



## Uranium Development & Exploration

The Athabasca Basin, Northern Saskatchewan

August 2019 | Wheeler River Site Visit

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# Wheeler River Site Visit August 2019

## Agenda:

- Arrive at Wheeler River
- Welcome to the Wheeler River Uranium Project
- Denison Mines overview
- Introductions
- Camp orientation & safety
- Depart for Field Tour of Stations #1-9
- Snacks / refreshments (Station #6)
- Return to camp for late lunch
- Wrap-up Q&A
- Depart Wheeler River





# Diversified Athabasca Basin Asset Base with Superior Development Leverage

## Strategic Project Portfolio:

- 90% interest in Flagship **Wheeler River** project <sup>(1)</sup>  
– largest undeveloped uranium project in infrastructure rich eastern Athabasca Basin
  - 22.5% interest in operating **McClean Lake Uranium Mill** – excess licensed capacity, +12% of global uranium production
  - Interests in uranium resources at McClean Lake, Midwest, and Waterbury Lake
  - ~305,000 hectares of prospective exploration ground in the Athabasca Basin
- ✓ Internal sources of **cash flow** from management services contract with Uranium Participation Corp. (TSX-U), and Denison Environmental Services (DES)





## ~305,000 Hectares of Prospective Exploration & Development Ground Focused in the Infrastructure Rich Eastern Athabasca Basin



# Wheeler River Project Advancing to Permitting<sup>(1)</sup>

## Pre-Feasibility Study Highlights<sup>(2)</sup>:

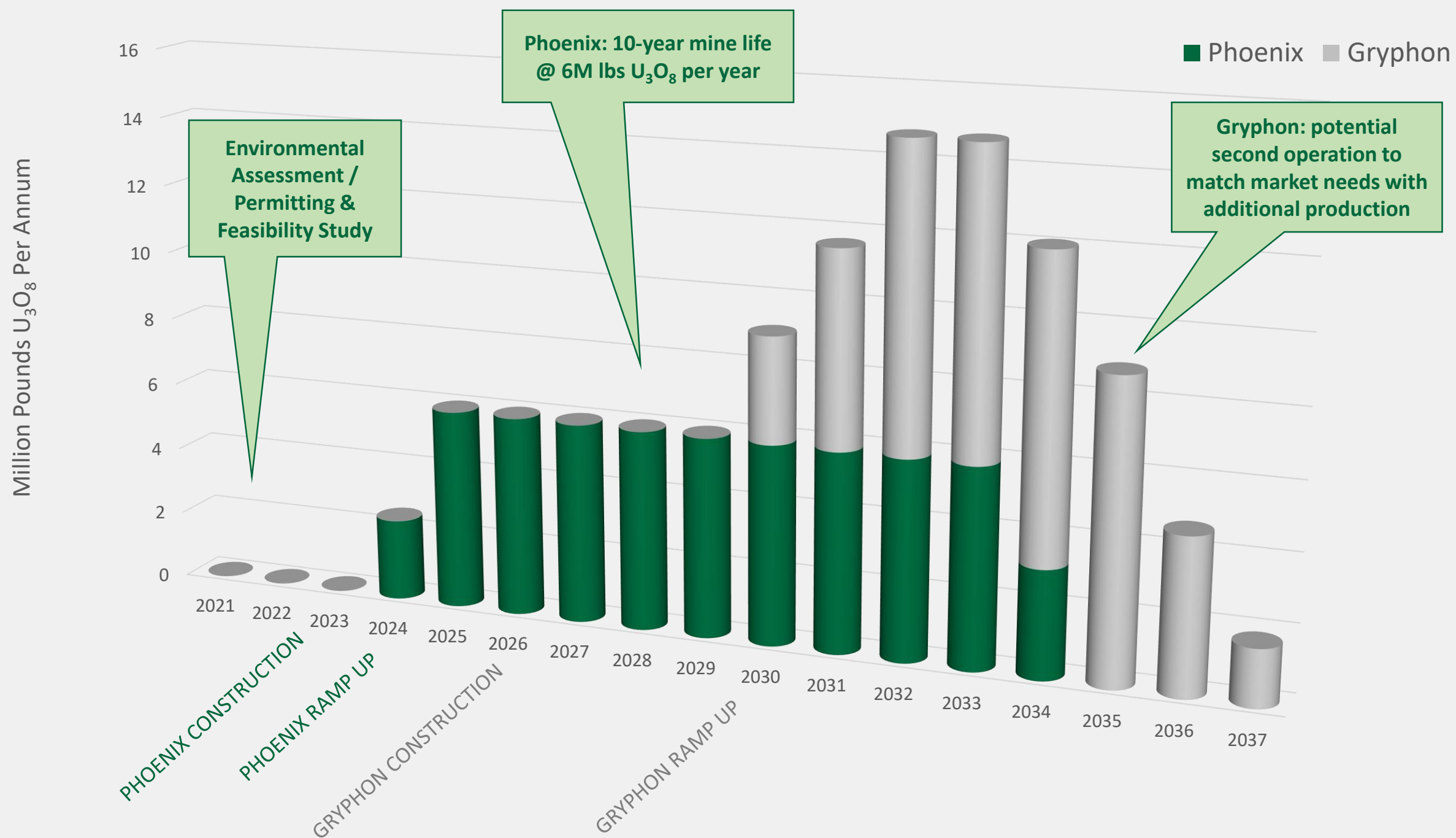
- PFS included selection of **In-Situ Recovery (“ISR”) mining method** for Phoenix with onsite processing at Wheeler River
- **Phoenix** estimated to have exceptionally low operating costs for an undeveloped uranium deposit globally – **US\$3.33/lb U<sub>3</sub>O<sub>8</sub>**
- Conventional UG **Gryphon** contributes additional low cost pounds – **US\$11.70/lb U<sub>3</sub>O<sub>8</sub>**
- **109.4M** lbs U<sub>3</sub>O<sub>8</sub> Probable Reserves
- **14** year mine life (7.8m lbs U<sub>3</sub>O<sub>8</sub>/year on avg.)
- Base-case pre-tax NPV<sub>8%</sub> (100%) of **\$1.31B**
- Base-case pre-tax IRR of **38.7%**
- Initial CAPEX of **\$322.5M** (100%)

✓ **Ownership<sup>(3)</sup>: 90% Denison, 10% JCU**

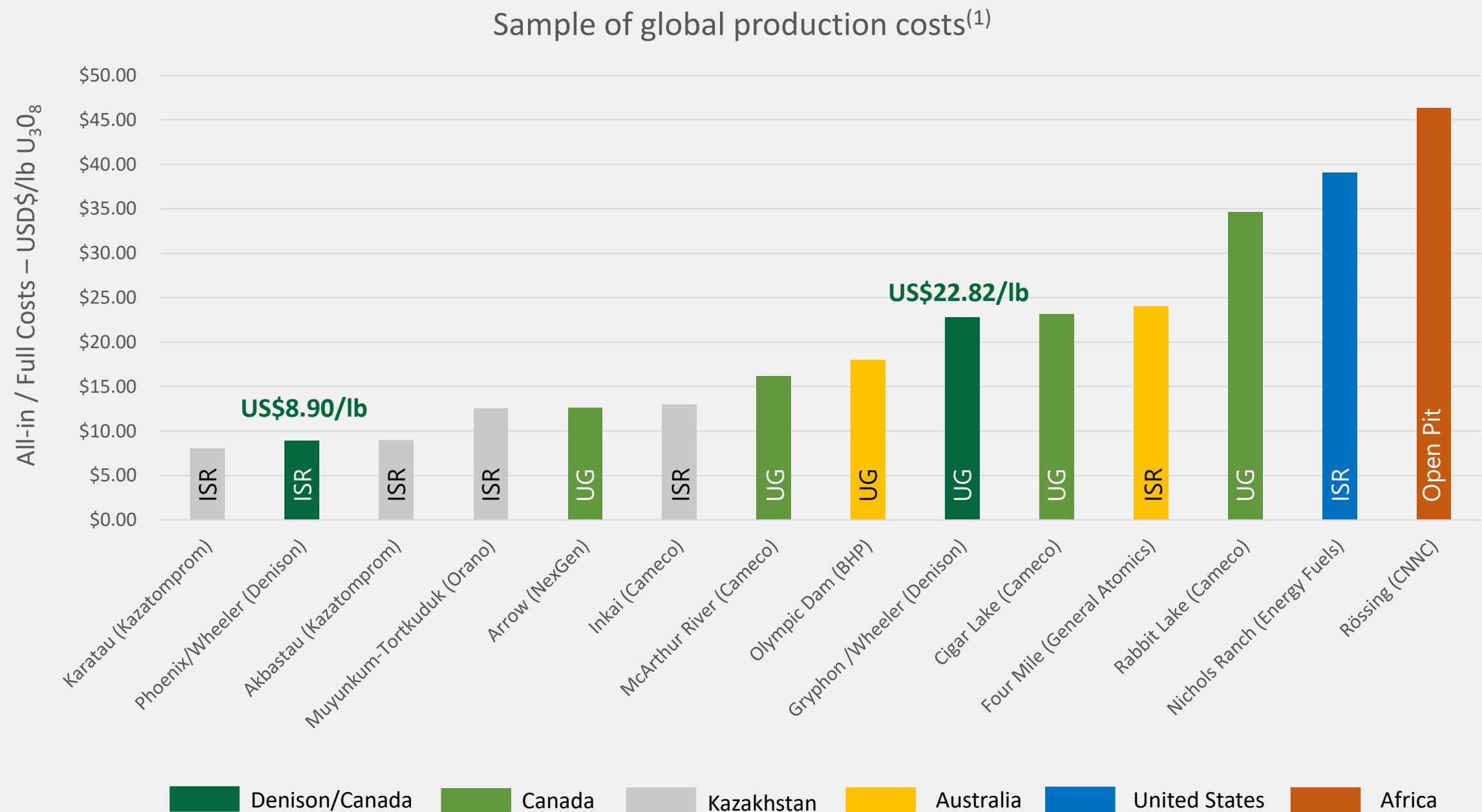




## Wheeler River PFS: 14-year mine life producing +7.5M lbs $U_3O_8$ per year on average<sup>(1)</sup>



# Phoenix ISR Operation: Potential to be one of the lowest cost uranium mining operations





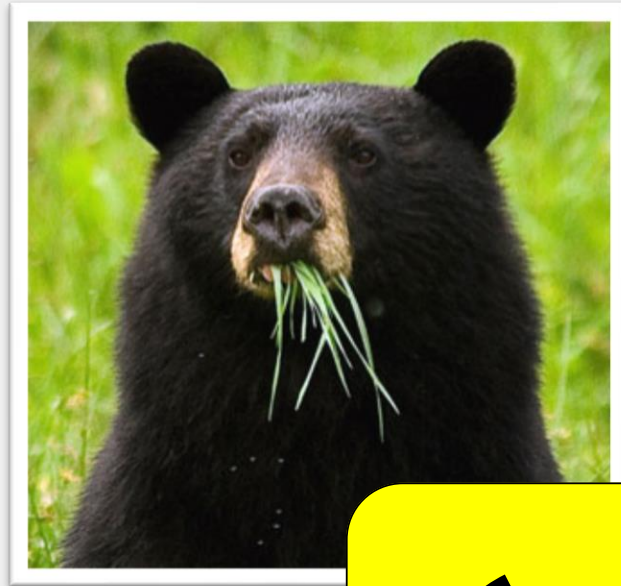
# Wheeler River Site Visit Introductions

## Management & Technical Team:

- David Cates – President & CEO
- Mac McDonald – VP Finance & CFO
- Tim Gabruch – VP Commercial
- Dale Verran – VP Exploration
- Chad Sorba – Technical Services Manager
- Carolanne Inglis-McQuay – CSR Manager
- Pam Bennett – Environment Manager
- Jared Orynik – Project Manager, Project Dev.
- Clark Gamelin – Project Manager, Exploration
- Shae Frosst – Corp. Dev. & IR Manager



## Wheeler River Site Visit: Safety and site orientation



<b>Side by side ATVs:</b>	Wear seatbelts, maintain safe speeds, beware of oncoming traffic and surroundings.
<b>Wildlife:</b>	Stay calm, slowly back away to vehicle, follow your Denison host
<b>Rough terrain:</b>	Tripping hazards, uneven surfaces
<b>UV exposure:</b>	Wear hat, apply sunscreen, stay hydrated
<b>Radiation safety:</b>	Time, Distance, Shielding ALARA (As Low As Reasonably Achievable) PPE (Personal Protective Equipment) Personal Decontamination

**IMPORTANT:** During the visit, the project site will be active. Accordingly, there are hazards that you may need to be made aware of during the field tour. Always listen to and follow instructions from your Denison hosts during the visit.



# Wheeler River 2019 Field Tour





## Station #1 – Gate House

Future home of the Phoenix ISR uranium mining operation

### Site Location

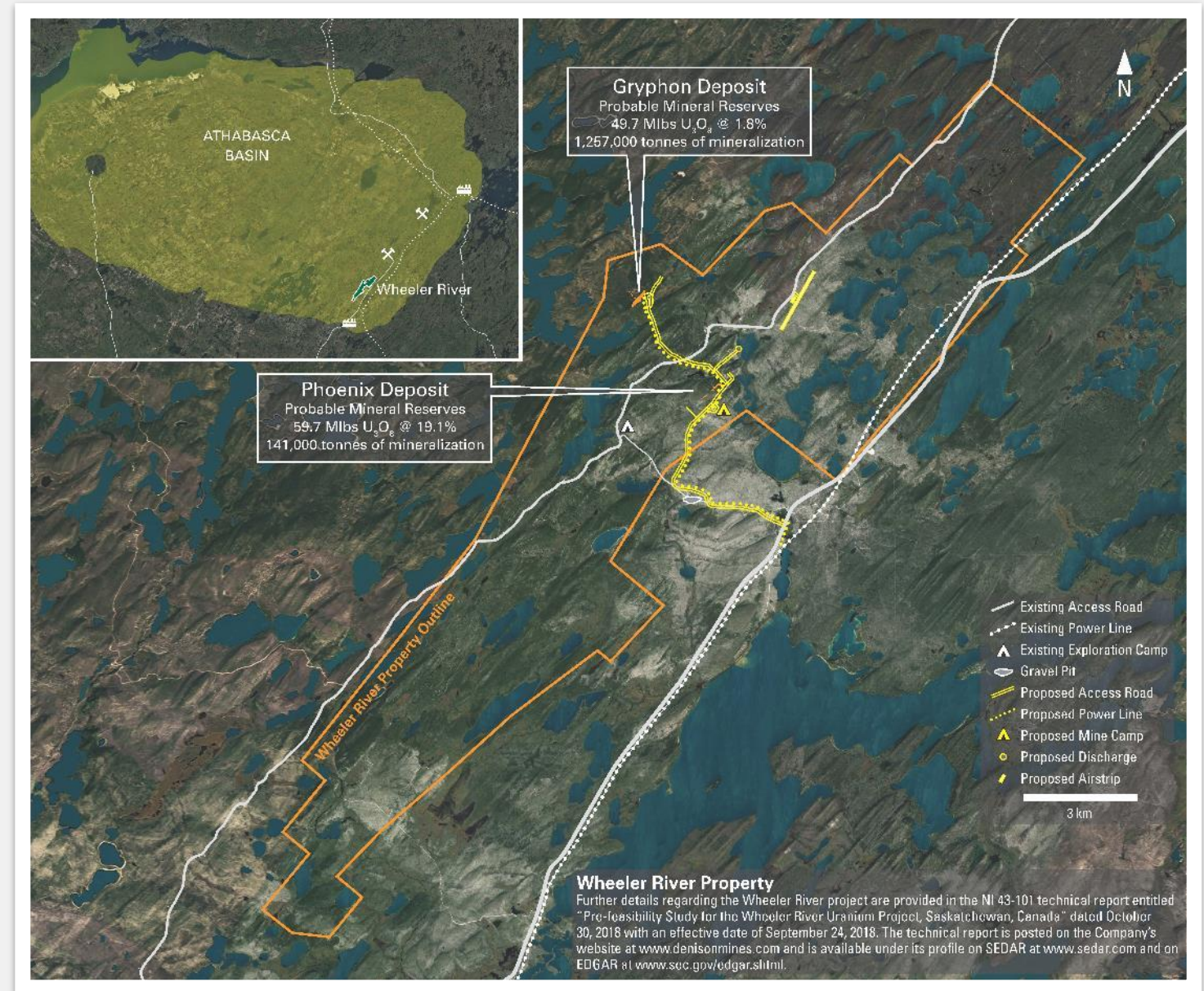
- 35 km north-northeast of the Key Lake mill and 35 km southwest of the McArthur River uranium mine in the southeastern portion of the Athabasca Basin region

### Existing Regional Infrastructure

- Highway 914 - eastern edge of property
- Provincial power grid – SaskPower transmission line along Highway 914

### Planned Site Infrastructure

- ~7km site road connection to Highway 914 outlined in Project Description
- Powerline connection to SaskPower transmission line
- Airstrip (1600 m length) and associated site road to allow for transport of staff



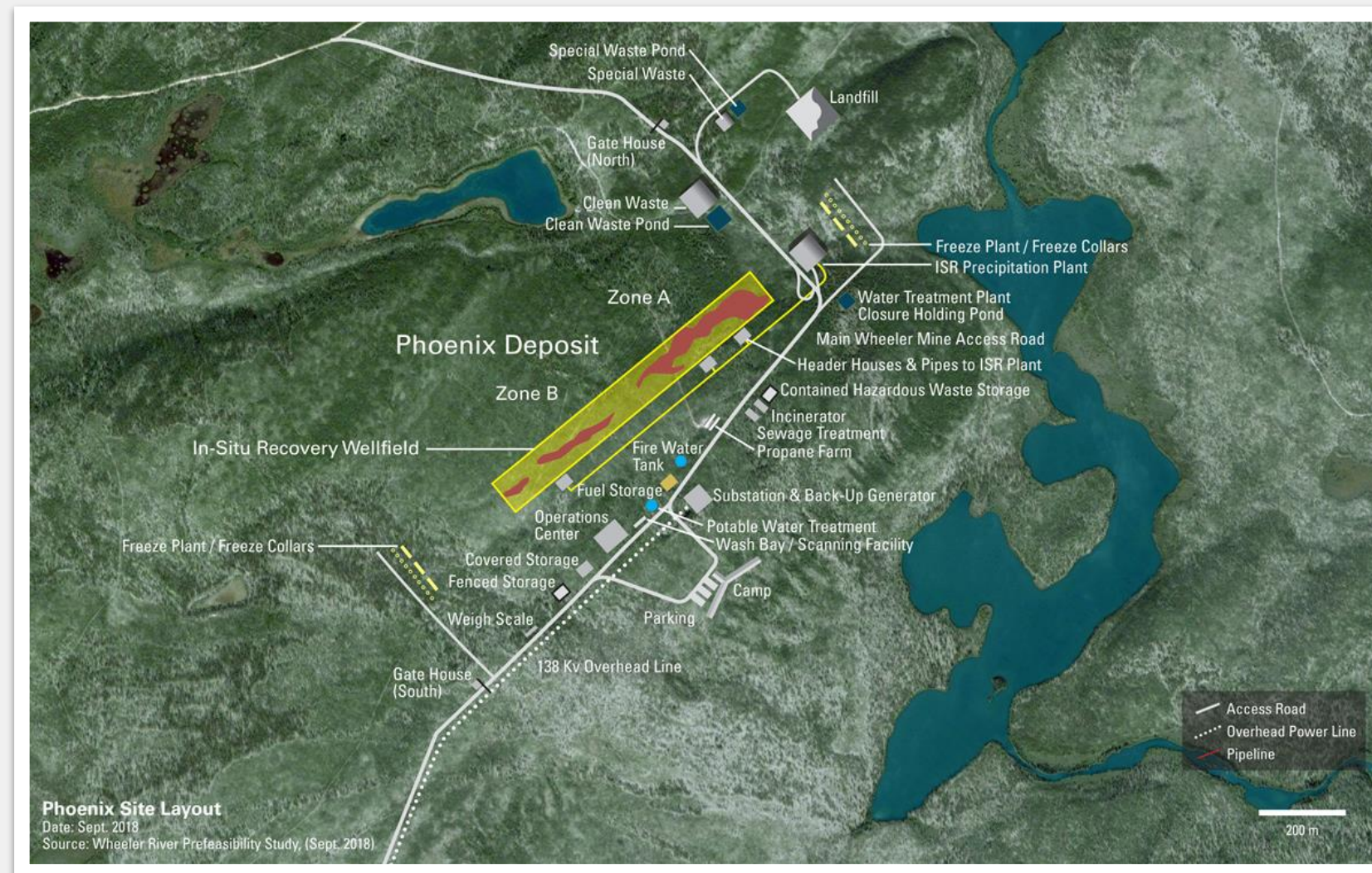


## Station #1 – Gate House

Future home of the Phoenix ISR uranium mining operation

### Evolution of Site Design

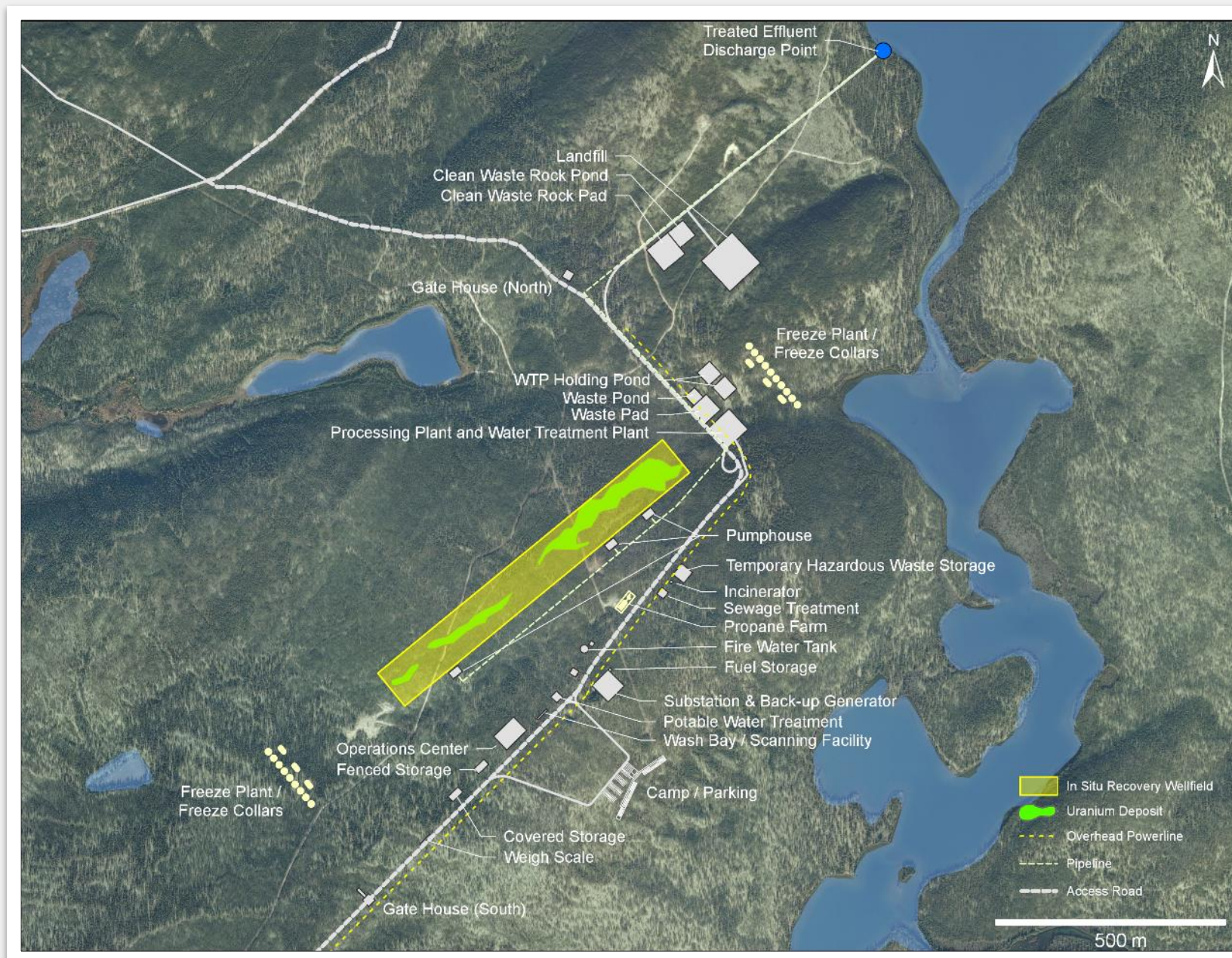
- Site infrastructure design from PFS (September, 2018) shown opposite
- Updated site infrastructure design submitted for the Project Description shown on next page
- Ongoing efforts to optimize site layout to minimize capital expenditure requirements and impacts to the environment





## Station #1 – Gate House

Future home of the Phoenix ISR uranium mining operation



### Key Site Elements:

- ~150 person camp facility
- Site operations centre
- ISR wellfield
- Freeze plants
- Processing plant / WTP
- Potential WTP holding ponds and treated effluent discharge point
- Warehousing and fuel storage facilities
- Back-up power generators
- Wash bay, scanning and weight scale facilities
- Potable and waste water treatment / storage



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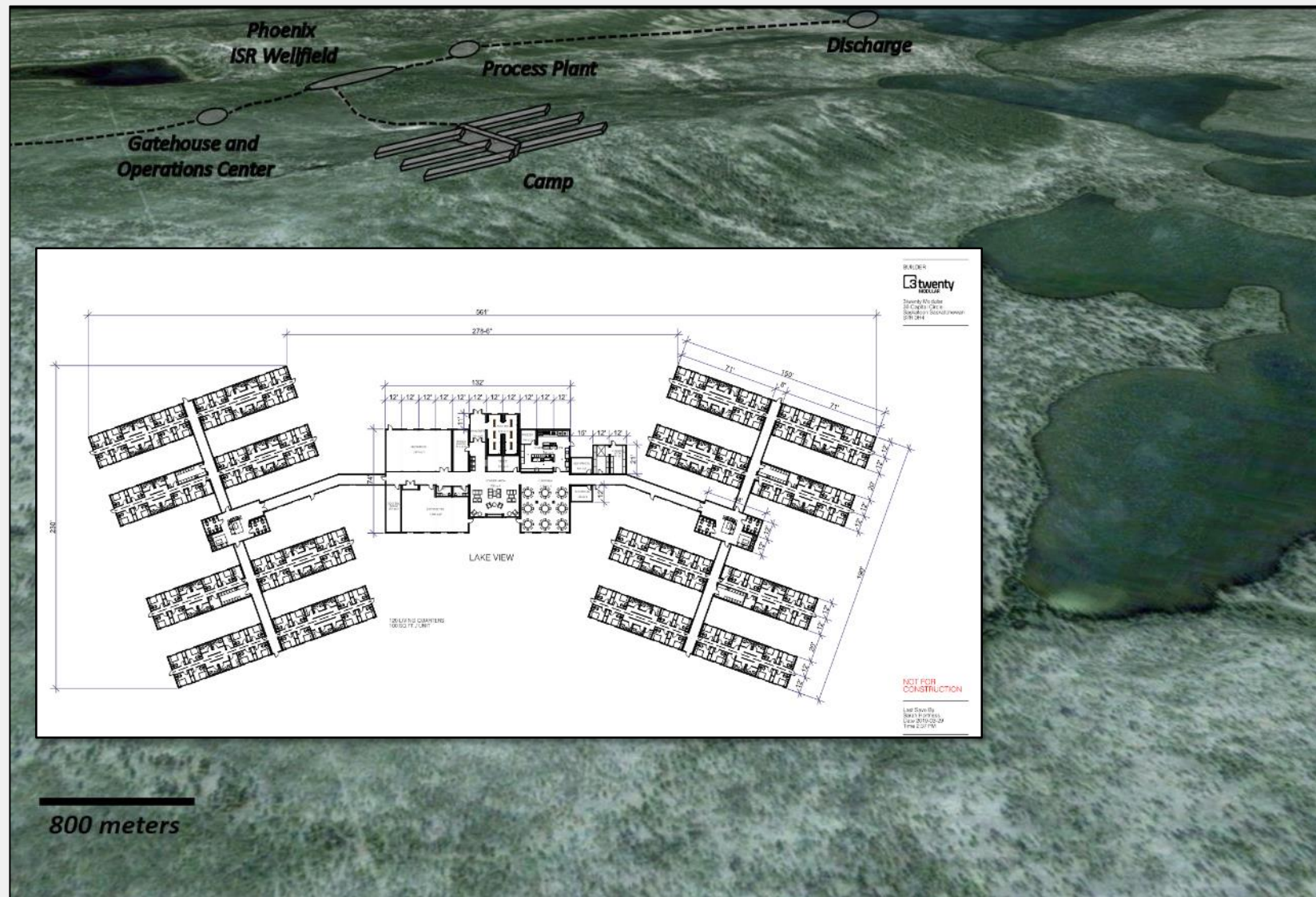
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## Station #2 – Phoenix Camp

### Designing a home away from home



### Preliminary Camp Design Features:

- ✓ ~150-person capacity
- ✓ Pre-fabricated design
- ✓ Single-occupancy units
- ✓ Kitchen & recreation facilities
- ✓ Situated within walking distance to work sites
- ✓ Common areas for relaxing, using the computer, doing laundry
- ✓ Layout to promote healthy lifestyle and enjoyment of the surrounding setting (lake view, fishing, etc.)



## **Station #2 – Phoenix Camp**

### **Building a local workforce**

#### **Potential employment opportunities associated with ISR mining operation:**

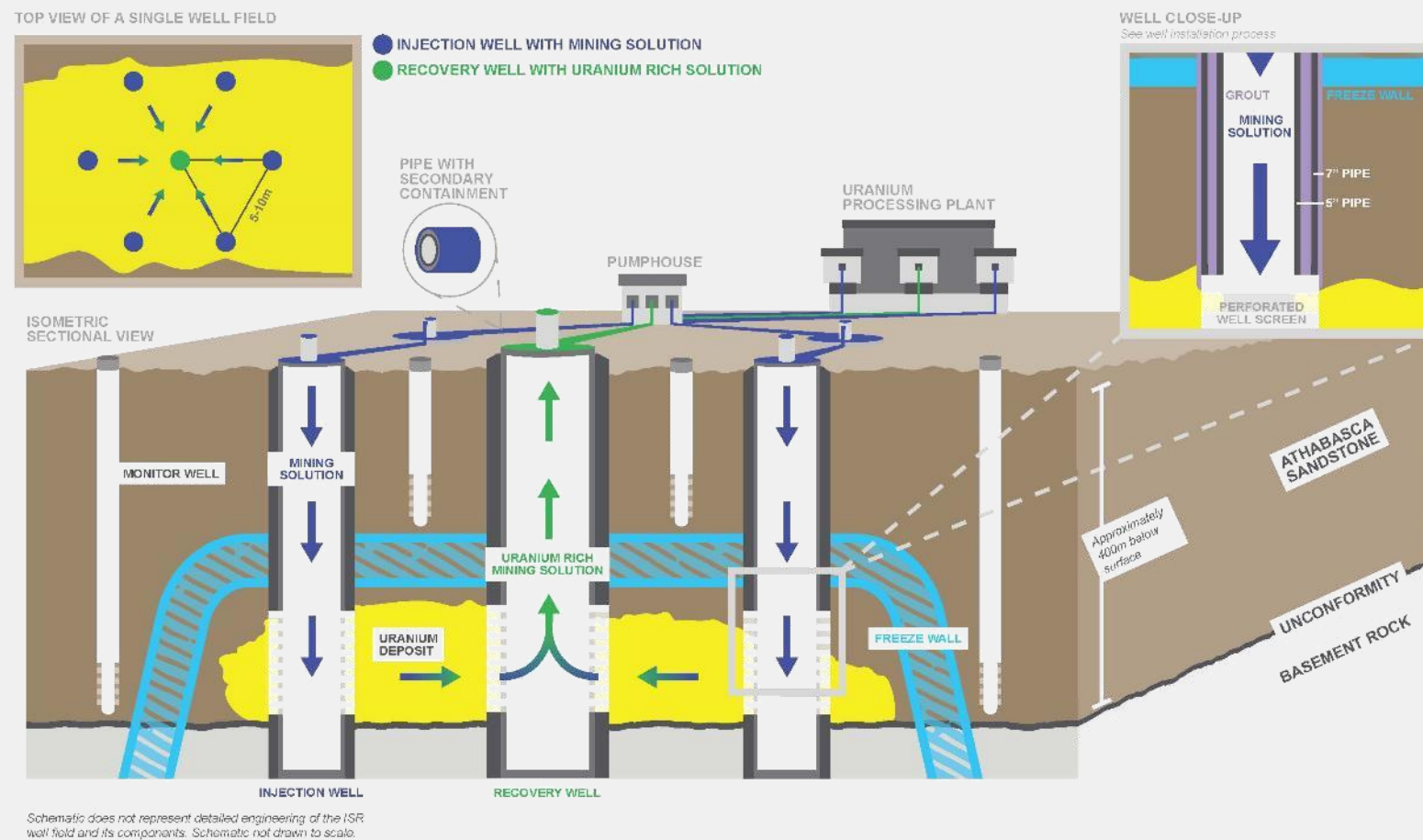
- Targeted to Wheeler Partner Communities
- Up to 300 jobs during ~2 years of construction
- Approximately 100 jobs during operation of the planned ISR mining operation
- Opportunities similar to other uranium mining operations (processing plant, camp, security and EH&S roles)
- Various unique opportunities specific to an ISR mining operation, which will require diploma or technical certification available in Saskatchewan. Examples:
  - ✓ Process Operation Technician (SIIT in Meadow Lake)
  - ✓ Chemical Technology (Sask Polytechnic)
- In-house training programs can be developed once operations begin
- ISR mining positions are all surface-based
- Expected to operate as a fly-in / fly-out operation from planned Wheeler River airstrip





## Station #3 – ISR Wellfield

Bringing the world's lowest cost uranium mining method to the jurisdiction hosting the world's highest-grade uranium deposits



### ISR Mining Process<sup>(1)</sup>:

1. Mining solution (also known as "lixiviant") is pumped through a permeable orebody via injection well;
2. Lixiviant dissolves the uranium as it travels through the orebody;
3. Uranium rich mining solution (also known as uranium bearing solution or "UBS") is pumped back to surface via recovery well;
4. UBS is sent to a processing plant on surface for chemical separation of the uranium and reconditioning of lixiviant;
5. Lixiviant is returned back to well field for further production



## Station #3 – ISR Wellfield

Phoenix Geology:  
Unique uranium deposit  
with exceptionally high grades

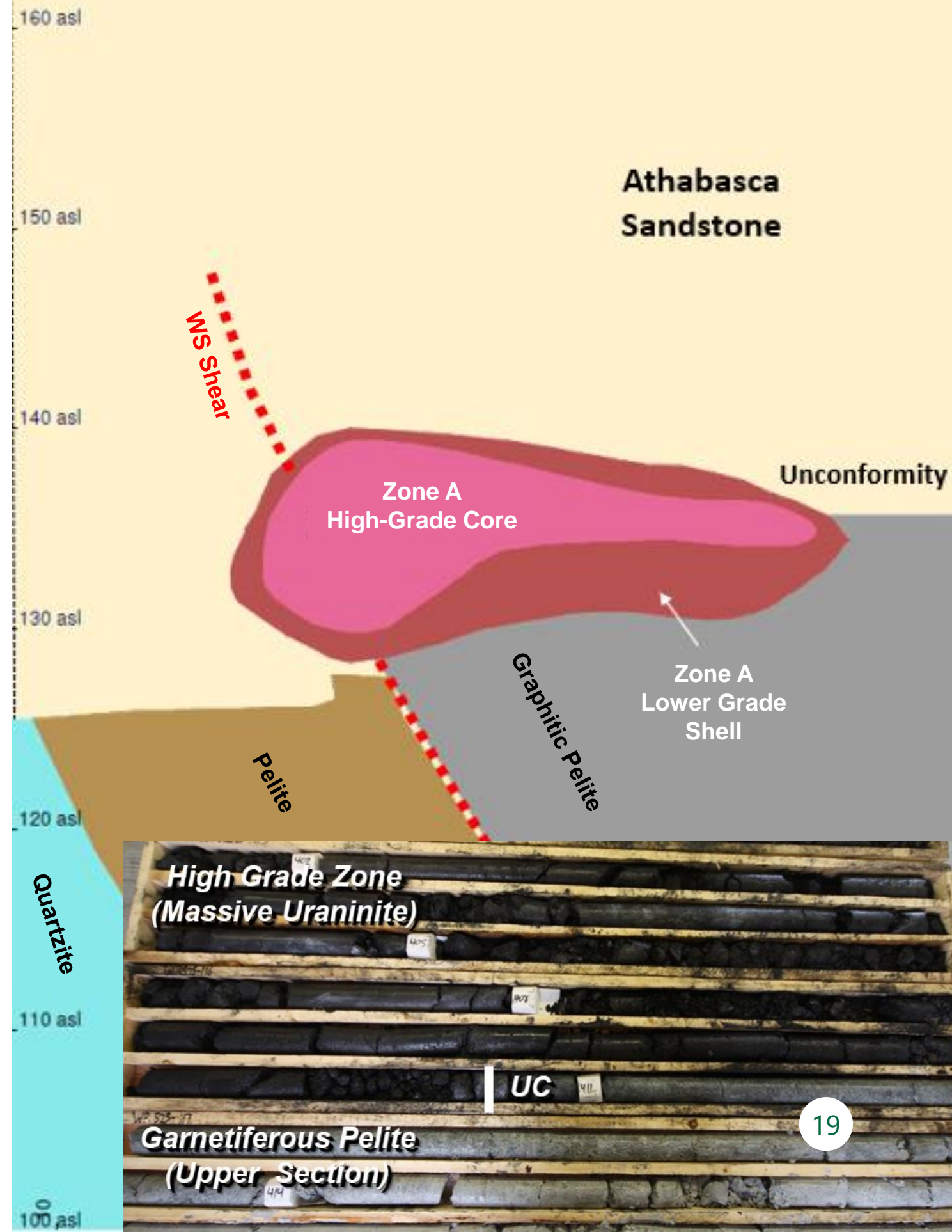
### Highlights<sup>(1)</sup>:

- Mineralization is situated at or immediately above the unconformity ("UC")
- Two distinct ore zones – Phoenix A + B
- Approximately 400 m below surface
- World's highest-grade undeveloped uranium deposit
- Indicated Mineral Resources 70.2 M lbs  $U_3O_8$  (166,000 tonnes at **19.1%  $U_3O_8$** )
  - Includes 59.9 M lbs  $U_3O_8$  estimated for Phoenix Zone A High-Grade Core (62,900 tonnes at **43.2%  $U_3O_8$** )
- Inferred Mineral Resources 1.1 M lbs  $U_3O_8$  (9,000 tonnes at 5.8%  $U_3O_8$ )
- Cut-off grade of 0.8%  $U_3O_8$
- ✓ Geological setting expected to be amenable to ISR mining, with ~90% of the mineral resource (contained metal) hosted in sandstone



**NOTES:** (1) Refer to the Wheeler River Technical Report titled "Pre-feasibility Study Report for the Wheeler River Uranium Project, Saskatchewan, Canada" dated September 24, 2018 for further details regarding the mineral resources estimated for the Phoenix deposit.

## Phoenix Zone A - Schematic Cross Section



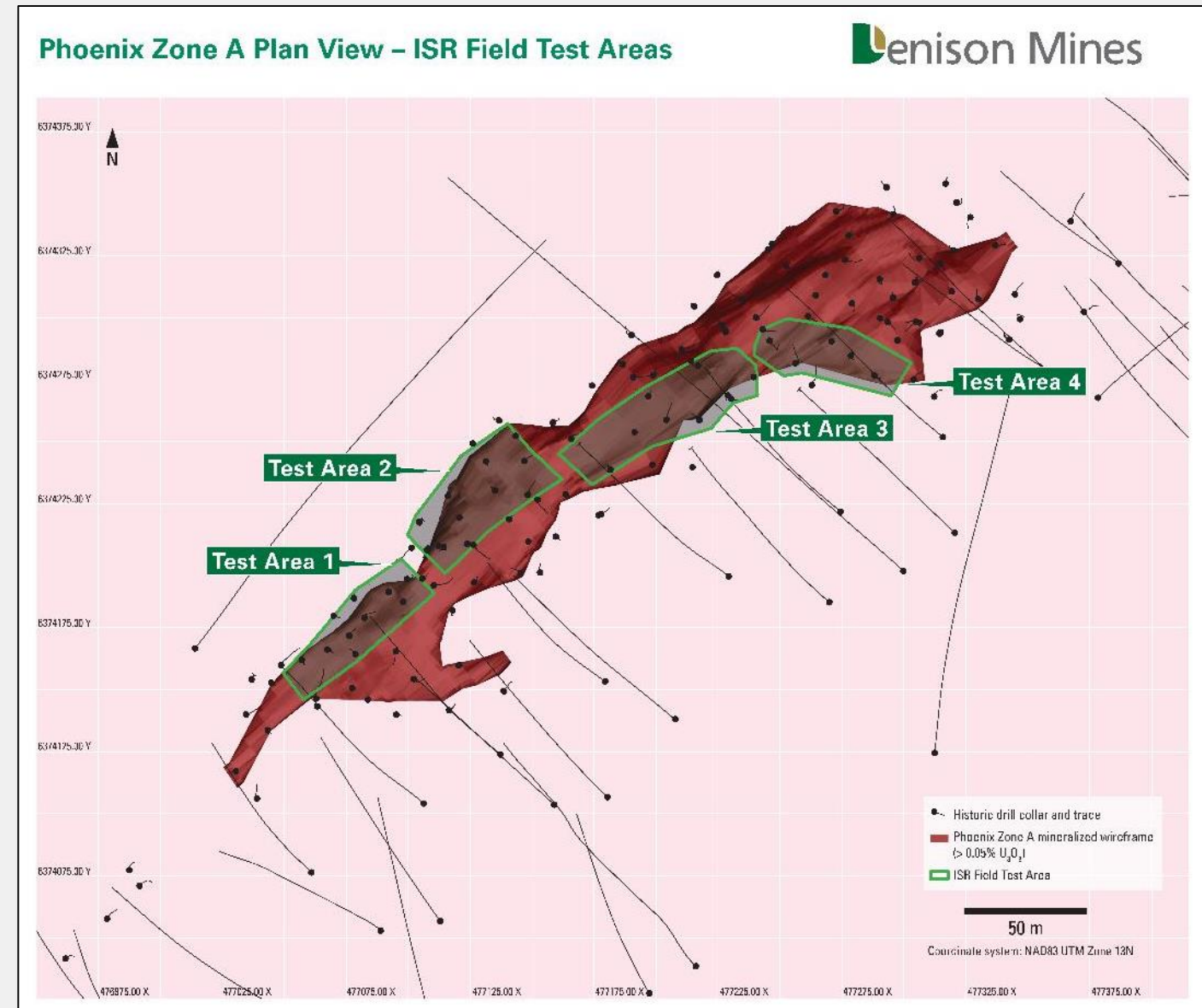


## Station #3 – ISR Wellfield

### First of its kind ISR Field Test in the Athabasca Basin

#### ISR Field Test Objectives:

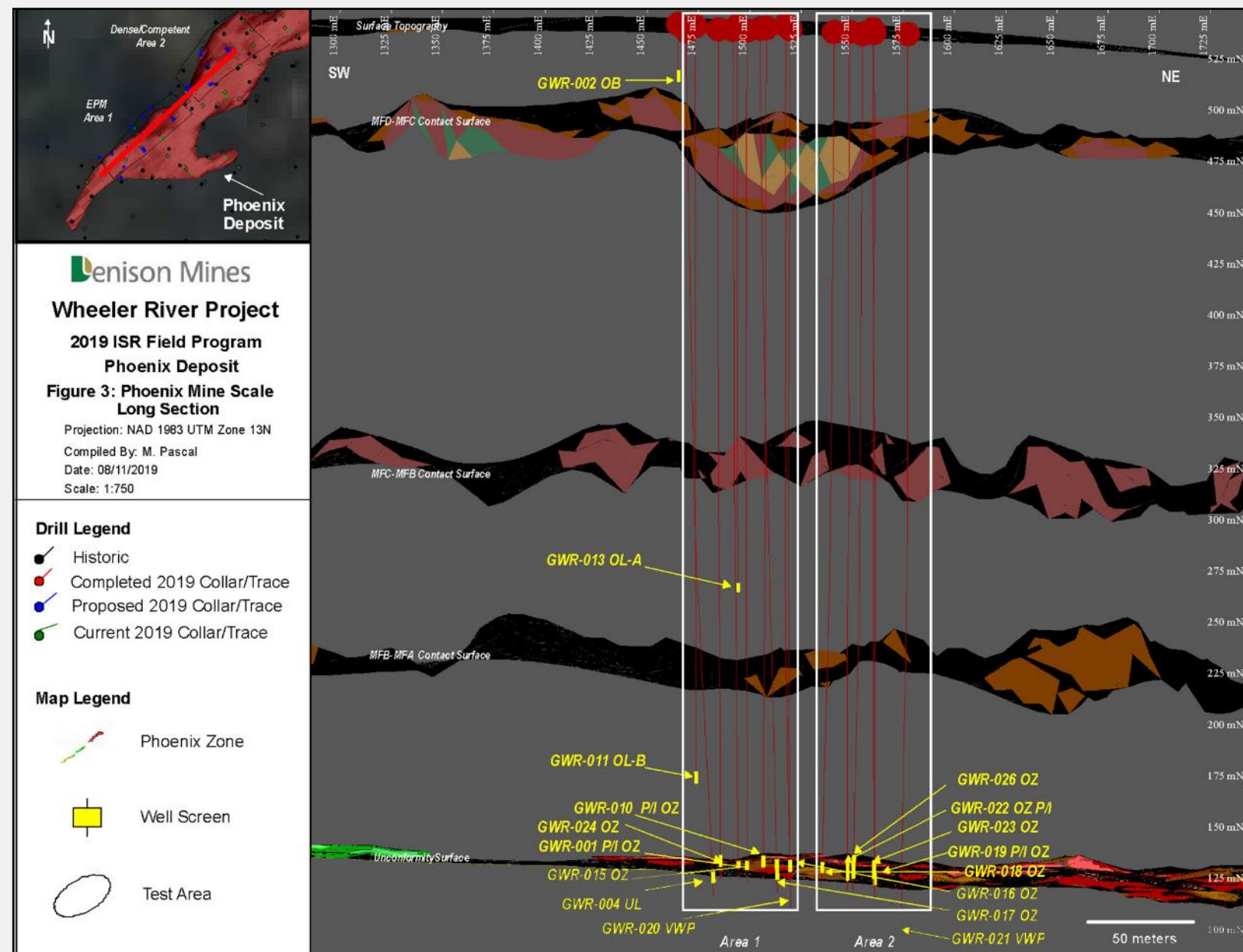
- In-situ field work is necessary to increase the confidence / reduce the risks associated with application of the ISR mining method at Phoenix
  - ✓ Data required for detailed hydrogeological modelling
  - ✓ Forms the basis for ISR wellfield and freeze dome design necessary for the FS and to support the EIA process.
- Phoenix deposit divided into four (4) representative test areas
  - ✓ Intended to cover each of the various fluid flow domains expected within the deposit
  - ✓ Test areas expected to cover ~65% of the Indicated Mineral Resources estimated for the Phoenix deposit





## Station #3 – ISR Wellfield

First of its kind ISR Field Test in the Athabasca Basin



### Summer 2019 ISR Field Test:

- Designed to acquire data from Test Areas 1 and Test Area 2
- In-situ testing in the orebody, and surrounding areas, using water to evaluate hydraulic conditions
- 29 wells (17 Phoenix wells + 12 regional wells) installed to allow for preliminary testing
- Existing exploration holes used for installation of near vertical wells, where possible
- One large-diameter well (commercial-scale) planned for each Test Area following preliminary evaluations
- Possible evaluation of certain permeability enhancement techniques

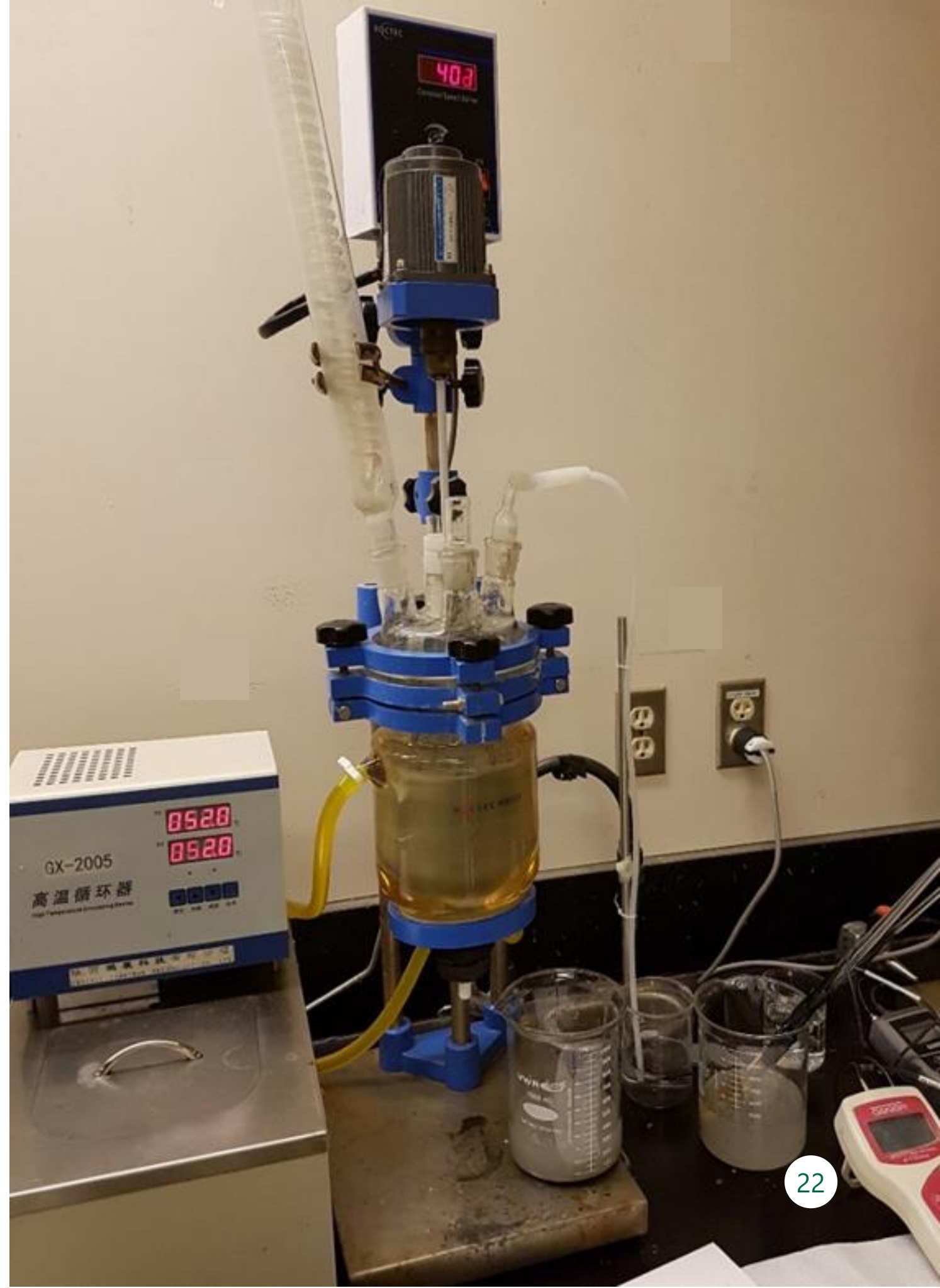


## Station #4 – ISR Processing Plant

### Phoenix PFS Test Work<sup>(1)</sup>: Confirms suitability of ISR mining method

Field and laboratory work included drill hole injection, permeability, metallurgical leach, agitated leach and column testing

- **Excellent Recoveries:** High rates of recovery in extraction (+90%) and processing (98.5%)
- **High Grade:** Agitated leach and column tests returned uranium concentrations of 12 to 20 grams per litre (g/L) – significantly higher than conventional low-grade ISR operations
- High uranium concentrations in the mining solution, plus low level of impurities (deleterious elements), allows for **direct precipitation of uranium**
- ✓ **No need for ion exchange or solvent extraction circuits = reduced costs**



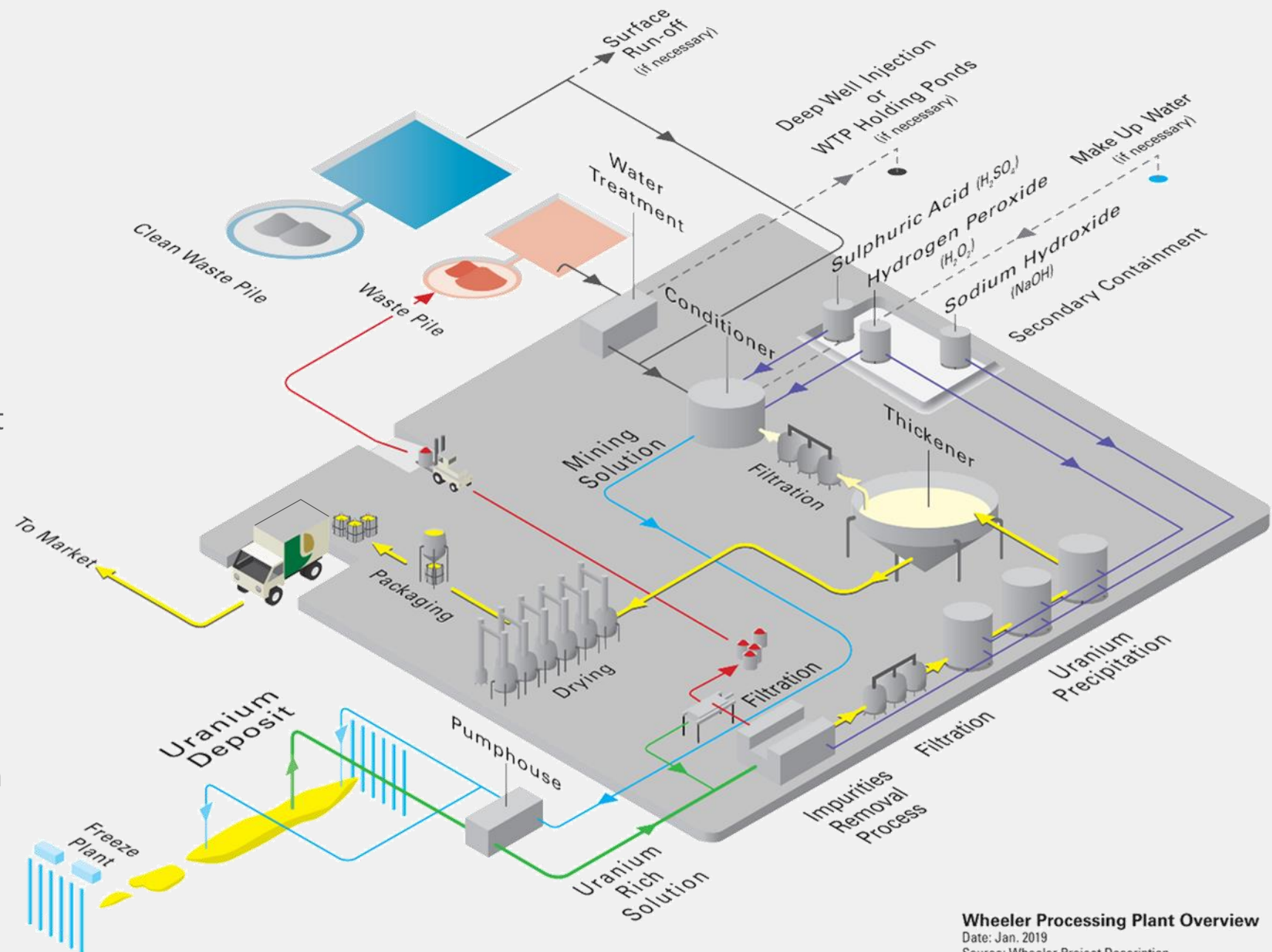


## Station #4 – ISR Processing Plant

### On-site processing to Yellowcake Uranium

#### On-Site Processing Plant<sup>(1)</sup>

- Annual production between 6 and 12 million lbs  $U_3O_8$  – depending on uranium concentrations from wellfield (10 g/L  $\rightarrow$  6M lbs  $U_3O_8$  / year)
- No crushing or grinding circuits required – results in small footprint
- Low impurity solution allows for direct precipitation and eliminates need for ion exchange or solvent extraction
- Potential for closed loop system that recycles mining solution back to ISR wellfield with little to no discharge of effluents
- Drying/calcining to be done on-site in preparation for market
- Plant to be powered by provincial power grid



**Wheeler Processing Plant Overview**  
Date: Jan. 2019  
Source: Wheeler Project Description



## Station #5 - Freeze Plant & Collars

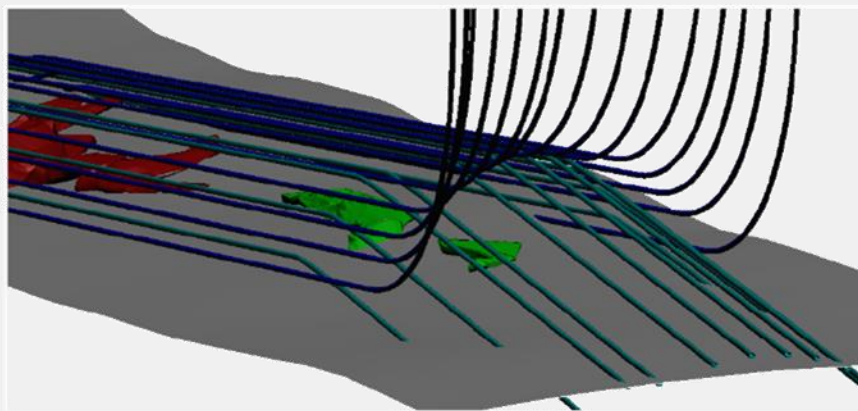
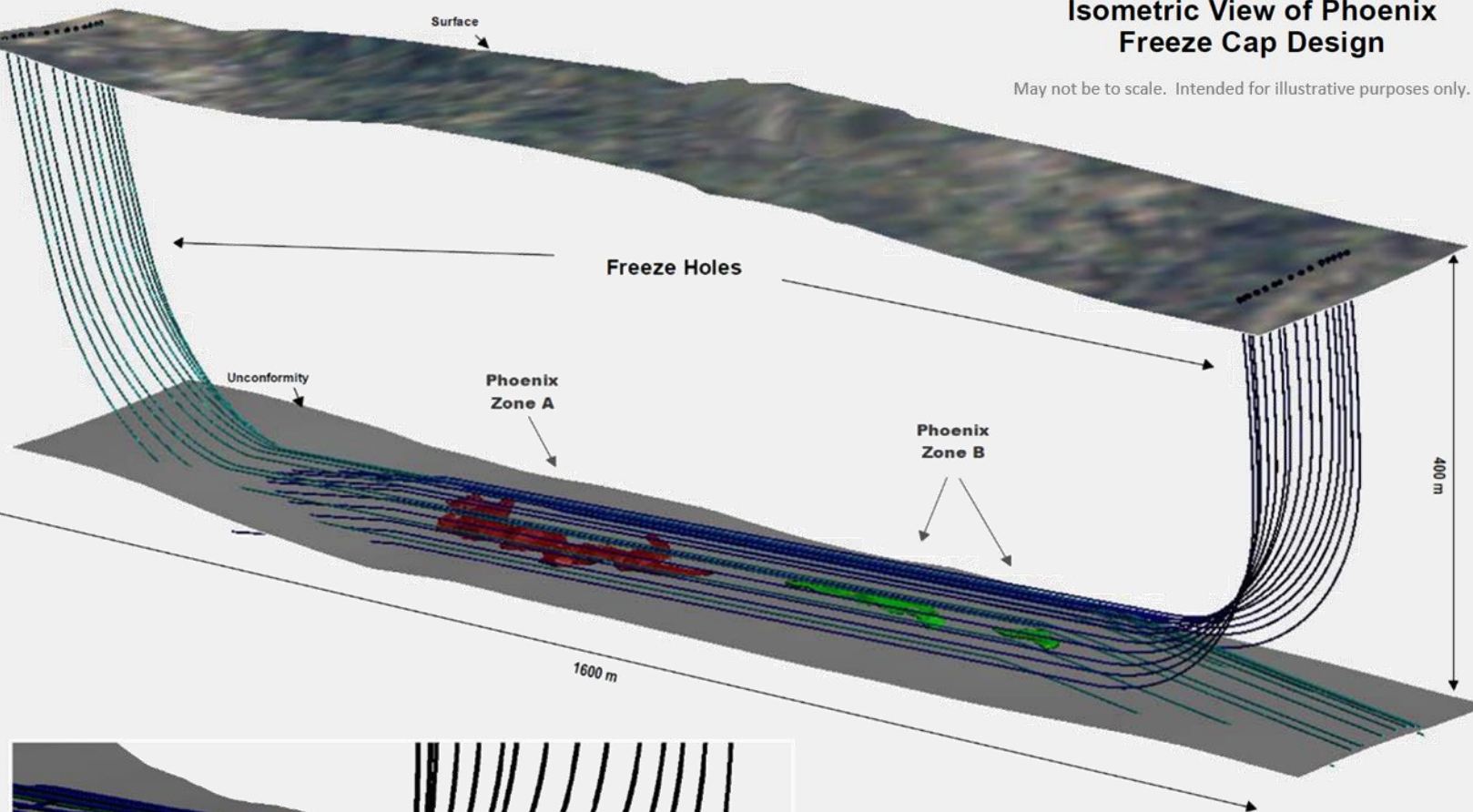
Novel concept to contain lixiviant, using established technology

Isometric View of Phoenix Freeze Cap Design

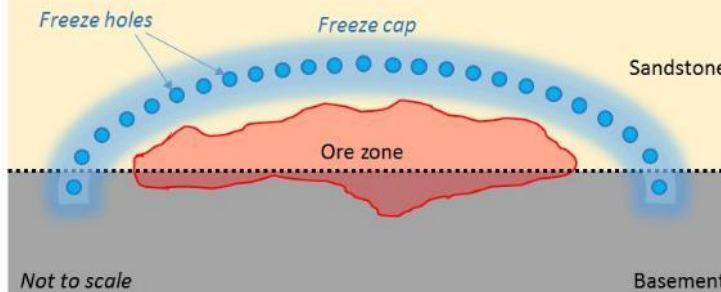
May not be to scale. Intended for illustrative purposes only.

**Artificial freeze cap replicates confining layer typically required for ISR mining operations<sup>(1)</sup>**

- Parallel cased holes drilled from surface and anchored into impermeable basement rock surrounding the Phoenix deposit
  - Circulation of low-temperature brine solution through cased pipes will freeze groundwater in sandstone surrounding the deposit
  - 10 metre thick freeze wall, together with basement rocks will encapsulate Phoenix deposit
- ✓ **Eliminates common environmental concerns with ISR mining and facilitates controlled reclamation**



Freeze Cap Schematic – Cross-Section



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## Station #6 – Environment & Community

### Environmental benefits of ISR mining

#### Advantages of ISR mining compared to existing uranium mining in Canada:

- ✓ Small surface footprint
- ✓ Lower water consumption
- ✓ Lower energy consumption
- ✓ Potentially near zero CO<sub>2</sub> emissions
- ✓ Small volume (potentially zero) treated effluent released to surface water bodies
- ✓ Potential for lower radiation doses to workers
- ✓ No tailings production
- ✓ Very small volumes of clean waste rock (sandstone core from wellfield development)



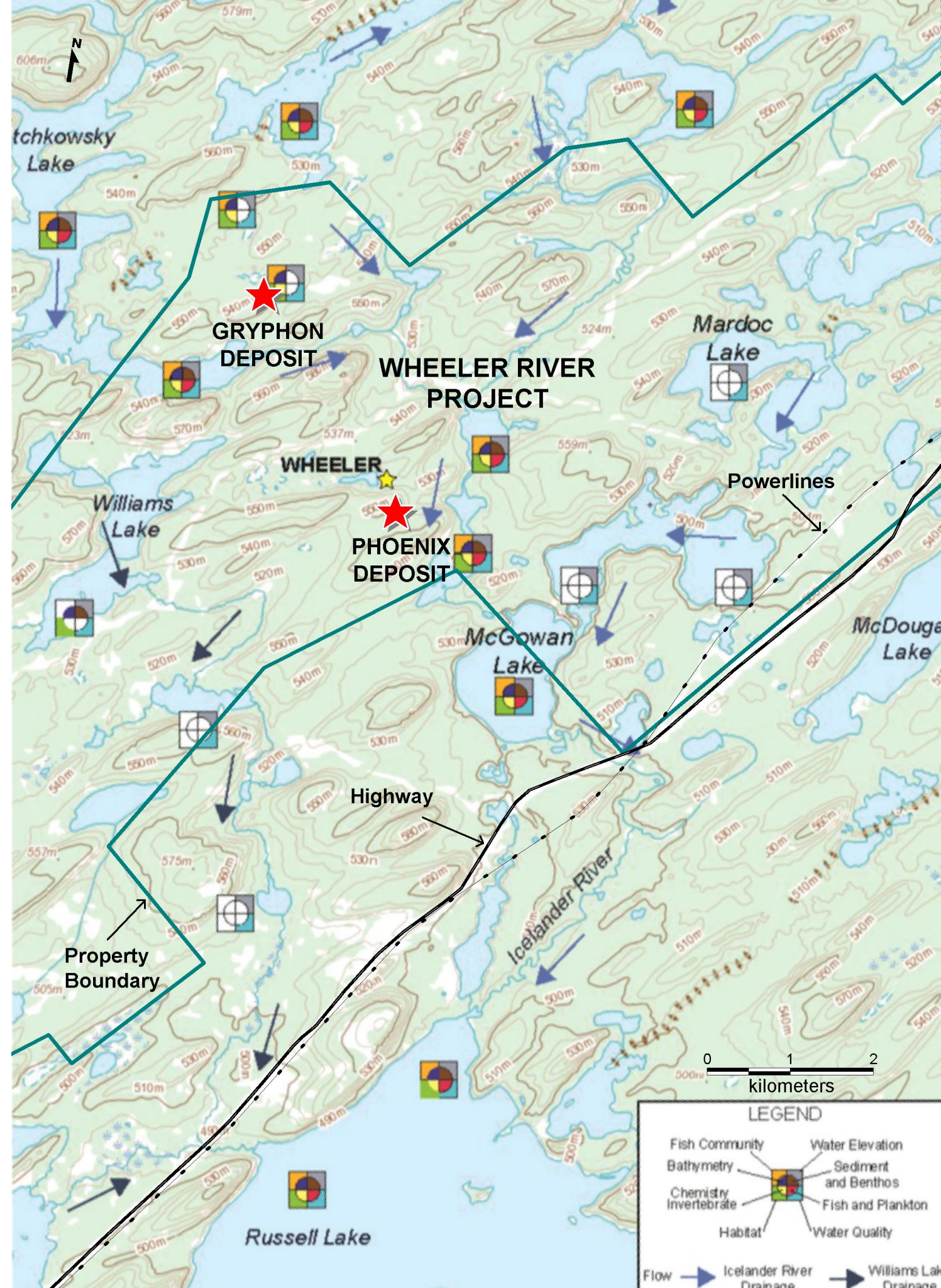


## Station #6 – Environment and Community

### Environmental baseline studies

### Foundation of the environmental impact assessment

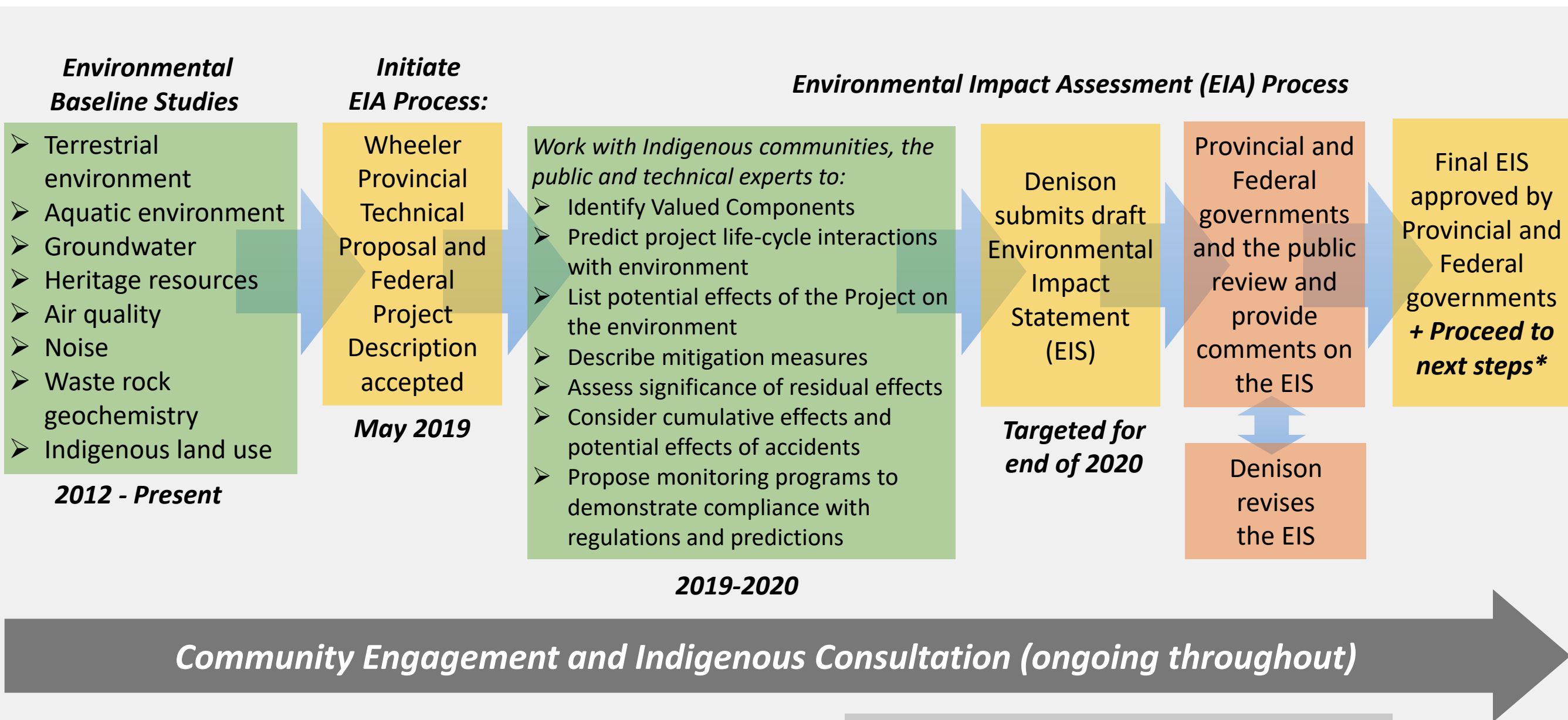
- Environmental baseline studies provide an understanding of current or existing conditions
- Overlay the proposed Project with the existing environment
- Identify where Project activities or components could interact with the environment
- ✓ **Having a robust baseline dataset allows Denison to more accurately predict potential environmental effects**





## Station #6 – Environment and Community

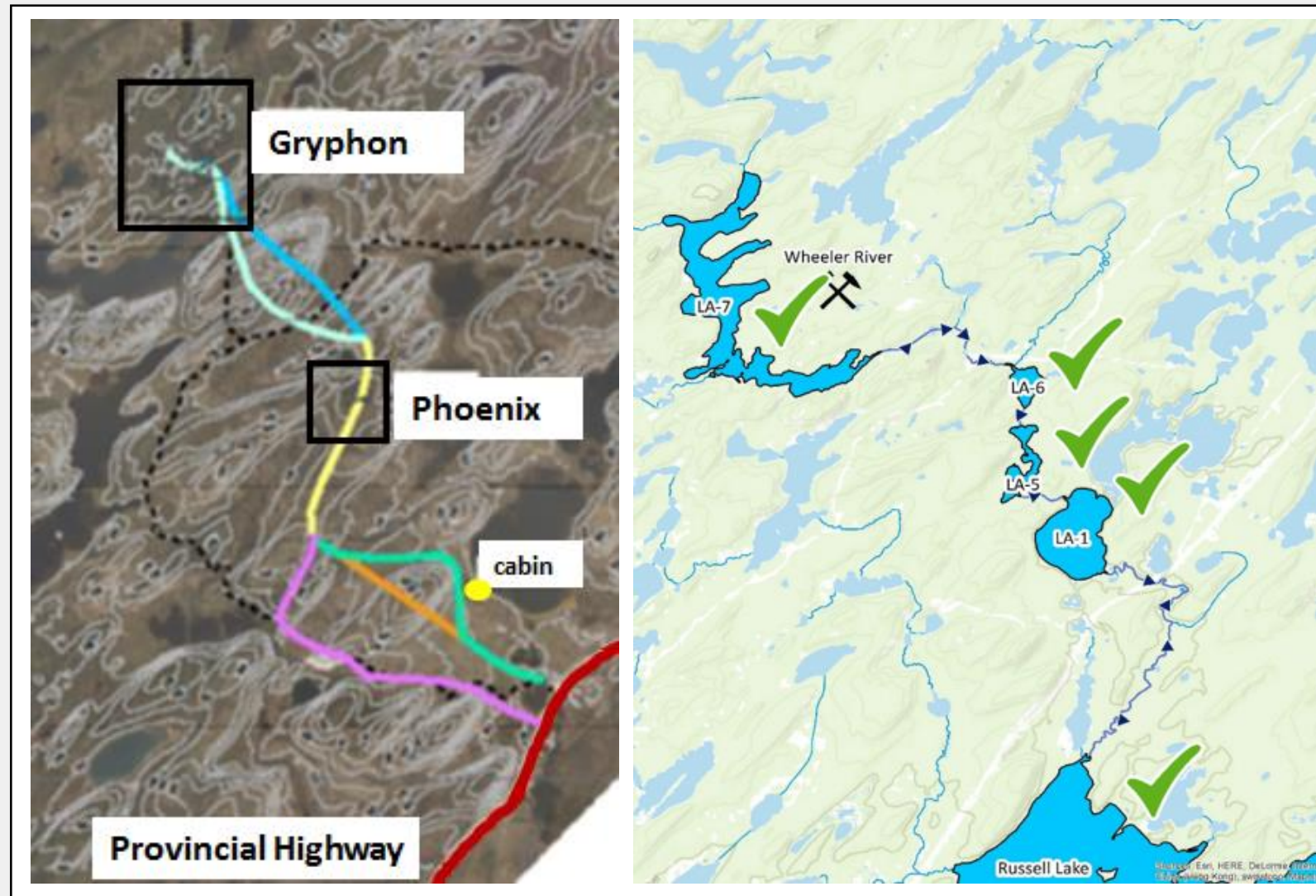
### The environmental impact assessment process



*\*Following final EIS approval, next steps involve commencement of detailed engineering, licensing, permitting, approvals to operate, and ultimately construction*

## Station #6 – Environment and Community

Committed to collaborative engagement with all interested parties



### Project design informed by collaborative engagement:

- ✓ Evaluation of alternative mining methods for the Phoenix deposit (ISR mining method)
- ✓ Selection of preferred route for the site access road and power line from existing provincial highway and transmission line
- ✓ Selection of preferred location for possible effluent discharge to surface water bodies



## **Station #6 – Environment and Community**

Committed to collaborative engagement with all interested parties



### **Denison's Approach:**

1. Present meaningful and relevant information in culturally appropriate format and language
2. Incorporate comments and recommendations into project decisions to minimize project impacts
3. Engage interested parties in a variety of ways and in a manner that respects local traditions, culture, timeframes and decision making processes
4. Provide frequent feedback, monitoring and evaluation related to the project and engagement activities

## **Station #6 – Environment and Community**

### Respect for Indigenous communities and knowledge

#### **Denison's Guiding Principles:**

- We acknowledge and respect that we are working within Treaty 10 and the traditional territory of the English River First Nation and the Métis
- We wish to share the land together and work in partnership, to return maximum benefits from the Project to the communities
- We aim to ensure Indigenous Knowledge is deeply respected by our Company and within the environmental assessment process
- We understand the importance of protecting the area in which we are working – the land, the water, the animals, the air, the history
- We have designed the Project to have minimal adverse impacts to Indigenous and Treaty Rights, as well as to the environment



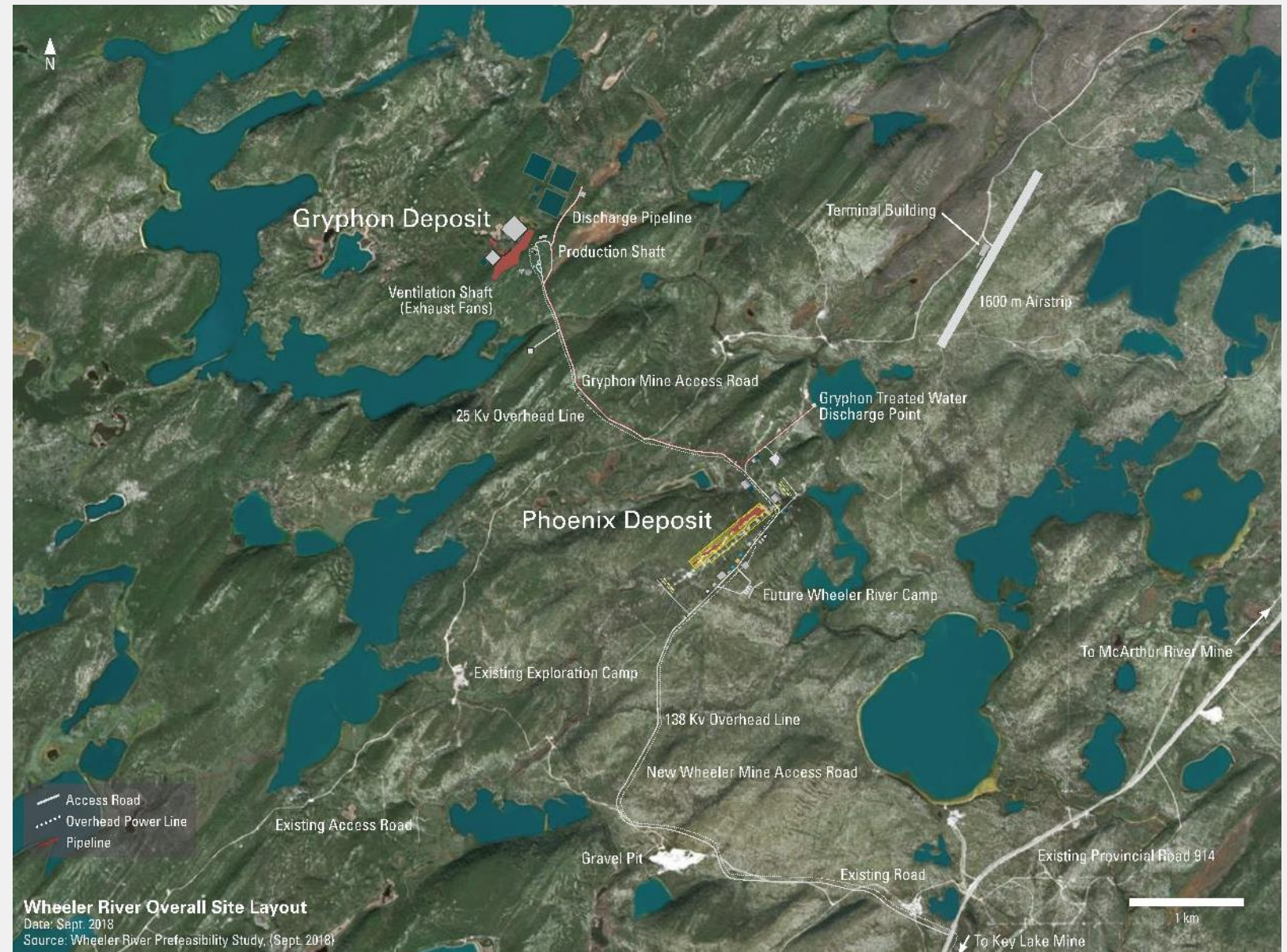


## Station #7 – Gryphon Deposit Turnoff

### Gryphon uranium deposit

#### Highlights:

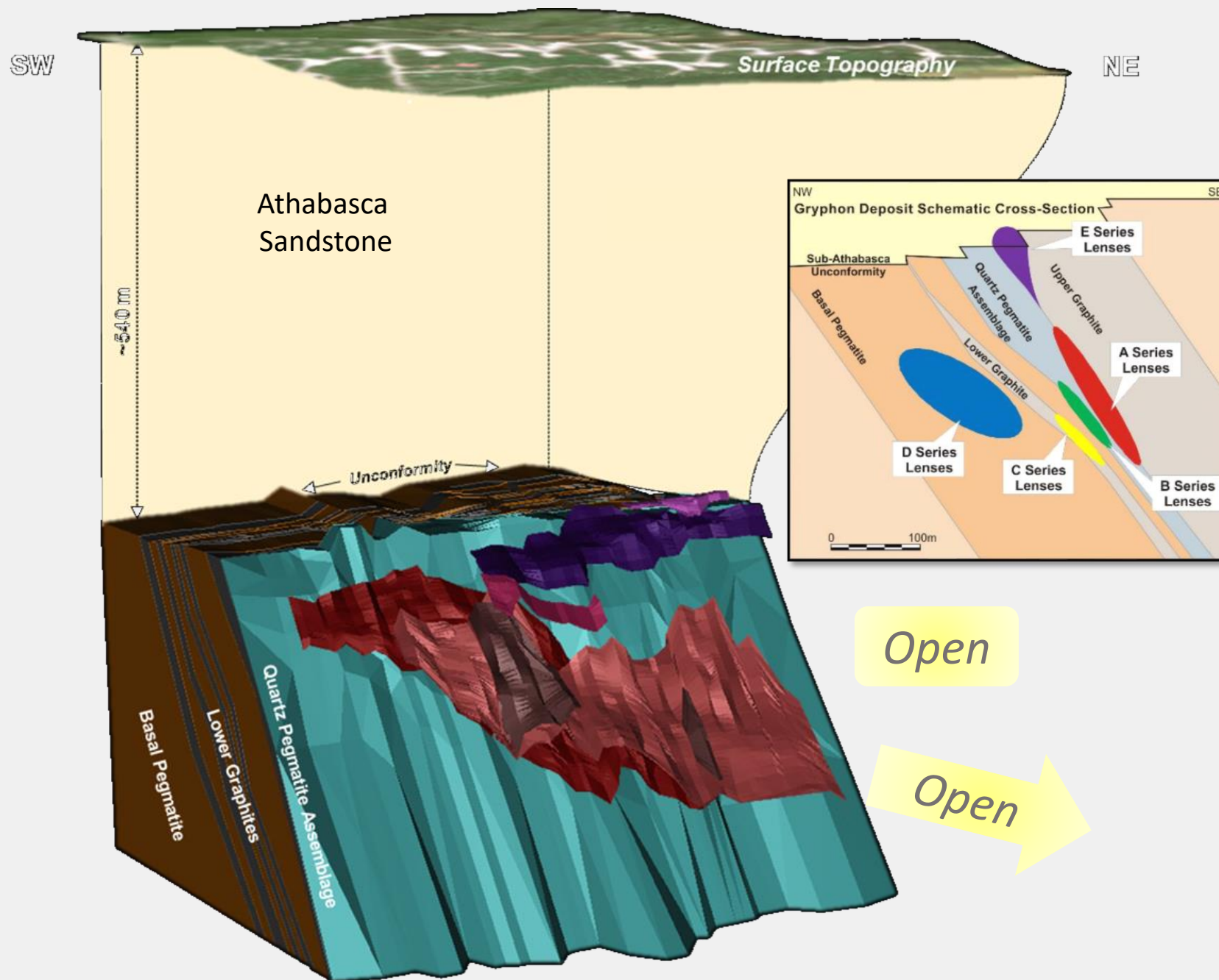
- Basement-hosted, high-grade uranium deposit amenable to conventional underground mining methods
- Not currently approved for advancement, given market conditions – potential to be developed as uranium prices and demand rise in future
- Development expected to make use of existing infrastructure to provide additional low-cost uranium production
- Cash flow from Phoenix operation may be available to fund development





## Station #7 – Gryphon Deposit Turnoff

### Gryphon uranium deposit



### Gryphon Geology & Estimated Mineral Resources

- 'Ingress-style' deposit occurring dominantly within crystalline basement rocks below the sub-Athabasca unconformity
- Consists of numerous stacked lenses of mineralization which are parallel to the dominant foliation and fault structures
- Indicated Mineral Resources 61.9 Mlbs  $U_3O_8$  (1,643,000 tonnes at 1.7%  $U_3O_8$ )
- Inferred Mineral Resources 1.9 Mlbs  $U_3O_8$  (73,000 tonnes at 1.2%  $U_3O_8$ )
- Cut-off grade of 0.2%  $U_3O_8$
- ✓ **Deposit remains open for resource expansion down-plunge and within certain areas along strike to northeast**

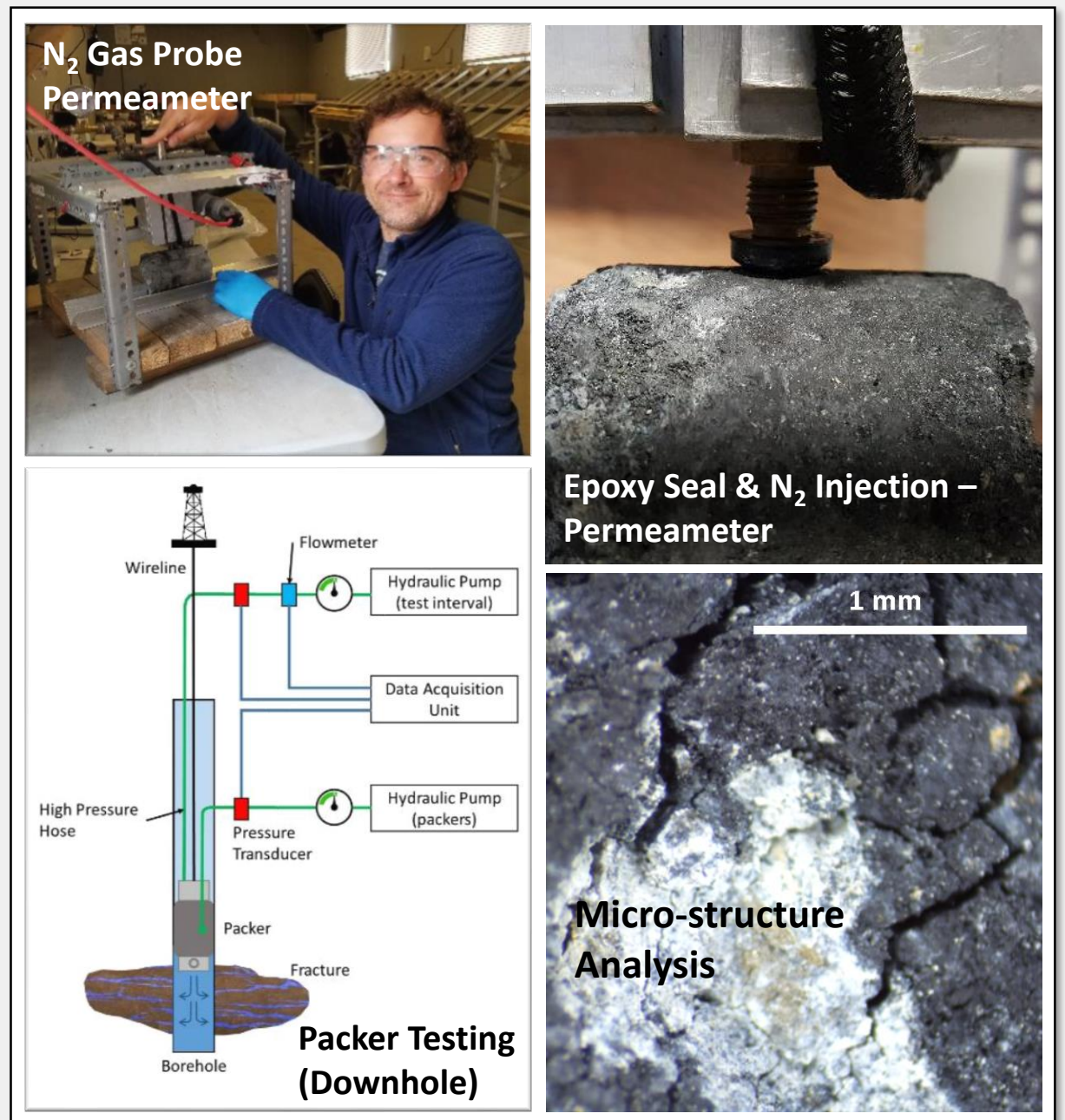


## Station #8 - Hot Shack

### Supportive permeability test work & metallurgical sampling

#### Summer 2019 ISR Field Program designed to facilitate various additional test work:

- Hydraulic conductivity tests (packer testing)
- Downhole geophysics (nuclear magnetic resonance and neutron), where borehole conditions allow.
- Additional mineralized core samples from the orebody, obtained from new drill holes or by wedging from existing boreholes, expected to be subject to the following:
  - Detailed onsite geological and geotechnical (structural & hydrogeological) logging
  - Permeability (permeameter) testing
- Specialized sample collection procedures in place and on-going to allow for metallurgical testing of undisturbed core in future metallurgical test programs

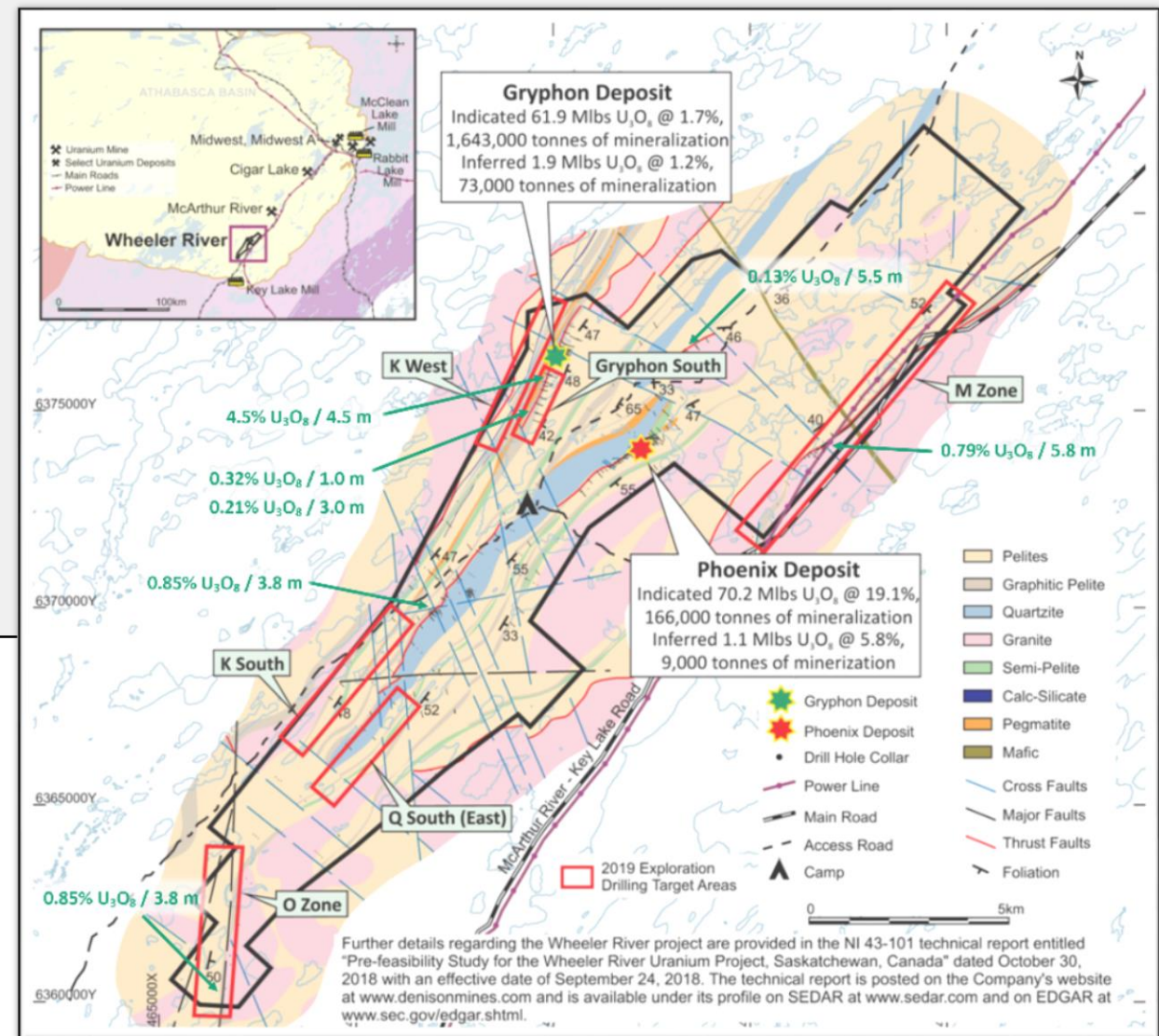
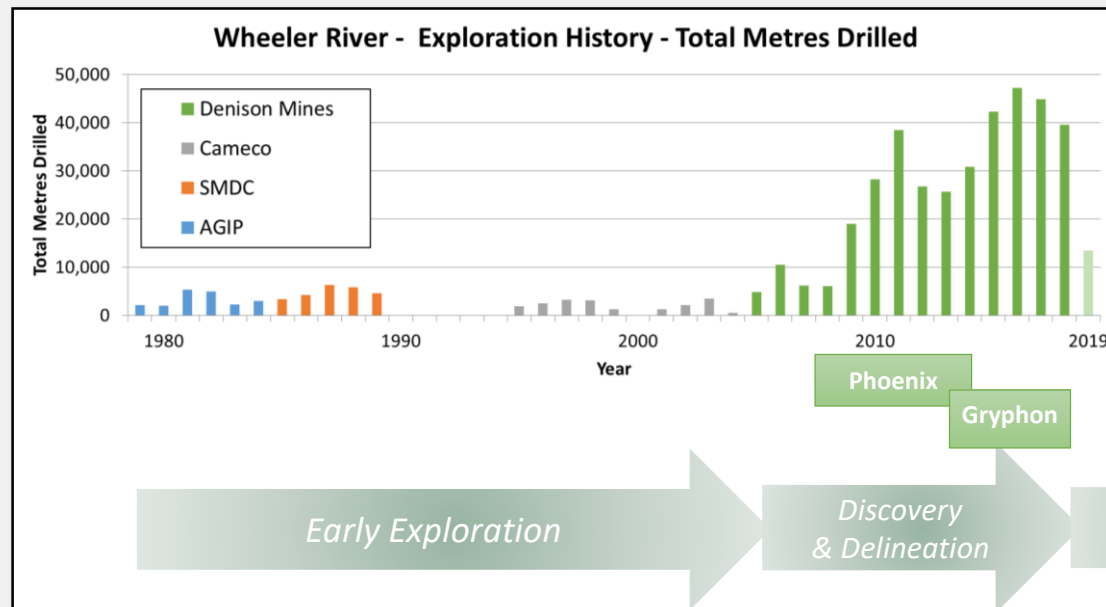


## Station #9 – Core Yard

### Considerable exploration potential remains at Wheeler River

#### Recent Exploration at Wheeler River:

- Targeting under or un-explored areas
- Multiple historic intercepts that warrant follow-up
- Focused on the discovery of additional high-grade deposits with the potential to form satellite ISR operations
- Winter 2019 exploration program included 7,434 metres in 14 holes; summer 2019 program ongoing



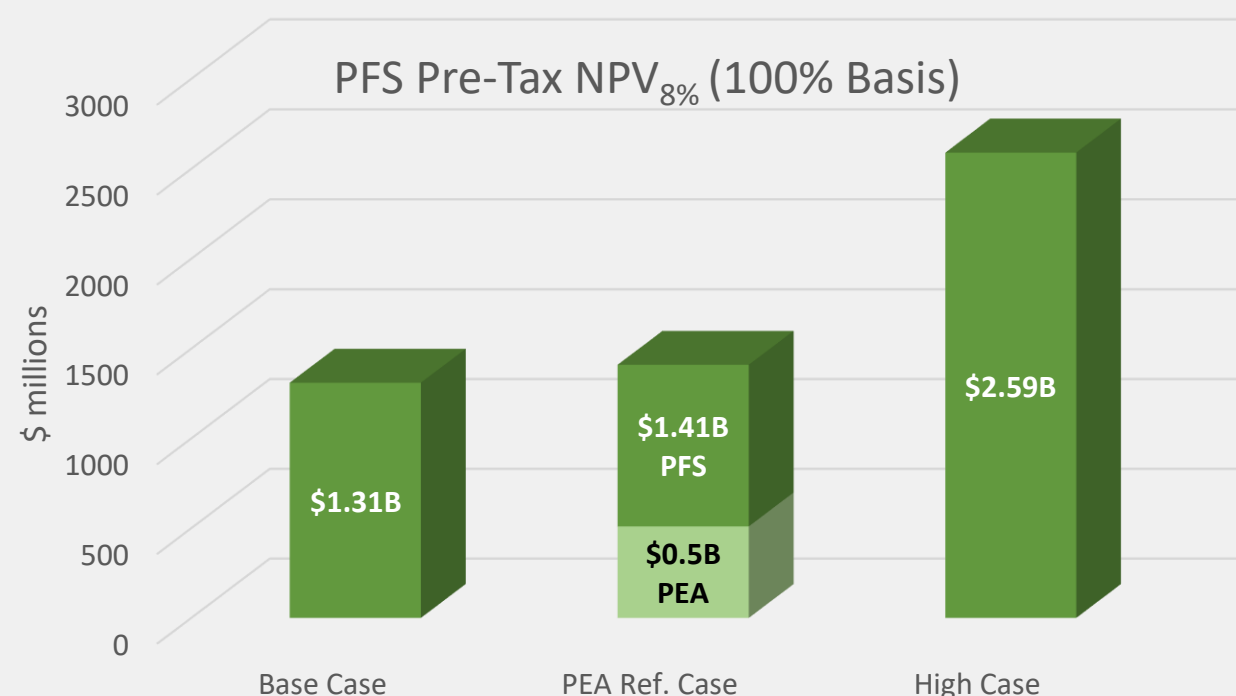


## Appendix: Pre-Feasibility Study (PFS) Economics





# Wheeler River PFS: Uranium price assumptions, and sensitivities



Assumptions / Results <sup>(1)</sup>	Base Case	PEA Ref. Case	High Case
Uranium selling price	As above	US\$44/lb U <sub>3</sub> O <sub>8</sub>	US\$65/lb U <sub>3</sub> O <sub>8</sub>
Pre-tax NPV <sub>8%</sub> <sup>(2)</sup> (100% Basis)	<b>\$1.31 billion</b>	<b>\$1.41 billion</b>	<b>\$2.59 billion</b>
Pre-tax IRR <sup>(2)</sup>	38.7%	47.4%	67.4%
Pre-tax payback period <sup>(3)</sup>	~24 months	~ 15 months	~ 11 months

## Base Case Price Assumptions:

- **Phoenix Operation:**
  - ~US\$29/lb U<sub>3</sub>O<sub>8</sub> to US\$45/lb U<sub>3</sub>O<sub>8</sub>
  - UxC Spot price forecast
  - "Composite Midpoint" scenario
  - Stated in "constant" 2018 dollars
- **Gryphon Operation:**
  - US\$50/lb U<sub>3</sub>O<sub>8</sub> fixed price

## Comparison to 2016 PEA

- 2016 PEA provided pre-tax project NPV<sub>8%</sub> of \$513 million at fixed uranium price of US\$44/lb U<sub>3</sub>O<sub>8</sub>
  - PFS equivalent NPV<sub>8%</sub> at US\$44/lb U<sub>3</sub>O<sub>8</sub> (\$1.4 billion) represents +**275% of pre-tax project NPV from PEA**



## Phoenix Operation: ISR mining method delivers industry leading cost per pound U<sub>3</sub>O<sub>8</sub>

Phoenix Operation	PFS Result <sup>(1)</sup>
Mine life	<b>10 years</b> (6.0 million lbs U <sub>3</sub> O <sub>8</sub> per year on average)
Average cash operating costs	<b>\$4.33 (US\$3.33) per lb U<sub>3</sub>O<sub>8</sub></b>
Initial capital costs (100% basis)	<b>\$322.5 million</b>
Operating margin <sup>(4)</sup>	<b>89.0%</b> at US\$29/lb U <sub>3</sub> O <sub>8</sub>
All-in cost <sup>(2)</sup>	<b>\$11.57 (US\$8.90) per lb U<sub>3</sub>O<sub>8</sub></b>

Assumptions / Results	Base Case	High Case
Uranium selling price	UxC Spot Price <sup>(3)</sup>	US\$65/lb U <sub>3</sub> O <sub>8</sub>
Operating margin <sup>(4)</sup>	<b>91.4%</b>	<b>95.0%</b>
Pre-tax NPV <sub>8%</sub> <sup>(5)</sup> (100%)	<b>\$930.4 million</b>	<b>\$1.91 billion</b>
Pre-tax IRR <sup>(5)</sup>	43.3%	71.5%
Pre-tax payback period <sup>(6)</sup>	~ 21 months	~ 11 months

## Gryphon Operation: Additional low-cost production with conventional UG mining

Gryphon Operation	PFS Result <sup>(1)</sup>
Mine life	<b>6.5 years</b> (7.6 million lbs U <sub>3</sub> O <sub>8</sub> per year on average)
Average cash operating costs	<b>\$15.21 (US\$11.70) per lb U<sub>3</sub>O<sub>8</sub></b>
Initial capital costs (100% basis)	<b>\$623.1 million</b>
Operating margin <sup>(3)</sup>	<b>77.0%</b> at US\$50/lb U <sub>3</sub> O <sub>8</sub>
All-in cost <sup>(2)</sup>	<b>\$29.67 (US\$22.82) per lb U<sub>3</sub>O<sub>8</sub></b>

Assumptions / Results	Base Case	High Case
Uranium selling price	US\$50/lb U <sub>3</sub> O <sub>8</sub>	US\$65/lb U <sub>3</sub> O <sub>8</sub>
Operating margin <sup>(3)</sup>	<b>77.0%</b>	<b>82.3%</b>
Pre-tax NPV <sub>8%</sub> <sup>(4)</sup> (100%)	<b>\$560.6 million</b>	<b>\$998.8 million</b>
Pre-tax IRR <sup>(4)</sup>	23.2%	31.0%
Pre-tax payback period <sup>(5)</sup>	~ 37 months	~ 31 months



## Wheeler River PFS <sup>(1)</sup> : Statement of Reserves and Denison indicative post-tax results

### Reserves<sup>(2, 3, 4, 7, 8)</sup>

Deposit	Class.	Tonnes	Grade	Lbs U <sub>3</sub> O <sub>8</sub>	Denison (90%)
Phoenix <sup>(5)</sup>	Probable	141,000	19.1% U <sub>3</sub> O <sub>8</sub>	59.7M	53.7M
Gryphon <sup>(6)</sup>	Probable	1,257,000	1.8% U <sub>3</sub> O <sub>8</sub>	49.7M	44.7M
<b>Total</b>	<b>Probable</b>	<b>1,398,000</b>	<b>3.5%</b>	<b>109.4M</b>	<b>98.4M</b>

### Indicative Denison post-tax results

Financial Results	Denison (90%)
<b>Initial capital costs</b>	<b>\$290.3 million</b>
Base case post-tax IRR <sup>(9)</sup>	32.7%
Base case post-tax NPV <sub>8%</sub> <sup>(9)</sup>	\$755.9 million
Base case post-tax payback period <sup>(10)</sup>	~ 26 months
<b>High case post-tax IRR<sup>(9)</sup></b>	<b>55.7%</b>
<b>High case post-tax NPV<sub>8%</sub><sup>(9)</sup></b>	<b>\$1.48 billion</b>
<b>High case post-tax payback period<sup>(10)</sup></b>	<b>~12 months</b>

Notes...

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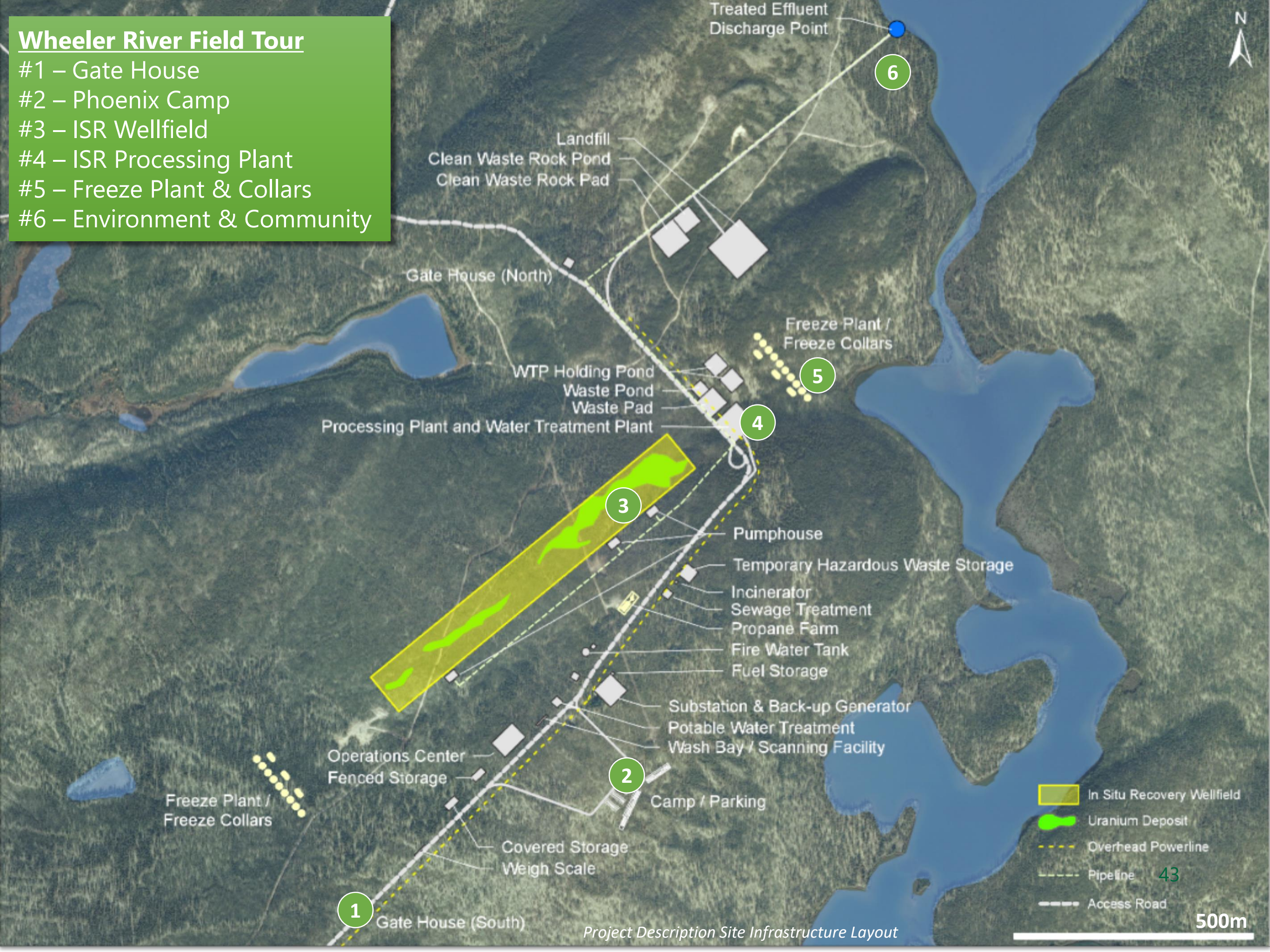
## Appendix: Wheeler River 2019 Field Tour Maps





Wheeler River Field Tour

- #1 – Gate House
- #2 – Phoenix Camp
- #3 – ISR Wellfield
- #4 – ISR Processing Plant
- #5 – Freeze Plant & Collars
- #6 – Environment & Community



Project Description Site Infrastructure Layout



## Wheeler River Field Tour

- #1 – Gate House
- #2 – Phoenix Camp
- #3 – ISR Wellfield
- #4 – ISR Processing Plant
- #5 – Freeze Plant & Collars
- #6 – Environment & Community
- #7 – Gryphon Deposit Turnoff
- #8 – Hot Shack
- #9 – Core Yard / Exploration

