Cost and Technically Effective Erosion and Sediment Control

Risk Based Stormwater Management

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Presentation Outline

- Past Stormwater Practices
- Trends in Construction Stormwater Regulations
- Typical Active Mine Stormwater Regulations
- Stormwater Regulations Trends Impacts on Design
- Stormwater Regulations Trends Impacts on Construction
- Stormwater Design Best Practices
- Stormwater Risk Evaluation
- Activity-Based Best Practices
- Closing Thoughts

Stormwater of the Past

- Submit an NOI
- Develop a SWPPP
- Install a few BMPs (e.g., silt fence, straw bales)
- Perform SWPPP Inspections
  - Weekly
  - During / After Storms
- Update SWPPP
  - Repair / Replace / Upgrade BMPs
  - Keep Trying and You're Good!

Trends / Changes to Construction Stormwater Requirements

- NOI / SWPPP
  - Requires Special Certifications for SWPPP Developers
  - NOI Review Period (14 - 60 days)
  - Signatory Requirements
- Endangered Species Act Considerations
- Historic Preservation Act Considerations
- NPDES Discharge Permit Requirements
  - Discharge Standards (e.g., Turbidity less than 25 NTU increase)
- SWPPP Inspections
  - Certification Requirements for Inspectors
  - Turbidity Testing During Storms
  - Electronic Filing of Discharge Monitoring Reports (DMRs)

Typical Active Mine Stormwater Permit Conditions

- Discharge Points and Mixing Zones
  - Understanding of every discharge point
  - Mixing zone may or may not be considered
- Effluent Limitations
  - Less than 5 NTU above natural
  - Comparison to paired undisturbed monitoring location
  - Maximum net monthly turbidity limitations
- Exceedances
  - All construction activities must cease until the proper BMPs can be constructed that can achieve a 5 NTU daily limit
- Outfall Monitoring
  - Turbidity – Measured Daily
  - BMPs – Observed Daily
  - Discharge Events – Observed Daily
  - Reports Due – For any BMP Compliance Issue or Discharge Event Observation

Stormwater Regulations Trends Impacts on Design

- Stormwater Considerations Impact Design Criteria
- Designs to Minimize Sediment Creation From a Site
- Water Balance Models
- Hydraulic and Hydrology Analysis
  - Pre- and Post- Construction
- Phase Designs and Construction to Prevent Generation of Sediment Impacted Stormwater
- Worst Case Scenario is Active Water Treatment During Construction

New Stormwater Regulation Impacts on Construction

- SWPPP Updates Reviewed By Regulatory Authority
- Filing of Discharge Monitoring Reports
- Disturbance Stabilization Initiated Immediately Upon Completion of Activity or Inactive
- Daily BMP inspection
- Exceedance of Turbidity Standards Shuts Down Construction Until Effective BMPs can be Installed

Stormwater Design Best Practices

- Evaluate site stormwater risk during design
- Minimize disturbance footprints
- Implement and install permanent stabilization as soon as practical to reduce need and use of temporary BMPs
- Design to reduce or eliminate (if possible) needs for sediment control / treatment
  - Sediment control / treatment is significantly more expensive than good design and construction practices that prevent the creation of sediment laden water

Stormwater Risk Evaluation

Risk Ranking	0	1	2	3
Soil Types (ST) More than 50% of the upper 1 foot of ground surface consist of:	**Rock** Cobble or larger	**Coarse** Coarse gravel - cobble	**Medium** Fine - medium gravel	**Fine** Clay, silt or sand
Grade of Slope (G)	> 5H:1V	2H:1V - 5H:1V	< 2H:1V	--
Disturbed Slope Length (SL)	< 30 feet	--	> 30 feet	--
Run-on Potential (RP)	No	--	Yes	--
Distance (D) To Discharge Point	**Disconnected** No path for discharge	> 100 feet	10-100 feet	0-10 feet

Stormwater Risk Evaluation (cont.)

- Sum of Numerical Ranking Ranges from 0 - 12
- Risk Ranking ≥ 8 (High Risk)
  - Temporary BMPs Needed During Construction
  - Design permanent stabilization measures
  - Implement permanent stabilization as soon as possible
  - Source and Sediment control BMPs likely needed
- Risk Ranking > 4 or <8 (Medium)
  - Temporary BMPs
  - Intensive monitoring program
  - Permanent stabilization plan
- Risk Ranking ≤ 4 (Low)
  - Monitor and update risk ranking as needed and to ensure erosion and sediment discharge not occurring
  - Implement temporary BMPs as needed

Activity Based Best Practices Examples

- Activities Typical of a Mine or Mine Reclamation
  - Haul Roads and Access Roads
  - Reclamation Sites (Large disturbed areas)
  - Waste Rock Consolidation

Haul and Access Road

Haul and Access Road

- Haul and Access Roads Stormwater Management Can Be Difficult
  - Constant disturbance by vehicles or haul trucks
  - Likely many creek crossings and discharge points
  - Active mines have roadside berm requirements
  - Likely constructed of gravel and rock and not covered by asphalt
- Haul and Access Roads BMPs to consider during design
  - Design and Control Stormwater Runoff
  - Understand Discharge and Monitoring Points
  - Evaluate stormwater risk along length of haul road
    - Many risk evaluations likely needed
  - Design and install permanent BMPs that reduce risk
  - Minimize need for temporary, manufactured BMPs

Rock Covered Road Surfaces

- Stabilized or rock covered surfaces help prevent rut creation
- Very wet or unsuitable subgrades may require geotextiles and drainage rock
- Prepare foundation and harden with larger rock, if needed
- Install top surface that can be maintained with a grader
- Grade road to drain where intended

Rock Filter Strip and Rock-Lined Down-Slope Ditches

- Install in natural depressions where stormwater will accumulate
- Rock filters will slow and remove some sediment
- Infiltration Trenches

Culverts

- Culverts
  - Stabilize inlet and outlet
- Install extra culverts to minimize stormwater accumulation on roads
- Reduces culvert maintenance
- Evaluate risk at every culvert for sediment control BMP needs

Sediment Control BMPs

- Where stormwater concentrates and the risk of discharge is high
  - Install them all, probably going to need it
- Minimize Need For These Type of BMPs

Reclamation Best Practices

Reclamation Best Practices

- Large Disturbance Footprints
- Typically Have Surface Drainage And Stormwater Run-on
- No Vegetation Immediately After Construction
- Reclamation Best Practices To Consider During Design
  - Design And Control Stormwater Run-off
  - Plan For, Design And Control Stormwater Run-on
  - Design And Install Temporary And Permanent BMPs That Reduce Risk
  - Minimize Need For Temporary, Manufactured BMPs
    - Short Term Use Only!
  - Steeper Slopes Or Higher Risk Sites, Mix 50% Rock Into Soil
  - Mix On-site Available Organics Into Soils
  - Loosen and Roughen Surfaces
  - Spread Salvaged Timber Across Site

Reclamation Best Practices

Mixing Soils with Rock and/or Woody Debris - Mulch

Stabilized and Controlled Run-Off Channels

Surface Roughening

Reclamation Best Practices

Controlled Run-
On and Run-Off

Reclamation Best Practices

Run-On and Mid-Slope Run-off Channels

Erosion Control Mats or Spray-On Mulches

Risk Based Reclamation Example

Risk – Before

Soil Type (ST) = Medium = 2
Grade (G) = 2H:1(V) = 2
Run-on Potential (RP) = High = 2
Length of Slope (SL) = > 30 Feet = 2
Distance (D) = 10 Feet = 3

Risk = (2+3+1+1+3) = 11
HIGH RISK!

Risk – After

ST = Medium = 2
G = Reduced to 3H:1V = 1
RP = Stabilized / Controlled, Low = 0
SL = Reduced to < 30 Feet = 0
D = Increased 15 Feet + rip-rap filter = 1
Risk = (2+1+0+0+1) = 4 (Low)
Seed + Hydromulch = Additional stabilization with vegetative cover
Monitor vegetation

Waste Rock Consolidation

Waste Rock Consolidation Best Practices

- Typically Large Disturbance Footprints
- Surface And Stormwater Run-on
- No Vegetation
- Waste Consolidation Best Practices
  - Plan For, Design And Control Stormwater Run-on
  - Collect And Convey Shallow Groundwater And Seeps Around Site
  - Phase Development
  - Slope Lengths < 120 Feet
  - Evaluate Waste Characteristics And Plan Accordingly
    - Run-off To Reduce Contact Water – Generate Stormwater
    - Infiltrate To Reduce Stormwater Run-off – Generate Contact Water
  - Rock Is Generally Available, Use It!

Waste Rock Consolidation Best Practices

Reduce Slope Lengths with Mid-Slope Benches

Prevent Run-On With Berms or Drainage Channels

Waste Rock Consolidation Best Practices

Base Drainage System – Groundwater Separation From Waste

Collect and Convey Groundwater Seeps

Waste Rock Consolidation Best Practices

Temporary Covers –

1) To Reduce Contact Water - Crushed Gravel or Finer To Encourage Run-off and Reduce Infiltration Through Waste
2) To Reduce Stormwater Run-off – Use Coarse Grained Temporary Cover Like Rock Mulch Or Coarse Gravel

Temporary Stabilization for Temporary Covers – Bonded Fiber Matrix or Others

Waste Rock Consolidation Best Practices

Grade Top Surface To Encourage Controlled Run-off

Evaluate Entire Site

Closing Thoughts

- Trends in Stormwater Regulations Are Changing and Impacting Design and Construction Planning
- Additional Brainstorming and Risk Based Planning During Design Can Reduce Potential Need For Higher Cost Treatment
- Geotechnical / Geologic Site Information To Understand Available Infiltration Locations
- Take Advantage Of Locally Available Materials To Reduce Costs of Stormwater Management
- Must Understand All Stormwater Run-on and Run-off
- Perform Adaptive Stormwater Management During Construction

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Questions?