RECLAMATION COVER DESIGN FOR TAILINGS AND WASTE ROCK STOCKPILES

LOCATION: Copper Queen and United Verde Mines, Arizona - USA

CLIENT: Phelps Dodge Mining Company

PROJECT TYPE:

- Hydrologic Site Characterization
- Unsaturated Zone Hydrology
- Optimal Cover Design
- Cost Estimates

S.E.T. developed **optimal cover designs** and associated **cost estimates** for several tailings and waste rock facilities at the Copper Queen and United Verde mine sites located in south and central Arizona. The design was initiated by evaluating the performance of the simplest and most economical design and by increasing the design complexity, as necessary, based upon performance evaluation (Figure 1). By developing the cover designs with optimal thicknesses to limit **net infiltration** and using various cover material sources originating from both sites, S.E.T.'s approach **saved millions of dollars** in capping cost.

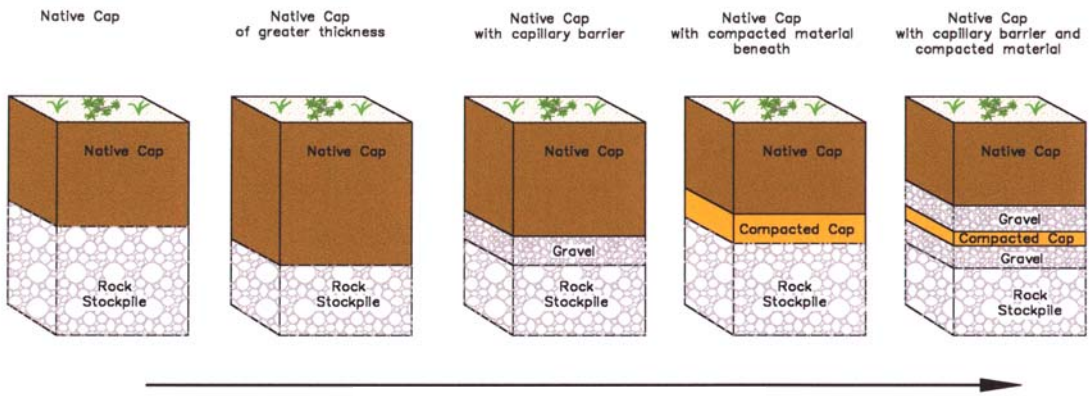

Figure 1. Optimization of Soil Cover Designs for Mine Waste Facilities in Arid Climates

HYDROLOGIC SITE CHARACTERIZATION

S.E.T.'s technical approach assessed cover performance based upon predetermined performance criteria, such as **allowable net infiltration** through the cover and **erosional loss** from the cover's surface.

Comprehensive **field** and **geotechnical laboratory tests** were conducted to determine the computer modeling parameters necessary for quantifying net infiltration. For example, Figures 2 and 3 show the field activities related to cover placement and vegetation test plots conducted for this project.

UNSATURATED ZONE HYDROLOGY

Optimal cover thickness was estimated using a state-of-the-art knowledge-based system (**SOILVISION®**) to rapidly estimate the soil-water characteristics curve (**SWCC**) and the unsaturated hydraulic conductivity function. These parameters were input into the **SOILCOVER®** and the EPA's **HELP®** models to predict net infiltration.

S.E.T. employed empirical-based modeling techniques (i.e., **HELP® model**) as **screening-level tools** and physical-based modeling techniques (i.e., **SOILCOVER®, UNSATH®** and **OPUS®**) to optimize cover thickness.

☑ *Cost Effective Project Completion*

☑ *Unparalleled Quality*

Figure 2. Cover Placement Test Plots

OPTIMAL COVER DESIGN

The main design objective was to minimize net infiltration beneath the cover and provide a permanent cover, on which native plant species could be established.

Factors used to develop optimal cover designs were:

- **Performance Criteria** (i.e., for infiltration, erosion potential, vegetation stability and desiccation potential);
- **Material Availability**; and
- **Economic Feasibility**.

Modeling results were evaluated against these factors to obtain optimal cover thicknesses.

COST ESTIMATES

As a final stage in the cover design optimization process, a **cost analysis** was performed to evaluate the economic feasibility of the designs. **Site-specific unit cost formulas** were developed that accounted for haulage, material preparation (i.e., blending or screening), material placement and revegetation costs.

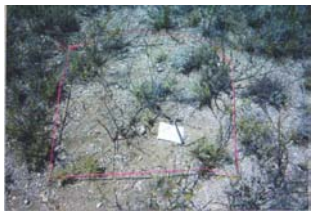

Figure 3. Vegetation Test Plot

For more information please go to www.savci-env.com

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