The Investigation of an Alternative Tailings Deposition System for Uranium Tailings

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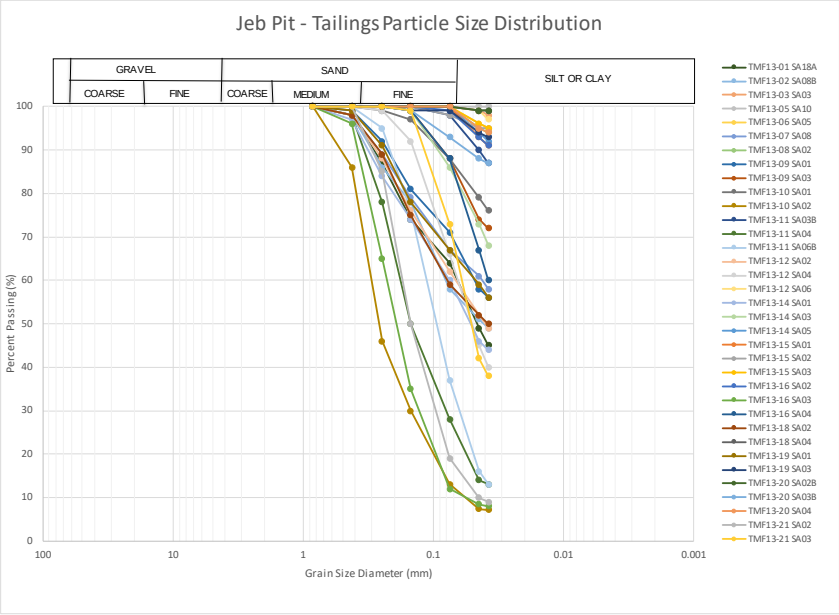
Problem Statement

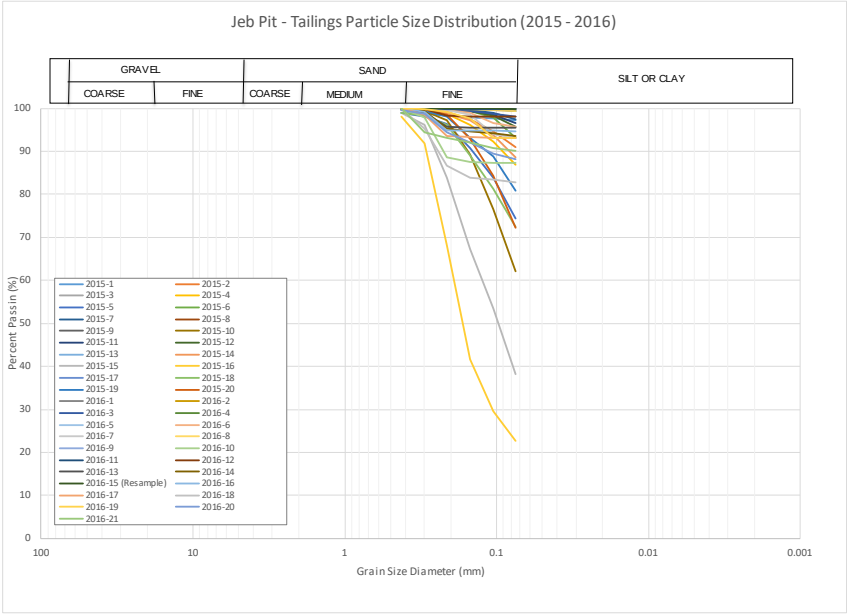
- Cigar Lake tailings properties and the tailings depositional system are resulting in inefficient use of the existing pit volume.
  - reduce the operating life of the existing TMF
  - accelerate capital expenditures to construct the various phases of optimization and/or expansion.

Tailings PSD

JEB/Sue Tailings PSD



Cigar Lake Tailings PSD (2015-2016)



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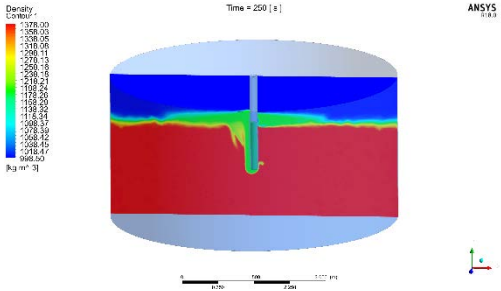
Deposition System & Considerations

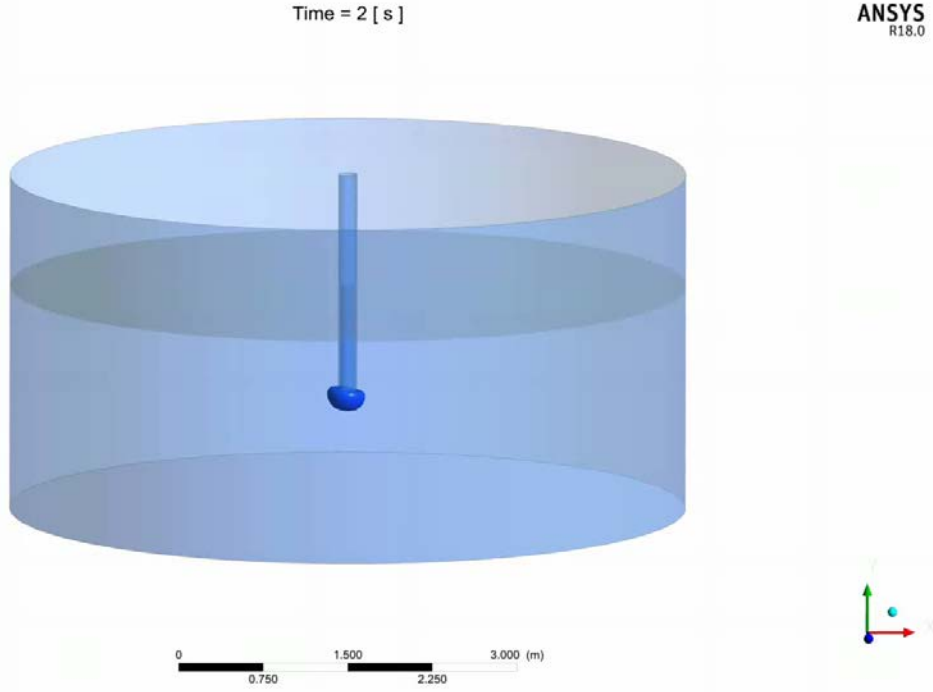
- Tremie adopted to minimize tailings segregation
- Pumping capacity is limited
  - ~ 25% solids for CL tails using the tremie method
  - ~ 35% solids based on existing pumping system
- One point of discharge
  - sufficient capacity for deposition over winter (November to June)
  - walkway freezes-in place resulting in the inability to move the discharge point

Deposition System & Considerations

- Barge movement completed by:
  - Rigid walkway structure and manual winches
  - Wind, waves, wet conditions and safe use of walkway
- Access to deposition areas is needed to meet regulatory sampling requirements, tremie house is heated
- Quality of the reclaim may be impacted if deposition barge is too close

Tremie Deposition





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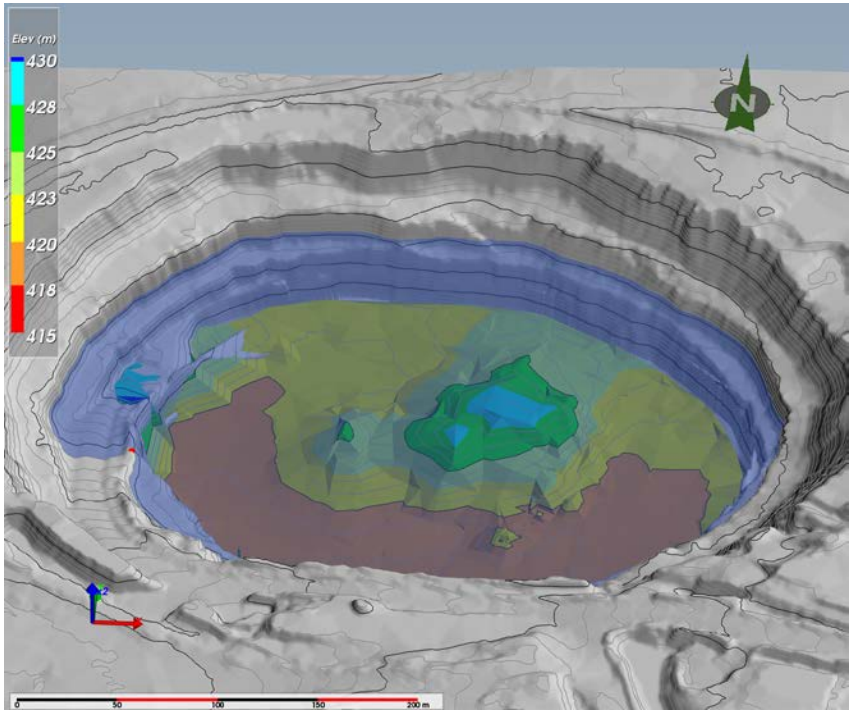
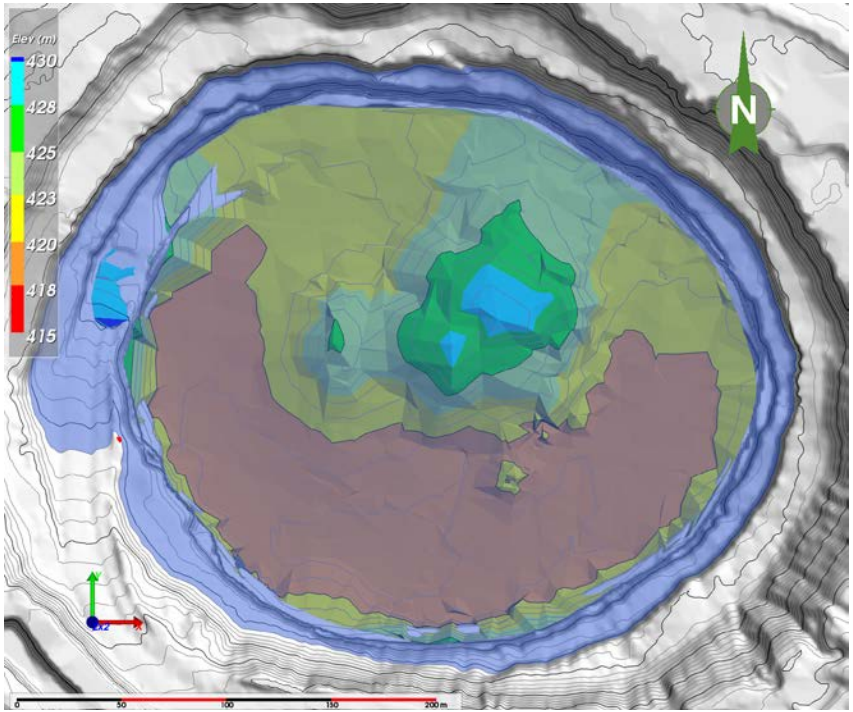
Tailings Surface Development - 2014





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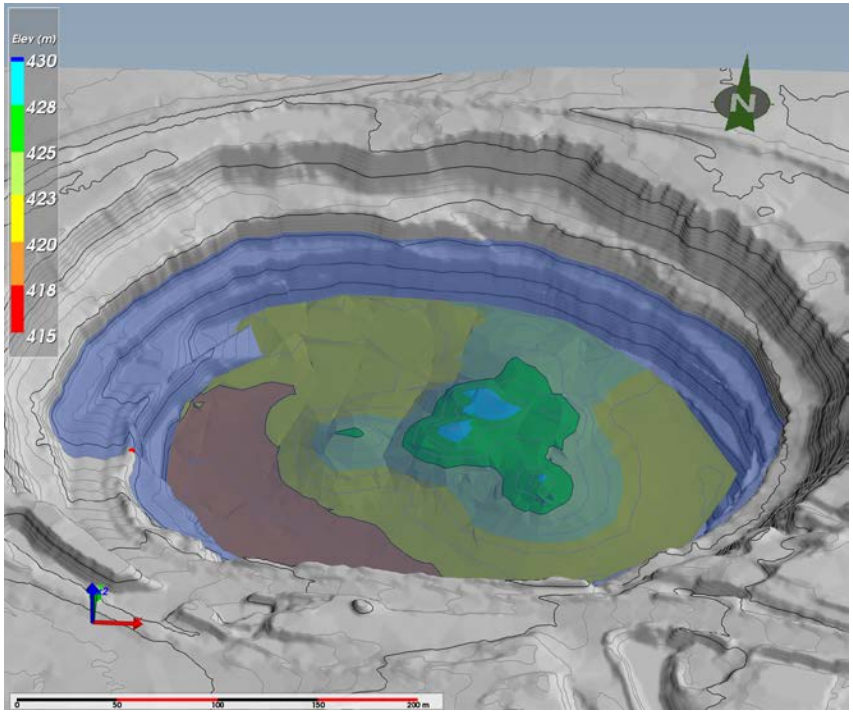
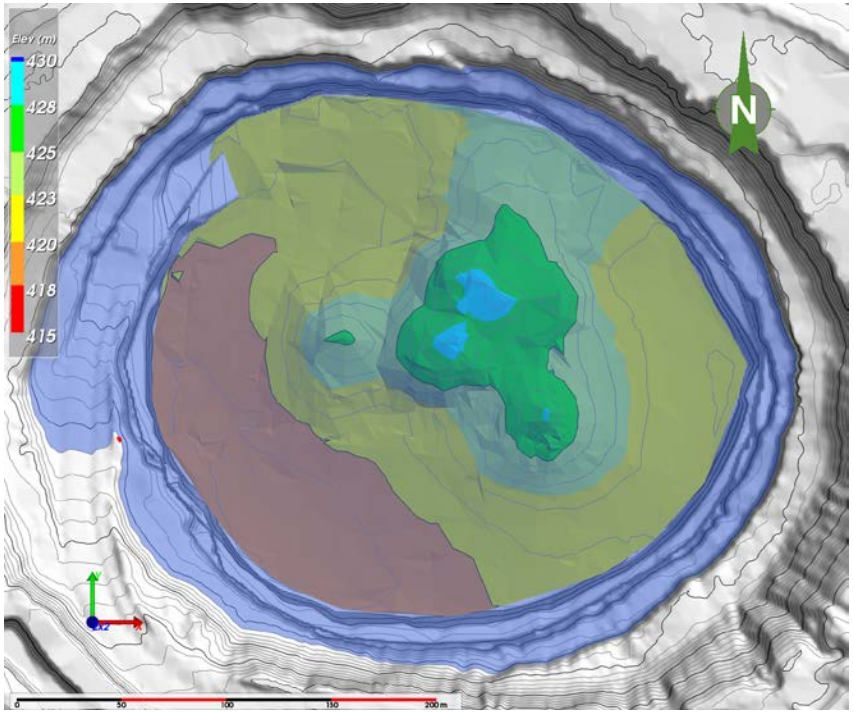
Tailings Surface Development - 2015





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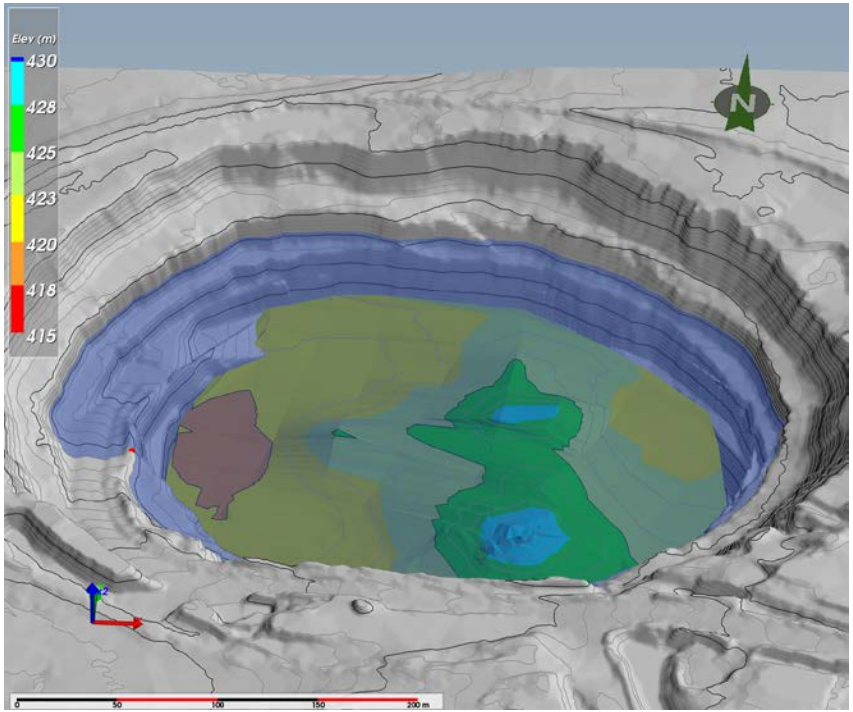
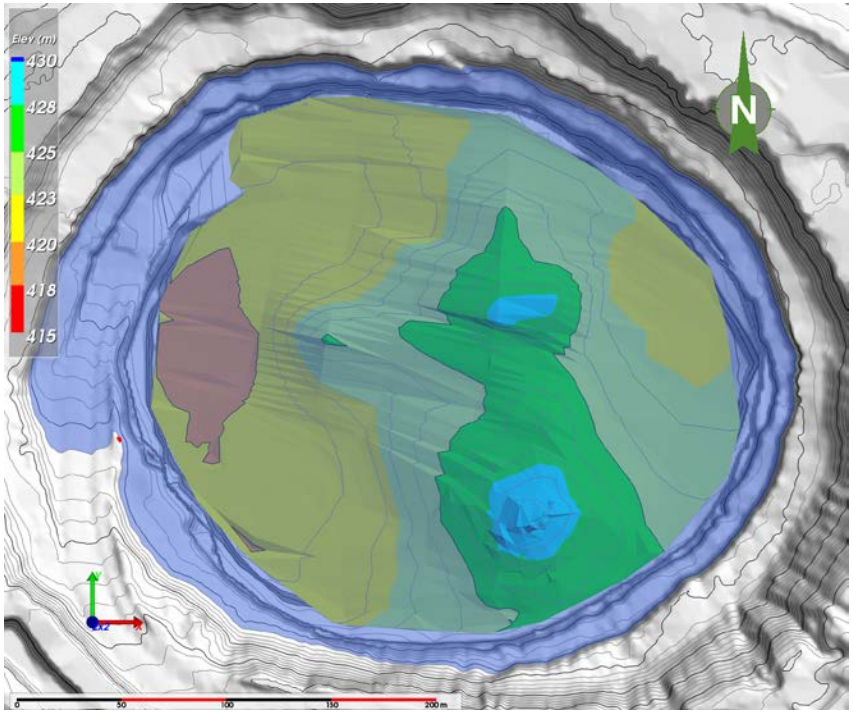
Tailings Surface Development - 2016





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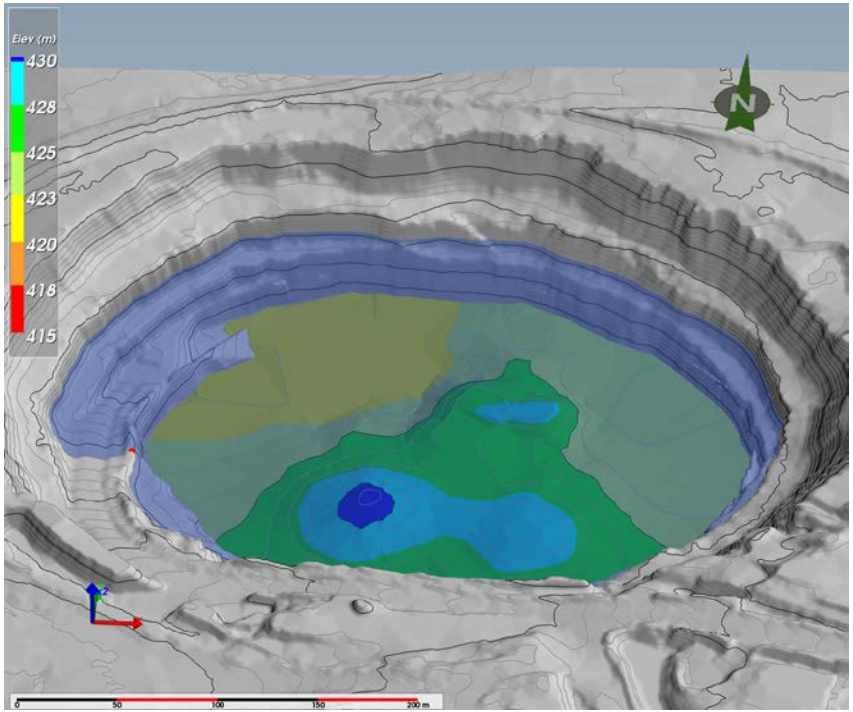
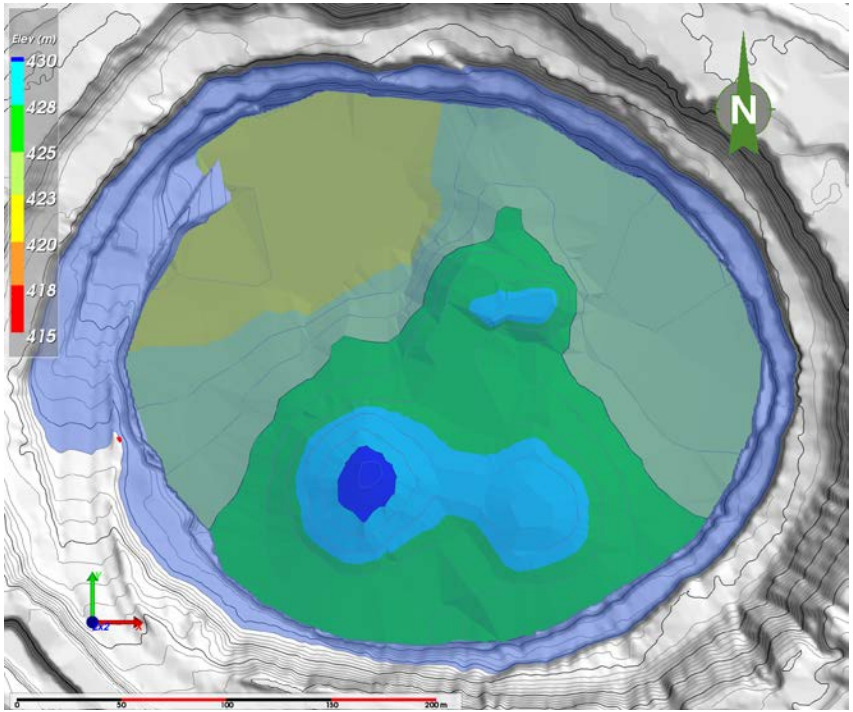
Tailings Surface Development - May 2017





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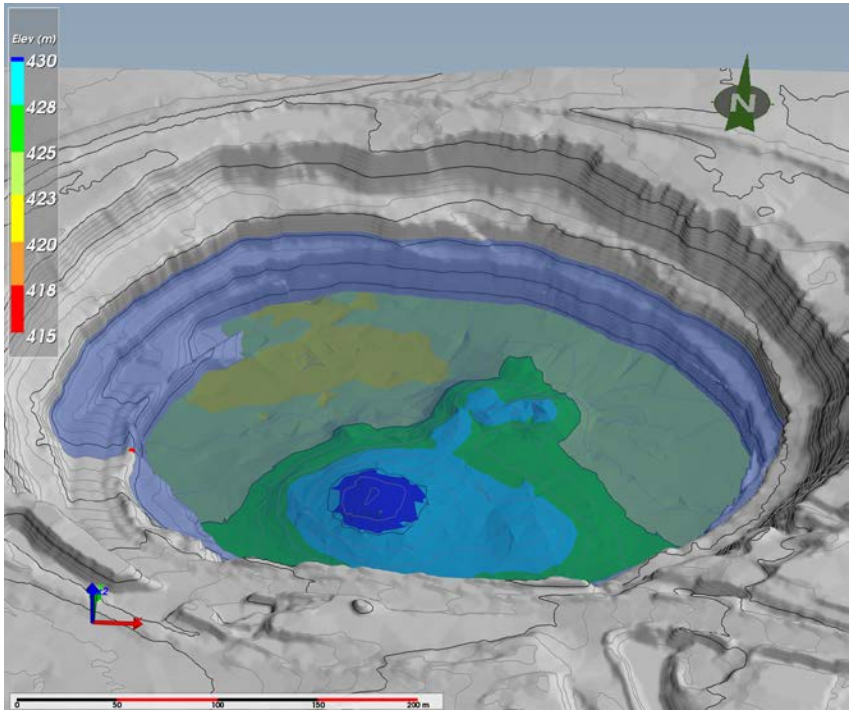
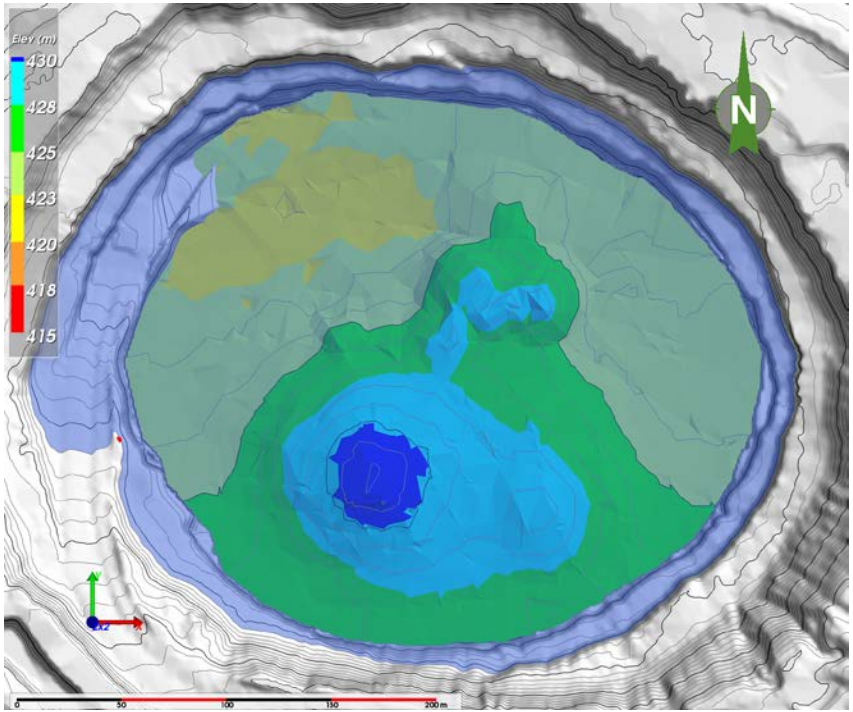
Tailings Surface Development - July 2017





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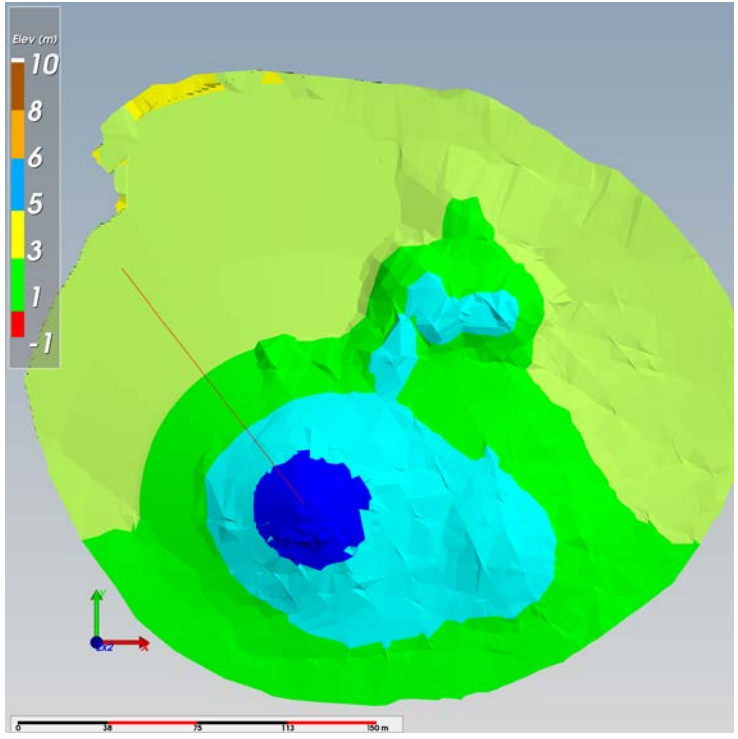
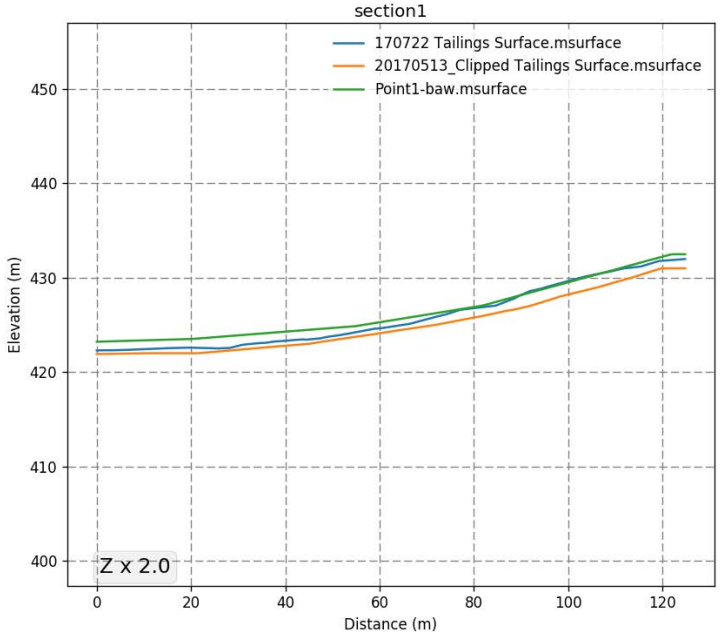
Deposition Planning – Post Modelling Comparison





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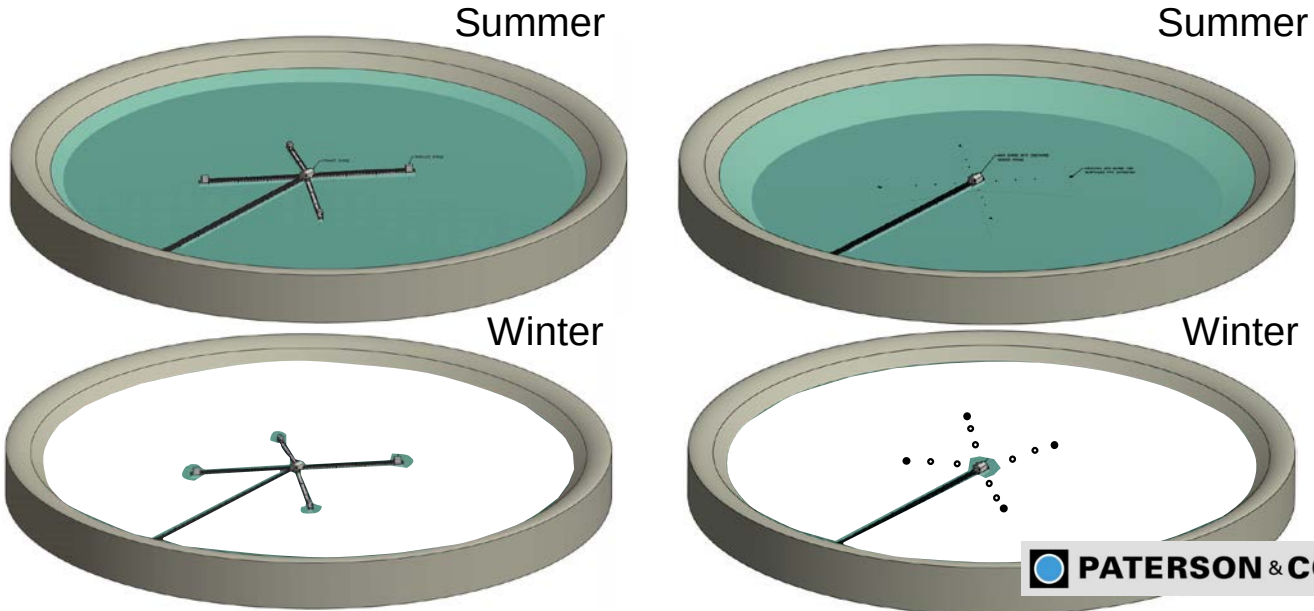
Preferred Options

- Two Preferred Options
  - satellite deposition barges from the existing barge structures
  - subaqueous deposition from barge with radial pipes



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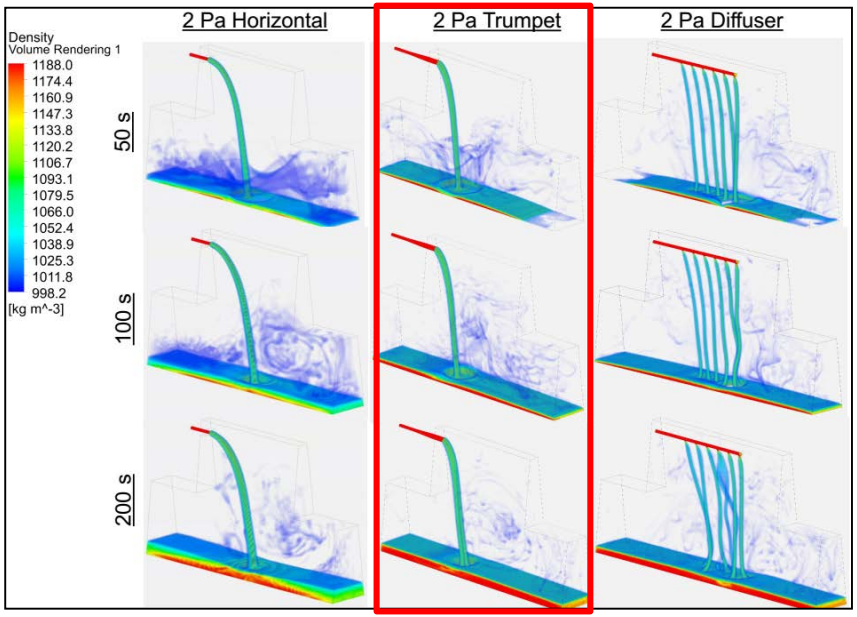
Subaqueous Deposition Trial Criteria for Success

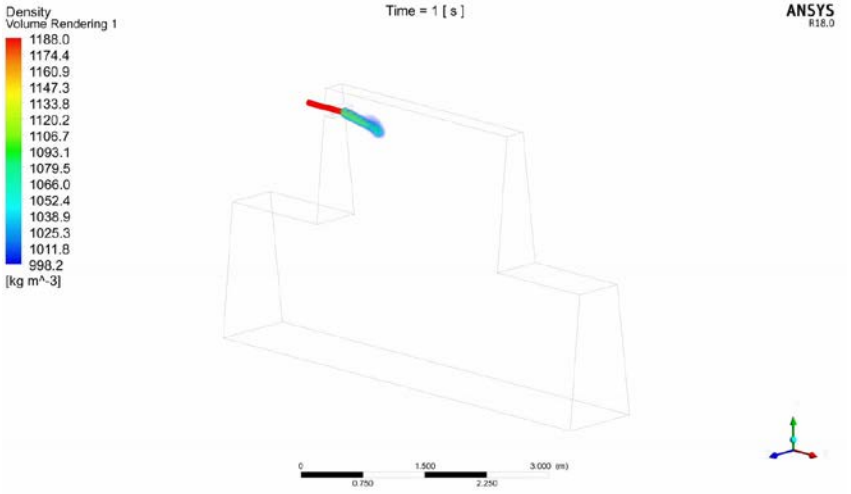
Concerns	Rational for Concern
Segregation of Deposited Tailings	• Any change in deposition method **must not worsen segregation**.
Prevent Blockages in the subaqueous Diffuser System	• Previous tremie design failed because it got stuck in tailings. • Test work will assess if the subaqueous deposition method is at risk of becoming blocked, placing additional burden on operations.
Impacts to TMF volume • **Deposition angle** • **Initial placed density**	• The volume in the TMF is a resource, we need to ensure that there are no negative impacts on that resource. Ineffective use of space may impact the construction schedule.

Subaqueous Deposition Planning

CFD Diffuser Evaluation Assuming a Solids Content of ~25%



CFD Modelling – No Diffuser



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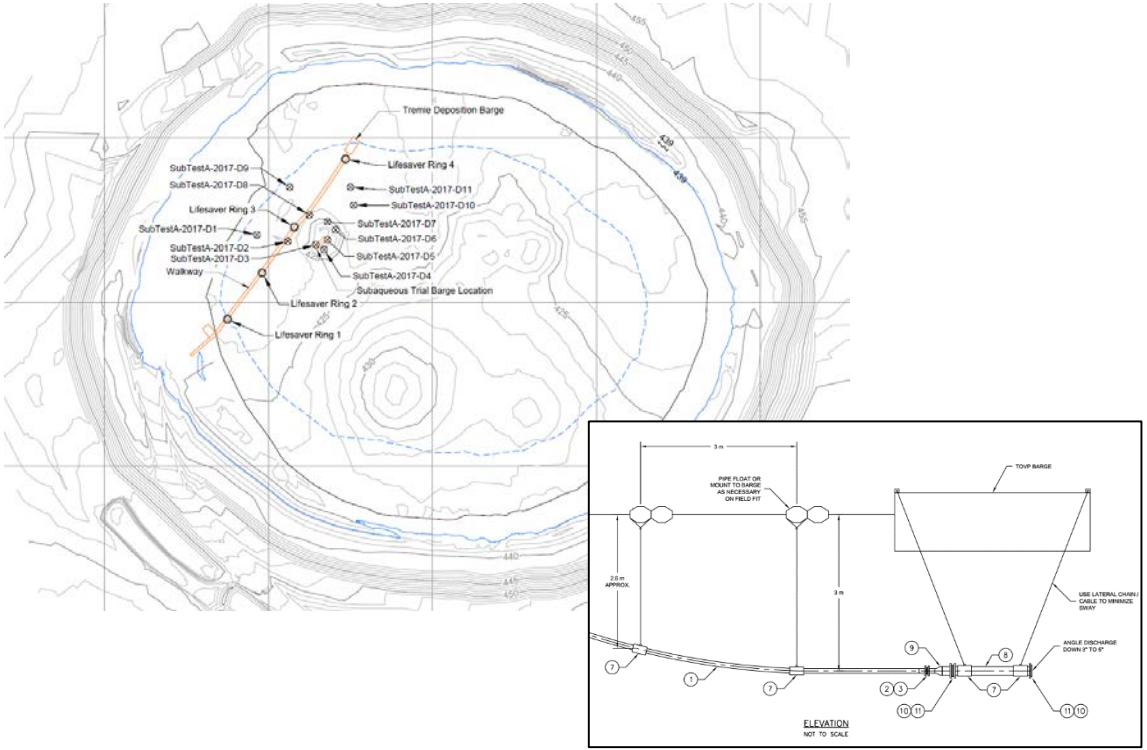
Subaqueous Deposition Trial Monitoring



Field Trail Subaqueous Diffuser Concept

- Water Sampling
- Particle size sampling
- Bathymetric surveys
- Orthophotos
- Deposition Stream Videos

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Subaqueous Deposition Trial

Trial Occurred September 24th to October 18th 2017

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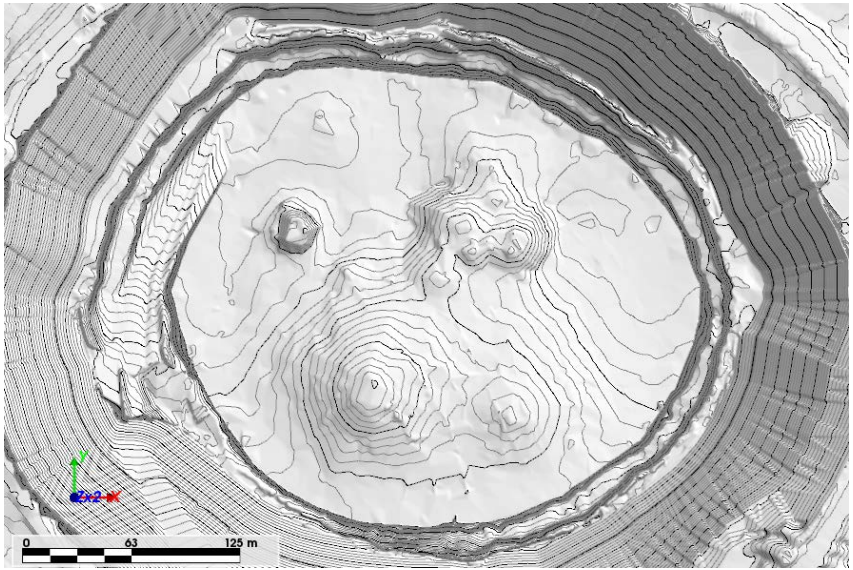
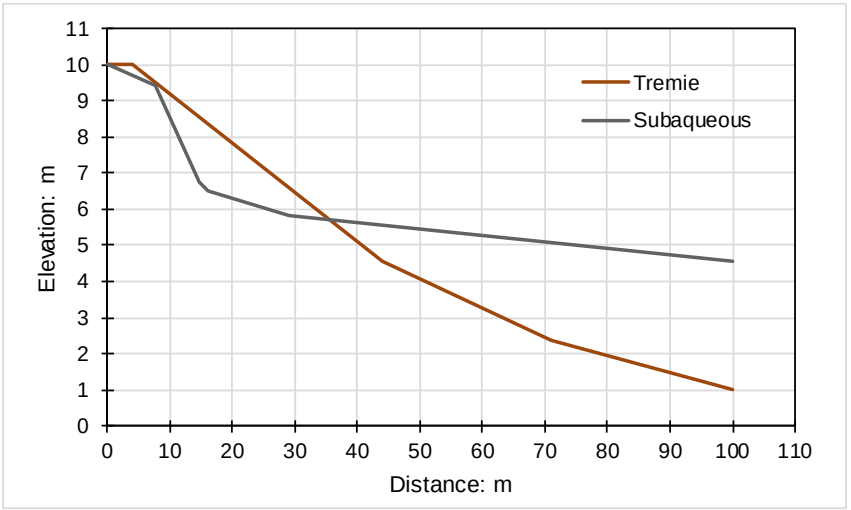
Subaqueous Deposition Trial - Results

Comparison of Resulting Profile at a Fixed 10 m Deposit Height Considering Compound Slopes





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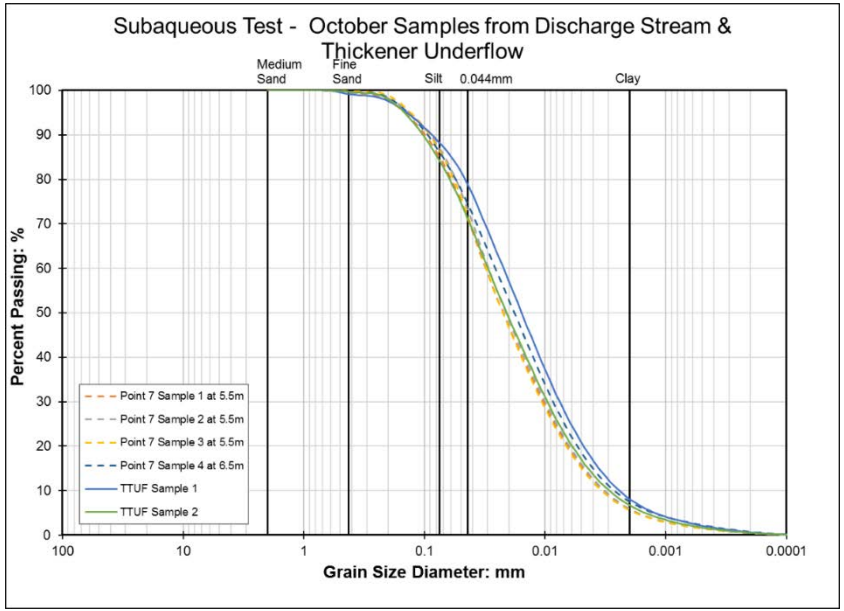
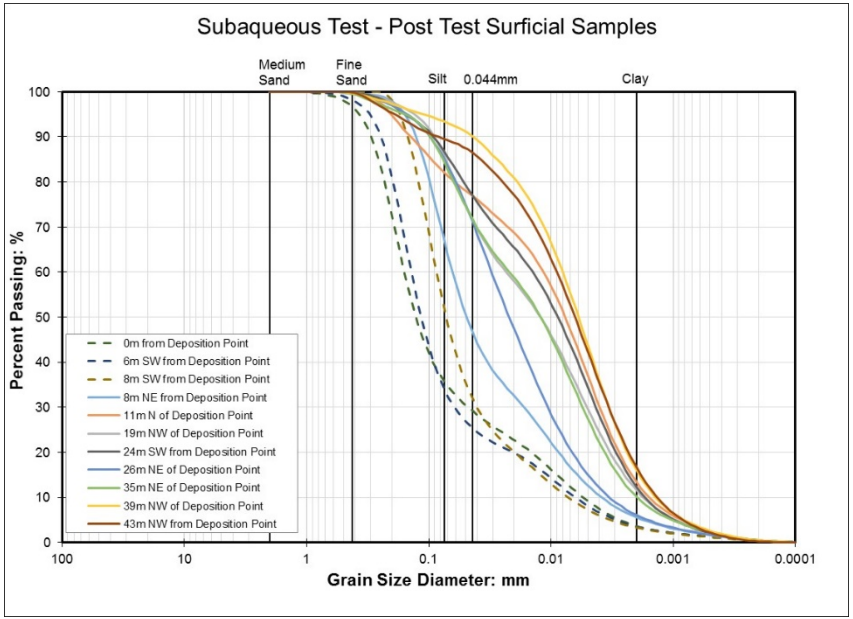
Subaqueous Deposition Trial - Results

Samples Collected from the Deposition Point and Thickener Underflow between October 12 and October 18, 2017



Surficial Samples Collected October 18



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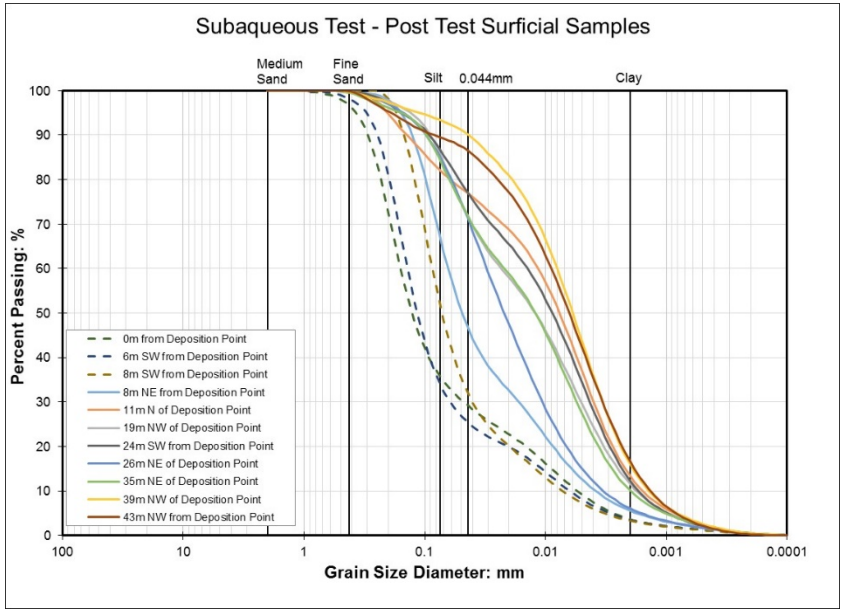
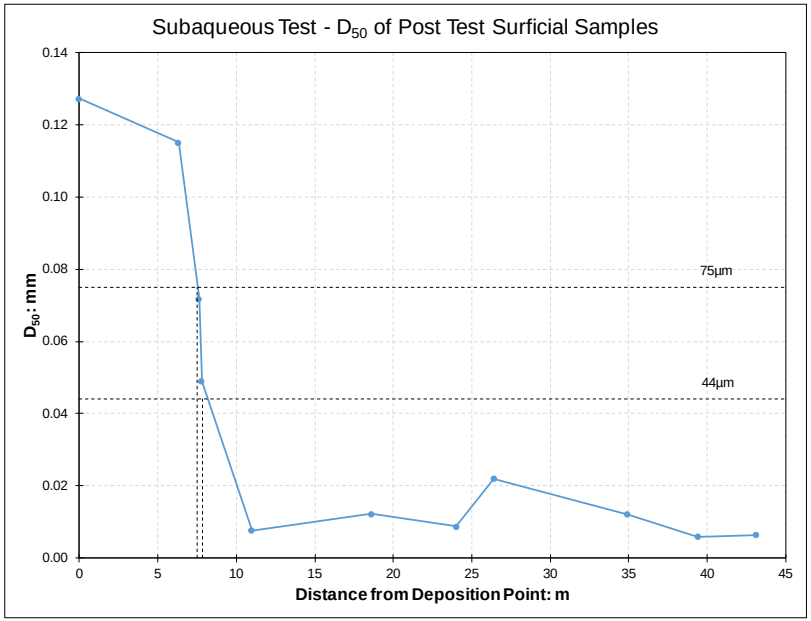
Subaqueous Deposition Trial - Results

Surficial Samples Collected October 18



D_{50} of the Surficial Samples Collected October 18



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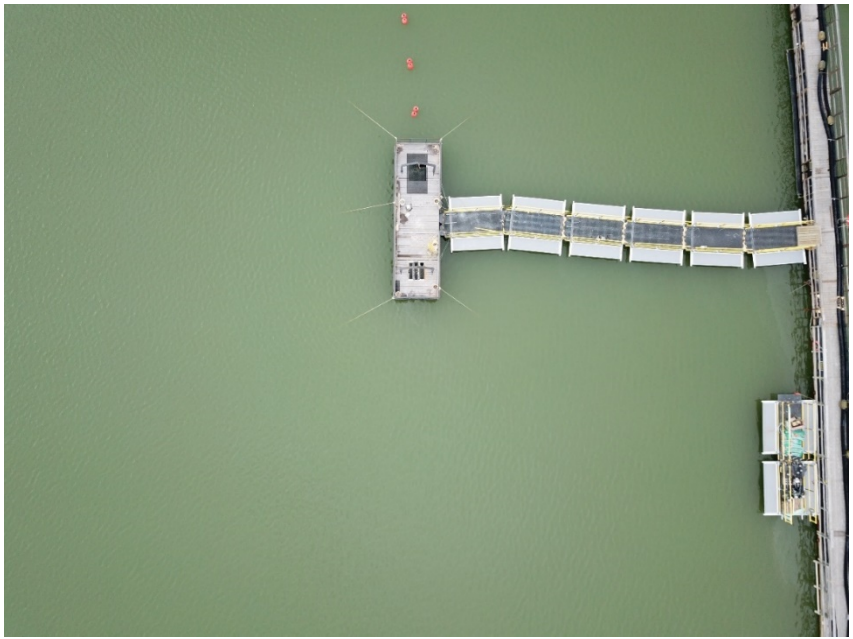
Flexible Walkway



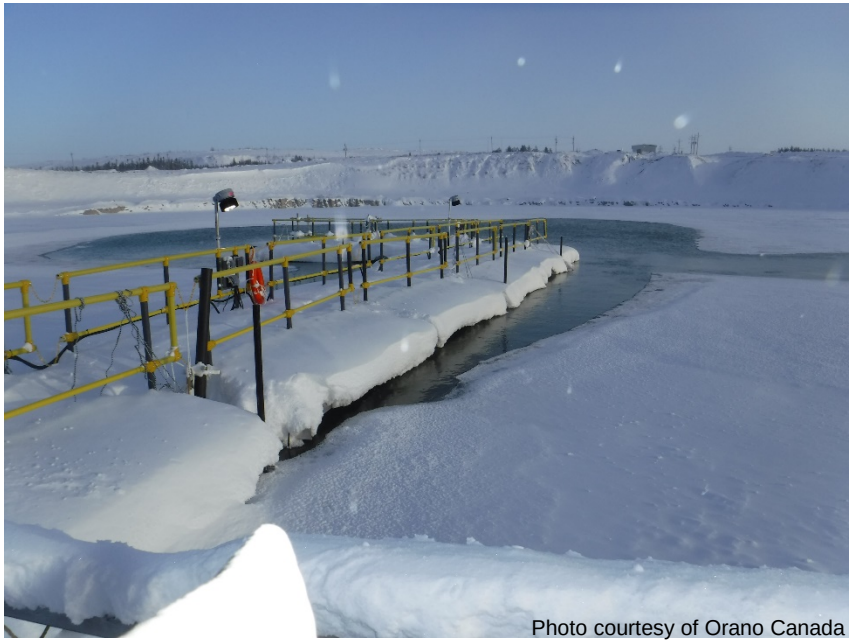


Photo courtesy of Orano Canada

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Conclusions

- Subaqueous deposition:
  - provide more flexibility with deposition points
  - allows the ability to maximize the use of the available pit capacity
  - does not compromise the tailings objectives
- System was installed fall 2018 and is currently operational


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Questions?

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