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POST-RECLAMATION TOPOGRAPHY

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LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED
1404	2014 Navajo Mine Permit Renewal	

34 **POST-RECLAMATION TOPOGRAPHY**

34.1 Post-Reclamation Final Surface Configuration

As described in Section 20 – Mining Operations overburden and parting material is removed by a dragline and cast into the adjacent mined out cut. Such placement creates spoil ridges (rows) or peaks which need to be backfilled and/or graded. Backfilling and grading will be done in logical blocks that follow the stripping sequence allowing large areas to be regraded at one time. This will provide a more consistent topography between regraded areas and will improve irrigation coverage by providing large, continuous areas rather than small irregular blocks. In most cases, these logical blocks become available every 1-3 years in each mining area, which will result in a substantial distance between the previous regraded area and the active pit just prior to the block becoming available. The areas around and in active ramps will be regraded to provide a road suitable for mining activities that include coal haulage. Pre-stripping ahead of the active mining strip allows for the material removed to be used in backfilling and grading. These materials are used to backfill finished pits, active mining ramps, and regrade areas requiring additional fill. Final pits will remain open until all mining activities are complete, at which time they will be backfilled. The backfilling and grading operations of each logical block are divided into primary and secondary operations.

Primary regrading utilizes track dozers to level off the spoil ridges. Primary regrading will be accomplished as necessary to accommodate the FSC and the reclamation schedule in Table 34-1. Some pits and ramps may not have sufficient backfill material readily available for bulldozers to adequately regrade the area. In these instances, supplemental equipment may be used to facilitate primary regrading activities. This equipment includes, but is not limited to, scrapers, draglines, and end-dump trucks working with a large front-end loader.

Several areas at Navajo Mine may require delays in reclamation in order to facilitate reaching the desired postmining topography. Changes or fluctuations in the dragline stripping sequence may cause variations in spoil placement resulting in localized peaks or valleys that may require regrading equipment and cause primary regrading delays.

Secondary regrading may, if needed, follow primary grading for additional smoothing of the land surface to accommodate topdressing replacement. At this time, any special water control or wildlife habitat features will be constructed.

During the process of secondary grading, small depressions may be established on an opportunistic basis. These features will enhance post-mining topographic diversity and act as seasonal surface water collection

sites. Small depressions will serve as wildlife enhancement features and micro-topographic niches for establishment of mesic and/or hydric plant species. Although these depressions will not have specific design criteria, they will be small enough that they will occur within the limits of the approved FSC. These small depressions will also meet the following specific criteria:

- Each depression or combination of directly adjacent depressions will be less than one acre foot total capacity
- No depression will be deeper than 10 feet
- All small depressions will be incised (below ground level)
- The maximum inslope for the small depression will be 6:1 and
- At bond release, small depression areas will be subject to vegetation sampling similar to any area within the bond release parcel

Highwalls and ramps will be backfilled and graded as shown on the FSC maps (Exhibit 34-1, Exhibit 34-2, Exhibit 34-3, Exhibit 34-4, Exhibit 34-5, and Exhibit 34-6). Interior slopes will be graded to less than or equal to 6.5 horizontal to 1 vertical (6.5h: 1v) overall. All outslopes of the affected areas will be graded to less than or equal to 4h: 1v overall. The overall slope will be measured from the crest to the toe of the slope. On long slopes a portion of the slope between the crest and toe could be steeper to facilitate the construction of terraces. The analysis indicates that the weighted average soil loss from a post-mining watershed exceeds the per-mining condition then terraces are constructed on long steep slopes to shorten the slope lengths and thereby minimize the erosion off the slope. Drainage details are available in Section 41 – Probable Hydrologic Consequences and in the Reclamation Surface Stabilization Handbook (NTEC-Navajo Mine, 1992), which was approved by the Office of Surface Mining Reclamation and Enforcement (OSMRE) in 1992. In locations where ash disposal has occurred, disposed ash volumes will be taken into consideration when developing the FSC.

Regraded lands are blended into the surrounding topography to establish drainage patterns, and the postmining land use of range livestock grazing will be unimpaired following topdressing distribution and revegetation.

34.2 Final Surface Configuration or Approximate Original Contour

Through the mining process, the original or pre-mine surface configuration and surface contour are altered. Reclamation plans are based on grading the mined areas to meet specific criteria outlined in this section. In order to ensure that these criteria will be met and the material balance maintained, designs of a new topographical surface are created based on current mine plans and features for a given operating area. This

replacement surface is defined as the Final Surface Configuration (FSC) or Approximate Original Contour (AOC); both terms can be used interchangeably within this permit. Reclamation plans are based specifically around meeting the drainage requirements of this FSC (or AOC) surface. Because this FSC (or AOC) surface is created from a modeled post mine surface, the actual contour configuration of the reclaimed topography may deviate from the design FSC (or AOC). The locations, configurations, and timing of mining plans and features may vary slightly from plans (e.g. ramp centerline locations, dragline plug locations, and so forth). However, these deviations will not be significant. The actual reclaimed surface will closely approximate the approved FSC (or AOC) and this surface will ensure current FSC (or AOC) drainage designs are maintained, still meet the requirements this section, and ensure a material balance.

The Final Surface Configuration (FSC) is achieved at Navajo Mine by:

1. Achieving mass balance while maximizing contemporaneous regrade acreage between ramps without requiring disturbance of revegetated pre-law lands,
2. Achieving positive drainage, except for the small depressions mentioned above, from all areas including pits and ramps,
3. Developing an adequate drainage density, and
4. Allowing development of stable drainage channels.

34.2.1 Area 1

The Area 1 North final surface configuration is shown in Exhibit 34-1. The northwestern portion of the exhibit is characterized by a hill that primarily slopes to the southeast. The area to the southeast is featured by a hilly terrain that contains a drainage. This drainage is called the Bitsui Wash that leaves the permit site to the north. The area from the Bitsui Wash to the southwestern corner of the exhibit is generally sloped to the northeast. The Dodge Diversion, originating near N 2,070,000 and a smaller drainage are located in this area. These two drainages facilitate the entire Area 1 North up to the Bitsui Wash. Cross sections for Area 1 North are shown in Exhibit 13-2. These cross sections illustrate that the post-mining surface generally resembles the pre-mining topography.

Near Doby Ramp 7 is hill (Power Pole Hill) that contains slopes on the south side that exceed 6.5h: 1v. This hill is pre-law but a narrow strip of Permanent Program land that traverses the toe was added to capture the public access across the mine. During reclamation of this road, slopes in excess of 6.5h: 1v were constructed in order to tie-in with the steep Pre-law slope. The area of Power Pole Hill containing the slopes is roughly 1 acre in size, is stable with respect to erosion and has established perennial vegetation

The Area 1 South final surface configuration is shown in Exhibit 34-2. The topography is described to be a moderately sloped terrain. The area between N 2,070,000 and N 2,065,000 divides and generally slopes to the east and west. The western slope will start dipping to the north near the lease line and tie in with the Area 1 North. The eastern half will drain off lease before connecting with a drainage to the south. This drainage is called the Chinde Diversion that will trend westerly near N 2,055,000. The area south of N 2,065,000 will generally be sloped to the southwest corner of the exhibit or the Big Fill area. This terrain will be moderately flat and trend across the Bighan and Doby Ramps down to the Chinde Diversion. The Area 1 South slope histogram shown in Figure 13-1 illustrates the post-mining slope distribution to generally be the same as the pre-mining distribution.

34.2.2 Area 2

The Area 2 final surface configuration is shown in Exhibit 34-3 and Exhibit 34-4. Exhibit 12-6A displays the Chinde Diversion, discussed in Area 1, and another drainage trending from the Figure 13-1 southeast to the northwest exiting at the Big Fill area. The drainage will run parallel but not directly on top of the final pit of North Barber. This channel will be routed through the final pits of Hosteen and Yazzie to merge with the Chinde Diversion. To the west of the drainage, the topography transitions into a hilly terrain sloping to the northwest. In Exhibit 12-6, the rolling terrain extends to the southwest where the topography flattens into moderate hills. This flat terrain contains drainages that trend from the southeast to northwest. Figure 13-2, Area 2 Slope Histogram shows the post-mining slope distribution to generally be the same as the pre-mining distribution.

In order to reestablish topographic diversity, bluff features will be constructed in the Block C area. These features will be established to recreate bluffs removed during the mining process. The location of premine bluffs are shown in Exhibit 34-6. Prior to disturbance, approximately 2,580 linear feet of native bluffs existed in the proposed disturbance area with slopes ranging from 25% to 60%. Prior to mining, the native topography in the Block C area included bluff-like features in the form of rock outcroppings, steeply sloped badlands with exposed rock strata and caprock, and scoria capped knobs. The constructed bluff features will consist of in situ overburden including fractured siltstones, mudstones, sandstones, and shales. In constructing the bluff features, the existing highwall will be backfilled to a minimum of 3 feet above the exposed rider coal seam leaving no more than 20 feet of exposed rock face. The bluff features will be constructed as shown in the conceptual drawing (see Figure 34-1). The area of constructed bluff features will be approximately 500 linear feet in length with no more than 20 vertical feet of exposed bluff. The constructed bluff features are intended to promote post-mine topographic diversity in the Block C area and may be considered a wildlife enhancement feature. In addition, the bluff features will result in an increase

in sinuosity of the reconstructed drainage in the reclaimed area. The native area drains to the north away from the constructed bluff features and no major spalling or slope instability should occur; however, similar to natural bluffs the face of the bluff is expected to physically weather over time, which will result in the creation of a rubble zone at the base of the feature. Based on the availability of suitable competent rock, rubble zones may also be constructed with boulders at the base of the bluff features to further enhance the utility of the features for wildlife and mimic natural bluffs in the area.

34.2.3 Area 3

The Area 3 final surface configuration will generally be a flat terrain with moderate hills between drainages. The northern section will typically be flat with drainages directed to the west. These northern drainages will reconnect with the western half of the Lowe Arroyo. To the east, the final Lowe and north Dixon Pits will be regraded to become a drainage channel aligned to the south, west and north, back to Lowe Arroyo. The drainages in south Dixon will tie in with the Cottonwood Arroyo. The Area 3 final surface configuration is shown in Exhibit 34-6.

Figure 13-3, Area 3 Slope Histogram generally shows the lower slope range (0-2.9 percent) to decrease and increase in the middle slope range (3-5.9% to 12-14.9%). The rolling topography created by the drainage system over a primarily flat pre-mine area will decrease the lower slope range and increase the middle slope range distribution.

34.3 Backfilling and Grading Schedule

SMCRA regulation state backfilling and grading activities "shall occur as contemporaneously as practicable with mining operations" (30 CFR 816.100). NTEC use the following guidelines to define practicable backfilling and grading:

- Sufficient equipment capacity and manning levels to sustain constant progress backfilling available areas simultaneous with mining operations
- Holding equipment and manning levels at a steady rate (not hiring or laying off extra people to meet demands caused by short term fluctuations in available regrade volumes).
- Allowing spoil material that is reserved to fill final pits and ramps to remain ungraded in place until the final pits or ramps are available to fill (not double handing material to develop out-of-pit spoil dumps)

NTEC provides information for short term and long term backfilling and grading. Both of these sources combined constitute the backfilling and grading plan.

Short term information is provided in Exhibit 34-7 and Exhibit 34-8. Exhibit 34-7 shows detailed regrading, mitigation and topsoil areas by year for three years. Exhibit 34-8 shows detailed revegetation and irrigation areas by year for three years. NTEC will submit these exhibits on an annual basis in conjunction with the submittal of the annual report by August 31st each year for OSM's review and approval

Long term backfill and grading information is provided in Table 34-1 and Figure 34-2. Table 34-1 shows the approximate volume of material placed in final regrade of Area 2 and Area 3 by fiscal year until all pits in those areas are completely regraded. Disturbed acres in this table are based on Exhibits 2-1 and 2-2, Permit Term Disturbance Schedule. Figure 34-2 shows a summary schedule for the final regrading of Area 2 and Area 3. The bars represent the cumulative fill volume available for final regrade i.e. final pits, ramps or fill areas. The lines represent the planned volume to be placed in final regrade in that fiscal year. Figure 34-1 and Table 34-1 do not provide information on the number of acres completed as "final regrade", regrade acres are provided in Exhibits 34-7 and Exhibit 34-8. The volumes presented in Table 34-1 and Figure 34-2 are general estimates based on the current mine plan and may be altered due to unforeseen significant changes

There are several factors in determining the appropriate timing for contemporaneous reclamation to be completed. Five examples of these factors are explained below.

1. Pit Backfill A buffer of approximately 4500 feet from the centerline of the final pit is required to leave enough cut material to backfill the final pit to FSC elevation. In order to successfully time the backfilling of pits, some spoil material must remain in place until their final resting place becomes available for regrading to the final surface configuration (FSC). This material is required for backfilling the ramps and pits, and will not be moved until the designated location for that material is available to be filled.
2. Drainage Construction. The re-establishment of postmining drainages requires that some acres not be regraded during active mining, but regraded after the area is inactive. This allows ramps and pits to be backfilled to proper elevations to establish drainage either through the old pits and ramps or through other mined-out areas as dictated by the FSC.
3. Maximization of Coal Recovery. In some areas, the land must not be regraded until a later date in order to facilitate future coal recovery in adjacent areas.

In FY 2011, the first 'jog' in Dixon Pit and the dragline stripped pit in Hosteen/Yazzie become available for backfilling. In FY 2014, the final Lowe Pit and the second 'jog' in Dixon Pit become available for

backfill. In FY 2019, the final Dixon Pit becomes available. In 2020, the final Hosteen/Yazzie Pit becomes available for backfill.

According to the Long-Term Regrade Plan, Barber Pit backfilling will be completed in FY 2015. Lowe Pit backfilling will be completed in 2019. Final backfilling for both Area 2 and Area 3 will be completed in FY 2021. Figure 34-2 shows the estimated annual material movement in Area 2 and Area 3.

34.3.1 Post-Reclamation Slope Stability

In certain cases reclaimed areas may require designed drainage control structures in order to stabilize reclaimed lands and minimize erosion. Drainage structures for surface water control and surface stabilization on reclaimed lands, will be designed and constructed following the guidelines outlined in the Reclamation Surface Stabilization Design Handbook (NTEC Minerals – Navajo Mine 1992). As-Built designs for control structures on permanent program lands, are provided in Appendix 34.A and listed in Table 34-2.

In addition to using drainage control structures, where appropriate and feasible, cattle may also be utilized to stabilize reclaimed land and minimize erosion. Cattle grazing will be used to impact reclaimed land to reduce erosion by incorporating mulch and seed into the soil, and increase water infiltration by creating increased surface roughness with cattle hoof action.

34.4 Subsidence Plan

No underground mining is anticipated within the proposed Permit Area, and therefore, there is no subsidence monitoring. No known active or abandoned underground workings exist within 500 feet of the Permit Area.