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**PLATEAU
MINING
CORPORATION**

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June 10, 2004

Mr. Daron R. Haddock
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

*Incoming #
C/007/0038
Task ID #1962*

**Re: Gravel Canyon Topsoil Stockpile Reclamation Scenarios, Plateau Mining Corporation,
Willow Creek Mine, C/007/038, Carbon County, Utah**

Dear Mr. Haddock:

Plateau Mining Corporation (PMC) is herewith submitting a couple of reclamation scenarios for the Gravel Canyon Topsoil Stockpile. The reclamation scenarios are presented in addition to the approved scenario based on volume of material removed.

PMC's additional scenarios address the current status where approximately 37,000 cubic yards has been removed and another scenario where approximately 65,000 cubic yards, in total, are removed. PMC presents the postmining topography and treatment for each respective area along with the appropriate drainage and alternative sediment control calculations demonstrating compliance with Utah's R645 Coal Rules.

The only reason PMC would need to recover additional soils from Gravel Canyon is if it can not generate sufficient quantities within the mine site area necessary to satisfy the highwall backfilling plan. Whether it is 37,000 or 65,000 cubic yards, or somewhere in-between, the final volume removed from Gravel Canyon will be properly addressed in the as-builts prepared for Phase I Bond Release. As-built topography will be generated via aerial flyover using 2-foot contour intervals within the disturbed area.

If you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,



Johnny Pappas
Sr. Environmental Engineer

Mine # C-1007/0038
File Incoming
Record # 0027
Doc. Date 6-10-04
Recd. Date 6-17-04

Enclosures

File: Willow Creek Mine - Gravel Canyon
Chron.: JP040603.ltr

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JUN 17 2004

DIV. OF OIL, GAS & MINING

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change New Permit Renewal Exploration Bond Release Transfer

Permittee: Plateau Mining Corporation

Mine: Willow Creek Mine

Permit Number: C/007/038

Title: Gravel Canyon Topsoil Stockpile Reclamation Scenarios

Description, Include reason for application and timing required to implement:
Reclamation scenarios based on volume removed

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

- Yes No 1. Change in the size of the Permit Area? Acres: ___ Disturbed Area: ___ increase decrease.
- Yes No 2. Is the application submitted as a result of a Division Order? DO# _____
- Yes No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
- Yes No 4. Does the application include operations in hydrologic basins other than as currently approved?
- Yes No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
- Yes No 6. Does the application require or include public notice publication?
- Yes No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
- Yes No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
- Yes No 9. Is the application submitted as a result of a Violation? NOV # _____
- Yes No 10. Is the application submitted as a result of other laws or regulations or policies?

Explain: _____

- Yes No 11. Does the application affect the surface landowner or change the post mining land use?
- Yes No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
- Yes No 13. Does the application require or include collection and reporting of any baseline information?
- Yes No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
- Yes No 15. Does the application require or include soil removal, storage or placement?
- Yes No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
- Yes No 17. Does the application require or include construction, modification, or removal of surface facilities?
- Yes No 18. Does the application require or include water monitoring, sediment or drainage control measures?
- Yes No 19. Does the application require or include certified designs, maps or calculation?
- Yes No 20. Does the application require or include subsidence control or monitoring?
- Yes No 21. Have reclamation costs for bonding been provided?
- Yes No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
- Yes No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

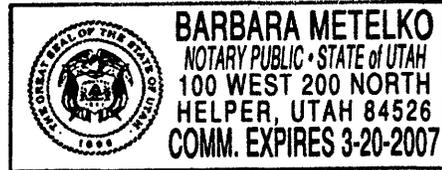
JOHNNY PAPPAS
 Print Name

[Signature] - Sr. Env. Engineer - 6/10/04
 Sign Name, Position, Date

Subscribed and sworn to before me this 10 day of June, 2004

Barbara Metelko
 Notary Public

My commission Expires: March 20, 2007
 Attest: State of UTAH } ss:
 County of CARBON



For Office Use Only: 	Assigned Tracking Number: 	Received by Oil, Gas & Mining <div style="font-size: 24px; font-weight: bold; margin: 10px 0;">RECEIVED</div> <div style="font-size: 18px; font-weight: bold; margin: 5px 0;">JUN 17 2004</div> <div style="font-weight: bold; margin-top: 10px;">DIV. OF OIL, GAS & MINING</div>
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SECTION 3.6
GRAVEL CANYON

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Diversion GCD-1 conveys the runoff from an undisturbed area (7.81 acres). The peak discharge, based on a 10-year 6-hour storm event, is 2.01 cfs. The design discharge will flow at a maximum depth of approximately 0.6 feet along the flatter reaches of the diversion, and at a velocity of approximately 6.3 feet per second along the steepest reach of the diversion. The existing diversion has adequate freeboard provided above the design flow depth.

Diversion GCD-2, along the south side of ancillary road A-1, collects runoff from both disturbed and undisturbed areas and channels it to the ditch along US Highway 6. This diversion also prevents runoff from crossing road A-1. The peak design flow from the 9.6 acre watershed is 2.66 cfs. The geometry of the diversion is summarized in Table 3.6-2 (Exhibit 19).

Berm ACB-1 is constructed along the north side of road A-1 to contain the storm runoff that falls on the road. For simplicity of design, the berm was designed to contain the runoff from all of watershed GCWS-D1. The minimum berm geometry is summarized in Table 3.6-3 (Exhibit 19).

3.6-3(2) Alternative Sediment Controls

There are no sediment ponds in Gravel Canyon. Currently the area is revegetated and thus no alternative sediment control structures are necessary.

3.6-4 Reclamation Plan

The reclamation work in Gravel Canyon will be done contemporaneously with the disturbance of the site. After material is taken from an area within the site, the area will be graded for overland flow and the site revegetated. The site will not be ready for final reclamation until all of the disturbed area sites in the ~~Castle Gate~~ Willow Creek Mine are reclaimed. ~~Therefore, final reclamation of the site will not take place for at least 25 years.~~ A total of approximately 97,000 cubic yards of resoiling material is available for use based on the postmining topography shown on Exhibit 3.6-3 (Exhibit 19). ~~If however, there is~~

approximately 37,000 to 65,000 cubic yards of resoiling material utilized, then the postmining topography will be similar to that shown on Exhibit 3.6-4, or somewhere in between. See Table 3.6-6 and Figure 3.6-5 (Exhibit 19) for the 97,000 cubic yard mass balance calculation summary and the grading cut/fill grid, respectively. Table 3.6-6 also presents the mass balance for the 37,000 and 65,000 cubic yard scenarios.

The land use for this area is wildlife habitat.

3.6-4(1) Reclamation Work

The reclamation work consists of the following:

Demolition: Any crushing or screening facilities which may be used will be removed. The existing retaining wall along US Highway 6 and 50 will also be removed.

Grading: Grading will be done to establish drainage and maximize the amount of material to be used as resoiling material. Access road A-1 will be removed in the process. The scheduling of the grading work will minimize the disturbance to the hydrologic balance. Prior to the start of grading work, alternative sediment control structures will be installed.

The grading plan as shown in the postmining topography, Exhibit 3.6-3 and 3.6-4 (Exhibit 19), meets the criteria set forth in R645-301-553, Backfilling and Grading. The disturbed areas are graded to approximate the original contours by blending spoil into the surrounding area which creates a landform which complements and resembles the surrounding terrain. There are no cut slopes or highwalls within the disturbed area boundary.

Resoiling: The 5 acres of disturbance which are to be reclaimed were disturbed prior to SMCRA. No topsoil was salvaged from the site. The existing soils at the site will be used for resoiling material. ~~The resoiling material will be analyzed for the following parameters: Ph, electrical conductivity, saturation percentage, particle size analysis, soluble Ca, Ma, and Na, sodium absorption ratio, selenium, total N, nitrate N, boron, maximum acid potential, neutralization potential, organic carbon, exchangeable sodium, available water capacity, and rock fragments. One test will be performed for every 2 1/2 acres of disturbance. Appropriate soil amendments will be added according to the results of these tests.~~

Seeding and Mulching: The Upland Seed Mixture (Table 5.3-2b, Section 5.3, Willow Creek Permit) will be used in Gravel Canyon. ~~The seed will be mixed with a small amount of wood fiber mulch for a tracer, and water to form a slurry, which will be applied to the reclaimed surfaces using a hydroseeder. The balance of the mulch, mixed with a tackifier and the fertilizer in a slurry will then be sprayed over the same area. The total coverage of mulch will be at the rate of 2,000 pounds per acre. In areas inaccessible to the hydroseeder, the seed and mulch will be broadcast by mechanical means. Areas inaccessible to the hydromulcher will be mulched with straw and tacked with a nylon or other suitable netting. The rate of application for straw will be 2,000 pounds per acre. Prior to application of the reclamation seed mix, hay will be incorporated into the growth media at a rate of 2 tons per acre. This will be done to improve soil structure for aeration purposes, increase micropore space, and improve the water holding capacity of the soil. Incorporation of the mulch will occur through deep gouging. No fertilizer will be used during the reseeding activities.~~

~~Following seeding, an additional 1.0 to 1.5 tons per acre of certified noxious weed free straw mulch will be spread over the seeded growth media mostly by mechanical blowers with occasional hand spreading. The straw mulch will then be sprayed with a tackifier and mulch mixture at about 500 lbs per acre following spreading to retain it on the reseeded slopes. The tackifier and mulch technique provides a better means for retaining the straw mulch onto the reseeded areas than did the crimping technique.~~

3.6-4(2) Reclamation Hydrology

Reclamation Channel Design: The reclamation channels were designed to approximate the geometry of the natural stream channel. The natural channel sections were measured in the field and approximated with a trapezoidal cross section. The reclamation channels were designed with a 3H:1V side slope to provide channel stability. The hydraulic slope of each channel was measured from the postmining topographic maps (Scale: 1" = 100').

The natural streambed that exists upstream of the disturbed area in Gravel Canyon can be considered ephemeral since it carries water only in direct response to a precipitation event, or the melting of snow and ice, and is above the local water table. Ephemeral streams are classified as carrying miscellaneous flows, per R645-301-742.330, which requires that permanent diversions be sized for the 10-year 6-hour storm event. Thus, the reclamation channels are designed to transport the peak discharge of a 10-year 6-hour precipitation event of 1.4 inches (Miller et. al, 1973). Riprap sizing for these drainages was also based on the peak discharge rates from the 10-year 6-hour precipitation event. A description of the methods used to determine the peak discharge rates is presented in Chapter 7 (Exhibit 19).

The reclamation channel drainage areas for Gravel Canyon are presented on Exhibit 3.6-3 (Exhibit 19). The large drainage areas not fully contained on Exhibit 3.6-3 (Exhibit 19) can be found on Exhibit 3.4-8 (Exhibit 19).

Curve numbers for the undisturbed drainage areas were estimated from vegetation data assumed to be similar to that of the Adit No.1 Canyon, as shown on Exhibit 9-1 (Exhibit 19). Therefore the same curve number for the Adit No. 1 Canyon was used for the undisturbed area of Gravel Canyon. A curve number of 75 was calculated for the undisturbed drainage areas and a curve number of 80 was assumed for the reclaimed areas. Curve number calculations are presented in Appendix 3.6B.

The following general approach was used during design of the reclamation channels:

- o The design capacity of the ephemeral reclamation channels was based on the 10-year 6-hour storm and the minimum channel slope.
- o Riprap was sized based on the 10-year 6-hour storm and the maximum channel slope for ephemeral drainage channels.
- o The roughness coefficient (Manning's "n") for riprapped channels was determined according to the equation (Barfield et al., 1981):

$$n = 0.0395D_{50}^{1/6}$$

where, n = Manning's roughness coefficient
 D_{50} = median riprap diameter (ft)

- o Designs are based on channel construction on fill. Where the reclamation channel construction occurs on rock, riprap quantities will be reduced or eliminated (depending on the competency of the rock).
- o Riprap sizing is based on the methodology presented in U.S. Department of Transportation Hydraulic Engineering Circular No. 11 (1967).
- o When transitioning downstream from a steep channel slope to a flat channel slope, the larger riprap from the steep section will be extended for 15 feet into the channel section with the flatter slope to minimize erosion.
- o Riprap volumes were calculated assuming a thickness of 6 inches, or 2.0 times the D_{50} value, whichever is greater. The filter blanket volume for the main channel was calculated assuming a filter thickness equal to one half the thickness of the over-lying riprap, but not less than 6 inches (Barfield et al., 1981).

Calculations regarding design of the Gravel Canyon reclamation channels are presented in Appendix 3.6B. A summary of the reclamation channel design is presented in Table 3.6-4 (Exhibit 19).

The reclamation channels were designed to pass the peak discharge with a minimum freeboard of 1 foot. It should be noted that those ephemeral channels designed based on the 10-year 6-hour storm will have adequate channel capacity to contain the 100-year 6-hour peak discharge with no freeboard.

A detailed riprap and filter blanket design is ~~not~~ presented in ~~Appendix 3.6B~~ ~~this text~~ ~~since adequate soil samples were not available.~~ ~~Castle Gate Coal is committed to preparing a detailed design for the riprap and filter blanket gradations.~~ ~~Samples will be taken once the reclamation grading has progressed sufficiently to expose the base of the reclamation channels.~~ The riprap and filter blanket gradations for the channels ~~will be~~ ~~have been~~ engineered based on methods presented in Barfield et al. (1981). The filter blanket will consist of a ~~6-inch thick layer of UDOT 1" base mix~~ ~~properly graded coarse grained soil;~~ ~~and~~ a synthetic fabric will not be used. ~~The detailed design will be submitted to the Division of Oil, Gas and Mining for approval prior to delivery of filter blanket and riprap materials to the site.~~ ~~The channel design presented in Appendix 3.6B is appropriate for both of the reclamation~~

scenarios presented in Exhibits 3.6-6 and 3.6-4 (Exhibit 19). The channel design is for the scenario that removes approximately 97,000 cubic yards of topsoil. This represents the worst case condition because it has both flatter and steeper slopes as well as having the largest water shed area. The reclamation channel for the option that removes approximately 37,000 cubic yards of topsoil ends in an existing pre-SMCRA undisturbed diversion channel.

Estimates for riprap and filter blanket volumes were prepared and are presented in Table 3.6-5 (Exhibit 19). Approximately ~~4,200~~ 7,560 cubic feet of riprap (~~290 tons~~) and ~~3,100~~ 7,088 cubic feet of filter material (~~200 tons~~) will be required to construct the reclamation channels associated with removing approximately 97,000 cubic yards of topsoil. To construct the reclamation channel associated with removing approximately 37,000 cubic yards of topsoil, approximately 6,347 cubic feet of riprap and 5950 cubic feet of filter material will be required.

3.6-4(3) Alternative Sediment Control Measures

The reclamation plan calls for the disturbed area of Gravel Canyon to be graded to allow storm runoff to overland flow to the permanent reclamation channel. Incorporation of sediment ponds and associated diversion ditches into the relatively small area of Gravel Canyon would result in redisturbance of these areas when these structures are removed after establishment of permanent vegetation. The use of a sediment pond would simply lengthen the time necessary to establish permanent vegetation throughout the permit area. In addition, a combination of alternative sediment control measures can achieve the same success in preventing sediment transport on the reclaimed area. Therefore, ponds will not be used to control sediment during Phase I of reclamation.

Castle Gate Mine proposes to employ the following alternative methods in varying degrees to limit and control sediment runoff:

1. ~~Filter fabric (silt) fences~~ Placement/Redistribution of growth media.

2. ~~Surface ripping~~ Incorporation of hay mulch into growth media,
3. ~~Mulch~~ Deep gouging of the growth media,
4. ~~Chemical (tackifier) added to mulch~~ Seeding the prepared soil,
5. ~~Straw bales~~ Addition of more mulch following seeding, and
6. ~~Seeding~~ Physically or chemically anchoring the final mulch layer.
7. ~~Reseeding areas that do not exhibit successful germination~~

Based on Simons, Li & Associates (1983, Table 8.1), these methods constitute some of the best available control technology for the purpose of mining reclamation. ~~These methods have been very successful at recently reclaimed sites and are expected to work well at this site.~~

~~The proposed a~~ Alternative sediment control measures can be classified into three categories: filtering structures, mechanical treatment, and surface protection measures. Filtering structures inhibit runoff and sediment transport capacity by reducing flow velocity. They also physically trap sediment in the filter openings while allowing water to pass through. Mechanical treatment increases surface roughness thereby reducing overland flow velocity, which minimizes the sediment transport capacity. Detaining some of the would-be runoff also improves soil moisture for plant germination. Surface protection measures include mulching, mulch binders, netting, and seeding. These measures are the most effective controls since they minimize the amount of soil detached by raindrop impact, and thus limit soil loss at the source. Surface protection measures also increase the surface roughness and increase water infiltration into the ground. ~~The above listed alternative sediment control methods combine mechanical and surface protection measures.~~

~~Simons, Li & Associates (1983, Figure 7.3) indicates that synthetic filter fabric is more efficient than straw bales at trapping silt. Therefore, synthetic fabric fences and not straw bales will be utilized wherever possible. The reaches of the reclamation channel protected by silt fences for Phase I reclamation are indicated in Exhibit 3.6-3 (Exhibit 19). The fences will be installed parallel to the contours with the ends of the fences turned up perpendicular to the contours to contain the sediment. Silt fences will be installed in accordance with Figures 3.6-3 and 3.6-4 (Exhibit 19). The filter fabric will be composed of a UV-resistant, perforated synthetic fabric with an integral supportive netting. A separate supportive backing could be~~

~~used in lieu of the integral netting. To prevent sediment runoff from passing under the fence, the fabric will be secured by burying the bottom edge of it in a small trench along the length of the fence.~~

~~Calculations have been performed that verify that a single tier system of 36 inch high silt fences will be adequate to capture sediment during a 10-year 6-hour storm event without failing, assuming they are properly maintained. Length, spacing, and angle of the fence segments are contingent on the slope of the reclaimed surface immediately adjacent to the channel and the relative expected sediment load along each specific reach of the canyon. For example, fence segments along the channel where the adjacent side slopes are comparatively steep are to be 50 feet in length and spaced about 50 feet on center, angled at about 40° from a line perpendicular to the channel. This general configuration will allow the fence segments to be parallel to the contours adjacent to the channel, and to provide a 20' projected overlap. See Figures 3.6-3 and 3.6-4 (Exhibit 19) for a typical silt fence installation and Appendix 3.6C for supporting calculations.~~

Mechanical treatment of slopes ~~of less than 20%~~ will be performed by ripping ~~and/or deep gouging~~ the soil to a depth of 18 inches to 24 inches. Ripper shanks, ~~if used~~, should be spaced about seven feet apart, ~~or as allowed by the piece of equipment~~, and create parallel slots four to ten inches wide. ~~Reclamation slopes steeper than 20% will be scarified with the tines of a backhoe.~~ Ripping ~~and or deep gouging~~ will loosen the soil and allow root penetration, ~~increase surface roughness~~, and increase moisture storage. This will allow for quicker vegetation establishment, which will reduce erosion. ~~The depressions from roughening trap sediment dislodged by raindrop impact and overland flow. They also shorten the exposed reaches over which runoff will flow, thereby reducing the sediment carrying capacity of the runoff.~~

In regard to surface protection measures, ~~the incorporation of the mulch into the surface roughening will ensure that the major portion of mulch is anchored on site, a chemical additive will be used in combination with wood fiber mulch to help prevent the removal of the mulch by wind.~~ The mulch itself can significantly reduce the amount of sediment yield from

an area (Simons, Li & Associates, 1983, p. 4.30) The mulch also helps retain moisture to allow for seed germination. Based on a rainfall intensity factor of 0.61 inches per hour, the minimum mulch application rate is 0.9 tons per acre to prevent mulch removal by rainfall (Simon et al., 1983, Figure 4.14). The referenced figure assumes that no chemical binder will be used. The intensity factor corresponds to a 10-year 6-hour storm event. Mulch, with a tackifier, will be applied at the rate of 2,000 pounds per acre.

Permanent plant growth is the best method of controlling erosion from slopes, according to Simons, Li & Associates (1983, p.4.44). Upon completion of the grading in accordance with the plan depicted in Exhibit 3.6-3 and 3.6-4 (Exhibit 19), and ripping mechanical treatment of the soil, the reclaimed area will be seeded with grasses, shrubs and forbs legumes. Seeding will be performed at the appropriate time of the year in consideration of available moisture for germination. Areas in which the seed does not germinate will be reseeded. Following seeding the area will be mulched again at a rate of 1.0 to 1.5 ton per acre.

Appendix 3.6C presents calculations that quantify the sediment yield that could be expected annually under pre-mining conditions, immediately after reclamation, and after vegetation establishment, as 24.2 tons/acre/year, 0.14 tons/acre/year, and 20.7 tons/acre/year, respectively and during a 10-year 6-hour storm event with and without various sediment control measures in place. These calculations were performed to compare the sediment yield during each of the time periods to demonstrate that the reclaimed surface will produce less sediment than the same area under undisturbed conditions, improvement of the sediment control measures listed above against background levels. The cumulative implementation of each sediment control measure substantially reduces the amount of sediment eroded from the reclaimed areas, to the point that the mulch and roughening theoretically inhibits soil loss more effectively than the undisturbed ground cover. Since the undisturbed areas contributing sediment to the stream channels through silt fences are larger than the reclaimed areas, most of the sediment erosion will occur from the undisturbed areas. As long as the depressions from surface roughening are in place, the sediment yield from up

~~gradient areas will be prevented from reaching any stream channels. Approximately 98% of the sediment loss trapped by the silt fence is from the undisturbed areas. Thus, the background sediment loss overshadows the sediment loss from the reclaimed areas once the wood fiber mulch is in place.~~

Whenever possible, a minimum of one method of sediment control will be in place during reclamation construction. Upon completion of the grading and soil ripping, the reclaimed area will be seeded and mulched ~~using either hydromulching or straw tacked by a suitable netting.~~

The possibility exists that a 10-year 6-hour storm (or larger) will occur during the grading operation and before the alternative sediment control measures are in place. Although every reasonable effort will be made to have at least one sediment control measure in place, there may be a period of time when that is not feasible. However, the probability that a 10-year event will occur during the construction period of approximately six months is only 5.1% (Linsley and Frazini, 1979, Eq. 5-3). This probability is relatively small, and thus no special measures will be taken to address this possibility.

The alternative sediment controls constructed during ~~Phase I~~ reclamation will be inspected quarterly or after every major storm event. Observations made during these inspections, as well as corrective actions taken, will be recorded. Corrections to any weaknesses in the implementation of the sediment control plan will be remedied immediately to prevent future silt runoff into the main stream channel. Corrective action will be taken when ~~sediment builds up on either side of a silt fence to half its height, when the sediment fence is listing more than 20 degrees from the vertical, when the straw bales become 50% saturated with silt, when a gully greater than six nine inches in depth is created due to lack of vegetation establishment, or when the mulch and seed have been transported by wind or overland flow.~~ Corrective action will consist of ~~repairing/replacing or adding filter fabric fences as necessary, replacing straw bales,~~ regrading of the ground surface only as necessary to fill in ~~six nine~~ inch gullies caused by erosion, and reseeding and mulching ~~as warranted,~~ to reestablish vegetation. ~~Soil material trapped by sediment control measures that is not used~~

~~in repairing the site will be removed and disposed of within the boundaries of the Castle Gate Mine permit area.~~

~~All alternative sediment control structures will remain in place for a minimum of two years after the last seeding, until the removal is authorized by DOGM, until vegetation over the reclaimed area is properly established in accordance with R645-301-763.100, and the water quality bond release standards of R645-301-880.320 are complied with.~~

3.6-5 Reclamation Timetable

~~No permanent or contemporaneous reclamation is anticipated to occur in the Gravel Canyon during the 1989-1994 renewal period.~~ The following timetable can be used to estimate the total amount of time needed to reclaim Gravel Canyon once the material to be placed on the Preparation Plant Refuse Pile has been removed.

Phase I Reclamation

- | | |
|---|-------------------------|
| 1. Demolition - Removal of structures and roads | Week 1-2 |
| 2. Installation of Alternative Sediment Control Structures | Week 1 |
| 3. Construction of permanent stream channel | Week 2 |
| 4 2. Grading and channel construction | Week 2-4 1-4 |
| 5. Removal of temporary stream diversions | Week 4 |
| 6 3. Seed bed preparation | Week 5 3-4 |
| 7 4. Seeding and mulching, and fertilizing | Week 6 3-4 after Oct. 1 |

Phase II Reclamation

- ~~8. Removal of Sediment Control Structures~~ ————— ~~All alternative sediment control structures will remain in place for a minimum of two years after the last seeding, until the removal is~~ —————

~~authorized by DOGM, until vegetation over the reclaimed area is properly established in accordance with R645-301-763.100, and the water quality bond release standards of R645-301-880.320 are complied with.~~

~~Phase III Reclamation~~

~~9-5. Vegetation and Water Monitoring~~

Until Bond Release

3.6-6 Transportation Facilities

Beltlines: There are no beltlines used in Gravel Canyon.

Roads: One ancillary road is used to access the Gravel Canyon Area. The road location is shown on Exhibit 3.6-2 (Exhibit 19). A typical cross section is found on Figure 3.6-1 (Exhibit 19). The primary purpose of this road is to access the site by mine personnel in light vehicles for inspection.

The ancillary road was constructed using non-toxic and non-acid bearing materials in the road's surface. No embankments were constructed to support this ancillary road. The side slopes of the road are revegetated. Erosion is controlled or prevented by channeling water in ditches or overland flow. Small road ditches that convey flow from one acre or less may use the minimum size of a generically designed diversion. A "generic" ditch must be a minimum of 1.0 feet deep, triangular in cross section, have 2:1 horizontal to vertical side slopes and be lined with a minimum D_{50} equal to 2.5". This design assumes a curve number of 90, one acre of drainage, a minimum channel slope of 2% and a maximum channel slope of 15% (see Table 3.6-2, Exhibit 19). The road will be maintained by grading when necessary to provide a driveable surface.

A primary road may be constructed for use when material is removed to cover the refuse pile at the Castle Gate Preparation Plant site (see Figure 3.6-2, Exhibit 19). No embankments will be needed to support this primary road. Erosion will be controlled or

prevented by channelling water in ditches or by overland flow across side slopes which utilize alternative sediment controls. The ditch design will be "generic" as described for ancillary road A-1 above. The maximum road grade will be 5%. The road will be maintained by grading when necessary to provide a driveable surface.

3.5-7 References

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U.S. Department of Transportation. 1967. Use of Riprap for Bank Protection. Hydraulic Engineering Circular No. 11. Washington, D.C..

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TABLE 3.6-4

**GRAVEL CANYON
RECLAMATION CHANNEL SUMMARY**

Reclamation Channel	Minimum Bottom Width (FT) ^(a)	Side Slopes (H:V)	Minimum Channel Depth (FT)	Minimum Bottom Slope (%)	Maximum Flow Depth (FT)	Freeboard (FT)	Maximum Bottom Slope (%)	Maximum Velocity (FT/S)	Riprap Max D ₅₀ (IN)
GCRD-1 ^{(b)(c)}	3	3:1	1.5	2.0	0.43	1.07	25	6.7	4

- (a) Minimum bottom width measured at minimum depth from top of channel.
- (b) Design based on 10-year 6-hour storm (Permanent structure fro ephemeral drainage).
- (c) *This channel design is appropriate for the presented reclamation options.*

TABLE 3.6-5

**GRAVEL CANYON
RECLAMATION CHANNELS RIPRAP AND FILTER BLANKET VOLUMES**

Channel	Riprap D ₅₀ (IN)	Length (FT)	Perimeter (FT)	Riprap Thickness (IN)	Riprap Volume (FT ³)	Filter Thickness (IN)	Filter Volume (FT ³)
GCRD-1 ^(a)	4	500 810	12.5	8	4188 7088	6	3125 7088
GCRD-1 ^(b)	4	840	12.5	8	7840	6	7350
GCRD-1 ^(c)	4	680	12.5	8	6347	6	5950

- (a) **97,000 CY Option**
- (b) **65,000 CY Option**
- (c) **37,000 CY Option**

TABLE 3.6-6

GRAVEL CANYON
RECLAMATION MASS BALANCE SUMMARY

Project: ~~CASTLE GATE MINE, CARBON COUNTY, UTAH~~
Site description: ~~GRAVEL CANYON~~

First surface: ~~EG: Second surface: FG~~

Cut: ~~101,731.9996 cubic yards~~
Fill: ~~4,638.9254 cubic yards~~
Net Volume: ~~97,093.0742 cubic yards (Cut)~~

Maximum cut: ~~44.811822 feet~~
Location: ~~2176968.301221 511364.290081~~

Maximum fill: ~~17.132024 feet~~
Location: ~~2177181.550561 511220.155701~~

~~Volume calculation by GRID method with a node spacing of 25 feet.~~

Source: ~~Softdesk, Inc. (formerly DCA Software, Inc.)~~
~~Earthworks Grading module~~
~~Registration #ERHE 15426~~
~~Registration to EarthFax Engineering, Inc.~~

OPTION	CUT (CY)	FILL (CY)	NET (CY)
Exhibit 3.6-3 Option A	101,732	4,639	97,093 Cut
Exhibit 3.6-4 Option B	65,103	126	64,977 Cut
Exhibit 3.6-4 Option C	37,228	150	37,078 Cut

Excess cut is topsoil hauled from the topsoil stockpile for the reclamation of other Mine properties.

Gravel Canyon Topsoil Stockpile Reclamation Channel Filter Design

The soil sample taken from the Gravel Canyon soil is described as a Clayey Sand with Gravel with 30% gravel, 30% sand and 40% silt and clay. The majority of the silt and clay fraction being silt instead of clay.

Evaluate a UDOT 1" base mix for the filter for a $D_{50} = 4"$ riprap. Since the soil has such a large percentage of silt and clay a filter is assumed to be necessary.

Use the criteria presented in Parfield et al. (1994). This criteria was developed for sizing filters around drain pipes to prevent piping of the soil into the drain. Using this criteria gives a conservative filter design since we are not concerned with sediment accumulation in the filter only that velocities in the filter are not such that the base soil erodes.

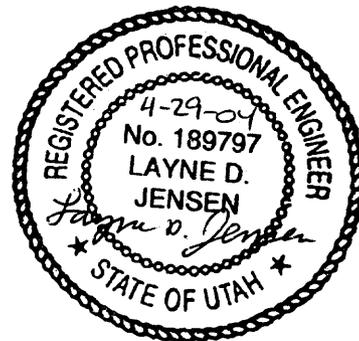
The criteria are:

$$(1) \frac{D_{50}(\text{Filter})}{D_{50}(\text{base})} < 40 \quad \text{also} \quad \frac{D_{50}(\text{Riprap})}{D_{50}(\text{filter})} < 40$$

$$(2) \frac{D_{15}(\text{filter})}{D_{15}(\text{base})} > 5 + < 40 \quad \text{and} \quad \frac{D_{15}(\text{Riprap})}{D_{15}(\text{filter})} > 5 + < 40$$

$$(3) \frac{D_{85}(\text{Filter})}{D_{85}(\text{base})} < 5 \quad \text{and} \quad \frac{D_{15}(\text{riprap})}{D_{85}(\text{filter})}$$

Riprap	$D_{85} = 7.2"$
	$D_{50} = 4"$
	$D_{15} = 1.7"$
Filter	$D_{85} = 0.5"$
	$D_{50} = 0.15"$
	$D_{15} = 0.007"$
base	$D_{85} = 0.55"$
	$D_{50} = 0.006"$
	$D_{15} = 0.0006"$



$$\frac{D_{50}(\text{riprap})}{D_{50}(\text{filter})} = \frac{4''}{0.15} = 26.7 < 40 \quad \text{OK}$$

$$\frac{D_{15}(\text{riprap})}{D_{15}(\text{filter})} = \frac{1.7}{0.007} = 243 > 40 \quad \text{concern}$$

$$\frac{D_{15}(\text{riprap})}{D_{85}(\text{filter})} = \frac{1.7}{0.5} = 3.4 < 5 \quad \text{OK}$$

Comparison of riprap to filter meets all criteria.

$$\frac{D_{50}(\text{filter})}{D_{50}(\text{base})} = \frac{0.15}{0.006} = 25 < 40 \quad \text{OK}$$

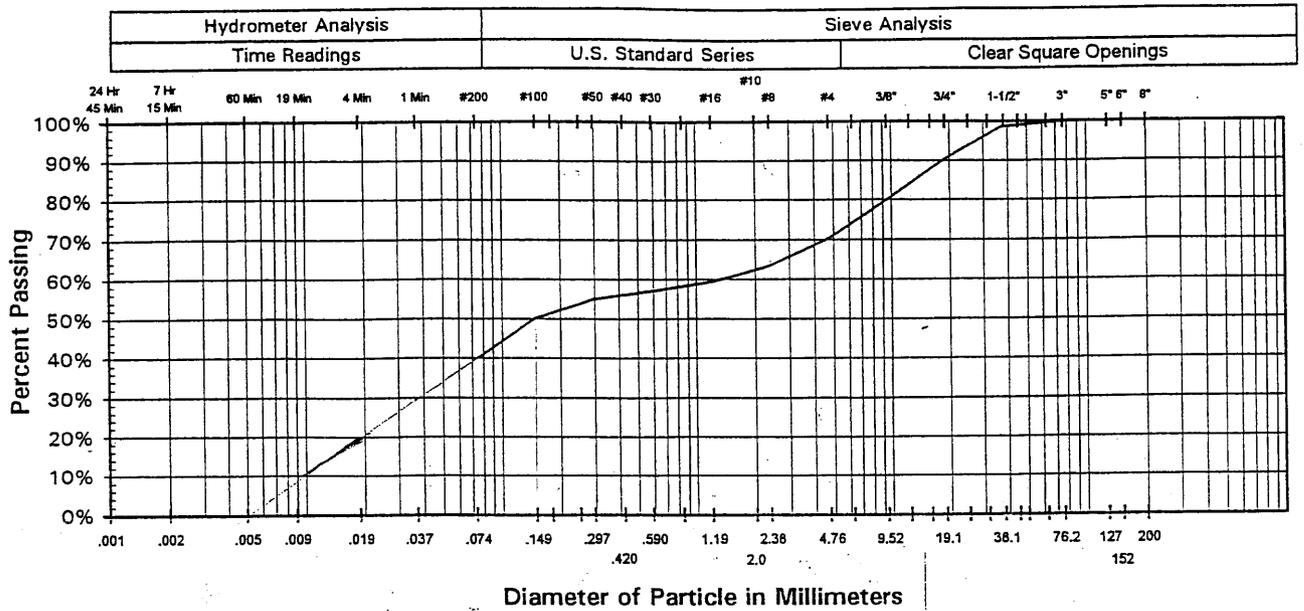
$$\frac{D_{15}(\text{filter})}{D_{15}(\text{base})} = \frac{0.007}{0.0006} = 11.7 > 5 + < 40 \quad \text{OK}$$

$$\frac{D_{15}(\text{filter})}{D_{85}(\text{base})} = \frac{0.007}{0.55} = 0.013 < 5 \quad \text{OK}$$

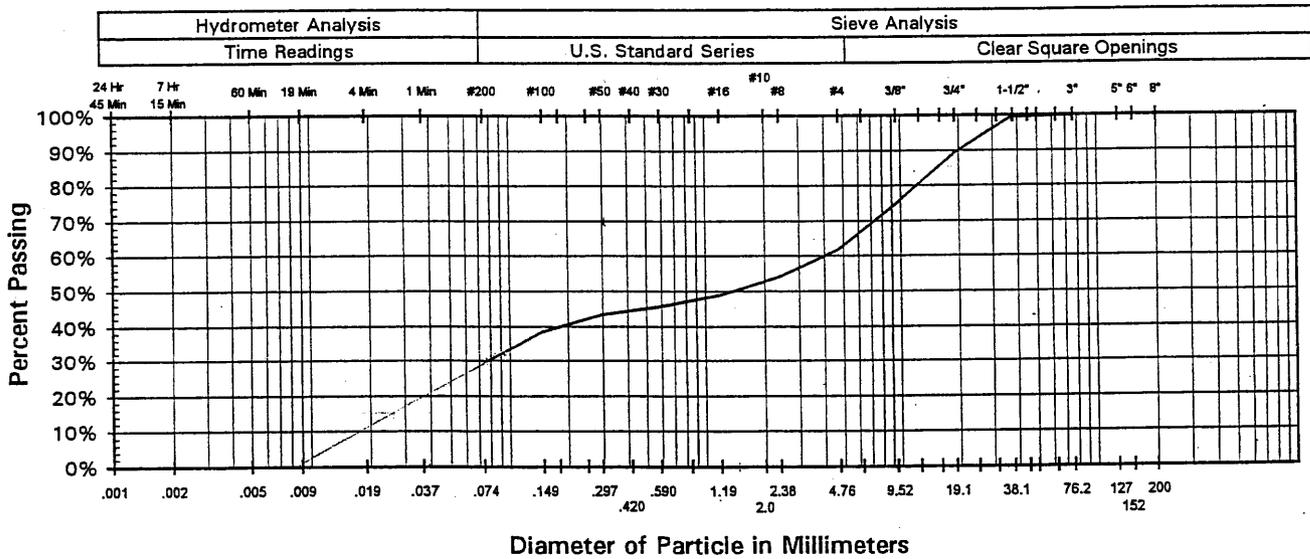
To address the one concern the riprap should be filled in with soil and seeded. The gravel and sand in the soil will fill in the spaces in the riprap and allow vegetation to further stabilize the channel.

The filter layer should 6" thick.

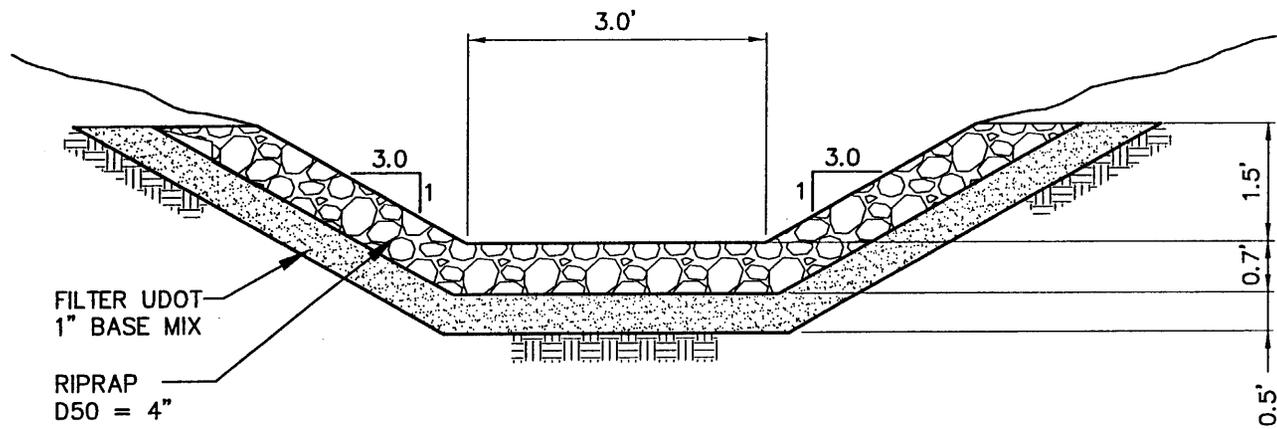
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		
Gravel	30%						
Sand	30%						
Silt and Clay	40%						
Sample Description	Clayey Sand with Gravel (SC)			Liquid Limit	-		
				Plasticity Index	-		
				Sample Location	Gravel Canyon Soil		



Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		
Gravel	38%						
Sand	32%						
Silt and Clay	30%						
Sample Description	Clayey Gravel with Sand (GC)			Liquid Limit	-		
				Plasticity Index	-		
				Sample Location	School House Canyon Soil		



FILTER UDOT
1" BASE MIX

RIPRAP
D50 = 4"



NO SCALE

CHANNEL CROSS-SECTION GCRD-1



APPENDIX 3.6C

ALTERNATIVE SEDIMENT CONTROL MEASURES
CALCULATIONS

Comparison of Pre-Mining and Post-Reclamation Sediment Yields for the Gravel Canyon Topsoil Stockpile

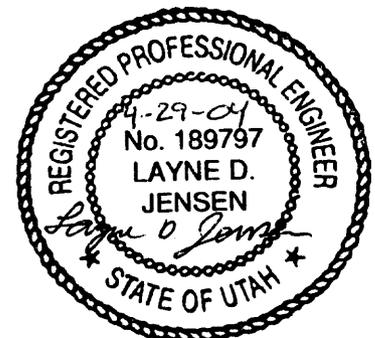
Sediment control after reclamation of the Gravel Canyon Topsoil Stockpile will be by Alternate Sediment Control Measures ("ASCM"). The same reclamation methods will be used for the reclamation of this site as was used for the reclamation of Hardscrabble Canyon, Crandall Canyon, Adit No. 1, and Star Point Mines. Sediment control at these sites have been successful and the same methods are expected to be successful at this site as well. The sediment control methods to be applied at this site are as follows:

1. Deep gouging;
2. Mixing hay into the soil;
3. Mulching the gouged surface;
4. Securing the mulch with a tackifier; and
5. Revegetation.

The purpose of this calculation is to evaluate the sediment yield characteristics of the disturbed area under pre-mining and post-mining conditions. The three conditions to be evaluated will be as follows:

1. Pre-mining, This site was disturbed prior to 1977 and was likely disturbed during mining early in the 1900s. The site has likely been disturbed for over 100 years. Hence pre-disturbance information is not available and the pre-mining condition is a disturbed condition. Although the pre-mining condition is a disturbed condition where possible an undisturbed condition will be assumed for these calculations.
2. Immediate Post-Reclamation, after deep gouging, mulching and seeding but before vegetation establishment.
3. Long Term Post-Reclamation, after vegetation is well established and depressions from deep gouging are mostly gone.

Mixing hay into the soil consists of 2 tons/acre of hay being mixed into the soil during deep gouging. Another 1 to 1.5 tons/acre of straw mulch will be broadcast on the surface. The straw mulch will be secured with a tackifier when the site is hydroseeded. A small amount of wood fiber mulch will also be applied with the tackifier during hydroseeding.



Methodology

Sediment yield calculations will be made using the Modified Universal Soil Loss Equation (“MUSLE”) as presented by Israelsen et. al. (1984) and Barfield et. al. (1994)

$$A = R * K * LS * VM$$

where:

A = Sediment Yield (tons/acre/year)
R = Rainfall Factor
K = Soil Erodibility Factor
LS = Length and Steepness of slope factor
VM = Erosion Control Factor

Each of the above factors will be evaluated for each of the three conditions.

Rainfall Factor (R)

R=11 From Map R7 Israelsen et. al. (1984)

The same factor will apply for all three conditions.

Soil Erodibility Factor (K)

Pre-mining

As mentioned above the site has been disturbed for a long time and pre-disturbance data are not available. The Soil Survey of Carbon Area, Utah catagorizes soils in the vicinity of the site that were not disturbed at the time of the survey. The Gravel Canyon area is identified as map unit 72 Pathead-Curecanti Family Association. The Soil Survey identifies the bottom of the canyon to be predominantly a Curecanti family soil. The erodibility factor identified in Table 12 on page 277 is 0.28 for the surface sample.

Post reclamation

The soils used in the reclamation of Gravel Canyon Topsoil Stockpile will be a mix of the native soils and soil hauled from Crandall Canyon and the Preparation Plant area. The source area for the topsoil hauled from Crandall Canyon is identified as map unit 125 Uinta-Toze Families Complex. This soil has a surface soil erodibility factor of 0.24 with the lower soil layers having a factor of 0.15 and 0.1. These soils had high organic content and lower clay content than the soils in the Preparation Plant Area and should be excellent growth media. The soils from the Preparation Plant area were likely Map unit 121 Travisilla-rock outcrop-Gerst Complex. The near surface has some cementation and has a very low erodibility of 0.05 while soils 2 inches

down have a much higher erodibility factor of 0.37. Since the Preparation Plant soils were near the top of the stockpile and have been hauled to the Refuse pile for reclamation it can be assumed that most of the soil used in reclamation is either native or from Crandall Canyon. The lower native soil layers in Gravel Canyon have a lower soil erodibility factor of 0.1. During reclamation the native soils and Crandall Canyon Soils will be mixed. I will assume a soil erodibility factor of 0.22 since much of the reclaimed soil surface will be the less erodible sub soils from Crandall Canyon and Gravel Canyon.

Length-Steepness Factor (LS)

$$LS = \left(\frac{65.41 S^2}{S^2 + 10,000} + \frac{4.56 S}{\sqrt{S^2 + 10,000}} + 0.065 \right) \left(\frac{l}{72.6} \right)^m$$

Where:

LS = Length Steepness Factor

S = Slope Gradient (%)

l = Slope Length (ft)

m = empirical exponent (function of slope)

Pre-mining

Since the site was likely disturbed about 1900 no pre-disturbance topography is available. However, using adjacent undisturbed topography the site had slopes between 10 and 100%. The site is located in the lower relatively flat area of Gravel Canyon. The slopes of the undisturbed areas on the canyon sides are mostly between 60% and 100%. In an undisturbed conditions the slopes extend unbroken from the ridge lines down to the channels in the canyons. These distances may be up to 1100'. However most slope lengths are 400' to 500' in length. The steepest slopes will generate the greatest erosion so I will focus on the steep areas when comparing sediment yield. For the undisturbed conditions I will assume a slope of 60% and a slope length of 400'.

$$LS = 46.3 \text{ (Table C-1 Israelsen et. al. (1984))}$$

Immediate Post Reclamation

The reclaimed areas will be deep gouged prior to seeding. Deep gouging creates 1 to 3' deep holes that prevent runoff from concentrating and achieving an erosive velocity. In the early stages of reclamation the gouges prevent any water from running off the reclaimed areas. The gouges also stop any runoff from upgradient undisturbed areas. Therefore, the slope length is very short. I will assume a slope length of 10' although the distance is actually less. The maximum slope of reclamation is a 2:1 slope or 50%. I will assume the maximum slope of 50% and a slope length of 10'.

$$LS = 5.64 \text{ (Table C-1 Israelsen et. al. (1984))}$$

Long-term Post Reclamation

In the long term the depressions from gouging will disappear leaving an unbroken slope with a maximum slope of 50%. I will assume a 50% slope and the same slope length as for the pre-mining condition (400').

LS = 35.65 (Table C-1 Israelsen et. al. (1984))

Erosion Control Factor (VM)

Pre-Mining

No pre-mining vegetation data is available. However, Map 6 and Appendix 9-1 of Exhibit 19 identifies adjacent undisturbed areas to be mostly mixed brush. I will use the Castle Gate Mixed Brush reference area (Appendix 9-1 Exhibit 19) to estimate the Erosion Control Factor.

Total vegetation cover = 40.9%	Grass density = 51% ==> 21%
Litter/rock cover = 35.2%	Sage brush = 26% ==> 10.6%
Bare soil = 23.9%	Other brush = 23% ==> 9.4%
	Total brush 20%

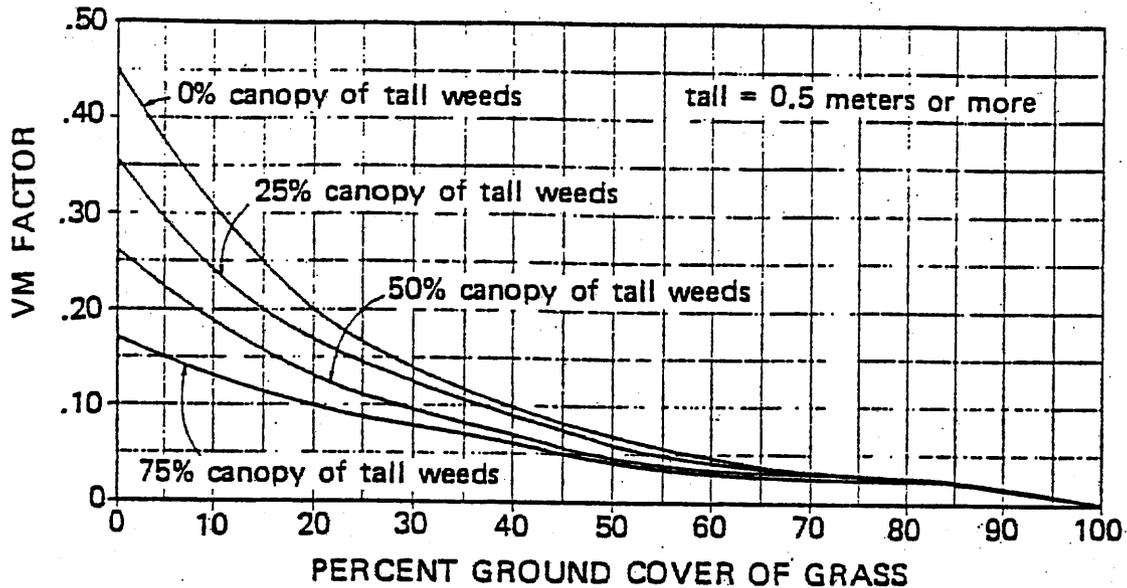


Figure 7. Relationship between grass density and VM factor.

VM = 0.17

Israelsen et. al. (1984)

Immediate Post Reclamation

$$R * K * LS = 11 * 0.22 * 5.64 = 13.65$$

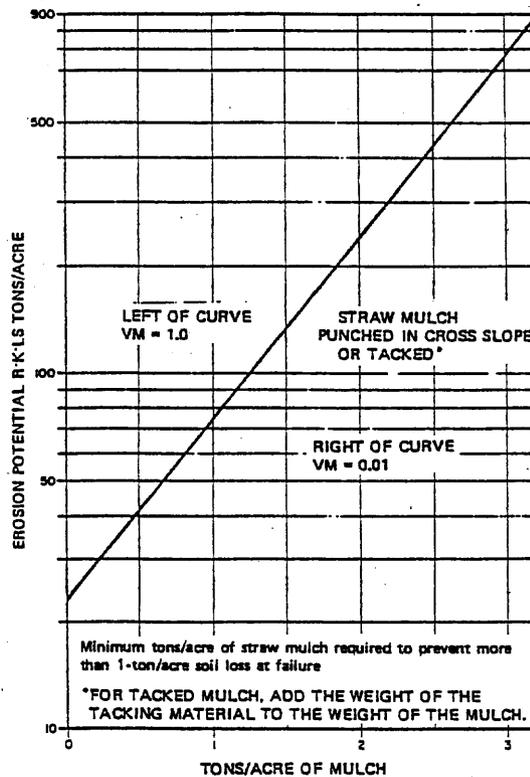


Figure 4. Straw mulch anchored vs. R·K·LS.

At least 1 ton/acre of mulch will be added with a tackifier to the reclaimed surface. Therefore, the point plots on the right side of the line.

$$VM = 0.01$$

Long-term Post Reclamation

Section 3.2.2.4 of the Willow Creek Permit describes the vegetation in an area near the site that has been reclaimed (The old Royal Refuse Pile). I will use that data to estimate the Erosion Control Factor although the Gravel Canyon reclamation area will be better vegetated.

- Total plant cover = 30%
- Brush density = 50% ==> 15.5%
- Grasses density = 40% ==> 12.4%

$$VM = 0.24 \text{ (see figure 7 on page 4)}$$

Calculation Summary

<u>Time Period</u>	<u>R</u>	<u>K</u>	<u>LS</u>	<u>VM</u>	<u>A (tons/acre/yr)</u>
Pre-Mining	11	0.28	46.3	0.17	24.2
Immediate Post Reclamation	11	0.22	5.64	0.01	0.14
Long-term Post Reclamation	11	0.22	35.65	0.24	20.7

Thus the reclaimed surface will generate far less sediment immediately after reclamation and will generate slightly less sediment for the long-term post reclamation period.