

Snowmaking as a Viable Groundwater Disposal Method at the Butte Highlands Mine

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Mine Design, Operations, & Closure Conference
May 4, 2011



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Organization



- Project Overview
- Water Overview
- Hydrologic Modeling
- Snowmaking

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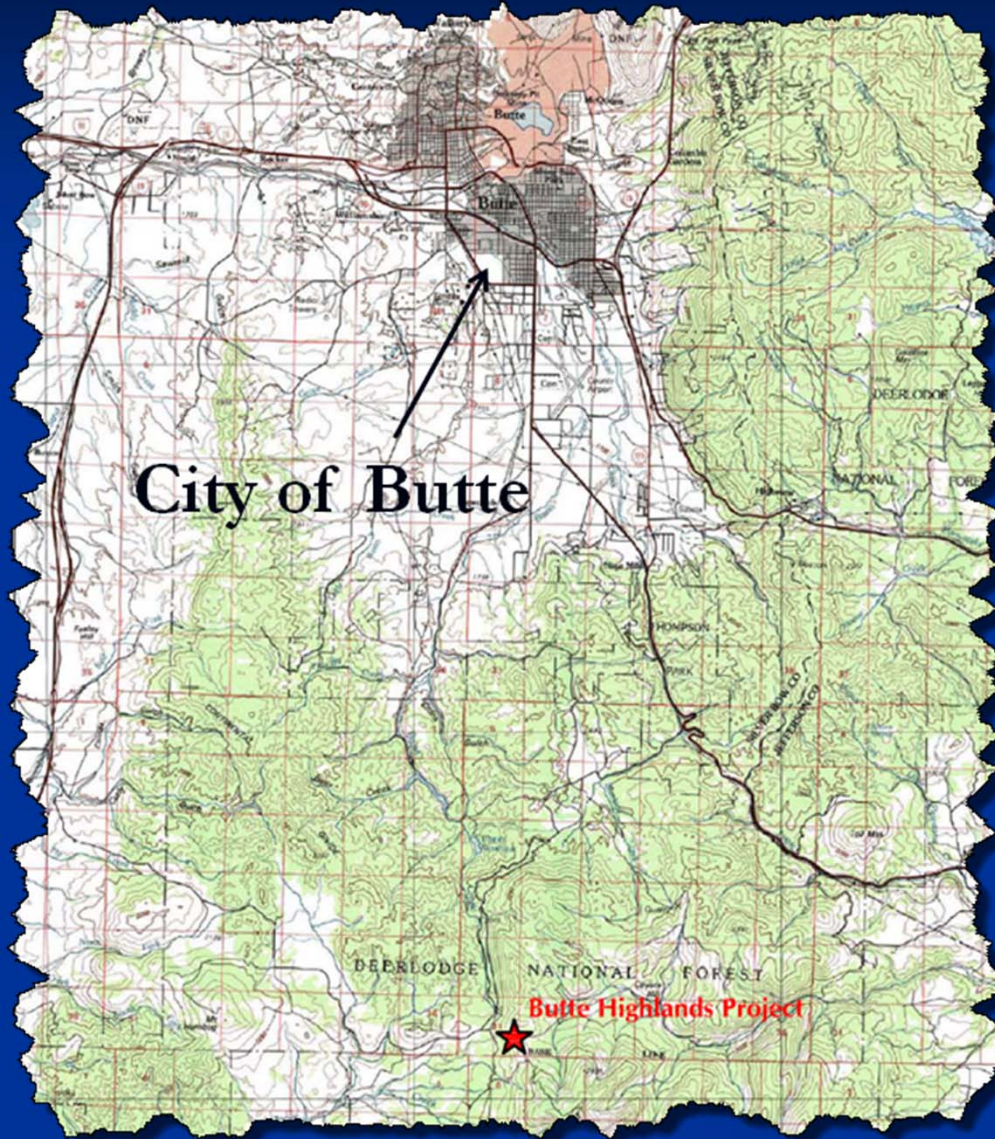
Project Overview

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Project Location

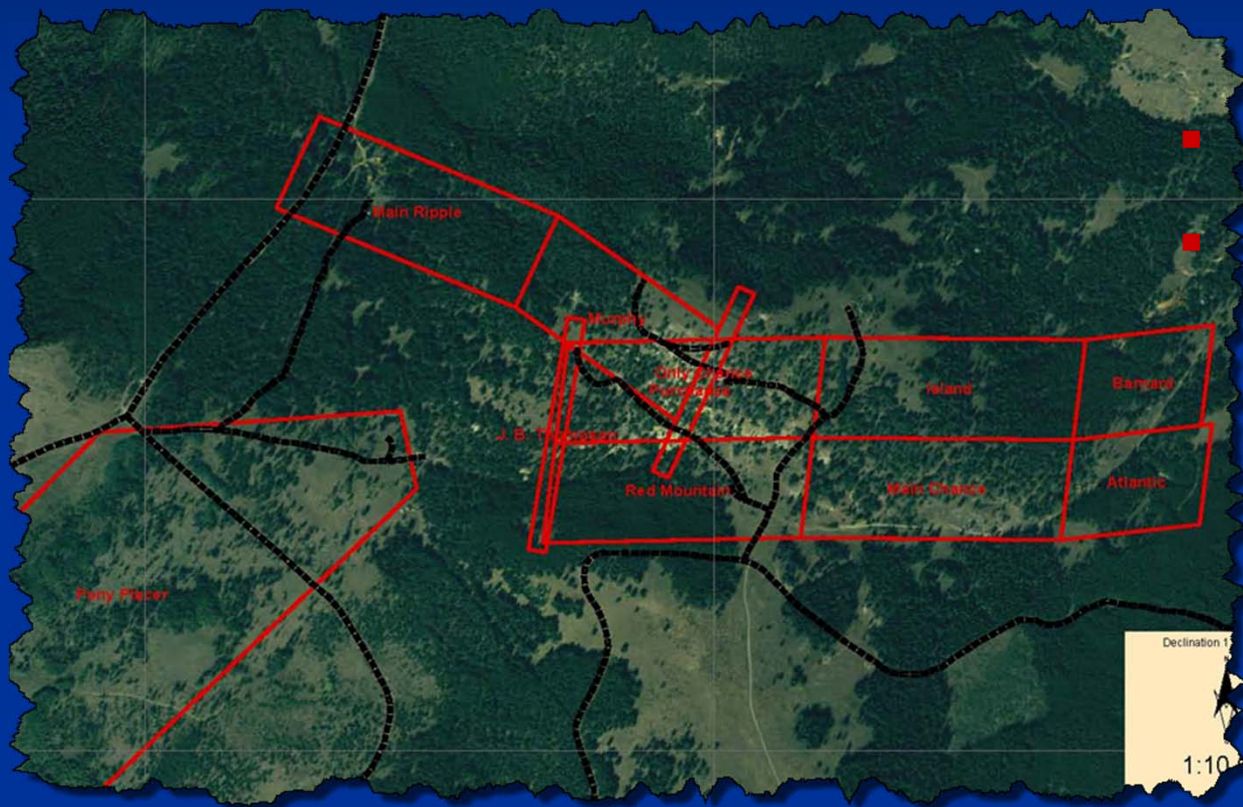


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Project Overview



- Seven Patented Claims
- Highland Mining District
 - Fish Creek Discovery – 1866
 - Highland Mine – 1930's
 - Modern Exploration – 1980's
 - Butte Highlands Mine - 2010

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Property Ownership

- Butte Highlands Joint Venture (BHJV)
 - 50/50 JV
 - Timberline Resources
 - Highland Mining Company
- Small Mine Development, LLC (SMD)
 - Operator/Contractor



Permitting

- DEQ Approved Exploration Permit
 - Site Preparation
 - Underground Development (drill stations)
 - Drilling
 - 10,000 ton Bulk Sample
- Operating Permit Submitted

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Project Overview



■ Surface

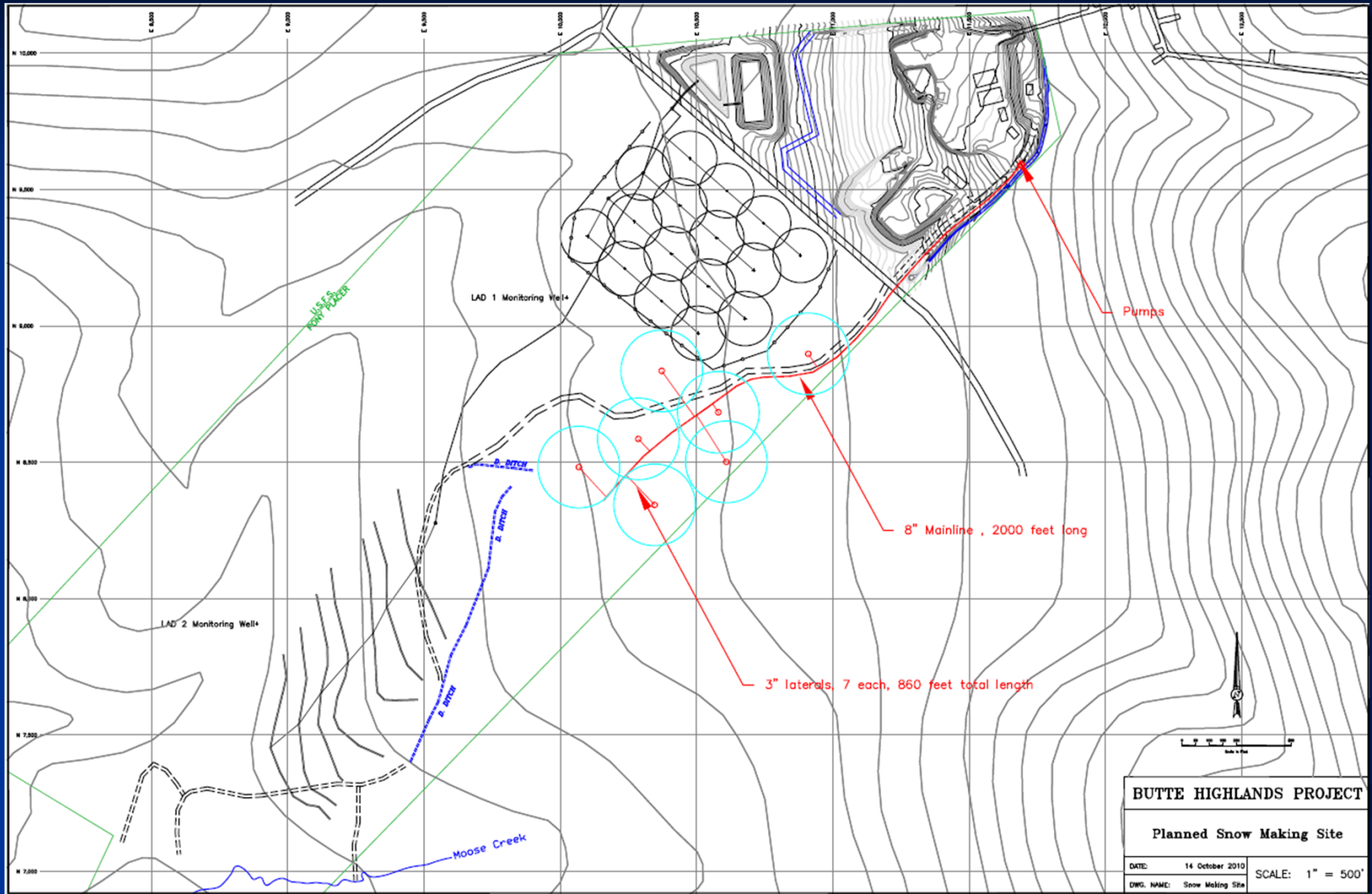
- Shops/Offices
- Batch Plant
- Pump Houses/Core Shed
- Ponds
 - Settling/Containment
- Land Application Disposal (LAD)



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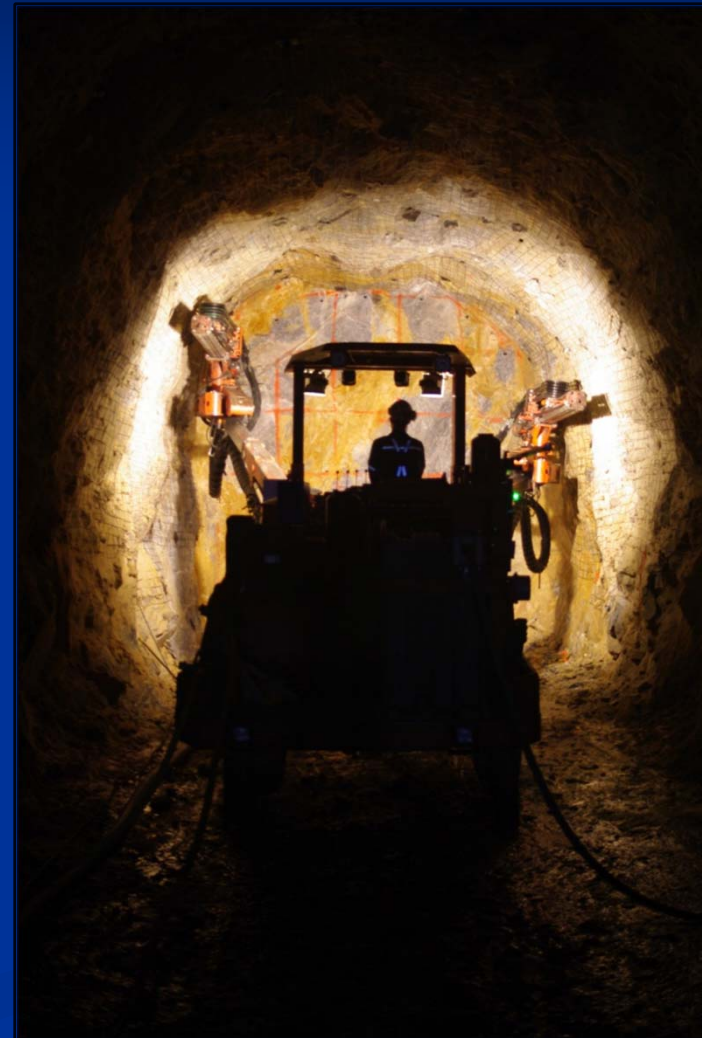
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Project Overview

- Underground
 - January 2010
 - Over 4,500' of Drift
 - 4 U/G Drill Stations



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Project Overview



- $\approx 50,000'$ of Core
- Estimated Completion Date
 - June 2011



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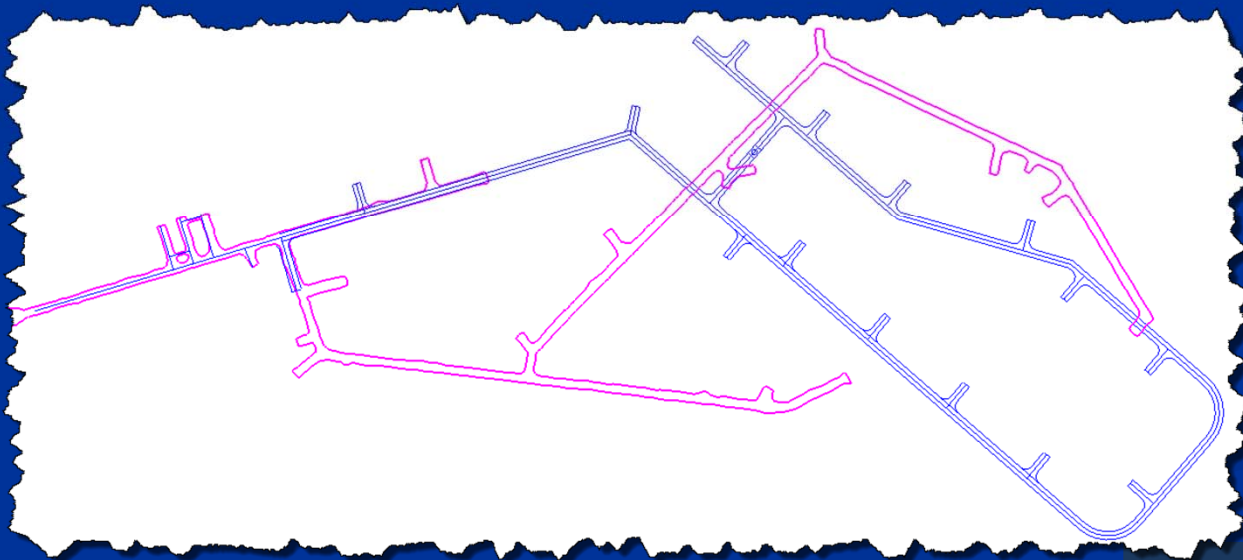
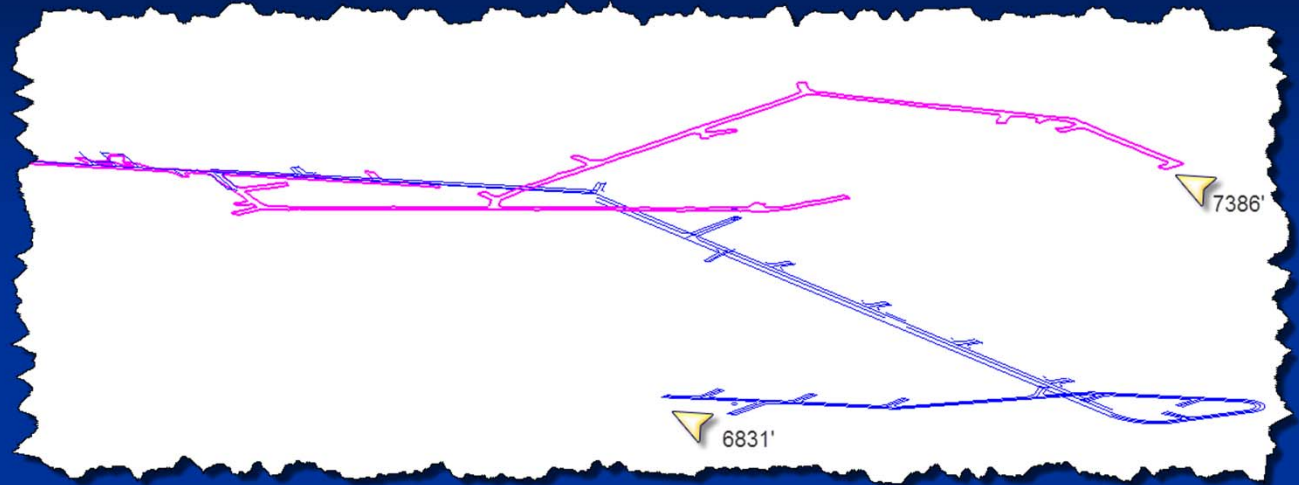
Hydrological Conditions

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Design vs. As-Built



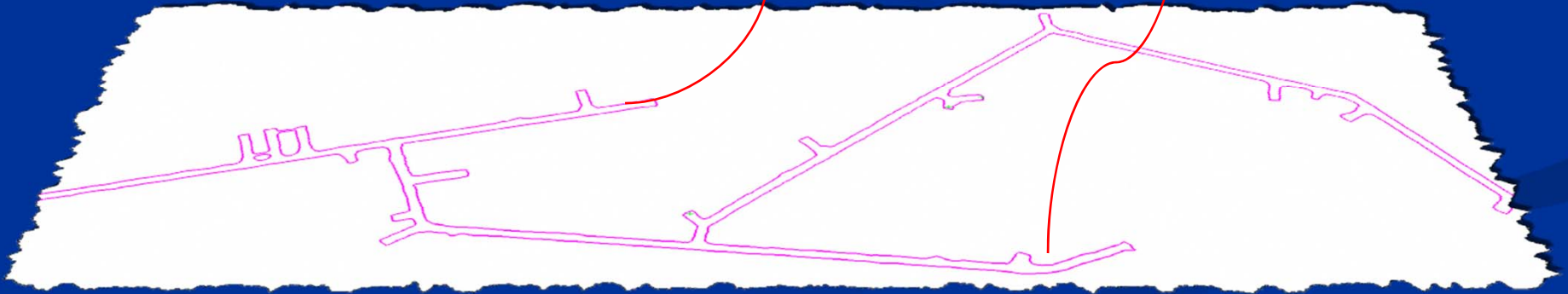
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Grouting

- Main Decline
- Upper Access Ramp (UAR)
 - 846,000 lbs of cement
 - 59.5 days – 7 tons/day
- Effective but Costly
 - Time Consuming



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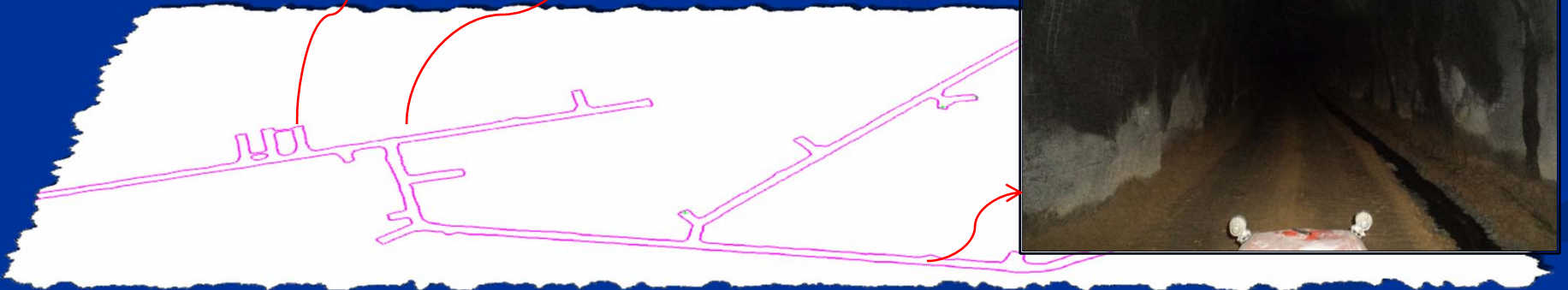


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Pump Stations



- Sump #3 – 34 gpm
- Re-circulating 20 gpm

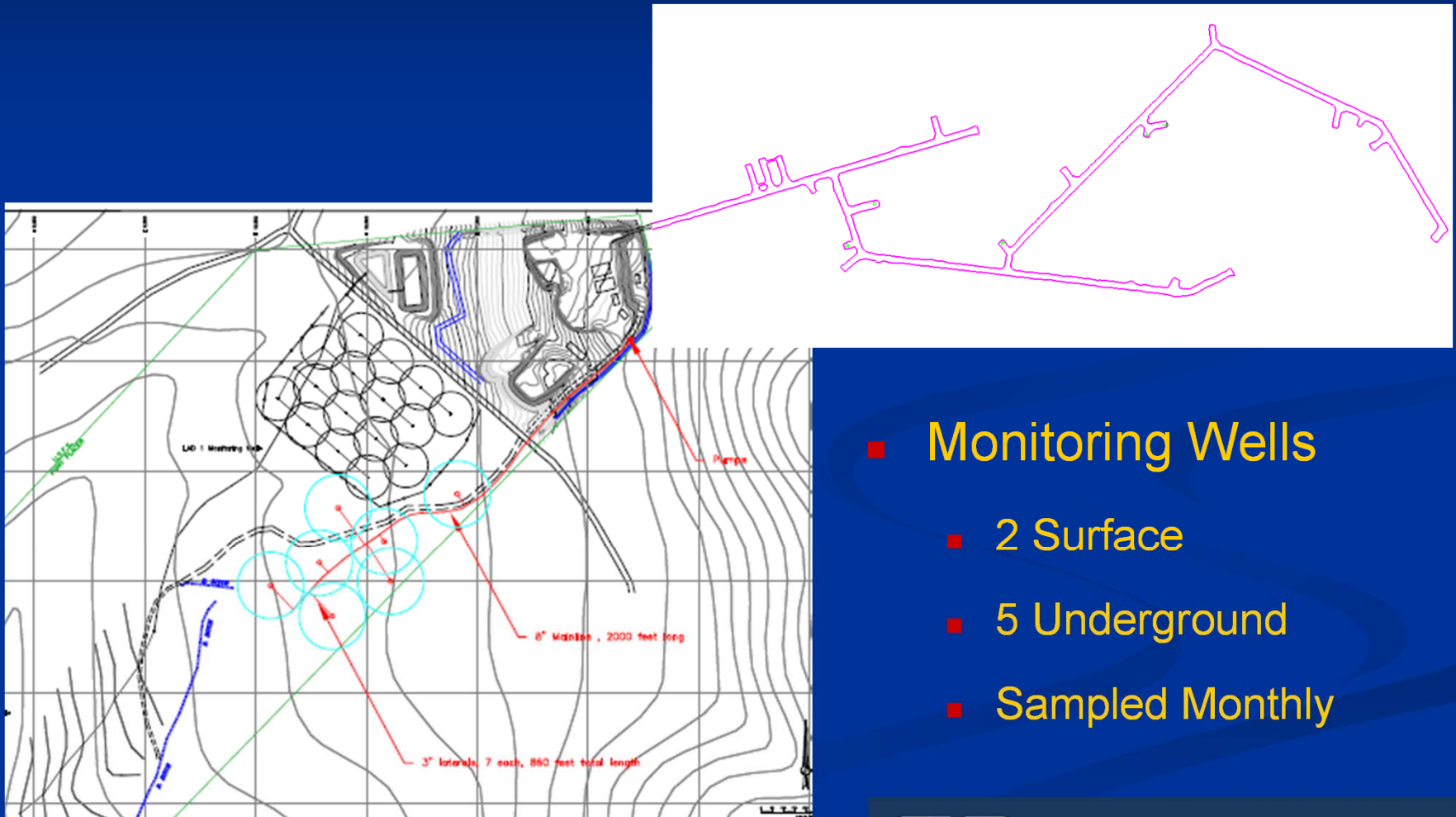


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Current Water Handling



Hydrology Test

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Hydrology Test

- Purpose
 - Model Underground Aquifer
 - Determine De-watering Pumping Rates
 - Placement of De-watering Wells
 - Model Surface Water Impacts

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Underground De-watering Well



O'KEEFE DRILLING

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De-watering Pump



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Hydrology Test

- Step Test
- Constant Pump Test
 - 350 gpm
 - 10 Days



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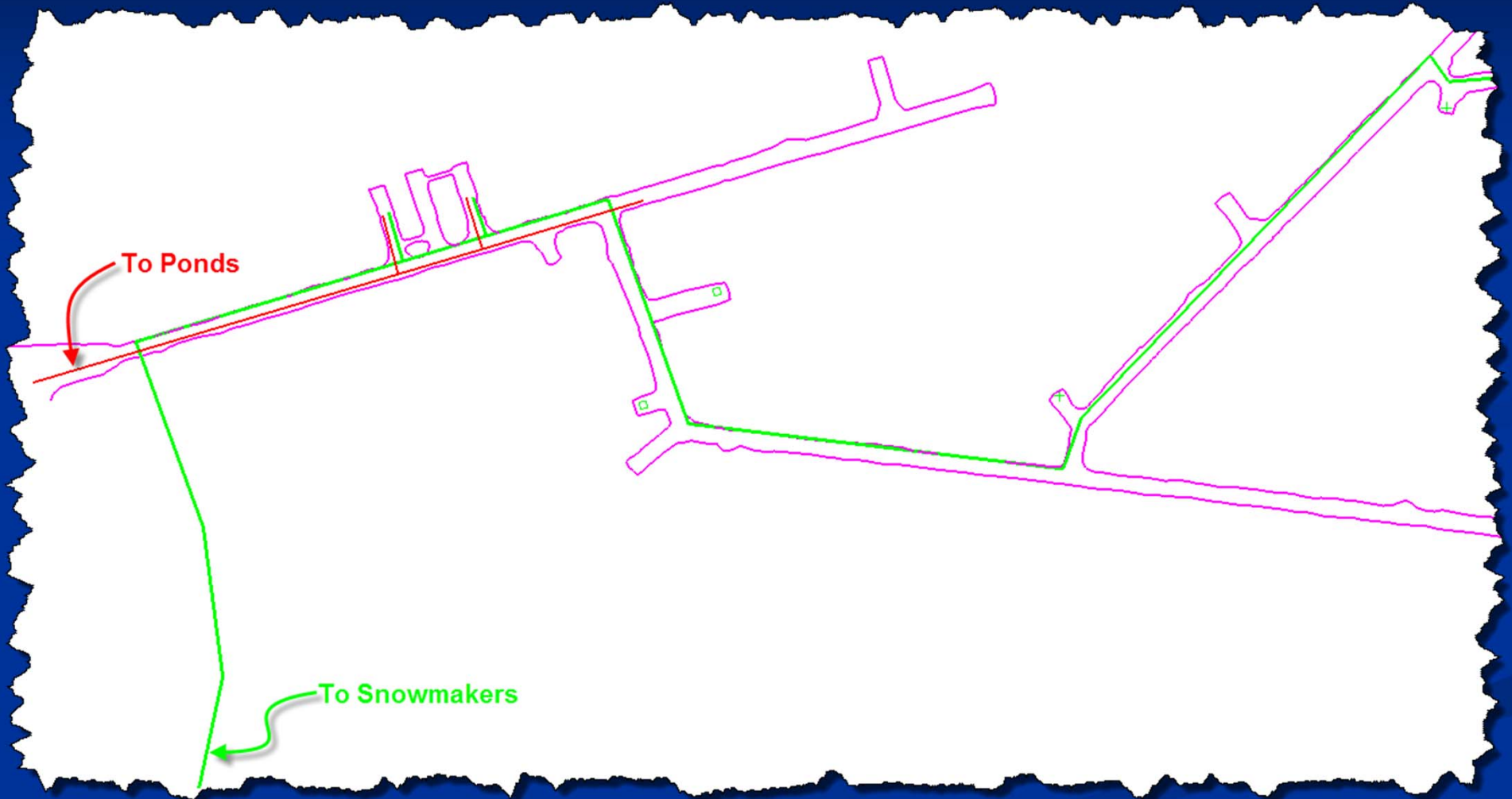
Snowmaking

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Contact vs. Non-Contact



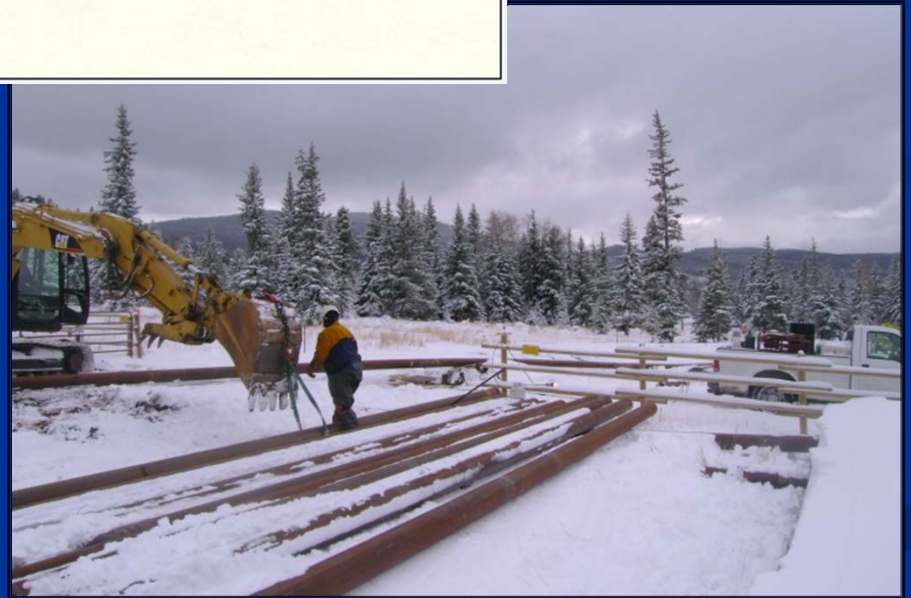
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Construction

Nov 6, 2010



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Snowmaker Pumps



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■ Pipe

- 6" Poly = 2,300'
- 8" Steel = 2,300'
- 3" Steel = 950'

■ Electrical Cable (480 v)

- 350 MCM = 1,450'
- 4/0 = 1,600'

SMI Super Pole Cat Snowmaker

- Tower Mounted
- Fan + Compressor: 35 hp
- Water Pressure: 100 – 750 psi
- 30 nozzles: 22 – 142 gpm
 - 5 Valve Banks
- 360 Degree Rotation
- 70 Degree Oscillation



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Snowmaking



- 7 Snow Makers
 - \approx 250' Spacing
 - Prevailing Wind
- For 350 gpm
 - Utilized 5 Guns @ $\frac{1}{4}$ Capacity

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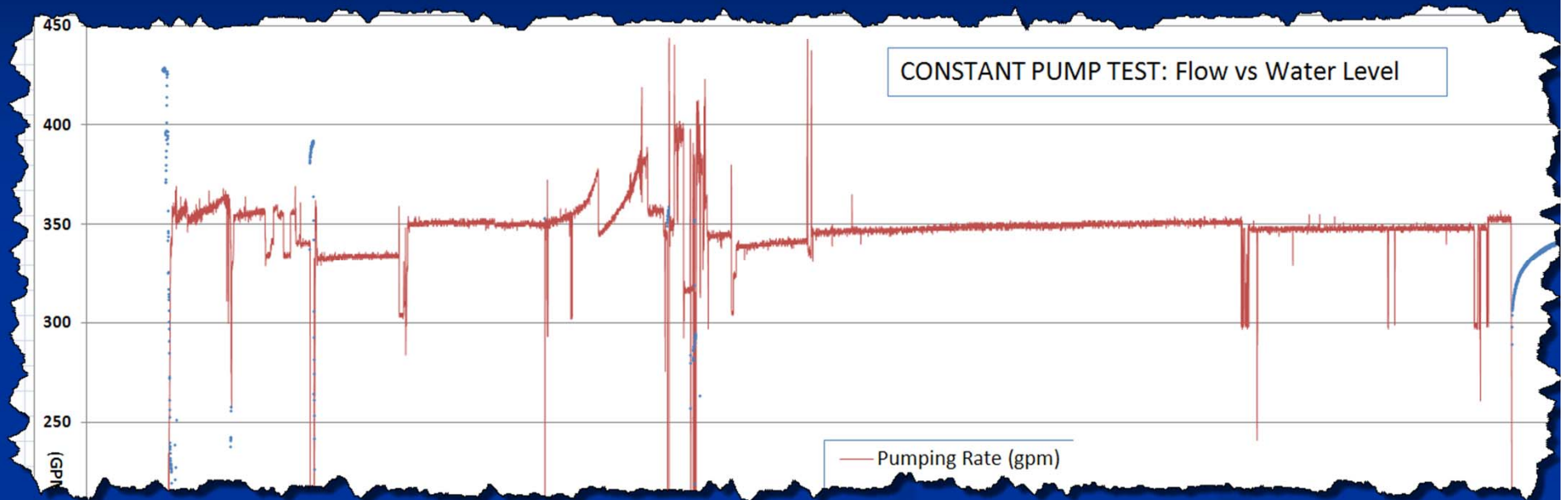


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Pump Test Data



- Jan 18 – Jan 28, 2011
- Total Water Pumped = 5,240,679 gallons

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Challenges



- Pumping System
- Learning Curve
- Weather Dependant
- Labor Intensive

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Lessons



- Hire Professionals
- Space Requirements
 - Placement of Snowmakers
- Expect Time

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Conclusion

- Snowmaking is a Viable Solution for Water Disposal at the Butte Highlands Mine
 - Limitations:
 - Snow Melt
 - Space
 - Weather Dependant
 - Cost (capital & labor)

Questions?



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