

LBNF/DUNE Project Update

Colossal Caverns: An In-Depth Discussion of the DUNE Excavation with Michael Gemelli
18 March 2024



U.S. DEPARTMENT OF
ENERGY

Office of
Science

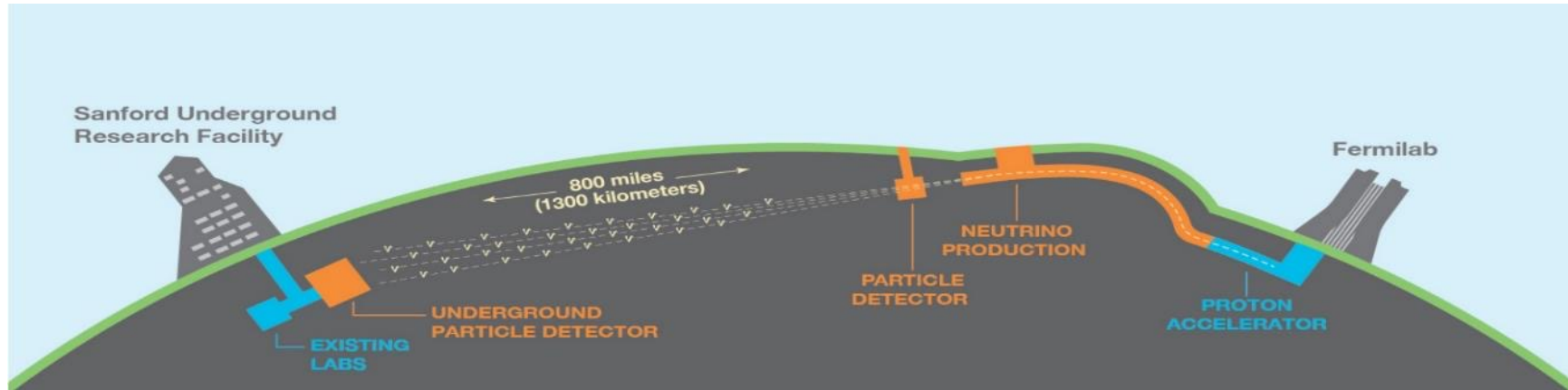
Agenda

Welcome and Introduction	<i>Zach Burton (LBNF Communication & Community Relations Manager)</i>
LBNF DUNE Project Explained	<i>Michael Gemelli (LBNF Excavation Project Manager)</i>
Excavation Update	<i>Michael Gemelli (LBNF Excavation Project Manager)</i>
Underground Pictures/Video	<i>Ryan Moe (US General Manager, Thyssen Mining Incorporated)</i>
Narrated Video	<i>James Rickard (LBNF Excavation Resident Engineer, Arup)</i>
Questions for the Crew	<i>Michael Gemelli (LBNF Excavation Project Manager)</i> <i>James Rickard (LBNF Excavation Resident Engineer, Arup)</i> <i>Ryan Moe (US General Manager, Thyssen Mining Incorporated)</i>

LBNF DUNE Project

Michael Gemelli

World-Class Facility supporting World-Class Experiment



- The **Deep Underground Neutrino Experiment (DUNE)** will be a **game-changing experiment for neutrino science**, potentially transforming our understanding of why the universe exists as it does.
- The **Long-Baseline Neutrino Facility (LBNF)** is the **infrastructure** necessary to send a powerful beam of neutrinos 800 miles through the earth and measure them deep underground at South Dakota's Sanford Underground Research Facility.
- The LBNF/DUNE Project will be the **first internationally conceived, constructed, and operated mega-science project** hosted by the Department of Energy in the United States.

LBNF Project will drive neutrino science forward the way CERN's Large Hadron Collider drove Nobel Prize-winning Higgs Discovery!!!

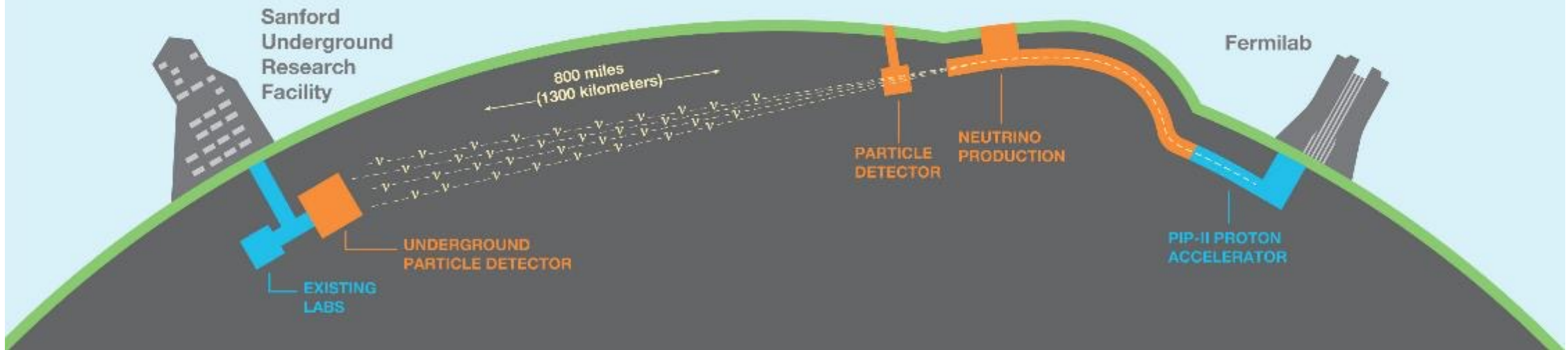
The “Big Picture”

Far Site – SURF in Lead, SD

Facility/Infrastructure and Far Detectors

Near Site – FNAL in Batavia, IL

Facility/Infrastructure, Neutrino Beamline, and Near Detectors



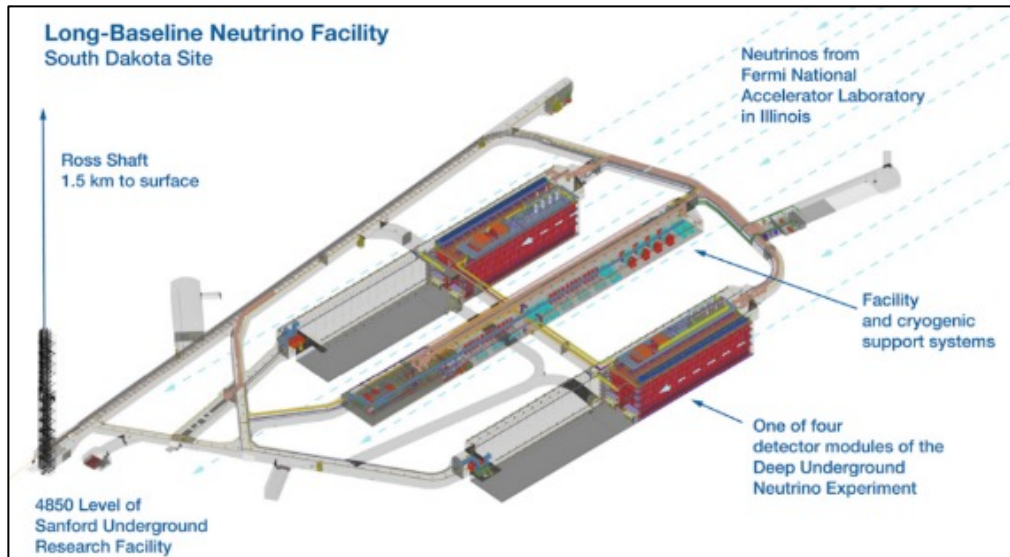
Three Subprojects

- **FSCF EXC** – Far Site Excavation
- **FSCF BSI** – Far Site Building & Site Infrastructure
- **FDC** – Far Detectors and Cryogenic Infrastructure

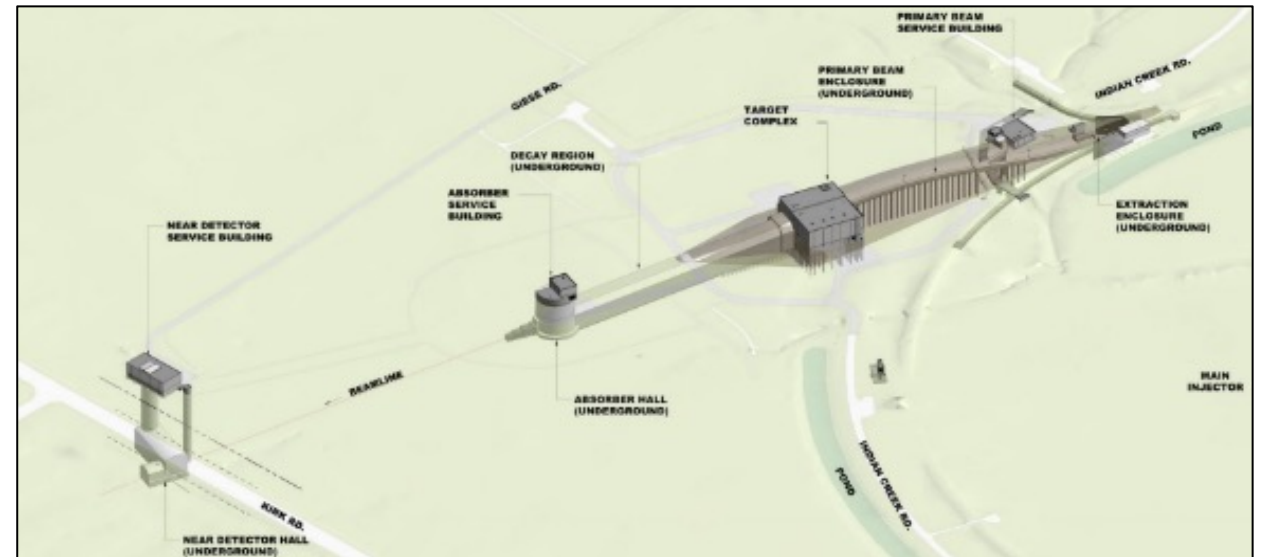
Two Subprojects

- **NSCF+B** – Near Site Conventional Facilities + Beamline
- **ND** – Near Detectors

LBNF DUNE Overview



Detectors in South Dakota



National Accelerator Laboratory in Illinois

LBNF DUNE's Three Major Science Goals:

- Whether neutrinos could be the reason the universe is made of matter.
- Look for subatomic phenomena that could help realize Einstein's dream of the unification of forces.
- Watch for neutrinos emerging from an exploding star, perhaps witnessing the birth of a neutron star or a black hole.

The LBNF DUNE Experiment's Location



Excavation Update

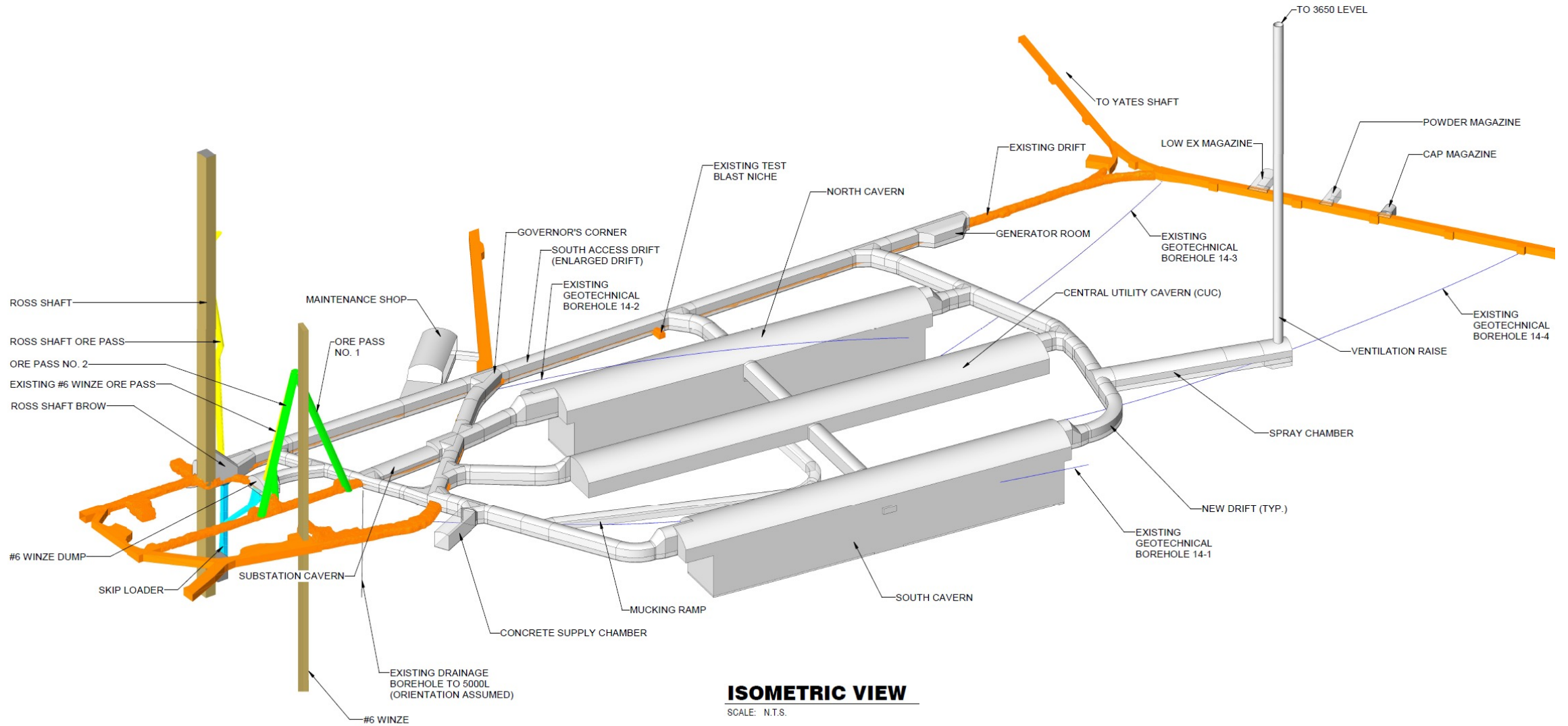
Michael Gemelli

Excavation Scope of Work

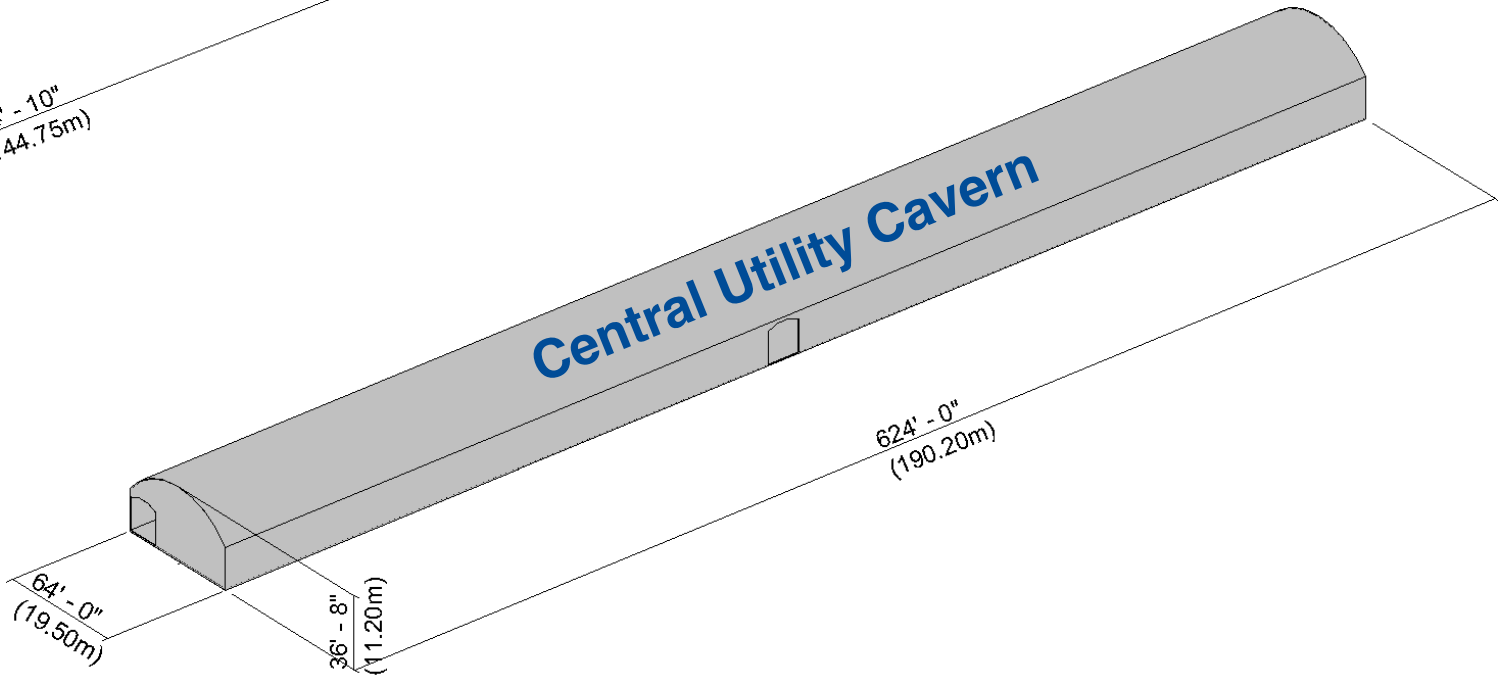
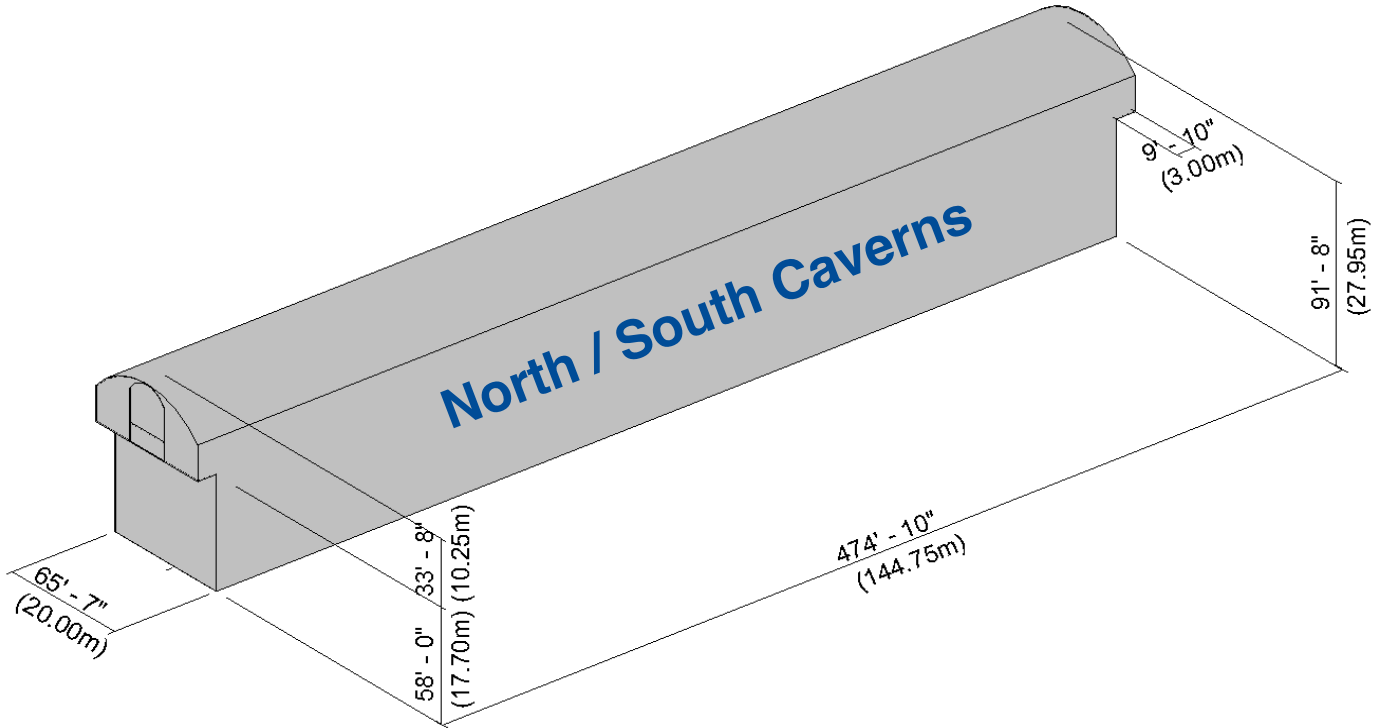
Excavation Includes:

- Development of all spaces underground, primarily through drill and blast techniques.
- Raise bore development connecting the 4850L to the 3650L
- Installation of ground support with a combination of rock bolts, mesh, and shotcrete (fiber and non-fiber reinforced used)
- Installation of finished concrete floors
- Provision in each detector cavern for:
 - Anchorages for bridges
 - Supports for mezzanines
 - Monorails for overhead cranes
- Installation of long-term rock monitoring systems

Excavation Overview

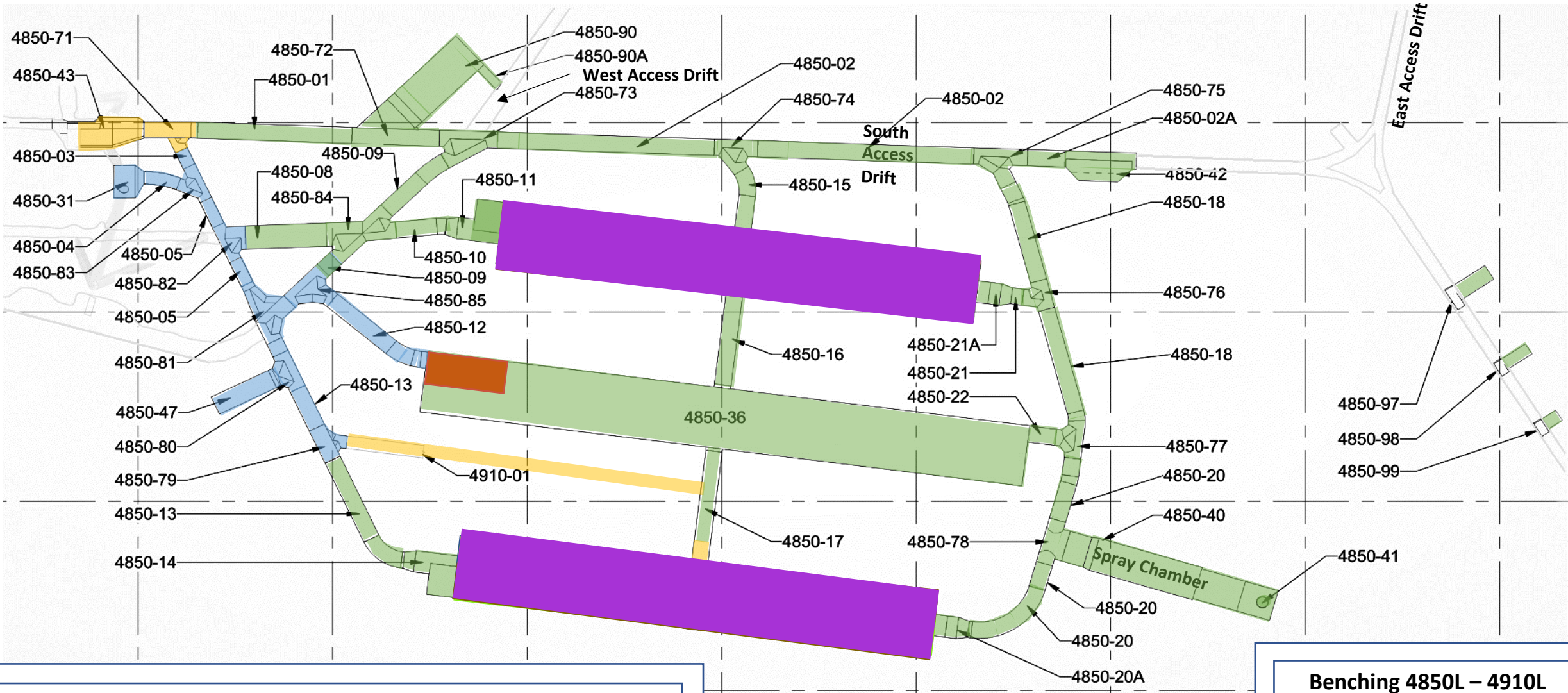





Size of Excavations








Total Excavation Completed to Date = 100%

February 19th, 2024



	4850L Excavation Completed
	Excavation and Ground Support Complete and Accepted
	Concrete Complete

Benching 4850L – 4910L	
Bench C	
Bench D	
Bench E	
Bench F	
Bench G	

Excavation Quantities

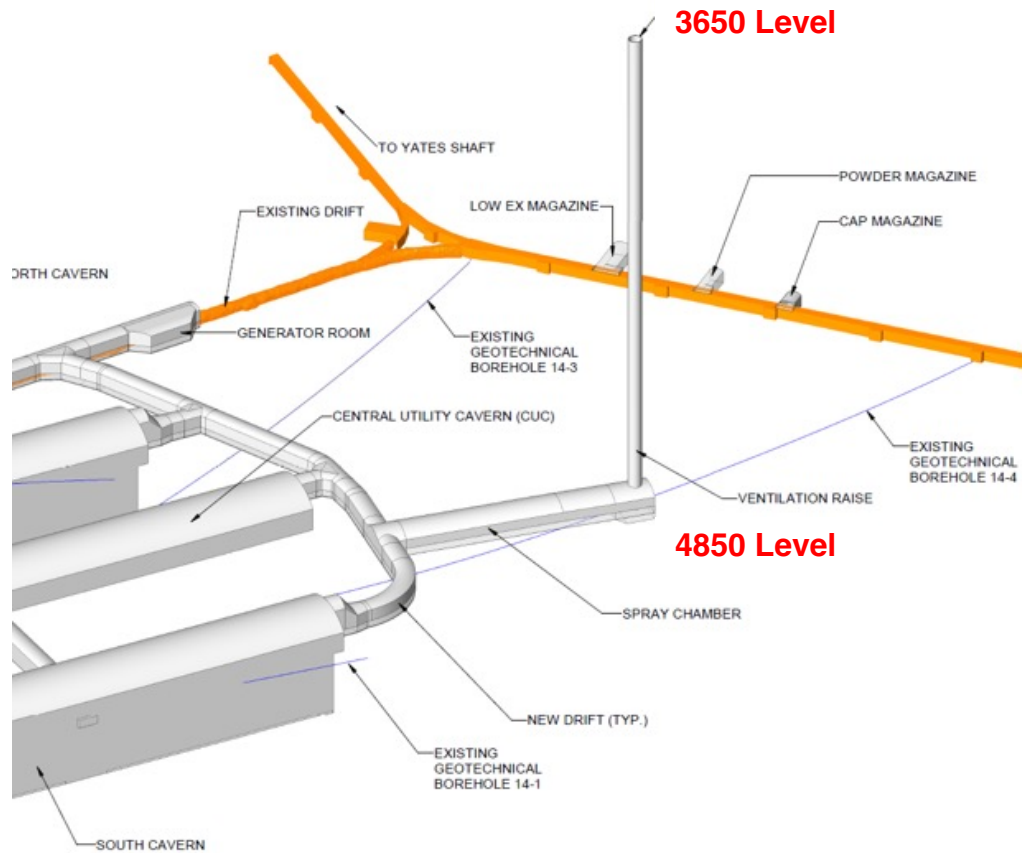
- Excavated 309,700 CYD or 819,600 Tons
- Explosives Consumed: 560 Tons or (1,120,000 lbs)
- 76,268 Split Set Bolts Installed
- 11,000 Threadbar Bolts
- 13,686 CT Bolts Installed
- 14,240 Welded Wire Mesh Sheets Installed (6' x 11')
- 12,000 CYD Shotcrete Applied
- 6,420 CYD Concrete Poured
- 3,000 Feet of Drifts

- Equivalent Weight = 8 Aircraft Carriers
- Equivalent Energy = 651,000 kW hours (3,000 homes/Week)
- Equivalent Length = 87 Miles (Lead to Rapid City to Lead)
- Equivalent of 21 Miles
- Equivalent of 52 Miles
- Equivalent to ~ 22 Acres
- Equivalent to ~ 4 Olympic Size Swimming Pools
- Equivalent to ~ 2 Olympic Size Swimming Pools
- Equivalent to ~ 0.5 Mile

The Initial Excavation – Raise Bore

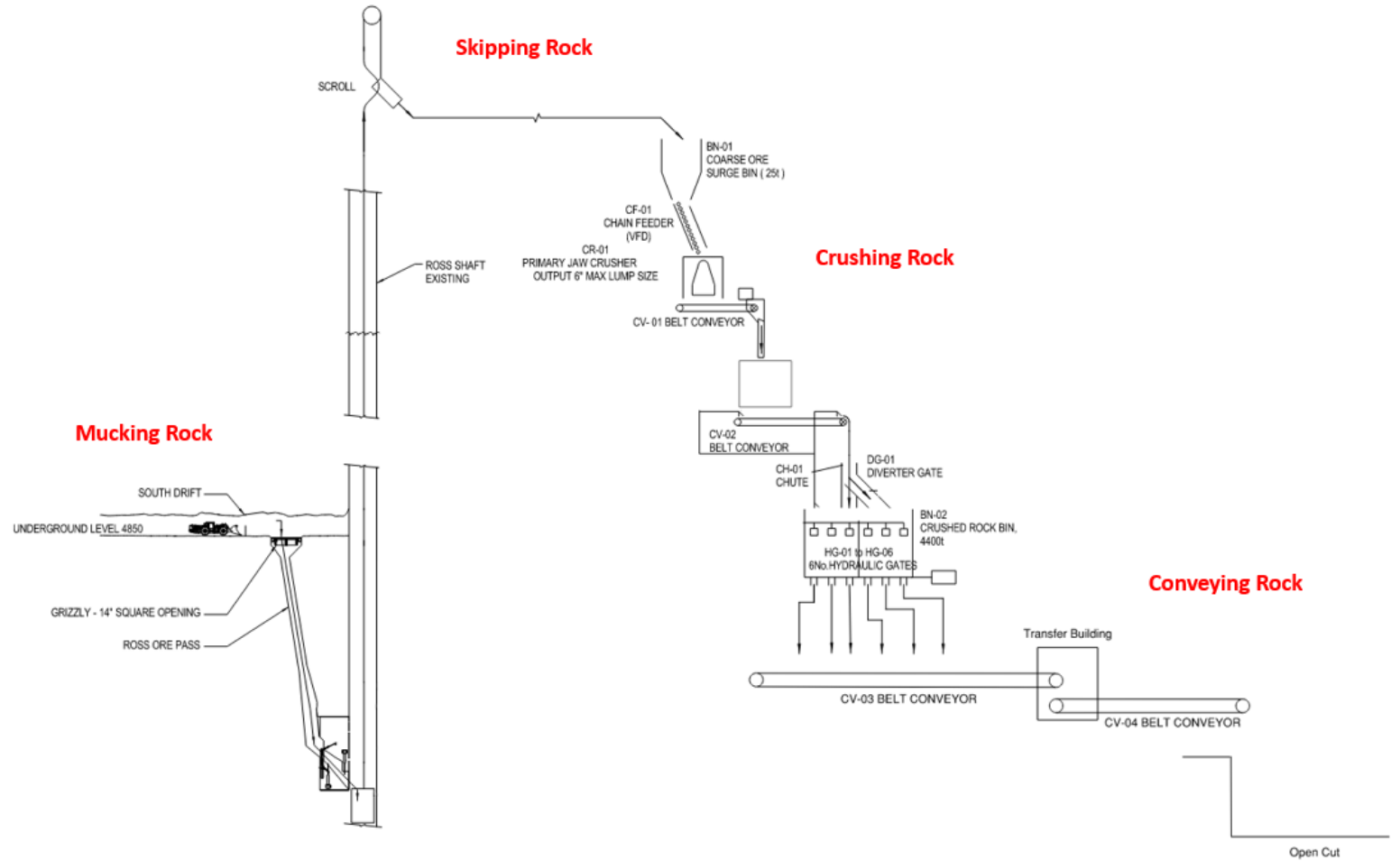
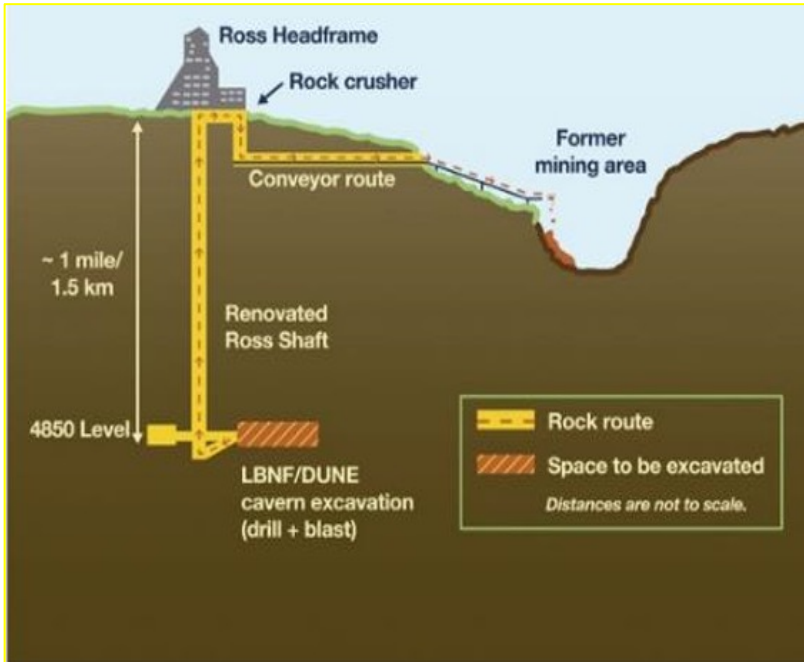


Ventilation and Cooling – Raise Bore (May 2021 – October 2021)



Raise Bore Cutter Head / Reamer (Break Through)

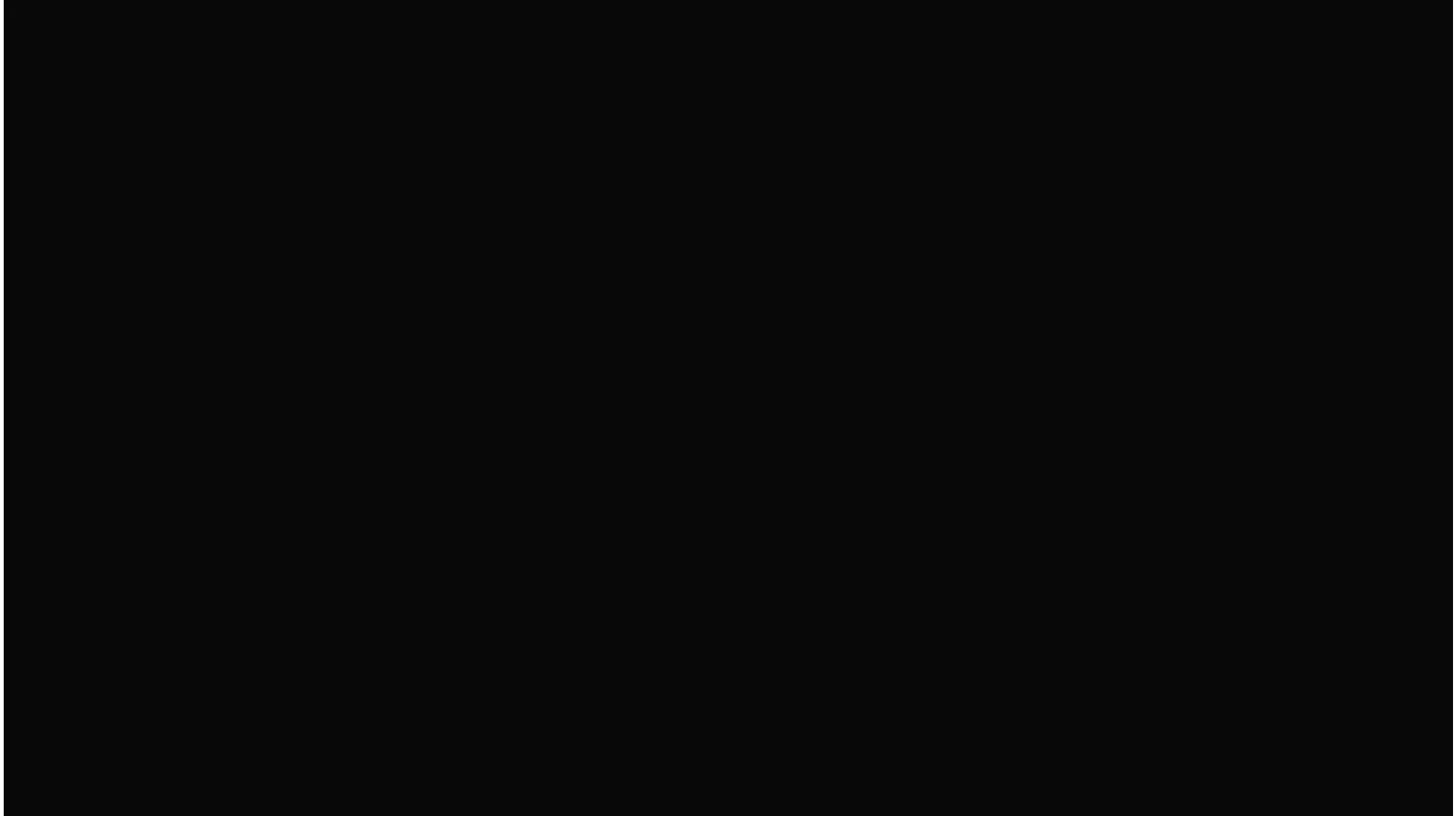
Rock Handling System Explained



Underground Pictures/Video

Ryan Moe

Drill and Blast Excavation Time Lapse Video Explained



Drill and Blast Excavation – Down Hole Bench Blasting



Far Site CF Excavation



Setting out the Blast Pattern



Scaling the Drift with the Jumbo

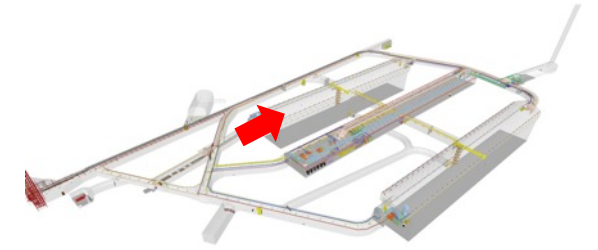
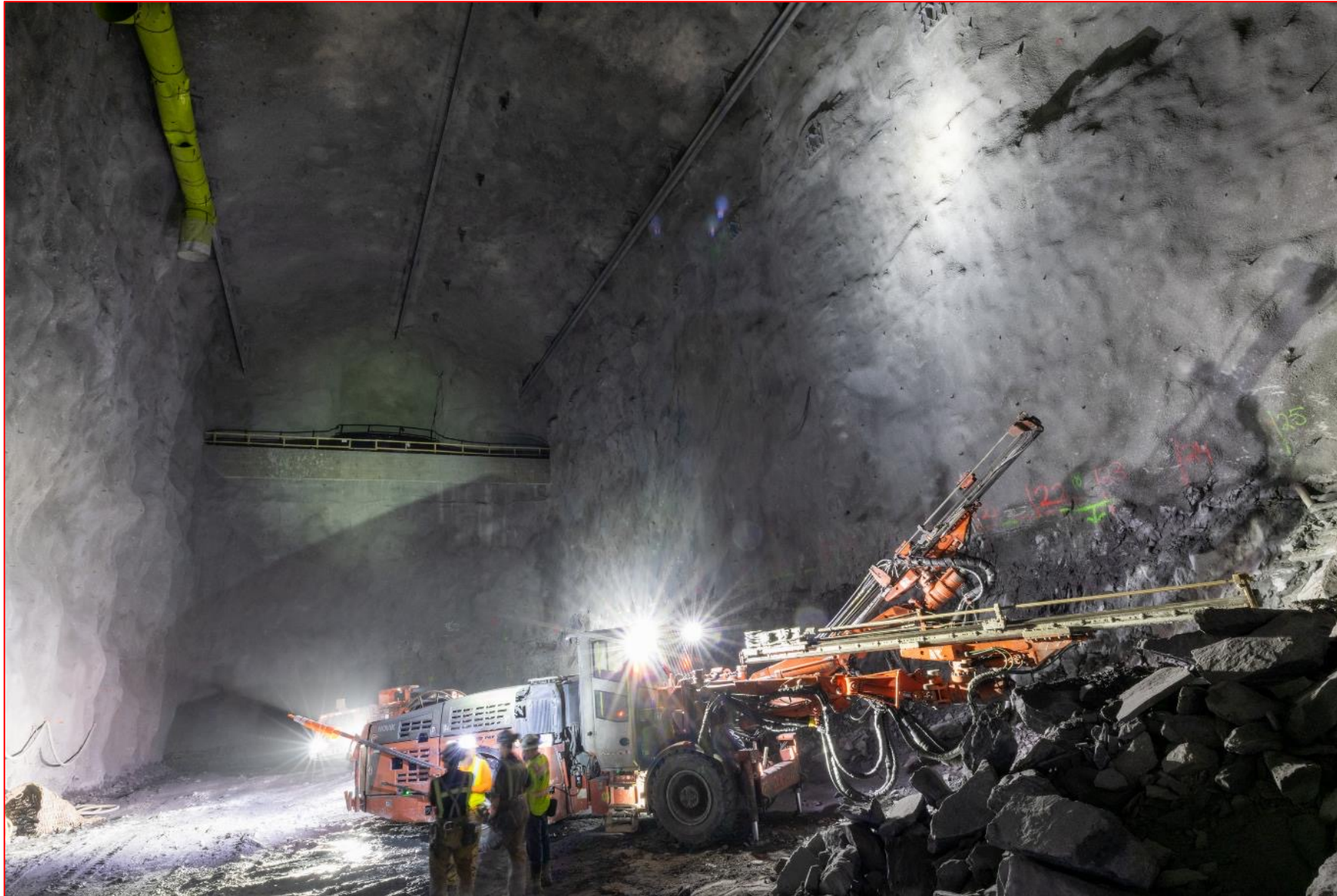


Robotic Shotcrete Machine

FSCF-EXC Excavation Progress – North Cavern



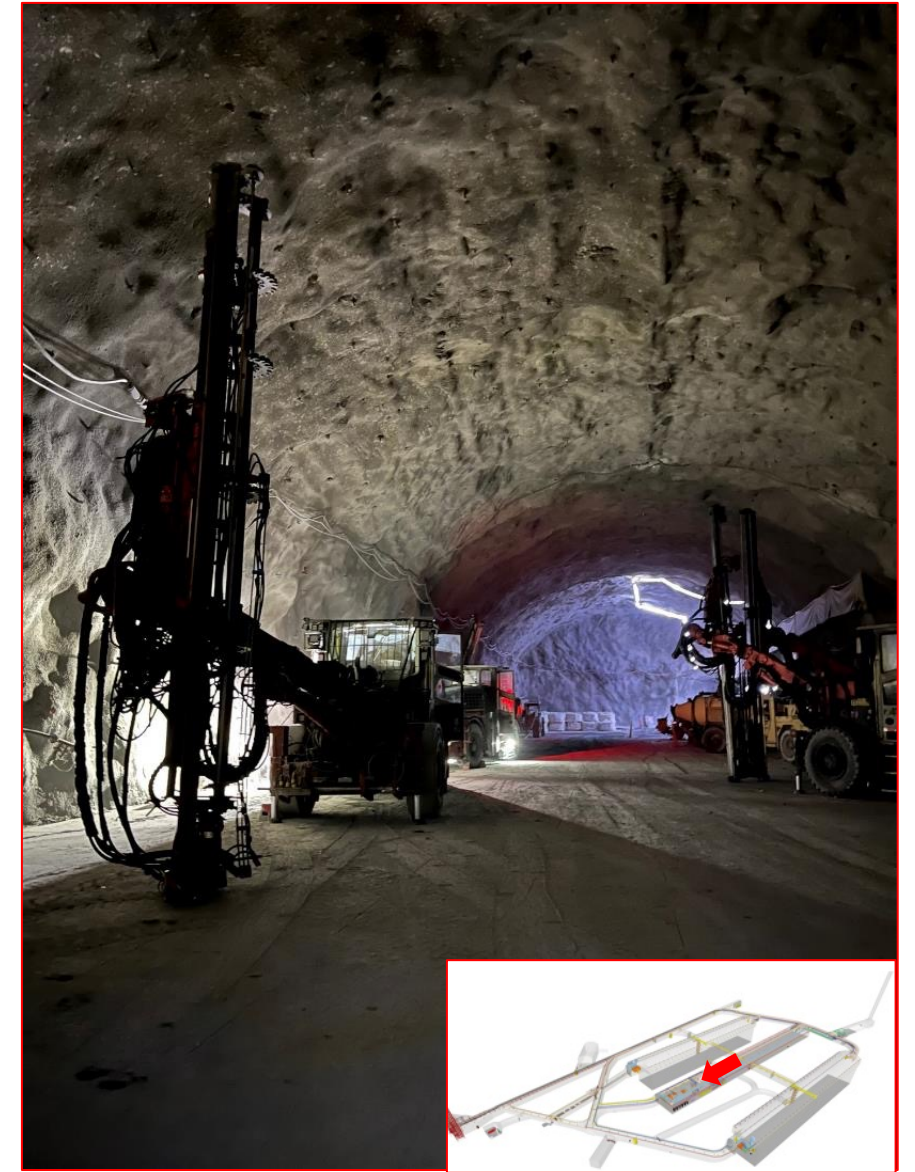
FSCF-EXC Excavation Progress – North Cavern



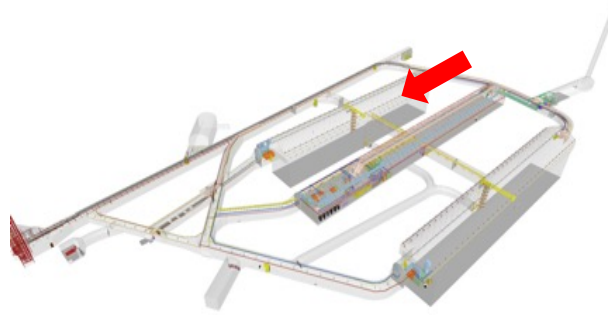
FSCF-EXC Excavation Progress – South Cavern



FSCF-EXC Excavation Progress – Central Utility Cavern



Excavation Status – North Cavern – Excavation Complete - Concrete Floor



Excavation Status – North Cavern – Excavation Complete - Concrete Floor

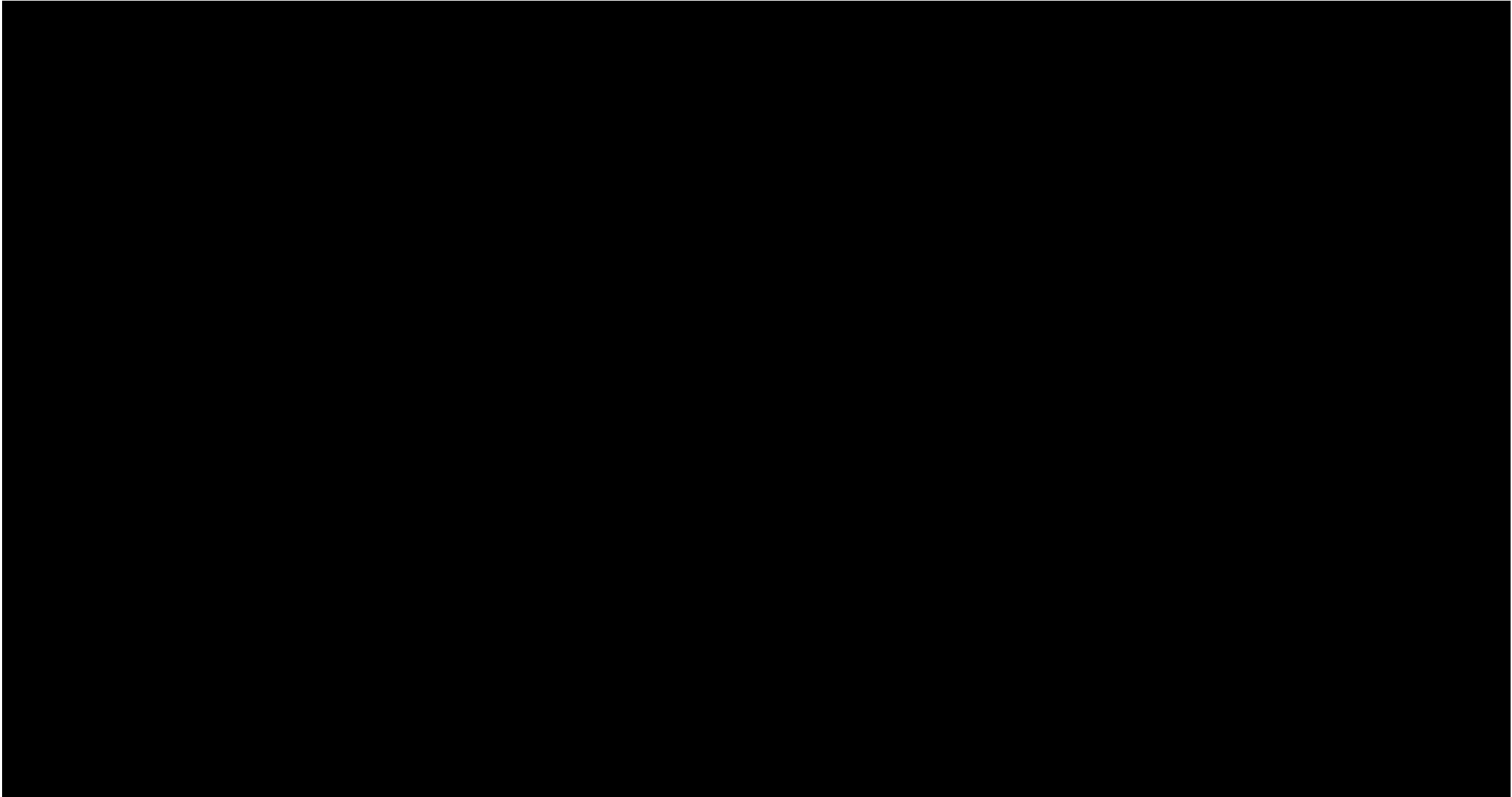


Ross Brow 4850L Station Excavation – End of the Excavation Phase!



Narrated Underground Video

James Rickard



Questions for the Crew

Michael Gemelli, James Rickard and Ryan Moe

