Erosion Control and Revegetation at DOE's Lowman Disposal Site, Lowman, Idaho

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The U.S. Department of Energy (DOE) completed remedial action at a Title I mill site in Lowman, Idaho, in 1992. The site is located in the Clear Creek valley on the western side of the Sawtooth Mountains at an elevation of 4,000 feet. The area surrounding the site is steep, mountainous, and forested by ponderosa pine (*Pinus ponderosa*). Average annual precipitation ranges between 20 and 25 inches, and much of it is from snow that falls in late winter or early spring.

An area approximately 5 acres in size located north of the disposal cell at the Lowman site did not revegetate successfully after remediation was completed. This area consisted of a long (approximately 500-foot), steep (slope gradients of 20 to 40 percent), west-facing slope. Native soils on the site were formed in decomposed granodiorite, were noncohesive, and consisted of extremely-gravelly sandy loam, sandy clay loam, and loamy sand textures. The remedial action contractor had graded the slope to a smooth finish, mulched it with an unknown material, but had not planted seed, as the contractor believed that the area would revegetate naturally over time.

By 1996, numerous rills and gullies, ranging in depth from 6 inches to 3 feet, had formed throughout the 5-acre area. DOE determined that corrective action needed to be taken.

First, the primary causes of the rill and gully erosion were determined. The forested watershed above the 5-acre area, although relatively small (about 5 acres), had extremely steep gradients of 40 to 60 percent. Snow melt and precipitation waters would run off the forested slopes and onto the noncohesive, smooth, unvegetated, 5-acre area and, in the process, form their own drainage pathways to the bottom of the slope, where they entered Clear Creek. DOE's first priority would be to provide more stable pathways for runoff to cross the 5-acre area.

Second, DOE determined that the area would need to be successfully revegetated if long-term erosion problems were to be avoided. As DOE developed a plan for preventing future erosion, a plan for revegetation was included.

In October and November 1998, DOE implemented its erosion control and revegetation plan. The 5-acre area was regraded, and the rills and gullies were filled in. Three interceptor terraces were installed on the slope to collect storm water and direct it into a natural drainage that emptied into Clear Creek. The first interceptor bench was installed along the slope contour just below the forested watershed to catch run-on waters. Run-on waters would then flow within the drainage formed by the interceptor bench to a collection ditch installed on the north end of the 5-acre area. The collection ditch was installed perpendicular to the slope contour and routed water into a natural drainage that emptied into Clear Creek. About one-third of the way downslope from the first interceptor bench, a second interceptor bench was installed along the slope contour, and about two-thirds of the way downslope from the top bench, a third interceptor bench was installed. These lower two trenches were designed to catch runoff from the slope itself and direct it to the same collection ditch.

The entire disturbed area was broadcast (at a rate of 1,800 pounds per acre) with a soil amendment called Biosol, a natural, organic-based fertilizer made from by-products of the penicillin manufacturing process. It was then broadcast-seeded with a native seed mix developed for the Lowman area (Table 1). Certified, weed-free straw mulch (at a rate of 1,500 pounds per acre) was spread over the seeded area and crimped in with a disc.

Table 1. Seed Mixture for Lowman Disposal Site

Scientific Name	Common Name	PLS[a] (pounds/acre[b])
Pascopyrum smithii	Western wheatgrass	4.0
Pseudoroegneria spicata ssp. *inermis*	Beardless bluebunch wheatgrass	8.0
Hesperostipa comata ssp. *comata*	Needle-and-thread grass	2.0
Koeleria cristata	Prairie junegrass	2.0
Amelanchier alnifolia	Saskatoon serviceberry	1.0
Rosa woodsii	Wood's rose	1.0
Achillea millefolium	Common yarrow	1.0
Penstemon strictus	Rocky Mountain penstemon	2.5
Ratibida columnifera	Prairie coneflower	1.0
Total		**22.5**

[a]PLS = pure live seed.
[b]Broadcast seeding rate.

The three interceptor benches were covered with erosion control fabric composed of 70 percent straw and 30 percent coconut fiber, and the collection ditch was armored with Presto Products Company's GEOWEB cellular confinement system—composed of open cells measuring 8 inches long by 9.6 inches wide by 4 inches deep—and filled with a soil-sand-rock matrix.

DOE visited the site in May 1999 to evaluate the success of the project following the first year's snowmelt and spring rains. Some portions of the upper interceptor terrace had washed out, and the erosion control fabric had slumped down to the invert of the bench. Approximately 300 feet of erosion control fabric required reanchoring in September 1999. Photo 1 shows the old, slumped fabric and the newly installed fabric.

In May 1999, DOE also noted that some areas of the downslope portion of the interceptor benches had washed away, mainly due to the noncohesive nature of the granodiorite soils. In September, these washed-out areas were armored with riprap. Photo 2 shows a repair of the middle interceptor bench.

The soil-sand-rock matrix that was used to fill the GEOWEB fabric installed in the collection ditch had also washed away shortly after installation. This matrix was too fine to withstand the erosive forces of the site's runoff water. DOE repaired this area by backfilling the GEOWEB fabric with angular rock measuring 1 to 3 inches in diameter. Photo 3 shows the collection ditch several years after the repair.

By the time of an October 2001 site visit, the interceptor benches, collection ditch, and vegetation were effectively controlling soil erosion in the 5-acre area. The revegetation effort was considered successful. Although some areas were dominated by cheatgrass (*Bromus tectorum*), an annual weedy species, most of the revegetated area supported healthy stands of desirable perennial species such as yarrow, penstemon, prairie coneflower, western wheatgrass, bluebunch wheatgrass, and needle-and-thread grass. In addition, volunteer plants of ponderosa pine were establishing. Photo 4 shows an overview of the 5-acre area in October 2001.

Lessons Learned

- For successful revegetation, planners must consider the potential effects of run-on and runoff waters on the newly revegetated site. Determine where run-on may enter the site and ensure that a pathway capable of handling expected flows exists. If the revegetated area itself contains long slopes (on which runoff could be generated), determine if the slope length needs to be shortened; regrade or roughen the soil surface accordingly.

- Vegetation plays a key role in preventing surface runoff. Consult with local experts to determine the best ways to encourage growth of native or adapted plant species in disturbed areas. Depending totally upon “mother nature” to revegetate a barren area often is unsuccessful, particularly if the disturbed area is greater than a few hundred square feet. At the Lowman site, volunteer ponderosa pine trees did establish themselves throughout the 5-acre area; however, the seedling trees did not provide adequate canopy cover or rooting area and depth to hold soils in place. Grasses and forbs can more successfully hold soils in place while an overstory of forest develops. Seeding desirable plant species is essential to revegetation. Depending upon soil conditions, organic amendments and mulches may help make the seeding more successful.

Photographs

Photo 1. Inspector checking erosion control fabric within the top interceptor bench.

Photo 2. Riprap repair of the downslope portion of middle interceptor bench.

Photo 3. View upslope of GEOWEB cellular confinement system, filled with rock, in the collection ditch

Photo 4. View east of the middle and lower interceptor benches in October 2001 (rock-covered disposal cell is in background).