

PLANT COMMUNITY ESTABLISHMENT ON RECLAIMED MOLYBDENUM TAILINGS, QUESTA TAILINGS FACILITY, QUESTA, NEW MEXICO¹

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Extended Abstract. Molycorp Inc. conducted vegetation monitoring at its Questa Tailing Facility, located near Questa, New Mexico. The tailing facility is the operational tailing ponds for the molybdenum processing mill. The purpose of this monitoring program was to identify and characterize the current plant communities and to document the depth of cover soil present on four tailing basins which have undergone interim reclamation. Interim reclamation is conducted on inactive areas of the facility. The four tailing areas represent different periods of reclamation; dating from reclamation completed in the 1970's to recent (2004) reclamation. The information collected will be used to assist in designing and implementing final reclamation at the tailing facility following closure.

Using geographical information system (GIS) software, sampling locations were identified in the four reclaim tailing areas and field located using global positioning system (GPS) receivers. At each sampling location a 50 meter point intercept transect was placed to estimate total and perennial plant cover. A 2x50 meter belt transect, placed parallel to cover transect, was used to estimate shrub density. Cover soil depth was estimated from two sampling locations randomly located along the sampling transect. Sampling was conducted in groups of five (5) samples until sampling adequacy had been met.

Sample adequacy was achieved in the 1970 Reclaim Area with 20 sampling locations. The 1970 Reclaim Area had a total plant cover of 25.5% (SD 6.4) and a perennial plant cover of 24.5% (SD 5.2), Table 1. A mean of 5.5 species (SD 2.0) were observed along the sampling transects, Table 1. Shrub density within the reclaim area was estimated at 2,302 shrubs/acre (SD 1,610), Table 1. The depth of cover soil averaged 7.9 inches (SD 7.3), Table 1.

Additional Key Words: Tailings basin revegetation, cover soil depth, and reclamation.

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Sample adequacy was achieved in the 1980 Reclaim Area with 20 sampling locations. The 1980 Reclaim Area had a total plant cover of 31.4% (SD 6.0) and a perennial plant cover of 31.2% (SD 6.0), Table 1. A mean of 6.0 species (SD 1.7) were observed along the sampling transects, Table 1. Shrub density within the reclaim area was estimated at 1,356 shrubs/acre (SD 942), Table 1. The depth of cover soil averaged 5.3 inches (SD 2.7), Table 1.

Sample adequacy was achieved in the 1993-1994 Reclaim Area with 20 sampling locations. The 1993-1994 Reclaim Area had a total plant cover of 31.2% (SD 6.7) and a perennial plant cover of 30.8% (SD 6.7), Table 1. A mean of 5.5 species (SD 1.3) were observed along the sampling transects, Table 1. Shrub density within the reclaim area was estimated at 3,255 shrubs/acre (SD 2,760), Table 1. The depth of cover soil averaged 13.1 inches (SD 5.7), Table 1.

Table 1. Reclaim Area Monitoring Summary, Questa Tailings Facility, Questa, New Mexico.

Parameter	1970 Reclaim Area	1980 Reclaim Area	1993-1994 Reclaim Area	1998-2004 Reclaim Area
Total Plant Cover (%)	25.5 (SD 6.4)	31.4 (SD 6.0)	31.2 (SD 6.7)	22.9 (SD 8.6)
Perennial Plant Cover (%)	24.5 (SD 5.2)	31.2 (SD 6.0)	30.8 (SD 6.7)	22.3 (SD 8.7)
Number of Species/ Transect	5.5 (SD 2.0)	6.0 (SD 1.7)	5.5 (SD 1.3)	4.0 (SD 1.6)
Shrub Density (shrubs/acre)	2,302 (SD 1,610)	1,356 (SD 942)	3,255 (SD 2,760)	385 (SD 451)
Depth of Cover Soil Material	7.9 (SD 7.3)	5.3 (2.7)	13.1 (SD 5.7)	9.4 (SD 6.0)

Sample adequacy was achieved in the 1998-2004 Reclaim Area with 50 sampling locations. The 1998-2004 Reclaim Area had a total plant cover of 22.5 (SD 8.6) and a perennial plant cover of 22.3% (SD 8.7), Table 1. A mean of 4.0 species (SD 1.6) were observed along the sampling transects, Table 1. Shrub Density within the reclaim area was estimated at 385 shrubs/acre (SD 451), Table 1. The depth of cover soil averaged 9.5 inches (SD 5.9), Table 1.

The individual reclaimed area transect results were then combined into a single data set for further analysis. The combined data set had a mean total and perennial plant cover of 26.4% (SD 8.3) and 25.9% (SD 8.3) respectively, Table 2. Shrub density for the data set was estimated at 1,432 shrubs/acre (SD 1,810), Table 2. A mean of 5.0 species (2.0) were observed along each of the transects, Table 2. The combined data set had mean cover soil depth of 9.2 inches (SD 5.6), Table 2.

Regression analysis was performed on the combined data set to determine if any relationships existed between the cover soil depth and the different plant community parameters. The results of this analysis suggest the depth of cover soil has a statistical effect on total plant cover ($r=.403$, $P<0.05$), perennial plant cover ($r=.385$, $P<0.05$), and shrub density ($r=.263$, $P<0.05$). However, the regression analysis suggested there was no relationship between cover soil depth and number of species per transect ($r=.147$, $P=NS$).

Table 2. Combined Reclaim Area Results Summary, Questa Tailings Facility, Questa, New Mexico.

Parameter	Mean Value	Standard Deviation
Total Plant Cover (%)	26.4	8.3
Perennial Plant Cover (%)	25.9	8.3
Number of Species/ Transect	5.0	2.0
Shrub Density (shrubs/acre)	1,432	1,810
Depth of Cover Soil Material	9.2	5.6

The results of the regression analysis suggest that, given the range of cover soils depths observed within tailing facility, the depth of cover soil material does have an effect on total plant cover, perennial plant cover, and shrub density. However, the analysis suggests there is no statistical relationship between the number of species per transect and the depth of cover soil material.