 2023). Acid rain was included in this section to address a community member concern that acid rain caused by industrial developments has the potential to impact the environment (ACFN Ltr. November 21 2022).

8.4.2.1 Potential for a Project Effect

The Project is situated in moderate proximity to SO_2 and NO_x emission sources, such as the Athabasca Oil Sands located approximately 160 km to the southwest. The area of the Project is acid-sensitive, as the Project is surrounded by granitic bedrock (overlain with

sandy soils), vegetation, wildlife, and waterbodies (Cathhart et al. 2016). An excess of deposited acid could be detrimental to the ecosystem, as the acid could leach metals, minerals, and nutrients from the soil and lower natural pH levels, which in turn can be destructive to fish, wildlife, and vegetation. While acid rain is not particularly harmful to human health, acid particulate matter in the air is, and inhaling particulate matter can damage internal organs. Additionally, acidic dust could accumulate on Project infrastructure that could corrode metal and painted surfaces, which increases maintenance costs and repairs (U.S. EPA 2023).

The pH of the water measured in Patterson Lake during baseline studies was near neutral (approximately 7) and the baseline study results collectively did not illustrate existing signs of acidification in the study area (refer to Section 4). In addition, the nitrogen dioxide (NO_2) and SO_2 data collected across four passive samplers during the baseline program confirmed that concentrations were well below the applicable criteria, as to be expected for a remote, natural setting (Appendix C.3). In the air quality assessment (Appendix D.1), concentrations of NO_2 and SO_2 were modelled during the construction and operations scenarios. During the construction scenario, modelled concentrations of SO_2 and NO_2 were predicted to be below the air quality criteria at all receptor locations outside of the PDA. During the operations scenario, concentrations of 1-hour SO_2 are predicted to exceed the Saskatchewan Ambient Air Quality Standards (SAAQS) less than 0.01% of the time over the modelled period while concentrations of 1-hour NO_2 at the maximum off-property receptor are predicted to exceed the SAAQS roughly 0.7% of the time. SO_2 and NO_2 concentrations are predicted to be higher for the Operations scenario even though emissions are modelled to decrease from the construction scenario. This is due to the change in the dominant emission source during Operation, the mine ventilation exhaust. The proximity of the mine ventilation exhaust to the PDA results in an increase in the overall maximum concentrations of SO_2 and NO_2 during the Operations scenario.

8.4.2.2 Mitigation Measures

Fission will follow all regulations related to SO_2 and NO_x emissions in the *Canadian Environmental Protection Act* (GC 1999) and Saskatchewan's *Environmental Management and Protection Act* (GS 2010). Mitigation measures will include the use of pollution control technologies on acid plant and process plant exhaust stacks with preventative maintenance and stack testing, and the use good engineering practices for exhaust stack design to enhance dispersion.

Extensive monitoring programs for air quality, climate, soil/sediment, vegetation, wildlife, water quality, and aquatic health will be implemented (refer to Section 9) and will include directly measuring SO_2 and NO_x emissions as well as other indicative parameters of acidification if it were to occur in the local environment. Comparing federal and provincial guidelines and regional information to data collected from the Project area will provide an accurate depiction of the surrounding ecosystem.

8.4.3 Extended Drought

Drought conditions result from a shortage of precipitation, which can be further exacerbated by failing to meet evapotranspiration demands. Drought occurs in Saskatchewan periodically. Climate change has the potential to increase the frequency and severity of drought because of predicted temperature increases; however, this may be offset by predicted increases in precipitation (Section 8.4.7). An extreme or prolonged drought could affect groundwater quantity (through a reduction in groundwater recharge), surface water quantity (with an absence of precipitation and potentially less groundwater), vegetation, and soil properties (with the degradation of soil creating airborne dust). Persistent drought conditions could also cause the boreal forest to be more susceptible to wildfires.

8.4.3.1 Potential for a Project Effect

A drought has the potential to negatively affect air quality by increasing suspended dust levels, which could affect the environment and worker health and would be expected to be of most concern during the construction period. Drought could also affect wildlife, through the loss of vegetation, food sources, habitat, as well as the availability of water during all Project phases.

Additionally, there is a potential risk of periods of extended drought reducing the quantity of surface water in the vicinity of the Project. This could affect surface water flows, availability of aquatic habitat, and potentially the mixing of treated effluent in the receiving environment. Patterson Lake is a large waterbody with a surface area of 38.1 km^2 and a volume of 525.3 x 10^6 m^3; thus, the likelihood of the above-mentioned potential drought effects occurring in the receiving environment is low. Water levels in Patterson Lake will be monitored throughout the life of the Project (see Section 9); thus, notable changes will be detected. A range of precipitation conditions was considered within the probabilistic modelling completed for the assessment of effluent dispersion and transport pathways for the Human Health and Ecological Risk Assessment (HHERA, Appendix D.7).

8.4.3.2 Mitigation Measures

The Canadian Drought Outlook is a monthly drought forecast that predicts if drought conditions across Canada will develop, stay the same, or improve for the end of the following month (Agriculture and Agri-food Canada 2023). This can be used as a tool to monitor predicted drought conditions for the Project area so that mitigation measures can be employed. As explained further in Section 8.4.7, climate change forecasts (RCP 8.5 scenario) for Patterson Lake, Saskatchewan predict at least a 10% increase in precipitation between 2021 and 2050 (CRIM 2023), which could mitigate the frequency and severity of drought in the Project area.

Negative impacts on air quality during periods of drought can be mitigated with an increase in dust suppression activities. Fission will have a series of groundwater wells to meet their freshwater requirements for the Project, primarily for potable water supply and emergency purposes (i.e., in case of fire). Additionally, other water requirements will be met through the use of water reclaimed from the mine dewatering system, drainage collection, TMF, and water treatment plant (refer to Section 2). Dust suppression and the identification of multiple water sources will limit the risk of drought-related effects on the Project.

Overall, drought conditions are likely to occur periodically, but the potential impacts on the Project are considered to be of low risk and can be effectively mitigated.

8.4.4 Extreme Temperatures

Extreme temperature refers to both hot and cold events. Alerts for extreme heat events are triggered if there are two or more consecutive days with daytime maximum temperatures expected to reach 29°C or warmer, or humidex values expected to reach 34°C or higher (GC 2023). Extreme cold alerts are triggered in Saskatchewan if temperature or wind chill is expected to reach -45°C for at least two hours (GC 2023).

8.4.4.1 Potential for a Project Effect

The Project area primarily lies within the Firebag Hills landscape area of the Mid-boreal Uplands Ecoregion of the Boreal Plain Ecozone, where the climate is characterized by short, cool summers and extremely cold winters (Section 4). Although summers are not consistently hot, periods of extreme heat have been recorded. Based on monthly summaries of meteorological data collected on-site from 2014 to 2022, the extreme maximum and minimum were 39.0°C and -40.2°C (Section 4). Climate normals collected by Environment

and Climate Change Canada (ECCC) at a climate station at Cluff Lake indicated that temperatures have registered above 34°C and below -45°C in the past (ECCC 2023). Due to climate change, climate variability may increase and potentially cause more extreme hot and cold temperatures (Section 8.4.7).

Extreme temperatures can affect construction, operations, and decommissioning through extreme heat and cold, freeze-thaw cycles, and temperature fluctuations. Extreme heat can damage surfaces, softening and reducing structural integrity, while extreme cold could freeze pipes and equipment, causing materials to become brittle and less durable. Both extreme temperatures can be problematic to worker health (i.e., heat stroke or hypothermia), and fluctuations could overwhelm heating, ventilation, and air conditioning (HVAC) systems to above and below ground structures, as well as the operation's power supply. The most damaging aspect of extreme temperatures to surfaces and infrastructure is the freeze-thaw cycle. This weathering process is caused by water freezing and expanding in cracks present in roadways, pipes, roofs, and walls, which reduces the durability and lifespan of different structural features of the Project.

8.4.4.2 Mitigation Measures

The Project will be designed, constructed, and operated to be resilient to extreme cold temperatures, as the probability of experiencing extreme cold is likely. Pipes, if buried, will be buried below the frost line, or if above ground, will be insulated and heat traced. Project infrastructure and equipment will be inspected regularly and maintained to prevent or repair cold weather damage, including freeze-thaw damage. To protect workers, Fission will implement an appropriate OHS program and implement guidelines and procedures for working in extreme cold and heat.

The probability of extreme heat occurring for short periods and extreme cold occurring for longer periods is high and therefore, it is important that the Project design and mitigation measures plan for these events to lower risk of adverse impacts.

8.4.5 Major Precipitation and Flooding

A major precipitation event (i.e., a 1:100-year event) in the Project area could cause regional surface flooding and erosion throughout the site as well as mine inflow. The yearly probability of these events occurring is low; however, they could occur more frequently due to climate change and a predicted increase in precipitation levels.

8.4.5.1 Potential for a Project Effect

The Project is located in an area with one of the lowest average annual maximum flows for rivers with 1,000 km^2 drainage areas in Canada (Figure 8-7). As such, the probability of significant large-scale surface floods due to rapid changes in water elevations is low.

Surface flooding from streams and lakes within the Project area and from a major precipitation event could adversely affect site access, key safety systems and services, and could cause site water to run-off into the local environment. The Project area drains towards Patterson Lake, which has a high capacity to absorb changes in water levels due to its large size (Section 8.4.3.1). Changes to surface water levels in Patterson Lake due to climate change, the Project, and the Rook I Project were assessed in Appendix D.5. This report predicted a maximum increase in water levels of 0.017 m during low flow periods. Figure 8-8 provides a visual representation of how increases in water levels in Patterson Lake could affect site infrastructure. This figure shows that the Project infrastructure (specifically the exhaust vent raise) would only be impacted if water levels were to increase by 0.72 m in Patterson Lake. As such, the potential for flooding of Project infrastructure from this lake during a major precipitation event or climate change scenario is low.

The Clearwater River flows through and within the Project area to other lakes downstream (Figure 8-9). There are no streams within the SSA that could cause flooding on site during high precipitation events (Section 4); however, overland flow on site could occur during intense precipitation events. The soils on-site are also sandy with a high infiltration rate, which limits the ability of sheet flow and run-off to cause Project effects (Section 4).

8.4.5.2 Mitigation Measures

To manage the risk of flooding and the potential for site water to run-off into the local environment, run-off storage and conveyance facilities have been designed to manage precipitation from a 24-hour duration 1:100-year storm with a factor applied to account for the impact of climate change. Water management will be achieved by using natural and artificial gradients as well as collection and diversion ditches. Run-off water designated for collection will be directed to one of two collection ponds – the Intermediate Settling Pond or the Surface Run-Off Pond. Additionally, ponds that do not collect run-off (i.e., the TMF, Settling Pond, Contingency Pond, and Monitoring Ponds) are designed to manage 24-hour probable maximum precipitation events for the direct surface area of the facility. Overall, given all the design provisions that Fission has proposed in combination with the low flood

risk in the region, it is expected that any flood events would be managed effectively, and the Project is not expected to be adversely affected.

8.4.6 Severe Snowstorms

A snowstorm is a combination of heavy snow, blowing snow, and/or dangerous wind chills and depending on the severity, storms could have negative effects on the Project, transportation, and the workforce.

8.4.6.1 Potential for a Project Effect

Northern Saskatchewan experiences harsh winter conditions, including extreme temperatures (Section 8.4.4), as well as snowstorms, blizzards, and other winter precipitation events. In addition to flooding discussed in Section 8.4.5, flooding may also occur during spring snow melt as a result of extreme snowfall events during winter.

Although the majority of precipitation occurs from spring to fall (Section 4.2.1.2), extreme snowfall or associated spring flooding could damage Project infrastructure, affect access and communications, and endanger workers during all Project phases, depending on their severity.

During construction, operations, and decommissioning, extreme snowfall and/or reduced visibility from blowing snow could force closure of roads and/or air travel for extended periods of time. Severe winter weather events could also lead to vehicle accidents, which could, in turn, result in releases of fuel and other hazardous materials and lead to further road closures.

Snow and ice build-up can increase loadings on Project infrastructure and have the potential to cause damage. Severe winter weather also has the potential to damage overhead power lines, resulting in temporary power outages.

8.4.6.2 Mitigation Measures

Critical structures, to the extent possible, will be constructed to withstand structural loading expected with weight associated with snow and ice. The on-site liquid natural gas (LNG) power supply will result in less overhead powerlines than traditional transmission lines, which in turn will reduce the likelihood of power outages due to damaged overhead lines during winter storms.

To reduce winter hazards, winter maintenance activities for the Project will include snow clearing and removal and ice control (sanding/salting roads and walkways). Snow will be piled in suitable areas (e.g., not in or near wetlands or areas where spring melt could cause adverse effects) and gaps will be left in snowbanks where wildlife movements may be impeded (e.g., along linear clearings such as roads, above ground pipelines).

8.4.7 Climate Change

Climate change is an external force that can influence the potential effects of the Project on the environment. To complete climate change evaluations, estimations of key climate parameters out to the year 2100 were compiled based on the representative concentration pathway (RCP) trajectory analysis adopted by the Intergovernmental Panel on Climate Change (IPCC) and outlined in the IPCC Synthesis Report AR5 (IPCC 2014). Three future climate scenarios were considered in accordance with this method:

- RCP 2.6: Stringent mitigation scenario (emissions strongly declining)
- RCP 4.5: Intermediate scenario (emissions slowly declining)
- RCP 8.5: High GHG emissions (emissions increasing)

RCP 2.6 assumes that carbon emissions reduce to zero by the end of the century, while RCP 4.5 reflects a scenario in which global carbon emissions stabilize by the end of the century. The RCP 8.5 assumes that global carbon emissions are still increasing by the end of the century, and do not stabilize until 2250. The RCP data sets were generated for various locales across Canada using an ensemble of 24 climate models, and future climate projection data for the Patterson Lake area were obtained from the Climatedata.ca data portal, which was defined by a ~10 km x 6 km grid cell (CRIM 2023).

Predictions for the various RCP scenarios include a median and a likely range; for purposes of plotting and presenting the data, the median values were used. The precipitation and temperature data sets generated for the Project area are presented in Figure 8-10 and Figure 8-11, respectively. Where possible, the climate projections were compared to climate normals for the area. The climate normals (1981-2010) were collected from the nearest ECCC climate normals station at Cluff Lake, Saskatchewan (station ID 4061861) (ECCC 2023), approximately 125 km from the Project area. Climate change forecasts for Patterson Lake, Saskatchewan (RCP 8.5 scenario – most severe), predict at least a 10% increase in precipitation between 2021 and 2050 (CRIM 2023).

Climate change scenarios were considered in cumulative effects assessments to ensure that Project design measures provide adequate mitigation for the changing climate; these are summarized for relevant valued components (VCs) in Table 8-4.

8.5 Summary

The effects of the environment on the Project considered the potential for seismic events, forest fires, and climatic events such as tornadoes, acid rain, extended drought, extreme temperatures, and major precipitation and flooding. It was concluded that the Project area has a low probability of seismic activity and acid rain, as well was a low risk of low magnitude tornadoes occurring. Therefore, additional mitigation measures beyond those inherent in the standard best practices and building codes for Saskatchewan are not required for these environmental events.

Forest fires, thunderstorms, periodic extended droughts, and extreme cold temperatures were identified as the natural forces most likely to occur in the Project area with their likelihood and severity potentially impacted by climate change. Various risk management strategies are proposed and incorporated in the Project design, mitigation measures, and management plans to minimize the adverse effects from these environmental events on the Project and workforce.

The effects of climate change on the Project were considered throughout the modelling and assessments completed for the EIS, and these specific aspects were incorporated into the EIS sections and technical documents.

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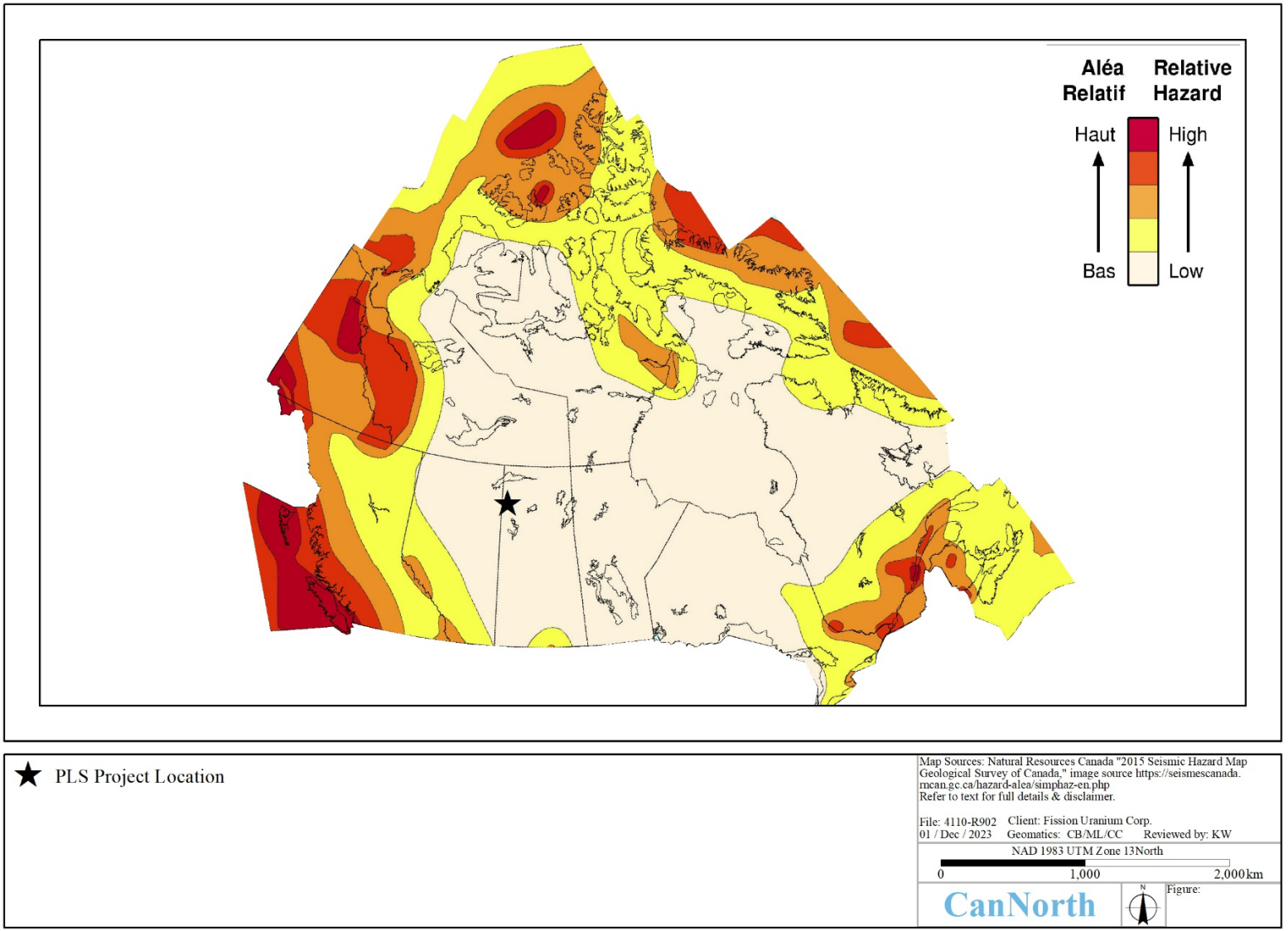

Figure 8-1
Seismic hazard map of Canada.

Source: Government of Canada (GC 2021b).

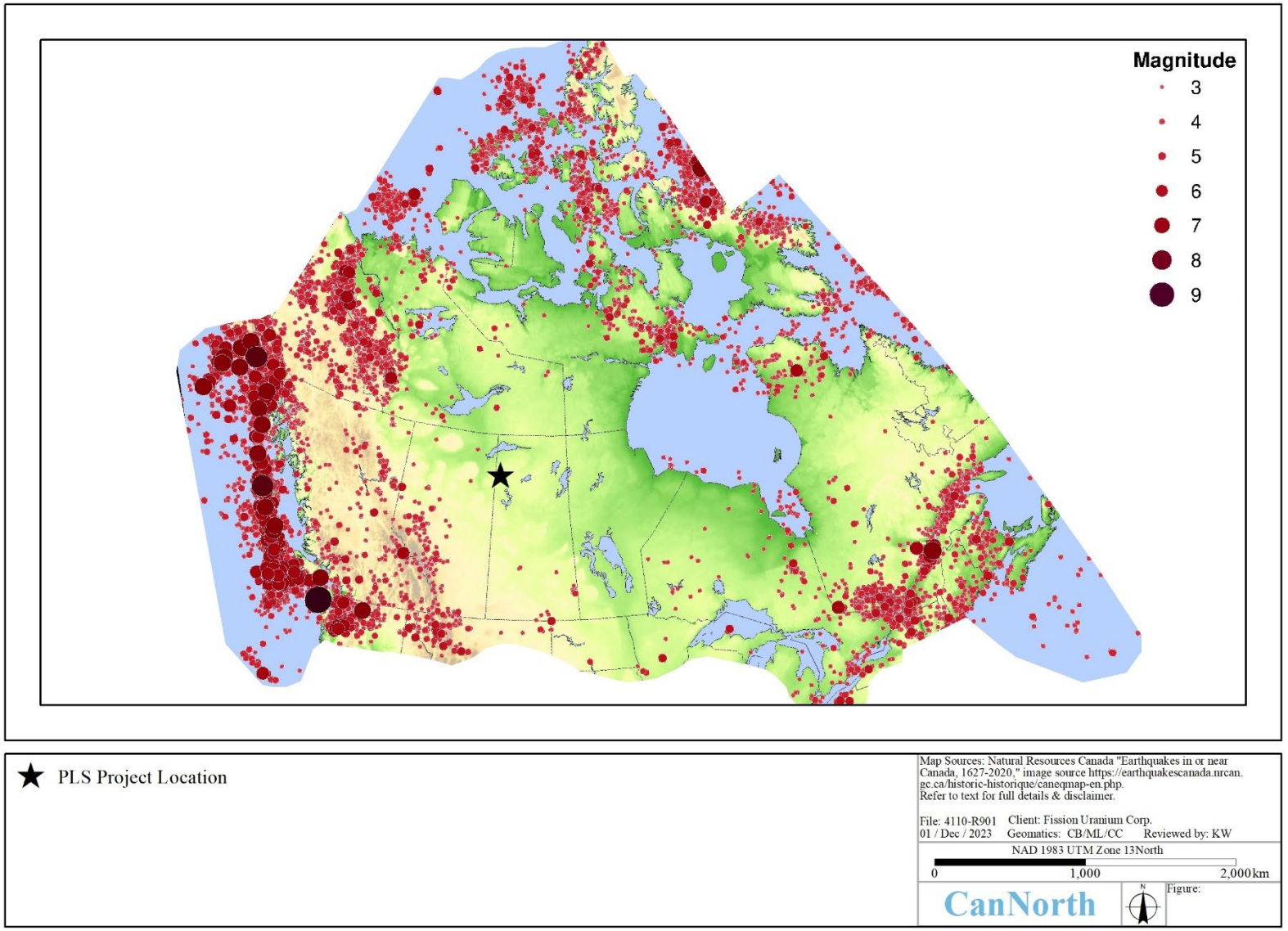

Figure 8-2
Earthquake occurrences in Canada with a magnitude of 3 or greater, 1627 – 2022.

Source: Government of Canada (GC 2021c).

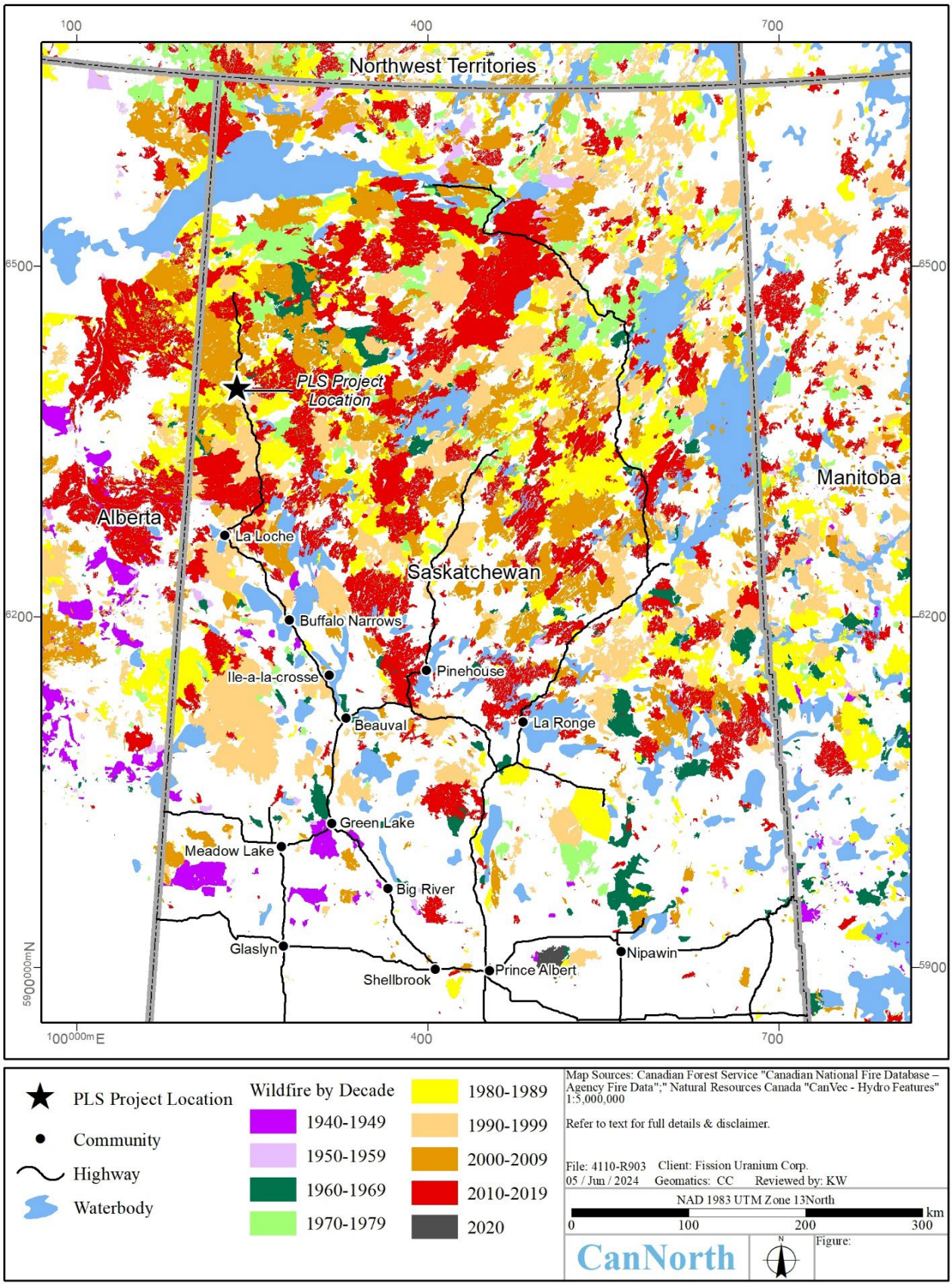

Figure 8-3
Saskatchewan wildfire history, 1945 to 2020.

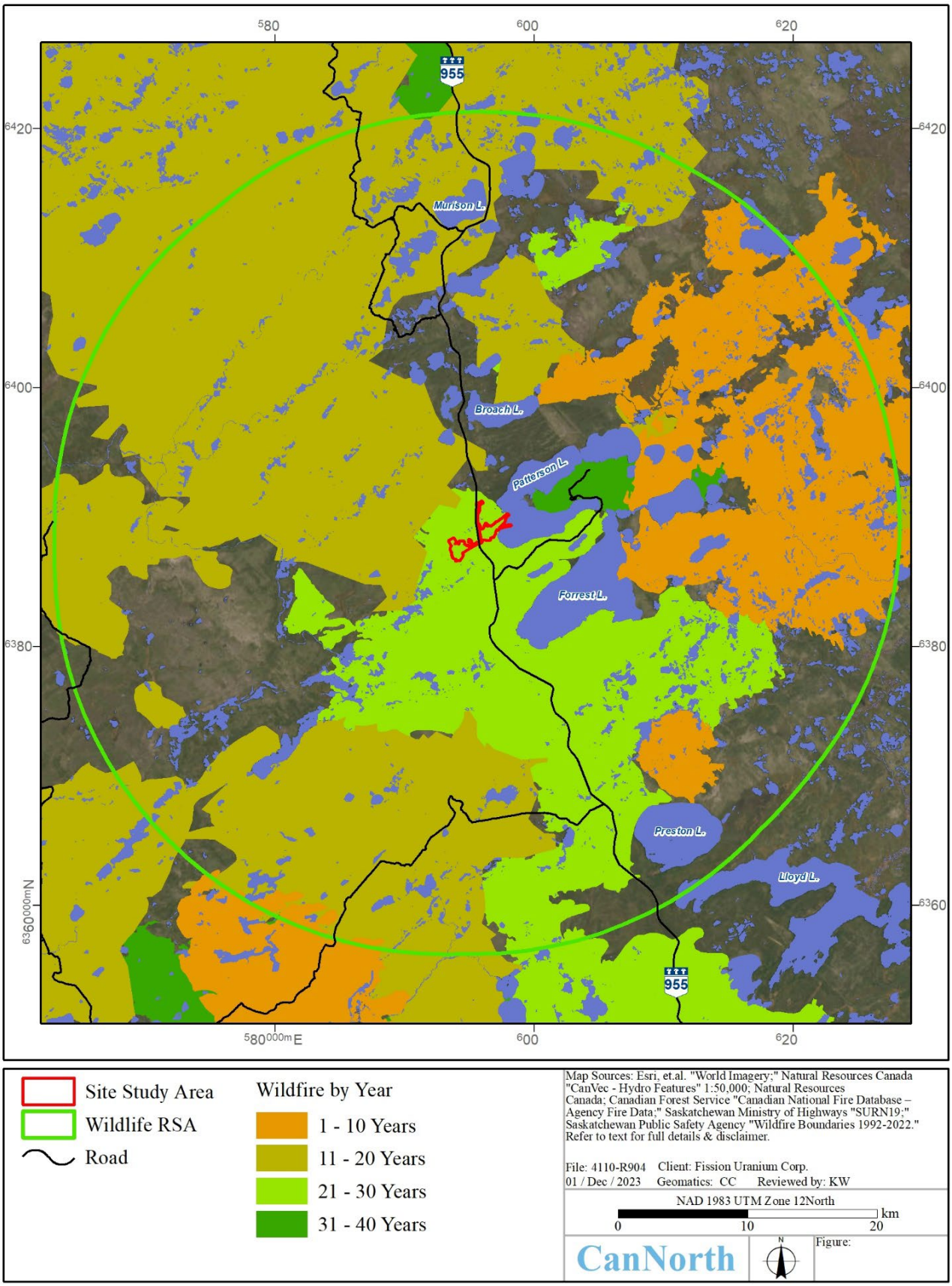

Figure 8-4
Recent wildfire activity in the Project area.

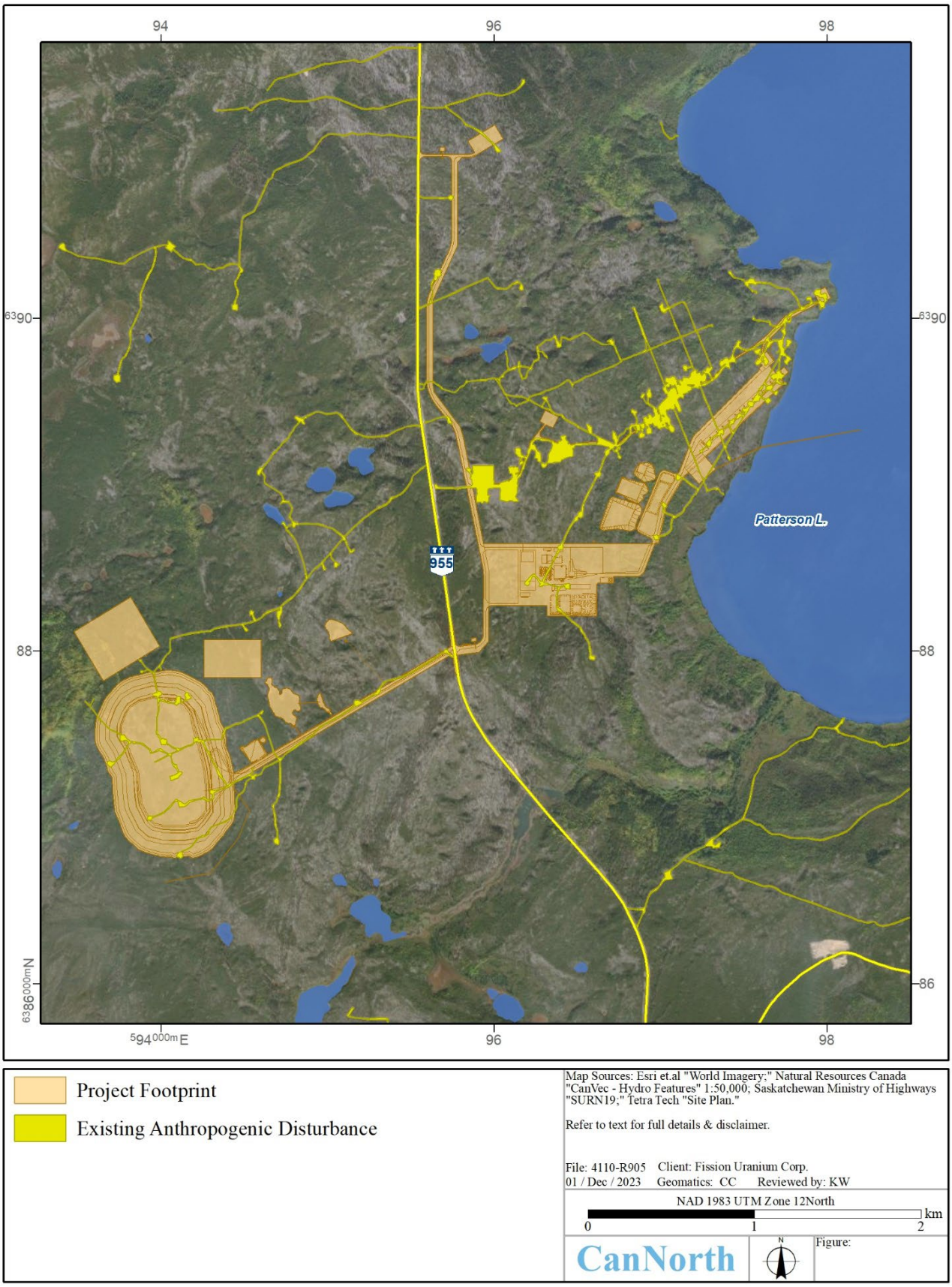

Figure 8-5
Disturbed area around the Project.

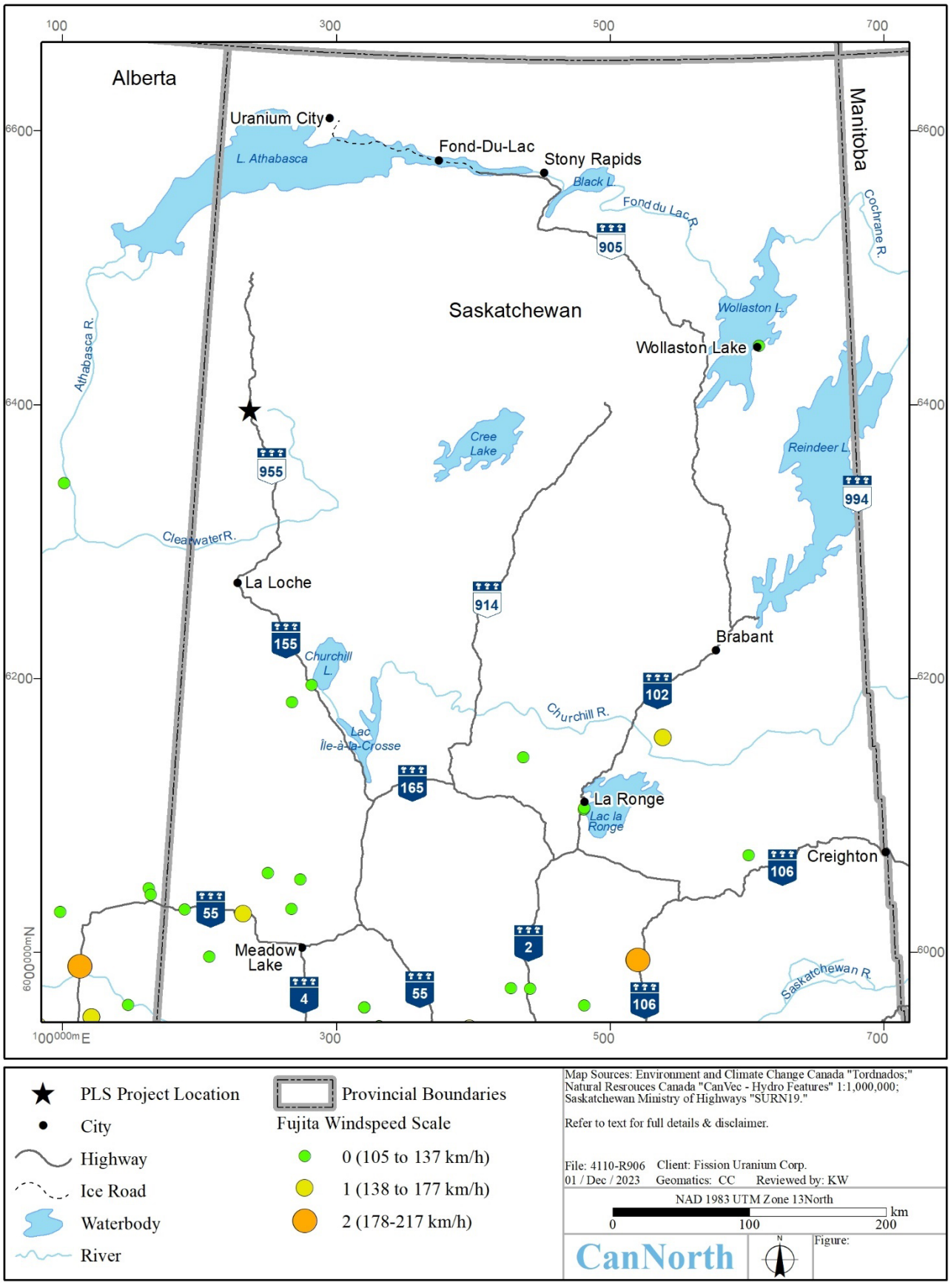

Figure 8-6
Tornadoes within 200 km of the Project area, 1980-2009.

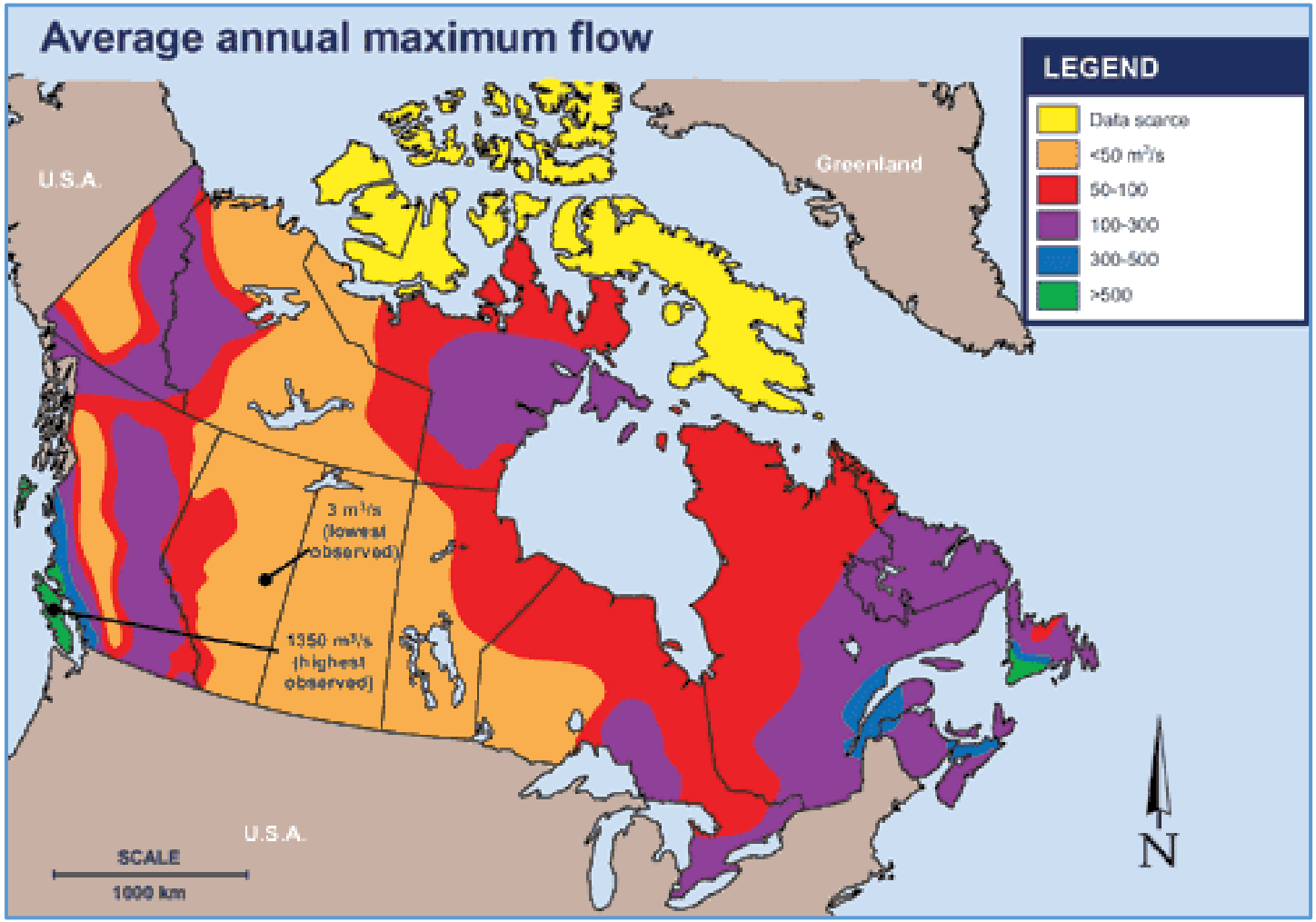

Figure 8-7
Annual maximum flow of a 1,000 km^2 river basin.

Source: Based on data obtained from Government of Canada (GC 2013).

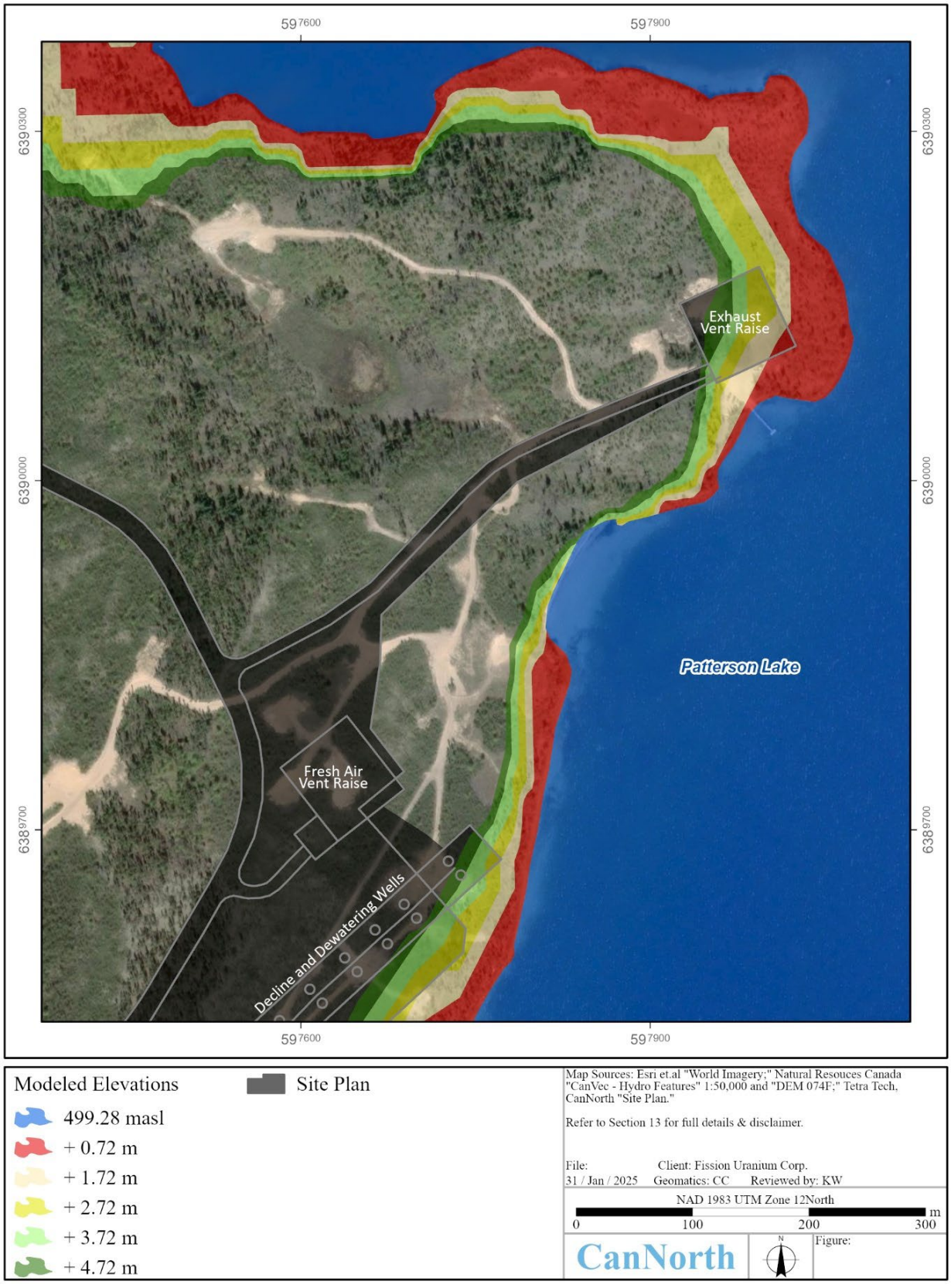

Figure 8-8
Lake level increases in Patteson Lake in comparison to the proposed location of the Project infrastructure.

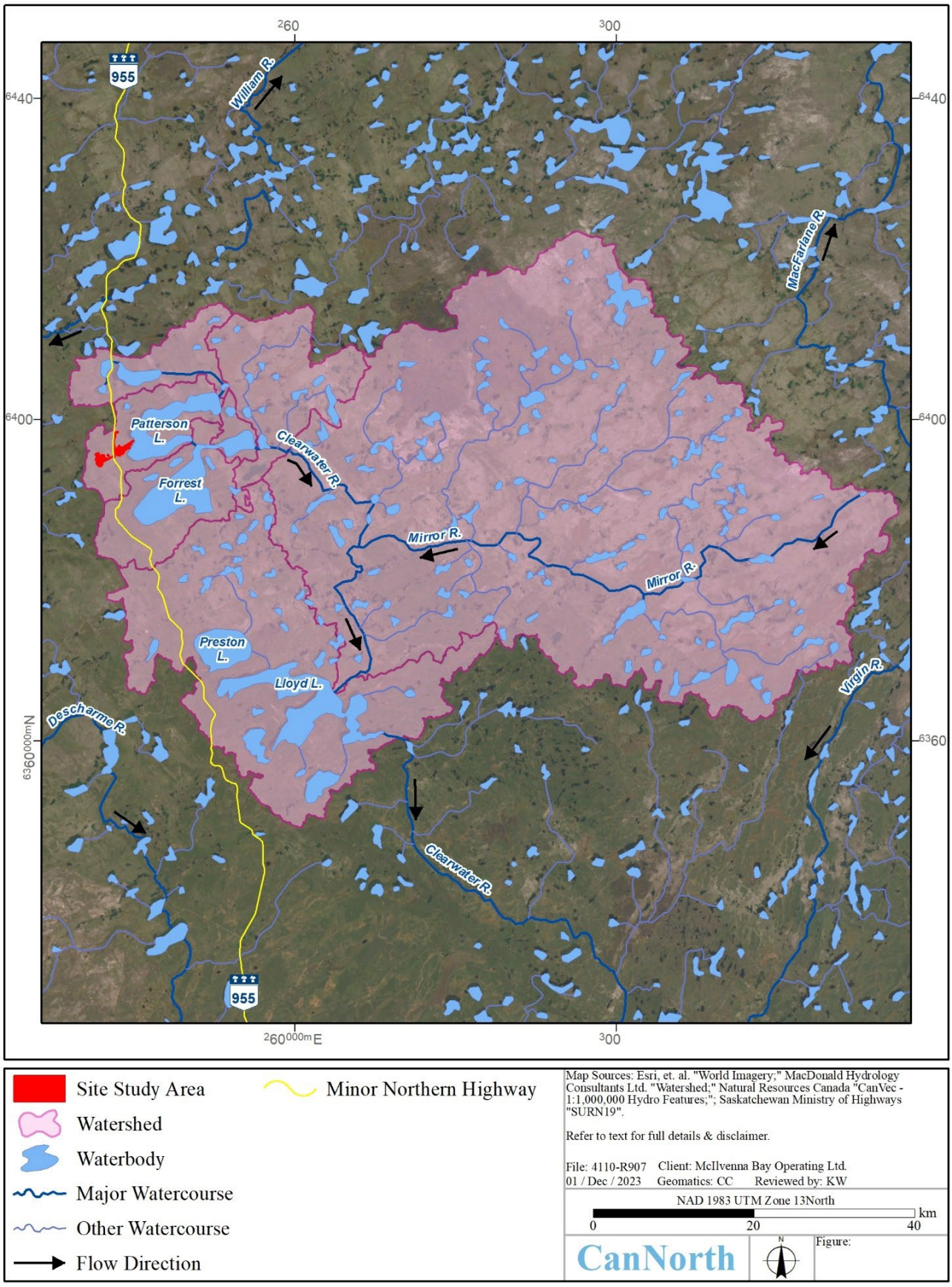

Figure 8-9
Drainage basins in the region surrounding the Project.

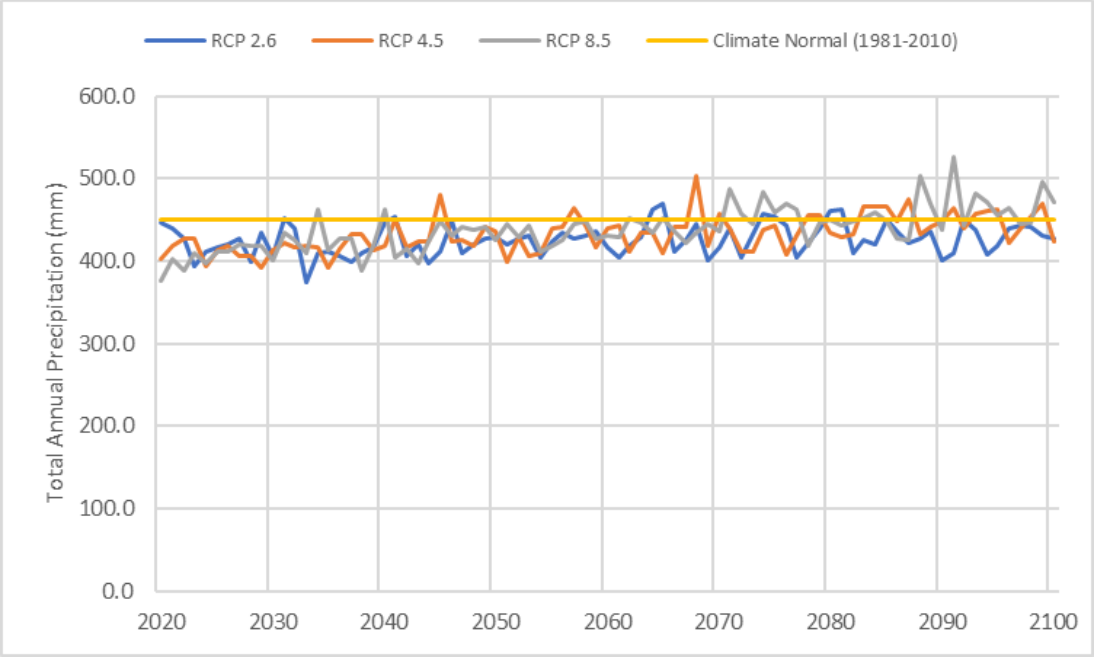

Figure 8-10
Total annual precipitation projections – 2020 to 2100.

Source: Based on data obtained from CRIM (2023).

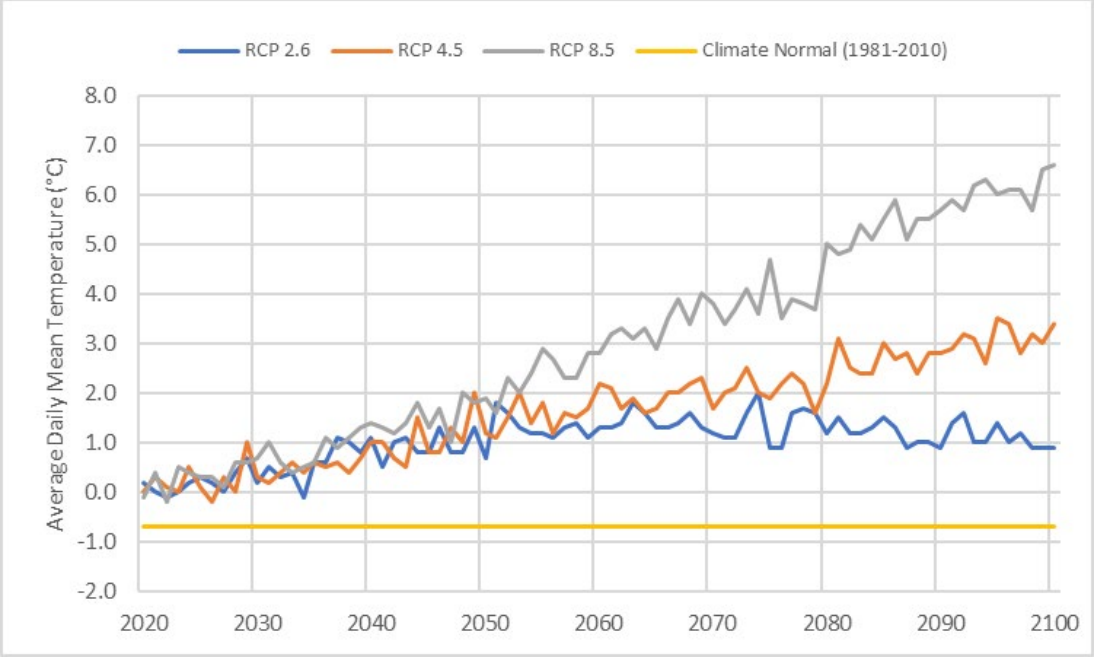

Figure 8-11
Average daily mean temperature projections – 2020 to 2100.

Source: Based on data obtained from CRIM (2023).

Table 8-1
Concordance table – effects of the environment on the development.

EIS Requirement	Section and Page #
b) evaluation of how each possible environmental event may impact the development, and the consequences of the impact on the development	Seismic Event (8.2.1), 8-2
	Forest Fire (8.3.1), 8-3
	Tornado, Severe Thunderstorms, and Plough Winds (8.4.1.1), 8-5
	Acid Rain (8.4.2.1), 8-6
	Drought (8.4.3.1), 8-8
	Extreme Temperatures (8.4.4.1), 8-9
	Major Precipitation and Flooding (8.4.5.1), 8-11
	Severe Snowstorms (8.4.6.1), 8-12
	Climate Change (8.4.7), 8-13
c) mitigation measures and contingency plans that may be employed to manage adverse effects of the environment on the development	Seismic Event (8.2.2), 8-2
	Forest Fire (8.3.2), 8-3
	Tornado, Severe Thunderstorms, and Plough Winds (8.4.1.2), 8-6
	Acid Rain (8.4.2.2), 8-7
	Drought (8.4.3.2), 8-9
	Extreme Temperatures (8.4.4.2), 8-10
	Major Precipitation and Flooding (8.4.5.2), 8-11
	Severe Snowstorms (8.4.6.2), 8-12
	Climate Change (8.4.7), 8-13
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Throughout Section
c) a section containing complete reference for citations, used to support the findings of the Environmental Impact Assessment (EIA)	Literature Cited (8.6), 8-14
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Appendix A.2, A.3, A.7, D.1, D.4, D.5, D.7

Table 8-2
Earthquake magnitude scale and effects.

Magnitude	Earthquake Effects
Less than 3.5	Recorded on local seismographs, but generally not felt.
3.5 - 5.4	Often felt, but rarely cause damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can cause damage to poorly constructed buildings and other structures in areas up to about 100 kilometers across where people live.
7.0 - 7.9	"Major" earthquake. Can cause serious damage over larger areas.
8.0 - 8.9	"Great" earthquake. Can cause serious damage and loss of life in areas several hundred kilometers across.
9	Rare great earthquake. Can cause major damage over a large region over 1,000 km across.

Source: GC 2021a.

Table 8-3
Typical damage of tornadoes.

Enhanced Fujita Scale	Wind Estimate[1]	Typical Damage
EF0 (F0)	90-130 (60-110)	Light damage. Some damage to chimneys, branches broken off trees, shallow-rooted trees pushed over, sign boards damaged.
EF1 (F1)	135-175 (120-170)	Moderate damage. Peels surface off roofs, mobile homes pushed off foundations or overturned, moving automobiles blown off roads.
EF2 (F2)	180-220 (180-240)	Significant damage. Roofs torn off frame houses, mobile homes demolished, boxcars overturned, large trees snapped or uprooted, light-object missiles generated, cars lifted off ground.
EF3 (F3)	225-265 (250-320)	Severe damage. Roofs and some walls torn off well-constructed houses, trains overturned, most trees in forest uprooted, heavy cars lifted off the ground and thrown.
EF4 (F4)	270-310 (330-410)	Devastating damage. Roofs and some walls torn off well-constructed houses, trains overturned, most trees in forest uprooted, heavy cars lifted off the ground and thrown, well-constructed houses levelled, structures with weak foundations blown away some distance, cars thrown and large missiles generated.
EF5 (F5)	>315 (420-510)	Incredible damage. Strong frame houses levelled off foundations and swept away, automobile-sized missiles fly through the air in excess of 100 m (109 yards), trees debarked, incredible phenomena will occur.

[1]Wind speed in km/h; value in brackets is wind speed for historic Fujita scale, provided for reference.

Table 8-4
Consideration of climate change in the assessments for the EIS.

Valued Component	Consideration of Climate Change in the Assessment	EIS Section/ Appendix
Air Quality	Climate is an integral component of the air quality modelling completed for the assessment and the potential effects of a changing climate are complex with the potential to both increase and decrease the air quality predictions. A qualitative discussion is provided here. • Changes to climate have potential to affect meteorological parameters that govern dispersion and resulting ambient concentrations and deposition rates of constituents of potential concern (COPC) used in the assessment. • An increase in temperature (expected under future climate conditions) would reduce the difference between in-stack temperature and ambient air temperature, which would decrease the buoyant flux and dispersion from point sources. • Initial dispersion for stacks at the Project are driven by momentum flux (i.e., the flow rate) and are unlikely to be sensitive to an increase in ambient temperature. • An increase in annual precipitation (expected under future climate conditions) would decrease suspended particulate matter by increasing the removal of suspended particulate (via wash out) in air and supressing emissions of fugitive dust from unpaved surfaces and storage areas. • An increase in temperature during summer months would lead to drier conditions and increased emissions of fugitive dust; this could be effectively managed through a dust management plan. • Changes to temperature would alter the assumed usage of heating and cooling equipment.	Section 6.2.4.1
Noise and Vibration	Climate is an integral component of the noise modelling completed for the assessment and the potential effects of a changing climate are complex with the potential to both increase and decrease the noise predictions. A qualitative discussion is provided here. • Climatological factors such as temperature, relative humidity, and temperature inversions may influence the propagation of sound. • Modelling accounted for these factors by assuming a downwind propagation in all directions, the presence of moderate temperature inversions, and temperature and humidity conditions that generally result in the most conservative prediction. • Changes to temperature would alter the assumed usage of heating and cooling equipment; the assessment assumed all equipment is operated at maximum load throughout the assessment period.	Section 6.3.4.1
Groundwater Quantity	The magnitude and extent of the groundwater drawdown impacts are unlikely to change in response to climate change. Changes in climate may potentially increase or decrease the amount of recharge across the site which may in turn impact water levels. Changes in water levels change the total amount of drawdown available within a geologic unit but have little impact to the amount of drawdown in response to pumping which is primarily governed by the hydraulic properties of the geologic unit.	Section 6.6.4.1
Groundwater Quality	Climate change was assessed in the scenarios modeled as a part of the sensitivity analysis. Recharge to the groundwater system was varied by ±25% in consideration of climate change scenario RCP 8.5.	Section 6.7.4.1; Appendix D.4
Surface Water Quantity	The hydrological modelling assessment considered climate change scenario RCP 8.5 to evaluate potential water level changes to Patterson and Naomi lakes and streamflow changes at three points along the Clearwater River (below Patterson Lake, below Naomi Lake, and below Lloyd Lake).	Section 6.8.4.1; Appendix D.6
Surface Water Quality	The fate and transport of constituents in the environment will be affected by climate change; however, there is uncertainty in how the many aspects of climate change will interact or combine effects within an exposure assessment. Water and sediment quality modelling considered the following elements of climate change: • Effluent quantities released to the environment incorporated water balance information based on the RCP 4.5 climate change scenario. Modelling was completed in a probabilistic framework to capture some of the uncertainties and account for, to an extent, possible future variations under a changed climate; for example, a range on the future precipitation assumption was considered to account for periods of low and high precipitation in the future.	Section 6.9.4.1; Appendix D.7

SECTION 9

MONITORING AND FOLLOW-UP PROGRAMS

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LIST OF ACRONYMS

ACFN	Athabasca Chipewyan Dene Nation
AHPP	Aquatic Habitat Protection Permit
BACI	Before-After-Control-Impact
BNDN	Birch Narrows Dene Nation
BRDN	Buffalo River Dene Nation
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CES	Critical Effect Size
CNSC	Canadian Nuclear Safety Commission
COPC	Constituent of Potential Concern
CRDN	Clearwater River Dene Nation
CSA	Canadian Standards Association
DCE	Decommissioning Cost Estimate
DDP	Detailed Decommissioning Plan
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
EEMER	Environmental Effects Monitoring Electronic Reporting
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMMP	Environmental Monitoring and Measurement Procedure
EMP	Environmental Management Program
ENV	Saskatchewan Ministry of Environment
EPR	Environmental Performance Report
Fission	Fission Uranium Corp.
GHG	Greenhouse Gases
GS	Government of Saskatchewan
HHERA	Human Health and Ecological Risk Assessment
HRMP	Heritage Resource Management Plan
HRDA	Human Resources Development Agreement
HRDP	Human Resource Development Plan
ICP	Institutional Control Program
IEMP	Independent Environmental Monitoring Program
IMS	Integrated Management System
ISEPP	Industrial Source Environmental Protection Plan
LNG	Liquified Natural Gas
LRWS	Ministry of Labour Relations and Workplace Safety
MDMER	*Metal and Diamond Mining Effluent Regulations*

MGR	Ministry of Government Relations
MN-S NR2	Métis Nation-Saskatchewan Northern Region 2
MSLA	Mine Surface Lease Agreement
NAG	Non-Acid Generating
NO_2	Nitrogen Dioxide
NPRI	National Pollutant Release Inventory
NSAD	Northern Saskatchewan Administration District
NSCA	*Nuclear Safety and Control Act*
OMS	Operation, Surveillance, and Maintenance
PAG	Potentially Acid Generating
PDA	Potential Disturbance Area
PDCE	Preliminary Decommissioning Cost Estimate
PDP	Preliminary Decommissioning Plan
the Project	The PLS Project
QA/QC	Quality Assurance and Quality Control
RSN	Residents of Saskatchewan's North
SEQG	Saskatchewan Environmental Quality Guidelines
SHMP	Health and Safety Management Program
SLA	Surface Lease Area
SO_2	Sulphur Dioxide
TOR	Terms of Reference
TMF	Tailings Management Facility
UMMR	*Uranium Mines and Mills Regulations*
VC	Valued Component
WRMF	Waste Rock/Stockpile Management Facilities
WSA	Water Security Agency
YNLR	Ya' Thi Néné Lands and Resources

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Figure 9-1 Preliminary Environmental Monitoring and Measurement Procedure aquatic monitoring locations for the PLS Project.

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Table 9-1 Concordance table – monitoring and follow-up programs.

Table 9-2 Preliminary Environmental Monitoring and Measurement Procedure design for the PLS Project.

9.0 MONITORING AND FOLLOW-UP PROGRAMS

9.1 Overview

Monitoring programs serve to measure potential project effects, to verify Environmental Impact Statement (EIS) predictions and mitigation effectiveness, to address uncertainties identified in the EIS, and to detect unforeseen impacts. During all phases of the PLS Project (the Project), comprehensive monitoring programs will be undertaken that consist of 1) compliance monitoring to meet requirements of regulations, permits, and approvals, and 2) studies to address commitments made in the Environmental Impact Assessment (EIA), EIA uncertainties, and other Project objectives. This EIS section describes the preliminary design of compliance and follow-up monitoring programs by outlining components, sampling locations, parameters, and frequencies. The final design will include input from regulatory agencies, stakeholders, and Indigenous Nations and communities. Additionally, summaries of the content and intent of management plans, procedures, manuals, and strategies that will be developed during permitting to guide the development, operation, maintenance, and monitoring of certain infrastructure/activities are provided below.

Monitoring program results will be utilized to quantify both positive and negative impacts of the Project, ensure that public interest and safety are addressed, inform environmental performance reporting, modelling updates, revisions to monitoring and management plans, and identify if further mitigations and corrective actions are required. Adaptive management will be used throughout the life of the Project to provide continual improvement in the protection of environmental and social components.

The type and extent of monitoring will vary depending on the Project stage. For example, monitoring during construction will focus on environmental protection during activities such as land clearing, while monitoring during decommissioning will focus on examining components such as revegetation success. During the operational period, monitoring and reporting requirements of numerous components will be required under the provincially-issued permit (Approval to Operate Pollutant Control Facilities), the Canadian Nuclear Safety Commission (CNSC) operating licence, and federal regulations (e.g., *Metal and Diamond Mining Effluent Regulations* [MDMER]).

The following sections describe the regulatory requirements and compliance for monitoring (Section 9.2), preliminary design of the Environmental Management Program (EMP; Section 9.3.1), and EIS follow-up programs (Section 9.13). The concordance table for monitoring and follow-up programs from the Saskatchewan Ministry of Environment

(ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021) is provided in Table 9-1.

9.2 Compliance

9.2.1 Mine Surface Lease Agreement

Fission Uranium Corp. (Fission) must comply with the terms and conditions of the Project-specific Mine Surface Lease Agreement (MSLA) issued by the Government of Saskatchewan (GS) and administered by the Ministry of Government Relations (MGR), the Ministry of Labour Relations and Workplace Safety (LRWS), and ENV.

The MSLA will be developed once Fission delineates the surface lease area (SLA) and submits a lease application to the GS. It is anticipated that the footprint of the SLA will be the Potential Disturbance Area (PDA) assessed as part of this EIA, which is illustrated in Figure 9-1. Once the agreement is in place, Fission expects to report annually to ENV on the developed and undeveloped land inside the SLA, such that land rent can be calculated. The lease rate per hectare of developed land is anticipated to be higher than for undeveloped land, which Fission understands to be a measure implemented by ENV to discourage unnecessary area development and to encourage progressive reclamation within the SLA over the lifecycle of the Project. The MSLA would be terminated when ENV declares successful completion of decommissioning and reclamation, and the Ministry of Energy and Resources affirms it will accept the lease lands into the Institutional Control Program (ICP) in accordance with and as defined in *The Reclaimed Industrial Sites Act*.

Once developed, the Project's MSLA is anticipated to include similar components to those issued for other uranium mines in the Northern Saskatchewan Administration District (NSAD), including the following:

- conditions related to the use of lands for exploration, mining, milling, and transportation related to those activities;
- provisions to provide access to the lease lands for GS employees and officials;
- conditions related to environmental protection including requirements to maintain compliance with applicable environmental acts and regulations including the *Mineral Industry Environmental Protection Regulations* and prepare and submit certain plans and reports;

- conditions related to the occupational health and safety of workers including requirements to maintain compliance with the *Saskatchewan Employment Act, 2020* and the *Mines Regulations, 2018*;
- conditions related to maximizing direct employment and business opportunities for Residents of Saskatchewan's North (RSN[1]) including the requirement to negotiate certain agreements and prepare and submit certain plans, forecasts, and reports;
- conditions related to establishing and implementing processes for compensation for loss of commercial income and preparing and submitting certain reports;
- conditions related to establishing and implementing a Public Information Program and preparing and submitting certain reports; and
- requirements for payment of taxes and improvement of roadways.

The MSLA will include specific reporting requirements. In addition to the aforementioned annual land development reports, Fission expects to summarize the applicable data in sand and gravel royalty return reports, industrial water use reports, human resource development plans, business opportunities forecasts, employment status reports, northern business participation reports, and compensation for loss of income reports as well as additional environmental reports set out in approvals granted pursuant to *The Environmental Management and Protection Act, 2010* (Section 9.2.2).

9.2.2 Approval to Construct, Operate, and Decommission Pollutant Control Facilities

Fission must apply for approvals to construct, operate, and decommission pollutant control facilities in accordance with the requirements of the *Mineral Industry Environmental Protection Regulations* pursuant to *The Environmental Management and Protection Act, 2010.*

Pollutant control facilities for the Project are expected to include the processing plant, refrigeration plant, the backfill plant, Liquified Natural Gas (LNG) power plant, waste rock

[1] A Resident of Saskatchewan's North is defined as:

- A person who has resided in Saskatchewan's North for a period of 10 years or one half or his or her age, whichever is lesser. Such a person: shall not lose status by relocating outside of Saskatchewan's North for educational purposes, shall not lose status by relocating outside of Saskatchewan's North for five years or less, and shall regain status if he or she has lived outside of Saskatchewan's North for more than five years but re-establishes primary residency in Saskatchewan's North at the time of hire.
- A person who transfers from one mine operation in Saskatchewan's North to another or is re-employed within one year after leaving mine employment in Saskatchewan's North, and who met the criteria of a Resident of Saskatchewan's North contained in the applicable Human Resource Development Agreement at the time of recruitment to that operation.
- A person who has been designated by the Minister to be a Resident of Saskatchewan's North.

and ore pads, water contingency and monitoring ponds, water treatment plant and treated effluent discharge pipeline, truck shop complex, fresh and exhaust air shafts, and the tailings management facility (TMF).

9.2.2.1 Approval to Construct Pollutant Control Facilities

Fission must comply with terms and conditions set forth in the applicable Approval to Construct Pollutant Control Facilities (Approval to Construct) issued by ENV. Although not yet developed, the Project-specific Approval to Construct is anticipated to comprise facility-specific construction requirements and measures including, but not limited to, inspection requirements and quality control and quality assurance.

9.2.2.2 Approval to Operate Pollutant Control Facilities

The Approval to Operate Pollutant Control Facilities (Approval to Operate) issued by ENV will describe the terms and conditions Fission must comply with. The development of the Approval to Operate will be a collaborative process between ENV and Fission to ensure a mutual understanding of its contents and to verify that appropriate site-specific monitoring plans and controls are in place. The Project-specific Approval to Operate is anticipated to include similar components, schedules, and reporting requirements as those issued for other uranium mines in Saskatchewan, including the following:

- conditions related to specific works and facilities; hazardous substances and waste dangerous goods construction, storage, and decommissioning; material storage, handling, and transport; air, water, and wastewater management; and waste handling, transportation, and disposal, including of radiologically-contaminated material;
- inspection requirements;
- management plan requirements; and
- details on the environmental monitoring program.

Regarding reporting, it is anticipated that Fission will submit quarterly environmental reports to the ENV, and these reports will form the basis of the annual report, which will include summaries and interpretations of the environmental monitoring data.

It is expected that an Environmental Performance Report (EPR) will be required by the Approval to Operate. EPRs are typically prepared every five years during lifecycle of a mine. The objectives of the EPR are to provide information that can be used by ENV to

issue or amend permits and verify that the Project is complying with regulatory requirements, performing within the basis of predicted environmental effects, that the environmental monitoring program is gathering sufficient information, and that any models used to predict environmental performance continue to be valid. Preparation of each EPR will follow the Environmental Performance Report Guideline (ENV 2013).

9.2.2.3 Preliminary Decommissioning Cost Estimate and Decommissioning Plan

Fission will be required to prepare and maintain a preliminary decommissioning cost estimate (PDCE) and preliminary decommissioning plan (PDP) for a "decommission tomorrow" scenario. The PDP and PDCE are anticipated to require update every five years, or when major changes occur at the Project that affect the PDP and PDCE.

9.2.3 Water Rights Licence and Approval to Operate

The Water Security Agency (WSA) will require a water rights licence and approval to operate to provide groundwater supply for the construction, operation, and decommissioning of the Project. The water rights licence application will be based on the results of a groundwater investigation which is also permitted by the WSA. Submission of water use and water level data will be required as part of the water rights licence and Approval to Operate. It is expected that the water rights licence and Approval to Operate would regulate the quantity of groundwater that could be withdrawn and would require annual reporting to the WSA on the actual quantity withdrawn.

9.2.4 Canadian Nuclear Safety Commission Licencing

Projects wishing to carry out activities related to the site preparation, construction, operation, decommissioning, and abandonment of nuclear facilities and uranium mines and mills in Canada must first obtain licences from the CNSC (CNSC 2022). These activities are regulated under the *Nuclear Safety and Control Act* (NSCA) which establishes the CNSC's authority to set regulatory requirements for all nuclear-related activities in Canada.

Fission will require multiple licences from the CNSC over the life of the Project as follows:

- licence to prepare site and construct;
- licence to operate;
- licence to decommission; and
- license to abandon.

The *Uranium Mines and Mills Regulations* (UMMR) list the information required to support the licence applications prepared by the proponent. It is possible that a licence may be issued by the CNSC that includes multiple phases of the Project's life cycle.

In the CNSC licence, it is expected that Fission will be required to implement and maintain an Environmental Protection Program (EPP). Fission accepts this responsibility and will develop an EPP that meets CNSC requirements.

9.2.5 Approval to Construct and Operate Waterworks

A potable water treatment plant will be necessary to support the construction, operational, and decommissioning phases of the Project. Design of the potable water system will also include potable water storage and a distribution system. A permit for the Construction of Waterworks must be obtained from the WSA prior to start of any construction activities associated with the potable water treatment plant. The permit application will include, at minimum, a detailed design brief of the plant and a written statement confirming that the treated water will meet all provincial requirements.

A Permit to Operate a Waterworks pursuant to the *Environmental Management and Protection Act, 2010* and the *Waterworks and Sewage Works Regulations, 2010* must be obtained from ENV prior to operation of the potable water system. The conditions of approval will include details of a treated water sampling program to be implemented by Fission, including criteria to be analysed, the proposed sampling location(s), and required times and frequencies of sampling.

9.2.6 Approval to Construct and Operate Sewage Works

A permit for the Construction of Sewage Works must be obtained from the WSA prior to start of any construction activities associated with the sewage works. Domestic wastewater (sewage) treatment for the Project is proposed to be a system based on Moving Bed Biofilm Reactor technology. The treated liquid sewage will be discharged into a process pond for treatment along with the Project's other wastewater streams, while the sludge will be dewatered, stored, and shipped offsite for disposal (see Section 2.0 for more detail). Material will be scanned/confirmed safe and approved for removal before sent off-site. The plant design will adhere to the Sewage Works Design Standards EPB 503 (WSA 2012). The Project will not meet the inclusion criteria for the federal *Wastewater Systems Effluent Regulations* and as such will be exempt from those regulations.

A Permit to Operate Sewage Works issued under *The Environmental Management and Protection Act, 2010* and *The Waterworks and Sewage Works Regulations* must be obtained from ENV and will establish a sewage quality monitoring protocol. To ensure compliance with the regulations, sewage effluent may be monitored before being discharged into the process pond for retention. Treated sewage effluent will be discharged alongside treated mine effluent through the diffuser in Patterson Lake.

9.2.7 Air Environmental Protection Plan

Air emissions generated during all phases of the Project are regulated under the Industrial Source (Air Quality) chapter of the Saskatchewan Environmental Code and require the development of an Industrial Source Environmental Protection Plan (ISEPP). An ISEPP details mitigation measures to manage air emissions and mitigate their effects on the environment and surrounding communities. The ISEPP will assist with establishing Project-specific air quality objectives and standards and assess how the Project will conform to these standards by detailing the following: relevant air emissions, mitigation requirements for air emission sources, operation of applicable air pollution control and abatement technologies, emergency response strategies for upset conditions, and reporting requirements. Monitoring of parameters in the Project's air emissions will be incorporated into the EPP (Section 0).

9.2.8 Aquatic Habitat Protection Permit

The *Environmental Management and Protection Act, 2010* and *the Environmental Management and Protection (General) Regulations* stipulate that any work that occurs in the bed, bank, or boundary of a waterbody or watercourse, or any discharge with adverse effects on water requires an Aquatic Habitat Protection Permit (AHPP) obtained from ENV prior to beginning work. This will apply to the area of the proposed treated effluent diffuser and pipeline into Patterson Lake and monitoring requirements will be stipulated in the permit.

9.2.9 Environmental Emergencies Regulations

The *Environmental Emergency Regulations* enacted under the *Canadian Environmental Protection Act* apply to facilities and locations that store prescribed materials above stipulated thresholds. These facilities are required to make certain plans and reports for submission into a federal database as well as conduct emergency response scenarios and

exercises as identified in the regulations. The Project is likely to require reporting with respect to its storage of LNG, diesel, or other substances.

9.2.10 Metal and Diamond Mining Effluent Regulations

Environment and Climate Change Canada (ECCC) is responsible for administration of the pollution prevention provisions of the *Fisheries Act*, which under Section 36 prohibits the deposit of deleterious substances in water frequented by fish unless authorized by regulations. The *Metal and Diamond Mining Effluent Regulations* (MDMER) of the *Fisheries Act* apply if a metal or diamond mine is releasing an effluent (i.e., treated effluent) at a flow rate that exceeds 50 m^3/day and are depositing deleterious substances into fish-bearing waters. The MDMER permit the release of treated effluent to fish-bearing waters if the pH is within a defined range, concentrations of specified deleterious substances do not exceed the maximum authorized limits, and if the treated effluent is not acutely lethal (GC 2022a). Consequently, the Project will trigger monitoring requirements under the MDMER because it will release treated effluent into Patterson Lake.

The MDMER requires treated effluent quality monitoring and Environmental Effects Monitoring (EEM; GC 2022a). The former includes measuring concentrations of deleterious substances weekly during discharge, monthly testing of acute lethality (the frequency of which may change; see Section 9.2.10.2), and monthly treated effluent volume and loading calculations, while the latter includes the following components:

- Treated effluent and receiving surface water quality monitoring studies consisting of treated effluent characterization, sub-lethal toxicity testing, and surface water quality monitoring (MDMER Schedule 5, Part 1); and
- Biological monitoring studies focusing on fish populations, benthic invertebrate communities, and fish tissues in the aquatic receiving environment to determine if the treated effluent discharge is having an effect on fish, fish habitat, or the use of fisheries resources (MDMER Schedule 5, Part 2).

9.2.10.1 Treated Effluent and Surface Water Monitoring

Submission of treated effluent monitoring data is required quarterly to ECCC using the online Environmental Effects Monitoring Electronic Reporting (EEMER) system.

A weekly grab sample or composite sample taken during discharge periods is required at the final point of control. Testing must comply with Table 1 of Schedule 3 of the MDMER

and testing frequency of certain parameters may be required to vary (either increased or decreased) if they meet the conditions laid out in clauses 13(1) to 13(6) of the MDMER. Monthly mean concentration, as well as monthly loading calculations, of each deleterious substance are also required to be reported. Total monthly treated effluent volume must also be reported for each month during which there is a deposit.

Surface water quality monitoring is also required at the designated EEM exposure area and related reference area(s) four times per year. Surface water characterization is conducted by recording the temperature, dissolved oxygen, pH, hardness, alkalinity, and conductivity of the water samples and measuring the total concentrations of parameters listed in Schedule 5, Part 1, Section 7(1) of the MDMER (GC 2022a).

In addition to the monitoring described above, treated effluent and surface water characterization must also be completed as part of the EEM program and includes analytical requirements from Table 2 of Schedule 3 of the MDMER.

The treated effluent plume delineation and assessment will be incorporated into the monitoring program and will include measuring constituents in the treated effluent and converting the data to relative treated effluent concentrations, as described in the Metal Mining Technical Guidance for Environmental Effects Monitoring (EC 2012).

9.2.10.2 Toxicity Testing

Acute lethality testing using rainbow trout (*Oncorhynchus mykiss*) and water fleas (*Daphnia magna*) is conducted monthly on treated effluent samples from mines releasing effluent to freshwater systems; however, frequency may be reduced or increased depending on the results of these tests. As per amendments in the MDMER that came into force January 1st, 2019, sub-lethal toxicity tests are to be conducted four times per year initially on fathead minnow (*Pimephales promelas*), an invertebrate species (*Ceriodaphnia dubia*), a plant species (*Lemna turionifera*, synonym *Lemna minor*), and an algal species (*Pseudokirchneriella subcapitata*). After three years, the tests are only required using a single species, which is determined based on the prior three years of results.

9.2.10.3 Biological Monitoring

Cyclical biological monitoring studies will be conducted for the EEM program downstream of the treated effluent discharge point and at associated reference waterbodies, as per Schedule 5, Section 2 of the MDMER (GC 2022a). The biological monitoring will include

benthic invertebrate community and fish population studies as well as supporting information meant to characterize the study area. An MDMER-defined "effect" on benthic invertebrate communities or fish populations is a statistically significant difference in specified endpoints between reference and exposure areas.

The MDMER requirement to conduct biological monitoring is based on treated effluent concentrations in the receiving environment. Amendments were made to incorporate the use of Critical Effect Sizes (CES) that are provided for select effect endpoints in Schedule 5 as triggers for subsequent monitoring tiers. The amendments also include caveats for which benthic invertebrate community or fish population studies do not need to occur.

The third component of EEM biological monitoring studies is to conduct fish tissue studies for select parameters. For mercury, the MDMER requires fish tissue mercury studies if the annual mean concentration of total mercury in the effluent is equal to or greater than 0.10 µg/L. For selenium, the MDMER require a fish tissue study if the total selenium concentration in the effluent is equal to or greater than 10 µg/L, or the annual mean concentration is equal to or greater than 5 µg/L.

9.2.11 Greenhouse Gas Emission Regulation and Reporting

Greenhouse gases (GHGs) including carbon dioxide, methane, and nitrous oxide that are associated with the LNG plant are expected to be regulated pursuant to *The Management and Reduction of Greenhouse Gases (Standards and Compliance) Regulations*, which are expected to apply as of January 2023 to electricity generation facilities within the boundaries of industrial facilities. *The Management and Reduction of Greenhouse Gases (Standards and Compliance) Regulations* are expected to require registration of the electricity facility, regular quantification of GHG emissions, submission of emission returns, and submission of compliance returns to address compliance obligations. The requirements for quantification, emission returns, and compliance returns are expected to be set out in the relevant standard.

Non-electricity generation GHG emissions associated with the proposed mine and mill would be regulated pursuant to *The Management and Reduction of Greenhouse Gases (Standards and Compliance) Regulations* if the direct GHGs generated by the facility exceed 25 kilotonnes carbon dioxide equivalent (CO_2e) per year, which the Project will exceed during all years of the operations phase, but not during the construction and decommissioning phases (Appendix A.7).

Additionally, the mineral mining sector is required to monitor and report direct GHG emissions under the authority of subsection 46(1) of the federal *Canadian Environmental Protection Act* (CEPA; GC 1999) per the *Technical Guidance on Reporting Greenhouse Gas Emissions, 2023,* and provincially under *The Management and Reduction of Greenhouse Gases (Reporting and General) Regulations*. This applies to facilities that emit 10 kilotonnes or more of direct GHGs (expressed as CO_2e) in the calendar year. The GHGs included are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

9.2.12 National Pollutant Release Inventory Reporting

As required by ECCC under the CEPA, prescribed substances exceeding specific threshold quantities released to water, land, and air must be reported annually through the National Pollutant Release Inventory (NPRI). Fission intends on reporting its releases through the NPRI online reporting system which regulates five categories of substances and is open to the public for review.

9.3 Integrated Management System Programs

An Integrated Management System (IMS) is being developed by the Project. An IMS combines a series of management programs into a comprehensive overall management system. A management system including programs that govern specific safety and control areas is required by the CNSC for uranium mines and mills. Programs related to environmental management, waste management, safety and health management, and radiation protection are discussed below.

9.3.1 Environmental Management Program

Fission will implement and maintain a comprehensive EMP which will summarize the actions performed at the Project for the protection of the environment. It will include environmental protection objectives, roles and responsibilities, and detailed monitoring plans for each Project phase. The EMP will align with all applicable agency requirements and guidance, including MDMER, CNSC Regulatory Document 2.9.1 (Environmental Protection: Environmental Principles, Assessments and Protection Measures; CNSC 2020), and CSA standards N288.4-19 (*Environmental monitoring programs at nuclear facilities and uranium mines and mills*; CSA 2019), N288.5-22 *(Effluent and emissions monitoring programs at nuclear facilities*; CSA 2022a), N288.6-22 (*Environmental risk assessments at nuclear facilities and uranium mines and mills*; CSA 2022b), N288.7-23

(*Groundwater protection and monitoring programs for nuclear facilities and uranium mines and mills*; CSA 2023a), and N288.8-17 (*Establishing and implementing action levels for releases to the environment from nuclear facilities*; CSA 2017). Adaptive management of the EMP will include periodic reviews of the EMP that will be used to identify potential gaps, redundancies, and additions to the program.

The EMP includes an Environmental Monitoring and Measurement Procedure (EMMP), which in addition to fulfilling the requirements of the CNSC licence, the Approval to Operate, and the MDMER, will provide the data necessary to verify and refine the models and predictions of the ERA and to inform the adaptive management process.

The following list of procedures or plans will be included in the EMP, or will be developed as standalone documents during the permitting stage:

- Environmental Monitoring and Measurement Procedure
- Waste Management Plan
- Construction Monitoring Procedure
- Wildlife Management and Monitoring Procedure, including caribou management
- Quality Assurance and Quality Control (QA/QC) Procedure
- Environmental Contingency Procedure
- Decommissioning and Reclamation Procedure

Additionally, specific manuals, procedures, and strategies will be developed to guide the operation of certain infrastructure/activities such as the TMF, waste rock storage, and water management. The following sections provide brief summaries of the content and intent of these procedures, plans, manuals, and strategies. Fission will consider feedback and comments from Clearwater River Dene Nation (CRDN), Métis Nation-Saskatchewan Northern Region 2 (MN-S NR2), Buffalo River Dene Nation (BRDN), Birch Narrows Dene Nation (BNDN), Athabasca Chipewyan Dene Nation (ACFN), and Ya' Thi Néné Lands and Resources (YNLR) in development of the EPP components listed herein.

9.3.1.1 Environmental Monitoring and Measurement Procedure

The EMMP will include monitoring of direct emissions from the Project to the surrounding environment and the surrounding environment itself. Emissions into water and the atmosphere will be assessed through comparison to the regulatory criteria set out in the Approval to Operate, MDMER, CNSC licence, CSA N288.4-19 (CSA 2019), and

applicable guidelines. The surrounding environment will be evaluated through comparison to applicable guidelines, reference areas, background or baseline levels, historical trends, and/or modelled predictions. Baseline and reference area data will be used to complete Before-After-Control-Impact (BACI) studies to the extent possible to measure spatial and temporal changes in endpoints.

Chosen media types will be based on regulatory requirements, the results of the EIA effects assessment, and what is routinely measured near other uranium mining and milling projects in Saskatchewan. The parameters and endpoints to be monitored in each media type include those that: 1) have benchmarks, guidelines, or legislated limits; 2) were identified as Constituents of Potential Concern (COPC) in the EIA, and/or 3) are standard practice to monitor or to provide supporting information. Exposure monitoring locations will represent areas of potential exposure to COPC, and reference areas will be selected based on the EIA modelling and baseline data. Specific study design components such as sample sizes will be chosen based on the size of the sampling area, study objectives, ability to test EIA predictions, the level of pre-existing variability in baseline parameter concentrations, and requirements of statistical analyses. Table 9-2 and Figure 9-1 present a preliminary EMMP, which will be revised and finalized during the permitting stage, and includes monitoring components, sampling locations and frequency, and parameter lists.

The EMMP design will be informed by Indigenous and community engagement and knowledge. The data collected through the EMMP will be used to monitor potential impacts to the human environment through comparisons to applicable human health guidelines for media types such as air, soil, surface water, and fish tissue, and updates to the HHRA.

Throughout the life of the Project, the EMMP will be regularly reviewed and revised as needed. Changes to location, methodology, parameter analyses, or frequency of monitoring will only be made following the necessary approvals.

Provided below is a summary of the monitoring components included in the preliminary EMMP (Table 9-2).

Air Quality

Air quality monitoring (source and ambient) will be conducted in accordance with the Air Monitoring Guidelines for Saskatchewan (ENV 2012), the Industrial Source (Air Quality) Chapter of *The Environmental Management and Protection Act* (Saskatchewan

Environmental Code Adoption) regulations, the Approval to Operate, and CSA N288.4-19 (CSA 2019).

The preliminary EMMP (Table 9-2) includes collecting air quality data for source emissions via stack testing (radionuclides and non-radionuclides) and for ambient emissions via high-volume samplers (particulate matter, radionuclides, and metals) and passive monitoring techniques (sulphur dioxide [SO_2], nitrogen dioxide [NO_2], and radon). The locations of the air quality stations will be determined using air dispersion modelling results, site accessibility considerations, baseline monitoring results, and detailed Project design information.

Meteorology

The dispersion and fate of pollutants released into the atmosphere by the Project will be influenced by the local meteorology, such as wind, rain, and air temperature. More specifically, prevailing wind direction, wind speed, and atmospheric stability control the pattern of emission plumes, while precipitation and air temperature affect the release of particulates and other pollutants. The existing on-site meteorological station will continue to collect hourly and daily data related to temperature, precipitation, wind speed/direction, solar radiation, and barometric pressure (Table 9-2).

Treated Effluent

A treated effluent monitoring program is meant to complement the EMMP such that information from one program can help provide better understanding of the other (CSA 2019). The treated effluent monitoring program at the Project will comply with the *Mineral Industry Environmental Protection Regulations, 1996* and the MDMER. Treated effluent discharged at the Project must continually and consistently meet the regulatory discharge limits specified in the Approval to Operate and the MDMER. The type of sample (i.e., grab or composite), monitoring frequency, and parameters to be measured are detailed in the preliminary EMMP (Table 9-2), which is subject to revision and finalization. In addition to chemical analyses, acute and sub-lethal toxicity testing will be completed on treated effluent samples to meet the requirements of the MDMER (see Section 9.2.10.2).

Groundwater

Groundwater monitoring at the Project is required and the sampling program will be designed to meet the standards outlined in CSA N288.4-19 (CSA 2019) and CSA N288.7-23 (CSA 2023b). Monitoring data from groundwater wells are subject to regulatory

requirements and serve to verify and confirm anticipated effects in the groundwater model. As presented in Table 9-2, quantity and quality of groundwater will be monitored at a network of locations during construction, operation, and decommissioning. The list of well locations will be informed by the hydrogeological model and the detailed design of Project facilities. It is noted the well locations may change over the lifespan of the Project.

Hydrology

The hydrology component of the preliminary EMMP will monitor changes in water level elevations and streamflow volumes over time such that they can be compared to predicted changes and background or baseline levels. The monitoring locations are in lakes and streams throughout the Project area, downstream of the Project, and in reference areas (Table 9-2 and Figure 9-1). Hydrological monitoring equipment (staff gauges and level loggers) are already established in these study areas and will continue to be monitored at regular frequencies. In addition, a monitoring station will be established in South Creek since it is downgradient of the TMF.

Surface Water

A comprehensive surface water monitoring program will be incorporated into the EMMP to meet regulatory requirements. The program will utilize a BACI design and the data will also be compared to guidelines and model predictions.

The near-field receiving environment is Patterson Lake South downstream of the treated effluent diffuser. Therefore, surface water monitoring will focus on the flow path from Patterson Lake to Lloyd Lake Inlet. Reference locations will potentially include Broach Lake and Hodge Lake; however, their suitability will be confirmed prior to monitoring program design finalization. The preliminary EMMP includes many of the same stations sampled during the baseline studies (Table 9-2 and Figure 9-1). In addition, a monitoring station will be established in South Creek since it is downgradient of the TMF.

Sediment

Sediment monitoring is required at the Project and is an important part of the EMMP because sediment can be a sink for COPC released to aquatic environments. It can also provide a pathway for COPC uptake by benthic invertebrates, fish, wildlife, and humans and concentrations of COPC in sediment can become re-suspended in the water column, providing a secondary source of COPC into the waterbody. The preliminary EMMP includes collecting sediment samples from Patterson Lake (upstream and downstream of

the treated effluent diffuser), downstream of Patterson Lake, and reference locations (potentially Hodge and Broach lakes). In addition, a monitoring station will be established in South Creek since it is downgradient of the TMF. More detail on sediment monitoring is provided in Table 9-2 and Figure 9-1.

Aquatic Biota

Aquatic biota in the EMMP includes benthic invertebrates and fish. Benthic invertebrates are important food sources for fish, and they can also be the first organisms to show exposure effects of COPC in water and/or sediment. Benthic invertebrate community monitoring will be required at the Project and samples will be collected concurrently and co-located with sediment samples in the preliminary EMMP (Table 9-2 and Figure 9-1).

Fish are important to local stakeholders and Indigenous Nations and communities. They are a valued food source for wildlife and humans, are an important component of ecosystems, and are a key Valued Component (VC) in this EIS. Fish monitoring will include both population and chemistry data collection. The exposure sampling location is anticipated to be Patterson Lake South and reference sampling locations may potentially include Hodge and Broach lakes (Table 9-2). There is potential for other lakes, such as Lloyd Lake Inlet, to be included for the component of fish chemistry. The reference locations will ideally be aligned with the water and sediment/benthic invertebrate programs. Specific fishing locations will be determined partly by the location of the treated effluent diffuser and the predicted effluent plume, as well as the location of appropriate fish habitat.

Prior to treated effluent release, additional fish community and site characterization information will be collected in the near-field exposure area downstream of the diffuser and from reference areas to inform the study design for the first cycle of EEM fish population studies. Consideration will be given to completing a non-lethal fish population study during the baseline period and completing fish chemistry studies on the fish species selected as fish population sentinel species.

Soil and Vegetation

Soil and vegetation chemistry is a component of air quality monitoring. It can be used to monitor influences from the aerial dispersion of COPC and incorporates the uptake by biota and transfer between media types. The preliminary EMMP for soil and vegetation chemistry utilizes a control-impact study design with exposure (downwind of the Project)

and reference (upwind of the Project) sampling locations (Table 9-2). The exact sampling locations will likely replicate those sampled during the baseline study in order to use a BACI design; however, changes may be necessary based on Project design (e.g., some locations may be destroyed by Project infrastructure and must be re-located).

9.3.2 Waste Management Plan

Fission will develop a Waste Management Plan to ensure all regulatory requirements as well as conditions set out in approvals and permits are met. The plan will include compononents to manage all waste types including hazardous, non-hazardous, low level radioactive waste, tailings, and waste rock. The Waste Management Plan will be regularly reviewed and revised as needed.

"Waste" refers to rubbish, tailings, treated effluent, sewage, garbage, refuse, scrap, discarded articles, bottles, or cans, and any other substance and/or material that is prescribed or is set out in the Saskatchewan Environment Code as per ENV (2013). Fission plans to manage waste through established programs and facilities to minimize any potential risk to the environment. In addition to treated effluent, waste streams for the Project that will be monitored include waste rock, tailings, low-level radioactive waste, domestic waste, hazardous materials, recycling, and sewage wastewater.

Provided below is summary information on several components of the Waste Management Plan.

9.3.2.1 TMF Operation, Surveillance, and Maintenance Manual

Fission will develop a Tailings Operation, Surveillance, and Maintenance (OMS) manual in order to describe the roles, responsibilities, and operational objectives for tailings management at the Project. The manual will follow guidelines set out by the Mining Association of Canada and the Canadian Dam Association, and summarize requirements related to staff training, data collection, instrumentation, inspection and monitoring, specific action levels or events for immediate reporting, and ongoing maintenance.

9.3.2.2 Waste Rock Management Procedure

As noted in Section 2.0, the waste rock/stockpile management facilities (WRMF) will store non-acid generating waste rock (NAG) and potentially acid generating waste rock (PAG) in facilities that will be lined and equipped with seepage collection systems where necessary. In order to effectively manage and store waste rock as mine development occurs,

a Waste Rock Management Procedure will be established. The procedure will outline roles, responsibilities, staff training and qualifications, and specific criteria to be utilized to guide waste rock management. The procedure will be updated as more information is gained on waste rock over the life of mine.

9.3.2.3 Water Management Strategy

Fission will implement a water management strategy to appropriately manage clean and contact water generated at the Project. The strategy will encompass numerous processes and procedures spanning multiple Project areas and functional groups. Each procedure and/or process of the strategy will outline roles, responsibilities, and required staff training and qualification to effectively execute that procedure or process. These procedures and processes include the management of water diversion and collection infrastructure, operating, monitoring, and maintenance procedures for water storage and treatment facilities, and operating, monitoring and maintenance procedures for effluent discharge facilities.

Processes and procedures for effluent discharge facilities include necessary activities to ensure regulatory expectations are met including the implementation of an environmental code of practice and the development of administrative and action levels to guide operational decision making regarding effluent treatment and discharge.

9.3.3 Construction Monitoring Procedure

As certain construction activities will require environmental monitoring, Fission will develop a Construction Monitoring Procedure to ensure timing windows, setback distances, activity restrictions, erosion control structures, and other mitigation measures outlined in the EIS and approvals/permits are followed during the construction phase of the Project. The procedure will include aspects such as nest sweeps prior to land disturbance, erosion control monitoring, weed/vegetation monitoring, and wildlife monitoring (see next sub-section below).

9.3.4 Wildlife Management Procedure

Wildlife monitoring will be necessary to understand the effects of the Project on wildlife species at risk or species of management concern throughout all phases of the Project. Fission will have a wildlife monitoring program which will serve to:

- verify impact predictions and monitor the effectiveness of mitigation measures;
- enhance the understanding of effects on wildlife predicted in the EIS and enable the implementation of adaptive management practices when required; and
- ensure compliance with the terms and conditions of the Approval to Operate.

The Woodland Caribou Mitigation Plan (see Appendix D.9) provides detailed information on the monitoring plan for this species. While monitoring for woodland caribou, it is expected that data obtained via trail cameras or other means will also be collected for other wildlife species in the area. Linear features and associated wildlife crossings and control measures (e.g., fences or gates) will be monitored to assess potential impacts on wildlife movement.

Human-wildlife interactions, including vehicle collisions, that occur at the Project will be documented and follow-up action will be taken if necessary. This type of monitoring information will help inform the Wildlife Management Procedure including adaptive management practices as a means to address unplanned effects (i.e., mass mortality, continued mortality, etc.), which in turn would change mitigation practices in order to comply with standards or guidelines as necessary. Considerations of adaptive management could include increased monitoring programs, targeted species monitoring, or studies focused on certain ecosystem components (e.g., boreal forest), administrative improvements (e.g., speed limit changes, etc.), or engineered improvements (i.e., site infrastructure changes) to reduce risk to wildlife or their habitat.

During construction and operation, Fission will mitigate risk to wildlife by using environmental monitors or experienced third-party environmental monitors. Project activities will comply with relevant legislation, including the *Migratory Birds Convention Act* (GC 1994), Migratory Birds Regulations (GC 2022b), the *Species at Risk Act* (GC 2002), provincial and federal activity restriction guidelines (EC 2009; ENV 2017), and *The Wildlife Act* (GS 1998). Activity restriction guidelines (setback distances and timing) will be followed, and any required deviations will be considered after consultation with ENV.

9.3.5 Quality Assurance and Quality Control Procedure

To ensure the high quality of processes, products, and services, as well as continual improvement of overall performance, Fission will implement a QA/QC Procedure. The QA/QC Procedure will ensure confidence in the data collected for environmental monitoring through the following components:

- the development and periodic review of work instructions for environmental field sampling, training, inspections, etc.;
- the use of a sampling schedule;
- the use of laboratories accredited by the Canadian Association for Laboratory Accreditation (CALA) to ensure trustworthy test results;
- the regular maintenance and calibration of analytical equipment and instruments as per manufacturer recommendations;
- the testing of QA samples (i.e., duplicates and blanks);
- ensuring environmental personnel are qualified and trained appropriately on site; and
- a data management system capable of data reduction, data assessment, and data reporting.

The QA/QC Procedure will address identified risks and opportunities to make sure the intended outcomes are achieved.

9.3.6 Environmental Contingency Procedure

Accident and malfunction scenarios at the Project could cause an unplanned release of a hazardous or nuclear substances or waste into the environment (see Section 7.0) or other environmental emergency (see Section 8.0; e.g., wildfire). The level of risk will be evaluated for these scenarios and mitigation measures will be developed to minimize the environmental risk associated with them. From these evaluations, an Environmental Contingency Procedure will be developed, which will outline roles and responsibilities of persons involved and provide information on the following: the types of environmental emergencies that may possibly occur; both on-site and off-site consequences; and the identification of associated prevention, preparedness, response, and recovery plans. An incident classification, reporting, and investigation system as well as an emergency response plan and emergency response team will be established through the Safety and Health Management Program (see Section 9.5) to respond to all incidents that may occur at the Project.

9.3.7 Decommissioning and Reclamation Procedure

As required in the regulatory process, Fission will develop a PDP that describes the steps to be taken to decommission Project infrastructure and reclaim the land using a decommission tomorrow strategy, as well as a cost estimate for implementation of the PDP

called the PDCE. The PDP will incorporate input from stakeholders and Indigenous Nations and communities for submission to ENV and CNSC as part of Project permitting. The PDP and PDCE are updated on a regular frequency to encompass Project changes, recognize progressive reclamation activities, and ensure the continued adequacy of the plan and cost estimate. Once the operations phase of the Project is complete and a decision to decommission is made, then a Detailed Decommissioning Plan (DDP) and Decommissioning Cost Estimate (DCE) will be developed which will require approval by CNSC and ENV prior to the start of the active decommissioning phase (see Section 2.4.4).

Following active decommissioning, which will involve the removal of all site infrastructure, remediation of all areas, closure of the TMF, and revegetation of the Project site, the Project would transition to post-decommissioning monitoring.

The purpose of post-decommissioning monitoring will be to evaluate whether the objectives of the DDP were achieved. Methods include environmental inspection and monitoring to verify that environmental targets were achieved and that vegetation re-growth progressed as expected. Once decommissioning performance criteria objectives have been met, Fission may apply to the CNSC to relinquish the Project's licensing requirements as well as ENV to transfer the site to the ICP.

9.4 Independent Environmental Monitoring Program

Fission anticipates the Project will become part of the CNSC Independent Environmental Monitoring Program (IEMP), which aims to independently ensure the health and safety of the public and environment around nuclear facilities in Canada. The IEMP is conducted at a different nuclear facility each year and is part of the CNSC's compliance verification program that helps to confirm its regulatory position and decision making. Samples collected for chemical analyses include water, fish, wildlife, and vegetation.

9.5 Safety and Health Management Program

Ensuring the safety of all workers, contractors, and visitors, and promoting a safety culture at the Project is a core value for Fission. Fission will develop a Safety and Health Management Plan (SHMP) which will set out occupational health and safety objectives, roles and responsibilities, and outline the measures Fission will take to manage workplace hazards. Periodic reviews of the SHMP will be used to identify potential gaps, redundancies, and additions to the program.

9.6 Radiation Protection Program

Fission will implement a Radiation Protection Program that meets or exceeds radiation safety requirements as per the *Nuclear Safety and Control Act* and Fission's own Safety and Health Management Program. The Radiation Protection Program will include, but not be limited to, the following:

- engineering controls and personal protective equipment to shield workers from radiation exposure;
- administrative controls to limit the amount of time spent by workers near radiation sources;
- continuous monitoring of radiation levels in enclosed work areas;
- personal dose monitoring of every worker; and
- reporting of radiation monitoring results to the appropriate regulatory agencies.

9.7 Human Resource Development Plan

The Human Resource Development Plan (HRDP) will serve as the overarching plan for coordination, planning, monitoring, and reporting of the advancement of Fission's human resource-related goals and commitments. Fission's goals, commitments, and reporting requirements will align with those set out in the MSLA.

Following the execution of the MSLA, Fission is prepared to negotiate a Human Resources Development Agreement (HRDA). The HRDA will set out the measures to be taken by Fission to maximize Project-related employment and economic opportunities for RSN and members of the priority recruitment communities to contribute toward Saskatchewan's northern employment goals. As part of the MSLA, and connected to the HRDP, Fission will prepare the following plans, reports, and forecasts.

- The HRDP will be submitted annually to outline Fission's progress and achievements toward social and economic benefit commitments related to employment, education, training, and employee services.
- A Business Opportunities Forecast will be prepared within three months of the decision to start commercial production. Updated five-year rolling Business Opportunities Forecasts will then be submitted annually to set benchmarks and identify processes to enable performance monitoring.

- Employment Status Reports will be filed in accordance with the terms of the HRDA and will detail employment statistics for Fission and its on-site contractors.
- Northern Business Participation Reports will detail objectives set forth for northern business participation from the Business Opportunities Forecast, and the nature, category, and value of all goods and services purchased during the year in the construction, operation, and decommissioning phases of the Project, and how many of these goods and services were purchased from Northern Businesses.
- Compensation for Loss of Income Reports will be prepared annually detailing any compensation paid to commercial land users who meet the criteria for loss of commercial income.

9.8 Travel and Traffic Management Plan

A Travel and Traffic Management Plan will be developed by Fission to manage traffic that will be arriving at or departing from the Project site including traffic associated with workers, freight and bulk commodities, wastes, and ore concentrates. The plan will outline objectives, roles and responsibilities, and management measures, as well as travel schedules for buses or commuter vehicles from local communities and procedures for communication on on-site roadways.

9.9 Heritage Resource Management Plan

Fission will develop, with the input of the local communities and a professional archaeologist, a Heritage Resource Management Plan (HRMP) to guide the management and procedures for protection of known heritage sites and cultural use areas. The HRMP will also include a Chance Finds Procedure and documentation that guides handling the discovery of previously undocumented cultural sites, heritage sites, artifacts, and other materials.

9.10 Public Information Program

Public information-sharing activities and reporting commitments are required as part of CNSC REGDOC-3.2.1 Public Information and Disclosure (CNSC 2018). A Public Information Program will be developed in consultation with appropriate regulatory bodies to establish plans, actions, and reporting mechanisms that address the regulatory requirements.

9.11 Regional Social Monitoring Program

To monitor and address changes to social condition including economics, land and resource use, and community wellbeing, a Regional Social Monitoring Program will be established. The program will take place every three to five years and will include a social impact assessment to determine current conditions and areas for improvement and a social management plan to identify actions Fission will take to address any unexpected adverse changes to social conditions. Fission has volunteered to develop and implement this program with input from local Indigenous Nations; it is not currently tied to a regulatory requirement or condition.

9.12 Regional Traditional Foods Study

A Regional Traditional Foods Study will be conducted voluntarily prior to operations and will be designed and coordinated with input and involvement from interested Indigenous Nations using the Patterson Lake region for traditional foods harvesting. The design of the Regional Traditional Foods Study is not confirmed, but it is expected to include an interview and mapping component and a tissue sampling component. The results will be used to inform updates to the Human Health Risk Assessment.

9.13 EIS Follow-up Programs

The data collected through the EMMP will be used throughout the life of the Project to update model predictions and validate the accuracy of EIS conclusions. Numerous studies were identified as EIS follow-up programs to address uncertainties, update models, provide information during the detailed design stage to inform permitting and licensing, and provide site characterization information for aquatic monitoring program study designs. Details on EIS follow-up programs are provided in the Commitments Register (Table 11-2 in Section 11, Conditions Management).

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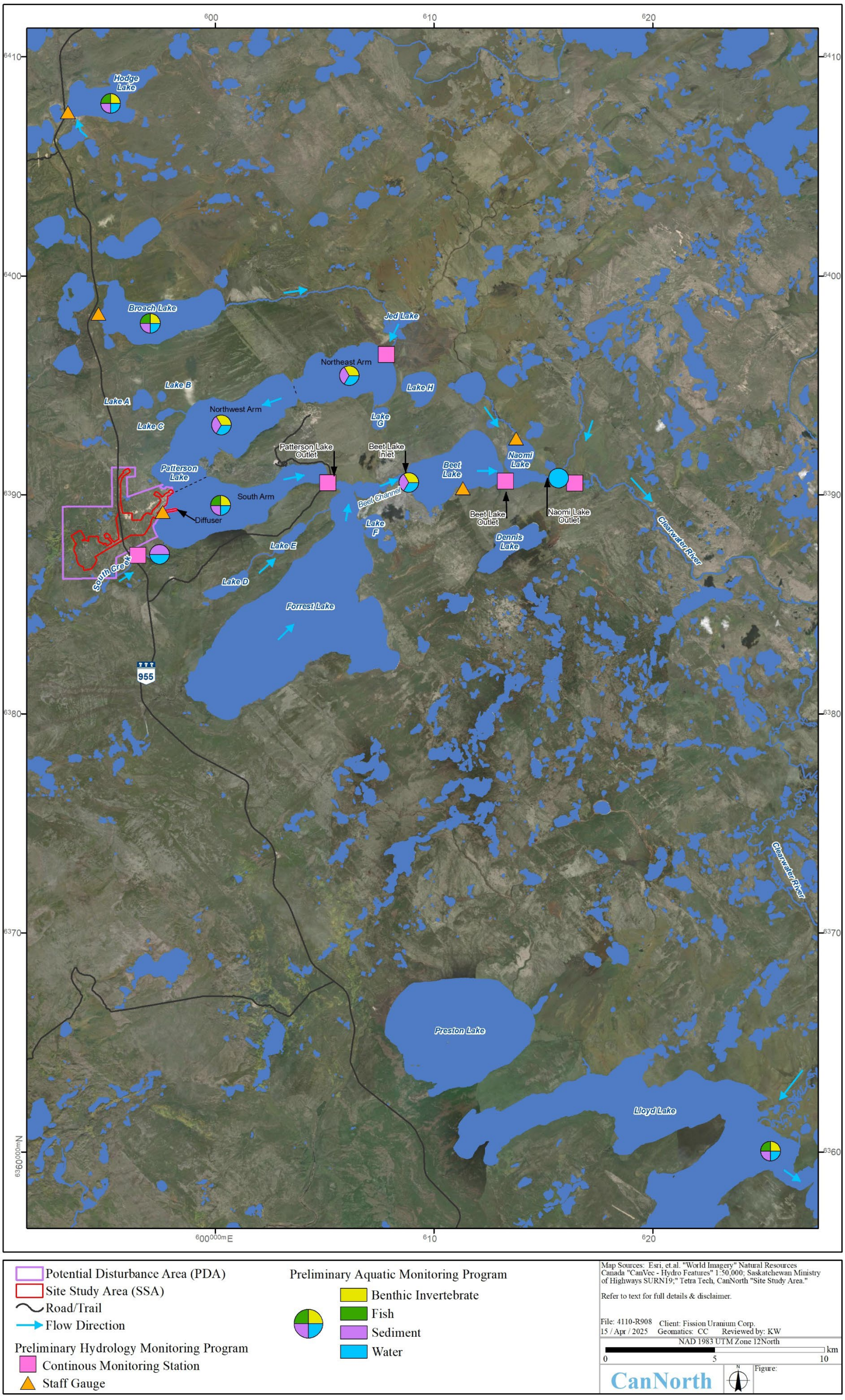

Figure 9-1
Preliminary Environmental Monitoring and Measurement Procedure aquatic monitoring locations for the PLS Project.

Table 9-1
Concordance table – monitoring and follow-up programs.

EIS Requirement	Section and Page #
b) preliminary monitoring plans for development-specific and regional effects that will: - verify the predicted impacts on VCs and their response to planned mitigation and reclamation activities; and - inform adaptive management and mitigation, if initial mitigation is ineffective or inappropriate	Environmental Management Program (9.3.1), 9-11
c) descriptions of monitoring parameters, protocols, analyses and schedules to be employed in the proposed monitoring programs	Environmental Management Program (9.3.1), 9-12, Table 9-2
d) timing and format for reporting on monitoring results	Environmental Management Program (9.3.1), 9-12, Table 9-2
e) process to be used for determining when and how adaptive management will be implemented in the event of unexpected monitoring results or non-compliance situations	Overview (9.1), 9-1
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Throughout Section
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (9.14), 9-25
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Appendix A.2, A.3, A.4, A.5, A.6, A,7, B.1, B.2, C.1, C.2, C.3, C.4, C.5, D.1, D.2, D.3, D.4, D.5, D.6, D.7, D.8, D.9, D.10

Table 9-2
Preliminary Environmental Monitoring and Measurement Procedure design for the PLS Project.

Monitoring Component	Objectives	Locations	Methodology	Parameters	Thresholds/ Benchmarks/ Guidelines	Regulator
Air	Monitor changes in air quality over time; compare to predicted changes, baseline/background levels, and guidelines	The number of stations and their locations will be chosen based on air dispersion modelling, site accessibility, baseline monitoring results, and detailed Project design	Source testing: stack testing (radionuclides and non-radionuclides) Ambient testing: high-volume air samplers (particulate matter, metals, radionuclides) and passive monitoring (SO_2, NO_2, radon) Real-time continuous monitoring down gradient of acid plant (SO_2)	Sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter, metals, radionuclides (lead-210, polonium-210, radium-226, and thorium-230), and radon	Air Monitoring Guidelines for Saskatchewan (ENV 2012)	CNSC; ECCC; ENV
Meteorology	Monitor on-site meteorological conditions to aid in air dispersion modelling	On-site meteorological station	On-site station continuously monitors all parameters	Temperature, precipitation, wind speed and wind direction, solar radiation, barometric pressure	-	-
Treated Effluent	Monitor effluent quality and quantity over time; compare to predicted changes and regulatory requirements	Final point of control	Grab or composite sample; weekly, annually, and monthly for select parameters	From each batch release or at least weekly during discharge period: pH, temperature, conductivity, arsenic, copper, lead, nickel, zinc, total suspended solids, radium-226, and total ammonia as nitrogen (parameters from Table 1, Schedule 3 of MDMER); Selenium, molybdenum, and uranium as well as other parameters are likely to be measured based on ENV Approval to Operate Quarterly or annually: aluminum, cadmium, iron, mercury, molybdenum, selenium, nitrate, chloride, chromium, cobalt, sulphate, thallium, uranium, phosphorus, manganese, total ammonia, hardness, alkalinity, conductivity, lead-210, polonium-210, radium-210, and thorium-230, biochemical oxygen demand, carbonaceous biochemical oxygen demand, total coliform, fecal coliform (parameters from Table 2, Schedule 3 of MDMER); Other parameters are likely to be measured based on ENV Approval to Operate Effluent volume Acute lethality and sub-lethal toxicity testing per MDMER requirements	MDMER; ENV	CNSC; ECCC; ENV
Groundwater	Monitor changes in groundwater quality and quantity over time; compare to predicted changes, baseline/background levels, and guidelines	**Groundwater Quality:** Upgradient and downgradient of: underground workings, tailings management facility, waste rock stockpile, ore stockpile, monitoring ponds, vehicle maintenance and fueling facilities, and mill processing facilities At the camp water supply well	**Groundwater Quality:** Annual sampling of all groundwater quality wells with subset sampled seasonally during construction, operation, and decommissioning Additional sampling related to accidents and malfunctions, as required	All locations: Physical tests (pH, conductivity, alkalinity, hardness, total dissolved solids) Anions and nutrients (ammonia, chloride, fluoride, nitrate, phosphate, sulphate) Select dissolved metals. Radium-226 At the camp water supply well: Drinking water quality parameters	Provincial and federal groundwater quality guidelines (CCME, SEQG)	CNSC; ENV

Table 9-2
Preliminary Environmental Monitoring and Measurement Procedure design for the PLS Project.

Monitoring Component	Objectives	Locations	Methodology	Parameters	Thresholds/ Benchmarks/ Guidelines	Regulator
Groundwater	Monitor changes in groundwater quality and quantity over time; compare to predicted changes, baseline/background levels, and guidelines	**Groundwater Quantity:** All locations included above plus along the mine decline during construction and upgradient and downgradient of the mill water supply wells (same locations as the mine decline wells) during operation and decommissioning	**Groundwater Quantity:** Semi-annual measurement of groundwater levels in all wells; continuous pressure transducers (data loggers) to be installed in selected wells	All locations: Physical tests (pH, conductivity, alkalinity, hardness, total dissolved solids) Anions and nutrients (ammonia, chloride, fluoride, nitrate, phosphate, sulphate) Select dissolved metals. Radium-226 At the camp water supply well: Drinking water quality parameters	Provincial and federal groundwater quality guidelines (CCME, SEQG)	CNSC; ENV
Hydrology	Monitor changes in water level elevations and streamflow over time; compare to predicted changes and background/baseline levels	Jed Creek Patterson Lake Patterson Lake Outlet Beet Lake Beet Lake Outlet Naomi Lake Naomi Lake Outlet[1] Hodge Lake[3] Broach Lake[3] South Creek	Water level elevations will be read off of the staff gauges installed at all locations Continuous streamflow will be measured at Jed Creek, Patterson Lake Outlet, Beet Lake Outlet, and Naomi Lake Outlet; Leveloggers paired with a barologger and discharge measurements will be taken	Water Level Elevation (m) Streamflow (m^3/s)	-	ENV
Surface Water Quality[4]	Monitor changes in water quality over time; compare to predicted changes, baseline/background levels, and guidelines	Patterson Lake Northeast (above potential thermocline) Patterson Lake Northeast (below potential thermocline) Patterson Lake Northwest (above potential thermocline) Patterson Lake Northwest (below potential thermocline) Patterson Lake South (above potential thermocline) Patterson Lake South (below potential thermocline) Beet Lake Inlet Naomi Lake Outlet[1] Lloyd Lake Inlet[2] Hodge Lake (above potential thermocline)[3] Hodge Lake (below potential thermocline)[3] Broach Lake (above potential thermocline)[3] Broach Lake (below potential thermocline)[3] South Creek	Composite or discrete water samples will be collected at each station depending on total depth QA/QC duplicate, field blank, and trip blank It is anticipated quarterly, semi-annual, or annual sampling will be needed based on location	Limnology profile: temperature, dissolved oxygen, specific conductance, and pH; Secchi disk depth Chemistry: alkalinity (phenolphthalein and total), bicarbonate, calcium, carbonate, chloride, fluoride, total hardness, hydroxide, magnesium, potassium, pH, sodium, specific conductance, sulphate, sum of ions, total dissolved solids, total suspended solids, turbidity, ammonia as nitrogen, nitrate + nitrite, nitrate (NO_3), total organic carbon, inorganic carbon, dissolved organic carbon, total phosphorus, total Kjeldahl nitrogen Total metals: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc Radionuclides: lead-210, polonium-210, radium-226, thorium-230	Provincial and federal surface water quality guidelines (CCME, SEQG, FEQG)	CNSC; ECCC; ENV

Table 9-2
Preliminary Environmental Monitoring and Measurement Procedure design for the PLS Project.

Monitoring Component	Objectives	Locations	Methodology	Parameters	Thresholds/ Benchmarks/ Guidelines	Regulator
Sediment Quality	Monitor changes in sediment quality over time; compare to predicted changes, baseline/background levels, and guidelines	Patterson Lake Northeast Patterson Lake West Patterson Lake South Beet Lake Inlet Lloyd Lake Inlet[2] Hodge Lake[3] Broach Lake[3] South Creek	0 cm to 2 cm sediment horizon collected with a Tech-Ops Corer from five stations per study area QA/QC duplicates Frequency of every 3 years	Chemistry: inorganic ions: calcium, magnesium, potassium, sodium Metals: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc Nutrients: total organic carbon, phosphorus, total Kjeldahl nitrogen Physical properties: loss on ignition, % moisture Radionuclides: radium-226, lead-210, thorium-230, and polonium-210 Particle size: % clay, % silt, % fine sand, % coarse, sand, and % gravel	Federal and published sediment quality guidelines/benchmarks	CNSC; ECCC (particle size and total organic carbon only); ENV
Benthic Invertebrates	Monitor changes in the benthic invertebrate community over time; compare to predicted changes and baseline/background conditions	Patterson Lake Northeast Patterson Lake West Patterson Lake South Beet Lake Inlet Lloyd Lake Inlet[2] Hodge Lake[3] Broach Lake[3]	Composite of 10 Ekman grabs per station; 5 stations per location Frequency of every 3 years	Taxonomic identification, enumeration, and biomass	MDMER endpoints[5]	CNSC; ECCC; ENV
Fish	Monitor changes in fish populations, health, and chemistry over time; compare to predicted changes, baseline/background conditions, and available guidelines	Patterson Lake South Lloyd Lake Inlet Hodge Lake[3] Broach Lake[3]	Fish chemistry: two fish species (one predatory species and one bottom-feeding species) collected for chemical analyses (n = 5 per species per location for flesh and bone analyses) Fish population: monitoring will be conducted using 2 sentinel species at Patterson Lake South and two references Frequency of every 3 years	Meristics: fork length, body weight, sex, spawning condition, stomach contents, and internal and external condition Flesh/bone chemistry: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc, lead-210, polonium-210, radium-210, thorium-230, and percent moisture Fish population study: endpoints dependent on whether the study is lethal or non-lethal Large-bodied fish ovary and small-bodied whole-body and ovary chemical analyses may be required based on CNSC licence and ENV Approval to Operate	MDMER endpoints[5] Available guidelines for fish tissue chemistry	CNSC[6]; ECCC[6]; ENV

Table 9-2
Preliminary Environmental Monitoring and Measurement Procedure design for the PLS Project.

Monitoring Component	Objectives	Locations	Methodology	Parameters	Thresholds/ Benchmarks/ Guidelines	Regulator
Soil	Monitor changes in soil chemistry over time; compare to predicted changes, baseline/background conditions, and guidelines	Six exposure and six reference sampling stations	Top layer (0 cm to 5 cm) of mineral soil from each station Frequency of every 3 years	Percent moisture, pH, total organic carbon, aluminum, antimony, arsenic, boron, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, phosphorous, potassium, selenium, sodium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc, sulphate, lead-210, polonium-210, radium-210, and thorium-230	Provincial and federal soil quality guidelines (CCME, SEQG)	ENV
Vegetation	Monitor changes in vegetation chemistry over time; compare to predicted changes and baseline/background conditions	Six exposure and six reference sampling stations	New growth of representative species collected at each location (potentially Labrador tea and/or berries and/or lichen) Frequency of every 3 years	Percent ash, percent moisture, aluminum, antimony, arsenic, boron, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, phosphorous, potassium, selenium, sodium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc, sulphate, lead-210, polonium-210, radium-210, and thorium-230	-	ENV

[1]Naomi Lake Outlet is also called Clearwater River Near-field.

[2]Lloyd Lake Inlet also called Clearwater River Far-field and will only be sampled in the spring, summer, and fall due to unsafe ice conditions in the winter.

[3]Broach and Hodge lakes have been site characterized and are considered suitable reference lakes to date.

[4]Relevant sewage parameters may be sampled at near-field stations including, but not limited to, biochemical oxygen demand, carbonaceous biochemical oxygen demand, total coliform, and fecal coliform.

[5]The MDMER stipulates which effect endpoints require measuring and are to be statistically compared between reference and exposure areas (GC 2022a).

[6]CNSC and ECCC regulate fish population only unless fish chemistry testing is triggered (for selenium and/or mercury).

CCME = Canadian Council of Ministers of the Environment; CNSC = Canadian Nuclear Safety Commission; ECCC = Environment and Climate Change Canada; ENV = Saskatchewan Ministry of Environment; FEQG = Federal Environmental Quality Guidelines; MDMER = Metal and Diamond Mining Effluent Regulations; SEQG = Saskatchewan Environmental Quality Guidelines.

SECTION 10

SUMMARY AND CONCLUSIONS

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LIST OF ACRONYMS

ATV	All-Terrain Vehicle
COPC	Constituents of Potential Concern
CNSC	Canadian Nuclear Safety Commission
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
GHG	Greenhouse Gas
HDPE	High-Density Polyethylene
LNG	Liquified Natural Gas
LSA	Local Study Area
PDA	Potential Disturbance Area
PLS	Patterson Lake South Project
RSA	Regional Study Area
SAAQS	Saskatchewan Ambient Air Quality Standards
SEQG	Saskatchewan Environmental Quality Guidelines
SLA	Surface Lease Area
SSA	Site Study Area
TOR	Terms of Reference
TMF	Tailings Management Facility
TSP	Total Suspended Particulate
UTV	Utility Terrain Vehicle
VC	Valued Component

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Table 10-1 Concordance table – summary and conclusions.

Table 10-2 Summary of key residual effects, design features and mitigation measures, and detailed assessment determination.

10.0 SUMMARY AND CONCLUSIONS

10.1 Introduction

The objective of the summary and conclusions section is to provide a succinct presentation of key impacts to valued components (VCs), mitigations/Project design features associated with those key impacts, and the expected residual effects after mitigation. The effects assessment for this Environmental Impact Statement (EIS) included a screening assessment whereby all potential Project-environment interactions were identified, Project design and mitigations measures were detailed, and it was determined whether the effect pathway moved forward to a residual effects assessment (REA) and cumulative effects assessment (CEA). There were several effect pathways predicted to have either 1) no linkage with the Project, 2) no measurable change or predicted minor changes in the VC assessment of measurable parameters, or 2) negligible residual effects. The focus of this section is to summarize Project-environment interactions that were identified as key interactions and obtained magnitude ratings of moderate or high (criteria of magnitude ratings for each VC are provided in Section 5, Table 5-5). This section also includes discussion of the significance of the key interactions and potential impacts to stakeholders and Indigenous Nations, as well as provincial environmental and economic objectives.

As requested in the Saskatchewan Ministry of Environment (ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021), this information is summarized in a table format. The concordance table for components for the EIS from the ENV guidelines for the TOR and EIS (ENV 2021) for summary and conclusions is provided in Table 10-1.

10.2 Key Impact Summary

A summary of the key interactions that were assessed as part of the REA and considered to have moderate or high magnitudes, including the effect pathway, affected VCs, primary Project design features/mitigations, and effects assessment results is presented in Table 10-2. This table also summarizes the results of evaluations completed to assess potential effects of the key interaction on stakeholders and Indigenous Nations.

10.3 Provincial Environmental and Economic Objectives

Development of the Project aligns with provincial growth plans that are outlined in Saskatchewan's Growth Plan 2020 to 2030 (GS 2020). Of the 20 action items outlined for the 2020's, the Project will contribute to the following:

- growing Indigenous participation in the economy through the growth of Saskatchewan's natural resource industries and labour market development;
- developing Saskatchewan's labour force; and
- delivering on the purpose of growth by ensuring growth builds a better quality of life for Saskatchewan families and communities.

The Government of Saskatchewan has an objective of encouraging the exploration and development of Saskatchewan mineral resources including strategic minerals and metals[1] (GS 2020). Furthermore, the Government of Canada currently recognizes uranium, which would be produced by the Project, as a critical mineral (GC 2022). The green energy transition is expected to significantly increase demand for uranium because of its uses in clean electricity generation. In addition to supporting diversification and growth of Saskatchewan's resource development sector, the Project would meet the objectives of Canada's Critical Mineral Strategy.

10.4 Literature Cited

ENV (Saskatchewan Ministry of Environment). 2021. Guidelines for the terms of reference and environmental impact statement. Prepared by the Environmental Assessment and Stewardship Branch, Ministry of Environment, November.

GC (Government of Canada). 2022. The Canadian critical minerals strategy. Cat. No. M34-82/2022E-PDF (Online).

GS (Government of Saskatchewan). 2020. Saskatchewan's growth plan, the next decade of growth 2020-2030.

[1] Strategic metals are defined as mineral resources that are essential to the economy and modern life (Government of Canada 2022).

Table 10-1
Concordance table – summary and conclusions.

EIS Requirement	Section and Page #
b) succinct presentation of the key impacts for each VC, the proposed mitigation, and expected residual effects after mitigation	Table 10-2
c) the significance of the residual effects and their impact on local communities, First Nations, Metis communities, and provincial environmental and economic objectives	Table 10-2
d) the offsets or accommodations proposed in response to significant residual effects	Table 10-2
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Throughout Section
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (10.4), 10-2
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Appendix A.2, A.3, A.4, A.5, A.6, A,7, B.1, B.2, C.1, C.2, C.3, C.4, C.5, C.6, D.1, D.2, D.3, D.4, D.5, D.6, D.7, D.8, D.10

Table 10-2
Summary of key residual effects, design features and mitigation measures, and detailed assessment determination.

Residual Effect	Affected Valued Component (s)	Design Features, Mitigation, and Commitments	Residual Effects Assessment[1]	Potential Key Impacts to Local Communities, Stakeholders, and Indigenous Nations
Modelled concentrations of 24-hour total suspended particulate (TSP) and particulate matter (PM_{10} and $PM_{2.5}$) are predicted to have measurable increases and be above the assessment criteria in the local study area (LSA) during construction and operations; annual $PM_{2.5}$ concentrations are predicted to have measurable increases and be above the assessment criteria during operations in the vicinity of the potential disturbance area (PDA)	Air quality (Intermediate)	• Limit vehicle speed and enforce speed limits on site roads to reduce generation of dust during all Project phases • Use suppressants to minimize dust generation along roads and active work areas, when required • Use suppressants to minimize dust generation from ore, waste rock, and aggregate storage areas, when required • Equip crushing and screening with wet suppression • Equip concrete batching plant with a dust suppression system • Prevent dust emissions from the TMF by implementing subaqueous tailings disposal • Implement an ambient air quality monitoring program	Magnitude: Moderate-High Geographic Extent: Local Duration: Medium-term Reversibility: Reversible – short-term Frequency: Periodic Likelihood: Moderate	The pathway of potential effects on human health from dust has a low magnitude, with concentrations of particulate matter rarely (3 days in 5 years) exceeding guidelines protective of human health. The deposition of dust on surface water, soil, and vegetation was found to also be of low magnitude. Overall, the potential for dust to impact human health is rated as not significant.
Modelled concentrations of 24-hour uranium are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA for construction and operations	Air quality (Intermediate)	• Use pollution control technology on acid plant and process plant exhaust stacks with preventative maintenance and stack testing • Use good engineering practices for exhaust stack design to the extent possible to enhance dispersion • Implement an ambient air quality monitoring program	Magnitude: Moderate Geographic Extent: Site Duration: Medium-term Reversibility: Reversible – short-term Frequency: Low Likelihood: Low	Exceedances of the criterion during construction were very limited with only one exceedance predicted at a receptor along the modelled PDA boundary. During the operations phase, exceedances were predicted to occur within a small area near the modelled PDA, with a maximum frequency of 0.2% of the time or about one day per year. Thus, the likelihood of this effect occurring is low.
Modelled concentrations of 1-hour carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and 24-hour NO_2 and acrolein are predicted to have measurable increases and be above the assessment criteria in the vicinity of the PDA during operations	Air quality (Intermediate)	• Evaluate opportunities to reduce fuel combustion requirements of infrastructure and equipment during detailed design to the extent possible • Maintain mobile mining equipment and vehicles and operate the equipment within parameters for engine exhaust system design • Primarily use liquefied natural gas (LNG) for power generation • Use pollution control technology on acid plant and process plant exhaust stacks with preventative maintenance and stack testing • Use good engineering practices for exhaust stack design to the extent possible to enhance dispersion • Cover the tailings management facility (TMF) with a water cover to minimize releases of radon gas • Implement an ambient air quality monitoring program	Magnitude: Moderate-High Geographic Extent: Site Duration: Medium-term Reversibility: Reversible – short-term Frequency: Periodic Likelihood: Low	The pathway of potential effects on human health from gaseous emissions is rated as not significant since predicted concentrations of air gases are below levels considered protective of human health, the geographic extent is site, the frequency is considered negligible, and the likelihood of the residual effect occurring is low.
A measurable change in landscape character is expected to generate a strong level of contrast and high visibility of sufficient scale and prominence to negatively affect visual amenities at sensitive viewpoints	Visual landscape (Intermediate)	• A 20 m setback from the site study area (SSA) was established to maximize the buffer of trees along property boundaries to act as visual screens, particularly along the lake-side portion of the SSA • Use previously disturbed areas to the extent possible to situate infrastructure and roads, and design an efficient site layout to minimize the extent of native habitat cleared • Complete progressive reclamation during operations on disturbed areas to promote revegetation as early as possible using native species or non-aggressive, non-native species appropriate for the conditions • Implement a detailed Decommissioning and Reclamation Plan and conduct decommissioning and post-decommissioning monitoring to measure revegetation success	Magnitude: High Geographic Extent: Local Duration: Medium-term Reversibility: Reversible – short-term Frequency: Continuous (daytime) Likelihood: High	Activities completed during construction and operations are predicted to result in measurable changes to the visibility and visual contrast in the LSA. The frequency is dependent on seasonal, recreational, or traditional land users being present at the assessed viewpoints on Patterson Lake. The effect is reversible through the implementation of a detailed Decommissioning and Reclamation Plan that will be focussed on returning the site to pre-development conditions to the extent possible.

Table 10-2

Summary of key residual effects, design features and mitigation measures, and detailed assessment determination.

Residual Effect	Affected Valued Component (s)	Design Features, Mitigation, and Commitments	Residual Effects Assessment[1]	Potential Key Impacts to Local Communities, Stakeholders, and Indigenous Nations
Altered terrain and reduced soil quantity and physical properties will result from Project activities; the TMF will remain post-decommissioning	Terrain and soils (Intermediate)	• Use previously disturbed areas to the extent possible to situate infrastructure and roads, and design an efficient site layout to minimize the extent of native habitat cleared • Complete progressive reclamation during operations on disturbed areas to promote revegetation as early as possible using native species or non-aggressive, non-native species appropriate for the conditions • Limit vegetation removal on steep slopes and minimize the steepness and length of slopes of disturbed areas and stockpiles • Identify areas of terrain sensitivities such as steep slopes (i.e., >15%) and avoid them where possible; if avoidance is not possible, soil stabilization measures will be used •Preserve natural drainage features such as pre-existing areas of natural macro and micro topographic relief • Use clearing equipment that minimizes surface disturbance, soil compaction, and topsoil loss, where feasible • Implement a detailed Decommissioning and Reclamation Plan and conduct decommissioning and post-decommissioning monitoring to measure revegetation success	Magnitude: Moderate-High Geographic Extent: Site Duration: Medium-term (TMF is permanent) Reversibility: Reversible – short term (TMF is irreversible) Frequency: Continuous Likelihood: High	Predicted impacts to terrain and soils are limited to disturbed areas in the SSA and upon closure, the site will be returned to pre-existing conditions to the extent possible. The TMF will have terrain specifications different than the baseline conditions and will be the only permanent landform that remains on site post-decommissioning.
Loss or alteration of vegetation from land clearing will occur during all Project stages; TMF will remain permanently altered	Vegetation	• Use previously disturbed areas to the extent possible to situate infrastructure and roads, and design an efficient site layout to minimize the extent of native habitat cleared • Use topsoil removed during the site preparation process for reclamation during future progressive and final closure activities • Use clearing equipment that minimizes surface disturbance, soil compaction, and topsoil loss, where feasible • Complete progressive reclamation during operations on disturbed areas to promote revegetation as early as possible using native species or non-aggressive, non-native species appropriate for the conditions • Implement a detailed Decommissioning and Reclamation Plan and conduct decommissioning and post-decommissioning monitoring to measure revegetation success	Magnitude: Moderate Geographic Extent: Site Duration: Long-term (TMF is permanent) Reversibility: Reversible – long term (TMF is irreversible) Frequency: Continuous Likelihood: High	Temporary loss of vegetation will be limited to disturbed areas in the SSA. Reclamation efforts will focus on returning habitat types to their existing state to the extent possible and decommissioning and post-decommissioning monitoring will occur to measure revegetation success. The TMF will be the only permanent landform that remains on site post-decommissioning, and it will be capped with shallow rooted species (i.e., grasses, shrubs).
Loss or alteration of habitat from land clearing will occur during all Project stages; TMF will remain permanently altered	Woodland Caribou	• Use previously disturbed areas to the extent possible to situate infrastructure and roads, and design an efficient site layout to minimize the extent of native habitat cleared • Complete progressive reclamation during operations on disturbed areas to promote revegetation as early as possible using native species or non-aggressive, non-native species appropriate for the conditions • Implement a detailed Decommissioning and Reclamation Plan and conduct decommissioning and post-decommissioning monitoring to measure revegetation success • Implement measures (including habitat offsets), monitoring, and adaptive management outlined in the Woodland Caribou Mitigation Plan	Magnitude: High Geographic Extent: Site Duration: Long-term (TMF is permanent) Reversibility: Reversible – long term (TMF is irreversible) Frequency: Continuous Likelihood: High	Baseline surveys completed for the Project indicated that woodland caribou are uncommon in the LSA and regional study area (RSA). Direct loss of areas in the SSA with high habitat potential for woodland caribou constitutes only 1.6% of the LSA and 0.04% of the RSA. The magnitude of the effect is considered high because of the conservation status of woodland caribou and the disturbance threshold criteria for the SK2 West Caribou administration unit.

Table 10-2
Summary of key residual effects, design features and mitigation measures, and detailed assessment determination.

Residual Effect	Affected Valued Component (s)	Design Features, Mitigation, and Commitments	Residual Effects Assessment[1]	Potential Key Impacts to Local Communities, Stakeholders, and Indigenous Nations
Project activities are predicted to cause sensory disturbances to wildlife	Woodland Caribou	• Employ noise abatement measures on equipment when practical including noise suppression on vehicles • Outfit LNG generators with enclosures and exhaust silencers • Use fan silencers on the surface mine ventilation infrastructure and direct the vents away from Patterson Lake to reduce noise travelling to the lake • Maintain roads to minimize ruts to reduce noise emissions from vehicles • Vehicles, equipment, and ATV/UTVs will remain on designated roads/trails • Limit light pollution to the extent practical by strategically planning lighting locations, brightness, and frequency/duration of use • Implement a Waste Management Plan to ensure the proper segregation, storage, and disposal of non-hazardous and hazardous wastes; non-hazardous waste storage facilities will be enclosed and fenced to reduce the potential for wildlife interactions • Implement measures, monitoring, and adaptive management outlined in the Woodland Caribou Mitigation Plan	Magnitude: Moderate Geographic Extent: Local Duration: Medium-term Reversibility: Reversible – short-term Frequency: Continuous Likelihood: High	Sensory disturbance effects are anticipated to occur if woodland caribou are present in the SSA and PDA. If woodland caribou avoid the area, this could affect resource use in the LSA. Potential noise effects to woodland caribou are predicted to attenuate in the LSA. The likelihood of effect is high yet reversible as the sensory disturbance will be removed once the Project is decommissioned.
Project activities are predicted to cause sensory disturbances to wildlife	Birds	• Employ noise abatement measures on equipment when practical including noise suppression on vehicles • Outfit LNG generators with enclosures and exhaust silencers • Use fan silencers on the surface mine ventilation infrastructure and direct the vents away from Patterson Lake to reduce noise travelling to the lake • Maintain roads to minimize ruts to reduce noise emissions from vehicles • Vehicles, equipment, and ATV/UTVs will remain on designated roads/trails • Limit light pollution to the extent practical by strategically planning lighting locations, brightness, and frequency/duration of use • Implement a Waste Management Plan to ensure the proper segregation, storage, and disposal of non-hazardous and hazardous wastes; non-hazardous waste storage facilities will be enclosed and fenced to reduce the potential for wildlife interactions • Implement an Environmental Management Program that will outline the requirements for pre-clearance surveys prior to clearing activities during sensitive timing windows for breeding birds, bats, and other wildlife as needed	Magnitude: Moderate Geographic Extent: Local Duration: Medium-term Reversibility: Reversible – short-term Frequency: Continuous Likelihood: Moderate-High	The magnitude of sensory disturbance is predicted to be moderate for birds as the key indicators may be more sensitive than other wildlife valued components (VCs) and could show avoidance, particularly during their breeding periods. If certain bird species avoid the area, this could affect resource use in the LSA. The likelihood of effect is moderate to high yet reversible as the sensory disturbance will be removed once the Project is decommissioned.

Table 10-2
Summary of key residual effects, design features and mitigation measures, and detailed assessment determination.

Residual Effects	Affected Valued Component (s)	Design Features, Mitigation, and Commitments	Residual Effects Assessment[1]	Potential Key Impacts to Local Communities, Stakeholders, and Indigenous Nations
Land clearing and disturbance and changes to land access and barriers to movement will reduce the quantity of land available and accessible for traditional and other uses in the SSA	Traditional land and resource use/other land and resource use	• Fission will consider alternatives to provide alternate trail access around the Project site for land users rather than through the Project access gate • Negotiate and execute a Mine Surface Lease Agreement with the Government of Saskatchewan that would include terms and conditions related to the use of lands, compensation for loss of commercial income, and public involvement • Implement a Public Information Program that will outline how Fission will maintain two-way dialogue with land users, Clearwater River Dene Nation (CRDN), Buffalo River Dene Nation (BRDN), Birch Narrows Dene Nation (BNDN), Métis Nation of Saskatchewan (MN-S), Athabasca Chipewyan First Nation (ACFN), and the Athabasca communities over the life of the mine	Magnitude: Moderate Geographic Extent: Site Duration: Medium-term Reversibility: Reversible – short-term Frequency: Continuous Likelihood: Low	Traditional and other land and resource activities will be restricted in the SSA on a continuous basis during construction, operations, and a portion of decommissioning, and will be restored prior to the post-decommissioning phase. Since the area lost comprises a small percentage of the land base available for continued use for land users (1% of the RSA), it is predicted that the magnitude of the effect will be moderate in that loss of function is present but limited to a small geographic area.
Measurable changes to the amount of land that has potential to be avoided by land and resource users are predicted to occur within the LSA	Traditional land and resource use/other land and resource use	• Mitigations presented above under the VCs of visual landscape and birds (sensory disturbance) apply here. • A public facing grievance mechanism will be in place where land users and other members of the public can express their concerns about potential impacts to land and resource use; Fission is also supportive of and encourages open dialogue and communication to identify and address issues as they arise • Members of the workforce will be transported to and from the site using shuttles which will limit the ability for members of the workforce to leave the site during their shifts • A security gate will be used to monitor who is coming and going from the site, which may also help limit interactions between members of the workforce and residents from local communities, including members of vulnerable groups • Implement a Public Information Program that will outline how Fission will maintain two-way dialogue with land users, CRDN, BRDN, BNDN, MN-S, ACFN, and the Athabasca communities over the life of the mine	Magnitude: Moderate Geographic Extent: Local Duration: Long-term Reversibility: Reversible – long-term Frequency: Continuous Likelihood: Moderate	There is potential for land users to avoid land in the LSA; however, it is estimated that the number of land users who are currently using land in the LSA is low, and that only a portion of those will begin avoiding the LSA. No unique or rare traditional use sites were identified in the LSA, and all resources in the LSA are as abundant in the RSA and broader area. The effect is reversible once the sensory disturbances are removed, use of the SSA ceases, and the site is reclaimed to the extent possible.

[1] Definitions of the residual effect ratings are provided in Tables 5-4 and 5-5 in Section 5.

SECTION 11

CONDITIONS MANAGEMENT

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LIST OF ACRONYMS

BATEA	Best Available Technology Economically Achievable
CNSC	Canadian Nuclear Safety Commission
DDP	Detailed Decommissioning Plan
DFO	Fisheries and Oceans Canada
EASB	Environmental Assessment and Stewardship Branch
ECCC	Environment and Climate Change Canada
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMMP	Environmental Monitoring and Measurement Procedure
ENV	Saskatchewan Ministry of Environment
EPB	Environmental Protection Branch
EPR	Environmental Performance Reporting
Fission	Fission Uranium Corp.
FSL	Full Supply Level
HHERA	Human Health and Ecological Risk Assessment
HRDP	Human Resource Development Plans
LRWS	Labour Relations and Workplace Safety
MHI	Ministry of Highways and Infrastructure
N/A	Not Applicable
PDP	Preliminary Decommissioning Plan
PMP	Probable Maximum Precipitation
TBD	To Be Determined
the Project	The PLS Project
TOR	Terms of Reference
TMF	Tailings Management Facility
WSA	Water Security Agency

LIST OF TABLES

Table 11-1 Concordance table – conditions management.

Table 11-2 Commitments register for the PLS Project.

11.0 CONDITIONS MANAGEMENT

11.1 Introduction

Throughout the life of the PLS Project (the Project), Fission Uranium Corp. (Fission) will manage commitments made in this Environmental Impact Statement (EIS) and outlined in regulations, permits, and approvals, including any terms or conditions imposed by the Minister as part of the Environmental Impact Assessment (EIA) approval. Fission will track responsibilities and facilitate ongoing regulatory involvement using a Commitments Register, which is further described below.

The concordance table for components for the EIS from the Saskatchewan Ministry of Environment (ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021) for conditions management is provided in Table 11-1.

11.2 Commitment Register

The Commitments Register matches the template provided in Appendix B of the ENV guidelines for the TOR and EIS (ENV 2021). The register is a living document that will be periodically updated throughout the life of the Project. The initial draft is provided in Table 11-2; however, many of the columns are blank as they pertain to actions taken at later dates (e.g., commitment status) or only if required (e.g., adaptive actions).

Commitments in the register include the development of management, monitoring, and response plans for the Project during the permitting stage. These plans will include detailed information pertinent to some of the other commitments. For example, a commitment in the register is developing an Environmental Monitoring and Measurement Procedure (EMMP) and the measure of compliance will be a condition of the issuance of an Approval to Operate a Pollutant Control Facility by ENV. Detailed information on monitoring requirements to meet commitments such as determining whether changes in surface water and groundwater quantity and quality remain within EIS predictions will be provided in the EMMP. Compliance and potential adaptive action requirements for these types of commitments will be evaluated during Environmental Performance Reporting (EPR) that is usually an approval requirement of ENV scheduled to occur on a five-year cycle (ENV 2013).

Other commitments included in the register stemmed from commitments made to communities during EIS engagement or follow-up studies to address uncertainties in EIS

predictions or to update modelling and assessments with updated Project information during the detailed design stage for permitting and licensing.

11.3 Follow-Up Reporting

Fission will be required to report to the appropriate government agencies on progress made on meeting commitments in the Commitments Register, at a minimum annually, or as required by each permitting agency. Specific reporting requirements and timelines will be determined during the licensing, approval, and permitting stages. As stated in ENV (2021), the following follow-up reporting may be requested:

- significant incidents or spills and the responses that were taken;
- how effectively commitments are being met;
- unforeseen events, including impacts of the environment on the development that may prevent commitments from being met;
- preventative actions where a commitment is at risk of not being met;
- corrective actions being taken (approved by the appropriate government agencies) where a commitment has not, or cannot be met;
- justification for why any commitment has not been met; and
- an assessment (where appropriate) of whether a commitment is sufficiently addressing the intended environmental protection or mitigation objectives.

11.4 Engagement Commitments

Commitments were made during engagement activities with local Indigenous Nations, communities, and stakeholders (see Section 3 for detailed engagement information) and are provided in Table 11-2. Fission has committed to developing mechanisms to share relevant Project information including environmental monitoring data, site safety performance, and other information required to keep all groups informed about Project activities. These mechanisms will include a Public Information Program, Nation-specific Communication and Information Sharing Plans, and an Indigenous Engagement Program that will set out how the identified information will be shared, and how on-going engagement and communication will be maintained.

11.5 Literature Cited

ENV (Saskatchewan Ministry of Environment). 2013. Saskatchewan environmental performance report guideline. September.

ENV (Saskatchewan Ministry of Environment). 2021. Guidelines for the terms of reference and environmental impact statement. Prepared by the Environmental Assessment and Stewardship Branch, Ministry of Environment, November.

Table 11-1
Concordance table – conditions management.

EIS Requirement	Section and Page #
Commitments Register	
b) commitments register outlining: - each commitment made to prevent or mitigate the environmental impacts of the preferred development alternatives and to meet regulatory requirements - specific commitments for monitoring as required - how and when each commitment will be implemented - specific, measurable, achievable and reportable outcomes -reference to acceptable tolerances (from existing material or material developed by the proponent) for determining whether a commitment has been met	Conditions Management (11.0); Table 11-2
Follow-Up Reporting	
b) completed commitments register and commitment to maintain the information for follow-up reporting	Table 11-2
c) identification of what follow-up reporting will likely be required and to which regulatory information will be submitted	Conditions Management (11.0); throughout; Table 11-2
d) proposed timeline for follow-up reporting where required	Conditions Management (11.0); throughout; Table 11-2
Literature Cited	
a citation for third-party information source within the text of the EIS	Throughout Section
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (11.5), 11-2
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	N/A

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
1	Apply for, obtain, and comply with all required permits, licences, and approvals to construct, operate, decommission, and abandon the facilities associated with the Project.	1		TBD		ENV, CNSC, WSA, ECCC, DFO, LRWS, other applicable agencies	Approvals obtained, maintained and re-issued as required				Periodically throughout the Project lifecycle		
2	Develop and implement an Environmental Monitoring and Measurement Procedure (EMMP) that includes the following specific sub-plans: air, soil and vegetation, groundwater, hydrology, treated effluent, surface water, sediment, and aquatic biota. Environmental monitoring plans and procedures will be shared with interested Indigenous Nations for review and comment.	9		TBD		ENV	Approval to Operate a Pollutant Control Facility is issued				Prior to operations		
3	Develop and implement management system programs, plans, and other documentation to mitigate project risk and achieve objectives. These may include the following or any other programs, procedures, plans, or other documentation as may be required: Environmental Management Program, Waste Management Program, Radiation Protection Program, Safety and Health Management Program, Emergency Preparedness and Response Program, Security Program, and Fire Protection Program.	9		TBD		CNSC	Licence to Construct a Uranium Mine and Mill is issued Licence to Operate a Uranium Mine and Mill is issued				Programs and documentation applicable to construction activities required prior to issuance of construction licence; programs and documentation applicable to operations required prior to issuance of operating licence		
4	During detailed design, complete additional baseline studies as required to ensure all areas not previously assessed during baseline studies conducted for the Environmental Impact Assessment (EIA) are fully characterized. This will include vegetation community studies, soil characterization studies, and a heritage resource impact assessment.	4		N/A		ENV	Completion of studies and reporting				Prior to construction		
5	Complete hydrology, water quality, and sediment quality baseline studies in South Creek.	4, 9		N/A		ENV, CNSC	Completion of study and reporting				Prior to construction		
6	Collect additional hydrology, water quality, sediment quality, benthic invertebrate community, and fish baseline information downstream of the final treated effluent diffuser location and from reference areas to inform aquatic monitoring program study designs.	4, 9		N/A		ENV	Completion of studies and reporting				Prior to in-water works that may disturb baseline conditions		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
7	Provide an updated Human Health and Ecological Risk Assessment (HHERA) utilizing the additional baseline sediment data and conduct necessary adaptive management if updated modelling with additional baseline data demonstrates elevated risks to receptors exceeding predictions of the significance of effects in this EIS. The effects of climate change on water quality will be considered within the HHERA updates.	9		N/A		CNSC	Completion of studies and reporting				Prior to in-water works that may disturb baseline conditions		
8	Changes in groundwater quantity and quality remain within Environmental Impact Statement (EIS) predictions.	6		N/A		ENV	Comparison of groundwater monitoring data to EIS predictions during Environmental Performance Reporting				As per reporting requirements		
9	Changes in air quality remain within EIS predictions.	6		N/A		ENV	Comparison of air quality monitoring data to EIS predictions during Environmental Performance Reporting				As per reporting requirements		
10	Changes in surface water levels and flows remain within EIS predictions.	6		N/A		ENV	Comparison of hydrology monitoring data to EIS predictions during Environmental Performance Reporting				As per reporting requirements		
11	Treated effluent quality will meet regulatory criteria prior to release to the environment.	2 and 9		N/A		ENV; ECCC	Compliance with maximum allowable limits set out in the Approval to Operate a Pollutant Control Facility and the *Metal and Diamond Mining Effluent Regulations*				Throughout the Project lifecycle		
12	Changes in surface water quality, sediment quality, and aquatic biota endpoints remain within EIS predictions and monitoring meets *Metal and Diamond Mining Effluent Regulations* requirements.	6 and 9		N/A		ENV; ECCC	Comparison of surface water, sediment, and aquatic biota monitoring data to EIS predictions and results of Environmental Effects Monitoring data evaluations				As per reporting requirements		
13	Implement erosion and sediment control measures and monitoring during in water works.	6		TBD		WSA, DFO	Permit conditions and Fisheries and Oceans Canada (DFO) Measures to Protect Fish and Fish Habitat are met				During installation and decommissioning of treated effluent pipeline and diffuser		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
14	Prepare and implement Preliminary Decommissioning Plan (PDP) that includes the progressive rehabilitation of existing disturbed areas/access roads that are no longer in use by the Project. Rehabilitation will focus on returning disturbed areas to pre-development or naturalized conditions using native species. Where possible, rehabilitation options that promote visual screens of Project infrastructure will be favored. The PDP and progressive reclamation plans will be provided to Indigenous Nations for review.	2 and 6		N/A		ENV/CNSC	PDP developed and revised as per regulatory requirements				Periodically throughout operations and decommissioning		
15	Conduct pre-clearance surveys for clearing activities that occur during the breeding migratory bird and bat maternity roost window (late April to mid-August).	6		TBD		ENV	Pre-clearance surveys and reporting are completed as outlined in the Construction Monitoring Procedure and provincial permits				Prior to site clearing activities planned during the late April to August window		
16	Conduct an employee wildlife education program that includes the importance of woodland caribou, recording wildlife observations, and avoiding wildlife interactions.	Appendix D.9		N/A		ENV	Training verification process				During employee, orientation, training, or other means		
17	Monitor woodland caribou and wildlife use of site and linear features using trail cameras and observation forms.	Appendix D.9		N/A		ENV	Evaluating and reporting data to ensure adequate information is being obtained to inform adaptive management of woodland caribou mitigation measures				Periodically throughout the Project lifecycle		
18	Develop and implement a Public Information Program to ensure that information related to the health, safety, and security of persons and the environment as they relate to the Project are effectively communicated to the public.	3 and 9		N/A		CNSC	Program existence with compliance verification via CNSC				Periodically throughout the Project lifecycle		
19	Conduct a plume delineation study immediately following treated effluent release so that concentrations can be mapped using real data to verify the accuracy of the predictions.	9		N/A		ENV	Completion of study and reporting				Following treated effluent release		
20	Prior to construction of the tailings management facility (TMF), complete a dam failure/inundation assessment for the facility to aid in design and planning for the facility as well as emergency preparedness and response planning.	7		N/A		N/A	Completion of assessment				Prior to TMF construction		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
21	Update the site-specific hydrogeological contaminant transport and stability models with updated TMF design information and geochemical/geotechnical data as required.	2		N/A		ENV	Submission of updated hydrogeological model report				Prior to operations; commitment required if source terms from backfill testing carry more environmental risk than assumed in current model		
22	Collaborate with NexGen Energy Ltd. or any future owner/operator of the Rook I Project to share Project related data from both Projects relevant to cumulative assessment components of reporting requirements for both the PLS Project and Rook I Project.	6		N/A		N/A	System implemented				Within 2 years of the date of commencement of concurrent operations		
23	Following any decision to permanently decommission the mine and mill, a Detailed Decommissioning Plan (DDP) will be developed and implemented to restore the disturbed landscapes. Overall, the plan will focus on returning the site to as near as possible its pre-disturbance state, while providing opportunities for traditional uses and recreation and creating natural habitats.	2		N/A		ENV, CNSC	Completion of DDP				Prior to site decommissioning		
24	A Heritage Resources Management Plan and Chance Finds Procedure will be developed in consultation with a professional archaeologist and Indigenous Nations. The Procedure will guide actions taken in the event that a heritage resource is identified and/or disturbed during Project activities.	6 and 9		N/A		N/A	Completion of Heritage Resource Management Plan and Chance Finds Procedure				Prior to construction		
25	A Best Available Technology Economically Achievable (BATEA) study will be completed with the tailings and water treatment technical programs for presentation to the regulatory agencies at the time of construction licensing/permitting.	2		N/A		ENV, CNSC	Completion of BATEA study and presentation of results				Prior to construction		
26	Updated assessments conducted during the licensing stage will 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.	8		N/A		CNSC	Completion of assessment and reporting				During CNSC licensing		
27	As the Project advances, Fission will provide comprehensive results of the tailings consolidation models, pore pressure, and settlement values.	Appendix A.3		N/A		ENV, CNSC	Submission of tailings consolidation model results				During licensing and permitting stage		
28	Fission will develop the criteria for an engineered tailings verification program and provide details at the time of licensing/permitting for construction.	7		N/A		ENV, CNSC	Submission of program details prior to construction				During licensing and permitting stage		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
29	As the Project advances, Fission will provide further information regarding assessment of collection, diversion, and conveyance structures. The information will include Probable Maximum Precipitation (PMP) event for sizing of water infrastructures used for storage and conveyance of contact water and provide the design used to size the Intermediate Settling Pond, Settling Pond, Contingency Pond, and Monitoring Ponds.	2		N/A		ENV, CNSC	Submission of assessment				During licensing and permitting stage		
30	Fission commits to work with the Ministry of Highways to enter into road-maintenance and upgrade cost-sharing agreements to mitigate any potential for impacts to roadway conditions that may result from over-limit vehicle use.	6		N/A		MHI	Agreement in place				Prior to use of over-limit vehicles		
31	A Travel and Traffic Management Plan will be developed and shared with Indigenous Nations for review and comments.	3		N/A		CNSC	Submission of required information				During licensing and permitting stage		
32	Communication and Information Sharing Plans will be developed in collaboration with all interested Indigenous Nations.	3		N/A		N/A	Submission of Nation-specific plan to each participating Nation				Prior to construction		
33	Geotechnical information on crown pillar stability will be shared with interested Indigenous Nations to help build confidence in the mine design and processes.	Appendix B.2		N/A		N/A	Submission of required information				Prior to construction		
34	A Social Monitoring Program will be implemented to monitor changes to economic, land and resource use, and community wellbeing conditions in local priority communities at regular intervals for the life of the Project. Local Indigenous Nations will be invited to participate in design and data collection for the program. Monitoring of Project-related traffic levels will be included in this program.	3		N/A		N/A	Invitation extended to Indigenous Nations and completion of Social Monitoring Program documentation				During construction and operations		
35	Further work will be completed to establish a full supply level (FSL) for the sedimentation ponds. During operations, potential discharge locations will be monitored and the FSL adjusted to mitigate any observed seepage. Fission commits to managing the ponds through the permitting process.	2		N/A		ENV-EPB	Submission of safe FSL and monitoring plan				During licensing and permitting stage		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
36	Further design and modeling will be completed as part of detailed design to demonstrate the achievable cover performance; this will include consideration of sourcing materials required for construction. The cover system will be designed to mitigate groundwater and surface water contamination from the decommissioned TMF and will be reviewed at time of detailed design. The performance of the of the TMF cover system will be monitored during active care and maintenance, mitigations will be employed should the cover not perform as anticipated.	2		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
37	Hydrogeological and stability modeling updates that make use of the liner optimization study, the detailed TMF design, and updates to tailings studies will be conducted during licencing and permitting once relevant information is available. Should the containment and decommissioning system not perform as designed, conceptual contingency plans will be investigated as part of detailed design and during operations and active care. Cover and liner performance will be monitored during active care and mitigations will be implemented should they be required.	Appendix A.3, 3.0		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
38	Sensitivity analysis of liner leakage rates will be conducted as a part of the updated hydrogeological modeling planned as a part of detailed design	Appendix D.4, 9.0		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
39	Sensitivity analysis on pore water chemistry and liner leakage rates will be conducted as a part of the updated hydrogeological modeling planned as a part of detailed design	Appendix D.4, 6.5		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
40	Further modeling is planned in detailed design to assess liner leakage rates and drainage system performance. The potential for losses to the water cover will continue to be assessed as a part of this ongoing work. Assessment of short-term flooding and potential mitigations will be carried forward as a part of detailed design.	Appendix A.3, 5.3		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
41	A dam breach and runout assessment are planned for detailed design that will consider the migration of tailings and pore water over the ground surface. This information will be provided during permitting and licensing.	Appendices A.3 and D.4		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
42	Detailed laboratory testing is underway to characterize the friction angle of the silt materials. The stability models will be updated with this information in detailed design.	Appendix A.3, 5.3		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
43	Updated contaminant transport modeling is planned at the detailed design stage of the project. Updates to the existing model will include the optimized design of the TMF, updated source term chemistry for both the TMF and the mine backfill, and sensitivity analysis on pore fluid variability.	Appendix D.4, 7.3		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
44	The performance of the drainage system will be monitored during operations and active care and management. Should performance differ from expectations, the appropriate mitigating measures identified in the adaptive risk management plan will be employed. The feasibility study showed that the tailings were filter compatible with the perimeter drains (fine filter) and that tailings particles would build up along the perimeter drain in contact with the water cover once tailings deposition had ceased. Further laboratory testing and modeling of this behavior is planned for detailed design. Further laboratory testing and modeling are planned during detailed design to demonstrate tailings behavior under reduced effective stress and to demonstrate filter compatibility and performance between the tailings and the filters (drains) to mitigate the risks of short circuiting. An adaptive risk management plan that addresses risks related to drainage system performance will also be developed during detailed design.	8 and Appendix A.3		N/A		CNSC	Submission of required information				During licensing and permitting stage		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
45	Laboratory testing of the tailings is ongoing. Once characterization of the tailings is complete, transport and stability models will be updated with the results of tailings testing during detailed design. The results of the updated consolidation models will be presented as a part of detailed design, as it becomes available.	Appendix A.3, 3.5		N/A		ENV-EPB	Submission of required information				During licensing and permitting stage		
46	Cobalt will be assessed as a contaminant of potential concern in the updated groundwater transport models.	4		N/A		CNSC	Submission of required information				During licensing and permitting stage		
47	The planned updates to the contaminant transport modeling will include modeling impacts over durations at which peak or steady state results are achieved. The applicability of a depleting source will be assessed as a part of this work.	Appendix D.4, 6.3		N/A		CNSC	Submission of required information				During licensing and permitting stage		
48	A regional traditional food study will be conducted and interested local Indigenous Nations will be invited participate in design and data collection and provided with funding to support their involvement.	3, Appendix B.2		N/A		N/A	Invitation extended to Indigenous Nations and funding provided where applicable and reasonable				Prior to operations		
49	Fission will engage with ENV, CNSC, industry partners, and interested local Indigenous Nations on the development of a regional monitoring program for the Patterson Lake region.	N/A		N/A		N/A	TBD				TBD		
50	An Environmental Management Plan will be developed and provided to Indigenous Nations for review and comment.	3		N/A		N/A	Submission of draft document to Nations for review				Prior to construction		
51	The Woodland Caribou Mitigation Plan will be provided to Indigenous Nations for review and comment.	3		N/A		N/A	Submission of draft document to Nations for review				Prior to construction		
52	A site water balance will be provided to interested Indigenous Nations for review and comment.	Appendix, B.2		N/A		N/A	Submission of draft document to Nations for review				During detailed design		
53	Indigenous Nations will be engaged prior to Fission undertaking any additional heritage work and will be invited to participate in field studies associated with the heritage resource impact assessments. Indigenous Nations will be invited to review and provide feedback on the draft heritage resource impact assessments prior to finalization.	Appendix, B.2		N/A		N/A	Submission of draft document to Nations for review				Periodically throughout the Project lifecycle		

Table 11-2
Commitments register for the PLS Project.

ID	Commitment	Section in EIS	Condition in Approval (y/n)	Permit Name and Number	Name and Section of Additional Report	Approving Agency	Measure of Compliance	Commitment Status	Preventative or Corrective Action	Adaptive Action	Commitment Due Date	Actual Completion Date	Comments
54	A Spill Management Plan will be developed and provided to interested Indigenous Nations for review and comment.	Appendix, B.2		N/A		N/A	Submission of draft document to Nations for review				Prior to construction		
55	A Human Resource Development Plan (HRDP) will be developed, and aspects will be shared with Indigenous Nations for review and input.	3		N/A		N/A	What we heard summary shared with participating Nations				Prior to or part of submission of HRDP		
56	The Project-environment interaction of treated water discharged during the short-term construction phase will be further assessed during permitting and licensing once detailed design information is available. Mitigation measures and monitoring will be updated as necessary.	2, Appendix A.2		N/A		N/A	Completion of assessment and model update				During licensing and permitting stage		
57	All direct employees will receive cultural sensitivity training. Indigenous Nations will be invited to participate in development and/or delivery of the training to ensure that local culture and rights are reflected in the training program.	Appendix, B.2		N/A		N/A	All direct employees receive training, and Nations are invited to participate in development and/or delivery.				Prior to construction and ongoing through operations		
58	The results of community-led studies completed to inform the EIS will be considered and incorporated into plans and procedures for the life of the Project.	Appendix, B.2		N/A		N/A	Confirmation that results were considered				Ongoing – all Project Phases		
59	An Indigenous Engagement Program will be developed using information from the Communication and Information Sharing Plans and will describe how Fission will engage with each of the Indigenous Nations for the life of the Project.	Appendix, B.2		N/A		CNSC	Submission of required information				During licensing and permitting stage		

TBD = to be determined; N/A = not applicable; EIS = Environmental Impact Statement; ENV = Saskatchewan Ministry of Environment; EASB = Environmental Assessment and Stewardship Branch; EPB = Environmental Protection Branch; CNSC = Canadian Nuclear Safety Commission; DFO = Fisheries and Oceans Canada; LRWS = Labour Relations and Workplace Safety; MHI = Ministry of Highways and Infrastructure; WSA = Water Security Agency; ECCC = Environment and Climate Change Canada.

SECTION 12

QUALIFIED PERSONS CREDENTIALS

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12.1 Key Personnel Credentials 12-1
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LIST OF ACRONYMS

AIA	Alberta Institute of Agrologists
APEGA	Association of Professional Engineers and Geoscientists of Alberta
APEGM	Association of Professional Engineers and Geoscientists of Manitoba
APEGS	Association of Professional Engineers and Geoscientists of Saskatchewan
APGO	Association of Professional Geoscientists of Ontario
ASET	Association of Science and Engineering Technology Professionals of Alberta
ASPB	Alberta Society of Professional Biologists
BCIA	British Columbia Institute of Agrologists
EGBC	Association of Professional Engineers and Geoscientists of the Province of British Columbia
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
OACETT	Ontario Association of Certified Engineering Technicians and Technologists
PEGNL	Professional Engineers and Geoscientists of Newfoundland & Labrador
PEO	Professional Engineers Ontario
the Project	The PLS Project
QP	Qualified Person
SAPA	Saskatchewan Association of Professional Archaeologists
SIA	Saskatchewan Institute of Agrologists
TOR	Terms of Reference
TPS	Technology Professionals Saskatchewan

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Table 12-1 Concordance table – qualified persons credentials.

Table 12-2 Qualified persons credentials.

12.0 QUALIFIED PERSONS CREDENTIALS

12.1 Key Personnel Credentials

Table 12-1 presents the concordance table of the qualified persons (QPs) components of the Environmental Impact Statement (EIS) from the Saskatchewan Ministry of Environment (ENV) guidelines for the Terms of Reference (TOR) and EIS (ENV 2021).

The identification of QPs undertaking the PLS Project (the Project) Environmental Impact Assessment (EIA) are listed in Table 12-2. Academic qualifications and credentials of key personnel are also provided.

12.2 Literature Cited

ENV (Saskatchewan Ministry of Environment). 2021. Guidelines for the terms of reference and environmental impact statement. Prepared by the Environmental Assessment and Stewardship Branch, Ministry of Environment, November.

Table 12-1
Concordance table – qualified persons credentials.

EIS Requirement	Section and Page #
c) final list of disciplinary leads responsible for undertaking the environmental assessment	Key Personnel Credentials (12.1), Table 12-2
d) academic or experiential qualifications, or credentials of a qualified person for members of a regulated discipline	Key Personnel Credentials (12.1), Table 12-2
Literature Cited	
b) a citation for third-party information source within the text of the EIS	Section 12 Qualified Persons Credentials; throughout
c) a section containing complete reference for citations, used to support the findings of the EIA	Literature Cited (12.2); 12-1
d) summaries of any relevant third-party data or other information used to support the findings of the EIA	Section 4 Existing Environment; throughout

Table 12-2
Qualified persons credentials.

Personnel and Credentials	Professional Association	EIS Role/Contribution	Company
Gary Haywood, P.Eng.	APEGS	VP Project Development	Fission Uranium Corp. (Fission)
Jeff Pryznyk, Engineering Licensee, A.Sc.T.	APEGS, TPS	Environment Manager, Senior Review	
		Regulatory Approval Requirements and Guidance	
Kanan Sarioglu, P.Geo.	APEGS, APEGA, EGBC	Geology and Geochemistry	
James Haley, P.Geo.	PEGNL	Geology and Geochemistry	
Lawrence Melis, P.Eng.	APEGS	Tailings and Effluent Treatment Test Work	Melis Engineering Ltd.
Katie Suek, M.SEM	-	Engagement Lead	Canada North Environmental Services (CanNorth)
		Human Environment Assessment	
Kelly Wells, M.Sc., P.Biol.	ASPB	Project Manager, Senior Review	
Christine Kary, B.Sc., P.Biol.	ASPB	Project Coordinator	
		Aquatic Assessment	
Beth Dolmage, B.Sc., A.Ag.	SIA	Vegetation Assessment	
Jessica Slopek, B.Sc., P.Ag.	SIA	Soil Assessment	
Joshua Traylor, Ph.D.	-	Woodland Caribou Mitigation Plan Wildlife Assessment	
Shelly Fisher, M.Sc.	-		
Jackie Mertler, M.Sc.	-		
Karmen VanderZwan, M.A.	SAPA	Heritage Assessment	
Katherine Woolhouse, M.Sc.	-	Human Health and Ecological Risk Assessment	
Stacey Fernandes, M.Sc., P.Eng., QP	PEO and APEGS Qualified Person in ON and SK under the Air Quality Chapter and the Corrective Action Plan Chapter (Tier 3)		
Mark Wittrup, M.Sc., P.Eng., P.Geo., CMC	APEGS, APEGA, EGBC	Clifton Lead, Senior Review, Advisory and Regulatory Support	Clifton Engineering Group (Clifton)
Dave Kent, M.Sc., P.Eng. FEC	APEGA, APEGM, APEGS	Senior Review - Hydrogeology and Tailings Management Facility	
Greg Potter, M.Sc., P.Eng., P.Geo.	APEGA, APEGM, APGO, APEGS, and EGBC	Senior Review - Hydrogeology and Tailings Management Facility	
Cathy Williamson, B.Sc., P.Geo.	APEGS	Hydrogeology Assessment	
Matthew Buchynski, M.Sc., P.Eng.	APEGS	Tailings Management Facility Pathway Modelling	
Daniel Budai, P.Eng.	APEGS	Greenhouse Gas Assessment	
David Ross-Hopley, M.Eng., M.A. (Econ.), B.A.Sc., E.I.T.	APEGS	Socio-economic Assessment	
Ezekiel Dada, Ph.D., P.Eng.	APEGA and APEGS	Traffic Impact Assessment	Bunt & Associates (Bunt)
Brandin McMillan, P.Tech.(Eng.)	ASET		
Gloria Shu, E.I.T.	APEGA		

Table 12-2
Qualified persons credentials.

Personnel and Credentials	Professional Association	EIS Role/Contribution	Company
Paul Kirby, M.Sc., C.E.T.	OACETT	Visual Landscape Assessment	Independent Environmental Consultants (IEC)
Nick Shinbin, M.A.Sc, P.Eng.	PEO	Noise Assessment	
Kim Theobald, B.Sc.	-	Air Quality Assessment	
Mehran Monabatti, Ph.D.	-	Accidents and Malfunctions Assessment	
Ryan MacDonald, Ph.D., P.Ag.	AIA and BCIA	Hydrology Assessment	MacDonald Hydrology Consultants (MacHydro)
Matthew Chernos, M.Sc., P.Geo.	APEGA and EGBC		
Ashlee Jollymore, Ph.D., P.Geo.	EGBC		

Professional Associations: AIA = Alberta Institute of Agrologists; APEGA = Association of Professional Engineers and Geoscientists of Alberta; APEGM = Association of Professional Engineers and Geoscientists of Manitoba; APEGS = Association of Professional Engineers and Geoscientists of Saskatchewan; APGO = Association of Professional Geoscientists of Ontario; ASET = Association of Science and Engineering Technology Professionals of Alberta; ASPB = Alberta Society of Professional Biologists; BCIA = British Columbia Institute of Agrologists; EGBC = Association of Professional Engineers and Geoscientists of British Columbia; OACETT = Ontario Association of Certified Engineering Technicians and Technologists; PEGNL = Professional Engineers and Geoscientists of Newfoundland & Labrador; PEO = Professional Engineers Ontario; SAPA = Saskatchewan Association of Professional Archaeologists; SIA = Saskatchewan Institute of Agrologists; TPS = Technology Professionals Saskatchewan.

SECTION 13

MAP SOURCES AND DISCLAIMERS

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13.0 MAP SOURCES AND DISCLAIMERS

13.1 Disclaimers

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