

EFNM Waste Consolidation Area

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**CDM
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Overview

- East Fork Ninemile (EFNM) Cleanup Plan (Upper Basin)
- History of EFNM Waste Consolidation Area (WCA)
- EFNM WCA Plan and Design Overview
- Phased Design and Construction
- Review Lessons Learned

East Fork Ninemile (EFNM) Plan

- What is the Problem?
 - Waste rock and tailings deposited high in the Coeur d'Alene Basin are the source of heavy metals (i.e., lead and zinc) contamination
- Solution
 - Remove the mine waste from its present location and place “high and dry”
 - Start at the top of the basins and with the highest loading and work down



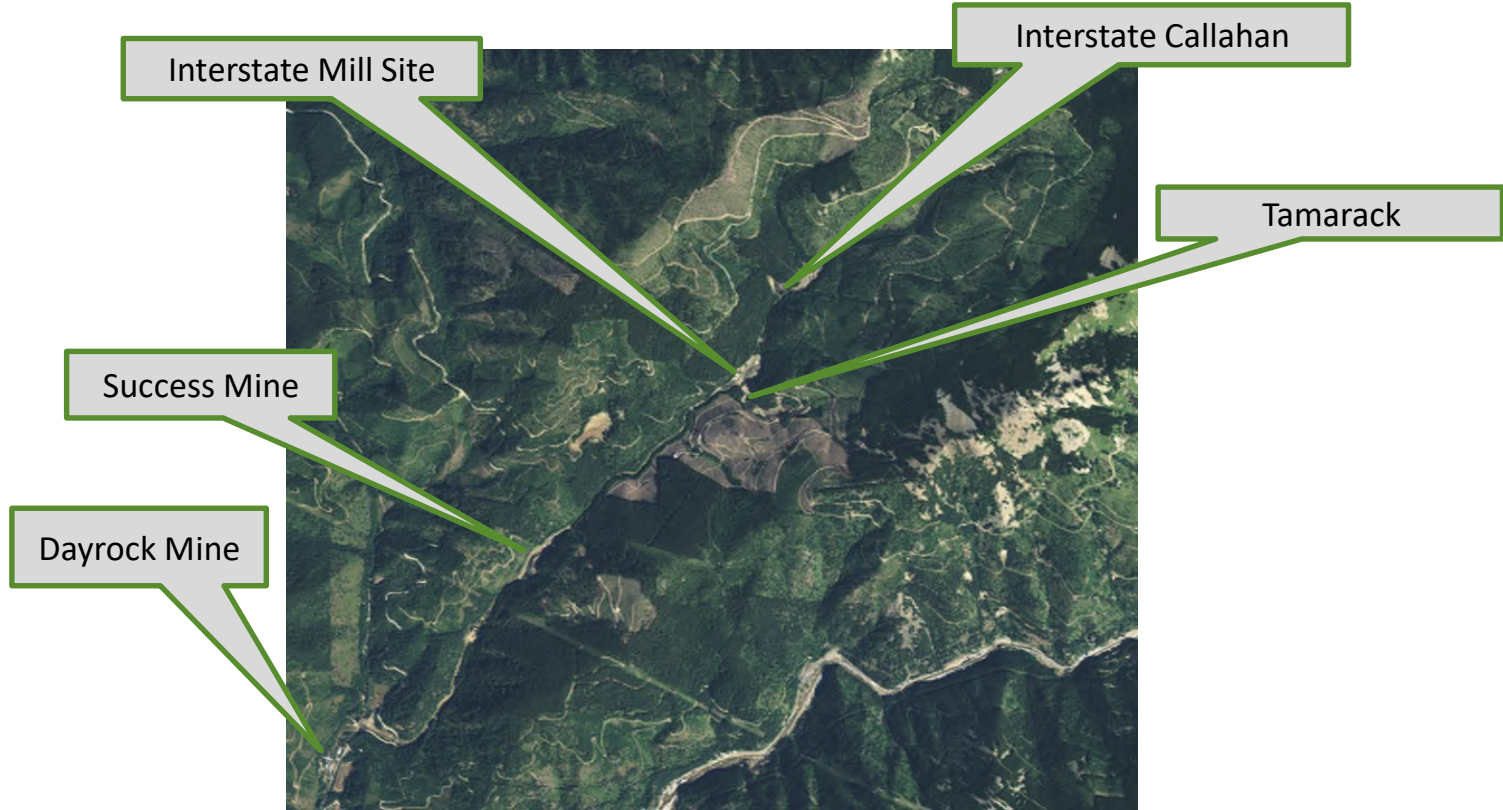
History of EFNM WCA

- Design activities Started in 2010
- Pre-Design Data Collection 2011
- Initial Construction Started in 2013
- 2 Phases of Expansion Completed (3rd in Progress)
- 2 Phase of Final Cover Installation Completed
- Planned Completion is 2025/2026

WCA – Location Selection Criteria

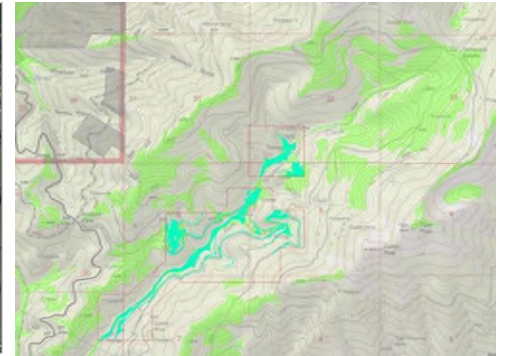
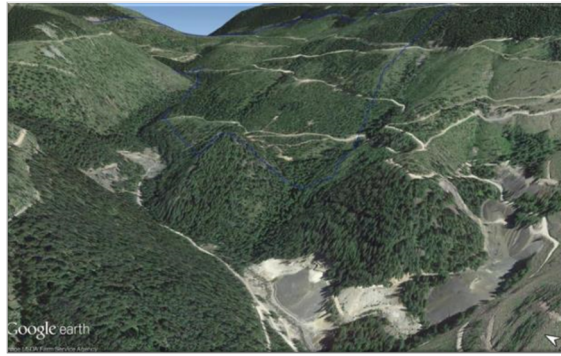
- Close to Remediation Sites
- Large Enough Area to Contain 1M to 3M CY Mine Waste (Flexibility Needed; Phased Construction)
- Existing Access Roads Present (Potential Cost Savings)
- Potential Clean Topsoil and Subsoil and/or Rock Borrow Source (Bonus)
- Free of Complex Land Ownership Issues
- Relatively Flat; Mine Waste to be Placed at 3H:1V or Flatter

EFNM Mine Waste Locations



Site Selection Tools

- ESRI ArcGIS Slope Analysis (LiDAR Data)
- Google Earth
- Site Visit!

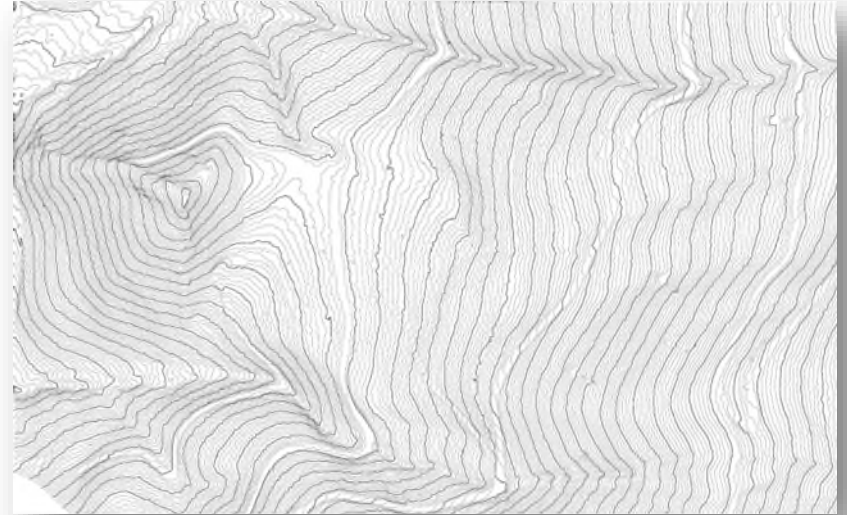


View From Tamarack

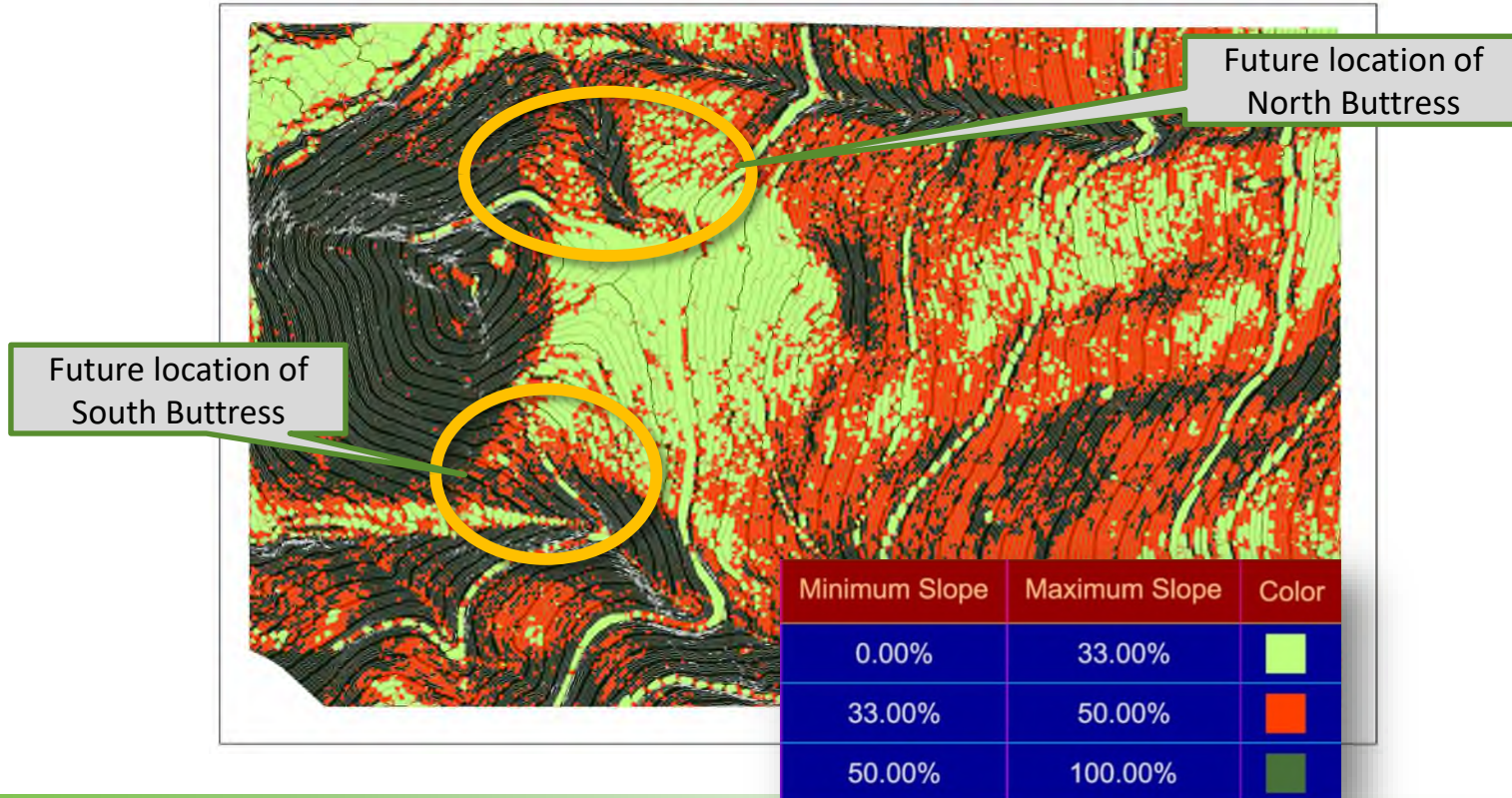


EFNM WCA – Site Selection

- Access / property
 - One owner
 - Existing access road
- Rock source
 - 400K CY need over 10 years
- Soil borrow
 - 200K CY needed over 10 years
- Flat area large enough for WCA base
 - Slope analysis



Existing Conditions Slope Analysis – CIVIL 3D





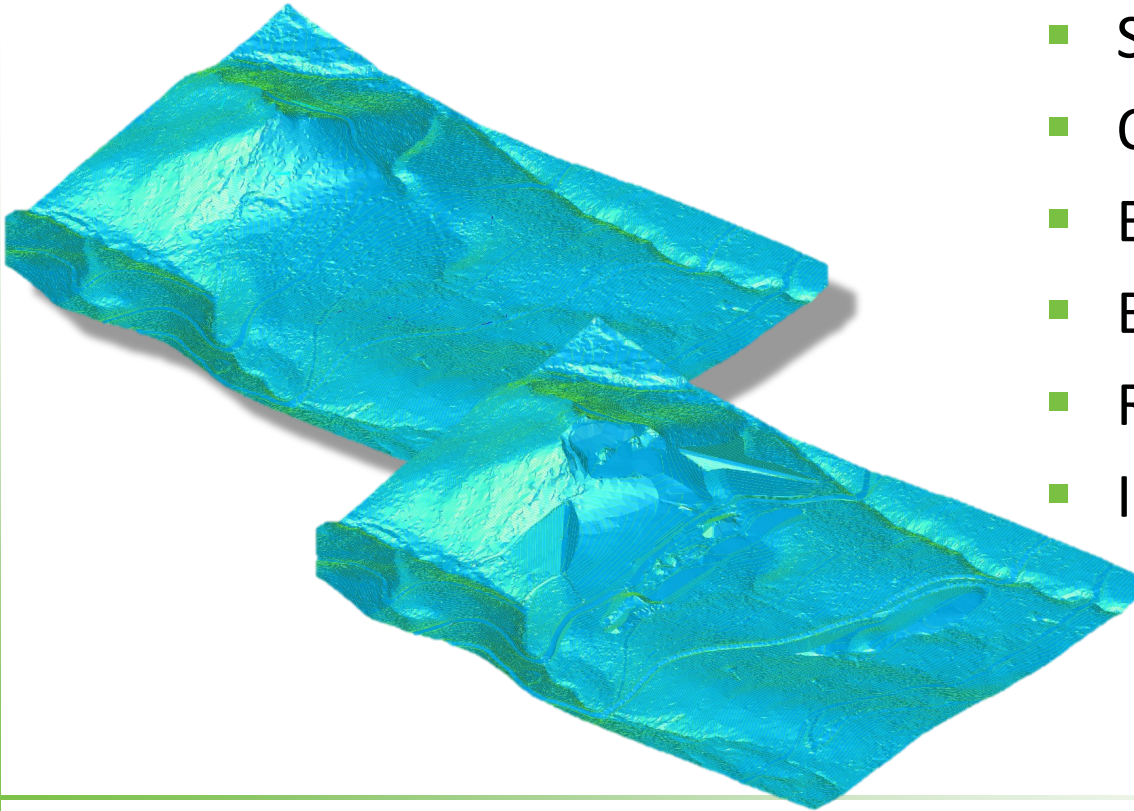
EFNM WCA Final Configuration

- **Buttress**
 - North and South Buttress Each ~35K CY After Soil Salvage
- **Rock / Soil Borrow**
 - On-Site Quarry 400K CY of rock or more
 - Rock Borrow Expandable and Almost Entirely Outside of the WCA Footprint
 - Soil Salvage 250K CY or More
- **Mine Waste Consolidation Capacity**
 - 1.3M CY

Phased Design and Construction

- Design and Construction Phase #1 – 2 Year Contract
 - Initial Development
 - Interstate Callahan Waste ~250K CY
- Design and Construction Phase #2 – 3 Year Contract
 - WCA Foundation Expansion #2
 - Success Mine Rock ~ 400K CY
- Design and Construction Phase #3 – 3 Year Contract
 - WCA Foundation Expansion #3
 - Phase 1 – Final Cover Installation (IC and Success Waste)
 - Interstate Mill Site ~ 200K CY
- Design and Construction Phase #4 – 3 Year Contract
 - Final WCA Waste Foundation Expansion #4
 - Phase 2 – Final Cover Installation (Success and Interstate Mill Site Waste)
 - Tamarack, Dayrock, Lower EFNM Creek ~ 450K CY
- Final Phase Cover Installation (2025 – 2026)

Design and Construction – Phase 1



- Soil Salvage
- Quarrying
- Buttress Construction
- Base Drainage System
- Runoff Control
- IC Waste

North and South Buttresses

- Buttress Construction
 - Remove Topsoil
 - Bench / Toe Drainage System
 - Buttress Rock Fill
 - 3" to 12" or 6" to 24" Rock
 - 2- or 3-Foot Lifts
 - 5-Passes w/ Vibratory Roller
- North Buttress
 - ~35K CY
- South Buttress
 - ~35K CY



North Buttress (As Constructed)



Phase 1 – IC Waste (~200 CCY)



Design and Construction Phase #2

- Elements of Expansion
 - Soil Salvage
 - Quarry Development and Rock Processing
 - Seep or Groundwater Collection Trenches
 - Base Drainage System



Phase 2 – Success Complex



Phase 2 – Success Complex



Phase 2 – Success Complex (~650K CCY Total)



Phase 1 of Final Cover

- Elements of Final Cover
 - Liner Cushion Layer (Waste)
 - Geotextile
 - 60-mil LLDPE Geomembrane
 - Geocomposite
 - Liner Cushion Layer (Clean)
 - 2-Foot Soil Cover
- Drainage Benches



EFNM WCA Phased Development



EFNM WCA Phased Development – Cont.



Lessons Learned

- Site Selection Provided Huge Savings to Client
 - More Efficient Waste Placement Design versus Alternate Sites
 - Existing Access Roads
 - On-Site Quarry and Soil Salvage Capabilities
- Construction Season Planning
 - Get Designs Approved Early
 - Perform Clearing and Grubbing in the Fall to Avoid Nesting Bird Issues
- LiDAR
 - Be suspect of LiDAR in heavily vegetated areas
 - Volume Variation May Be Significant
 - Truth Check LiDAR or Survey After Clearing and Grubbing
- Pre-Design/Construction Data Collection
 - Designer / CM Involvement a must

Lessons Learned

- Phased Development of EFNM WCA Saved Investment Income
- Quarry Rock and Salvaging On-Site Soil
 - Use of On-Site Quarry Saved at least \$10M in hauling costs
 - Environmental pollution reduction
- Waste Compaction
 - Compaction / Shrinkage Hard to Estimate
 - Consider Bulk Testing Approach Prior to Construction
 - Large Waste Rock = Higher Compaction / Shrinkage
 - Floodplain waste = Lower Compaction / Shrinkage
 - Lots of Variation (i.e., grain size, debris, moisture content)
- Winterization
 - BFM v. Copolymer

Questions?



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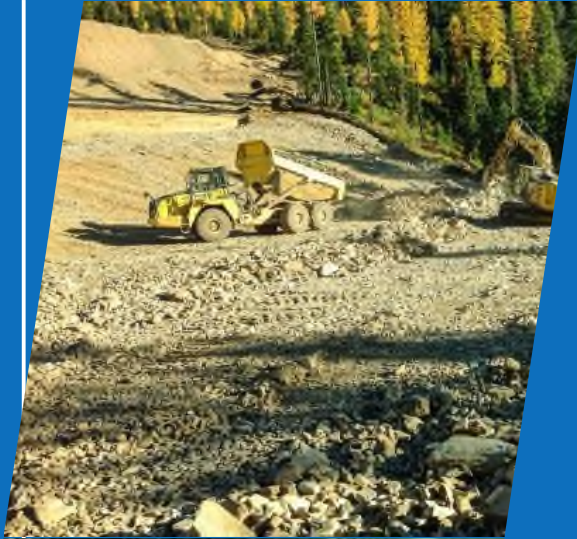


Extras

North Buttress (As Constructed)

- Final Volume ~34K
- Toe Bench / Drain Installed
 - Dry
- Very Steep Terrain
 - Difficult to Get Rock to Toe
- Topsoil Salvage Very Difficult
 - Removed Majority
 - Very Rocky





South Buttress (As Constructed)

- Final Volume ~44K
- ~22K in 2013
- Toe Bench / Drain Installed
 - Very Wet / Natural Spring at Toe
 - Difficult to Prepare
 - Difficult to Define Toe
- GPS Shift
 - Shift Occurred Design to Construction / Survey GPS
 - Out / Downhill 5-Feet





South Buttress (As Constructed)

- 5-Foot Shift Ripple Effect
 - Developed Quarry Volume Based on 35K CY South Buttress
 - Extra 14,000 CY From Quarry
 - Ratio Changed 50% 3" Minus / 50% 3" Plus
 - Extra 8,000 CY of Buttress Rock
 - Extra 8,000 CY of 3" Minus
- Changed Topsoil Screen to 3"
- Utilized 6" Minus in Upper 5 Feet

Base Drainage System Plan



- Remove Topsoil / Subsoil
- Prepare Foundation
- Install Secondary Drainage Pipe Trench
- Place Geotextile
- 2 Feet of 1" to 3" Drainage Rock
- Place Geotextile

Base Drainage (As Constructed)



Interstate Callahan Waste Placement Plan

- 220K BCY of Waste
 - As Measured In Place Prior to Excavation
- 120K BCY of Waste Planned for 2014
- Start Placement in South Buttress Area
- Utilize Waste Transfer Station Until Initial Construction Complete
 - Extra Handling
 - Additional Contractor Coordination

