NPDES Permit No. NM29581

Appendix B – Sediment Control Plan (SCP)

Note: Copies of these documents as submitted by Permitee in electronic format available.

SCP FILES SUBMITTED BY THE PERMITTEE AND INCORPORATED INTO THE PERMIT BY INCLUSION IN ATTACHMENT A OR BY REFERENCE

Files included in Attachment A:

- Chapter 2 Section 900.B.1 Dams, Embankments and Impoundments
- Chapter 2 Section 900.B.6 Water and Air Pollution Control facilities
- Chapter 2 Section 906 Reclamation Plan
- Chapter 2 Section 907 Protection of the Hydrologic Balance
- Chapter 2 Section 909 Ponds, Impoundments, Banks, Dams and Embankments
- Chapter 2 Section 911 Diversions
- Chapter 9 Section 805 Introduction
- Chapter 9 Section 909 Ponds, Impoundments, Banks, Dams and Embankments
- Chapter 9 Section 911 Diversions

CHAPTER II

OPERATIONS AND RECLAMATION PLANS

900.B (1). Dams, Embankments and Impoundments

Impoundments will be installed before surface mining activities are initiated in the drainage area to be disturbed. Temporary impoundments with less than 10 acre feet capacity will be capable of passing the 25-year 6-hour event or contain the runoff from a 100-year, 6-hour precipitation event. A combination of excavated impoundments and embankment type impoundments may be constructed in future mine areas to receive water that accumulates in the pits and contain runoff from disturbed areas. The typical design of the excavated impoundments is shown on FIGURE II-5. Spillways of permanent impoundments will meet the 50-year, 6-hour event for the spillway. A typical design for the embankment type impoundments is presented on FIGURE II-6. Detailed design plans and locations for future impoundments will be submitted to the MMD for review and approval prior to construction. The preliminary designs for impoundments to be constructed for the next five year permit period can be found in APPENDIX IX-5.

All impoundments will be capable of safely containing or treating a 10-year/24 hr event as required by Subparts 2009.D(1), 2010.A(1), 2010.B(1), 2014.C. The impoundments will be designed and constructed in accordance with Subparts 2015 and 2017 of 19 NMAC 8.2. Hydrologic calculations for impoundments and diversions are located in the appendices of Chapter IX.

Locations of the impoundments currently existing within the permit area and approved by the MMD are discussed and shown in Chapter IX, Surface Water Hydrology. Impoundments SP-1 and SP-2 are designed to capture water from the mine facilities and hold ground water from wells for use in dust suppression. EVAP-2 is designed to receive water that has passed through the sewage treatment system for the mine. The other impoundments constructed within the permit area are used to receive water that accumulates in the pits and control sediment from disturbed areas.

All impoundments with dams or embankments will be examined for signs of structural weakness, erosion, and other hazardous conditions at least quarterly. The existing and future impoundments will be maintained as needed to ensure proper functioning.

Impoundments constructed in reclamation areas will typically be retained as permanent structures. Existing impoundment SP-4A, P35-90-1 and P25-94-1, are planned to be permanent structures. Final reclamation in pit 5 will develop into an impoundment for the Mulatto Drainage, and final reclamation in pit 1 will develop into an impoundment for the Tinaja Drainage. Both impoundments have been sized to hold less than the 10yr/24hr event in order to help ensure that the impoundments will contain a higher level of water for the intended postmining land use. Appendix IX-6 outlines Tinaja and Mulatto impoundment design and drawings. Water levels in the permanent impoundments will be dependent upon precipitation. In accordance with Subpart 2017 of 19 NMAC 8.2, the applicable state and federal water quality standards for the intended purpose will be met.

Any future impoundments that are not approved for retention as permanent structures will be removed in accordance with Subpart 2014.K of 19 NMAC 8.2. The permanent impoundments are expected to be dry for a portion of most years due to the ephemeral nature of the contributing drainage and the semi-arid to arid conditions existing within the permit area. Permanent impoundments will provide a source of water for livestock, which is compatible with the post-mining land use of rangeland. Retention of as many impoundments as possible following mining was requested by the surface owner (Fernandez Company, Ltd.) in a letter to the MMD dated February 3, 1988. A copy of this letter is provided in EXHIBIT II-1.

Diversion channels and dikes will be used to direct overland flow and runoff in ephemeral arroyos from undisturbed areas around or through disturbed areas. Temporary diversions/dikes from which overflow would not be contained within the pit will be designed, constructed and maintained to safely pass the peak runoff from a 10-year 24-hour precipitation event. Permanent diversions/dikes that will be designed, constructed, and maintained to safely pass the peak runoff from the 10-year, 24-hour precipitation events. A typical design for the channel type diversions is presented on FIGURE II-7. The typical design of a dike is shown on FIGURE II-8. Detailed design plans and locations for future diversions and dikes will be submitted to the MMD for review and approval prior to construction.

The approved diversions presently existing within the permit area are shown on PLATES IX-44 & IX-45 and discussed in chapter IX Surface Water Hydrology. Arroyo Tinaja Diversion, Desliz Dike, and the western 3700' of the Mulatto Canyon Diversion are planned to be permanent. Piedra Dike, the eastern portion of the Mulatto Canyon Diversion and the Mulatto Dike may be removed or relocated in the future. Temporary diversions will be removed in accordance with Subpart 2011.E of 19 NMAC 8.2 when no longer needed.

PLATE II-10 (Post Mining Topography) shows the approximate location of the final drainage systems.

Ditches and berms will be utilized to convey runoff from disturbed areas into impoundments and for sediment control. The ditches and berms used to transport water into temporary and permanent impoundments will be capable of safely passing the peak runoff from the 10-year, 24-hour precipitation event. A combination of ditches, berms, riprap, contour furrows, straw dikes, dugout ponds, earthfill or rock check dams and other effective methods will be used to reduce overland flow velocities, decrease runoff volume, or retain sediment within disturbed areas. These sediment control measures will be installed in appropriate locations using standard accepted methods.

No coal processing waste banks, dams, or embankments are planned to be constructed within the permit area.

900.B(6). Water and Air Pollution Control Facilities

Impoundments, diversions, dikes, and sediment control measures will be utilized at the mine for water pollution control. The location of the approved impoundments, diversions, and dikes presently existing within the permit area are shown on PLATES II-2 and II-3. Designs and locations for future impoundments, diversions, and dikes will be submitted to the MMD for review and approval prior to construction. Sediment control measures will be used within the permit area to reduce overland flow velocities, decrease runoff volume, or trap sediment. Ditches and berms will be installed as needed in graded spoils to maintain suitable pit conditions and retain sediment within disturbed areas. A combination of ditches, berms, riprap, contour furrows, earthfill or rock check dams, straw dikes, erosion-control fabric, dugout ponds and other effective methods will be used in areas that have been topdressed to minimize erosion and reduce overland flow velocities. Contour furrows will not be installed in topdressed areas with slopes steeper than 7 horizontal to 1 vertical. Berms will be developed around the base and crest of topdressing stockpiles, around the perimeter of topdressed areas, and along the crest of topdressed slopes to control erosion, decrease runoff volume, and trap sediment. The sediment control measures will be installed in appropriate locations using standard accepted methods.

Topdressed areas will be seeded with the permanent seed mixture and mulched during the first normal period for favorable planting conditions after final preparation. Interseeding may be conducted without mulch depending upon conditions. Permanent impoundments installed in reclaimed areas as a source of water for livestock will provide an added measure of sediment control following mining.

Air pollution control will be accomplished at the coal handling facilities through the use of water sprays and a dust collection system. Water trucks and routine maintenance activities will be used to control dust emissions from the haul roads and active mine areas. Dust control devices are installed on the drills utilized for preparing blast holes. Revegetation of disturbed areas that have been topdressed will stabilize the soil surface and reduce dust emissions.

906. RECLAMATION PLAN

The major objectives of the reclamation plan developed for the Lee Ranch Mine are to minimize potential adverse environmental impacts, create a landscape configuration that is compatible with the post-mining land use and surrounding terrain, return disturbed areas to the pre-mining land use of rangeland, and meet the revegetation standards for success specified in Subpart 2065 of 19 NMAC 8.2. These objectives will be accomplished through backfilling and grading, redistribution of suitable topdressing materials, and revegetation. Information obtained during pre-mining environmental investigations, published technical information, and guidelines provided by the MMD and other State and Federal agencies have been used in the development of the reclamation plan.

906.B(1). Reclamation Timetable

A timetable for the major steps in the reclamation plan is presented in TABLE II-3. Reclamation acreage data is provided in the Lee Ranch Mine Annual Report. The life-of-mine final regrade sequence is shown on PLATES II-7, II-8 and II-9. The sequence of the reclamation operations will be influenced by several factors, the most significant being modification of the operations plan to meet coal quality requirements and accommodate coal demand by customers. Coal shipments are totally controlled by customers and vary monthly. Production could increase during unanticipated times, intervals, or durations due to spot coal sales. These factors have a direct effect upon the sequence and timing of the reclamation operations. LRCC will endeavor to conduct reclamation operations as contemporaneously as practicable with the mining operations.

906.B(2). Reclamation Cost Estimate

A detailed estimate of the cost of reclamation has been prepared by the Lee Ranch Mine and submitted to the New Mexico Mining and Minerals Division (MMD) as provided for under Subpart 1405.A(4) of 19 NMAC 8.2. The reclamation cost estimate contains costs for structure demolition, backfilling and grading, topdressing replacement, and revegetation, with supporting calculations. The Bonding Proposal submitted with this revision request (BONDING PROPOSAL 2008, $135M) is based on the mining sequence proposed with this revision.

906.B(3). Backfilling and Grading Plan

The backfilling and grading plan is designed to create a stable landscape configuration that is compatible with the post-mining land use of rangeland and the surrounding terrain. Backfilling will be accomplished by transporting excavated overburden/interburden to designated fill areas with haul trucks or by directly sidecasting spoils into a previous pit with the dragline. Grading operations will be performed using bulldozers and motor graders. The overburden/interburden materials that will be used to backfill the pits were evaluated for suitability as a potential root zone material and for placement in or below the potential post-mining water table. Analyses results from overburden and interburden samples collected at 17 sampling locations within the permit area indicate that the majority of these materials are suitable. Unsuitable materials were occasionally associated with the strata immediately above or below the coal seams and in thin interburden zones. Mobile equipment will typically be used to remove the materials within 1' to 2' of the top of the coal seams and remove interburden less than 15' in thickness. Four feet of suitable material will cover potentially toxic forming materials should sampling identify any. Suitability will be determined using TABLE D of The New Mexico Overburden and Soils Inventory and Handling Guidelines March 1987. The position of the unsuitable materials in the overburden/interburden sequence and the dilution and mixing that occurs during handling are expected to minimize the potential for the occurrence of significant toxic or inhibitory concentrations in the potential root zone following mining. Analyses results for the overburden and interburden samples are presented and discussed in CHAPTER III.

Overburden/interburden suitability for placement in or below the potential post-mining water table was evaluated using the analyses results from samples collected at 17 locations within the permit area. A review of the overburden/interburden data from 32 samples collected reveals that the majority of the unsuitable materials occur below the pre-mining water table. At sampling location D15-41oc, all three of the samples with negative acid/base potentials and one of the three samples with elevated SAR values were below a depth of 30.80' where water was first reported. All three of the unsuitable overburden/interburden samples obtained at sampling location D22-17oc were at or below a depth of 10.00' where water was first encountered. Considering the position of the unsuitable materials in the pre-mining overburden/interburden sequence and the dilution and mixing associated with backfilling and grading, significant adverse impacts on ground water quality are not anticipated. Trace element concentrations for 41 overburden/interburden samples were compared to the EPA livestock water quality standards to determine suitability. The only parameters exceeding the EPA standards were aluminum, boron, cobalt, and fluoride. Aluminum and boron were above the livestock water quality standards in only 2% of the samples. Cobalt and fluoride exceeded the EPA livestock water quality standards in only 5% of the samples. These parameters are not expected to exist in toxic concentrations following mining due to the relatively small quantity of unsuitable materials combined with decreased solubility under calcareous or alkaline conditions and the dilution and mixing that occurs during overburden handling. The trace element concentrations were determined using a standard digestion method 3050 and EPA analytical procedure SW846. Solubility to water due to natural weathering is expected to be much less than the total

digestion method used for analysis. The additional seven overburden exploratory holes drilled for the permit expansion in 1997 were not included in the above summaries. The analysis for the latest overburden sampling is very comparable to previous sampling. Analytical results for the 1997 overburden sampling are included in chapter III.

The rough backfilling and grading line in the shovel/truck mining areas is estimated to be approximately 1000' behind removal of the lowest minable coal seam, except for boxcut and final cut areas and in pits used to maintain coal quality. The 1000' rough backfilling and grading line will apply primarily to the pits beyond the boxcuts and behind the final cuts in Sections 15, 16, 21, 22, 29 and 30, T15N, R7W. Boxcut and final cut areas in these sections and the pits in Sections 22, 26, 27, 28 and 35, T15N, R8W will require a distance greater than 1000' to eliminate highwalls, establish drainages, meet coal quality requirements, or develop slopes conducive to revegetation. A comparison of the disturbance sequence (PLATES II-4 and II-5) to the final regrade sequence (PLATES II-7 and II-8) reveals the approximate distance and time frame between initial disturbance and reclamation.

Rough backfilling and grading of the dragline spoils will be completed within 180 days following removal of the lowest minable coal seam and no more than four spoil ridges will remain ungraded at any time, except in the boxcut and final cut areas. A total of eight spoil ridges and 360 days will be required to complete rough backfilling and grading operations in the dragline boxcut and final cut areas. The additional time beyond 180 days and four spoil ridges will be required for highwall reduction, drainage establishment, and the development of slopes in the dragline boxcut and final cut areas that are compatible with the post-mining land use of rangeland and the surrounding terrain. LRCC requests a variance from the 180 day, 4 spoil ridge, rough backfilling and grading requirement for the dragline boxcut areas, dragline final cut areas, and long-term ramps and haul roads, as provided for under Subpart 2054.A(3) of 19 NMAC 8.2. The dragline boxcuts are in Sections 25, 26, 35 and 36, T15N, R8W, and Section 30, T15N, R7W as shown on PLATES II-4 and II-5. Final cut areas for the dragline are in Sections 13, 25 and 36, T15N, R8W, and Sections 18, 19, 30 and 31, T15N, R7W, as shown on PLATES II-4 and II-5. The final grade sequence shown on PLATES II-7 and II-8 incorporates the additional time required for rough backfilling and grading of the dragline boxcut areas, dragline final cut areas, and long-term ramps and haulroads.

Haulroads and ramps not retained for use under the approved post-mining land use will be backfilled and/or graded, topdressed, and revegetated when no longer needed for mining and reclamation. The haulroads and ramps will be removed as shown on PLATES II-7 and II-8.

The final grading operations will be conducted along the contour using bulldozers and motor graders. Topsoiled areas will be ripped to a depth of approximately three feet. Ripping into the overburden allows mixing of sandy topdressing material and spoil potentially improving water retention capacity.....

The anticipated final surface configuration of the disturbed areas within the permit area is shown on PLATES II-10 and II-11. Haul roads, ramps, and final cuts in the dragline mining areas are planned to be developed as drainages following mining. Development of the ramps as drainages will occur in stages as the mining pits advance. Several factors will influence the sequencing and timing of the final grading, topdressing redistribution, and revegetation operations in these drainages. A width of approximately 800' is shown on PLATES II-7 and II-8 for final reclamation of the ramps designated for the post-mine establishment of drainages. The 800' width is intended to minimize the potential for redisturbing previously reclaimed areas and provide sufficient operating room for various activities and structures. Sumps, dugout ponds, temporary impoundments, ditches and berms may be installed along the ramps to control surface runoff into the mining pits and to receive water that is pumped out of the pits. Temporary

water loadout stations may be established at the water control structures for use in dust suppression. Gravel for road surfacing and topdressing may be stockpiled adjacent to the ramps. Equipment ready lines and storage areas may be developed along the ramps. Collectively, these factors necessitate the 800' width shown on PLATES II-7 and II-8. LRCC will endeavor to develop final slopes into the drainages as contemporaneously as practicable with the mining operations. The drainage gradients and widths shown on PLATES II-10 and II-11 are intended to minimize erosion, conserve soil moisture, and promote revegetation success. Plans containing channel profiles and peak flow velocity calculations for major drainages created where haul roads, ramps, and final cuts existed in the dragline mining areas will be provided to the MMD prior to final grading. Critical areas within the drainages will be stabilized with riprap, earthfill or rock check dams, straw dikes, dugout ponds, erosion-control fabric, or other effective methods. Permanent impoundments may be constructed in or along the drainages to reduce runoff volumes and provide a post-mining source of water for livestock. Swell factors of 20% and 25% were used in developing the post-mining topography for the shovel/truck and dragline mining areas, respectively. These swell factors do not account for coal removal. The net swell realized in a particular area will be dependent upon the strip ratio, topographic relief, number of coal seams, coal recovery, blasting method, overburden/interburden lithology, and mining method. Due to the anticipated swell and the mining sequence, the final surface will typically be higher in elevation than the pre-mining landscape. Cross sections showing the anticipated final surface are presented on plates II-13 through II-22. The locations of the cross sections are listed by the coordinates shown on PLATES II-10 and II-11. The gentle rolling terrain in the dragline mining areas is compatible with the post-mining land use of rangeland and will encourage and enhance the interspersion of vegetation types and utilization by wildlife and livestock. A surface configuration resembling the pre-mining landscape is planned to be developed in the shovel/truck mining areas, as shown on PLATES II-10 and II-11. Post-mining slopes in final graded spoils will not be steeper than 6 horizontal to 1 vertical unless the required stability analyses for steeper slopes are submitted to the MMD for review and approval. All future slopes will be designed to blend in with the surrounding topography. The lower portion of long, continuous slopes steeper than 10 horizontal to 1 vertical will be concave in shape to the extent possible. Slopes of diversions, dikes, impoundments and road fills will not exceed 2 horizontal to 1 vertical.

906.B(4). Topdressing Handling Plan

Unconsolidated materials occurring within and adjacent to the drainages in the permit area have been and will continue to be used as topdressing at the mine. Suitable topsoil located above the unconsolidated material will be included. Analytical results documenting the suitability of the unconsolidated materials for use as topdressing are presented and discussed in CHAPTER V. The shovel/truck and loader/truck methods, or scrapers will be used for removal of the topdressing materials. Plate II-23 is an isopach of unconsolidated topdressing material based on exploration drilling. Medsystem mine planning software was used to generate Plate II-23. Table II-5 lists available topdressing by year calculated from the area to be disturbed and the depths of unconsolidated material as shown on PLATE II-23.

A mixture of topsoil and subsoil horizons may be used in areas where the unconsolidated materials are not readily available. Pre-mining soils information identifying the soil series that are suitable and unsuitable for use as topdressing is provided in CHAPTER V. The loader/truck method or scrapers will be used if a topsoil-subsoil mixture is utilized as a source of topdressing.

Haul trucks or scrapers will transport the topdressing materials to designated reclamation areas or stockpiles. The topdressing materials will be directly redistributed on the final graded spoils whenever possible. Topdressed areas will be ripped to a depth of approximately 3 ft allowing penetration into thespoil material to eliminate slippage planes and promote root penetration. The topdressing materials

will be redistributed in a manner that prevents excess compaction. Topdressing materials will be redistributed to a thickness of approximately 1' with some variability and graded along the contour.

Berms will be installed around the perimeter of newly topdressed areas that do not adjoin previous reclaimed areas. The berms will be removed as adjacent areas are topdressed. Berms may be constructed along the crest of topdressed slopes to reduce overland flow, decrease runoff volumes, and/or trap sediment. A berm will be installed around the toe and crest of topdressing stockpiles to control erosion. Current topdressing stockpile locations and volumes will be shown in the annual reports.

Topdressed areas will be seeded with the permanent seed mixture(s) during the first normal period for favorable planting conditions after final preparation in accordance with Subpart 2062 of 19 NMAC 8.2. LRCC will attempt to redistribute topdressing materials as soon as possible prior to the planting season. In areas where this is practicable, the topdressing will be planted with temporary vegetation or allowed to lay fallow and accumulate soil moisture. Topdressing stockpiles that are to be undisturbed for over three years may be seeded with the permanent seed mixture or a modification of the permanent seed mixture approved by the Director. Topdressed areas will be periodically inspected for rills and gullies. LRCC proposes to monitor topdressed areas that have developing rills and gullies that do not disrupt the approved post-mining land use, interfere with the establishment of permanent vegetation, or result in a non-compliance of the applicable water quality standards for receiving streams. The monitoring activities will be designed to determine if the rills and gullies will naturally stabilize without remedial actions by LRCC. Active rills and gullies in topdressed areas which are expected to be detrimental will be filled, regraded, or otherwise stabilized in accordance with Subpart 2059 of 19 NMAC 8.2. Rill and gully repairs requiring heavy equipment will be initiated when the topdressing moisture conditions permit access and minimize the potential for rutting and compaction. The rill and gully repair areas will be mechanically or hand seeded in accordance with the revegetation plan.

906.B(5). Revegetation Plan

The revegetation plan is designed to establish a permanent vegetative cover that supports the post-mining land use of rangeland. Revegetation activities will be conducted in a manner that encourages meeting the revegetation standards for success specified in Subpart 2065 of 19 NMAC 8.2.

906.B(5)(i). Revegetation Schedule.

The primary period for seeding permanent vegetation is between April and September. Seeding during these months is intended to take advantage of summer precipitation. The greatest amount of precipitation typically occurs between July and September. During years with favorable winter, spring, or early-summer precipitation, seeding may be conducted before April or after September with director's approval. Dormant fall and winter seedings may be performed (with the approval of MMD's Director) during years with unfavorable summer precipitation or when large topdressed areas are prepared after the primary planting season. The primary and secondary planting periods for permanent vegetation are presented in TABLE II-3.

Annual grasses and/or grains may be planted during periods that are not favorable for planting permanent vegetation. Should temporary vegetation provide adequate soil erosion control, it will be used as in situ mulch for the permanent vegetation. The primary and secondary periods for planting annual grasses and/or grains are presented in TABLE II-3.

906.B(5)(ii). Seed Mixtures and Rates.

The plant species selected for inclusion in the permanent seed mixture(s) are adapted to the environmental conditions existing within the permit area. Grass and shrub species observed during pre-mining vegetation sampling within the permit area that are commercially available and support the post-mining land use of rangeland have been included in the permanent seed mixture(s). Perennial forbs capable of persisting under the site conditions in the permit area may be included in the seed mixtures to enhance the botanical composition of the revegetated areas. A list of the perennial species and corresponding seeding rates that are used for revegetation are presented in TABLE II-6. TABLE II-6 shows the minimal seed mix to be used. Variations to the TABLE II-6 may be utilized for test plots. The variations of the permanent seed mixture(s) utilized during a given year or in a particular location based upon seed availability and the nature of the area being revegetated will be approved by the director. During years or in areas with a large proportion of drainages to be revegetated, the percentage of species that typically perform better in higher moisture areas will probably be increased (i.e., fourwing saltbush, alkali sacaton, and western wheatgrass). A similar adjustment to the seed mixture(s) will likely be made for years or areas with a large percentage of upland area to be revegetated. A description of the site preferences and important characteristics of each species that may be included in the seed mixture(s) is provided below:

Indian ricegrass (Oryzopsis hymenoides) is a native, cool season perennial bunchgrass that grows on dry sandy and silty soils. This species is drought tolerant and has good forage value for livestock and wildlife, especially during the winter (Stubbendieck, et al., 1986).

Western wheatgrass (Agropyron smithii) is a native, cool season perennial grass that occurs in and along drainages. This rhizomatous species provides excellent erosion control and has good forage value for livestock and fair for wildlife (Stubbendieck, et al., 1986).

Alkali sacaton (Sporobolus airoides) is a native, warm season perennial bunchgrass that grows in and around drainages with salt- or sodium-affected soils. This species provides good erosion control and has fair forage value for livestock and poor for wildlife (Stubbendieck, et al., 1986).

Black grama (Bouteloua eriopoda) is a native, warm season perennial grass that occurs on mesas and hills. This species provides an excellent source of forage for all classes of livestock and wildlife throughout the year (Stubbendieck, et al., 1986).

Blue grama (Bouteloua gracilis) is a native, warm season perennial short grass that occurs on upland areas and rocky slopes. The forage value for this species is good for all classes of livestock and wildlife (Stubbendieck, et al., 1986).

Galleta (Hilaria jamesii) is a native, warm season perennial grass that occurs on upland areas and in drainages. This rhizomatous species provides excellent erosion control and has a good forage value for all classes of livestock and wildlife while green (Stubbendieck, et al., 1986).

Giant dropseed (Sporobolus giganteus) is a native, warm season perennial grass that occurs on upland areas with sandy soils.

Sand dropseed (Sporobolus cryptandrus) is a native, warm season perennial grass that grows on sandy soils in upland areas. This species is drought tolerant and has a forage value of fair to good for livestock and poor for wildlife (Stubbendieck, et al., 1986).

Sideoats grama (Bouteloua curtipendula) is a native, warm season perennial grass that occurs on a variety of sites. The forage value of this species is good for all classes of livestock (Stubbendieck, et al., 1986).

Spike muhly (Muhlenbergia wrightii) is a native, warm season perennial grass that occurs on upland areas.

Blue flax (Linum lewisii) is a native, cool season perennial forb that occurs on hills and open ridges with rocky soils.

Rocky Mountain penstemon (Penstemon strictus) is a native, cool season perennial forb that occurs on rocky to sandy loam soils and is adapted to a variety of sites.

Purple prairie clover (Petalostemum purpureum) is a native, warm season perennial forb that occurs on plains and hills. This species has an excellent forage value for livestock and wildlife (Stubbendieck, et al., 1986).

Scarlet globemallow (Sphaeralcea coccinea) is a native, warm season perennial forb that occurs on dry hills and plains. This species has fair to poor forage value for livestock and excellent for deer (Stubbendieck, et al., 1986)

Fourwing saltbush (Atriplex canescens) is a native, perennial, evergreen shrub that occurs in drainages and on some upland areas. This species is valuable browse for all classes of livestock and deer (Stubbendieck, et al., 1986).

Shadscale (Atriplex confertifolia) is a native, cool season perennial shrub that occurs on alkaline soils in drainages and upland areas. This species is used by all classes of livestock, especially as winter and spring browse, and the seeds provide food for game birds and song birds (Stubbendieck, et al., 1986).

Winterfat (Ceratoides lanata) is a native, cool season perennial shrub that occurs on shallow, sandy or clayey soils in upland areas. This species provides good erosion control and is valuable browse for livestock and wildlife, especially during the winter Stubbendieck, et al., 1986).

Annual grasses and/or grains that may be used during periods that are not favorable for planting permanent vegetation are listed in TABLE II-8. The species and seeding rates specified in TABLE II-8 are expected to provide adequate soil erosion control and are currently being tested for suitability as an in situ mulch for the permanent vegetation.

906.B(5)(iii). Planting and Seeding Methods.

The condition of the seedbed will be visually evaluated prior to seeding. Areas with unfavorable physical characteristics will be tilled as needed to prepare a suitable seedbed. Conventional tillage implements will be used in areas where seedbed preparation would benefit the seeding operations. A chisel, disc, harrow, or clod-buster may be used alone or in combination. The tillage operations will be conducted along the contour to the extent possible. Fertilization of the topdressing materials is not anticipated at this time. The native plant species included in the permanent seed mixture(s) are adapted to the low fertility soils existing in the vicinity of the mine. Application of fertilizers containing nitrogen tends to stimulate the annual forb species before the perennial species in the seed mixture(s) become established. In the event fertilizer is used, it will be applied at a rate appropriate to the site conditions and approved by MMD

using one of the following four methods: 1) band applied below seed that is drilled, 2) broadcast on the surface during drill seeding, 3) broadcast and incorporated prior to seeding, or 4) broadcast following germination of the species in the permanent seed mixture(s). Seeding will be performed using a drill, broadcast seeder, or hydroseeder. Drill seeding will be conducted along the approximate contour to the extent possible. The drill seeder will be calibrated to plant the appropriate quantity of seed at the proper depth. Broadcast seeding will be conducted in a manner designed to ensure uniform distribution of seeds on the surface. The seeding rates presented in TABLES II-6 will be increased to provide 60 pure live seeds (PLS) per square foot in areas where broadcast seeding is used. In areas to be broadcast seeded, the topdressing may be disked prior to seeding and harrowed following seeding. The small channels created during the crimping operation that follows mulching, tend to capture seed broadcast on the surface and fill in with sediment. This results in a situation very similar to drill seeding. A hydroseeder will be utilized on areas that are not accessible to conventional farm equipment.

906.B(5)(iv). Mulching Techniques

Annual grasses and grains may be used as a temporary cover during periods that are unfavorable for planting the permanent seed mixture(s). The annual grasses and grains could be used as in situ mulch (depending upon testing and director approval) in areas where these species provide adequate soil erosion control.

Topdressed areas that lay fallow over the winter and spring typically develop a dense cover of annual forbs. Prior to application of mulch, where the volunteer forb species provide adequate soil erosion control will be identified. In these cases, LRCC will petition to MMD to not apply a surface mulch following planting.

A variable mulching rate will be used on areas without a protective cover of annual grasses, grains, or volunteer forb species. Mulch will be applied at a rate of 1.5 to 2.0 tons per acre on most of the reclamation areas that require mulching. A mulching rate of 1.0 to 1.5 tons per acre will be utilized on a limited basis in areas with slopes less than 10%. Areas mulched at 1.0 to 1.5 tons per acre will be monitored to determine whether the lower mulching rates are appropriate on larger areas. Mulching will normally be conducted following planting of the permanent seed mixture(s). The mulching operations may be conducted prior to planting in topdressed areas that will not be seeded with the permanent seed mixture(s) for an extended period of time or in areas that are particularly susceptible to erosion. Potential mulching materials include straw, native grass hay, or tame grass hay. The mulching materials will be relatively free of viable weed and introduced perennial grass seed, to the extent that can be controlled by LRCC. Mulch containing viable noxious weed seed will not be utilized. The mulching operations will be conducted in a manner designed to uniformly distribute the mulch over the surface. Tub type mulchers, hay busters, square or round bale mulching equipment will be used to apply the mulch. The mulch will be mechanically anchored to the soil surface with a crimper. The crimping operations will be conducted along the contour to the extent possible. A wood fiber mulch or similar product and a tackifier will be applied to areas that are hydroseeded.

906.B(5)(v). Irrigation and Management

Irrigation of the areas seeded with the permanent seed mixture(s) is presently not planned. In the event irrigation is determined to be beneficial, a portable system will be used to apply water during the first one or two growing seasons. Water used for irrigation will be of suitable quality. Herbicides may be used to suppress weed growth in the reclamation areas. Contact or pre-emergent type herbicides will be applied in accordance with the label instructions and State and Federal regulations.

Spring burning to suppress weed growth while enhancing the perennial grasses in the reclaimed areas has been very successful and will be continued as a management tool where appropriate.

906.B(5)(vi). Revegetation Success Evaluation.

Sampling of the vegetation within the east permit area of Lee Ranch Coal Mine was designed to establish a historic record of the pre-mining conditions as a basis for comparison to the post-mining vegetation. Pre-mining data sampled in 1981 and 1982 from the west permit area and pre-mining data sampled in 1989 and 1997 – 2001 from the east permit area were included in the data analysis. Lee Ranch Coal Company uses pre-mining vegetation sampling data for vegetative ground cover, production, and diversity combined to determine the success of the revegetation for bond release within permit area.

Lee Ranch Coal Company used pre-mining vegetation sampling data from the east permit area as well as established revegetation success standards from the west permit area to create revegetation success standards for the east permit area.

Revegetation Success Standards:

- Vegetative cover must comprise sixteen and fifty five one hundredths percent (16.55%) of the total ground cover.
- Two (2) warm season grass species must each comprise at least five percent (5%) of the relative vegetative cover.
- One (1) cool season grass species must comprise at least one percent (1%) of the relative vegetative cover. (Through 2013). Beginning in the 2014 vegetation sampling period the cool season grass species standard will be 0.5% relative vegetation cover of cool season grass species (relative cool season grass cover = cool season grass cover/total vegetation cover).
- Production must be at least four hundred thirty five (435) pounds per acre for the west side and one hundred sixty (160) pounds per acre for the east amendment area.
- Shrub density must be at least four hundred thirty six (436) shrubs per acre.
- Two (2) shrub species must each comprise at least five percent (5%) of the shrub density.

Total Cover

The technical standard for total cover in the east permit area is sixteen and fifty five one hundredths percent (16.55%) vegetative cover. This is the same standard as the western permit area and was developed using pre-mining data collected in the west permit area from 1981 through 1987.

Warm Season Grass Species

Two warm season grasses must each comprise at least five percent (5%) of the relative cover is a technical standard in the west permit area and is proposed to remain the same in the eastern permit area.

Cool Season Grass Species

One percent (1%) relative cover for a cool season grass species is the standard for the permit area through 2014. Initial analysis of the baseline vegetation data (See Chapter 06 – Vegetation), the cool season grass species with the largest contributing relative cover in pre-mining vegetation sampling was estimated to

have a weighted average of seventy eight one hundredths of a percent (0.78%) relative cover. One percent (1%) relative cover of a cool season grass species will provide the reclaimed vegetation with a significant amount of cool season grass species that will enhance diversity and stability in the plant community.

A more thorough analysis of the premine baseline data was completed in late 2012. Table II-13 and Table II-14 provide a detailed analysis of the relative cover contribution of cool season grasses in the native vegetation types and the basis for a revised cool season grass standard. The actual cool season weighted relative cover in the native vegetation was 0.61%. Beginning in the 2014 vegetation sampling period the cool season grass species standard will be 0.5% relative vegetation cover (relative vegetation cover of cool season grass = cool season grass cover/total vegetation cover). The 0.5% relative vegetation cover for cool season grasses provides sufficient diversity and seasonality and considers the more early successional characteristics of the reclaimed plant communities as well as shorter term climatic impacts on these reclaimed areas when compared to the climax native vegetation in the area.

Production

The proposed production technical standard for the east permit area is one hundred and sixty pounds per acre (160 lb/ac). This is a reduction from the west permit area. Pre-mining baseline vegetation sampling performed in the east permit area showed a weighted average for production to be (159.5 lb/ac).

Shrub Density

A shrub density of 436 shrubs per acre is the proposed shrub density technical standard for the permit area.

Shrub Diversity

Two shrub species must each comprise five percent (5%) of the shrub density is the proposed technical standard for the east permit area. This is the same standard as the west permit area.

Establishment of Revegetation Success Standards:

Intensive sampling of the vegetation within the west permit area over a period of seven years was designed to establish a historic record of the pre-mining conditions as a basis for comparison to the post-mining vegetation. LRCC plans to use the 1981 through 1987 pre-mining vegetation sampling data presented and discussed in CHAPTER VI for vegetative ground cover, production and diversity as the basis for a historic record or other forms of ecological assessment approved by the MMD to determine the success of the revegetation within the west permit area (TABLE II-10 and II-11).

Intensive sampling of the vegetation within the east permit expansion area was begun in 1997. LRCC continued to sample the east permit expansion area 1998,1999,2000, and 2001 establishing a historic record of pre-mining conditions to use as a basis for comparison to the post-mining vegetation. LRCC used this information as the basis for a historic record to determine the success of the revegetation within the permit All potential revegetation types are discussed in Chapter VI.

Measurements for Success Standards

Estimates to be taken for purposes of determining revegetation success will be accomplished during the last two years of the bonding period. The comparison of the reclaimed area to the revegetation success standard will also be made during this time period. The period of responsibility will commence after completion of reclamation, with the exception of those activities allowed during the bonding period. The required period of extended revegetation responsibility for the Lee Ranch Mine will be 10 years.

For comparison of herbaceous ground cover on the post-mining vegetation types, the mean ground cover of similar vegetation type or types, as obtained from the historical record, will be compared to the mean obtained from sampling similar reclaimed sites.

Herbaceous diversity will also be considered. A minimum of five perennial species will be established on the reclaimed areas. Two will be warm season grasses, one will be a cool season grass and two will be shrubs. The use of topsoil and native hay also contribute pioneer species which will complement species diversity.

In accordance with Subpart 2064, productivity of each revegetated type suitable for grazing will be measured during the final two years of the responsibility period to demonstrate that the land has the capability to support the appropriate rate of livestock grazing. The success of the vegetation production of reclaimed sites will be compared to the historical record data for each vegetation type grazed.

Production data will be collected on the same schedule as other historical record data. All post-mine vegetation types will have as a minimum 436 woody stems per acre. This is the recommended minimum density for wildlife habitat and is derived from the suggested one stem per 100 ft^2 (Plummer et al. 1968; Yoakum et al. 1980). Shrub diversity will be established on reclaimed areas. Within each vegetation type at least two shrub species will be established. Each will comprise at least 5% of the shrub density. It is well established in the literature that the best predictor of standing crop is season of precipitation occurrence rather than total precipitation (Clark et al. 1943; Rogler and Haas 1947; Smoliak 1956; Whitman and Haugse 1972 and 1973). Therefore, local data will be correlated with growing season precipitation if development of such relationships becomes necessary.

It is acknowledged that the historical record data may reflect less than optimum range condition, particularly the earlier data that had recently been fenced to exclude livestock grazing. It is anticipated that more recent data will more accurately reflect the vegetative potential for the various vegetation types and that some upward adjustments in the revegetation success standards for cover, production and diversity may have to be made. Soil Conservation Service range site guides for the WP-2 and ND subresource areas will also be used in establishing realistic success standards. The soils being replaced does not match one particular range site, but are most similar to the shallow sandstones of the area.

In all types, for comparison of herbaceous ground cover, productivity and density, the mean values of the equivalent vegetation type as obtained from the historical record (or set values in the cases where a technical standard is set based on Vegetative type and MMD approval) will be compared to the mean obtained from sampling the reclaimed sites. Each post-mine vegetation type will be sampled according to the statistical adequacy presented in Chapter VI. For final comparison of means for determining success, a student's test will be used for small samples, (i.e., $n < 30$) (Snedecor and Cochran 1967). If **x** reclaimed equals **x** historical record, no special statistical test will be necessary because of the high level of confidence inherent in the mean values of each parameter obtained from the historical record. The hypotheses in all cases to be tested will be:

$$H_O : \mathbf{x}_r - 0.90(\mathbf{x}_h) = o$$

$$H_a : \mathbf{x}_r - 0.90(\mathbf{x}_h) > o,$$

As according to the Act, the parameters to be measured on the reclaimed sites shall be equal to or greater than those parameters measured from undisturbed vegetation, in this case, the historical record. The appropriate test is a one-tailed t test (Larson 1980) with a 90% confidence interval. The test statistic is:

$$\mathbf{X}_r - 0.90\,(\mathbf{x}_h)$$

$$t = \frac{S_r}{\sqrt{n_r}}$$

Where $\mathbf{x}_r$ is the reclamation mean

$\mathbf{x}_h$ is the historic record technical standard

s_r is the reclamation standard deviation

n_r is the reclamation sample size

If the mean values of the sample parameters from the reclaimed sites are equal to or greater than those of the historical record with the appropriate confidence level, the revegetation shall be deemed successful. To use the above test, the assumptions must be valid that the data is drawn from a normal population. Fortunately the t test remains relatively valid for non-normal populations which possess a mound shaped probability distribution (Mendenhall 1975).

For those means resulting from a large number of samples (n > 30), the appropriate test statistic would be z instead of t (Snedecor and Cochran 1967; Mendenhall 1975).

Measurement of vegetation, soils and water will be taken during the last two years of the responsibility period for the purpose of determining the success of revegetation.

For the purposes of bond release, a formal application requesting bond release and a report describing the revegetation's cover, productivity, and diversity will be submitted to the Director after the growing season (September - October). A post-mine vegetation map illustrating location, size, shape and proportion of shrub cover and forage areas will accompany the report. Data to support the bond release application will be collected during the two prior growing seasons (July - August). This would be the most suitable period for the on site reclamation evaluation required in Subpart 1412.B of 19 NMAC 8.2.

Vegetation parameters discussed will be cover, density and production as required in Subparts 2060, 2065 and 2066 of 19 NMAC 8.2. Each reclaimed vegetation type will be described as to acreage, slope, aspect and soils. Comprehensive species lists for each vegetation type and seasonality will be compared to those of the same vegetation type from the historical record. Successional development will be discussed in terms of reclamation techniques, site potential, climate and recognized successional stages of natural vegetation of the area. Production would be adjusted for precipitation during the two prior growing seasons. Adjustment factors will be mutually agreed upon by LRCC and MMD.

The vegetation types will be evaluated for the capability to support the post-mine land uses. The plant species seeded and established will also be judged for suitability in relation to the post-mine land uses.

REVEGETATION SAMPLING SCHEDULE

EVALUATION METHOD

YEARS*	
1-3	VISUAL EVALUATION OF GERMINATION, GROWTH, ESTABLISHMENT AND SPECIES COMPOSITION OF REVEGETATED AREAS.
4	RELATIVE PERCENT COVER OF PERENNIAL GRASSES, FORBS AND SHRUBS.
5	VISUAL EVALUATION OF PLANT DENSITY, COVER AND PRODUCTION.
6	COVER, PRODUCTION, AND DIVERSITY USING THE SAME METHODOLOGY AS THE HISTORIC RECORD.
7	VISUAL EVALUATION OF PLANT DENSITY, COVER AND PRODUCTION.
9-10	COVER AND PRODUCTION MEASUREMENTS FOR DETERMINING REVEGETATION SUCCESS FOR BOND RELEASE.

*YEARS REFERS TO THE NUMBER OF YEARS AFTER SEEDING WAS COMPLETED

906.B(5)(vii). Soil Testing Plan.

An intensive grid sampling program consisting of collecting samples to a depth of 1.0’ on approximately 200’ centers was used to evaluate the suitability of redistributed topdressing materials until 1989. Analyti0cal results derived from 273 samples collected since 1987 were compared to the Soil and Soil Substitute Suitability ratings in the New Mexico Overburden and Soils Inventory and Handling Guidelines dated March 1987. These comparisons revealed that all of the redistributed topdressing materials sampled had suitable pH, electrical conductivity, sodium adsorption ratios (SAR) and clay values. A summary of the 1987 through 1996 post-mining topdressing sampling data is presented in TABLE II-9.

Based upon the overall suitability of the previously collected post-mining topdressing samples, LRCC has been conducting and will continue to conduct sampling of the redistributed topdressing materials on approximately 400’ centers to a depth of 1.0’. The samples will be sent to a laboratory for analysis of pH, electrical conductivity (EC) and texture. Samples having a pH equal to or less than 8.2 and an EC equal to or less than 4.0 will be considered suitable. All other samples will be tested for soluble calcium, magnesium and sodium. The SAR will be calculated to determine if material meets suitability criteria for that parameter. Analyses results and sampling location maps or coordinates will be on file at the Lee Ranch Mine and included in annual reports. LRCC will make every attempt to notify the MMD when sampling is performed.

The pre-mining topdressing sampling program described in CHAPTER V will be used to identify areas with suitable topdressing materials prior to removal. Periodic visual inspections of the topdressing removal and redistribution areas will be conducted to confirm the suitability of the topdressing materials prior to final preparation for seeding. In the event significant areas with unsuitable materials are encountered, these materials will either be removed or covered with approximately 1.0' of suitable

materials. The 400' post-mining topdressing sampling program will provide the final check on the suitability of the redistributed materials.

Topdressing thickness control will typically be achieved using fill stakes marked at least one foot above the final graded surface or tail dump spacing if topdressing is moved with end dumps. The fill stakes will be placed on approximately 150' to 250' centers and topdressing redistributed to the depth indicated on the stakes. In locations adjacent to previously topdressed areas, thickness control will be accomplished using the surrounding topdressing as a reference. When tail dump spacing is used the trucks dump at spacing that will allow for an average of 1 foot of topdressing material when the tail dumps are leveled out. Final verification that an average of 1 foot of topdressing materials exist in the reclamation areas will occur during the 400' topdressing sampling program.

906.B(6). Maximization and Conservation of the Coal Resource

The operations plan developed for the Lee Ranch Mine is designed to recover coal seams ranging from 1.0' to 17.0' in thickness. Recovery of the coal resource within the permit area is conducted in an environmentally sound manner that minimizes the potential of re-affecting the land in the future through surface mining operations.

906.B(7). Waste Disposal

A refuse disposal plan has been implemented for non-coal waste generated at the mine. The non-coal waste materials are collected and stored in appropriate containers prior to disposal. Covered dumpsters located at the mine office, coal lab, and near the shop/warehouse complex are used to temporarily hold non-coal wastes such as glass, wood, paper, boxes, metal, plastic, rubber, etc. These non-coal waste materials are disposed in the backfill of the pits and periodically covered to prevent combustion and wind-borne waste. Non-coal wastes will be placed at least six feet below the final surface. The position of the non-coal wastes in the backfill areas prevents leachate and runoff from degrading surface or ground water. The relatively small quantity of this material, combined with the advancing nature of the backfill, minimizes the amount in a particular area. Backfill areas used for non-coal waste disposal will be topdressed and revegetated with the surrounding areas. Used lubrication and cleaning fluids are collected in an above-ground steel storage tanks or 55 gallon drums. Used oils and fluids are periodically removed by a truck and delivered to a recycling company.

Soil or overburden contaminated with petroleum products caused by spills or leaks will be land farmed on site. The land farm area will be bermed and capable of containing the precipitation from a 100 yr/24 hr event. No run on or run off water will be allowed. Contaminated soils will be spread within the landfarm in approximately 6” lifts. Stack heights will be limited to 18” or less for future lifts. As lifts are completed, adjacent lifts will be started to avoid placing newer material over older material. Soils will be disked and watered monthly during the summer months (June-August) to enhance biodegradation and control blowing dust.

Each lift will be sampled for total petroleum hydrocarbons (TPH), BTEX, and benzene on an annual basis starting the second year after a lift is completed**.** Land farmed material will be considered remediated and ready to be disposed of in the backfill when total petroleum hydrocarbons (TPH) are below 1000 mg/kg, BTEX is below 50 ppm, and benzene is less than 10 ppm. A field soil vapor headspace measurement of 100 ppm (highest peak reading) may be substituted for a laboratory analysis of the benzene and BTEX concentration limits when a PID or FID organic vapor meter (OVM) is used. The OVM will be calibrated to assume a benzene response factor. TPH levels and a copy of the results will be sent to MMD.

Hazardous waste (paints, some cleaning solvents, etc.) will be recycled or disposed off site in compliance with EPA's hazardous waste regulations.

The overburden/interburden sampling programs conducted within the permit area have identified a few isolated strata that are not suitable for placement in the potential root zone. Unsuitable materials were occasionally encountered in the overburden and the strata immediately above or below the coal seams and in thin interburden zones. Mobile equipment will typically be used to remove the materials within 1' to 2' of the top of the coal seams and remove interburden less than 15' in thickness. Unsuitable overburden/interburden materials will be placed below the root zone during backfilling operations such that approximately 4 feet or more of suitable material covers these unsuitable materials. The position of the unsuitable materials in the overburden/interburden sequence and the dilution and mixing that occurs during handling are expected to minimize the potential for the occurrence of significant toxic or inhibitory concentrations in the potential root zone following mining.

To insure PATFM are not in the root zone, a minimum of 30 graded spoil samples will be collected on 330 foot centers for the first year of operation in Pit 8. The first three feet of spoil will be sampled in twelve-inch increments. Samples will be analyzed for (pH,EC,SAR,texture,total and soluble selenium and saturation percentage. Any areas of unsuitable material (based on NM Overburden and Soil guidelines) will be mitigated by importing suitable material or exporting unsuitable material to ensure a 4-foot root zone. In consultation with MMD, the first year's analytical results will be evaluated to determine if and how additional sampling in the future will proceed as Pit 8 advances.

Exposed coal seams will be covered during the backfilling operations. Combustion of exposed coal seams is highly unlikely. Burning or smoldering coal in the pits or coal stockpile will be extinguished.

906.B(8). Casing, Sealing and Managing Drill Holes and Wells

Drill holes will be cased, sealed, or managed to prevent contamination of the surface or ground water systems and to ensure the safety of people, livestock, wildlife, and machinery. All drill holes that are not used for water monitoring or otherwise managed in an approved manner will be permanently sealed. Drill holes that intercept water-bearing strata will be sealed with cement or abandonment mud extending 50' above and below the water-bearing unit or to the bottom of the hole. The upper 5' of these holes and drill holes that do not encounter water will be backfilled and sealed with cement.

Mining is expected to result in the removal of 11 wells within the permit area. Water wells uncovered or exposed by mining activities will be permanently closed using cement or abandonment mud unless approved for water monitoring, or otherwise managed in a manner approved by the Director, as provided for in Subparts 2001 and 2021 of 19 NMAC 8.2. Prior to plugging of any well all requirements listed in NMAC 19.27.4.30 C and NMAC 19.27.4.31.K depending on the type of well must be met including submitting a plugging plan for approval by the State Engineers Office, keeping a plugging record, and any other requirements for well plugging as stated.

906.B(9). Compliance with the Clean Air and Clean Water Acts

The previously discussed air pollution control plan is designed to maintain fugitive dust emissions within allowable limits. Fugitive dust emissions from the active haul roads, ramps, mining and reclamation areas will be controlled through the application of water and/or chemical dust suppressants. Road maintenance activities and restriction of vehicle speeds and travel of unauthorized vehicles on other than established roads will be used to minimize fugitive dust emissions. The drills utilized in the blasting operations will have dust control devices. Water sprays, a dust collection system, and a covered conveyor

will be used to control dust emissions from the coal handling facilities. Topdressed areas will be seeded with the permanent seed mixture and mulched if needed during the first normal period for favorable planting conditions after final preparation. An air quality monitoring program has been implemented to evaluate the effectiveness of the fugitive dust control practices.

Compliance with the Clean Water Act will be achieved through the use of diversions, dikes, impoundments, sediment control measures and appropriate mining and reclamation practices. These structures, measures and practices will be used to retain sediment within disturbed areas, reduce overland flow velocities, decrease runoff volumes, minimize erosion, and meet the effluent limitations specified under Subpart 2010 of 19 NMAC 8.2 and in NPDES Permit No. NM0029581 for the Lee Ranch Mine.

907. PROTECTION OF THE HYDROLOGIC BALANCE

The operations and reclamation plans developed for the Lee Ranch Mine will minimize adverse impacts on the hydrologic balance within and adjacent to the permit area. Appropriate measures will be taken to protect the surface and ground water systems from the adverse effects of the surface coal mining operations.

907.A(1). Surface and Ground Water Quality

Surface water quality will be protected through the use of diversions, dikes, impoundments, sediment control measures and mining and reclamation practices capable of minimizing adverse impacts. A combination of temporary and permanent diversions and dikes will be used to direct overland flow and runoff in ephemeral arroyos from undisturbed areas around or through disturbed areas. The diversions and dikes will be designed, constructed and maintained to prevent additional contributions of suspended solids to stream flow and runoff outside the permit area, to the extent possible. Typical diversion and dike cross sections are shown on FIGURES II-7 and II-8, respectively. The approved diversions and dikes presently existing within the permit area are shown on PLATES IX-44 and IX-45. Designs or as-builts for existing diversions or dikes are shown on PLATES IX- 5 through IX-43. Temporary diversions and dikes removed during mining will be graded, topdressed, and revegetated in accordance with the reclamation plan.

Impoundments will be used to control runoff from disturbed areas. These structures will be used individually or in series to contain the runoff from the 10-year, 24-hour precipitation event and will be installed before surface mining activities are initiated in the drainage area to be disturbed. Typical cross sections for the impoundments are presented on FIGURES II-5 and II-6. The approved impoundments presently existing within the permit area are shown on PLATES IX-44 an IX-45. As-builts for all existing impoundments are shown on PLATES IX-5 through IX-43. Impoundments outside the area to be mined and not approved for retention will be removed in accordance with Subpart 2014.K of 19 NMAC 8.2. The majority of the impoundments that are not removed during mining will be retained as permanent structures. Permanent impoundments are compatible with the post-mining use of rangeland and will provide an added measure of sediment control.

Sediment control measures will be used to retain sediment within disturbed areas, reduce overland flow velocities, and decrease runoff volumes. A combination of ditches, berms, riprap, contour furrows, straw dikes, erosion-control fabric, dugout ponds, earthfill or rock check dams, and other effective measures will be installed in appropriate locations using standard accepted methods.

The mining and reclamation operations will minimize adverse impacts by isolating unsuitable overburden/interburden materials from the potential root zone and contact with surface water, redistributing suitable topdressing materials, and implementing revegetation practices capable of stabilizing the soil surface. The development of rolling terrain with an increased drainage density during backfilling and grading in the dragline mining areas will conserve soil moisture, promote revegetation success, and minimize erosion. Compared to the pre-mining drainage system that was composed largely of gentle slopes and few defined drainages, the drainage system planned for construction in the dragline mining areas will have higher drainage densities as a result of developing haul roads, ramps, and final cuts into reconstructed drainages. The targeted densities of these reconstructed drainages will depend on the configuration of the haul roads, ramps and final cuts in each area prior to commencing backfilling and grading operations. In combination with roughened surfaces in the upland areas as a result of backfilling and ripping of replaced topsoil, and the formation of minor drainages that will form naturally in these areas, the reconstructed drainage systems in the dragline mining areas will develop into stable drainage systems with higher densities than the pre-mining landscape depending on the frequency, duration, and intensity of runoff events. Anticipated final surface contours for the areas to be disturbed by mining are shown on PLATES II-10, II-11 and II-12. Additional protection of the surface water system will be provided through conducting reclamation activities as contemporaneously as practicable with the mining operations. Collectively, the use of diversions, dikes, impoundments, sediment control measures and appropriate mining and reclamation practices are expected to adequately protect surface water quality.

Ground water quality is not expected to be significantly impacted by the mining operations. The principal measures used to protect ground water quality during mining include backfilling and grading of the mining cuts as contemporaneously as practicable with the mining operations, pumping water that accumulates in the pits, and minimizing the area of disturbance. These practices, combined with the surface water protection measures, will minimize the exposure of spoil materials to contact with surface water and leachate. This will effectively protect the quality of the ground water within and adjacent to the permit area.

907.A(2). Surface and Ground Water Users and Rights

Surface water within the permit area is primarily restricted to ephemeral arroyos that flow only in direct response to storm events or snow melt and have channel bottoms that are above the local water table. The C mine area is drained by Mulatto Canyon, Arroyo Tinaja, and several small tributaries to San Isidro Arroyo. An unnamed tributary to Doctor Arroyo is the major drainage in the area east of C mine area. Watersheds for Mulatto Canyon, Arroyo Tinaja, and the unnamed tributary to Doctor Arroyo within and above the permit area are shown on PLATE IX-1. These ephemeral arroyos drain into San Isidro Arroyo, which joins Arroyo Chico, a tributary of the Rio Puerco. The Rio Puerco flows southeastward to the Rio Grande. Surface water bodies within and adjacent to the permit area prior to mining are shown on PLATES IX-1, X-1 and XII-1.

Embankments have been constructed by the surface land owner (Fernandez Company, Ltd.) in the ephemeral drainages to capture the infrequent runoff as a source of water for livestock. No other use is made of the surface water within the permit or adjacent areas. The embankments located in the areas designated for mining will be removed as the mining approaches that area. LRCC proposes to retain the majority of the impoundments that are not removed during mining and impoundments constructed in reclamation areas as permanent structures. These structures will serve the same function as the embankments constructed by the surface land owner that are removed. Retention of as many impoundments as possible following mining was requested by the surface owner (Fernandez Company, Ltd.) in a letter to the MMD dated February 3, 1988. A copy of this letter is provided in EXHIBIT II-1.

Ground water in the Cleary Coal Member of the Menefee Formation is used exclusively by the surface owner as a source of water for livestock. Wells completed in the Point Lookout Sandstone are primarily used for stock water by the surface owner. The only well completed in the Point Lookout that is utilized for domestic purposes within the permit area is located at the Four Corners Cow Camp, which is owned by the Fernandez Company, Ltd. The Four Corners Cow Camp well is not used as a source of drinking water due to the poor quality of the water. Water wells occurring within and adjacent to the permit area are listed in TABLE X-1 and shown on PLATE X-1. Springs identified in and around the permit area are listed in TABLE X-2 and shown on PLATE X-1.

Water supply wells for the Lee Ranch Mine have been installed at two locations within the permit area. These two wells are completed in the Dilco Coal Member of the Crevasse Canyon Formation and the Gallup Sandstone, which are beneath the Point Lookout Sandstone. Water Well No. 1 is approximately 1,553' in total depth and Well No. 2 was completed to a depth of about 1,524'. A permit to appropriate 1,500 acre feet of ground water for use at the mine was approved by the New Mexico State Engineer's Office on December 30, 1982. The locations of these two water supply wells for the mine are shown on PLATE X-1.

Mining is expected to result in the removal of up to 11 domestic, stock and idle water wells and five springs within the permit area. The Four Corners Cow Camp well is the only domestic water supply well developed and utilized by the surface owner (Fernandez Company, Ltd.) that is expected to be removed during mining (see TABLE X-1 and X-2). Water wells uncovered or exposed by mining activities will be permanently closed unless approved for water monitoring, or otherwise managed in a manner approved by the Director, as provided for in Subparts 2001 and 2021 of 19 NMAC 8.2. The Four Corners Cow Camp well and any other wells utilized as a source of water by the surface owner that are permanently impaired by the mining operation will be replaced, modified or relocated. The five springs that are expected to be removed during mining are identified in TABLE X-2 on PLATE X-1.

Dr. Spring will not be destroyed by mining. The spring has been developed by constructing a spring box at the site and connecting the spring box to a piping system, overflow tank and livestock drinker. The overflow from the tank and drinker provides a source of water for livestock and wildlife, and shallow recharge for maintaining the wet portion of the swale in the vicinity. Beginning in 2008 through 2010, LRCC will inspect and maintain the pipe, tank, and drinker at Dr. Spring on a quarterly basis to insure sufficient water is available for providing a source of wildlife and livestock drinking water, and for maintaining wet conditions in the swale. LRCC will complete any repairs noted during quarterly maintenance visits within 30 days. If the increased maintenance inspections and repairs do not adequately maintain water availability at the spring and associated tank, drinker, and wet portion of the swale, or should the source of water to the spring box become significantly reduced as a result of mining-induced drawdown during the life of mining, LRCC will replace the source of water at Dr. Spring with a deep well completed in the Point Lookout Sandstone.

Any wetlands impacted as result of mining activities will be mitigated or re-established in consultation with U.S. Army Corps of Engineers. These two springs and any other springs that are permanently impaired by mining and do not recover following reclamation will be replaced with wells. Replacement well locations will be selected with the intent of enhancing the post-mining land use of rangeland. Alternative sources of water supply that could be developed to replace the existing sources are the Point Lookout Sandstone, the Crevasse Canyon Formation or the Gallup Sandstone. These aquifers are sufficiently isolated from the mining activities to provide a comparable quantity and quality of water. Surface mining is not expected to result in the contamination, diminution, or interruption of the ground

water source in wells or springs outside the permit area. The land use map showing the permit area is located in PLATE XII-1.

907.A(3). Surface and Ground Water Quantity

The quantity of surface water available within and adjacent to the permit area will be maximized to the extent possible during mining by diverting runoff from undisturbed areas away from or through disturbed areas. Backfilling and grading of the mining pits, drainage reconstruction, redistribution of topdressing materials that have properties similar to the native soils, and revegetation with species that naturally occur in the area are expected to result in post-mining surface water quantities that approximate the pre-mine conditions.

Mining activities will be restricted to the Cleary Coal Member of the Menefee Formation. The majority of the lithologic units constituting the Menefee are in an unsaturated condition. Ground water occurs in some of the sandstone units and coal seams in the Menefee Formation. Sandstone and coal within the Menefee are generally lenticular and tend to lack lateral continuity. Due to the discontinuous nature of the water-bearing units, any changes in the quantity of ground water in this formation are expected to be very localized and relatively minor. Significant ground water inflows have not previously been encountered in the mining pits at the Lee Ranch Mine. The major recharge area for the Menefee Formation or the underlying Point Lookout Sandstone will not be disturbed by mining. The dominant factor controlling the quantity of water available for recharge following mining will continue to be evapotranspiration. Excavation of the overburden/interburden and removal of restrictive shale layers are expected to increase vertical permeability and porosity in the backfill areas. Spoil permeability will likely approach the pre-mining conditions as settlement occurs. Considering the size of the area to be disturbed in relation to the total recharge area, any changes in recharge associated with the mining and reclamation operations will not be significant relative to the total recharge volumes. Minimizing the area of disturbance, and conducting backfilling and grading as contemporaneously as practicable with the mining operations are expected to adequately protect ground water quantities.

907.A(4). Water Quality for Underground Mines

No underground mines exist or are proposed for the permit area.

907.B(1). Surface and Ground Water Control

Impoundments, diversions, dikes, and sediment control measures will be used to control drainage into, through, and out of the permit area. Runoff from disturbed areas will be controlled using impoundments or other approved methods. Overland flow and runoff in ephemeral arroyos from undisturbed areas will be directed around or through disturbed areas using diversions and dikes. Sediment control measures will be used to stabilize critical areas, reduce overland flow velocities, decrease runoff volumes and retain sediment within disturbed areas.

Backfilling and grading to a stable landscape configuration, drainage reconstruction, topdressing redistribution, and revegetation are expected to result in runoff characteristics within and adjacent to the permit area that are similar to the pre-mine conditions. Haul roads, ramps, and final cuts in the dragline mining areas are planned to be developed as drainages following mining. Plans containing channel profiles and peak flow velocity calculations for major drainages created where haul roads, ramps, and final cuts existed in the dragline mining areas will be provided to the MMD prior to final grading.

The quantity of ground water that enters the mining pits will be controlled by minimizing the area of disturbance to the extent possible and conducting backfilling and grading as contemporaneously as practicable with the mining operations. Ditches, berms, and sumps will be used to control surface runoff and ground water in the pits. Water that accumulates in the pits may be used for dust suppression or pumped to impoundments, which will provide a source of water for livestock or wildlife. The ground water monitoring data presented in CHAPTER X for the Menefee Formation indicates that the water is suitable for livestock and wildlife consumption. A depressurization plan will be submitted to the MMD for review and approval prior to implementation in the event dewatering ahead of the mining operation is required to maintain suitable pit conditions. Significant ground water inflows have not previously been encountered in the mining pits at the Lee Ranch Mine.

907.B(2). Treatment Plan

Temporary and permanent impoundments are the only treatment facilities planned for surface and ground water drainage from disturbed areas. The impoundments are expected to be capable of providing the treatment required to meet the effluent limitations specified under Subpart 2010 of 19 NMAC 8.2 and in NPDES Permit No. NM0029581 for the Lee Ranch Mine.

The new five (5) year runoff control plan includes control and passage of clean water around and past the proposed active mining areas at Pit 6 and Pit 6 South. The diversions are essentially extensions of existing diversions and locations are shown on PLATE II-2. The diversions have been designed to safely pass a 100 year/24 hour storm event. The designs are contained in Section 911, Diversions.

Within the new five (5) year mining (disturbed) area temporary and permanent impoundments have been located, sized and designed to be capable of providing the treatment required to meet the effluent limitations specified under Subpart 2010 of 19 NMAC 8.2 and in NPDES Permit No. NM0029581 for the Lee Ranch Mine. The SEDCAD designs are contained in Section 909, Ponds, Embankments, Banks, Dams, Impoundments.

907.B(3). Restoration of Recharge Capacity

Mining will not occur in the major recharge areas for the Cleary Coal Member of the Menefee Formation or the Point Lookout Sandstone. The principal recharge area for the Menefee Formation and Point Lookout Sandstone is in and around the sandstone outcrops located to the south and southwest of the permit area. Recharge through the soil is limited by the high evapotranspiration rates characterizing the area. A discussion of the pre-mining recharge characteristics of the Menefee Formation and Point Lookout is presented in CHAPTER X.

The recharge capacity of the pre-mining and post-mining areas are expected to be similar. Evapotranspiration will continue to be the dominant factor controlling the quantity of water available for recharge following mining. Fracturing of the overburden/interburden and elimination of restrictive shale layers are expected to increase vertical permeability and porosity in the backfill areas. Permeability of the spoils will likely approach the pre-mining conditions as settlement occurs. The redistribution of approximately 1' of topdressing materials in a manner designed to minimize compaction will initially result in higher infiltration rates. The infiltration rates are expected to approach the pre-mining conditions over time. Considering the size of the area to be disturbed in relation to the total recharge area, any changes in recharge associated with the mining and reclamation operations will not be significant relative to the total recharge volumes.

907.B(4). Surface and Ground Water Monitoring Plans

A detailed description of the surface water monitoring program developed for the Lee Ranch Mine is provided in CHAPTER IX. The ground water and spring monitoring plans are described in detail in CHAPTER X.

907.C. Probable Hydrologic Consequences

The probable hydrologic consequences associated with the surface coal mining operations proposed to be conducted at the Lee Ranch Mine were assessed through an evaluation of relevant pre-mining environmental resources information and predicted post-mining conditions. Surface water, ground water, overburden/interburden, soils, topdressing, vegetation, and climatological data collected within and adjacent to the permit area were considered in the determination of the probable hydrologic consequences of the mining operation.

No significant adverse impacts are anticipated on the quantity or quality of surface water within the permit or adjacent areas due to the nature of the surface water system and the previously described protection measures. Surface water within the permit and adjacent areas is primarily ephemeral arroyos that flow only in direct response to storm events or snowmelt. Doctor Arroyo is the only surface water possibly classified as an intermittent stream receiving base flow from natural ground water discharge. No perennial streams occur in vicinity of the permit area. The watercourses throughout most of the permit area are broad, flat channels. Flow depths for the 10-year, 24-hour precipitation event are generally less than two feet. A detailed description of the surface water hydrology within and adjacent to the permit area is presented in CHAPTER IX.

Mining activities will be conducted in portions of the Mulatto Canyon and Arroyo Tinaja watersheds and several small tributaries to San Isidro Arroyo in the C mine area. An unnamed tributary to Doctor Arroyo will be affected. Watersheds for the major drainages that will be disturbed by mining are shown on PLATE IX-1. Monitoring data collected within the permit area indicates that the greatest amount of runoff occurs in the summer months. This corresponds to the season of highest precipitation. Runoff in the fall exceeds that in the winter and spring, due to the higher soil moisture contents and greater thunderstorm activity. These relationships are not expected to change as a result of mining, since the seasonal flow regimes in the ephemeral arroyos are closely related to the precipitation patterns in the area.

Soils and vegetation occurring within a watershed have a very marked effect on the amount of runoff. Redistribution of topdressing materials with properties similar to the pre-mining soils and revegetation with plant species that naturally occur in the area will minimize changes in runoff volumes within and adjacent to the permit area. Existing reclamation areas that have been topdressed and the pre-mining topsoil have a weighted mean texture of sandy loam. Post-mining infiltration rates are initially expected to be higher than the native soils due to the redistribution of topdressing materials in a manner designed to minimize compaction. This will result in a temporary reduction in runoff volumes. As the topdressing settles and vegetation becomes established, infiltration rates and runoff volumes are expected to approach the pre-mining conditions.

Development of rolling terrain in the dragline mining areas will increase the area in slopes, as shown on PLATE II-8. Potential increases in runoff volumes in these areas will be minimized through the use of sediment control measures and the creation of drainages with gradients and widths capable of promoting infiltration and conserving soil moisture. Considering the size of the dragline mining areas in relation to the total watershed area, changes in the quantity of surface water within or adjacent to the permit area are expected to be insignificant.

Impoundments used to contain runoff from disturbed areas are expected to result in a minor reduction in the quantity of surface water within the ephemeral arroyos. The majority of the impoundments that are not removed during mining will be retained as permanent impoundments. These structures will serve the same function as the embankments removed during mining that were previously constructed by the surface land owner to capture the infrequent runoff as a source of water for livestock. The diversion of runoff from undisturbed areas away from or through disturbed areas during mining and the reconstruction of drainages following mining are expected to minimize the potential for significantly altering the quantity of surface water within or adjacent to the permit area.

Surface water quality is not expected to be appreciably affected by the mining operations. Total suspended solids (TSS) contents are expected to be within the range of the pre-mining conditions. The use of impoundments, sediment control measures, topdressing materials with properties similar to the pre-mining soils, and revegetation of disturbed areas will minimize the potential for increases in TSS contents. A greater drainage density in the dragline mining areas will be used to encourage stability and reduce erosion.

Localized increases in total dissolved solids (TDS) may occur as a result of exposing topdressing materials that have not been recently subjected to weathering. Increases in TDS contents will be minimized by using topdressing materials with properties similar to the pre-mining soils. The existing topdressed areas have a weighted mean electrical conductivity that is below 4.0 mmhos/cm and a weighted mean sodium adsorption ratio that is less than 1.0. These values are well within the range of the pre-mine conditions. All of the post-mining topdressing samples are suitable with respect to the soil and soil substitute ratings in the New Mexico Overburden and Soils Inventory and Handling Guidelines.

Trace element concentrations are typically very low in the topdressing and overburden/interburden. The alkaline or calcareous nature of these materials will further limit the potential for iron, manganese, and the other trace element constituents from exceeding the baseline conditions. Isolation of unsuitable overburden/interburden materials from the potential root zone will minimize the potential for contact with surface water. This will effectively limit changes in surface water chemistry.

In summary, precipitation will be the dominant pre-mining and post-mining factor influencing the frequency, duration, and volume of runoff in the ephemeral arroyos within the permit and adjacent areas. Localized and temporary alterations in the quantity and quality of surface water are anticipated, but are not expected to persist following mining. The previously described mining and reclamation methods and protection measures will minimize the potential for significant adverse impacts on the surface water system.

Potential adverse impacts of the mining operation on the quantity and quality of ground water are expected to be relatively minor. A combination of aquifer characteristics, climatic conditions, and the planned mining, reclamation, and protection methods will be the primary factors minimizing adverse impacts.

The Cleary Coal Member of the Menefee Formation contains the minable coal seams. Ground water occurs in some of the sandstone units and coal seams in the Menefee. Sandstone and coal within the Menefee Formation are generally lenticular and tend to lack lateral continuity. The majority of the lithologic units constituting the Menefee are in an unsaturated condition. Transmissivities ranging from 0.69 to 4.81 gpd/ft. have been determined for the Menefee within and adjacent to the permit area. Due to the discontinuous nature of the water-bearing units and the low transmissivities reported for the Menefee, this formation is not considered to be a significant aquifer within the permit or adjacent areas. The limited utility of the Menefee as a source of water is evidenced by the fact that a single pre-mining well

(Fernandez), other than the monitor wells (D15-9 and E3-3) installed by SFPCC, has been completed exclusively in this formation within the permit or adjacent areas. Fernandez well is located approximately three miles southeast of the permit area (PLATE X-1) and will not be disturbed by mining. The quality of the water in the Cleary Coal Member of the Menefee Formation limits use to a source of water for livestock. A detailed description of the pre-mining ground water hydrology within and adjacent to the permit area is presented in CHAPTER X.

Excavation of the overburden/interburden materials and disruption of restrictive shale layers during mining are expected to increase the vertical permeability and porosity of the spoils. Permeability of the spoils will likely approach pre-mining conditions as settlement occurs. The quantity of water that percolates through the backfilled materials is expected to be limited by the high evapotranspiration rates characterizing the area. Recharge capacities of the pre-mining and post-mining areas are expected to be similar. Considering the size of the area to be disturbed in relation to the total recharge area, any changes in recharge will not be significant relative to the total recharge volumes.

Fracturing of the overburden/interburden and the temporary exposure of the materials to weathering has the potential to affect ground water quality. Increased vertical permeability and porosity prior to settlement of the spoils may result in greater solute leaching and higher total dissolved solids concentrations in the ground water. The low precipitation and high evapotranspiration rates characteristic of the permit area will minimize the quantity of water that contacts the spoils and enters the ground water system. Backfilling, grading, topdressing replacement, and revegetation as contemporaneously as practicable with the mining operation will limit the time that the spoils are exposed to weathering and leaching. Trace element concentrations are not expected to increase significantly due to mining. Pre-mining overburden/interburden samples collected within the permit area indicate that trace element concentrations are typically below water quality standards for drinking water and/or livestock water. The alkaline or calcareous nature of the overburden/interburden will decrease the solubility of many trace element parameters. Minor alterations in ground water chemistry will essentially be restricted to the permit area due to the discontinuous nature of the water-bearing units and the low transmissivities reported for the Menefee Formation. The combined effects of dilution, dispersion, and adsorption will further minimize changes to ground water quality.

The stratum immediately below the lowest coal seam to be mined is predominantly shale, which will form a barrier between the mining activities and the underlying Point Lookout Sandstone. At least 10' of undisturbed material will separate the Point Lookout Sandstone from the mining disturbance, unless previously approved by the Director. PLATE III-8 Isopach Map is reviewed to insure that at least 10' of undisturbed material is left in place above the Point Lookout Sandstone. Mining will not occur in the major recharge area for the Point Lookout Sandstone, which is in and around the sandstone outcrops located to the south and southwest of the permit area. The Point Lookout Sandstone is laterally continuous and exists in a confined condition throughout the permit area. Vertical permeabilities ranging from 0.1 to 0.51 gpd/ft^2 have been reported for the Point Lookout within and adjacent to the permit area. A limited amount of hydraulic communication is suspected of occurring between the Menefee Formation and the Point Lookout Sandstone due to faulting. Temporary lowering of the water levels in the Point Lookout Sandstone are anticipated in the vicinity of the active pits. Water level measurements indicate that the potentiometric surface of the Point Lookout Sandstone is dropping in the vicinity of monitor well PL-1.

The quality of the ground water in the Point Lookout Sandstone is not expected to be adversely impacted by the mining operations. This is attributable to the fact that the water in the Point Lookout Sandstone is at a head higher than the pit floor and pre-mining water table. It is expected, therefore, that there will continue to be flow upward from the Point Lookout before, during and after mining. The upward flow out of the Point Lookout Sandstone is expected to prevent adverse impacts on the quality of the water in this aquifer as a result of mining. Ground water monitoring information collected since 1983 at monitor well PL-1 has not revealed any changes in ground water quality within the Point Lookout Sandstone due to mining. The ground water monitoring plan described in CHAPTER X will be used to document any future changes that occur within the Point Lookout Sandstone.

Mining is expected to result in the removal of up to 11 domestic, stock and idle water wells and five springs within the permit area. The Four Corners Cow Camp well is the only domestic water supply well developed and utilized by the surface owner (Fernandez Company, Ltd.) that is expected to be removed during mining (see TABLE X-1 and X-2). Water wells uncovered or exposed by mining activities will be permanently closed unless approved for water monitoring, or otherwise managed in a manner approved by the Director, as provided for in Subparts 2001 and 2021 of 19 NMAC 8.2. The Four Corners Cow Camp well and any other wells utilized as a source of water by the surface owner that are permanently impaired by the mining operation will be replaced, modified or relocated. The five springs that are expected to be removed during mining are identified in TABLE X-2 and on PLATE X-1. Replacement well locations will be selected with the intent of enhancing the post-mining land use of rangeland. Alternative sources of water supply that could be developed to replace the existing sources are the Point Lookout Sandstone, the Crevasse Canyon Formation, or the Gallup Sandstone. These aquifers are sufficiently isolated from the mining activities to provide a comparable quantity and quality of water. Water wells used for the mining activities will be retained by the land surface owners enhancing the post mining land use.

Dewatering of the mine pits will result in lowering of the potentiometric surface within the Menefee Formation in the immediate vicinity of the permit area. The mine pits may require about 1000 years to resaturate. Groundwater modeling of the Point Lookout indicates minimal impacts to that aquifer.

909 . PONDS, IMPOUNDMENTS, BANKS, DAMS, EMBANKMENTS

Impoundments will be installed before surface mining activities are initiated in the drainage area to be disturbed. Temporary impoundments will be used individually or in series to contain the runoff from the 100-year/6-hour or safely pass a 25 year/6 hour precipitation event. A combination of excavated impoundments and embankment type impoundments may be constructed in future mine areas to receive water that accumulates in the pits and contain runoff from disturbed areas. The typical design of the excavated impoundments is shown on FIGURE II-5. The outlet side of an excavated impoundment is considered the spillway, since these structures are totally incised below the ground surface. A typical design for the embankment type impoundments is presented on FIGURE II-6. Detailed design plans and locations for future impoundments will be submitted to the MMD for review and approval prior to construction. The impoundments will be designed and constructed in accordance with Subparts 2015 and 2017 of 19 NMAC 8.2.

Locations of the impoundments currently existing within the permit area and approved by the MMD are shown on PLATES IX-44 and IX-45. Impoundments SP-1 and SP-2 are designed to capture water from the mine facilities and hold ground water from wells for use in dust suppression. EVAP-2 is designed to receive water that has passed through the sewage treatment system for the mine. The other impoundments

constructed within the permit area are used to receive water that accumulates in the pits and control sediment from disturbed areas.

Any future impoundments with dams or embankments will be examined for signs of structural weakness, erosion, and other hazardous conditions four times per year. The existing and future impoundments will be maintained as needed to ensure proper functioning.

LRCC proposes to retain the majority of the impoundments that are not removed during mining as permanent structures. SP-1, EVAP-1, EVAP-2, SP-3 and SP-5 are the only impoundments outside the area to be mined that are presently planned for removal. These impoundments and any future impoundments that are not approved for retention as a permanent structures will be removed in accordance with Subpart 2014.K of 19 NMAC 8.2. The impoundments constructed in reclamation areas will be typically retained as permanent structures. Water levels in the permanent impoundments will be dependent upon precipitation. The permanent impoundments are expected to be dry for a portion of most years due to the ephemeral nature of the contributing drainages and the semi-arid to arid conditions existing within the permit area. Permanent impoundments will provide a source of water for livestock, which is compatible with the post-mining land use of rangeland. The permanent impoundments are intended to supplement other water sources which will enhance the livestock carrying capacity of the reclaimed areas. Vegetative cover and the nontoxic soil material will allow water quality standards to be met. Retention of as many impoundments as possible following mining was requested by the surface owner (Fernandez Company, Ltd.) in a letter to the MMD dated February 3, 1988. A copy of this letter is provided in EXHIBIT II-1. Permanent impoundments will be located in areas to encourage proper livestock distribution and minimize erosion.

No coal processing waste banks, dams, or embankments are planned to be constructed within the permit area.

911. DIVERSIONS

Diversions and dikes will be used to direct overland flow and runoff in ephemeral arroyos from undisturbed areas around or through disturbed areas. Temporary and permanent diversions/dikes will be designed, constructed, and maintained to divert water to treatment facilities or prevent undisturbed water from entering treatment facilities from the peak runoff of a 10-year, 24-hour precipitation event. A typical design for the channel type diversions is presented on FIGURE II-7. The typical design of a dike is shown on FIGURE II-8. Detailed design plans and locations for diversions and dikes will be submitted to the MMD for review and approval prior to construction. The diversions and dikes will be designed, constructed, and maintained to prevent additional contributions of suspended solids to stream flow and runoff outside the permit area, to the extent possible. Sediment control measures that may be used to stabilize diversions and dikes include channel linings, vegetation, roughness structures, detention basins, riprap, straw dikes, erosion-control fabric, and other effective methods.

The approved diversions and dikes presently existing within the permit area are shown on PLATES IX-44, IX-45 and IX-48. Existing diversion designs are shown on plates IX-38 through IX-41. Appendix IX-5 contains typical design calculations for diversions. Arroyo Tinaja Diversion, Desliz Dike, and the western 3700' of the Mulatto Canyon Diversion are planned to remain as permanent diversions. Piedra Dike, the eastern portion of the Mulatto Canyon Diversion, and the Mulatto Dike will be modified to permanent diversions in the future. As temporary diversions are modified to permanent diversions the detail design will be submitted and approved by MMD. Temporary diversions and dikes will be removed in accordance with Subpart 2011.E of 19 NMAC 8.2 when no longer needed. The watersheds for the diversions and dikes are shown on plate IX-48.

The fractured sandstone used to construct the permanent Desliz Dike and temporary Mulatto Dike has provided a suitable plant growth medium resistant to erosion. The establishment of perennial grasses has been very successful re-seeding or the application of topdressing will not be necessary. Dikes will be sampled prior to or directly after seeding. Samples will be collected to a depth of 1' every 400' along the dikes. The samples will be submitted to a laboratory for analysis of pH, electrical conductivity, texture, soluble sodium, soluble calcium, and soluble magnesium in accordance with the New Mexico Overburden and Soils Inventory and Handling Guidelines dated March 1987. Analyses results from the samples will be compared to the MMD Soil and Soil Substitute Suitability Ratings. Areas with materials that are not suitable as a plant growth medium will be covered with approximately 1' of suitable topdressing material. Future diversions and dikes constructed within the permit area may be sampled, evaluated, and revegetated in the same manner.

The Piedra Dike was constructed using suitable topdressing materials. The dike was seeded with the permanent seed mixture and mulched during 1990. This temporary dike will be utilized as a source of topdressing between 2007 and 2010 when no longer needed to direct undisturbed runoff around disturbed areas.

Ditches and berms will be utilized to convey runoff from disturbed areas into impoundments and for sediment control. The ditches and berms used to transport water into temporary and permanent impoundments will be capable of safely passing the peak runoff from the 10-year, 24-hour precipitation event. A combination of ditches, berms, riprap, contour furrows, straw dikes, dugout ponds, earthfill or rock check dams, and other effective methods will be used to reduce overland flow velocities, decrease runoff volumes, or retain sediment within disturbed areas. These sediment control measures will be installed in appropriate locations using standard accepted methods.

CHAPTER IX

SURFACE WATER HYDROLOGY

805. INTRODUCTION

A study of the surface water flow patterns and sedimentation characteristics, on and upstream from the permit area, was undertaken to develop estimates of flows, sediment yields, and soil loss in the vicinity of the Lee Ranch Mine. Also included is a surface water monitoring plan for the permit area and existing surface water diversion and sedimentation structure as-builts.

The permit area lies east of the continental divide. The western portion of the mine area is drained by Mulatto Canyon, Arroyo Tinaja, and several small tributaries to San Isidro Arroyo. San Isidro Arroyo and Doctor Arroyo are the major drainage in the eastern portion of the mine area. Watersheds for Mulatto Canyon, Arroyo Tinaja, San Isidro Arroyo and Doctor Arroyo within and above the permit area are shown on PLATE IX-1. These ephemeral arroyos drain into San Isidro Arroyo, which joins Arroyo Chico, a tributary of the Rio Puerco. The Rio Puerco flows southeastward to the Rio Grande. Surface water bodies within and adjacent to the permit area prior to mining are shown on PLATES IX-1, X-1 and XII-1. The ephemeral arroyos passing through the permit area flow only in direct response to storm events and have channel bottoms that are above the local water table. The water courses throughout most of the permit area are broad, flat channels. The flow depths for the 10-year, 24-hour event are generally less than two feet.

Watersheds that have the potential to receive water discharges from the mining operations are Mulatto Canyon, Arroyo Tinaja, and San Isidro Arroyo in the western area. The Doctor Arroyo and San Isidro Arroyo watersheds could potentially receive water discharges in the eastern area. All of these watersheds drain into Segment 2-105 of the Rio Grande Basin.

DISCHARGE CONDITIONS

Seven points within the permit area were selected for hydrologic evaluation. The points were evaluated under pre and post-mining conditions, post mining conditions were evaluated assuming all disturbed areas had been reclaimed to the approximate original contour plan as described in CHAPTER II. Peak flows during mining are not expected to change very much from the pre-mining conditions as only a small portion of any watershed will be disturbed at a particular time over the course of mining.

Since stream gage data is not available for the drainages in the permit area, all arroyo flows developed in this chapter are based on rainfall runoff relationships. The procedures used are those developed by the USDA, Soil Conservation Service for use on watersheds where stream flow records are not available.

Watershed characteristics and precipitation-frequency data were used in conjunction with a mathematical model (USDA-SCS, 1971) to arrive at runoff volumes and peak flows for various frequency precipitation events. The hydrography developed as a part of this study was developed using the unit hydrograph procedure as adopted and used by the Soil Conservation Service (USDA-SCS, 1971). The analyses were performed on a Hewlett Packard Model 9825T mini-computer at the offices of Metric Corporation in Albuquerque, New Mexico.

The hydrograph at a particular point is dependent upon the size of the area that contributes runoff to the point, as well as the characteristics of the area. PLATE IX-1 depicts the watersheds above each prediction point for pre-mining conditions. PLATE IX-2 shows the watersheds for post-mining conditions.

The soils and the types and density of vegetation occurring within a watershed have a major effect on the amount of runoff. In the methods utilized in this study, the amount of runoff is determined by the combined effect of soil and vegetative cover. The runoff curve number is a function of the watershed soils and vegetative cover.

Soils in the watersheds above the prediction points were grouped into four hydrologic soil groups according to their infiltration rates and hydraulic characteristics. The hydrologic soil groups are A through D with high to very low infiltration rates, respectively (USDA-SCS, 1971). The soils in the watersheds were mapped from unpublished USDA-SCS and US Forest Service soil surveys.

Vegetation affects runoff in several ways. The foliage and its litter maintain the soil's infiltration potential by preventing the sealing of the soil surface from the impact of raindrops. Some moisture intercepted by foliage is evaporated back to the atmosphere. Vegetation forms numerous barriers along the path of water flowing over the surface of the land. The density of the vegetation or percentage of ground cover has a very marked effect upon the peak discharge which can be expected from a watershed. Cover densities and types within the watersheds were determined based on field measurements of line intercept transects. For the post-mining conditions, vegetation cover values for the total reclaimed areas were estimated from transect measurements taken on the existing reclaimed portion of the mine. Vegetation cover densities and types were used to determine appropriate runoff curve numbers for each soil type within the watersheds. Weighted average curve numbers were determined for the watersheds above each prediction point as outlined in EXHIBITS IX-1 through IX-7 for pre-mining conditions and

in EXHIBITS IX-8 through IX-11 for post-mining conditions. The line intercept transect locations are shown on PLATE IX-1.

As the area of a watershed increases, the average rainfall for a particular frequency event tends to decrease. This relationship is plotted on FIGURE IX-1 and is extracted from USDC-NOAA, 1973. The appropriate areal correction factors are presented in EXHIBITS IX-1 through IX-7.

The shape of a hydrograph and the peak flow from a watershed are greatly dependent upon the time of concentration of the watershed. The time of concentration (T_c) is defined as the time required for the runoff to travel from the hydraulically most distant point of a watershed to the prediction point. In hydrograph development utilizing the unit hydrograph theory, Watershed Lag (a function of T_c) is used rather than the time of concentration. Watershed lag is the weighted average time of concentration.

The method used to determine the time of concentration for this study is the Modified Kirpich or California Department of Highways method.

The equation is as follows:

$$T_c = \frac{11.9\,L^3}{H}^{.385}$$

T_c = time of concentration (hours)

L = length of longest watercourse (miles)

H = elevation of difference (feet)

This equation is also presented in nomograph form in SCS, 1973.

Watershed Lag is subsequently estimated as:

$$\text{Lag} = 0.6\,T_c$$

Rainfall intensity has a very significant effect on the peak runoff from a watershed for a storm of a given rainfall. To account for this, a rainfall distribution curve typical of the project area was incorporated into the analysis. FIGURE IX-2 depicts this relationship. It is a redistributed logarithmic curve with 70% of the 24-hour rainfall occurring within one hour, and the maximum intensity occurring at six hours.

For these analyses, point rainfalls were determined for a point near the centroid of the watershed area. Basic 24-hour rainfalls for 2, 5, 10, 25, 50 and 100-year storms were determined by linear interpolation between the isopluvial lines. The rainfalls were converted to the annual series and then plotted on log-normal probability paper. To obtain consistency in the precipitation frequency data, a straight line was fitted to the points and the 2- through 100-year values were read from the line. The plots for each watershed are presented in EXHIBITS IX-1 through IX-7.

The values from the annual series plots represent point rainfalls. They were subsequently converted to areal rainfalls for the watershed corresponding to each prediction point by the relationship presented in the USDC-NOAA, 1973 (FIGURE IX-1).

Peak discharges for both the pre-mining and post-mining watersheds are summarized in TABLE IX-1, and runoff volumes are summarized in TABLE IX-2. Average annual runoff at each of the prediction points was determined using the procedures in USDA-SCS, 1985. The average annual runoff for the Lee Ranch Mine area is 0.2”/year as determined from EXHIBIT 2-1 in USDA-SCS, 1985. The watershed yield for each prediction point was calculated by multiplying the average annual runoff by the watershed area in acres and dividing by 12 to get acre-feet. The results for both the pre and post-mining conditions are presented in TABLE IX-3. Minimum discharge conditions and critical low flows for the ephemeral arroyos within the permit area are zero, since the arroyos flow only in direct response to precipitation and have channels that are above the local water table. Cross sections and stage discharge curves for each prediction point are presented in APPENDIX IX-1.

Impacts to discharges by mining are minimal as shown on TABLES IX-1 and IX-2. The 10 year 24 hour peak discharges will increase by a maximum of 210 cfs, (6%), at prediction point PP-4. The maximum change in runoff volumes is 65 acre feet at PP-4 for the 10 year 24 hour event. These increases are primarily due to slight increase in the watershed curve numbers and secondarily due to changes in watershed areas for some watersheds.

SURFACE WATER QUALITY

Surface water within the permit area is confined to ephemeral arroyos. The water courses at Points A and B (see PLATE IX-1) are broad flat channels. Surveyed cross-sections for Points A and B are presented on FIGURES IX-3 and IX-4, respectively. The maximum flow depth for the 10-year, 24-hour event is less than 1.5’ in each case. The average velocity for the 10-year event is 3.7’/second at Point A, and 3.4’/second at Point B. The water surface is in excess of 1,000’ wide for the 10-year flow in each case.

Channel bed materials were sampled at Points A and B. Grain size distribution analyses are presented for Point A in TABLE IX-4, and for Point B in TABLE IX-5. The analyses show that the channel bed materials at both points are clay soils with 80-90% of the material finer than 0.5 mm, indicating that virtually all sediment is transported as wash load.

Bed load material has its source in the bed of the stream, whereas the wash load originates from an external source, primarily from erosion in the upstream watershed. While Mulatto Canyon is carrying a substantial bed load where it enters the permit area at Prediction Point 6 (see PLATE IX-1), the channel geometry and bed materials render it incapable of carrying anything more than a truly suspended wash load by the time it leaves the permit area at Prediction Point 4.

The average flow velocities for the 10-year storm event of 3.7’ and 3.4’/second at Points A and B, respectively, are less than the allowable velocity of 3.9’/second specified for compact clays by Lane, 1955. This further confirms that the flows leaving the permit area are non-erosive and incapable of transporting channel bed materials.

Soil Loss and Sediment Yields

In order to evaluate soil loss impacts within the permit area and the watersheds above it, a soil loss survey was conducted. Average soil loss values were determined for each of 24 soil mapping units and the post mining reclaimed area. The Universal Soil Loss Equation (USLE), as developed by the U.S. Department of Agriculture, Soil Conservation Service, was used for the study.

The procedures used in this study are presented in USDA-SCS, Technical Release No. 51, Rev. January 1975, and further refined for New Mexico conditions in USDA-SCS, New Mexico Conservation Agronomy Technical Note No. 28, October 1975. The Universal Soil Loss Equation, A = RK(LS)CP, is used to estimate sheet and rill erosion.

A = Estimated average annual soil loss in tons per acre per year.

R = Rainfall factor. It is the number of erosion-index units in a normal year's rain. The erosion-index is a measure of a specific rainfall. The R value for the Lee Ranch Mine area is 20.

K = The soil erodibility factor. It is a measure of the erodibility of a specific soil. Soil properties that influence erodibility by water are: (1) those that affect the infiltration rate, permeability and total water holding capacity; and (2) those that resist dispersion, splashing, abrasion, and transportation forces of the rainfall and runoff. K-factors were determined by using Wischmeier's Nomograph with grain size distributions determined by laboratory analysis of soil samples taken from each soil series. Post-mining K values were averaged from K values determined from soil samples taken on the existing reclaimed areas. Values were determined for each of two mapping units delineated by topographic slope. Average K values for each mapping unit are presented in APPENDIX IX-2. Laboratory reports are presented in APPENDIX IX-3.

LS = The slope-effect factor. It is a function of slope length and slope gradient determined by field measurements. The slope length is defined as the distance from the point of origin of overland flow to the point where (1) slope decreases to the extent that deposition begins, or (2) runoff enters a defined channel. The slope gradient factor is the predominant slope for the particular soil or area. Post-mining slope lengths for estimated transects were taken as the average of measured reclaimed area slope lengths. Slope gradients for the post-mining estimated transects were measured from the AOC map at the locations where transects are plotted (PLATE IX-1). The LS-factors were interpolated from TABLE 3 (page 12) in Agriculture Handbook 537 (USDA-SEA, 1978).

C = The cover factor. It is a measure of the cover and management variable plus the growth stage and vegetal cover at the time of the rain. Vegetative cover was measured in the field at several locations within each mapping unit. The C-factors were interpolated from TABLE 6 (page 12) in Technical Note 28 (USDA-SCS, 1984). The C factor used in the post-mining evaluation was estimated by plotting measured reclaimed area C factors against the number of years since the area had been reclaimed. Using curve fitting methods on the data collected between years 5 through 11 a C value of 0.18 was selected as representative after 10 years of reclamation. The data collected within the last 5 years

was discarded as possibly being affected by reclamation operations such as mulch litter and weeds. The graph is presented as FIGURE IX-5.

P = The erosion control practice factor. It is a measure of the effectiveness of any erosion control practices. For no practices, the value is 1.0.

Soil loss values were determined for each significant soil series present in the area by the USLE method. Weighted average soil loss values for each soil mapping unit were then determined. The soil mapping unit names used during the original soil survey within and adjacent to the permit area have been revised to reflect the soils presently recognized in McKinley County by the SCS. Soil loss values calculated for the mapping units within and adjacent to the permit area, including post-mining reclaimed areas, are presented in TABLE IX-6. Post-mining reclaimed areas were divided into two separate units based on topographic slope. Supporting data for the USLE calculations are presented in APPENDIX IX-2.

It is recognized that a large watershed tends to deliver a smaller percentage of eroded soil to a reservoir or reference point than does a small watershed. In other terms, a large watershed has a smaller delivery ratio than does a small watershed. The following equation, developed by A.D. Bull and currently in use by the USDA-SCS in New Mexico, has been used to determine average annual sediment yields for each prediction point. The results for both the pre and post-mining conditions are presented in TABLE IX-7.

$$C = \frac{52.17}{A^{0.142}}$$

where:

A = drainage area in square miles

C = delivery ratio in percent

Permit Area Pre-Mining and Post-Mining Erosion Rates

Pre-mining erosion rates were determined for the Lee Ranch Mine permit area using the Universal Soil Loss Equation. The pre-mining erosion rates are used as a standard in designing the post-mining topography and topdressing applications. The objective of the pre-mining erosion rate measurements and post-mining configuration design is to ensure the long term erosion stability of the reclaimed areas by demonstrating that the pre-mining and post-mining erosion rates are comparable.

Pre-mining erosion rate measurements were made on undisturbed lands within and adjacent to the permit area to represent pre-mining conditions as described in the previous section. The pre-mining permit area erosion values are presented in TABLE IX-8. Mapping unit average soil loss values were subsequently computed.

Post mining soil loss values were determined using a combination of measured and estimated USLE transects. The AOC map was divided into two distinct units based on topographic slope with the break point at slopes greater than or less than 10%. A total of 33 USLE transect measurements were performed on existing reclamation areas at the Lee Ranch Mine. Average "K" values from the measured transects were used in the estimated soil loss calculations. A "C" value of 0.18 for the estimated transects was determined as described in the C factor discussion above. Slope lengths were taken as the average of the measured transect slope lengths for the estimated transects. Slope gradient measurements for the estimated transects were taken from the AOC plan. Calculations supporting the USLE evaluation are supplied in APPENDIX IX-2. The results of the post-mining soil loss evaluation are presented in TABLE IX-9. Pre and post-mining soil mapping units and transect locations are shown on PLATES IX-3 and IX-4.

The results of the pre and post-mining erosion rate calculations indicate a slight increase in the erosion rate will occur within the permit area following mining. Although the post-mining rate is slightly higher (0.47 tons per acre per year, vs. 0.32 tons per acre per year) it still within the same range as the pre-mining rate and is well below the allowable rate of 3 tons per acre per year indicated in TABLE 1 of Tech Note 28 for landscape stability. The change in the erosion rate is also small enough to assure post mining surface water quality will not be impacted by mining as suspended sediment is a function of the energy available in the flow rather than the availability of sediment.

Surface Water Monitoring Information

Surface water monitoring stations were installed at four locations within or immediately adjacent to the approved Permit No. 19-1P boundary during October 1981. Monitoring station locations were selected using information derived from pre-mining hydrologic investigations. The pre-mine analyses revealed that the Mulatto Canyon and Arroyo Tinaja drainages were the major watersheds within the original permit area. Mulatto Canyon and Arroyo Tinaja are classified as ephemeral arroyos. Stations 1 and 4 were established in the Mulatto Canyon drainage where it entered and exited the original permit area, respectively. Monitoring stations 5 and 6 were installed where Arroyo Tinaja entered and exited the Permit No. 19-1P area, respectively, A fifth monitoring station (#2) was established during November 1985 near the end of the Mulatto Canyon Diversion where it meets the original drainage channel. Monitoring stations 7 and 8 have been added to gain background information. Monitoring station 9 has been added to the gravel pit area. Proposed monitoring stations 10, 11, 12, 13, 14 and 15 will be installed to monitor the additional watersheds and replace stations which will be destroyed by mining.

A crest-stage gauge capable of measuring flow depths up to five feet was installed at each monitoring location. The design of the crest-stage gauges is shown on FIGURE IX-6. A pair of single stage sediment samplers, each with the capacity to collect a one-liter sample at two different flow depths, are located at each monitoring station. The single stage sediment samplers used at the mine are similar to those developed by the USGS for water quality and sediment sampling on remote ephemeral streams in New Mexico. A typical design for the single stage sediment sampler is shown on FIGURE IX-7.

Surface water monitoring consists of checking the stations on a monthly or noticeable event basis depending upon access to the monitors. Flow depths are recorded and water samples collected each month that measurable surface runoff has occurred. Analyses results for 125 surface water samples collected between 1982 and 1998 and the corresponding flow depths are presented in TABLE IX-10.

Seasonal variations for 1982 through 1989 in surface water flows and quality are evident when the data is grouped according to season. Mean flow depths and parameter values for each season are summarized in TABLE IX-11. Of the 125 samples collected, 65 of the samples (52%) were obtained in the summer, 36 (28.8%) in the fall, 14 (11.2%) in the winter, and 10 (8%) in the spring. Surface runoff is directly related to the type and seasonal distribution of precipitation in the area. Approximately 47% of the annual precipitation is received during the summer months. Summer precipitation typically occurs as a result of brief, localized thunderstorms. The more intense summer thunderstorms are generally responsible for the majority of the annual surface runoff. The fall and spring months account for about 17% and 22% of the mean annual precipitation, respectively. Precipitation received during these two seasons occurs as a combination of light rain, snow, and occasional thunderstorms. The fact that twice as many samples have been collected in the fall than in the spring is related to higher soil moisture contents and greater thunderstorm activity during the fall. Winter is normally the driest, with approximately 14% of the annual precipitation occurring during this season. Precipitation usually occurs as light rain or snow. Surface runoff following these precipitation events is commonly minimal.

Seasonal variations in surface water chemistry are evident upon review of TABLE IX-11. Dissolved constituents and trace element contents in the surface water samples are generally lowest in the winter and highest during the fall. The lower concentrations of these parameters in the winter months are at least partially attributable to freezing of the upper soil horizons. The mean total suspended solids (TSS) values were lowest in the winter and highest in the spring, as shown in TABLE IX-11. An increase in TSS normally occurs as discharge increases. This relationship is not apparent in the mean TSS values, since average flow depths were lower in the spring than any other season. Loosening of the soil surface through freeze-thaw action is suspected of being responsible for the higher TSS content of the spring water samples. The mean total dissolved solids (TDS) concentrations were highest in the summer and lowest in the winter. Total dissolved solids usually decrease as discharge increases. The reversal of this tendency is possibly related to the increased movement of soluble constituents in the soil profile during the summer.

Mean, minimum and maximum parameter values are summarized in TABLE IX-12. The majority of the parameters were compared to livestock water quality criteria developed by the Environmental Protection Agency (EPA, 1976). Drinking water standards developed by the New Mexico Water Quality Control Commission (WQCC, 1988) and effluent limitations specified in Subpart 2010(a)(8) of 19 NMAC 8.2 were utilized to evaluate parameters without EPA stock water quality criteria. These comparisons revealed that the two major ephemeral streams within the permit area have baseline total suspended solids, sulfate, arsenic, barium, cadmium, iron, lead, and manganese that exceeded the respective water quality standards. The sulfate, barium, and dissolved manganese deviations are not considered significant since these parameters were compared to drinking water standards.

The parameter values for all of the surface water samples are considered to represent baseline conditions since runoff from areas disturbed by mining is contained by sediment control structures. This suggests that surface water in the Mulatto Canyon and Arroyo Tinaja drainages has total suspended solids, sulfate, arsenic, barium, cadmium, iron, lead and manganese concentrations that exceed the various water quality standards under natural or baseline conditions.

The infrequent flows and quality of the water in the ephemeral arroyos within the permit area limits use to a source of water for livestock and wildlife. Locations of the pre-mining surface water bodies existing within the permit area are shown on PLATES IX-1, X-1 and XII-1.

Potential affects of mining on the quantity and quality of surface water are addressed in CHAPTER II.

SURFACE WATER MONITORING PLAN

Lee Ranch Mine in October 1990 eliminated surface water monitoring at Station 2, relocated Stations 4 and 6, and established two new stations in the D mine area on the unnamed tributary to Doctor Arroyo. Continued sampling at Station 2 was considered unnecessary, since surface mining activities are presently being conducted "downstream" from this monitoring location in the Mulatto Canyon watershed. The relocation of Stations 4 and 6 provide surface water quality data where the Mulatto Canyon and Arroyo Tinaja drainages exit the permit expansion area, respectively. Stations 4, 6, 7 and 8 locations are shown on PLATE IX-1. Installation of six stations in the permit area has established a baseline water quality in the eastern portion of the permit area. The monitoring stations have a five foot crest-stage gauge and two single stage sediment samplers similar in design to the existing stations.

Lee Ranch Mine will continue to check the surface water monitoring stations on a monthly or noticeable event basis depending upon access to the monitors. Flow depths will be recorded and samples collected during each month that sufficient surface runoff has occurred. The water samples will be submitted to a laboratory for analysis within the storage times recommended for each parameter by the EPA. Analyses will be performed in accordance with Standard Methods for Examination of Water and Wastewater published by the American Public Health Association and any applicable EPA guidelines. The analyses results will be reported to the MMD on a quarterly basis.

Based upon comparisons of the surface water data collected since 1982 with water quality standards (TABLE IX-10), LRCC proposes to analyze future samples collected at existing Stations 1 and 5 and relocated Stations 4 and 6 for the parameters listed in TABLE IX-13. Analyses results from previously collected surface water samples indicate that the other parameters listed in Subpart 2009.E(3)(i) of 19 NMAC 8.2 are of little or no significance at these locations. Surface water samples obtained at the six new stations in the expansion area have been analyzed for the parameters presented in TABLE IX-14 for at least two years. Samples collected during subsequent years from these two monitoring stations may be analyzed for a reduced list of parameters based upon the results from the initial two years. The data from all of the monitoring stations will be periodically evaluated to determine if additional parameters should be added or eliminated.

909. PONDS, IMPOUNDMENTS, BANKS, DAMS, EMBANKMENTS

Impoundments will be installed before surface mining activities are initiated in the drainage area to be disturbed. The impoundments are used individually or in series to contain the runoff from the 100-year/6-hour or safely pass a 25 year/6 hour precipitation event. Spillways of permanent impoundments will meet the 50-year, 6-hour event for the spillway. A combination of excavated impoundments and embankment type impoundments may be constructed in future mine areas to receive water that accumulates in the pits and contain runoff from disturbed areas. Proposed impoundments will be submitted to the MMD for review and approval prior to construction.

All impoundments will be capable of safely containing or treating a 10-year/24-hour event as required by Subparts 2009.D(1), 2010.A(1), 2010.B(1), 2014.C. All impoundments will be designed and constructed in accordance with Subparts 2015 and 2017 of 19 NMAC 8.2. Hydrologic calculations for impoundments and diversions are located in Appendices 29-63 of this chapter. The existing and future impoundments will be maintained as needed to ensure proper functioning.

As-builts for all current impoundments are shown on PLATES IX-5 through IX-43. Locations of the impoundments currently existing within the permit area and approved by the MMD are shown on PLATES IX-44 and IX-45.

911. DIVERSIONS

Diversions and dikes will be used to direct overland flow and runoff in ephemeral arroyos from undisturbed areas around or through disturbed areas. Temporary and permanent diversions/dikes are designed, constructed, and maintained to safely pass the peak runoff from 2-year, 24-hour and 10-year, 24-hour precipitation events, respectively. Arroyo Tinaja, Desliz Dike, and the western 3700' of the Mulatto Canyon Diversion are the currently existing diversions that are planned to be permanent. The temporary portion of the Mulatto diversion will be modified to become permanent at the final AOC. Prior to construction of the additional permanent portion of the Mulatto diversion plans and maps will be submitted and approved by MMD. The locations of approved diversions and dikes presently existing within the permit area are shown on PLATE IX-48. Existing diversion designs are shown on Plates IX-38 through IX-41. Arroyo Tinaja Diversion, Desliz Dike, and the western 3700' of the Mulatto Canyon Diversion are planned to be permanent. Piedra Dike, the eastern portion of the Mulatto Canyon Diversion, and the Mulatto Dike may be removed or relocated in the future. Temporary diversions and dikes will be removed in accordance with Subpart 2011.E of 19 NMAC 8.2 when no longer needed.

Ditches and berms are utilized to convey runoff from disturbed areas into impoundments and for sediment control. The ditches and berms used to transport water into temporary and permanent impoundments are capable of safely passing the peak runoff from the 10-year, 24-hour precipitation event.

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PLATES IX-28 – IX-29 REMOVED FOR E-PERMIT

PLATE IX-30 - P35-90-1 AS-BUILT

PLATE IX-31 - P35-90-2 AS-BUILT

PLATES IX-32 – IX-36 REMOVED FOR E-PERMIT

PLATE IX-37 - INNER LOOP IMPOUNDMENT P34-94-01

PLATE IX-38.1 - MULATTO CANYON DIVERSION DESIGN

PLATE IX-38.2 - MULATTO CANYON DIVERSION DESIGN

PLATE IX-38.3 - MULATTO CANYON DIVERSION DESIGN

PLATE IX-39 - ARROYO TINAJA DIVERSION DESIGN

PLATE IX-40 - DESLIZ DIKE DIVERSION DESIGN

PLATE IX-41 - PIEDRA DIKE DIVERSION DESIGN

PLATE IX-42 - POND “AS-BUILT” FOR P23-96-01

PLATE IX-43 - POND “AS-BUILT” FOR P25-94-1 AUGUST 1995

PLATE IX-44 - CURRENT SURFACE WATER CONTROL MINE SITE

PLATE IX-45 - CURRENT SURFACE WATER CONTROL GRAVEL PIT

PLATE IX-46 – WATERSHED AREA

REMOVED FOR PERMIT MODIFICATION 10-04

PLATE IX-48 – DIVERSION WATERSHED MAP