PLATEAU MINING CORPORATION
WILLOW CREEK MINE
C/007/038

INDUSTRIAL POSTMINING LAND USE PERMIT CHANGE APPLICATION

APRIL 2003

File in:
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Refer to Record No 0010 Date 04/7/2003
In C/0070038 Incoming
For additional information

Month Day, 2003

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Mr. Gary Harwood
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Director Land Management
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Mr. Dave Levanger
Carbon County Planning and Zoning Commission
120 East Main Street
Price, Utah 84501

Re: <u>Industrial Post Mining Land Use, Willow Creek Mine, C/007/038, Carbon County, Utah</u>

Dear Mr. Last Name:

In accordance with the requirements of R645-301-412.200, Plateau Mining Corporation (PMC) is notifying the surface landowners and local government agencies adjacent to the Willow Creek Mine that it has filed an application with the Utah Division of Oil, Gas and Mining for a change in the post mining land use to Permit C/007/038. The land use change will facilitate an industrial use under the provisions of the Utah Coal Mining and Reclamation Act pursuant to R645-301-413.300 of the Utah R645 Coal Rules.

The industrial land use boundary will contain 36.4 acres, more or less. Within this acreage, support facilities like the shop, warehouse, bathhouse/administration building, substation, access roads, material storage areas, runoff control pond, and other appurtenant structures will remain to support the proposed land use. The surface owner of the land is Plateau Mining Corporation.

Comments from the legal or equitable owner of record of the surface areas to be affected and from the Federal, Utah and local government agencies should be mailed to: Plateau Mining Corporation, Attention: Johnny Pappas, P.O. Box 30, 847 NW Highway 191, Helper, Utah 84526.

If you have any questions or need additional information, please do not hesitate to contact me at (435) 472-4741.

Sincerely,

Johnny Pappas
Sr. Environmental Engineer

Enclosure

Env: Willow Creek Mine-PMLUC
Chrono: JP030402.LTR

Public Notice

Application for Post Mining Land Use Change
Willow Creek Mine
Plateau Mining Corporation
Permit C/007/038, Approved 04/24/96
Carbon County, Utah

Notice is hereby given that Plateau Mining Corporation, P.O. Box 30, 847 Northwest Highway 191, Helper, Utah 84526, a subsidiary of RAG American Coal Company, 999 Corporate Blvd., Linthicum Heights, MD 21090, has filed an application with the Utah Department of Natural Resources, Division of Oil, Gas and Mining for a change in post mining land use to Permit C/007/038. The land use change will facilitate an industrial use under the provisions of the Utah Coal Mining and Reclamation Act pursuant to R645-301-413.300 of the Utah Coal Program Regulations. The portion of the permit area that is affected is located in Carbon County, Utah as follows:

Township 12 South, Range 10 East
Section 31: Portions of SW/4
Township 13 South, Range 10 East
Section 6: Portions of NW/4NW/4
Township 13 South, Range 9 East
Section 1: Portions of E/2NE/4; NW/4NE/4; E/2SW/4NE/4
(Containing a total of 36.4 acres more or less)

The permit area is shown on the Helper U.S. Geological Survey 7.5-minute map.

The Mining and Reclamation Plan is available for public review at: Utah Division of Oil, Gas and Mining, 1594 West North Temple, Suite 1210, Salt Lake City, Utah 84114-5801, and at the Carbon County Courthouse, 120 East Main Street, Price, Utah 84501.

Written comments, objections and requests for information conferences on this proposal may be addressed to:

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

Closing date for submission of such comments, objections and requests for public hearing or information conference on this proposal must be submitted by Month Date, 2003

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3.4 LAND USE INFORMATION

3.4.1 General Land Use Information

This section describes existing land uses, land use classifications, and land use condition and capabilities within the permit area and adjacent areas which could be affected or impacted by the mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-400) for coal mine permitting in the State of Utah.

3.4.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses rule R645-301-411. Reclamation plans and performance standards (Rules R645-301-412 through R645-301-414) are addressed in Section 5.4 of this permit application. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section		Regulatory Provisions Addressed
3.4.1		
	3.4.1.1	
	3.4.1.2	R645-301-130
	3.4.1.3	R645-301-411.110 and 200
	3.4.1.4	R645-301-411.110, 140, and 141, and 512
3.4.2		
	3.4.2.1	R645-301-411.100 and 120
	3.4.2.2	R645-301-411.110 and 130; 411.200
	3.4.2.3	R645-301-411.120
	3.4.2.4	R645-301-411.130 and 141
	3.4.2.5	R645-301-411.130
3.4.3		
	3.4.3.1	R645-301-411.140
	3.4.3.2	R645-301-411.140
	3.4.3.3	R645-301-411.140
	3.4.3.4	R645-301-411.140, 141, 143, and 144
	3.4.3.5	R645-301-411.142
3.4.4		
	3.4.4.1	R645-301-411.200, 240
	3.4.4.2	R645-301-411.200 through 250
3.4.5		
	3.4.5.1	R645-301-412.100 through 412.140, R645-302-270 through 271.820
	3.4.5.2	R645-301-412.200 and 300
3.4.6		
	3.4.6.1	R645-301-413.100 through 413.334
Maps		R645-301-411.110, 140, 141, and 230
Exhibits		R645-301-411.140 through 143, and 412.200

3.4.4 Previous Mining Activity

Previous mining activities within the permit area and adjacent areas are important because they directly impact the coal resource available to support further mining operations and may be associated with existing site disturbance and environmental impacts as reflected by baseline environmental characterizations. The nature and extent of previous mining and related activities in the permit area and adjacent areas have been identified and characterized through review of historical mine maps, records, and reports and conversations with individuals familiar with the history of the area.

3.4.4.1 History of Previous Mining Activity

As previously described in Section 3.4.3.2, Historical Context, the earliest recorded mining activity in the area was the development of the Castle Gate No. 1 Mine in 1888. Extensive mine development and operations continued throughout the area through World War II. After the war, mining in the area experienced a gradual decline due primarily to the shift from coal fired to diesel locomotives. In the permit area and adjacent areas important mining centers included the towns of Castle Gate and Kenilworth. The last of the Castle Gate Mines closed in 1972 and the only active mining operation in the immediate area at the present time is Andalex Resources Centennial Mine located to the southeast of the permit area.

3.4.4.2 Description of Known Historic Mining Operations

Essentially all of the previous historical mining operations in the area have been conventional underground room and pillar coal mines extracting coal reserves from one or more of the known coal seams in the Blackhawk Formation. Table 3.4-1, Previous Mining Operations in the Permit and Adjacent Areas, summarizes the limited available information on previous historical mining operations including mine names, seam(s) mined, period of operation, and primary mining method. The location and areal extent of previous underground mining operations as well as any known associated surface disturbance are also shown on the Previous Mining Activity Map, (Map 10).

3.4.5 Reclamation Plan

The reclamation plan in Section 5.4 will support the postmining land uses of industrial and wildlife habitat. This reflects the predisturbance use of this and adjacent areas, existing land use plans and policies, the desires of affected surface landowners, and practical constrains relative to land use capability and condition. The Willow Creek reclamation plan has been designed to successfully meet these objectives and will result in effective surface stabilization and a postmining configuration which blends with the surrounding terrain, provides environmental values consistent with or superior to those which existed prior to mining, and capable of supporting a higher and better use of the land.

3.4.5.1 Post Mining Land-Use Plan

The postmining land uses will be achieved by eliminating potential hazards, establishing a stable postmining configuration, restoring effective drainage, establishing a productive self-sustaining vegetation community, and removing mining and related structures and facilities that do not support the postmining land uses of wildlife habitat and industrial. Map 18C - Industrial Postmining Land Use Surface Facilities Map, shows the structures and support facilities that will remain to support the industrial land use. Maps 21A through 21E - Postmining Topography and Drainage Structures Location Maps show the drainage and sediment control features which will be retained during reclamation to support the postimining land uses and assure long term stability, minimize erosion, and prevent or control additional contributions of suspended solids or other pollutants to the streamflow.

The Willow Creek Mine site area will support components of the industrial and wildlife habitat land uses. Map 21G - Industrial Postmining Land Use Watershed and Treatment Map, shows the industrial land use boundary along with those areas reclaimed to support wildlife habitat.

The industrial land use for this area is consistent with the land use policies for the area and once approved by the Division for such a use as described in Section 3.4.2.2.

To support the industrial land use, complete backfilling of the highwall can not be achieved. Map 21A shows the postmining topography for the industrial land use. Given that the Willow Creek development activities effectively constituted remining of the previously disturbed areas which included a preexisting highwall, under the applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 554), a variance from the AOC restoration requirements is not necessary.

However, it should be noted that the remaining highwall is compatible with the higher and better industrial postmining land use, will be stable (Exhibit 11), will not be greater in height or length than the cliffs within the area, will be compatible with the geomorphic process of the area, and will not pose a hazard to the public health and safety or the environment.

3.4.5.2 Land Owner Comments and Compatibility

Plateau Mining Corporation (PMC) is the legal owner of record of the surface where the industrial postmining land use is to occur. PMC wants the surface after reclamation to support not only wildlife habitat, but an industrial use consistent with its premining land use (Exhibit 1). This land use is the same as the premining land use as discussed in Section 3.4.2.2 and addressed in letters, dated January 23, 1996, to surface owners in the area as required by R645-301-412.200 (Exhibit 1).

Maps 21A through 21E - Postmining Topography and Drainage Structures Location Maps show the final fills suitable for reclamation and revegetation and are compatible with the natural surroundings and the post mining land uses.

3.4.6 Performance Standards

3.4.6.1 Postmining Land Use

All disturbed areas will be restored in a timely manner to conditions that are capable of supporting the premining land uses of wildlife habitat and industrial. The industrial land use is the highest and best use that can be achieved which is compatible with other land uses in the surrounding areas (Map 9) and does not require the disturbance of areas previously unaffected by mining.

The industrial land use has a reasonable likelihood for achievement, does not present any actual or probable hazard to public health or safety, or threat of water diminution or pollution, will not be impractical or unreasonable, will be consistent with applicable land uses policies or plans, will not involve unreasonable delay in implementation, or cause or contribute to violation of Federal, State, or local law.

Documentation supporting the achieved industrial postmining land use is presented in Exhibit 1.

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5.4 RECLAMATION OF MINING DISTURBANCE

5.4.1 General Description of Reclamation Plans

This section presents and describes reclamation plans and practices to be used to restore disturbed areas resulting from mining and related activities to productive self-sustaining use. Information in this section was developed in accordance with applicable regulatory requirements (R645-301-500) for coal mine permitting in the State of Utah.

5.4.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Rules R645-301-511, 541 through 553, and 560. The following cross-references headings and corresponding information presented in this section to the applicable regulatory provisions;

Permit Section		Applicable Regulatory Requirements
5.4.1		
	5.4.1.1	General Introductory Information
	5.4.1.2	R645-301-511.300 and 541.100 through 400
	5.4.1.3	R645-301-553.500 through 524, and 553.600 through 653
	5.4.1.4	R645-301-512.200 through 260 and 515.320 through 322
	5.4.1.5	R645-301-512.200 through 260 and 542.200 through 320
5.4.2		
	5.4.2.1	R645-301-542.100 and 500
	5.4.2.2	R645-301-541.100 through 400 and 542.200
	5.4.2.3	R645-301-542.300 through 800, 550 through 553.900, and 560
5.4.3		R645-301-542.800
Maps		R645-301-512.200 through 260 and 542.200 through 320
Exhibits		R645-301-542.800

5.4.1.2 General Reclamation Objectives and Activities

Reclamation will be an integral part of the Willow Creek mining and related activities, however, because the mine will be an underground mine and the surface facilities and related surface disturbance areas will remain in place until the end of the mine life, mining and reclamation will not occur concurrently or, in the case of progressive mining activities, sequentially. Reclamation of surface disturbance areas will generally occur following the cessation of mining operations to complete the mining and reclamation cycle although PMC will implement temporary stabilization measures in certain areas following initial construction or during ongoing operations, including progressive reclamation of the Schoolhouse Canyon refuse stockpile.

Objectives of the planned reclamation activities will be twofold; 1) For construction disturbance and ongoing surface disturbance such as that associated with expansion of the coal refuse stockpile, temporary stabilization and contemporaneous reclamation will serve to stabilize disturbance areas, minimize erosion, and limit potential surface water impacts; 2) For long-term use areas, final reclamation is designed to restore disturbed areas to a safe, stable condition and to reestablish the productivity of the land consistent with the postmining land use(s). The proposed postmining land use of industrial and wildlife habitat reflects the predisturbance use of this and adjacent areas, existing land use plans and policies, the desires of affected surface landowners, and practical constraints relative to land use capability and condition. Specific land use considerations and constraints are discussed in Section 3.4, Land

Use Information. The Willow Creek reclamation plan has been designed to successfully meet these objectives and will result in effective temporary stabilization, and a postmining configuration which blends with the surrounding terrain and provides environmental values consistent with or superior to those which existed prior to mining.

The Willow Creek reclamation plan has been developed utilizing available information on the existing environmental resources as described in Section 3.0, Environmental Information. In addition, PMC has incorporated both available information on current successful reclamation technology and practices and their extensive operating experience in the area. While the plans presented in this permit represent what PMC feels to be the most effective reclamation practices for this site, it is important to note that successful reclamation must be a dynamic process, incorporating new information to optimize overall effectiveness. In order to meet the reclamation objectives these plans may be modified as appropriate to reflect changing conditions, revised regulatory requirements, advances in reclamation technology, and the results on ongoing research and experience relative to the long-term effectiveness of various reclamation practices. Any future plan modifications will be addressed under applicable regulatory requirements for permit revision and modification.

Reclamation will involve a logical sequence of activities designed to achieve the overall reclamation objectives in an organized progressive manner. The following represent the general steps for reclamation of any mine or mine related surface disturbance areas:

- Facility Demolition and Removal
- Stabilization and Sealing of Mine Openings
- Disposal of Coal Refuse, Non-Coal Wastes, and Mine Waste Materials
- Backfilling and Grading to Establish the Final Design Configuration and removal of Sedimentation Ponds and Associated Structures
- Drainage Reestablishment
- Road Removal
- Soil/Substitute Replacement
- Revegetation
- Post-Reclamation Management, Maintenance, and Monitoring

These activities are discussed in detail in the following sections.

5.4.1.3 Proposed Variances from Regulatory Standards

Due to previous mining and other disturbance of the area there is not sufficient available spoil to completely backfill all highwalls. Given that the Willow Creek development activities effectively constitute remining of the previously disturbed areas which included a preexisting highwall, under the applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 554). Since the requirements of Rule R645-301-553.500 apply, a variance from the AOC restoration requirements is not necessary.

A variance from the requirement to reclaim the Barn Canyon Access Road is requested based on the following: (The Barn Canyon shaft project was never constructed; therefore, any and all reference to the project should be ignored.)

1. The road existed prior to mining activities.
2. The road is in the bottom of an intermittent channel.
3. The road surface is comprised primarily of sandy soil, gravel, cobbles and boulders created in the natural erosional processes.
4. Culverts installed on the road for use during mining activities will be removed at final reclamation of the shaft site. The culvert removal areas will be replaced with broad swales to allow continued use of the road. As shown on Figure 5.4-1 DC-24 will be replaced by reclamation swale 1 and DC-25 will be replaced by reclamation swale 2. Map 33 shows the location of the culverts to be replaced during reclamation. Design calculations for the reclamation swales can be found in Exhibit 22. The road/channel will be re-established as it existed prior to use by PMC with the exception of the swales installed during construction, which will continue to divert water off the road and into the natural channel after reclamation is complete.
5. Leaving the road in no way detracts from, and is compatible with the post-mining land use.

5.4.1.4 Certification and Reporting

Rule R645-301-512 specifies that certain designated cross-sections, maps, and plans be prepared by or under the direction of a qualified Registered Professional Engineer (PE) and that certain maps and design plans be certified by a PE. These cross-sections, maps and plans will be certified as required.

5.4.1.5 Mapping of Reclamation Information

Information presented on the reclamation maps and cross-sections includes:

- Anticipated final surface configuration
- Postmining drainage features
- Location of any structures and facilities which will be retained as permanent structures following the completion of mining
- Any structures and roads to be retained in conjunction with the postmining land use

5.4.2 Reclamation Plans and Practices

The specific reclamation plans developed for the Willow Creek area and the proposed reclamation practices reflect the overall reclamation objectives, site specific conditions and constraints, and the best current reclamation techniques and methods. The following sections describe the timing and sequencing of reclamation activities, general reclamation requirements, and specific reclamation practices.

5.4.2.1 Reclamation Timing and Sequencing

PMC will reclaim mining related surface disturbance areas as soon as operationally practicable following completion of mining and related activities. For construction related disturbance, this commitment translates into regrading, establishment of effective drainage and sediment control, and temporary vegetation of the disturbed areas to stabilize these areas and prevent erosion or uncontrolled runoff. Timely reclamation of the progressive disturbance associated with ongoing construction and expansion of the coal refuse stockpile has been approved under the existing Castle Gate Permit and will involve regrading, soil or substitute replacement, and seeding to establish permanent vegetation of completed stockpile areas as soon as operationally feasible after each area reaches the design elevation and will no longer be disturbed.

With the exceptions of temporary stabilization of construction disturbance and progressive reclamation of completed portions of the coal refuse stockpile, other mining related disturbance areas are expected to remain in a disturbed condition until after the completion of mining and related activities. Reclamation of mine surface facilities areas (including ventilation fan and shaft facilities), following completion of mining will be initiated as soon as operationally feasible after mining ceases and no later than the next normal field season (typically May through October). It is anticipated that final reclamation would be completed within 24 months from the time the last coal is either produced or shipped from the property, whichever is later. Figure 5.4-2, Reclamation Timetable - Mine Facilities Area, outlines the specific sequence and anticipated timing of final site reclamation activities.

Final reclamation will involve removal of all mine related structures and facilities, closure and sealing of portals and mine openings, disposal of waste materials, backfilling and grading, drainage reestablishment, road removal, placement of soil or substitute materials, and revegetation. Generally, soil/substitute replacement and revegetation efforts will be coordinated so that soil materials are revegetated as soon as practically possible following placement. Normally this will involve placement of soil/substitute and immediate reseeding at the end of the field season in late fall. This approach allows the seed to "winter over" with germination in the spring when soil moisture conditions are elevated due to winter snow accumulations and spring melt.

Following final reclamation of mine facilities ~~areas~~, the only disturbance which will remain will be that necessary to support the postmining land use and any roads required to access any permanent drainage or other structures.

These structures will remain in place to provide access during the extended liability period and to support the post mining land use. The proposed drainage and sediment control plan proposes to utilize alternative sediment control methods as the primary means of controlling erosion and sediment contributions. The Willow Creek Mine - Postmining Topography and Drainage Structures Location Maps (21A through 21E) and Postmining Reclamation Treatment and Watershed Map (Map 21F), show the drainage and sediment control features which will be retained during the reclamation liability period and support the postmining land use. Components of the drainage and sediment control plan are identified and discussed in detail in Exhibit 13, Drainage and Sediment Control Plan, with the exception of RASCA-6 which is discussed in Exhibit 22 and shown on Map 32A. Straw bales and/or silt fence structures will be installed as deemed necessary prior to and during any reclamation activities to serve as a protective barrier between the reclamation areas and the Willow Creek buffer zone and/or channel. Shortly after the deep gouging and final mulching activities are completed, the temporary silt fences and/or straw bales will be removed, whereby treatment of the reclaimed site will be the ASCMs presented in Section 5.5.2.4 and in Exhibit 13, Section 4.5.2.

5.4.2.2 Reclamation Plan

Beyond the general reclamation objectives of restoring disturbed areas to a safe, stable condition and reestablishing the productivity of the land consistent with the postmining land use(s), this reclamation plan is designed to achieve the following specific operational and environmental objectives:

- Removal of Mining Related Structures and Facilities
- Eliminate Potential Hazards
- Establish a Stable Postmining Configuration
- Restore Effective Drainage
- Establish a Productive Self-Sustaining Vegetation Community
- Support the Industrial Postmining Land Use

The following sections briefly describe important considerations and the rationale behind each of these specific objectives.

Removal of Mining Related Structures and Facilities

Given that many of the existing ~~and proposed~~ mining and related surface structures are not generally compatible with the proposed postmining land use of industrial and wildlife habitat, these structures and facilities will be removed following completion of mining. All or portions of the Willow Creek mine surface facilities area, Castle Gate preparation plant and loadout areas, and Crandall Canyon surface facilities may be reclaimed at any given time dependent on the location and nature of potential future mining operations in this general area. There are still substantial minable reserves located to the west of the Price River and it is believed that substantial coal reserves also exist to the north which are presently not minable given the depth of overburden cover in this area and limitations of current mining technology. If reserves in either area are developed in the future the possibility exists that mine ventilation, coal processing, refuse disposal, and/or coal loadout facilities may be retained in conjunction with these future mining operations. In any case, when surface facilities are no longer required to support ongoing mining and related operations they will be removed and the associated surface disturbance areas reclaimed.

Eliminate Potential Hazards

On completion of mining operations there will be a number of mining related features and some materials which, if not properly addressed, could pose a potential health or safety hazard to both humans and wildlife. Potentially hazardous features would include certain mine structures, portals and other mine openings, and steep slopes, refuse fill structures, and highwall areas. Coal refuse materials, non-coal wastes, and mine waste materials could represent a potential hazard due to any toxicity characteristics associated with these materials and the potential flammability of certain non-coal wastes such as waste petroleum products.

Mine structures not compatible with the postmining land uses will be removed and associated disturbance areas reclaimed, effectively eliminating any potential associated hazards. As part of the final reclamation activities, all portals and other mine openings will be stabilized, sealed, and the associated disturbance areas backfilled, graded, and reclaimed. Similarly, steep slopes and highwall areas will be partially or fully backfilled, regraded, and reclaimed eliminating or minimizing potential related hazards. Refuse fill structures have been designed and both previous and future construction practices are planned to provide for long-term stability and effective drainage of the fill in order to minimize the potential for either localized or mass failure.

Evaluation of coal roof and floor materials and overburden/interburden materials along with samples of existing coal refuse and mine waste materials indicates no significant toxicity concerns relative to these materials. In addition, specific operational placement and reclamation methods and plans will control or minimize any potential toxicity concerns for both coal refuse and mine waste materials. As described in Section 4.5.2.3, Mine Structures and Facilities, under the subtitle of Non-Coal Waste Disposal, all non-coal wastes will be collected and stored in appropriate containers and will be disposed of off-site by a licensed contract disposal firm. These disposal plans include any non-coal wastes remaining on completion of mining operations with the exceptions of concrete demolition debris, road surfacing materials, and minor amount of steel resulting from facility removal which will be placed and buried in the mine facilities, preparation plant, or loadout areas. Off-site disposal of most non-coalwastes and the planned disposal measures for demolition debris will effectively eliminate any potential associated hazards.

Establish a Stable Postmining Configuration

Following removal of mining related structures and facilities and closure and sealing of portals and mine openings the associated surface disturbance areas will be backfilled and regraded to establish a stable postmining configuration which blends with the surrounding terrain, provides for effective drainage, and is consistent with the postmining land uses of industrial and wildlife habitat. Given that the mine face-up area, railroad grade, rock tunnels, and several cut slopes represent existing disturbance and that available fill material is limited to the existing fill bench where some of the mine surface facilities will be located, backfilling will be limited to the materials available consistent with applicable remaining provisions of the State of Utah Coal Mining Rules (R645-301-553.500 through 524). To the extent possible using all available material, disturbed areas will be backfilled and regraded to blend with the surrounding terrain, highwalls will be eliminated or reduced, and any exposed coal seams will be covered with a minimum of 4 feet of suitable cover material.

Restore Effective Drainage

In conjunction with final backfilling and regrading activities, permanent drainage features, designed to pass the peak flows from the 10 -year, 6-hour event, will be established to effectively pass natural drainage through the reclaimed areas and provide for effective control of runoff from reclaimed areas while minimizing the potential for any significant erosion.

Establish a Productive Self-Sustaining Vegetation Community

Consistent with the postmining land use of wildlife habitat, PMC will reestablish a self-sustaining vegetation community composed primarily of indigenous native species but also including adaptive introduced species as appropriate to provide for rapid reestablishment, productivity, and species diversity. Activities related to vegetative reestablishment will include replacement of available soil or substitute materials, addition of any necessary soil amendments, seedbed preparation, seeding with the appropriate revegetation seed mixture, and selective application of mulch or other erosion control materials to minimize erosion and provide an opportunity for initial vegetative establishment.

Support the Industrial Post Mining Land Use

The mine site bathhouse, warehouse, maintenance shop, storage areas, parking, roads and other ancillary support facilities will remain to support the industrial postmining land use (Map 18C - Industrial Postmining Land Use Surface Facilities Map). Runoff control structures will remain to divert runoff around and through the industrial site and any precipitation coming in contact with the industrial site will be conveyed to sediment pond 001 for treatment to minimize the threat of water diminution or pollution. Section 3.4.5 provides the supporting information for the industrial postmining land use.

5.4.2.3 Reclamation Practices

The reclamation practices described in this section reflect PMC's detailed review of information on the existing site configuration and environmental values, consideration of site reclamation potential and any important limitations, and application of the best current reclamation technology and both PMC's and other coal operators extensive operating experience in this area. The following sections provide a detailed description of the specific reclamation practices proposed for surface disturbance areas associated with the Willow Creek Mine. It should be noted that the following discussions generally focus on the mine facilities area since the Castle Gate preparation plant and loadout areas already has an existing approved reclamation plan in place under the Castle Gate Mine permit. The existing approved reclamation plans for these areas are provided for reference in Exhibit 19, Castle Gate Information, and Exhibit 20, Crandall Canyon Information.

Hydrologic Monitoring

PMC will continue its comprehensive program to monitor surface ~~and groundwater~~ quality and quantity over the duration of the proposed reclamation operations and through the extended liability period. Table 4.7-1, Willow Creek Mine - Hydrologic Monitoring Stations, summarizes the type, location and geology. The reclamation phase monitoring compliance list is presented in Table 4.7-2, Hydrologic Monitoring Program - Water Quality Analysis Parameters. Table 4.7-3, Sampling Frequency summarizes the frequency of data collection and submittal, in accordance with applicable UDOGM guidelines.

Facility Demolition and Removal

All existing structures and facilities and those structures and facilities constructed specifically to support the mining and related activities will be utilized and will remain in place until the mining and related activities which they support have been completed. At that time, ~~all~~ specific structures and facilities will be demolished or salvaged in order to reclaim the site and establish the postmining land uses. Map 18C - Industrial Postmining Land Use Surface Facilities Map, shows the structures and facilities that will remain to support the industrial land use.

At the current time the effective mine life is projected at 15 to 20 years, although mine life could be extended significantly with development of additional reserves to the north and west. Dependent on age and condition, much of the equipment which will be utilized for the mining and related operations, including conveyors and associated coal handling components, the primary crusher, process equipment, maintenance equipment, and some of the smaller prefabricated buildings or building components may be salvageable for continued beneficial use at the end of the mine life. Any equipment which is not salvageable will be dismantled and any buildings or otherstructures not salvaged will be demolished. ~~Structures and facilities to be salvaged or demolished are identified in Section 4.5.2.3, Mine Structures and Facilities.~~

During reclamation the components of the power lines which connect Crandall Canyon to Sowbelly Canyon will be removed. The power poles will be cut below the surface and the poles and associated wiring removed from the site.

Equipment and facilities to be salvaged will be dismantled and removed from the site by PMC, a buyer, or private salvage contractors. Disassembly and demolition of remaining equipment and structures will involve dismantling or cutting equipment, steel structures, and other large components into pieces which can be readily handled by mobile equipment; using heavy equipment, explosives; and cutting torches to break-up structural concrete members, exposed

foundations, and masonry structures; ripping and removal of road surfacing materials; and removal of buried foundations and utilities to at least 4 feet below the design reclaimed surface.

Nonhazardous and nonflammable materials, such as concrete, asphalt, and steel will be incorporated into the backfill and used as fill in areas such as highwalls and cut slopes. These materials will be incorporated into the backfill in a manner that will not create voids within the backfill or reduce the effective compaction necessary for backfilling. These materials will be intermixed with backfill to ensure voids are filled and compacted. Additionally, the top four feet will be clean and not contain non-coal waste. Concrete slabs or foundations buried in-place will be covered with a minimum of four feet of fill to ensure adequate root depth and soil moisture retention for vegetation. Whenever possible, steel will be salvaged rather than buried. However, rebar or other steel that is incorporated in the concrete will not be removed from the concrete prior to burial.

Other non-coal wastes found during demolition (or other reclamation activities) including, but not limited to: grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber, and other combustible materials generated during previous mining activities will be place and stored in a controlled manner in a designated portion of the mine's disturbed area. This storage area will be determined at the time of reclamation activities and will be at the discretion of the permittee. Final disposal of non-coal mine wastes will be in a designated disposal site within the permit area or at a State approved solid waste disposal facility. Notwithstanding any other provisions of the R645 Rules, any non-coal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) and 40 CFR Part 261 will be handled in accordance with the requirements of Subtitle C of RCRA and any implementing agency.

Stabilization and Sealing of Mine Openings

On completion of mining and related activities, all mine openings including portals, shafts, raises, boreholes, and wells will be stabilized if required and sealed unless they are to be utilized for ongoing monitoring or in conjunctionwith the postmining land use. Methods and requirements for sealing wellsand boreholes are presented and described in Section 4.6.1, Geologic Protection Plans.

Current plans call for fourteen underground mine openings, the five main portals, the main ventilation raise, one ventilation shaft in the Willow Creek area, one ventilation shaft in the Barn Canyon, two existing shafts in Crandall Canyon, and the four portal openings on Rock Tunnels No. 1 and 2. These openings will be permanently sealed on completion of mining to prevent access to the underground workings and, in the case of the mine openings, to provide an effective hydraulic seal to prevent surface drainage and infiltration through the backfill from entering the underground mine workings. Portals, except for the 4 openings at Rock Tunnels No. 1 and 2, will be sealed and stabilized by constructing a concrete block wall approximately 10 to 25 feet in by the portal openings. The two layer thick solid block wall, which will be constructed as illustrated by Figure 5.4-3, Typical Portal Seal, will be keyed into the mine entry at least 6 inches on all sides and, for the mine portals, an MSHA approved sealant will be applied to the outer surface of the barrier to provide a positive water seal. The rock tunnel openings will be backfilled in accordance with 30 CFR 75.1711-2 as required by MSHA.

In order to assure the long-term integrity of the mine portal seals, PMC, as part of the MSHA roof control plan, will maintain adequate barrier pillars and will utilize appropriate roofsupport including timber or concrete cribs, posts, roof bolts, trusses, or other supports to minimize subsidence and collapse or caving of the mine workings in the vicinity of the portal seals. Once the portals seals are in place, the remaining void space between the seals and the portal opening will be backfilled using a LHD or small backhoe to assure proper backfill placement.

The ventilation raise will be sealed using the same methods as described above for mine portals; a permanent plug will be established, or if more effective shaft sealing methods are available at the time of mine closure they may be utilized subject to UDOGM approval. Installation of a permanent plug will involve placement of a steel bulkhead at least 7 feet below the raise opening to the surface and placement of at least 3 feet of reinforced concrete on top of the bulkhead. The bulkhead will be anchored into the sides of the raise by transverse steel beams set into slots cut into the sides of the raise and the reinforcing steel for the concrete plug will extend into drilled holes inthe sides of the raise. The upper surface of the concrete plug and the adjacent sides of the raise will be coated with an MSHA approved sealant to provide a positive water seal. The void space between the top of the concrete plug and the raise opening will be backfilled in conjunction with subsequent backfilling and grading operations.

The Barn Canyon ventilation shaft will be sealed using a permanent reinforced upward expanding concrete plug, (see Exhibit 18-1, Volume 12) or if more effective shaft sealing methods are available at the time of mine closure they may be utilized subject to UDOGM approval. Installation of a permanent plug will involve placement of a steel bulkhead at least 9 feet below the raise opening to the surface and placement of at least 5 feet of reinforced concrete on top of the bulkhead. This will allow for a 4 foot soil cover to protect the concrete plug from frost action. The bulkhead will

be anchored into the sides of the raise by transverse steel beams set into slots cut into the sides of the raise and the reinforcing steel for the concrete plug will extend into drilled holes in the sides of the raise. The upper surface of the concrete plug and the adjacent sides of the raise will be coated with an MSHA approved sealant to provide a positive water seal. The void space between the top of the concrete plug and the raise opening will be backfilled in conjunction with subsequent backfilling and grading operations. A MSHA approved ventilation pipe will be added to the plug. The ventilation pipe will be a 2-inch diameter, Schedule 80 galvanized steel pipe that will require no additional support. The ventilation pipe will be grounded to a 60-inch solid copper rod placed in the ground, extending 6 inches above the ground surface. A braided copper cable will run below ground between the ventilation pipe and the copper rod, with the cable being clamped to the pipe and copper rod on both ends.

Disposal of Coal Refuse, Mine Waste, and Non-Coal Waste

As described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subtitles of Mine Development Waste Handling and Disposal and Coal Processing Waste Handling and Disposal, both mine waste and coal processing waste or coal refuse will be placed in the existing permitted Schoolhouse Canyon coal refuse stockpile. This facility has been designed and constructed to affect compliance with all applicable regulatory provisions for mine waste and coal processing waste disposal. Future coal refuse and mine waste placement in this facility and facility reclamation will be consistent with the existing approved plans presented in Exhibit 19, Castle Gate Information. The existing approved operation and reclamation plans are designed to provide for effective drainage from and around the stockpile, to assure the short and long-term stability of the pile, and to provide for effective progressive reclamation of discrete areas of the stockpile as they are completed to the design grade.

Pre-mining coal waste and coal waste mixed with soil located in the embankment of Pond 001 (Exhibit 11)will remain in-place during and following reclamation of the pond area. This material is currently covered with at least 3 feet of soil and during reclamation will receive additional soil as depicted in cross-section H-H' on Map 22B. Section 5.4.2.2 "Eliminate Potential Hazards" discusses the evaluation of samples of existing coal refuse and mine wastematerials and concluded there were no significant toxicity concerns related to these materials.

All non-coal wastes will be collected and stored in appropriate containers and will be disposed of off-site by a licensed contract disposal firm as described in Section 4.5.2.3, Mine Structures and Facilities, under the subtitle of Non-Coal Waste Disposal. These disposal plans include any non-coal wastes remaining on completion of mining operations with the exception of some demolition debris as previously discussed.

Backfilling and Grading to Establish Final Configuration

Following completion of mining and related operations and subsequent facility removal and sealing of mine openings the associated surface disturbance areas , not supporting the industrial postmining land use, will be backfilled and regraded. As previously noted in Section 5.4.2.2, Reclamation Plan, there are a number of features in the mine facilities, preparation plant, and loadout areas which represent existing disturbance. Some of these features are related to existing structures that will be utilized in conjunction with the Willow Creek mining and related activities and mine design and facility layout have taken advantage of other existing features in order to minimize overall surface disturbance. Existing disturbance features are shown on the Mine Surface Facilities Map, (Map 18A), and documented by Exhibit 7, Documentation of Existing Site Conditions, and include:

- Road cuts and bench cut in the Fire-Fighting and Mine Water Tank location
- Road cuts and fill bench in the Mine Ventilation Fan area
- Existing mine face-up area
- Fill bench and sidehill cuts in Run of Mine Coal Stockpile area
- Road cuts and bench cut in Potable Water Tank area
- Sidehill cuts along Conveyor SC-1 alignment
- Sidehill cuts and fills along most of the old railroad grade
- Rock Tunnels No. 1 and 2
- Cuts and fills along existing main access road to the mine facilities area

For many of the existing disturbance features, backfilling and regrading to a pre-disturbance configuration would be difficult if not impossible since they involve very steep sideslope cuts in competent or weathered rock and insufficient fill material exists within the Willow Creek disturbance area to completely backfill and regrade the existing disturbance. Given this constraint, planned backfilling and grading will involve selective placement of all reasonably available spoil material consistent with applicable regulatory provisions for backfilling and grading (R645-301-553 through 553.200), and previously mined areas (R645-301-553.500through 524), and based on the following priorities:

1. Cover exposed coal seams, sealed mine openings, rock tunnel openings, and any solid waste disposal sites with a minimum of 4 feet of suitable material
2. Backfill and/or regrade disturbed slopes to establish a stable configuration which provides for effective drainage and minimizes erosion potential
3. Backfill and regrade steep cuts and highwall areas to partially or completely eliminate cut or highwall exposures
4. Support the industrial postmining land use

The land configuration in the mine facilities area prior to development of the PMC Willow Creek operations is illustrated by the Facilities Area Soils Map, (Map 4) and Mine Surface Facilities (Pre-Mining Configuration and Facilities) Map 18A. This map shows that most of the mine surface facilities area consists of an elevated bench on the north and west side of Willow Creek with the existing face-up area and AMR coal refuse fill at the northeast end, the existing railroad bed and rock tunnels along the northern and western limit of the facilities area, the existing access road running along the length of the area parallel to Willow Creek, and numerous roads and small disturbance areas breaking off from the main facilities area. The existing configuration in the Castle Gate preparation plant and loadout areas and the Crandall Canyon facilities area is addressed by the permit information for these two areas included as Exhibit 19, Castle Gate Information, and Exhibit 20, Crandall Canyon Information, in this permit submittal. The pre-mining land configuration for the Barn Canyon Shaft Site can be seen on Map 31A, Barn Canyon Shaft Facility

The designed postmining configurations for the mine facilities area and those disturbance areas on the Castle Gate side which do not fall within the Castle Gate Exhibit 19, are shown by the Willow Creek Mine - Postmining Topography and Drainage Structure an Location Maps, (Map 21A through 21E). These maps reflect~~s~~ an industrial postmining land use scenario whose topography is similar to that shown on Map 18A that supported the 1990 light industrial land use for the area, and an approved and bonded postmining topography utilizing the recovery of available fill from the original fill bench above Willow Creek and the original fill bench in the Run of Mine Coal Stockpile area; backfilling and grading to cover the sealed mine portals and exposed coal seam, the ventilation raise, and the solid waste disposal areas; elimination of the depression in the mine portal area; partial backfilling of the face-up area; grading along the conveyor alignment to reduce bench width and stabilize associate cut/fill slopes; backfilling of the west portal of the long tunnel and reclamation of the associated access road; and other backfilling and grading to establish stable slopes, promote effective drainage, and blend the reclaimed areas with the surrounding terrain. The reclaimed configuration for the Castle Gate preparation plant and loadout areas and the Crandall Canyon facilities area is addressed by the permit information for these two areas included as Exhibit 19, Castle Gate Information, and Exhibit 20, Crandall Canyon Information, in this permit submittal. The designed post-mining configuration for the Barn Canyon Shaft Facility is shown by the Barn Canyon Shaft Facility Maps 32A and 32B.

The designed postmining configurations for the facilities area ~~is~~ are based on the utilization of all available spoil material to achieve the stated reclamation objectives within the constraints of site topography, drainage considerations, and the noted backfilling and regrading priorities. The limits of available fill material were determined by identifying all existing spoil fills in the facilities area and estimating fill thickness and area from both the available mapping and the geotechnical boring logs. Depending on the reclamation scenario, final backfilling and grading, and topsoiling of the main mine surface facilities area will require the movement of approximately 407,507 cubic yards of material for the worst-case bonding scenario, and 44,420 cubic yards for the industrial postmining land use scenario. Table 5.4.2 demonstrates possible cut and fill balances.

A much less significant quantity approximately 3,862 cubic yards will require movement at the Barn Canyon shaft site (see Table 5.4-1, Maps 31B and 32B, and Exhibit 22 for a summary of cut and fill volume estimates). As shown on Table 5.4-1 there is 2,640 cubic yards (approximate) of fill needed to complete reclamation. The additional fill needed for reclamation will be hauled from the Gravel Canyon and Willow Creek Mine topsoil stockpiles. During construction of the Barn Canyon shaft facility topsoil was hauled to both the Gravel Canyon and Willow Creek Mine topsoil stockpiles. Table 5.4-1 demonstrates possible cut and fill balances.

TABLE 5.4-1
BARN CANYON SHAFT FACILITY CUT AND FILL BALANCE[1]
(NEVER CONSTRUCTED)

SURFACES BEING COMPARED	Cut (yd^3)	Fill (yd^3)	Net (yd^3)
Existing and Operational	3090	538	2552 (a)
Operational and Reclaimed	611	3251	2640 (b)

Volumes generated by using the grid method in Soft Desk 8, Civil Survey Design Earthworks Module.

(1) Soil quantities are projected. No soil has been removed as of August 1999. The table will be updated once construction of the shaft facility is completed.

(a) Topsoil and substitute soil/growth medium will be hauled to the Gravel Canyon topsoil stockpile, except for mollisol soils which will be hauled to the Willow Creek Mine topsoil stockpile. These soils will be segregated, signed and during site reclamation be hauled back to the Barn Canyon shaft facility when it is time for the facility to be reclaimed. Refer to Tables 4.2-1 and 4.2-1A for additional information pertaining to soil recovery and storage.

(b) The topsoil and substitute topsoil/growth medium required for reclamation will be hauled from the Gravel Canyon topsoil stockpile where it was stored during construction of the Barn Canyon shaft facility. In addition, mollisol topsoil removed from Barn Canyon and stored at the Willow Creek topsoil stockpile will be returned to the site during reclamation. Refer to Tables 4.2-1 and 4.2-1A for additional information.

TABLE 5.4-2
MASS BALANCE EARTHWORK SUMMARY

WILLOW CREEK MINE FULL RECLAMATION PLAN

AREA	CUT (CY)		FILL (CY)		NET (CY)	
	Subsoil	Topsoil	Subsoil	Topsoil	Subsoil	Topsoil
WILLOW CREEK MINE TOPSOIL STOCKPILE	0	120,470[a]	0	0	0	120,470 (C)[a]
WILLOW CREEK MINE SURFACE FACILITIES	268,756	0	395,356	0	126,599 (F)[b]	0
POND 12A AND 12B AREA	12,554	0	12,151	0	403 (C)[b]	0
SUBTOTAL	281,310	120,470	407,507	0	126,196 (F)[b]	0
TOTAL	401,780		407,507		5,726 (F)	

(a) The volume of topsoil available was obtained from Table 4.2-1. This volume does not include the Barn Canyon Shaft Facility topsoil since this facility has not yet been built.

(b) Volume calculation by GRID method with a node spacing of 10 feet or less and a swell factor of 1.0. (Softdesk, Inc., formerly DCA Software, Inc.)

(c) Excess cut material and fill shortages will be compensated for in the field with minor excavation and backfill modifications during reclamation construction activities. Changes will be based on survey information generated during reclamation.

WILLOW CREEK MINE INDUSTRIAL POSTMINING ALTERNATIVE RECLAMATION PLAN

AREA	CUT (CY)		FILL (CY)		NET (CY)	
	Subsoil	Topsoil	Subsoil	Topsoil	Subsoil	Topsoil
WILLOW CREEK MINE SURFACE FACILITIES	28,513	0	29,269	0	756 (F)[b]	0
POND 12A AND 12B AREA	12,554	0	12,151	0	403 (C)[b]	0
SUBTOTAL	41,067	0	41,420	0	353 (F)[b]	0
TOTAL	41,067		44,420		353 (F)	

(b) Volume calculation by GRID method with a node spacing of 10 feet or less and a swell factor of 1.0. (Softdesk, Inc., formerly DCA Software, Inc.)

(c) Excess cut material and fill shortages will be compensated for in the field with minor excavation and backfill modifications during reclamation construction activities. Changes will be based on survey information generated during reclamation.

Comparison of the land configuration prior to site development with the designed postmining topography based on the Facilities Area Soils Map, (Map 4), the Willow Creek Mine - Postmining Topography and Drainage Structure Location Maps, (Map 21A through 21E), the Willow Creek Mine - Premining, Operational and Postmining Cross-Section Maps, (Maps 22A and 22B), and the Willow Creek Mine - Premining, Operation and Postmining Stream Profile Maps, (Maps 22C and 22D), indicates that the designed postmining topography scenarios will resemble the stable land configuration prior to the site development, and/or result in more stable slopes, reduce overall highwall and cut exposures, provide for more effective drainage, and offer better blending of the area with the surrounding terrain.
As can be seen from pre and post contours shown on the Barn Canyon Site Plan (Map 31A) and the Barn Canyon Surface Facilities Area - Postmining Topography Map (Map 32A), reclamation contours will have the effect of eliminating pre pad disturbance and returning the contours to a more approximate natural configuration. Reclamation Contours have been prepared to match as closely as possible those that existed prior to disturbance. Special attention was paid to attempt to replace as much of the pre-disturbance materials as possible in an effort to reducelocal land slopes as much as possible. Limited existing soil quantities and the steepness of existing slopes preclude the ability to obtain ideal surface slopes for reclamation.

During final backfilling and grading operations, drainage and sediment will be controlled by those components of the drainage control network and alternative sediment control practices.

Backfilling and grading will involve the use of tractor scrapers, tracked dozers, wheel loaders and trucks, and motor graders, as necessary to recover, move, place, grade, and compact backfill materials. Generally, backfill material will be placed in relatively uniform lifts and will be compacted by normal equipment traffic. Backfilled areas will be sloped and graded to promote effective drainage and to the extend operationally feasible long unbroken fill slopes will be avoided to minimize sheet flow and potential resultant erosion. Fill slopes will be limited to a maximum slope of approximately 2H:1V (except at the Barn Canyon shaft site) and graded slopes in native material will vary dependent on material from less than 5H:1V to as much as 0.5H:1V in competent rock consistent with slope stability considerations as documented in Exhibit 11, Geotechnical Investigations. Recommended slope limitations for final cut and fill slopes will result in slope configurations having a static factor of safety of at least 1.3. The design safety factor for any benched slopes is 1.5. For the most part, backfilled areas at the Barn Canyon site will be placed at a 2H:1V slope since 1) the site has been previously disturbed and currently has slopes exceeding 3H:1V, 2) the site is located in a narrow canyon and slopes steeper than 2H:1V exceed available limits, and 3) natural local topography exceeds 3H:1V slopes. In limited areas where reclamation slopes will be tying into undisturbed slopes the reclamation slope will be up to 1.1H:1V. The slopes at greater than 2H:1V will be of limited length and width and will only be a small portion of the reclamation slope. A slope stability analysis was performed on the longest reclamation slope, which also contained a section with the maximum proposed slope. This slope stability analysis can be found in Exhibit 22. The slope stability analysis established a minimum factor of safety for the reclamation slope of 1.30 which complies with the minimum requirements of R645-301-553.130.

Graded areas will incorporate undulations consistent with the surrounding terrain and the postmining drainage configuration and the surface of graded areas will be left in a roughened condition to minimize runoff and erosion in the interim before soil/substitute replacement, improve bonding between the regraded surface and soil/substitute materials, and increase infiltration to maximize soil moisture levels and promote revegetation.

Under the applicable regulatory provisions dealing with the postmining land use reclamation scenarios for remining of previously mined areas (R645-301-553.500through 524), the planned backfilling and grading operations will utilize all available spoil material to minimize or eliminate remaining highwall and cut slope exposures to the maximum extent technically practical. Fill material placed against highwall and cut slope areas will be placed and graded to assure long-term stability and final slopes will provide for effective drainage and be compatible with both natural slopes in the area and the postmining land uses of industrial and wildlife habitat. Highwall and cut slope exposures remaining after backfilling and regrading will be no more than 10 to ~~3~~ 60 feet high, will be in competent rock materials similar to the natural cliff exposures in the immediate area which range from 10 to over 100 feet in height, and will have an aesthetic appearance and geomorphic characteristics similar to these natural rock exposures.

The Barn Canyon Shaft site will be constructed using standard cut and fill operations and the site will conform to the site plan shown on Maps 31A and 31B. Since the site is near the bottomof the canyon, with steep side slopes, and since the site plan depends on the function of the shaft and associated facilities, cut and fill balancing is not entirely possible. There may be excess cut (substitute topsoil/growth medium) which will be stored at the Gravel Canyon topsoil stockpile area, . with the exception of soils that have been characterized as mollisol. Mollisol soils will be taken to a separate topsoil stockpile in the Willow Creek Mine surface facilities area, where the soil will be segregated

and a sign placed to identify the soils as coming from Barn Canyon The location of both stockpiles can be found on Map 18B.

Drainage Reestablishment

In conjunction with final backfilling and grading activities, PMC will establish a postmining drainage configuration which is compatible with the postmining land use and with the natural drainage pattern of the surrounding terrain, will effectively route natural drainage from upgradient areas through the reclaimed area with minimal erosion or increase in sediment concentrations, and will effectively control drainage and erosion in the reclaimed areas. The design postmining drainage configuration is shown by the Willow Creek Mine - Postmining Topography and Drainage Structure Location Maps, (Maps 21A through 21E), Premining, Operation and Postmining Stream Profiles Maps (Maps 22C and 22D), Postmining Reclamation Treatment and Watershed Map (Map 21F), and for the BarnCanyon Shaft site by the Barn Canyon Shaft Facility, Post-mining Topography Map (Maps 32A and 32B). Additional discussion of postmining drainage reestablishment is provided in Section 5.5, Hydrologic Restoration.

The Barn Canyon ventilation shaft area has been an alternate sediment control area during operation and will continue to be an alternate sediment control area during the interim reclamation period. The Barn Canyon reclamation site will be roughened and mulched to resist erosion until vegetation is established. The site will be monitored for erosion until vegetation is established. The reclamation alternate sediment control area for Barn Canyon can be seen on Map 32A labeled as RASCA-6.

Road Removal

Certain roads within the mine facilities area will remain to support the industrial postmining land use (Map 18C) and where necessary to continue to provide access to specific areas during both reclamation and the extended liability period ~~although most roads will be removed and reclaimed during final site reclamation~~. Generally, the primary access roads will be removed and reclaimed in two phases. The first phase will involve ripping of these roads and removal of the associated road surfacing materials. This phase will occur in conjunction with facility demolition and removal and the surfacing materials removed will be placed as previously discussed. The second phase of road removal for primary roads will be sequenced to coincide with backfilling and grading of the areas that the roads either provide access to or pass through. When roads are no longer needed, they will be removed and the associated disturbance areas will be regraded and reclaimed.

Road reclamation will generally involve the use of tracked dozers to rip the road surface and grade any surfacing material into piles which will normally be recovered by wheel loader and either hauled directly or loaded into trucks for haulage. Road surfaces will then be ripped to alleviate any compaction and the road area will be graded to blend with surrounding reclaimed areas. During final grading, any culverts will be removed and transported to a temporary steel debris storage site for either salvage or disposal off-site. Cut/fill areas will be reclaimed by pulling the fill material upslope into the cut and grading any remaining cut slope, the fill material, and disturbed downslope areas to a stable configuration consistent with natural drainage patterns and blending with the surrounding terrain. Any major road cuts will be reclaimed by partially backfilling the cut and grading any remaining cut slope exposures so that they are stable as described in the backfilling and grading plan discussion. Any major road fills which would interfere with postmining drainage will be removed and the associated disturbance areas regraded in conjunction with overall site grading activities.

In order to provide access to drainage and sediment control structures, soil/substitute stockpiles, and monitoring sites, several roads will be retained through the extended liability period. Primary Road PR-3 in the Castle Gate preparation plant area will be retained as a permanent road to provide continued access to existing facilities owned by Price City, Utah Power, Helper City, and Price River Water Improvement District. This road follows an existing right of way and utility easement for several existing water mains and a main sewer line. Road PR-3 follows the old County road right-of-way through Price Canyon and is used by several partiesfor access to areas to the north. Given continuing access requirements there is no justification for either removal of this road or modification to an ancillary road. Primary Road PR-5 is an existing road which will also be retained following completion of mining. Given the existing bridge across the Price River, the short access road to the Castle Gate loadout area will also be retained to provide access to the west side of the river. In addition, Primary Road PR-19 in Barn Canyon will be retained as discussed in Section 5.4.1.3. In addition, the road provides access to BLM land; a letter to the BLM has been sent requesting their input on leaving the road for post mine land use. A copy of this letter can be found in Exhibit 1.

Soil/Substitute Replacement

Following completion of backfilling, grading, and drainage reestablishment, available soil material will be replaced on the regraded areas as a growth medium for subsequent revegetation. Soil will be replaced as soon as operationally practicable following completion of the other necessary activities in the reclamation sequence, however, the timing of soil placement will also reflect the need to reestablish vegetation as soon as possible to stabilize and prevent loss or erosion of the topsoil.

Available soil will be recovered from stockpiles established during site development for placement on disturbed areas. Prior to soil replacement, graded areas will be ripped to alleviate compaction, promote moisture infiltration, and provide a good bond between the soil and underlying materials. Given limited soil availability, seed bed preparation as described in Sections 5.2, Soil Replacement Plans, and 5.3, Habitat Restoration Plans will also enhance overall soil conditions to provide for effective root penetration and enhance soil water holding capacity. Tractor scrapers or wheel loaders, trucks, and tracked dozers will be utilized to recover and place the available soil material at a uniform thickness. Replaced soil materials will be left in a roughened condition to control runoff, limit erosion and soil loss, and promote moisture infiltration.

Revegetation

Backfilling and grading will address establishment of a stable topographic configuration which provides for effective drainage and blends effectively with the surrounding terrain. Soil replacement will provide an effective vegetative growth medium. Revegetation will be the final step in restoring disturbed lands to productive, self-sustaining use. As the final step in the reclamation process, all surface disturbance areas except those associated with roads which will be retained to support the postmining land use will be revegetated. Revegetation plans are designed to restore a postmining land use of wildlife habitat consistent with pre-disturbance land use patterns in the area and support the industrial postmining land use.

Revegetation efforts will focus on establishment of effective vegetative cover as soon as reasonably possible following placement of soil/substitute material in order to prevent loss or erosion of these materials. PMC has selected the revegetation seed mixture to promote rapid vegetative establishment; assure good site adaptability; provide vegetative cover and production values consistent with effective erosion control and postmining land use requirements; and establish a healthy self-sustaining vegetative community. Typically seeding will occur in late fall in order to allow the sees to lie dormant over the winter and take advantage of increased soil moisture levels resulting from snowmelt and runoff during the spring. Seeding may occur at other times where appropriate to minimize erosion due to location, aspect, or other site specific factors. Any required shrub or woody species transplanting will occur in the fall or late spring.

Seedbed plans and practices are provided in Section 5.2, Soil Replacement Plans and revegetation plans and practices are provided in Section 5.3, Habitat Restoration Plans.

Post-Reclamation Management and Monitoring

PMC's objectives in managing reclaimed areas include interim inspection and maintenance to address any minor erosion, seeding failures, drainage problems, or other measures necessary to achieve the long-term goal of successful revegetation and drainage restoration consistent with the postmining land use of wildlife habitat. As part of the postmining management program, reclaimed area will be inspected on a regular quarterly basis at a minimum for any indications of significant erosion, siltation, surface instability, drainage problems, seeding failure, weed infestations, or other conditions which could adversely impact reclamation success. Inspections will continue throughout the extended liability period to assure effective reclamation. Any problems identified as a result of these regular inspections will be addressed in a timely manner consistent with overall reclamation plans and practices.

The reclamation plan for the Willow Creek Mine has been designed to prevent or minimize erosion and restore disturbed areas to a stable and productive condition and support the postmining land uses. If despite PMC's best efforts, inspection of the reclaimed areas indicates that natural erosional processes are creating significant rills or gullies, PMC will implement appropriate remedial/protective measures within 60 days following identification of erosional features meeting specific depth criteria. In order to minimize any associated surface disturbance, the

proposed erosion mitigation measures reflect consideration of the nature and extent of erosional damage and are designed to be implemented in phases dependent on the severity of or potential for damage.

The lowest level of mitigation will be designed to prevent further damage and either repair damaged areas or establish surface controls which will facilitate repair through natural ongoing processes. For any areal erosion problems, where high overland flow velocities, steep slopes, or poor vegetative reestablishment have resulted in numerous rills and gullies nine inches or more in depth, evaluation and mitigation will focus on upslope drainage control and stabilization of eroded areas. Various control measures may be implemented to limit upgradient flow volumes and velocities and stabilize eroded areas dependent on site specific conditions including supplemental grading of small upgradient areas to distribute flows over a larger area, placement of large riprap or other velocity dissipaters, selective placement of straw bales or sediment fences, application of erosion control netting or other materials, supplemental seeding, mulching, or combinations of these methods.

By limiting flow volume and velocities and stabilizing the effected areas, sediment loss will be reduced, features such as sediment fences and straw bales will trap and hold sediment to help repair erosional features, and problem areas can be stabilized over time. If inspection subsequent to application of the initial mitigation measures indicated that erosional problems are continuing, the number and density of control structures may be increased or more intensive controls including contour furrowing, upslope diversion, or additional backfilling and grading of problem areas may be implemented.

For isolated erosional problems, where channelization of surface runoff has resulted in the creation of one or more gullies one foot or greater in depth, both upslope drainage and the nature of the erosional damage will be evaluated and addressed as appropriate. If upslope drainage is the primary causative factor, localized measures to control flow velocities or distribute flow will be implemented including placement of straw bales or large riprap to break up concentrated flows; establishment of berm or contour furrows to temporarily divert flows away from problem areas; and localized placement of fill, reseeding, and placement of straw bales, sediment fences, or erosion control materials to allow the damaged area(s) to stabilize.

Any seeding failures or weed infestations identified by the post-reclamation management inspections will be addressed during appropriate time periods to achieve optimal mitigation. Any areas where partial or complete seeding failure is indicated by limited vegetative reestablishment or excessive dominance of one or more species will be addressed by reseeding the effected areas during either the early spring or late fall. Essentially the same seeding methods will be utilized as for initial seeding with the exception of seedbed preparation. Any significant weed infestations will be addressed through consultation with UDOGM to determine appropriate control measures. If the controls determined through this consultation process involve the application of herbicides, only those chemicals approved for use by the appropriate State and Federal agencies will be considered and control practices will be limited to spot application at the appropriate time period for best control of the problem species. selective herbicides

Removal of Drainage and Sediment Control Structures

The Willow Creek Mine Facilities area will utilize a network of stream channels and alternative sediment control measures (ASCMs) during reclamation of the site to reduce the quantity of sediment yield from the area. This is further discussed in Section 5.5, Hydrologic Resource Restoration. The worst-case approved Postmining Reclamation Treatment is presented on Map 21F. The industrial postmining land use reclamation treatment is presented on Map 21G.

5.4.3 Reclamation Cost Estimate

Consistent with applicable regulatory provisions (R645-301-542.800 and R645-301-800) which require that reclamation bonding calculations be based on an approved reclamation plan, PMC has developed a detailed reclamation cost estimates based on the approved and proposed reclamation plans. The detailed estimate s include s costs for all activities described in the approved and proposed plans with specific consideration of the areas to be reclaimed and the nature and difficulty of required reclamation efforts. Additional information on the reclamation cost estimates and related bonding considerations is provided in Section 6.1, Bonding Information, and the detailed bond reclamation cost estimate has been provided for insertion as Exhibit 17, Bonding and Insurance Information.

SECTION 5.5

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5.5 HYDROLOGIC RESOURCE RESTORATION

This section describes the plan for restoration of hydrologic resources in the permit and adjacent areas that could potentially be affected or impacted by the mining and reclamation activities. Information in this section was developed in accordance with applicable regulatory guidelines (R645-301-700) for coal mine permitting in the State of Utah.

5.5.1 General Description of the Hydrologic Restoration Plan

5.5.1.1 Applicable Regulatory Sections Addressed

Specifically, this section addresses Reclamation Plans (Rule R645-301-760). The following table cross-references the headings and corresponding information presented in this section to the applicable regulatory provisions:

Permit Section		Regulatory Provision Addressed
5.5		R645-301-700
5.5.1		R645-301-700
	5.5.1.1	Not Applicable
	5.5.1.2	R645-301-760 and 761
5.5.2		R645-301-760, 764
	5.5.2.1	R645-301-761 and 764
	5.5.2.2	R645-301-761
	5.5.2.3	R645-301-762.100 and 764
	5.5.2.4	R645-301-762.200 and 764
	5.5.2.5	R645-301-763.100, 763.200, and 764
	5.5.2.6	R645-301-764 and 765

5.5.1.2 General Hydrologic Restoration Requirements

Before abandoning the Willow Creek mine area or seeking final bond release, PMC will meet applicable regulatory requirements.

5.5.2 Hydrologic Restoration Plans

All areas disturbed by mining and related operations will be reclaimed as soon as operationally practical following completion of mining. PMC has incorporated specific control and mitigation measures in mining, processing, and reclamation plans in order to prevent any significant impacts on surface or ground water quality. All mining related activities including soil/substitute removal, mine development, coal recovery, mine sealing, backfilling and grading, topsoiling, and revegetation are designed and sequenced to minimize disturbance and progress in a logical manner towards effective restoration of disturbed areas to pre-disturbance conditions. Reclamation will involve backfilling and regrading disturbance areas, replacement of soil or substitute materials, and revegetation, re-establishment of drainage patterns similar to those existing in the premining environment, ~~and~~ development of a self-sustaining vegetative community, and support the postmining land uses. As a result of effective reclamation, infiltration and runoff relationships will be restored, limiting the time interval over which water quality impacts may occur.

As a component of the planned reclamation activities PMC will establish designed permanent postmining drainage structures to provide for effective drainage and sediment control during the extended reclamation liability period. Details of the drainage control plan are presented in Exhibit 13, Drainage and Sediment Control Plan and illustrated by the Willow Creek Mine - Postmining Topography and Drainage Structure Location Maps, (Maps 21A through 21E), Postmining Reclamation Treatment and Watershed Maps (Maps 21F and 21G), and Postmining, Operational and Postmining Stream Profile Maps, (Maps 22C and 22D).

Barn Canyon (shaft project never constructed) reclamation drainage and sediment control plans are discussed in Exhibit 22 and are illustrated on Barn Canyon Surface Facilities Area - Postmining Topography Maps, (Maps 32A and 32B). For the Barn Canyon Shaft site, reclamation drainage controls will consist of roughening the surface and theuse of mulch. Since the road was the canyon drainage prior to PMC operations, and will be again after reclamation, the road will remain as the channel with improvements, such as swales to divert runoff into the natural channel, remaining after reclamation (Map 33). Calculations in Exhibit 22 demonstrate that sediment yield will be less after reclamation than if the site was never disturbed. It is proposed that any ditches constructed at the edge of the Barn Canyon Access Road (PR-19) be left in place for post-mining land use. These ditches will enhance the road for post-mine land use, and prevent erosion of the road surface. Barn Canyon drainage and sediment control calculations can be found in Exhibit 22.

5.5.2.1 Removal and Reclamation of Temporary Structures

When no longer required for sediment control and to support the industrial postmining land use, all temporary diversions will be removed and the affected lands reclaimed. Reclamation will consist of full or partial filling of the diversion ditches with material from adjacent areas consistent with the designed postmining drainage configurations, grading to blend ditch areas with surrounding terrain, replacement of available soil and reseeding.

~~Sedimentation pond reclamation~~ Reclamation of the sedimentation ponds that will not support the industrial postmining land use will involve removal of any man-made discharge structures, removal and disposal of any riprap and bedding materials which will not be utilized in conjunction with reestablishment of post-mining drainages, grading of embankment fill into pond basin areas, and regrading associated disturbance areas to blend with the surrounding terrain. Replacement of soil and revegetation as described in Section 5.0, Reclamation Plan, will complete pond reclamation. Upon restoration of disturbed areas, ~~all~~ the sedimentation ponds and water storage and treatment impoundments will be removed and associated disturbance areas reclaimed. In addition, all reclaimed areas will be regraded to reestablish natural drainage patterns and eliminate any significant depressions which could impound water.

5.5.2.2 Compliance of Permanent Structures

In conjunction with reclamation of all areas disturbed by mining and related activities, PMC will reestablish an effective postmining drainage configuration as shown on the Willow Creek Mine Postmining Reclamation Treatment and Watershed Maps, (Maps 21F 21G), and for the Barn Canyon Shaft site refer to Map 32A. Postmining drainages have been designed in compliance with requirements for permanent diversions and provide drainage distribution and density characteristics similar to the pre-disturbance environment. Anticipated runoff characteristics and site geomorphic considerations have been incorporated in postmining drainage designs to assure long-tern stability, minimize erosion, and prevent significant additional contributions of suspended solids to area drainages. Effective restoration will include a determination of revegetation success and restoration of surface drainage characteristics such that contributions of suspended solids from reclaimed area runoff are within applicable water quality limitations. PMC has designed and constructed two permanent diversions segments and will construct several permanent collection channels/ditches to provide effective long-term drainage control for reclaimed areas.

5.5.2.3 Reclamation of Roads

Roads that will not be retained for use under an approved postmining land uses will be reclaimed immediately after they no longer needed for coal mining and reclamation activities. Reclamation of roads will include reshaping of all cut and fill slopes to be compatible with post-mining land use and to compliment the drainage pattern of the surrounding terrain.

5.5.2.4 Restoration of Natural Drainage Patterns

As an underground mining operation, surface disturbance associated with Willow Creeks's mining activities will be minimal relative to the overall permit area. However, where disturbance does occur, PMC will reclaim disturbed

areas using reclamation practices that restore normal infiltration and runoff characteristics to conditions that are comparable to premining conditions. This will be done as soon as operationally feasible following completion of mining and related activities.

Reclamation will involve backfilling and grading to stabilize the slopes, reestablishment of natural drainage patterns, topsoil replacement, and revegetation. PMC has also designed the postmining topographies ~~y~~ and associated backfilling and grading plans to effectively utilize available materials, support the postmining land use, and minimize disturbance of adjacent areas.

Permanent postmining drainages have been located and designed to generally duplicate premining drainage patterns and densities and to effectively convey surface drainage flows. Postmining drainage patterns and designs are illustrated by the Willow Creek Mine - Postmining Topography and Drainage Structure Location Maps, (Maps 21A through 21E), Willow Creek Mine - Premining, Operational and Postmining Cross-Section Maps (Maps 22A and 22B), Willow Creek Mine - Premining, Operational and Postmining Stream Profile Maps (Maps 22C and 22D), Willow Creek Mine - Postmining Reclamation Treatment and Watershed Maps (Maps 21F and 21G), and for the Barn Canyon Shaft site refer to the Barn Canyon Shaft Facility , Post-Mining Topographic Map, (Map 32A). Design calculations are found in Exhibit 13, Drainage and Sediment Control Plan and Exhibit 22 for Barn Canyon.

Disturbance areas will be backfilled where necessary and regraded to establish a stable undulating configuration with relatively short gradual slopes which will blend with surrounding undisturbed terrain. Regraded surfaces will be left in a roughened condition to limit runoff and provide for an effective bond between the regraded materials and subsequently placed topsoil. Soil replacement and reseeding will be scheduled to minimize the period of time during which soil materials will be exposed without a protective vegetative cover.

Reclamation will be completed by replacing available soil resources and revegetating disturbance areas to establish an effective vegetative cover which will control runoff, erosion, and provide effective habitat and grazing/forage values for wildlife and support the industrial postmining land use.

5.5.2.5 Maintenance of Siltation Structures

To avoid redisturbance of a significant portion of the Willow Creek Mine Facilities area in a future phase of reclamation, the operational hydrology sedimentation ponds ~~001,~~ 002, 012A and 012B will be removed during the back filling and grading phase. Therefore, alternative sediment control measures (ASCMs) will be implemented during reclamation of the site to reduce the quantity of sediment yield from the area. These ASCMs will include the following practices in varying degrees:

1. Ripping of the regraded surface prior to placement of growth media,
2. Incorporation of hay mulch or other suitable substitute, with a high organic matter content into the growth media,
3. Deep gouging of the growth media,
4. Seeding the prepared soil,
5. Addition of more mulch following seeding, and
6. Physically or chemically anchoring the final mulch layer.

Also, stream channels which are constructed during reclamation will be armored or protected to provide long-term protection against channel erosion. Furthermore, areas that do not exhibit successful revegetation will be reseeded. Based on Simons, Li & Associates (1983), these methods are effective at controlling sediment yields for the purpose of mine reclamation.

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feet. Sediment from this area is controlled by a sediment trap and silt fences or straw bales. The sediment trap does not have the capacity to hold the runoff from the 10-year 24-hour storm event. Therefore a silt fence or straw bales have been placed at the sediment trap outlet to further treat the runoff.

ASCA-5 is a small area at the outlet of the "long tunnel". A small amount of disturbed area, approximately 900 square feet, drain to an undisturbed drainage ditch, UD-23A. A silt fence or straw bales will be placed in UD-23B to treat any disturbed runoff before it leaves the area. In addition to the silt fence or straw bales the runoff flows into a well vegetated depression left by previous mining activities in an area undisturbed by PMC. The depression can hold approximately 7000 cubic feet of runoff before the runoff continues to undisturbed drainage ditch UD-23C . This well vegetated depression will remove more sediment from the runoff.

4.5 POSTMINING DRAINAGE DESIGN

Reclamation of surface disturbance areas will generally occur following the cessation of mining operations to complete the mining and reclamation cycle although PMC will implement temporary stabilization measures in certain areas following initial construction or during ongoing operations.

An integral part of the Willow Creek Mine reclamation plan is the postmine drainage configuration. Objectives of the planned reclamation activities involve stabilizing surface disturbance areas, minimizing erosion, restoring the natural drainage pattern, ~~and~~ limiting potential adverse surface water impacts, and supporting the post mining land uses.

The postmine drainage configuration will be compatible with the natural drainage pattern of the surrounding terrain and with the industrial and wildlife postmining land uses. Additionally, it will effectively route natural drainage from undisturbed upgradient areas through the reclaimed surface facilities area with minimal erosion or increases in sediment loading. This section describes the postmine reclamation drainage configuration and plan for the Willow Creek Mine.

4.5.1 Reclamation

The postmining reclamation topographies ~~y~~ for both the Willow Creek area and the Pond 12A and 12B area which is adjacent to the Castle Gate Preparation Plant ~~is~~ are shown on Maps 21A through 21E, Postmining Topography and Drainage Structure Location Map. The proposed reclamation plan for the existing Castle Gate Preparation Plant area was developed and approved separately from this mining and reclamation plan and is discussed in Exhibit 19, Castle Gate Information. The Willow Creek Mine reclamation plan is further described in Section 5.0, Reclamation Plans of the M&RP. Section 5.4.2.3 of the MR&P specifically discusses hydrologic monitoring, facility demolition and removal, backfilling and grading, drainage reestablishment, soil replacement, revegetation, post-reclamation management and monitoring, and the removal of drainages and sediment control structures.

Required grading work will be completed in order to establish a stable postmining configuration which supports the postmining land uses, blends with the surrounding terrain and provides for effective overland flow drainage patterns. Existing conditions in the Willow Creek mine-surface facilities area reflect previous mine-related disturbance. Since the pre-mining configuration represents a disturbed landform, PMC will modify the surface configuration during reclamation in order to establish an effective drainage pattern and blend the mine surface facilities area into the adjacent, undisturbed topography. Maps 21A through 21E, Postmining Topography and Drainage Structures Location Map, display ~~s~~ the approved and proposed postmining topographies ~~y~~ for the Willow Creek areas.

The land configuration in the mine surface facilities area adjacent to the Castle Gate Preparation Plant is very steep and was disturbed by previous activities. PMC will blend the disturbed area into the existing adjacent topography and create a landform which resembles the surrounding topography. The postmining topography for the Willow Creek Mine surface facilities area which is adjacent to the Castle Gate Preparation Plant is shown on Map 21E, Postmining Topography and Drainage Structures Location Map. Backfilling and grading during reclamation are discussed in Section 5.4.2.3.

As a component of the planned reclamation activities PMC will establish designed permanent postmining drainage structures to provide for effective drainage and sediment control during the extended reclamation liability period and support the industrial and wildlife habitat postmining land uses. No temporary channels will be built during reclamation, all constructed channels will be permanent, refer to Sections 5.4.2.2 and 5.5 of the M&RP.

To limit erosion and sediment loading of Willow Creek PMC proposes to use alternative sediment control measures (ASCM's). The proposed alternative control method technologies are described in Section 4.5.2 and in Section 5.5.2.5 of the M&RP

Except for sedimentation pond 001 which will treat storm water runoff from the industrial post mining land use area, sedimentation ponds will not be retained for sediment control. Siltation fences and/or straw bales will control sediment during rough grading and permanent alternate sediment control measures will control sediment thereafter. Straw bales and/or silt fence structures will be installed as deemed necessary prior to and during any reclamation activities to serve as a protective barrier between the reclamation areas and the Willow Creek buffer zone and/or channel. In addition to the silt fences and/or straw bales used during rough grading the sediment ponds and operational drainage ditches will be left in place as long as feasible, to control sediment during the rough grading. Upon completion of the final/permanent sediment control treatment measures of deep gouging and mulching, the temporary sediment control structures will be removed. The proposed alternative control methods are described in Section 5.5.2.5 and in Exhibit 13, Section 4.5.2.

All channels to be constructed will be permanent and designed to handle the 10-year 6-hour storm eventas specified in regulation R645-301-742.333. Channels will be excavated during rough grading, following which, the filter and riprap or the erosion control matting will be installed. A more detail discussion of the reclamation channels can be found in Section 4.5.3.

Alternate sediment control measures to be used are discussed in Section 4.5.2. Following installation of channels and ASCMs the site will be seeded as described in Section 5.3 of the M&RP.

PMC will continue its comprehensive hydrologic monitoring program during reclamation. Activities specified for the reclamation phase hydrologic monitoring program, including the monitoring network and the parameter compliance list are presented in Sections 4.7.2 and 5.5 of the M&RP.

PMC proposes a modified monitoring network and parameter compliance list during the limited liability period through bond release. Hydrologic monitoring will occur on Willow Creek and the Price River upstream and downstream of the former mine surface facilities area to demonstrate the success of PMC's reclamation plan.

The proposed reclamation hydrologic monitoring parameter compliance list to be used during the bond period will include:

- pH
- Temperature
- Specific conductance (corrected to 25 °C)
- Total Dissolved Solids
- Total Suspended Solids
- Total iron
- ~~Total~~ Dissolved manganese
- Flow

4.5.2 Alternative Sediment Control Measures

The mine surface facilities area is primarily located within a narrow strip of land along the north bank of Willow Creek. Two additional areas, however, all relatively small in size will be disturbed by mine surface facilities construction. One area, the existing office trailer area and Willow Creek topsoil stockpile area, is located along the south side of Willow Creek, between State Highway 191 and Willow Creek. The second area, the west portal of the long tunnel, Pond 012A and 012B area and associated access roads are located along the east bank of the Price River south of and adjacent to the Castle Gate Preparation Plant area.

The use of sediment ponds as primary sediment control could potentially lengthen the time necessary to establish permanent vegetation in all mine disturbance areas. The incorporation of sediment ponds and associated diversion ditches for all operational areas during the reclamation process may result in redisturbance of significant areas of established vegetation. PMC proposes that alternative sediment control measures (ASCM's) be utilized as the primary means to control erosion and sediment yields from the disturbance areas Map 21F and Map 21G, Postmining Reclamation Treatment and Watershed Map, displays the mine surface facilities areas where PMC will use ASCM's as the primary sediment control measures during reclamation.

The following alternative control methods, utilized individually or in combination, are proposed to limit and control erosion and sediment runoff:

- Ripping the subgrade prior to placement of growth media,
- Incorporation of hay mulch or high organic content material into growth media,
- Deep gouging,
- Seeding,
- Additional mulch following seeding,
- Anchoring mulch by crimping or by use of a tackifier.

These methods are considered the best available control technology for mine reclamation applications.

The proposed alternative sediment control measures can be classified into three categories: mechanical treatments, surface protection measures, and vegetation. Mechanical treatments, such as deep gouging, increase surface roughness thereby reducing overland flow velocity, and minimizing sediment transport capacity. Reduction of runoff also increases soil moisture for plant germination. Surface protection measures include mulch, mulch binders, seeding, and rock armoring. These measures are the most effective controls since they minimize the amount of soil exposed, reducing soil detachment by raindrop impact, and thus limit soil loss at the source. Surface protection measures also increase surface roughness and increase water infiltration. Vegetative sediment filters reduce overland flow velocities, remove fine sediment from overland flow, and control erosion on the disturbed areas. Mechanical treatment will consist of ripping the subgrade, and deep gouging. Ripping will loosen the soil and allow root penetration and increased moisture storage. This will allow vegetation re-establishment, which will reduce erosion. Deep gouging consists of a rough surface with irregular ridges and depressions. This reduces the length of potential flow paths and limits flow velocities, thereby reducing the sediment carrying capacity of the runoff. Deep gouging is similar to ripping in that many small pockets or depressions are created which trap runoff and reduce overland flow. The depressions also encourage water infiltration providing for increased soil moisture storage.

Prior to, and during deep gouging approximately 2 tons per acre of hay or high organic content mulch will be incorporated into the growth media. The mulch adds organic matter to the soil as well as increases the capacity of the soil to hold water. Increasing the water holding capacity of the soil reduces the amount of runoff and thereby the amount of sediment generated.

Mulching can significantly reduce the amount of sediment yield from an area (Simons, et al., 1983). Mulching also helps retain moisture to allow for seed germination. Mulching is particularly valuable in protecting seeded areas from the high intensity, short duration storms (USDA- USFS, 1979). The rainfall intensity factor for the 10-year, 6-hour storm event in the Willow Creek area is 0.61 inches per hour (EarthFax, 1995) . A minimum mulch application rate of 0.9 tons per acre will be required to prevent mulch loss from rainfall with a rainfall intensity factor of 0.61 inches per hour (Simons, et al., 1983). To assure that the mulch will remain in place, it will be applied at the rate of 1 to 1.5 tons per acre and crimped or tacked in place.

Permanent plant growth is the best method of controlling erosion from slopes (Simons, et al., 1983). Upon completion of the grading and mechanical treatment of the soil, reclaimed areas will be seeded with permanent seed mixtures. The seedbed preparation and seeding activities, including the seed mixtures are discussed in Section 5.3.2.2, Revegetation Practices, and Section 5.3.2.3, Revegetation Species and Amounts.

Calculations which support the use of alternative sediment control measures for controlling erosion and sediment production can be found in Appendix H-4.

The ASCM's will be inspected quarterly or after every major storm event. Observations made during these inspections, as well as corrective actions taken, will be recorded. Any necessary modifications to the sediment control plan indicated by those inspections will be implemented in a timely manner. Corrective action will be taken when a gully greater than 9 inches in depth is created. This corrective action will consist of identifying the cause, remedying the cause, working the ground surface sufficiently to fill the adjacent gully, and reseeding and mulching if necessary to reestablish vegetation. Any reseeding and mulching will be determined in cooperation with the Division.

4.5.3 Reclamation Hydrology

The postmine drainage configuration will be compatible with the existing natural drainage patterns. The drainage pattern will effectively route natural drainage from undisturbed areas through the reclaimed area with minimal erosion or sediment loads. Maps 21A through 21E, Postmining Topography and Drainage Structures Loacation Map, show the postmine drainage configuration and the permanent drainage features used to support the postmining land use. The drainage structures to support the industrial postmining land use are presented in Table 13-15.

4.5.3.1 Reclamation Channel Design

All reclamation channels will be permanent diversions. None of the reclamation channels are for intermittent or perennial drainages. Therefore, according to R645-301-742.333 these drainages must be designed to handle the 10-year 6-hour storm event. To the extent possible the reclamation channels have been designed to approximate the natural undisturbed channels while still being structurally sound.

FlowMaster 1 (Haestad Methods, 1990) was utilized to size the reclamation channels. FlowMaster incorporates Manning's and continuity equations and solves for open channel flow. The channel bottom width, side slopes, an assumed Manning's roughness coefficient, and peak discharge are inputs for each channel. Flow depth and velocity are model outputs. For reaches where flow velocity exceeded 5 fps, channel design included riprap sizing or design of other erosion control methods, such as erosion control matting. The average D_{50} material and filter requirements were determined using the same methodology as described in Sections 3.4 and 4.1. Once the riprap D_{50} was calculated, then Abt's equation (Abt, et al., 1988) was used to verify that a reasonable Manning's n was incorporated into the ditch design.

All calculations supporting the design of the reclamation channels are presented in Appendix H-1, Reclamation Diversion Design.

Permanent drainage channels will be established to carry storm runoff from the ~~majority of the~~ upgradient undisturbed areas through the reclaimed mine facilities area. These channels will be designed to approximate the geometry of the existing natural drainage channels. The permanent channels will be designed to ensure channel stability. The minimum cross sectional area of the channel was determined based on the peak design discharge, minimum slope found in the channel reach and roughest surface, i.e. assuming the largest riprap or mature vegetation. The erosion protection in the channel was designed based on the peak design discharge and the maximum slope. Maps 21A through 21E, Postmining Topography and Drainage Structures Location Map, shows the location of the permanent channels. To complywith UDOGM regulations, these drainage features were designed to pass peak flows from the 10-year, 6-hour storm event (R645-301-742.333). According to this regulation, permanent diversion channels that are not perennial or intermittent streams should be designed to handle the 10-year 6-hour storm event. All calculations supporting the design are presented in Appendix H-1, Reclamation Diversions Design.

Table 13-11 Reclamation Watershed Drainage Characteristics, gives details on the individual watersheds and the peak flow. Map s 21F and 21G Postmining Reclamation Treatment and Watershed Map, show s the location of the watersheds.

Table 13-12 Reclamation Curve Number Summary, gives the areas of undisturbed, reclaimed, and Pre-SMCRA disturbance not redisturbed by PMC, within the watershed. The final curve number used to calculate the peak flow is an area weighted average of the three areas. A more detailed discussion of the curve numbers can be found in Appendix H-1 Reclamation Diversion Design.

As mentioned before when possible the channel designs will approximate the undisturbed natural channel. The natural channels in the area generally have a trapezoidal cross section with large rocks and vegetation in the channel with a soil bottom. The large rocks and vegetation slow down the runoff and therefore provide erosion protection. A hard armor system such as riprap does provide good erosion protection but it does not look very natural. Where possible PMC proposes using a soft armor system for erosion protection. An erosion control mat will be used to reinforce the root system of vegetation and resist erosion. The erosion control mat is placed on the growth media and then covered with an additional half to three quarter inches of topsoil. The channel is then seeded with the rest of the site. This system will more closely approximate the appearance of the natural channel in the sections where a drainage flattens out prior to reaching Willow Creek or the Price River. The channels have been designed with adequate freeboard such that large rocks may be randomly placed in the channel for a more natural appearance.

To reduce design time and simplify installation two generic erosion control mat channel designs were prepared. Each design could handle a range of conditions for channel slope and peak flow. The generic channel designs are referred to as Standard Swale Design #1 and #2. Standard Swale #1 was appropriate for drainages with a design flow less than 5 cfs and slopes between 4 and 50%. Standard Swale #2 was appropriate for drainages with a design flow less than 3 cfs and slopes between 4 and 50%. Some drainages did not fit within the parameters for either standard design and the standard design was verified as adequate on an individual basis. The drainages that exceeded the capabilities of the erosion control mat were designed as riprapped channels. The detailed designs for the channel can be found in Appendix H-1, Reclamation Diversion Design. Table 13-13 Reclamation Drainage Channels provides a summary of the channel designs. The methodology used for design of a riprap channel is discussed below.

Calculations for riprap sizing for the permanent postmining drainage channels are included in Appendix H-1, Reclamation Diversion Design. The thickness, and thus the volume, of the riprap for each channel is related to the average proposed riprap stone diameter. Channel riprap D_{50} requirements were determined using the nomographs presented in the Hydraulic Engineering Circular No. 1 by the U.S. Department of Transportation "Use of Riprap for Bank Protection" (Searcy, 1967).

It is essential for a riprap layer to be composed of rock having a gradation such that the voids between the larger particles are filled with smaller particles to reduce interstitial flows and provide overall stability to the system (Fiske, et al., 1994). Table 13-7, Riprap Gradation Particle Sizes displays an appropriate particle size gradation for use in riprapping structures. Proper placement of the rock course is necessary to fully realize the erosion mitigation potential of a riprap design. The thickness of a riprap is typically a function of the rock size and is expressed in terms of the riprap D_{50}. The riprap layer design will follow these general guidelines:

- The thickness of a riprap layer will be at least 2 times the D_{50}
- Riprap layers will be at least 6 inches in thickness
- Where the D_{50} is greater than 8 inches, the placement procedures will include a certain amount of individual placement (using specialized equipment or hand labor) to ensure that the proper thickness and cover is achieved.

Filter fabric with a gravel protective layer or a gravel filter blanket will be placed beneath any riprap course to stabilize the riprap layer and prevent erosion in the in-situ base material underlying the riprap. The filter blanket will consist of granular material placed to a depth of 0.5 the riprap D_{50} or a minimum of six inches, which ever is greater.

4.5.3.2 Reclamation Culvert Design

One new culvert will be installed during reclamation. Four culverts are to remain after reclamation. All four of these culverts are in the Pond 012A and 12B area and are shown on Map 21E, Postmining Topography and Drainage Structures Location Map. WCRC-2 is an existing pre-SMCRA culvert under the old railroad grade. This area has not been disturbed by PMC and will not be reclaimed. However, the culvert can easily handle the design storm event. WCRC-1 and WCRC-3 are needed due to the fact that the road is to remain after reclamation. WCRC-1 replaces an existing culvert which could not handle the design storm event. WCRC-3 is an existing box culvert which easily handles the design storm event. WCRC-4 is an existing box culvert under the railroad tracks, which are to remain after reclamation. Table 13-14 Reclamation Drainage Culverts, provides details about the reclamation culverts. Calculations for the design of the reclamation culverts are presented in Appendix H-1, Reclamation Diversions Design.

4.5.3.3 Reclamation Sedimentation Ponds

Alternate sediment control measures will be used to minimize sediment loading to Willow Creek. Calculations in Appendix H-4, Alternate Sediment Control Calculations, demonstrate that the postmining sediment yield will be less than the premining sediment yield. Therefore, sedimentation ponds will not be retained because alternate sediment control provides acceptable erosion control. To support the industrial postmining land use, sediment pond 001 will be retained to treat stormwater runoff from the site.

4.5.4 Reclamation Timetable

The reclamation timetable can be seen on Figure 5.4-2 in the M&RP.

TABLE 13-13
RECLAMATION DRAINAGE CHANNELS
10-YEAR 6-HOUR STORM EVENT
(PAGE 1 of 2)

Diversion Ditch WCRD-	10yr-6hr Design Flow (cfs)	Minimum Existing Conditions						Calculation Results [d]		Freeboard (ft) [b]	Comments [c]
		Bottom Width (ft)	Side Slopes (ft)	Max. Bottom Slope (%)	Min. Bottom Slope (%)	Channel Depth (ft)	Erosion Protedtion (see note) (a)	Max. Velocity (ft/s)	Max. Flow Depth (ft)		
1	22.02	15	2:1	17.7	6.8	1	EM	7.88	0.37	0.63	#2
2	2.23	2	3:1	27.8	17.1	1	EM				Standard Swale#2
3	2.48	2	3:1	40.0	14.3	1	EM				Standard Swale#2
4	0.86	2	3:1	40.0	7.2	1	EM				Standard Swale#2
5	4.21	4	3:1	33.3	18.2	1	EM				Standard Swale#1
6A	5.26	4	5:1	24.9	8.3	1	EM	7.50	0.30	0.70	Standard Swale#1
6B	6.12	4	5:1	15.4	10.3	1	EM	6.72	0.30	0.70	Standard Swale#1
7	1.92	2	3:1	36.4	2.2	1	EM				Standard Swale#2
8	1.16	2	3:1	47.6	4.3	1	EM				Standard Swale#2
9A	0.44	2	3:1	34.0	5.4	1	EM				Standard Swale#2
9B	2.25	2	3:1	25.6	5.4	1	EM				Standard Swale#2
10	11.37	5	2:1	37.0	8.7	1	6"	7.04	0.39	0.61	Riprap
11*	2.53	2	3:1	43.5	6.3	1	EM				Standard Swale#2
12*	2.18	2	3:1	26.7	11.8	1	EM				Standard Swale#2
13*	0.42	0	2:1	4.3	0.5	1	NONE	2.60	0.43	0.57	
14A*	6.33	3	2:1	17.4	10.6	1	6"	5.50	0.35	0.65	Riprap
14B*	6.75	3	2:1	18.2	14.4	1	6"	5.68	0.34	0.66	Riprap
15*	1.10	1	2:1	33.9	1.1	1	3"	4.84	0.34	0.66	Riprap

(a) EM = Erosion control matting used tor erosion control, A number designates the median diameter riprap stone in inches for channels to be riprapped.
(b) According to Barfield et.al., (1994) a freeboard of 0.2 (flow depth) or 0.5', whichever is greater should be an adequate freeboard
(c) Standard Swale #1 or #2 refers to a standard channel design that is defined in Appendix H-1
(d) Blanks in the table indicate that slope and peak flow were in the acceptable range for the standard design and specific calculations were not made
* Reclamation channels that **will** be constructed as part of the industrial postmining reclamation alternative.

TABLE 13-13
RECLAMATION DRAINAGE CHANNELS
10-YEAR 6-HOUR STORM EVENT
(PAGE 2 of 2)

Diversion Ditch WCRD-	10yr-6hr Design Flow (cfs)	Minimum Existing Conditions						Calculation Results		Freeboard (ft) [b]	Comments [c]
		Bottom Width (ft)	Side Slopes (ft)	Max. Bottom Slope (%)	Min. Bottom Slope (%)	Channel Depth (ft)	Erosion Protedtion (see note) (a)	Max. Velocity (ft/s)	Max. Flow Depth (ft)		
16*	0.93	0	2:1	7.0	1.3	1	NONE	3.80	0.48	0.52	
17A*	8.57	4	2:1	45.7	13.5	1	6"	7.10	0.42	0.58	Riprap
17B*	14.54	4	5:1	6.3	1.5	1.5	EM	6.45	0.78	0.72	Standard Swale #1 with 0.5' added to the depth
18*	5.97	4	5:1	3.5	1.3	1.5	EM	4.02	0.52	0.98	Standard Swale #1 with 0.5' added to the depth
19*	5.97	4	2:1	6.3	0.6	1.5	NONE	4.77	0.54	0.96	

(a) EM = Erosion control matting used tor erosion control, A number designates the median diameter riprap stone in inches for channels to be riprapped.
(b) According to Barfield et.al., (1994) a freeboard of 0.2 (flow depth) or 0.5', whichever is greater should be an adequate freeboard
(c) Standard Swale #1 or #2 refers to a standard channel design that is defined in Appendix H-1
* Reclamation channels that **will** be constructed as part of the industrial postmining reclamation alternative.

TABLE 13-15
INDUSTRIAL POSTMINING DRAINAGE STRUCTURES
10-YEAR 6-HOUR OR 10-YEAR 24-HOUR STORM EVENT
(PAGE 1 of 5)

Diversion Ditch	Design Flow (cfs)[b]	Minimum Existing Conditions						Calculation Results		Required Channel Depth (ft)[a]	Freeboard (ft)[a]
		Bottom Width (ft)	Side Slopes (ft)	Max. Bottom Slope (%)	Min. Bottom Slope (%)	Channel Depth (ft)	Riprap D_{50} (in)	Max. Velocity (ft/s)	Max. Flow Depth (ft)		
DD-1	0.46 #	2	1.5:1	1	0.5	1	-	1.59	0.31	0.81	0.5
DD-2 [c]	0.16	2	1:1	4.3	1.5	1	-	1.43	0.07	0.57	0.5
DD-5A	2.9 #	4.5	2:1	11.8	3.6	2	11	3.34	0.24	0.74	0.5
DD-5B	3.52 #	2.5	1:1	18	2.4	2	6	4 4.98	0.40	0.90	0.5
DD-5C	4.06 #	4	1.5:1	13.3	2	2.5	9	4.14	0.35	0.85	0.5
DD-5D	7.72 #	3	1.5:1	1.1	0.4	1.5	-	3.30	0.92	1.42	0.5
DD-5E	8.6 #	5	1:1	1.1	0.6	2	-	3.01	0.62	1.12	0.5
DD-5F	32.20 #	4	1:1	10	3.3	3	concrete	13.48	0.73	1.23	0.5
DD-6	0.39	2	1:1	1	0.5	1.5	-	1.26	0.18	0.68	0.5
DD-7A	6.52	8	vertical	2	0.5	2	-	2.88	0.43	0.93	0.5
DD-7B	6.82	2	1.5:1 1:1	1	0.5	2	-	3.11	0.90	1.4	0.5
DD-7C	11.02	4.5	1:1	1.5	1.25	3	15	3.36	0.67	1.17	0.5
DD-8*	0.3	-	1:1	33.3	11.8	2.5	-	4.85	0.30	0.8	0.5
DD-9	3.10	3	0.75:1	11.3	5.6	2	-	4.47	0.18	0.68	0.5
DD-10	0.57	-	1:1 8:1	5.6	0.5	1	-	2.60	0.35	0.85	0.5
DD-11	0.41	1	2:1	4	1	1	-	2.28	0.21	0.71	0.5

Notes: The ditches described above represent the section of ditch with the least capacity to handle runoff. It does not indicate the ditch configuration everywhere. DD designates ditches that handle drainage from the disturbed area.

(a) According to Barfield et.al., (1994) a freeboard of 0.2* (flow depth) or 0.5', whichever is greater should be an adequate freeboard.
* A 24" culvert is laid in the ditch.
(b) Unless noted by a # symbol the design flow is for a 10-year 6-hour storm event.
(c) Portions of this ditch will be modified during reclamation. The drainage area reporting to this ditch will be reduced, thus reducing the design flow. Therefore, since only the design flow is reduced the channel as constructed is still adequate.

TABLE 13-15
INDUSTRIAL POSTMINING DRAINAGE STRUCTURES
10-YEAR 6-HOUR OR 10-YEAR 24-HOUR STORM EVENT
(PAGE 2 of 5)

Diversion Ditch	Design Flow (cfs)[b]	Minimum Existing Conditions						Calculation Results		Required Channel Depth (ft)[a]	Freeboard (ft)[a]
		Bottom Width (ft)	Side Slopes (ft)	Max. Bottom Slope (%)	Min. Bottom Slope (%)	Channel Depth (ft)	Riprap D_{50} (in)	Max. Velocity (ft/s)	Max. Flow Depth (ft)		
DD-12A	0.30	1.75	2:1	6.1	2.7	0.75	-	2.07	0.10	0.6	0.5
DD-12B	1.85	4	1:1	4	4	2	-	2.79	0.16	0.66	0.5
DD-13	0.21	2	1:1	7.4	4.8	2	-	1.88	0.06	0.56	0.5
DD-14	0.43	2	2:1	3.7	1.2	1	-	1.93	0.14	0.64	0.5
DD-15A	0.08	-	1:1 6:1	7.4	4	1	-	1.87	0.12	0.62	0.5
DD-15B	0.27	1.5	2:1	7.4	2.5	1.25	-	2.21	0.10	0.6	0.5
DD-16	0.44	1	2:1 4:1	10	3.8	1	-	3.04	0.14	0.64	0.5
DD-17	0.51	1.5	2:1	12.5	2.2	1	-	3.28	0.15	0.65	0.5
DD-19	0.25	5.5	1:1	43	43	2.5	5	1.69	0.03	0.53	0.5
DD-20	36.87 #	8.5	2:1	57	8	2	15	9.6	0.67	1.17	0.5
DD-21A	0.3 #	-	2:1	16.7	3.3	1.25	-	3.97	0.53	1.03	0.5
DD-21B	0.28 #	0.5	1.5:1	5.7	1.4	1	-	2.97	0.25	0.75	0.5
DD-25	0.07 #	-	1:1	4	4	1	-	1.71	80.20	0.70	0.5
DD-26	0.65 #	4	1:1	50	28.5	1	10	2.68	0.07	0.57	0.5
DD-27C[c]	1.25	0.5	1:1	10	6.7	2.5	-	4.48	0.48	0.98	0.5

Notes: The ditches described above represent the section of ditch with the least capacity to handle runoff. It does not indicate the ditch configuration everywhere. DD designates ditches that handle drainage from the disturbed area.

(a) According to Barfield et.al., (1994) a freeboard of 0.2* (flow depth) or 0.5', whichever is greater should be an adequate freeboard.
(b) Unless noted by a # symbol the design flow is for a 10-year 6-hour storm event.
(c) Portions of this ditch will be modified during reclamation. The drainage area reporting to this ditch will be reduced, thus reducing the design flow. Therefore, since only the design flow is reduced the channel as constructed is still adequate.

TABLE 13-15
INDUSTRIAL POSTMINING DRAINAGE STRUCTURES
10-YEAR 24-HOUR STORM EVENT
(PAGE 3 of 5)

Diversion Ditch	10yr-24hr Design Flow (cfs)	Minimum Existing Conditions						Calculation Results		Required Channel Depth (ft)[a]	Freeboard (ft)[a]
		Bottom Width (ft)	Side Slopes (ft)	Max. Bottom Slope (%)	Min. Bottom Slope (%)	Channel Depth (ft)	Riprap D_{50} (in)	Max. Velocity (ft/s)	Max. Flow Depth (ft)		
UD-1A	7.28	-	1:1	6.7	1	4	6	5.39	1.59	2.09	0.50
UD-1B	7.28	-	0.9:1	25	8.7	5	9	7.18	1.09	1.59	0.50
UD-1C	7.28	4	2:1	18.8	3	4	14	5.30	0.49	0.99	0.50
UD-1D	64.9	4	2.5:1	5	1	4	14	7.99	2.52	3.02	0.50
UD-1E	64.9	9	1.5:1	33	1.6	3.25	14	10.36	1.25	1.75	0.50
UD-1F [d]	64.9	10	2:1	300	1.6	2.5	36	14.65	1.30	1.80	0.50
UD-2	57.61	4	2.5:1	20	11.1	2.5	14	10.74	1.36	1.86	0.50
UD-3	11.96	6.5	1:1	16.7	5.4	3	12	5.35	0.41	0.91	0.50
UD-7B	3.91	7	1:1	11.8	5	4.5	15	3.11	0.21	0.71	0.50
UD-8	4.76	2.5	1:1	4	0.5	2	-	4.45	0.69	1.19	0.50
UD-9	1.59	2.3	1.5:1	10	2.6	8	-	4.23	0.24	0.74	0.50
UD-10	1.35	3	1:1	6.7	1.8	3	-	3.20	0.20	0.70	0.50
UD-11	29.74	35	1.5:1	16	6.7	5.5	15	4.02	0.25	0.75	0.50
UD-12	0.39	1	1:1 4:1	3.7	2.1	1	-	2.34	0.18	0.68	0.50
UD-13	0.39	3.5	0.75:1	25	5.7	2.5	5	2.14	0.07	0.57	0.50

Notes: The ditches described above represent the section of ditch with the least capacity to handle runoff. It does not indicate the ditch configuration everywhere.
UD designates ditches that diverts runoff from undisturbed areas around the disturbed area.

(a) According to Barfield et.al., (1994) a freeboard of 0.2 (flow depth) or 0.5', whichever is greater should be an adequate freeboard
(d) See attached RB&G Engineering Report

TABLE 13-15
INDUSTRIAL POSTMINING DRAINAGE STRUCTURES
DISTURBED DRAINAGE - CULVERTS
(PAGE 4 of 5)

Culvert	Existing Pipe Diameter (in)	Inlet Type	Pipe Slope (%)	Allowable HW/D [e]	Inlet Control Capacity (cfs)	Design Discharge (cfs) [g]	Minimum Allowable Culvert Size (in)	Design Status
DC-1	24"	Projecting	8	1.25	15	0.28	6	OK
DC-4	24"	Projecting	1	1.25	15	3.52 [f]	15	OK
DC-5	24"	Mitered	12	1.25	15.5	3.92 [f]	15	OK
DC-6	24"	Mitered	27	1.25	15.5	0.57	6	OK
DC-7	24"	Mitered	49	1.25	15.5	0.87	12	OK
DC-8	24"	Projecting	9	1.25	15	1.94	12	OK
DC-9	24"	Mitered	40	1.25	15.5	3.1	15	OK
DC-10	24"	Projecting	1.7	1.75	20	9.92	18	OK
DC-11	24"	Mitered	40	1.25	15.5	0.57	6	OK
DC-12	24"	Projecting	2.1	1.67	19	5.51	15	OK
DC-13	24"	Projecting	2.1	1.67	19	5.51	15	OK
DC-14	24"	Mitered	43	1.25	15.5	0.70	12	OK
DC-15	24"	Projecting	2.1	1.25	15	1.50	12	OK
DC-16	24"	Mitered	26.7	1.25	15.5	1.85	12	OK
DC-17	24"	Projecting	3.8	1.25	15	2.06	12	OK
DC-18	48"	Projecting	3.3	1.125	78	29.71 [f]	33	OK
DC-19	24"	Projecting	4	1.25	15	0.64	6	OK
DC-20 [h]	24"	Mitered	61	1.25	15.5	2.53 [h]	12	OK

Note: DC designates culverts that handle runoff from disturbed areas

(e) HW/D = Ratio of the maximum headwater depth and the culvert diameter
(f) Designates a 10-year 24-hour storm event.
(g) Discharge is for the 10-year 6-hour storm event unless otherwise noted.
(h) This culvert now handles runoff from reclamation channel WCRD-11. As shown on the table this culvert can easily handle the design flow.

TABLE 13-15
INDUSTRIAL POSTMINING DRAINAGE STRUCTURES
UNDISTURBED DRAINAGE - CULVERTS
(PAGE 5 of 5)

Culvert	Existing Pipe Diameter (in)	Inlet Type	Pipe Slope (%)	HW/D	Inlet Control Capacity (cfs)	Design Discharge (cfs) (g)	Minimum Allowable Culvert Size (in)	Design Status
UC-1	30"	Projecting	35	1.2	25	11.96	24	OK
UC-2	48"	Projecting	N/A	1.125	78	11.17	24	OK
Second Section of UC-2 after manhole	60"	in a manhole	6.5	N/A since 48" cmp feeding into it	>100	11.17	24	OK
UC-3	24"	Projecting	28	1.25	15	4.76	18	OK
UC-4	24"	Projecting	21.6	1.25	15	2.94	12	OK
UC-5	24"	Projecting	12.2	1.25	15	2.94	12	OK
UC-6	60"	Mitered	13.9	1.1	138	29.74	33	OK
UC-7	96"	Mitered	N/A	>2	840	815(i)	96	OK

Note: UC designates culverts that divert runoff from undisturbed areas around the disturbed area.

(g) Discharge is for a 10-year 24-hour storm event unless otherwise noted.
(i) For the 100-yr 6-hr storm event as calculated by TerraMatrix, see Exhibit 14 calculations

EXHIBIT 13
ADDENDUM TO APPENDIX C

SEDIMENT POND 001 ALTERNATE RECLAMATION DESIGN

REGISTERED PROFESSIONAL ENGINEER
4-2-03
No. 189797
LAYNE D.
JENSEN
STATE OF UTAH

Sediment Pond 001
Alternate Reclamation Design

The purpose of this calculation is to verify that Pond 001 Still has the capacity to hold the 10-yr 24-hr storm event and pass the 25-yr 6-hr storm event assuming the postmining land use change to industrial occurs. As a result of reclaiming parts of the belt corridor adjacent to the short and long tunnels Additional drainage area is reporting to the pond.

To make this calculation more conservative and to save time it is being assumed that all operational watersheds have not changed although some areas within the watershed have been reclaimed. Runoff from a reclaimed area is less than the same operational area.

Information for these calculations is being collected from Appendix C of Exhibit 13 as well as operational watershed maps 16A, 16B and 16C. Watershed information was also gathered from Appendix A of Exhibit 13

Watersheds contributing runoff to Pond 001 are: WS-9 (new), WS-10 (new), 40% of WS-14, WS-16, 40% of WS-25, WS-28 through WS-32, WS-34 through WS-49.

The runoff flow depth (and thus the runoff volume) is controlled by the Curve Number. The area of each watershed is as follows:

Disturbed:			
	CN = 100	(Pond)	0.49 Acres
	CN = 98	(Paved)	6.37 Acres
	CN = 90		25.61
Undisturbed	CN = 80		23.28
	CN = 75		1.08

Design runoff depth: $Q = \frac{(P-0.2S)^2}{P+0.8S}$ $S = 1000/CN - 10$

P = 10-yr 24-hr storm = 1.8 (Appendix C Exhibit 13)

Curve Number	Drainage Area (Ac)	Runoff (in)	Runoff (ac-ft)
100	0.49	1.8	0.074
98	6.37	1.58	0.84
90	25.61	0.93	1.98
80	23.28	0.44	0.85
75	1.08	0.29	0.026
			3.77 ac-ft

There is no longer any mine discharge. ∴ total runoff to the pond during the 10-yr 24-hr storm is 3.77 ac-ft.

The capacity of the pond below the primary spillway is 11.5 ac-ft (Appendix C Exhibit 13)

Therefore the pond has 11.5 - 3.77 ac-ft = 7.79 ac-ft of excess capacity.

According to Appendix C of Exhibit 13 there is 4.5 ac-ft of capacity below the decant. ∴ the storm can be contained below the decants.

- Evaluate the Capacity of spillways to handle 25-yr 6-hr storm

Using Information in Appendix C of Exhibit 13 and adjusting Watersheds as necessary.

The same 3 cases evaluated in Appendix C of Exhibit 13 will be evaluated here

Case No	Peak inflow (cfs)	Peak Outflow Flow (cfs)	Peak Outflow Stage (ft)	Status
1	32.83	3.76	6165.75	ok
2	32.83	11.64	6171.71	ok
3	32.83	17.46	6172.5	ok

Check outlets of Spillways.

Primary Spillway.

24" culvert
outlet is a concrete and steel box surrounded by grouted 12" riprop.
Max. Discharge = 11.64 cfs.

Outlet velocity = 5.28 fps
Required riprop = 3"

More than adequate.

Emergency Spillway

Slope = 100%
BW = 19.5'
SS = 2:1
Discharge = 17.46 cfs

D_{50} = 12" grouted or 36"

max velocity = 6.01 fps
required D_{50} = 6"

More than adequate

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WILLOW CREEK ALTERNATE RECLAMATION WITH DECANT

by

Name: Layne Jensen

Company Name: EarthFax Engineering INC.
File Name: C:\PROJECTS\P1-ALL4

Date: 03-18-2003

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-ALL4 User: Layne Jensen
Date: 03-18-2003 Time: 13:11:30
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.74	89	F	0.041	0.000	0.000	0.0	0.22	2.56
111	2	19.87	87	F	0.064	0.000	0.000	0.0	1.00	11.69
111	3	9.60	92	F	0.093	0.000	0.000	0.0	0.71	8.08
111	4	8.25	80	M	0.104	0.000	0.000	0.0	0.23	2.54
111	5	4.65	80	M	0.060	0.000	0.000	0.0	0.13	1.43
111	6	4.44	84	F	0.040	0.000	0.000	0.0	0.18	2.03
111	7	0.72	90	F	0.022	0.000	0.000	0.0	0.05	0.53
111	8	0.76	90	F	0.018	0.000	0.000	0.0	0.05	0.56
111	9	1.96	93	F	0.015	0.000	0.000	0.0	0.16	1.76
111	10	0.56	94	F	0.088	0.000	0.000	0.0	0.05	0.53
111	11	0.28	96	F	0.075	0.000	0.000	0.0	0.03	0.30
111	12	0.58	80	M	0.025	0.000	0.000	0.0	0.02	0.18
111	13	1.42	84	F	0.020	0.000	0.000	0.0	0.06	0.65
			Type: Pond		Label: Pond 1					
111	Structure	56.83							2.87	
111	Total IN	56.83							2.87	32.83
111	Total OUT								2.87	3.76

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-ALL4 User: Layne Jensen
Date: 03-18-2003 Time: 13:11:30
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	24.0	----
Riser Height (ft)	7.80	----
Barrel Diameter (in)	24.0	----
Barrel Length (ft)	85.50	----
Barrel Slope (%)	1.50	----
Manning's n of Pipe	0.024	----
Spillway Elevation	6171.0	----
Lowest Elevation of Holes	6163.7	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6172.0
Crest Length (ft)	----	18.0
Z:1 (Left and Right)	-- --	8 8
Bottom Width (ft)	----	19.5

POND RESULTS:

Permanent Pool (ac-ft)
4.4

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	2.87	32.83
OUT	2.87	3.76

Peak Elevation	Hydrograph Detention Time (hrs)
6165.8	0.00

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.8 days

****

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-ALL4 User: Layne Jensen
Date: 03-18-2003 Time: 13:11:30
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
6156.80	0.0	0.0	0.0
6157.30	0.0	0.0	0.0
6157.80	0.0	0.0	0.0
6158.30	0.0	0.0	0.0
6158.80	0.0	0.0	0.0
6159.30	0.0	0.0	0.0
6159.80	0.0	0.0	0.0
6160.30	0.0	0.0	0.0
6160.80	0.0	0.0	0.0
6161.30	0.0	0.0	0.0
6161.80	0.0	0.0	0.0
6162.30	0.0	0.0	0.0
6162.80	0.0	0.0	0.0
6163.30	0.0	0.0	0.0
6163.70	0.0>%10.00	0.0	0.0
6163.80	0.8	0.0	0.8
6164.30	2.0	0.0	2.0
6164.80	2.8	0.0	2.8
6165.30	3.3	0.0	3.3
6165.80	3.8	0.0	3.8
6166.30	4.2	0.0	4.2
6166.80	4.6	0.0	4.6
6167.30	5.0	0.0	5.0
6167.80	5.3	0.0	5.3
6168.30	5.6	0.0	5.6
6168.80	5.9	0.0	5.9
6169.30	6.2	0.0	6.2
6169.80	6.5	0.0	6.5
6170.30	6.7	0.0	6.7
6170.80	7.0	0.0	7.0
6171.00	7.1	0.0	7.1
6171.30	7.2	0.0	7.2
6171.80	13.5	0.0	13.5
6172.00	15.1	0.0	15.1

c

6172.30	17.2	10.5	27.8
6172.60	19.1	21.0	40.1
6172.70	19.7	27.7	47.4
6172.80	20.3	36.6	56.8
6172.90	20.8	45.7	66.5
6173.00	21.4	56.4	77.8
6173.30	22.9	94.8	117.7
6173.50	23.9	125.7	149.5
6173.80	25.3	181.7	207.1
6174.00	26.2	225.1	251.3

****

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-ALL4 User: Layne Jensen
Date: 03-18-2003 Time: 13:11:30
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6156.80	0.00	0.00	0.00	0.00	
6157.30	0.50	0.38	0.06	0.00	
6157.80	1.00	0.54	0.29	0.00	
6158.30	1.50	0.62	0.58	0.00	
6158.80	2.00	0.64	0.90	0.00	
6159.30	2.50	0.66	1.22	0.00	
6159.80	3.00	0.67	1.55	0.00	
6160.30	3.50	0.69	1.89	0.00	
6160.80	4.00	0.71	2.24	0.00	
6161.30	4.50	0.73	2.60	0.00	
6161.80	5.00	0.74	2.97	0.00	
6162.30	5.50	0.76	3.34	0.00	
6162.80	6.00	0.78	3.73	0.00	
6163.30	6.50	0.80	4.13	0.00	
6163.70	6.90	0.82	4.45	0.00	Low Orifice of SW#1
6163.80	7.00	0.82	4.53	0.83	
6164.30	7.50	0.84	4.95	2.03	
6164.80	8.00	0.86	5.37	2.75	
6165.30	8.50	0.88	5.80	3.32	
6165.75	8.95	0.88	6.21	3.76	Peak Stage
6165.80	9.00	0.89	6.25	3.81	
6166.30	9.50	0.91	6.70	4.23	
6166.80	10.00	0.93	7.16	4.62	
6167.30	10.50	0.95	7.63	4.98	
6167.80	11.00	0.97	8.11	5.32	
6168.30	11.50	0.99	8.60	5.63	
6168.80	12.00	1.01	9.10	5.93	
6169.30	12.50	1.03	9.61	6.21	
6169.80	13.00	1.05	10.13	6.49	
6170.30	13.50	1.07	10.67	6.75	
6170.80	14.00	1.10	11.21	7.00	
6171.00	14.20	1.10	11.43	7.10	Stage of SW#1
6171.30	14.50	1.12	11.76	7.24	

6171.80	15.00	1.14	12.33	13.53	
6172.00	15.20	1.15	12.55	15.13	Stage of SW#2
6172.30	15.50	1.17	12.90	27.77	
6172.60	15.80	1.19	13.26	40.13	
6172.70	15.90	1.20	13.38	47.36	
6172.80	16.00	1.21	13.50	56.85	
6172.90	16.10	1.21	13.62	66.50	
6173.00	16.20	1.22	13.74	77.77	
6173.30	16.50	1.24	14.11	117.69	
6173.50	16.70	1.25	14.36	149.54	
6173.80	17.00	1.28	14.74	207.06	
6174.00	17.20	1.29	14.99	251.33	

****

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WILLOW CREEK ALTERNATE RECLAMATION No DECANT

by

Name: Layne Jensen

Company Name: EarthFax Engineering INC.
File Name: C:\PROJECTS\P1-DROP

Date: 03-18-2003

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-DROP User: Layne Jensen
Date: 03-18-2003 Time: 13:17:24
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.74	89	F	0.041	0.000	0.000	0.0	0.22	2.56
111	2	19.87	87	F	0.064	0.000	0.000	0.0	1.00	11.69
111	3	9.60	92	F	0.093	0.000	0.000	0.0	0.71	8.08
111	4	8.25	80	M	0.104	0.000	0.000	0.0	0.23	2.54
111	5	4.65	80	M	0.060	0.000	0.000	0.0	0.13	1.43
111	6	4.44	84	F	0.040	0.000	0.000	0.0	0.18	2.03
111	7	0.72	90	F	0.022	0.000	0.000	0.0	0.05	0.53
111	8	0.76	90	F	0.018	0.000	0.000	0.0	0.05	0.56
111	9	1.96	93	F	0.015	0.000	0.000	0.0	0.16	1.76
111	10	0.56	94	F	0.088	0.000	0.000	0.0	0.05	0.53
111	11	0.28	96	F	0.075	0.000	0.000	0.0	0.03	0.30
111	12	0.58	80	M	0.025	0.000	0.000	0.0	0.02	0.18
111	13	1.42	84	F	0.020	0.000	0.000	0.0	0.06	0.65
		Type: Pond			Label: Pond 1					
111	Structure	56.83							2.87	
111	Total IN	56.83							2.87	32.83
111	Total OUT								2.87	11.64

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-DROP User: Layne Jensen
Date: 03-18-2003 Time: 13:17:24
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

DISCHARGE OPTIONS:

	Drop Inlet	Emergency Spillway
Riser Diameter (in)	24.0	----
Riser Height (ft)	7.80	----
Barrel Diameter (in)	24.0	----
Barrel Length (ft)	85.50	----
Barrel Slope (%)	1.50	----
Manning's n of Pipe	0.024	----
Spillway Elevation	6171.0	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6172.0
Crest Length (ft)	----	18.0
Z:1 (Left and Right)	-- --	8 8
Bottom Width (ft)	----	19.5

POND RESULTS:

Permanent Pool (ac-ft)
11.4

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	2.87	32.83
OUT	2.87	11.64

Peak Elevation	Hydrograph Detention Time (hrs)
6171.7	0.00

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-DROP User: Layne Jensen
Date: 03-18-2003 Time: 13:17:24
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

Elevation	Drop Inlet (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
6156.80	0.0	0.0	0.0
6157.30	0.0	0.0	0.0
6157.80	0.0	0.0	0.0
6158.30	0.0	0.0	0.0
6158.80	0.0	0.0	0.0
6159.30	0.0	0.0	0.0
6159.80	0.0	0.0	0.0
6160.30	0.0	0.0	0.0
6160.80	0.0	0.0	0.0
6161.30	0.0	0.0	0.0
6161.80	0.0	0.0	0.0
6162.30	0.0	0.0	0.0
6162.80	0.0	0.0	0.0
6163.30	0.0	0.0	0.0
6163.80	0.0	0.0	0.0
6164.30	0.0	0.0	0.0
6164.80	0.0	0.0	0.0
6165.30	0.0	0.0	0.0
6165.80	0.0	0.0	0.0
6166.30	0.0	0.0	0.0
6166.80	0.0	0.0	0.0
6167.30	0.0	0.0	0.0
6167.80	0.0	0.0	0.0
6168.30	0.0	0.0	0.0
6168.80	0.0	0.0	0.0
6169.30	0.0	0.0	0.0
6169.80	0.0	0.0	0.0
6170.30	0.0	0.0	0.0
6170.80	0.0	0.0	0.0
6171.00	0.0	0.0	0.0
6171.30	3.2	0.0	3.2
6171.80	13.5	0.0	13.5
6172.00	15.1	0.0	15.1
6172.30	17.2	10.5	27.8

6172.60	19.1	21.0	40.1
6172.70	19.7	27.7	47.4
6172.80	20.3	36.6	56.8
6172.90	20.8	45.7	66.5
6173.00	21.4	56.4	77.8
6173.30	22.9	94.8	117.7
6173.50	23.9	125.7	149.5
6173.80	25.3	181.7	207.1
6174.00	26.2	225.1	251.3

****

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-DROP User: Layne Jensen
Date: 03-18-2003 Time: 13:17:24
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

SW#1: Drop Inlet
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6156.80	0.00	0.00	0.00	0.00	
6157.30	0.50	0.38	0.06	0.00	
6157.80	1.00	0.54	0.29	0.00	
6158.30	1.50	0.62	0.58	0.00	
6158.80	2.00	0.64	0.90	0.00	
6159.30	2.50	0.66	1.22	0.00	
6159.80	3.00	0.67	1.55	0.00	
6160.30	3.50	0.69	1.89	0.00	
6160.80	4.00	0.71	2.24	0.00	
6161.30	4.50	0.73	2.60	0.00	
6161.80	5.00	0.74	2.97	0.00	
6162.30	5.50	0.76	3.34	0.00	
6162.80	6.00	0.78	3.73	0.00	
6163.30	6.50	0.80	4.13	0.00	
6163.80	7.00	0.82	4.53	0.00	
6164.30	7.50	0.84	4.95	0.00	
6164.80	8.00	0.86	5.37	0.00	
6165.30	8.50	0.88	5.80	0.00	
6165.80	9.00	0.89	6.25	0.00	
6166.30	9.50	0.91	6.70	0.00	
6166.80	10.00	0.93	7.16	0.00	
6167.30	10.50	0.95	7.63	0.00	
6167.80	11.00	0.97	8.11	0.00	
6168.30	11.50	0.99	8.60	0.00	
6168.80	12.00	1.01	9.10	0.00	
6169.30	12.50	1.03	9.61	0.00	
6169.80	13.00	1.05	10.13	0.00	
6170.30	13.50	1.07	10.66	0.00	
6170.80	14.00	1.10	11.21	0.00	
6171.00	14.20	1.10	11.43	0.00	Stage of SW#1
6171.30	14.50	1.12	11.76	3.20	
6171.71	14.91	1.12	12.22	11.64	Peak Stage
6171.80	15.00	1.14	12.33	13.53	

6172.00	15.20	1.15	12.55	15.13	Stage of SW#2
6172.30	15.50	1.17	12.90	27.77	
6172.60	15.80	1.19	13.26	40.13	
6172.70	15.90	1.20	13.38	47.36	
6172.80	16.00	1.21	13.50	56.85	
6172.90	16.10	1.21	13.62	66.50	
6173.00	16.20	1.22	13.74	77.77	
6173.30	16.50	1.24	14.11	117.69	
6173.50	16.70	1.25	14.36	149.54	
6173.80	17.00	1.28	14.74	207.06	
6174.00	17.20	1.29	14.99	251.33	

****

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

WILLOW CREEK ALTERNATE RECLAMATION
Emergency Spillway Only

by

Name: Layne Jensen

Company Name: EarthFax Engineering INC.
File Name: C:\PROJECTS\P1-EMER

Date: 03-18-2003

Civil Software Design -- SEDCAD+ Version 3.1
Copyright (C) 1987-1992. Pamela J. Schwab. All rights reserved.

Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-EMER User: Layne Jensen
Date: 03-18-2003 Time: 13:20:35
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	3.74	89	F	0.041	0.000	0.000	0.0	0.22	2.56
111	2	19.87	87	F	0.064	0.000	0.000	0.0	1.00	11.69
111	3	9.60	92	F	0.093	0.000	0.000	0.0	0.71	8.08
111	4	8.25	80	M	0.104	0.000	0.000	0.0	0.23	2.54
111	5	4.65	80	M	0.060	0.000	0.000	0.0	0.13	1.43
111	6	4.44	84	F	0.040	0.000	0.000	0.0	0.18	2.03
111	7	0.72	90	F	0.022	0.000	0.000	0.0	0.05	0.53
111	8	0.76	90	F	0.018	0.000	0.000	0.0	0.05	0.56
111	9	1.96	93	F	0.015	0.000	0.000	0.0	0.16	1.76
111	10	0.56	94	F	0.088	0.000	0.000	0.0	0.05	0.53
111	11	0.28	96	F	0.075	0.000	0.000	0.0	0.03	0.30
111	12	0.58	80	M	0.025	0.000	0.000	0.0	0.02	0.18
111	13	1.42	84	F	0.020	0.000	0.000	0.0	0.06	0.65
			Type: Pond		Label: Pond 1					
111	Structure	56.83							2.87	
111	Total IN	56.83							2.87	32.83
111	Total OUT								2.87	17.46

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-EMER User: Layne Jensen
Date: 03-18-2003 Time: 13:20:35
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

==========
POND INPUT/OUTPUT TABLE
==========

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

DISCHARGE OPTIONS:

	Emergency Spillway
Riser Diameter (in)	----
Riser Height (ft)	----
Barrel Diameter (in)	----
Barrel Length (ft)	----
Barrel Slope (%)	----
Manning's n of Pipe	----
Spillway Elevation	----
Lowest Elevation of Holes	----
# of Holes/Elevation	----
Entrance Loss Coefficient	----
Tailwater Depth (ft)	----
Notch Angle (degrees)	----
Weir Width (ft)	----
Siphon Crest Elevation	----
Siphon Tube Diameter (in)	----
Siphon Tube Length (ft)	----
Manning's n of Siphon	----
Siphon Inlet Elevation	----
Siphon Outlet Elevation	----
Emergency Spillway Elevation	6172.0
Crest Length (ft)	18.0
Z:1 (Left and Right)	8 8
Bottom Width (ft)	19.5

POND RESULTS:

Permanent Pool (ac-ft)
12.6

	Runoff Volume (ac-ft)	Peak Discharge (cfs)
IN	2.87	32.83
OUT	2.87	17.46

Peak Elevation	Hydrograph Detention Time (hrs)
6172.5	0.00

****

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-EMER User: Layne Jensen
Date: 03-18-2003 Time: 13:20:35
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

Elevation	Emergency Spillway (cfs)	Total Discharge (cfs)
6156.80	0.0	0.0
6157.30	0.0	0.0
6157.80	0.0	0.0
6158.30	0.0	0.0
6158.80	0.0	0.0
6159.30	0.0	0.0
6159.80	0.0	0.0
6160.30	0.0	0.0
6160.80	0.0	0.0
6161.30	0.0	0.0
6161.80	0.0	0.0
6162.30	0.0	0.0
6162.80	0.0	0.0
6163.30	0.0	0.0
6163.80	0.0	0.0
6164.30	0.0	0.0
6164.80	0.0	0.0
6165.30	0.0	0.0
6165.80	0.0	0.0
6166.30	0.0	0.0
6166.80	0.0	0.0
6167.30	0.0	0.0
6167.80	0.0	0.0
6168.30	0.0	0.0
6168.80	0.0	0.0
6169.30	0.0	0.0
6169.80	0.0	0.0
6170.30	0.0	0.0
6170.80	0.0	0.0
6171.30	0.0	0.0
6171.80	0.0	0.0
6172.00	0.0	0.0
6172.30	10.5	10.5
6172.60	21.0	21.0

6172.70	27.7	27.7
6172.80	36.6	36.6
6172.90	45.7	45.7
6173.00	56.4	56.4
6173.30	94.8	94.8
6173.50	125.7	125.7
6173.80	181.7	181.7
6174.00	225.1	225.1

****

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Company Name: EarthFax Engineering INC.
Filename: C:\PROJECTS\P1-EMER User: Layne Jensen
Date: 03-18-2003 Time: 13:20:35
Willow Creek Alternate Reclamation with decant
Storm: 1.60 inches, 25 year- 6 hour, SCS 6 Hour
Hydrograph Convolution Interval: 0.1 hr

==========
ELEVATION-AREA-CAPACITY-DISCHARGE TABLE
==========

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-13: 56.8 acres
Total Contributing Drainage Area: 56.8 acres

SW#1: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
6156.80	0.00	0.00	0.00	0.00	
6157.30	0.50	0.38	0.06	0.00	
6157.80	1.00	0.54	0.29	0.00	
6158.30	1.50	0.62	0.58	0.00	
6158.80	2.00	0.64	0.90	0.00	
6159.30	2.50	0.66	1.22	0.00	
6159.80	3.00	0.67	1.55	0.00	
6160.30	3.50	0.69	1.89	0.00	
6160.80	4.00	0.71	2.24	0.00	
6161.30	4.50	0.73	2.60	0.00	
6161.80	5.00	0.74	2.97	0.00	
6162.30	5.50	0.76	3.34	0.00	
6162.80	6.00	0.78	3.73	0.00	
6163.30	6.50	0.80	4.13	0.00	
6163.80	7.00	0.82	4.53	0.00	
6164.30	7.50	0.84	4.95	0.00	
6164.80	8.00	0.86	5.37	0.00	
6165.30	8.50	0.88	5.80	0.00	
6165.80	9.00	0.89	6.25	0.00	
6166.30	9.50	0.91	6.70	0.00	
6166.80	10.00	0.93	7.16	0.00	
6167.30	10.50	0.95	7.63	0.00	
6167.80	11.00	0.97	8.11	0.00	
6168.30	11.50	0.99	8.60	0.00	
6168.80	12.00	1.01	9.10	0.00	
6169.30	12.50	1.03	9.61	0.00	
6169.80	13.00	1.05	10.13	0.00	
6170.30	13.50	1.07	10.66	0.00	
6170.80	14.00	1.10	11.21	0.00	
6171.30	14.50	1.12	11.76	0.00	
6171.80	15.00	1.14	12.33	0.00	
6172.00	15.20	1.15	12.55	0.00	Stage of SW#1
6172.30	15.50	1.17	12.90	10.52	
6172.50	15.70	1.17	13.14	17.46	Peak Stage

6172.60	15.80	1.19	13.26	21.05
6172.70	15.90	1.20	13.38	27.67
6172.80	16.00	1.21	13.50	36.55
6172.90	16.10	1.21	13.62	45.68
6173.00	16.20	1.22	13.74	56.41
6173.30	16.50	1.24	14.11	94.75
6173.50	16.70	1.25	14.36	125.65
6173.80	17.00	1.28	14.74	181.75
6174.00	17.20	1.29	14.99	225.13

****

POND 1 PRIMARY SPILLWAY
Worksheet for Circular Channel

Project Description	
Worksheet	W.C. POND 1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.024	
Slope	0.015000	ft/ft
Diameter	24	in
Discharge	11.64	cfs

Results		
Depth	1.32	ft
Flow Area	2.2	ft²
Wetted Perimeter	3.80	ft
Top Width	1.89	ft
Critical Depth	1.22	ft
Percent Full	66.2	%
Critical Slope	0.018780	ft/ft
Velocity	5.28	ft/s
Velocity Head	0.43	ft
Specific Energy	1.76	ft
Froude Number	0.86	
Maximum Discharge	16.14	cfs
Discharge Full	15.01	cfs
Slope Full	0.009024	ft/ft
Flow Type	Subcritical	

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EarthFax Engineering Inc
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

W. C. POND 1 EMERGENCY SPILLWAY
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channel - 1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.068	
Slope	1.000000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	19.50	ft
Discharge	17.46	cfs

$n = 0.456 (D_{50} \times Slope)^{0.159}$

$D_{50} = 12''$

$Slope = 1$

$n = 0.068$

Results		
Depth	0.15	ft
Flow Area	2.9	ft²
Wetted Perimeter	20.16	ft
Top Width	20.09	ft
Critical Depth	0.29	ft
Critical Slope	0.103770	ft/ft
Velocity	6.01	ft/s
Velocity Head	0.56	ft
Specific Energy	0.71	ft
Froude Number	2.78	
Flow Type	Supercritical	

Status of Structures at the Willow Creek Mine Assuming Postmining Land Use Change

Structures removed, demolished, or sealed

2. Run of Mine (R.O.M.) Coal Stockpile
4. R.O.M. Escape Tunnel
5. Elevated Conveyor Canopy
6. Mine Ventilation Fan Set (Equipment removed, foundations to be covered with 4' of fill during reclamation.)
7. Mine Ventilation Shaft
9 U-G1 Belt Drive Building
10. Mine Portals (5 ea.)
13. Motor Control Building and Methane Pump Facility
15. 4" Temporary Water Line
18. Conveyor UG-1
19. Run-Of-Mine Stacking Tube & Reclaim Tunnel
20. Conveyor SC-1
21. Conveyor SC-2
22. Conveyor SC-3
31. Office Trailer
35. Conveyor SC-4
68 Crude Oil Storage and Treatment Facility
78A. SC-1/SC-2 Motor Control and Transfer Building
78B. SC-2/SC-3 Motor Control and Transfer Building
78C. SC-3/SC-4 Motor Control and Transfer Building
78D. SC-4/SC-5 Motor Control and Transfer Building
82. Explosives Magazine
83. Temporary Coal Processing Waste Storage Area
84. Rock Dust Bin
85. Control Building
91. Concrete Retaining Wall
95. Crusher/Screen Building
98. Temporary Methane Pump Site
99. Transfer Pump Power Center
100. Methane Pipeline
102. Motor Control Building

Structures to be removed, demolished, or sealed during reclamation (included in the bond)

28. Rock Tunnel No. 1 (265 ft. Long) 2 ea. Portals - Backfill per 30 CFR 75.1711-2
30. Rock Tunnel No. 2 (1000 ft. Long) 2 ea. Portals - Backfill per 30 CFR 75.1711-2
31. Office Trailer (Concrete demolition only)
32. Sedimentation Pond No. 002
36. Sediment Pond 012A
54. Sediment Pond 12B

Note: Numbers above correspond to the numbers identifying structures on Map 18B

Industrial Postmining Structures Retained After Reclamation

1. Mine/Fire Water Tank - 350,000 Gallons
3. Propane Tanks
8. Main Substation
11. Shop Building
12. Warehouse Building
14. Administration and Bathhouse Building
16. Used Oil Tanks
17. Potable Water Tank - 40,000 Gallons
23. Willow Creek Culvert
24. Willow Creek Stream Relocation No. 1
25. Willow Creek Stream Relocation No. 2
26. Sedimentation Pond No. 001
33. Topsoil Stockpile
38. Equipment/Material Storage Yards
57. Parking Lot
61. Pump House
67. Barrel Storage
69. Misc. Structures - Fuel Tanks, Antifreeze Tanks, Sheds
70. Pump House No. 1, PRWID
71. Pump House No. 3, Cyprus Plateau
72. 46KV Power Line, PacifiCorp
73. 5KV Power Line, Cyprus Plateau
74. Sanitary Sewer, PRWID
75. Process Water, PRWID
76. Potable Water, Helper City
79. Water and Sewer Pipelines
88. Hilfiker Retaining Wall

PR-1 Primary Road 1 = Willow Creek Operations
PR-2 Primary Road 2 = Run-Of-Mine Pile
PR-3 Primary Road 3 = Castle Gate Prep Plant Operations
PR-6 Primary Road 6 = Fan Site
PR-7 Primary Road 7 = Sed. Pond 001 & Rock Tunnels
PR-12 Primary Road 12 = Access Road To Water Tanks
PR-13 Primary Road 13 = Access Road To Run-Of-Mine Stacking Tube
PR-17 Primary Road 17 = Ramp to Sediment Pond 001
PR-18 Primary Road 18 = Access Road to Equipment Storage Area
PR-19 Primary Road 19 = Access Road to Barn Canyon
AN-1 Ancillary Road 1 = Access to Ditch UD-3 and Methane Pump Facility

Note: Numbers above correspond to the numbers identifying structures on Map 18C

WILLOW CRE[illegible]MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMA[illegible]N BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost		Equipment Cost		Labor Cost		Project Cost	
					Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total
		DEMOLITION										

Note: Unless otherwise noted, no salvage value
was considered for any of this equipment.
(a) Means Heavy Construction Cost Data, 2000
(b) A Day is assumed to be 8 hours
(c) Permit No. corresponds to numbers on Map 18B
(d) In Means the cost for the domolition of footings is given in LF. However, few of the actually footings fit the few examples given in Means.
To adjust for this the unit cost for the most expensive footing which is a 2' x 3' was converted to a CF basis by dividing by the volume per linear foot of this footing.
Thus the unit cost was divided by 6 to get the costs used for footings. Also 10% added for reinforcment
(e) All tanks except the fire water, and potable water tank are assumed to be sold prior to reclamation, with the buyer removing the tanks

Permit No.	Item No.	Description	Quantity	Unit	Material Cost Per Unit	Material Cost Total	Equipment Cost Per Unit	Equipment Cost Total	Labor Cost Per Unit	Labor Cost Total	Project Cost Per Unit	Project Cost Total
6 and 102	1	Mine Ventialtion Fan Set										
		Concrete stem wall (30'X1.5'X3')X2 = 270 CF	2.80	DAY			1125.00	3150	337.20	944	1462.20	4,094
		(01590-200-0300) w 2 CY Hydraulic Excavator										
		Onsite disposal of concrete (loose) (02220-550-4200)	10.00	CY			3.48	35	1.76	18	5.24	52
		Down the air shaft (020-754-4200)										
36 & 54	2	SEDIMENTATION PONDS NO. 12A & B										
		Spillway riser (consider as demolition of hydrants)	2.00	EA			80.00	160.00	218.00	436.00	298.00	596
		(02220-875-0900)										
		10' Steel rails (consider as guide post)	42.00	EA			2.36	99.12	6.30	264.60	8.66	364
		(02220-875-0860)										
		Onsite disposal of material	1.00	LS			125.00	125.00	125.00	125.00	250.00	250
31	4	Office Trailer removal - Concrete demolition only										
		Concrete pad w/rebar 110' X 42' X.67') = 3095 CF	115.00	CY			42.00	4830	42.00	4830	84.00	9,660
		(02220-875-2200)										
		Onsite disposal of concrete (loose) (02220-550-4200)	115.00	CY			3.48	400	1.76	202	5.24	603
32	5	Sediment Pond No 2 removal										
		Spillway barrel removal - Consider as 12 " culvert removal	50.00	LF			1.16	58	3.30	165	4.46	223
		(02220-875-2960)										
		Excavation 2' wide X 8' deep X 40')	24.00	CY			1.67	40	0.44	11	2.11	51
		2 1/2 CY Hydraulic Excavator (02315-900-0620)										
		Spillway riser and decant (assume demo for fire hydrant)	1.00	EA			80.00	80	218.00	218	298.00	298
		(02220-875-0900)										

WILLOW CRE[illegible]MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMA[illegible]N BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost Per Unit	Material Cost Total	Equipment Cost Per Unit	Equipment Cost Total	Labor Cost Per Unit	Labor Cost Total	Project Cost Per Unit	Project Cost Total
		DEMOLITION CONTINUED										
	6	Water Truck for Reclamation Project (01590-400-7000)	1.00	MO			3000.00	3000	4136.00	4136	7136.00	7,136
		assume half time driver and oper. cost at $188/day										
		Assume 22 operating days per month 8 hours per day										
	7	Culvert Removal										
		6" steel pipe DC-27 (05051-600-2100)	40.00	LF					1.77	71	1.77	71
		24" CMP (DC- 2 and DC-3)	210.00	LF			0.85	179	2.41	506	3.26	685
		UC-10 (02220-875-2960) x 0.5										
		30" CMP UC- 8, 9, and 11 (02220-875-3000) x 0.5	315.00	LF			1.13	356	3.20	1008	4.33	1,364
		The unit cost for pipe removal in the Means catalog is for a concrete sewer pipe. Removal of CMP and HDPE pipe is much easier than removal of concrete pipe. Therefore, the unit demolition cost will be multiplied by 0.5. Also Means does not have a removal cost for pipe above a 36" diameter. Hence the unit cost will be multiplied by a factor if the pipe is larger										
		Excavation for 6" culvert DC-27										
		(1' wide x 2' deep x 40' LF) = 3 CY										
		(02315-900-0060) ½ CY tractor loader/backhoe	3.00	CY			1.37	4	2.04	6	3.41	10
		Excavation for 24"culverts (DC-2 and DC-3);										
		UC-10										
		(30" wide X 4' deep X 210 LF) = 78 CY										
		(02315-900-0060) ½ CY tractor loader/backhoe	78.00	CY			1.37	107	2.04	159	3.41	266
		Excavation for 30"culverts UC-8, 9, and 11										
		(3.5' wide X 4' deep X 315 LF) = 163 Cy										
		(02315-900-0060) ½ CY tractor loader/backhoe	163.00	CY			1.37	223	2.04	333	3.41	556
		Backfilling for all culverts included in rough grading										
	8	Seal Monitoring Wells - seal, excavate, cut pipe off	9.00	EA							5000.00	45,000
		Includes all wells associated with the mine and prep plant										
	9	Foreman - assume 1 month project (01310-700-0200)	1.00	MO					5937.00	5937	5937.00	5,937
		Pickup Truck -assume 1 month project (01590-400-7200)	1.00	MO			720.00	720			720.00	720
		DEMOLITION TOTAL										77,935

WILLOW CREEK MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMATION BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost		Equipment Cost		Labor Cost		Project Cost	
					Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total
		EXCAVATION - BACKFILL & GRADING										
		WILLOW CREEK MINE AREA										
	2	Cat D8R Dozer excavation with Ripper										
		Excavation and placement of 10,000 CY or all cut not loaded	0.25	MONTH			15395.00	3849			15395.00	3,849
		Dozer operating cost assuming a 300' haul	40	HRS					43.90	1756	43.90	1,756
		(Dataquest bluebook 3Q00 pg 9-42 and 47)										
		Operator labor cost (Means 02315-410-5420)	10000	CY					0.78	7800	0.78	7,800
	3	Cat D8R Dozer contouring without Ripper										
		Contouring of 28,513 CY or 100% of fill	0.50	MONTH			13145.00	6573			13145.00	6,573
		Dozer operating cost assuming a 150' haul	60	HRS					39.65	2379	39.65	2,379
		(Dataquest bluebook 3Q00 pg 9- 47)										
		Operator labor cost (Means 02315-410-5220)	28513	CY					0.40	11405	0.40	11,405
	5	Rough grading and loading with a 4 CY Excavator										
		Excavation and loading of 20,000 CY	0.60	MONTH			15280.00	9168			15280.00	9,168
		Excavator operating cost	120	HRS					41.85	5022	41.85	5,022
		(Dataquest bluebook 3Q00 pg 10-7)										
		Operator labor cost (Means 02315-400-0300)	20000	CY					0.34	6800	0.34	6,800
	6	Hauling with 12 CY truck										
		Hauling of 38,922 CY or 10% of cut (assume 4 trucks)	0.60	MONTH			11280.00	6768			11280.00	6,768
		truck operating cost assuming a 2000' round trip haul	480	HRS					18.05	8664	18.05	8,664
		(Dataquest bluebook 2Q00 pg 20-1)										
		Operator labor cost (Means 02320-200-0310)	20000	CY					0.63	12600	0.63	12,600
	7	Compaction of areas not compacted by truck traffic										
		Compaction of 17,108 CY or 60% of fill	17108	CY			0.16	2737	0.09	1540	0.25	4,277
		(Means 02315-300-5700)										

WILLOW CRE[illegible]MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMA[illegible]N BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost Per Unit	Material Cost Total	Equipment Cost Per Unit	Equipment Cost Total	Labor Cost Per Unit	Labor Cost Total	Project Cost Per Unit	Project Cost Total
		EXCAVATION - BACKFILL & GRADING CONTINUED										
		PREPARATION PLANT AREA										
	8	Cat D8R Dozer excavation with Ripper										
		Excavation and placement of 8,790 CY or 70% of cut	0.25	MONTH			15395.00	3849			15395.00	3,849
		Dozer operating cost assuming a 300' haul	40	HRS					43.90	1756	43.90	1,756
		(Dataquest bluebook 3Q00 pg 9-42 and 47)										
		Operator labor cost (Means 02315-410-5420)	8790	CY					0.78	6856	0.78	6,856
	9	Cat D8R Dozer contouring without Ripper										
		Contouring of 12,151 CY or 100% of fill	0.25	MONTH			13145.00	3286			13145.00	3,286
		Dozer operating cost assuming a 150' haul	40	HRS					39.65	1586	39.65	1,586
		(Dataquest bluebook 3Q00 pg 9- 47)										
		Operator labor cost (Means 02315-410-5220)	12151	CY					0.40	4860	0.40	4,860
	10	Rough grading with a 4 CY Excavator										
		Excavation of 3,770 CY or 30% of cut	0.25	MONTH			15280.00	3820			15280.00	3,820
		Excavator operating cost	40	HRS					41.85	1674	41.85	1,674
		(Dataquest bluebook 3Q00 pg 10-7)										
		Operator labor cost (Means 02315-400-0300)	3770	CY					0.34	1282	0.34	1,282
	11	Compaction of areas with fill less than 2' thick										
		Compaction of 6,075 CY or 50% of fill	6075	CY			0.16	972	0.09	547	0.25	1,519
		(Means 02315-300-5700)										
	12	Surveying (01107-700-1100))	2.00	DAYS					500.00	1000	500.00	1,000
	13	Foreman - assume 2 month project (01310-700-0200)	2.00	MO					5937.00	11874	5937.00	11,874
	14	Pickup Truck -assume 2 month project (01590-400-7200)	2.00	MO			720.00	1440			720.00	1,440
	15	topsoil sampling & evaluation	10.00	EA					250.00	2500	250.00	2,500
	16	topsoil testing - Lab	10.00	EA					250.00	2500	250.00	2,500
		EXCAVATION - BACKFILL & GRADING TOTAL										**136,863**

WILLOW CREEK MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMATION BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost		Equipment Cost		Labor Cost		Project Cost	
					Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total

Notes and Assumptions

Production and rental rates assume 5 10-hour work days per week and 21 work days per month. Rental time has been rounded up to the nearest quarter month
The operating costs are based on the hours needed by the equipment to move the specified amount of material. Some double handling of the material is assumed.
Rental and operation rates for the scrappers, dozers, excavator, and trucks were obtained from Wayne Western of the Utah Division of Oil Gas and Mining.
Dozer production for excavation and ripping obtained from the Caterpiller Performance Handbook Edition 30. Excavation production for a D8R dozer assuming a 300' haul is 325 CY/hr
Ripper production using the Cat Handbook is estimated to be 1750 CY/hr assuming a siesmic velocity of 3 ft/sec x 1000
Dozer production for a D8R dozer with a 150' haul for contouring is 700 CY/hr based on the Catipiller Performance Handbook.
Excavator production for a 345BL excavator assuming a 75% efficiency is 450 CY/hr for loading trucks and excavating channels
The production for 12 CY trucks assumes 3.5 round trips per hour or 42 CY/hr/truck. The cost calculation assumes 4 trucks operating at the same time to keep the excavator efficient
Since hauling is from multiple areas to the portal and trailer areas the production changes for each location. production ranges between 3 to 4.25 round trips per hour.
An average production of 3.5 round trips/hour has been assumed for this calculation. Each round trip is assumed to have 10 minutes for loading and dumping in addition to travel time at 10 mph.
The top 2' of backfill will not be compacts and scrappers will compact some of the backfill by driving over it. Hence only 60% of fill is assumed to be compacted by sheepsfoot compactor
Surveying is not required full time. Assume that 30 days of surveying by a 2 man crew is needed.
The reclamation time table states it will take 24 months to reclaim the mine facilities and prep plant areas. This calculation assumes 15 months will be spent to reclaim the mine facilities area.
In the demolition section a foreman and pickup truck were accounted for 9 months leaving 6 months for the rest of the work accounted for here.
The water truck was accounted for in the demolition section.
THE HANDLING AND PLACEMENT OF TOPSOIL IS INCLUDED IN THE EXCAVATION - BACKFILL AND GRADING

WILLOW CREEK MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMATION BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost		Equipment Cost		Labor Cost		Project Cost	
					Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total
		DRAINAGE CONTROLS										
		Assume channel excavations completed during										
		rough grading										
	1	Filter Material	84.00	CY	21.00	1764.00	1.35	113.40	3.85	323.40	26.20	2,201
		(02540-700-2800)										
	2	Riprap Placement										
		Dumped, 50# ave. (3" riprap)	40.00	TON	5.00	200.00	1.01	40.40	0.51	20.40	6.52	261
		(02370-300-0300)										
		Dumped, 100# ave. (6" and 9" riprap)	135.00	TON	7.15	965.25	1.15	155.25	0.58	78.30	8.88	1,199
		(02370-300-0350)										
	3	Install Culverts WCRC-1	75.00	LF	34.50	2587.50	4.66	349.50	11.20	840.00	50.36	3,777
		(02630-100-2160)										
	4	Installation of Erosion control mat	1650.00	SY	6.68	11022.00			0.22	363.00	6.90	11,385
		(2370-550-200) see notes										
	5	Excavator to cover erosion mat with thin layer of topsoil	0.25	MONTH			8745.00	2186			8745.00	2,186
		Excavator operating cost (322BL)	40.00	HRS					23.20	928	23.20	928
		(Dataquest bluebook 3Q00 pg 10-7)										
		Operator labor cost (Means 02315-400-0300)	4000.00	CY					0.34	1360	0.34	1,360
		DRAINAGE CONTROLS TOTAL										**23,297**
		Note: culverts are assumed to be installed during										
		rough grading, therefore there is no excavation costs.										
		Cost of riprap is multiplied by 0.5 since it will be generated										
		on-site										
		The cost of the erosion control matting was obtained from a										
		local vendor (Contech Construction Products)										
		Densities										
		3" riprap 120 lb/cubic foot										
		6" and 9" riprap 130 lb/ cubic foot										

WILLOW CR[illegible] MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAM[illegible]N BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost Per Unit	Material Cost Total	Equipment Cost Per Unit	Equipment Cost Total	Labor Cost Per Unit	Labor Cost Total	Project Cost Per Unit	Project Cost Total
		REVEGETATION										
	1	Seeding, hydro with mulch and fertilizer (35lb/acre)	386.00	MSF	16.50	6369.00	7.85	3030.10	7.40	2856.40	31.75	12,256
		(02920-510-1700)										
	2	Straw mulch - 2 tons/acre incorporated into the soil	386.00	MSF	18.50	7141.00	0.86	331.96	0.67	258.62	20.03	7,732
		during gouging										
		(02910-500-0350)										
	3	Deep gouging/mixing in mulch with excavator 2 CY (rental)	0.25	MONTH			11490.00	2872.50			11490.00	2,873
		(Dataquest 3Q00 pg 10-7)										
		Operating costs (Dataquest 3Q00 pg 10-7)	40.00	HR			32.15	1286.00			32.15	1,286
		Operator labor cost (Means 0.2315-400-0260)	5000.00	CY					0.42	2100.00	0.42	2,100
		REVEGETATION SUBTOTAL										26,246
		RESEEDING AND REPLANTING 25%										6,561
		REVEGETATION TOTAL										**32,807**

WILLOW CREEK MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMATION BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost Per Unit	Material Cost Total	Equipment Cost Per Unit	Equipment Cost Total	Labor Cost Per Unit	Labor Cost Total	Project Cost Per Unit	Project Cost Total
		MONITORING & SITE MAINTENANCE										
	1	Vegetation Monitoring	10.00	YR							2000.00	20,000
	2	Water Quality	10.00	YR							2500.00	25,000
	3	Site Maintenance	10.00	YR							2000.00	20,000
		MONITORING & SITE MAINTENANCE TOTAL										**65,000**

WILLOW CREEK MINE MAIN FACILITIES AREA INDUSTRIAL ALTERNATIVE RECLAMATION BOND COST ESTIMATE

Permit No.	Item No.	Description	Quantity	Unit	Material Cost		Equipment Cost		Labor Cost		Project Cost	
					Per Unit	Total	Per Unit	Total	Per Unit	Total	Per Unit	Total
		DIRECT COST SUMMARY										
		Demolition Total										77,935
		Excavation - Backfilling & Rough Grading Total										136,863
		Drainage Controls										23,297
		Revegetation Total										32,807
		Monitoring Total										65,000
		TOTAL DIRECT COSTS										335,901
		INDIRECT COSTS										
		Mobilization / Demobilization (5%)	Average from 2000 OSM Reclamation Bond Amount Calculation Handbook and DOGM recommended									16,795
		Contingencies (4%)	Average from 2000 OSM Reclamation Bond Amount Calculation Handbook									13,436
		Engineering Redesign Fee (2.5%)	Minimum from 2000 OSM Reclamation Bond Amount Calculation Handbook									8,398
		Contractor Profit and Overhead (10%)										33,590
		Reclamation Management Fee (2% of inflated direct costs)	From 2000 OSM Reclamation Bond Amount Calculation Handbook									7,890
		TOTAL INDIRECT COSTS										80,109
		SUBTOTAL RECLAMATION COST										416,010
		ESCALATION 3.27% OVER 5 YEARS = 17.45%										72,594
		TOTAL RECLAMATION COST										488,604

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Map(s) is kept with this application located in the Public Information Center of our Salt Lake City office.

MAP 6

MAP 9

MAP 18A

MAP 18C

MAP 21A

MAP 21B

MAP 21C

MAP 21D

MAP 21G

MAP 22A

MAP 22D