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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Act 1007/004
#2

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TO: Daron Haddock, Permit Supervisor

FROM: Paul Baker, Reclamation Biologist *PBB*

RE: Draft Review, Crandall Canyon Mining and reclamation Plan, Castle Gate Mine, Amax Coal Co., ACT/007/004-95D, Working File, Carbon County, Utah *#2*

SYNOPSIS

The majority of Division Order 94A concerned revising the Crandall Canyon mining and reclamation plan. The portion dealing with biology is item No. 3. It says:

R645-301-300. Biology. The permittee must provide plans to protect reclaimed areas which show adequate seedbed preparation plans, separate application of seed and fertilizer so that they will not be mixed in the hydroseeder, plans for the use of the supplemental planting mix for ephemeral/intermittent drainages, including locations shown on the reclamation maps and timing of the planting operations, and the final revegetation plans for the cut and fill slopes associated with the Crandall Canyon facilities and access road. Planting, mulching, seeding, and seed mixes proposed should correspond with the information provided in Chapter IX. Reference areas or other standards for measuring success need to be provided in the plan for evaluation of the reclaimed areas to demonstrate reclamation success.

Although this item restricts the requirements of the Division Order to specific items, this review evaluates compliance with all applicable aspects of the biology regulations with the exception of those that apply to the entire mine or that do not affect the reclamation plan. The exceptions are fish and wildlife information, operational fish and wildlife protection plans, subsidence mitigation, and interim revegetation. These plans are presented elsewhere in the mining and reclamation plan.

The proposed reclamation plan does not meet regulatory requirements and needs to be revised.

ANALYSIS

VEGETATION INFORMATION

Regulatory Reference: R645-301-321

Analysis:

Baseline vegetation information is in Chapter 9, Appendix 9-1, of the existing mining and reclamation plan. Vegetation types in the disturbed area were mixed brush, conifer, grass-sage, riparian bottom, and previously disturbed. Three reference areas were established in Crandall Canyon. They are conifer, pinyon-juniper, and riparian bottom. The pinyon-juniper reference area would only be used for judging revegetation success in an area of Barn Canyon formerly proposed for disturbance. Additional reference areas that would be used for judging revegetation success in Crandall Canyon are the Castle Gate mixed brush and the Barn Canyon grass-sage reference areas.

The Crandall riparian reference area had vegetation cover of 47%. Dominant species included narrowleaf cottonwood, bluegrass, an aster, and some weedy plants. Some of the other woody plants were bigtooth maple, Gambel oak, snowberry, juniper, Douglas fir, and ponderosa pine. Thirty-six species were found in this reference area.

Vegetative cover in the Crandall conifer reference area was 74%, mostly from Douglas fir and ponderosa pine. Other frequently occurring plants included snowberry and perennial grasses. Twenty-three species were encountered in this reference area.

The Crandall pinyon-juniper reference area had 53% total vegetative cover comprised primarily of intermediate wheatgrass, western wheatgrass, pinyon, juniper, and curleaf mountain mahogany.

The two other reference areas associated proposed as standards for revegetation success are outside Crandall Canyon. The Castle Gate mixed brush and Barn Canyon grass-sage reference areas had 41 and 53% vegetative cover, respectively. Dominant species are typical for these vegetation communities, including *Agropyron* sp. (probably salina wild rye rather than a wheatgrass), sagebrush, Utah serviceberry, and fourwing saltbush.

The summary information in Appendix 9-1 is not complete and needs to be supplemented with the complete set of raw data. It is difficult to base a reclamation plan on a list of four or five dominant species. In addition, the Division normally requires sampling of areas proposed for disturbance before they are disturbed. This information may not exist, and it would be impossible to obtain it now. If it is available, however, it should be included in the plan.

Revegetation feasibility is discussed under "Revegetation."

Findings:

The mining and reclamation plan is complete and accurate with the following exception:

1. Complete data from the original Mariah vegetation report, or comparable data that would satisfy the requirements of R645-301-321, needs to be included in the plan. If information is available describing the vegetation in the disturbed area prior to disturbance, it should be included in the plan.

REVEGETATION

Regulatory Reference: R645-301-340

Analysis:

Revegetation Methods

Revegetation plans are contained in both Chapter 9 and the proposed amendment.

The Division Order specifically requires seedbed preparation plans. Prior to spreading topsoil, all regraded areas will be scarified by deep ripping. Topsoil will be spread in one lift and will be disced. Chapter 9 says wildlife habitat will be created by development of microtopographic features, such as swales and rises. Seeding will commence immediately after seedbed preparation to minimize the potential for erosion.

Discing tends to leave a relatively smooth surface. Probably the most consistently successful surface preparation technique used in Utah is surface roughening. The best techniques for both vegetation establishment and erosion control are to gouge or pit the surface irregularly. When finished, the area may look somewhat like a ski slope with moguls. These gouges trap nearly all precipitation and keep it in the area being revegetated. In the Division's experience, this also reduces runoff, erosion, and sedimentation. The Crandall Canyon area receives enough precipitation that it is probably impossible to say revegetation is not feasible without using this technique; however, it is highly recommended.

Planting will typically occur after October 15 and before the ground freezes. When necessary, spring planting may occur between March 15 and May 15. Drainages will be planted in April when possible. Unusually favorable weather conditions or compliance requirements may necessitate planting at other times.

The planting times discussed in Chapter 9 are standard for Utah. Spring seeding is not recommended but is sometimes necessary. Where it is necessary, it should be done as early as possible; May is usually too late (except in 1995).

According to the current Chapter 9, areas disturbed after May 1978 will be planted with species lists 2 and 3. North-facing slopes will receive transplants.

It is assumed that the north-facing slopes mentioned in Chapter 9 refer to north-facing slopes in Crandall Canyon where conifers should be planted. Species list 2 should be amended to include conifers to be planted in these areas (north-facing slopes only, not the entire Crandall Canyon area). Recommended species and rates are 300 per acre of Douglas fir, 200 per acre ponderosa pine, and 100 per acre white fir. Assuming a mortality rate of 20%, this would give 480 trees per acre. Although this is less than the density in the reference area, the reference area probably has a higher density than the area can properly support. Also, tree density in the reference area included a relatively small tree, juniper.

Amax has recently proposed changing its species lists in Chapter 9, and the proposal was recommended for approval. The new species list 5 would be used for areas within 20 feet of reclamation channels. The proposed Crandall Canyon reclamation plan says species list 5 will be used within 20 feet of reclamation channels CCRD-23A, CCRD-23B, and CCRD-23C. Exhibit 3.7-12 contains a footnote with this same comment. Species list 5 is very similar to species list 3, but cottonwoods and willows would be optional. Cottonwoods and willows should be planted in Crandall Canyon. However, as discussed in the "Revegetation Success Standards" section below, it is not expected that a riparian community could be established using the proposed reclamation plan.

Amax proposes to seed the Hilfiker walls by doubling the rate of tackifier application for both the seed and mulch mixes to improve adhesion. Seed from species list 2 would be used to seed the Hilfiker walls. The hydroseed slurry would be applied through a nozzle at the end of a hose, and the hose would be held within six feet of the wall to ensure seed penetration. Fertilizer would be applied at a minimum rate of 200 pounds per acre.

The proposed reclamation channels with Hilfiker on a side do not have side slopes within twenty feet conducive to seeding with species list 5. The Hilfiker walls are all within twenty feet of the reclamation channels and should, therefore, be seeded with the seed from species list 5. However, since the Hilfiker walls have few or no riparian characteristics, species list 2 is appropriate if the Hilfiker walls are left. The regulations require riparian areas to be restored or enhanced, so it will be necessary to provide slopes configurations conducive to establishing a riparian community.

Nearly all of the species in the planting mixtures are native to the area. Non-native species are legumes that increase microbial activity and add nitrogen. The Division of

Wildlife Resources reviewed the species lists and had no comment about those that would be used in Crandall Canyon. The species meet the requirements of R645-301-342 and R645-301-350.

Seed would be mixed with a small amount of wood fiber mulch and water to form a slurry, and this would be applied to the reclaimed area with a hydroseeder. The balance of the mulch, together with fertilizer and tackifier, would then be applied. Chapter 9 says seed and fertilizer will not be mixed in the hydroseeder. The total amount of mulch used will be 2000 pounds per acre.

In areas inaccessible to the hydroseeder, seed will be broadcast by mechanical means. These areas will be mulched with 2000 pounds per acre of straw, and the mulch will be anchored with nylon or other suitable netting. This plan conflicts with Chapter 9 which says native hay or straw will be applied at a rate of no less than two tons per acre. The higher rate has been shown to reduce erosion and increase seedling establishment better than one ton per acre.

Mechanical broadcasting or broadcasting combined with drilling is preferred over hydroseeding. Hydroseeding tends to leave "shadows" of unseeded areas. Also, several studies have shown straw or hay mulch to be more effective at controlling erosion and increasing seedling establishment than hydraulically-applied wood fiber. Nevertheless, with the exception of the riparian areas, revegetation is still considered feasible using the proposed techniques.

Chapter 9 discusses irrigation and pest and disease control. No irrigation is planned, but transplants will be watered on a case-by-case basis to minimize drought kill. No pest or disease control measures are anticipated to be necessary, but a plan will be developed in coordination with Carbon County Weed and Pest if needed. This plan would also be approved by the Division.

Revegetation Success Standards

The revegetation success standards will be the Crandall conifer, Crandall riparian bottom, Castle Gate mixed brush, and Barn Canyon sage-grass reference areas. The amendment application says these revegetation standards will apply to all areas that are reclaimed within the disturbed area boundary except the leach field and the north-facing slopes south of Shaft No. 1. It also says the leach field could be used if the canyon is designated for residential development, and planting additional woody vegetation to increase diversity would not be desirable because of possible root penetration.

The north-facing slopes south of Shaft No. 1 were vegetated with conifer prior to mine development. The application says the proposed reclamation topography for the area is

relatively flat, so these areas will not include north-facing slopes that can be vegetated with conifers.

Residential development is considered a "potential" postmining land use. The application does not officially propose that this be a designated land use, and Amax has not fulfilled the requirements to change the land use. Therefore, the plan must indicate how the approved land use in the plan will be achieved. The plan is contradictory whether the use is undeveloped land, wildlife habitat, grazing, or some combination of these. In any case, residential is not a proposed or approved postmining land use, and Amax must achieve the diversity success standards for the leach field area. If the use is changed at some time in the future, there would still need to be a diversity success standard, but it might not include shrubs.

Although the area north of Shaft No. 1 may have had a conifer vegetation type before the area was disturbed, it is not absolutely necessary to compare it to the conifer reference area for judging revegetation success. It might be compared to the mixed brush reference area instead. No matter which reference area is used, there must be a success standard.

The application does not discuss exactly which areas will be compared with which reference areas for judging revegetation success. Table 3.3 in Appendix 9-1 shows that the leach field area will be compared with the Barn Canyon grass-sage, the Castle Gate mixed brush, and the Crandall conifer reference areas, and that the shaft site will be compared with the Castle Gate mixed brush, the Crandall conifer, and the Crandall riparian bottom reference areas. However, this table does not show which parts of these two areas will be compared with which reference areas. This could be shown on a map, or it could be discussed in the text.

With the exception of erosion control, Chapter 9 includes methods for judging the diversity, seasonality, and other characteristics of reestablished vegetation as required by R645-301-353 and R645-301-356. Absolute cover will be used to compute the Motyka Index. This index will then be used to compare reclaimed and undisturbed areas. Cover, production, and stocking, as applicable, will need to meet the requirements of R645-301-356.100 and R645-301-356.200.

According to Section 3.7 of the current mining and reclamation plan, the postmining land use for the Crandall Canyon area is undeveloped land. This is different from a wildlife or rangeland grazing postmining land use mainly in the degree of management it receives. Because the postmining land use is not wildlife, no specific woody plant density standard for success is being established. However, Amax will still need to meet diversity requirements which will necessarily include establishment of trees and shrubs.

Chapter 9 says some erosion is natural as part of a functioning hydrogeomorphologic

system, but it will be controlled if it becomes or threatens to become disruptive of the postmining land use or inconsistent with erosional activities typical of the local area. It says suitable methods of measuring erosion will be developed in consultation with the Division and will be employed upon approval.

Amax needs to propose erosion control success standards and specific methods of measuring erosion. This is becoming urgent for reclaimed areas of the Castle Gate Mine, such as Goose Island and Sowbelly Gulch. Amax is required to demonstrate that reestablished vegetation is controlling erosion, but, without a specific and approved method, the measurements will probably be overlooked. Even if Amax does make erosion measurements, the Division will at some point review the adequacy of the methods. If the methods or standards are not approved, bond release could be delayed.

The Division is required to make a finding that reclamation as required by the State Program can be accomplished according to information given in the permit application. R645-301-321 requires the application to have adequate information for the Division to make this finding. Revegetation according to the reclamation plan is feasible in most disturbed areas of Crandall Canyon. Most slopes are not extraordinarily steep although Amax does propose to leave some cut slopes. The Hilfiker walls themselves would probably have minimal vegetative cover; however, their areal extent is very limited. The area where Amax cannot achieve the revegetation success standards is in and adjacent to the stream channels.

It is impossible to tell from the vegetation maps exactly how wide the riparian areas were prior to disturbance. The narrowest part of the riparian area below the disturbance is about 50 feet; it is about 100 feet wide immediately below the disturbed area. Above the disturbed area, there is very little riparian area because the stream channel is eroded into the alluvium next to the adjacent mixed brush and conifer communities. However, as discussed below, even if the channel through the disturbed area was in a degraded condition prior to mining, the regulations require the operator to enhance these areas where practicable. Also, the designated success standard is the riparian reference area.

The cross sections shown on Exhibit 3.7-7D show the stream channel through the disturbed area varying in width from about 12 to possibly as much as 25 feet. Side slopes both with Hilfiker and in some of the cut slopes are about 0.7h:1v. This basically leaves an area to be revegetated to a riparian community one-fourth or less the width of the riparian area immediately below the disturbed area.

Using the proposed reclamation plan, Amax cannot restore a riparian community of the same extent as apparently existed prior to mining. The application says species list 2 (for riparian areas) will be planted within 20 feet of each side of the channel for a total of 40 feet width. Cottonwoods and other riparian species may become established to a limited extent in the channel, but the channel, as built, is designed more as a water conveyance structure

than for habitat. Riparian species present in the reference area and species list 2 would not survive in the more xeric habitats above the cut slopes and Hilfiker walls.

R645-301-358.400 requires the operator to avoid disturbances to, enhance where practicable, restore, or replace, wetlands and riparian vegetation along rivers and streams. Coal mining and reclamation operations must also avoid disturbances to, enhance where practicable, or restore, habitats of unusually high value for fish and wildlife. Riparian areas are considered critical wildlife habitat.

In summary, Amax needs to restore and/or enhance riparian habitat along Crandall Creek for the following reasons:

1. Without changing the stream channel configuration, it is impossible to establish a riparian community equal in extent to what probably existed prior to mining. A riparian community reference area is the standard for revegetation success for these areas, and this standard cannot be achieved using the proposed plan.
2. Riparian areas are considered critical wildlife habitat that need to be restored and/or enhanced where practicable. Whether the channel through the disturbed area was in a degraded or pristine condition prior to mining, Amax should present plans that would restore the area to a condition similar to the reference area or better if possible.

The application contains arguments that retention of the flat pad areas and the Hilfiker walls offers benefits to the postmining land use. The facilities area could be graded to eliminate much of the pad area, but the resulting topography would be characterized by significantly steeper slopes near the main stream channel. The application says soil erosion would be increased, plant production would be adversely affected, and there would be a corresponding negative impact to the postmining land uses of wildlife habitat and grazing.

Properly-managed riparian areas are very productive vegetation communities. Considering the number of weedy species present in the Crandall Canyon riparian reference area, it is not in ideal condition and was probably overgrazed in the historical past. Nevertheless, productivity for this reference area, as shown in Table 3.8 of Appendix 9-1, was 2500-3000 pounds per acre. Productivity for other reference areas to be used in Crandall Canyon was 650-700 and 200-300 pounds per acre for the Castle Gate mixed brush and Crandall conifer reference areas, respectively. (The plan does not show productivity in the Barn Canyon grass-sage reference area.) Restoring a productive riparian area would more than offset production losses caused by steeper slopes in a few areas.

Erosion could, theoretically, increase slightly where Amax would grade slopes toward the channel. However, the revegetation success standards allow relatively little bare ground.

The Crandall conifer reference area had 6% bare ground, the Castle Gate mixed brush reference area had 24% bare ground, and the Barn Canyon grass-sage reference area had only 1% bare ground. This small amount of bare ground does not allow very much erosion. Also, vegetation in flat areas near the creek should filter out most sediment that does erode.

Leaving the Hilfiker walls and the channel in its current configuration does not offer benefits to postmining land uses discussed in the application. A good quality riparian area is far more compatible with wildlife and grazing uses than the narrow, steep-sloped, riprapped channel. The creek becomes accessible for watering, it creates greater habitat diversity, and there is increased vegetation production. For residential or recreation postmining land uses, a stream with good ground cover, cottonwoods and ponderosa pines, and associated wildlife is much more aesthetically pleasing than an engineered channel with Hilfiker walls.

Fish and Wildlife Habitat

Chapter 9 says microtopographic features, such as swales and rises, will be created during regrading. Where rocks become available, Amax will construct rock piles. Snags and roosts will be constructed whenever materials become available. Wetland areas will be created where topography and hydrology lend themselves to their creation.

The application says the ponds provide habitat for waterfowl, fish, and amphibians. It is unlikely that fish inhabit either of the ponds. They are not large enough and do not have adequate shoreline cover to provide waterfowl nesting habitat. At most, they might be used as resting places for migrating birds. Tiger salamander larvae apparently live in pond 14.

In Section 3.7-5(2)(2), the application says two water sources will allow the land owner to fence one of the ponds for cattle and allow the other to be used by wildlife. This statement is unclear. If cattle can access a pond, wildlife can also. If one pond is left unfenced for wildlife, livestock will also use it. The ponds are close enough to each other that there is no need from either a wildlife or grazing standpoint for both of them to remain after reclamation unless there is some other habitat enhancement feature associated with leaving both ponds. The same enhanced vegetation created by leaving pond 15 could be achieved with swales discussed in Chapter 9.

A warm season water source in Crandall Canyon is very desirable for wildlife habitat enhancement. Current Division personnel have never seen pond 14 without water, and the vegetation near this pond is indicative of a continual water source. However, other regulatory requirements, such as an adequate stability demonstration, must also be met before Amax can leave the pond. Since it appears there is a seep or spring in this area, Amax could develop it into a small wetland area with enough free water to provide a water source for wildlife.

The application says in Section 3.7-5(3)(1) that primary power poles will remain for raptor habitat. Amax needs to determine whether the power poles are being used by raptors. They may also need to be modified. If the poles are being used now, it could be considered they are in good locations and would continue to be used after reclamation. Use would be evidenced by whitewash on the poles or regurgitated bones or portions of animal carcasses at the base. However, any poles not now being used are probably not needed for raptor habitat and should be removed. The Division of Wildlife Resources should be able to provide additional information about what modifications may be needed and which poles are in good locations.

Findings:

This portion of the application and Chapter 9 of the current plan is complete and accurate with the following exceptions:

1. The mulching plan in Section 3.7 of Chapter 3 needs to be consistent with Chapter 9. Chapter 9 says no less than two tons per acre of straw or hay will be applied when straw or hay is used as mulch. Chapter 3 says only one ton per acre will be used.
2. Amax needs to provide plans to plant conifers on north-facing slopes of Crandall Canyon.
3. Portions of the application indicating diversity standards will not apply to the leach field area and the slopes north of Shaft No. 1 need to be modified. Diversity standards need to be applied no matter what the postmining land use may be. For the present, residential development is not an approved land use, so Amax needs to propose methods of achieving the required diversity.
4. Amax needs to show which reference areas will be used to compare to which reclaimed areas.
5. Amax needs to propose erosion control success standards and methods to measure erosion.
6. The Division cannot find that revegetation, as required under the State Program, is feasible for the riparian areas as Amax has proposed to reclaim them. Amax would leave twelve- to twenty-five-foot-wide channels with nearly vertical side slopes in many areas. These areas cannot be revegetated to a condition similar to the riparian reference area. In addition, R645-301-358 requires Amax to restore or enhance riparian areas and to use the best technology currently available to enhance fish and wildlife and related

environmental values. The proposed plan does not fulfill these requirements.

7. Providing a water source for wildlife or livestock is desirable, but there is no good reason to leave both ponds. In the Division's experience, pond 14 has always contained water. To leave this pond, Amax must meet applicable regulatory requirements, such as those in R645-301-733.220.
8. To leave power poles as raptor habitat, Amax needs to determine which poles are in favored locations or are currently being used. Some may need modification. Poles not being used or not needed for habitat should be removed.

RECOMMENDATIONS

Amax has satisfied most requirements of the biology portion of Division Order 94A. They still need to propose methods and standards for success for erosion control. Also, Amax needs to show which reference areas will be compared to which reclaimed areas for revegetation success comparison.

Other parts of the reclamation plan are inadequate and need to be revised. Amax needs to use the best technology currently available to enhance wildlife habitat. In the configuration proposed in the application, Amax cannot achieve the riparian reference area revegetation success standards for areas near the channel. The riparian area was apparently, or at least should have been, about 50-100 feet wide prior to disturbance, but the reclaimed channel would be only about 12-25 feet wide. Even if the channel was in a degraded condition before disturbance, Amax needs to enhance the riparian area.