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Fwd: 0250005 Coal Hollow Mine North Lease Prime Farmland Coordination update on review

1 message

Priscilla Burton <priscillaburton@utah.gov> Wed, Dec 2, 2015 at 8:57 AM
To: OGMCOAL DNR <ogmcoal@utah.gov>

-------- Forwarded message --------
From: **Domeier, Michael - NRCS, Salt Lake City, UT** <Mike.Domeier@ut.usda.gov>
Date: Tue, Dec 1, 2015 at 5:01 PM
Subject: update on review
To: Priscilla Burton <priscillaburton@utah.gov>

Priscilla,

NRCS will provide a formal response to the Divisions request for consultation. This email is an update on a few items for your information and consideration.

The reclamation goal for the mined area needs to be established. Based on the apparent lack of reliable irrigation water it appears that a goal of alfalfa production may not be what the Division requires. However, there is some irrigation water available based on the 2014 photos you forwarded. Perhaps the reclamation goal could be for irrigated pasture. The NRCS (and others) use Animal Unit Months (AUM) to measure the productivity for pasture. The Soil Survey Project Leader in Richfield will be providing an estimate of AUMs for the Prime and Statewide important soils in the North Lease Area. For the Ecological Sites in the Prime Farmland Unit 1111 the dry weight production for a normal year is 900 pounds per acre. The reclamation goal will probably be something less than alfalfa, with no water limits, and the Ecological Site with no water added.

I've been trying to establish the depth of suitable material needed above the Tropic Shale fill to insure there aren't any reclamation issues. I have a request in to our range specialist on rooting depths of grasses identified for the Ecological Sites in the area.

The NRCS uses a National Engineering Handbook for irrigation water management. A page on rooting depth is attached. The standard for alfalfa is 5 feet of soil depth and 80% of the roots would occupy this space. However the combination of precipitation and irrigation water might not fill the entire profile. None- the-less it provides some documentation for a 5 foot depth of acceptable material.

I've not completed the review of the soil survey by Robert Long but there are no problems noted so far in regard to the quality of his work. Table C is very useful from a reclamation point of view. The following picture is from Grand Staircase-Escalante and shows the calcium carbonate layer beginning at 40 cm. At that depth the calcium carbonate percent is 52 which would inhibit the availability of nutrients. Many of the soil horizons in table C are identified with high calcium carbonate percent. These layers should be avoided in the stock piling of the top soil. Salinity and sodium adsorption ratio weren't identified as series issues.

The State Soil Scientist in Colorado provided me a report (attached) for a Colorado topsoil reclamation and the general requirement was 48 inches of suitable material.

The NRCS has a Soil Climate Analysis Network with 35 stations. Two of these sites will be useful in establishing how deep the water moves into the soil profile without supplemental irrigation. With over 16 of precipitation at Alton and some supplemental irrigation water supply a well-managed pasture could be fairly productive.

The following note from Long Resources Report shows the importance of avoiding the Tropic Shale. Conductivity of over 4 dS/m should be avoided. “Conductivities of 4 to 8 dS/m occur in the lower subsoil of the Sideshow family which develops from Tropic shale. A soil conductivity of 10.9 dS/m was measured in a Tropic shale bedrock sample at soil profile location 12AS015.”

In the field on November 23 the coal company representatives stated that they would be handling the Prime and Statewide Important Farmlands in the same fashion for practical reasons even though the regulations don’t require them to do so. Would the Division want to have it specifically stated that both categories of Important Farmlands would be handled the same?

I’ll look for this in the report but the method of placing the top 4 or 5 feet of reclaimed material should involve consideration of avoiding soil compaction that would restrict roots.

If the reclaimed land has the topsoil placed properly, an available water capacity of about 10 inches in the top 5 feet, high calcium carbonate horizons not stockpiled for reclamation, and the Tropic Shale at greater than 5 feet then there should be a successful reclamation.

I'll be continuing the review tomorrow.

Mike Domeier

Utah NRCS - State Soil Scientist

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2 attachments

Irrigation Guide-root-depths.pdf
18K

western_fuels_topsoil_report.pdf
11388K

(d) Rooting depth and moisture extraction patterns

The soil is a storehouse for plant nutrients, an environment for biological activity, an anchorage for plants, and a reservoir for water to sustain plant growth. The amount of water a soil can hold available for plant use is determined by its physical properties. It also determines the frequency of irrigation and the capacity of the irrigation system needed to ensure continuous crop growth and development.

The type of root system a plant has is fixed by genetic factors. Some plants have tap roots that penetrate deeply into the soil, while others develop many shallow lateral roots. The depth of the soil reservoir that holds water available to a plant is determined by that plant's rooting characteristics and soil characteristics including compaction layers and water management. The distribution of the plant roots determines its moisture extraction pattern. Figure 3–1 shows typical root distribution for several field and vegetable crops. Typical rooting depths for various crops grown on a deep, well drained soil with good water and soil management are listed in table 3–4.

For annual crops, rooting depths vary by stage of growth and should be considered in determining the amount of water to be replaced each irrigation. All plants have very shallow roots early in their development period; therefore, only light and frequent irrigations are needed. Because roots will not grow into a dry soil, soil moisture outside the actual root development area is needed for the plant to develop a full root system in the soil profile. Excess moisture in this area will also limit root development.

For most plants, the concentration of moisture absorbing roots is greatest in the upper part of the root zone (usually in the top quarter). Extraction is most rapid in the zone of greatest root concentration and where the most favorable conditions of aeration, biological activity, temperature, and nutrient availability occur. Water also evaporates from the upper few inches of the soil; therefore, water is diminished most rapidly from the upper part of the soil. This creates a high soil-water potential gradient.

Table 3–4 Depths to which the roots of mature crops will extract available soil water from a deep, uniform, well drained soil under average unrestricted conditions (depths shown are for 80% of the roots)

Crop	Depth (ft)	Crop	Depth (ft)
Alfalfa	5	Peas	2 - 3
Asparagus	5	Peppers	1 - 2
Bananas	5	Potatoes, Irish	2 - 3
Beans, dry	2 - 3	Potatoes, sweet	2 - 3
Beans, green	2 - 3	Pumpkins	3 - 4
Beets, table	2 - 3	Radishes	1
Broccoli	2	Safflower	4
Berries, blue	4 - 5	Sorghum	4
Berries, cane	4 - 5	Spinach	1 - 2
Brussel sprouts	2	Squash	3 - 4
Cabbage	2	Strawberries	1 - 2
Cantaloupes	3	Sudan grass	3 - 4
Carrots	2	Sugar beets	4 - 5
Cauliflower	2	Sugarcane	4 - 5
Celery	1 - 2	Sunflower	4 - 5
Chard	1 - 2	Tobacco	3 - 4
Clover, Ladino	2 - 3	Tomato	3
Cranberries	1	Turnips	2 - 3
Corn, sweet	2 - 3	Watermelon	3 - 4
Corn, grain	3 - 4	Wheat	4
Corn seed	3 - 4		
Corn, silage	3 - 4		
Cotton	4 - 5	**Trees**	
Cucumber	1 - 2	Fruit	4 - 5
Eggplant	2	Citrus	3 - 4
Garlic	1 - 2	Nut	4 - 5
Grains & flax	3 - 4		
Grapes	5	**Shrubs & misc. trees for windbreaks**	
Grass pasture/hay	2 - 4		
Grass seed	3 - 4	< 10 ft tall	2 – 3+
Lettuce	1 - 2	10 – 25 ft tall	3 – 4+
Melons	2 - 3	> 25 ft tall	5+
Milo	2 - 4		
Mustard	2	**Other**	
Onions	1 - 2	Turf (sod & lawn)	1 - 2
Parsnips	2 - 3	Nursery stock	1 - 3
Peanuts	2 - 3	Nursery stock	pots

Section 2.05.4(2)(d)

TOPSOIL HANDLING, STOCKPILING, AND REDISTRIBUTION

Section 2.05.4(2)(d)

Topsoil Handling, Stockpiling and Redistribution

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Section 2.05.4(2)(d)
Topsoil Handling, Stockpiling and Redistribution

1.0 Introduction

All predicted topsoil salvage information is located in permit Section 2.04.9 Soils Resource Information. As of the submittal of PR-08, all topsoil from the site has been stripped. Much of the topsoil stripped from areas west of 2700 Road has been placed in various stockpiles. Actual topsoil salvaged has been measured in all the stockpiles and a full volume balance has been made for the proposed redistribution of soil. The topsoil handling and stockpiling requirements of Rule 2.05.3(5) are addressed in this permit Section 2.05.4(2)(d). All topsoil replacement information is also in this permit Section. Prime farmland specifics (Rule 4.25 satisfaction) of topsoil handling are found in permit Section 2.06.6.

This section outlines WFC's plan for removal, storage and redistribution of topsoil, subsoils and other material, to meet the requirement of Rule 4.06. The plan addresses those reclamation activities that are conducted during and immediately after backfilling and grading (Section 2.05.4(2)(c)), but prior to revegetation (Section 2.05.4(2)(e)). The objectives of the plan are to reconstruct plant growth and aquifer mediums that are capable of supporting the postmining land uses. The plan presents an account of the plant growth material and aquifer medium requirements based upon current and projected disturbance acreage and plant growth material and aquifer medium availability based on topsoil depth mapping and overburden assessments. The plan also describes the procedural aspects of removal, storage, redistribution, and testing of topsoil materials.

As of the submittal of PR-08, all mining areas east of 2700 Road have been backfilled, topsoiled and seeded according to the requirements of the approved permit. Large portions of this area have been granted Phase 1 and Phase 2 bond release. The majority of this area has been restored to Irrigated Pasture with excellent productivity. Topsoil erosion has been extremely low due to the vegetation present. No topsoil redistribution for the areas east of 2700 Road have been affected by the changes present in PR-08.

2.0 Overburden and Interburden Characteristics

Overburden and interburden characteristics for New Horizon 2 are presented in Section 2.04.6, Geology Description. Overburden and interburden suitability and lithologic units for the New Horizon #2 Mine described in Section 2.04.6 are very similar to the shallow overburden units at the New Horizon #1 Mine area. The only significant difference between mine areas is the mean thickness of Unit 1 (Bench 1) which averages 5 feet at New Horizon #1 Mine compared to about 55 feet within the New Horizon #2 permit area. Approximately 83 percent of the overburden and interburden material at New Horizon 2, consisting predominantly of Units 1 (Bench 1) and 3. Unsuitable material was identified in the lower overburden and interburden (Units 2 and 4) within the proposed disturbance area (Peabody, Appendix 6-5).

3.0 Acid and Toxic-Forming Materials at New Horizon 2 Mine

Acid and toxic-forming materials were identified within the New Horizon 2 study area; however, only the acid-forming material occurs within the projected mining disturbance area (Peabody Appendix 6-5 and Map 2.04.6-1, Geologic Cross Section and Sample Locations for New Horizon 2 Study Area). Therefore, some ameliorating activity such as mixing, normal burial, or special handling will be required to replace a suitable four-foot root growth medium and to prevent leachates and runoff from entering the ground water system or discharging into the surface water system. No roads will be surfaced with the acid-forming material. Mitigation of all unsuitable zones within the underburden material (five percent of all unsuitable zones which were identified) will be by avoidance, i.e., these zones will not be disturbed by mining activities. Certain areas of overburden and interburden will also be avoided due to the projected disturbance area boundary described within this application (Map 2.05.3-1, Current Mine Plan - New Horizon 2) or excessive Dakota coal seam depths. These additional avoided areas comprise about 60 to 65 percent of all unsuitable zones which were identified.

Complete mixing of the thicker, calcareous overburden Unit 1 or Bench 1 (30.5 feet) and interburden Unit 3 (6.7 feet) with the thinner, acidic overburden/interburden Units 2 (4.5 feet) and 4 (2.9 feet) would produce a suitable alkaline spoil (see Section 2.04.6, Table 2.04.6-10). Partial mixing of alkaline and acidic materials is anticipated during free dig, dozer pushing, shovel, and

truck fleet handling due to the thinness of Units 2 and 4 and the stratification of alkaline and acidic strata. Normal overburden/interburden handling operations also effectively bury the acid-forming strata.

Typical overburden/interburden handling operations are described in Section 2.05.3, Operation Plan and Section 2.05.4(2)(c), Backfilling and Grading.

Once topsoil is removed, soft upper overburden (Bench 1 or Unit 1 material) is normally removed by the shovel and truck fleet and taken to the back of the previous pit for backfilling using the same temporary road around the end of the pit. A significant amount of this Bench 1 material is typically placed immediately below the topsoil and subsoil. The amount of Bench 1 placed varies per area, and these thicknesses are shown on Map 2.05.4-4. Some of this Bench 1 will be used as subsoil, see Map 2.05.4-7.

Lower overburden (Bench 2) is usually cast blasted, dozed and loaded/hauled with shovel and trucks and placed in the previous mined out pit for backfilling purposes. As the overburden trucks dump off the backfill spoil dump, large dozer(s) will final grade the truck dump area into the final pre topsoiled contours. This overburden is always buried beneath several feet of Bench 1 in reclamation.

The regraded spoil will be mechanically loosened and mixed by ripping, chiseling, or approved alternate forms of scarification. Rocks discovered during scarification on Irrigated Cropland will be removed. The major advantages of scarification are related to the physical properties of the spoil. The topsoil and spoil are scarified to decrease compaction, increase aeration and water movement, and increase plant rooting depths. Increased water movement may, to some degree, allow more downward leaching of carbonates. Therefore, although the greatest benefits of scarifying are related to the physical soil properties (density, porosity), a lesser geochemical benefit (increased rate of carbonate leaching due to increased water movement) may result.

4.0 Redistributed Soil and Spoil Monitoring Program

In order to provide a feedback system to check the reliability of the overburden sampling and analysis program, a redistributed soil and spoil sampling program is in place. The redistributed soil

and spoil will be sampled prior to topsoil replacement with a hydraulic soil sampler, a bucket auger, or other suitable equipment. Personnel will inspect the surface spoil between sample points. If a significant change in characteristics is observed between sample points, additional sample sites will be located. Redistributed material will also be visually inspected for compaction, possible root growth problems, and the potential for slippage at the topsoil/subsoil/spoil interface. The lateral and vertical sampling intensities are closely evaluated once sufficient samples are collected to determine the degree of sample variability. This sampling program will ensure that the redistributed soil and spoil is chemically and physically suitable for the intended crops. See Table 2.05.4(2)(d)-1 for all sample parameters, increments, and frequency.

Table 2.05.4(2)(d)-1 Spoil and Soil Criteria for Areas West of 2700 Road (Revised with NRCS and DRMS 2010)

Parameter	Unit	Benson-West, Lloyd, and WFC (Non-Prime)	WFC Prime Farmland		Morgan Property	Areas West of 2700 Road
		Zones 5-7	Zone 8		Zones 1-4	All Zones
		Mixed Topsoil (single lift)	Mixed Topsoil (Upper 2 feet)	Mixed Topsoil (Below 2 feet) & Bench 1 Substitute Subsoil	No soil testing on Morgan Property during redistribution (soil stockpiles previously tested)	Bench 1 Surface Spoil
pH[3]	standard units	<6.1 >8.4	<6.1 >8.4	<6.1 >8.4		<6.1 >8.4
Electrical Conductivity (EC)	mmho/cm	>6 at any location or >5 average/landowner	>4 at any location	>6 at any location or >5 average/landowner		>8
Saturation Percentage	%	<25, >80	<25, >80	<25, >80		
Sodium Adsorption Ratio (SAR)	Ratio	>4	>4	>4		
Exchangeable Sodium (ESP)	%	N/A	>15	N/A		
Calcium Carbonate	%	N/A	>15	>40		
USDA Soil Texture (based on particle size analysis)[1]	All Except	S, LS, SC, SIC, C	S, LS, SC, SIC, C	S, LS, SC, SIC, C		
Boron	ppm	N/A	N/A	N/A		>5
Rock Fragments[2]	%	N/A	N/A	>15		N/A
Sample Grid		1 per 5 acres	1 per 2.5 acres	1 per 2.5 acres		1 per 5 acres
Sample Thickness		Total lift thickness; max 2-ft increment per sample	Top 2 feet	Total lift thickness; max 2-ft increment per sample		1, 2-ft increments

[1]USDA Soil Textures - unsuitable textures area: S-sand, LS-loamy sand, SC-Sandy clay: SIC-Silty clay, C-Clay
[2]The 3-inch-plus % is estimated visually (by volume) by sweeping the face of the area being inspected, measuring out the area's depth, and then estimating boulders, cobbles, and stones using USDA criteria. The 3-inch-minus rock fragment volume is estimated using sieve and collection pans. This is done by taking the thickness sample of the material, placing it in a graduated sieve with a 2 mm final sieve size, and sieving the soil to the bottom of the sieve pan. The volume of soil remaining in the 2 mm and larger sieves is then estimated for the 3-inch-minus rock fragment. These two component measurements are then summed to give the Rock Fragments value.
[3]pH values in the table represent the acceptable range that sample pH must fall between.

The thresholds in the table are formatted according to DRMS requirements. The notation indicates what values would be outside the suitability threshold. For example, a rock fragment of more than 15% is unsuitable, thus the threshold is written as ">15".

5.0 Unsuitable Spoil Mitigation Plan

In the event that any one spoil sample result exceeds the limits listed in Table 2.05.4(2)(d)-1, WFC will implement the Unsuitable Spoil Mitigation Plan listed below.

If one or more parameters fall within the unsuitable range at a given grid point, a three-part mitigation plan will be implemented.

1. The area around a suspect hole will be sampled on a closer spacing interval in order to better define the lateral extent and variability of the unsuitable material. This sampling will be called the 2nd Phase sampling and the interval is one hole per 50 feet distance around the bad point in all directions for Prime Farmland (Zones 3 & 8), and one hole per 100 feet distance around the bad point in all directions for non-prime farmland.

2. If 2nd phase sampling shows an exceedance, follow-up sampling will take place to delineate the area of exceedance. Delineated areas of exceedance that are larger than 0.1 acres for irrigated cropland, 0.25 acres for reclaimed irrigated pastureland or 0.50 acres for dryland pasture will be remediated.

3. For remediation, any area identified above which exceeds the acreages stipulated above for unsuitable surface spoil material will be placed at least eight feet below the final soil surface. New spoil material will be used in its place. This material will be tested according to the original grid (1 hole per 5 acres) to confirm its suitability.

4. If none of the above procedures satisfactorily mitigate a certain problem, the Division will be notified and recommended actions will then be implemented.

Any remedial backfilling and/or burial will be completed in a manner that results in final surface elevations and topography that are consistent with the approved reclamation plan and are compatible with the post mining land use for the remediated area.

WFC will maintain and periodically review the existing quality control program used to evaluate overburden, interburden, and spoil handling activities at New Horizon Mine. WFC will maintain records of the sampling results for each logical reclamation unit. These records will be kept on file at the mine site and will be reported within the topsoil balance/spoil quality report to be submitted annually to DRMS on April 15th of

each year.

6.0 New Horizon #2 Mine Spoil Compactibility and Erodibility

Determining the compaction potential of disturbed overburden is important to assess postmine spoil conditions including: hydraulic conductivity, revegetation success, landscape stability, and equipment traffic. Generally, stability and/or compaction problems are related to soils high in shrink/swell clays, soils with large proportions of sand and clay (sandy clay texture), and soils with approximately equal proportions of the sand, silt, and clay-size particle fractions. These three conditions are not highly desirable since a high shrink/swell clay content in postmine landscapes causes poor stability and low permeability conditions, a sandy clay textured soil develops surface crusting problems, and an equal particle-size distribution causes excessive compaction which results in restricted water movement and root growth.

The first two considerations listed above were among those used for establishing the grading system for texture. Unsuitable clay textures were identified within two thin lenses of the upper overburden in the western half of the study area (Section 2.04.6). These clay lenses occur only near overburden Drill Site 870E (see Map 2.04.6-1, Geologic Cross Section and Sample Locations for New Horizon 2 Study Area). These clay lenses are in the projected mining disturbance area and when they are being excavated, they will be thoroughly mixed with non clay type overburden. The mixing and dilution process will be accomplished by: 1) blasting, which will start the mixing of clay lenses with non clay formations above and below the clay seam 2) the overburden shovel will be digging a full face through the clay lense from top to bottom to load each truck for transportation to the backfill, 3) and finally, the trucks with the diluted clay lenses on board will dump their load along a several hundred foot dump face. After this process, the concentration in any one spot of clay like material will be minimal and compatibility of the backfill will be negligible.

The New Horizon 2 postmine spoil textures will typically be loamy with an approximate particle size distribution of 65 percent sand, 25 percent silt, and 10 percent clay (Section 2.04.6, Geology Description). Surface crusting, which is critical to seedling emergence, is discussed in the Soil Survey (Section 2.04.9), Revegetation Plan (Section 2.05.4(2)(e)), and Topsoil Management of this Section. Since clay percentages and shrink-swell potentials are low, stability and trafficability problems are not anticipated.

The resultant loamy textured spoil will possess physical qualities which are conducive to plant growth. The available water holding capacity will likely be moderately low to moderate (approximately 0.07 to 0.11 inches of water per inch of soil), permeability moderate to moderately rapid (about 1.0 to 6.0 inches per

hour), and cation exchange capacity low to moderately low (5 to 10 milli-equivalents per 100 grams).

The chemical properties of the overburden/interburden are also quite favorable. Sodicity and salinity levels are low to moderate in the New Horizon 2 permit area and should pose no severe problem to successful reclamation. Salinity levels in the upper four feet of regraded Bench 1 material will likely be comparable to premining values.

The uppermost overburden transitions into the subsoil gradually on the majority of the permit area. Much of this upper overburden (also called Bench 1 material) is subsoil. For the area west of 2700 Road, it is standard practice that Bench 1 material will be used to supplement the subsoil to provide the best chance for reclamation success. The topsoil replacement calculations discussed later in this Section accounts for the use of some of this material. In all areas, Bench 1 is the first spoil below topsoil and subsoil. This is the same as the pre mine conditions.

7.0 New Horizon 2 Mine Topsoil Management Plan General Considerations

The New Horizon 2 Mine topsoil handling procedures, based upon the detailed soil survey information contained in Section 2.04.9, were developed to insure that the topsoil resources within the disturbance area are salvaged and replaced. The plan outlined in the following subsections focuses on the topsoil replacement that has already occurred (as of late 2011) and describes salvage depths and techniques, storage, redistribution, and maintenance or testing procedures necessary to restore the disturbed areas to the desired postmine land use.

The terms "topsoil" and "subsoil" are used throughout the permit in reference to two vertical portions of soil profiles on site. Topsoil is the uppermost portion, while subsoil is the portion immediately below topsoil.

Topsoil handling will be minimized to the extent possible, utilizing direct lay down as much as possible. Topsoil and subsoil has been stripped from all of the Morgan property as of September 2011, and stockpiled in the piles shown on Map 2.05.4-6. All topsoil and subsoil to be placed on the Morgan property is contained within these stockpiles.

Subsoil and topsoil replacement thicknesses and distribution plans are shown on Map 2.05.4-4, for the entire permit area. Map 2.05.4-6 shows the topsoil distribution and balance for the Morgan Property, and Map 2.05.4-7 shows these items for the areas north of BB Road and west of 2700 Road.

8.0 Topsoil Storage

All efforts will be made to direct haul and place all topsoil excavated. When the direct haul of topsoil is not feasible, the topsoil will be stored in stockpiles.

Stockpiling of topsoil will be required for topsoil removal in the initial box cut, haul road, spoil stockpile areas, sediment pond, shop area, and final pit/highwall reduction areas. Topsoil stockpiles will either be located in areas that will not be disturbed by the ongoing mining operation or in freshly backfilled areas prior to topsoiling. This will be necessary especially at the end of mine life and on Morgan property prime farmland in order to insure that topsoil is placed correctly for the post mine land use. Stockpiles will also be place in areas where the stored topsoil will not be lost to wind erosion or surface runoff. When a topsoil stockpile is placed, it will not be moved until soil is needed for distribution on graded areas, or is consolidated into other existing stockpiles. Stockpile locations were also evaluated and selected to minimize truck travel distance, to reduce equipment cost, and to increase efficiency.

Signs will serve as continuing reminders to personnel that stockpile areas are to be preserved and undisturbed.

Any topsoil stockpile which will remain in place less than 90 days will not be revegetated. The surface of each pile will be left in a roughened condition to retard wind and water erosion. A self-contained grader ditch or berm will be constructed around the perimeter of the stockpile to prevent loss of the topsoil resource.

Any topsoil stockpile which will remain in place for 90 to 180 days will be stabilized by utilizing an annual grain (barley, oats or wheat) cover crop. The seeding rate will be 70 pound per acre broadcast.

Protection and maintenance of "long-term" topsoil stockpiles will begin when a stockpile is temporarily or fully completed and no more additions or withdrawals of topsoil are to be made within a 180 day time period. Topsoil stockpiles will be stabilized primarily by perennial plant establishment. The seed mixture, and seeding rate for long-term topsoil stockpiles is described in the Revegetation Plan, Section 2.05.4(2)(e).

Establishing vegetative cover will aid in overall stabilization and erosion control of stockpiles. Vegetative cover will aid in reducing runoff and raindrop impact and will increase moisture infiltration by maintaining the upper soil surfaces in a friable, noncrusted condition. Organic matter, soil nitrogen, and microorganism activity will be maintained or enhanced by the seeding of deep rooted species or species with fibrous root systems.

The topsoil storage breakdown as of PR-08 can be seen in Table 2.05.4(2)(d)-2 below. The stockpile locations are shown on Map 2.05.4-9.

Table 2.05.4(2)(d)-2 Topsoil Stockpile Inventory (June 2012)

Topsoil Pile Name	Type of Topsoil	Volume (CY)	Location
A	REMOVED		
B	Mixed	4,330	East Side of 27 Road
C	Lift A Topsoil	6,260	East Side of 27 Road
D	Mixed	5,015	East Side of 27 Road
E	Lift A Topsoil	2,990	East Side of 27 Road
F	Mixed	22,740	East Side of 27 Road
G	Mixed	35,280	East Side of 27 Road
H	Lift B Topsoil	41,760	East Side of 27 Road
I	REMOVED		
J	REMOVED		
K	REMOVED		
Sub Total		118,375	East Side of 27 Road
1	REMOVED		
2	Mixed	9,410	West Side of 27 Road
3	REMOVED		West Side of 27 Road
4	Prime Farmland Pond 013	13,266	West Side of 27 Road
5	REMOVED		
6	Lift A (Morgan)	185,491	West Side of 27 Road
7	Lift A (Morgan)	9,007	West Side of 27 Road
8	Lift A (Morgan)	17,067	West Side of 27 Road
9	Mixed (Morgan)	129,670	West Side of 27 Road
10	Mixed (Morgan)	9,279	West Side of 27 Road
11	Lift B (Morgan)	392,463	West Side of 27 Road
12	Mixed Topsoil	110,511	West end of Lloyd Property (Multiple piles)
Sub Total		876,164	West of 27 Road
TOTALS		994,539	

All of the topsoil in the above listed stockpiles numbered A through I are committed to the final reclamation of the area east of 2700 Road. This includes the area of the overburden stockpile, the haul roads and some other minor disturbance.

All stockpiles have slopes less than 3H:1V and have been seeded and mulched in the past. All have reasonable vegetation cover and are not experiencing excessive erosion. The runoff from all stockpiles is handled in designed sediment control structures. There is adequate topsoil in these piles to perform the required placement in these areas according to the thicknesses shown on Map 2.05.4-4.

8.1 Topsoil Storage Prime Farmland

An area near Pond 013 (4.76 acres) in the northwest corner of the Johnson (WFC) property was determined to be Prime Farmland. The construction of the Pond 013 led to the disturbance of 3.96 acres of this area. The disturbance is a mix of Pond 013 itself, the prime farmland soil stockpile, and related disturbance. The prime farmland soils that were stripped are now in Stockpile 4 near Pond 013. This stockpile can be seen on Map 2.05.4-7. They can also be found listed in Table 2.05.4(2)(d)-2.

Since Pond 013 will be in place well after the surrounding land has been reclaimed, the prime farmland will be reclaimed as a new 3.96 acre area of Irrigated Cropland post-mine land use as shown in Section 2.05.4(2)(e).The 3.96 acres of Irrigated Cropland will be a combination of 1.13 acres of prime farmland soils that Stockpile #4 was placed on, and 2.83 acres of prime farmland constructed from the stockpiled soil. Map 2.05.4-8 shows the layout of this area and its surroundings for reference.

The stockpiles on the Morgan Property will be used to complete the reclamation of the Morgan Property. This includes 85.10 acres of Prime Farmland, which when combined with the undisturbed (1.93 acres) Prime Farmland areas, restore the total 87.03 acres of Prime Farmland present on the Morgan Property prior to mining. Map 2.05.4-6 shows the stockpiles, and Table 2.05.4(2)(d)-2 lists them. The 1.90 acre Irrigated Cropland reference area will not have any soil placed on it as it is undisturbed.

8.2 Topsoil Storage Non-Prime Farmland Areas

Topsoil salvaged for Non-prime Farmland areas will be salvaged according to Section 2.04.9. Most topsoil will be directly placed on the backfilled areas that follow the mining pit across the permit. Some topsoil will be stockpiled for ponds and for the final topsoil replacement at the end of mine life. The locations and size of these stockpiles can be seen on Map 2.05.4-9. Additionally, these stockpiles are listed in Table 2.05.4(2)(d)-2.

9.0 General Topsoil Handling & Placement Procedures Prior to February 2008

The mine was initially started in a box cut in the southeast corner of the permit area. Mixed Lift Topsoil and Lift A topsoil was placed in Stockpiles C, D, E and H as shown on Map 2.05.4-9. Additional stockpiles were created as the mine advanced. Once these stockpiles were created, almost all additional topsoil was excavated and directly placed on regraded spoil behind the active pit.

Prior to February 2008, some topsoil was stripped and replaced on the reclaimed area in a single lift and other areas (the majority) was stripped in 2 lifts and replaced in 2 lifts. A minimum of three feet of Bench 1 material was placed beneath the topsoil. Map 2.05.4-4 shows the actual topsoil material replacement thicknesses for the permit area. All of the area east of 2700 Road was re-topsoiled prior to February 2008. The February 2008 date is important since the topsoil on the eastern portion of the Morgan property was stripped in a single lift up to that date.

Also, WFC had stripped a small area for Pond 013 in the northwest corner of the permit area, where 98A soil was present. This topsoil was also ruled to be prime farmland soil by the NRCS, and had to be handled accordingly. The topsoil was stripped in a mixed lift and was placed in Stockpile 4.

Details of historic soil salvaging can be found in Section 2.04.9.

9.1 Morgan Property Soil Augmentation Plan

In order to satisfy requirements of legal settlements with the Morgans, 32,800 CY of topsoil from the Johnson (WFC) and Benson property will be transferred to the Morgan Property. This topsoil will come from stockpiles on the aforementioned properties. This WFC Extra topsoil will be placed on the Morgan Property as additional subsoil. The quantities and thickness of the WFC Extra can be seen on Map 2.05.4-6 and are discussed in subsection 12.0.

To make up for the removal of topsoil (WFC Extra) from the Johnson property, stockpiled Bench 1 material was selected to place below the topsoil and create a total soil depth of 25 inches. This Bench 1 material was studied by a experts on WFC's behalf and was found to be usable as subsoil. A report to this effect can be seen in Attachment 2.05.4(2)(d)-3. This Bench 1 subsoil will be sampled for quality as it is placed, in the same fashion as the Mixed Topsoil that will be placed atop of it. The Bench 1 subsoil will be rock picked prior to placement to minimize coarse fragment content. Map 2.05.4-7 shows the material balance

of the Bench 1 and Mixed Topsoil placement on the Johnson property (Zone 6 & 7).

10.0 General Topsoil Handling & Placement Procedures After February 2008

Topsoil will be replaced on the Morgan Property once the approved postmine topography (projected from the top of the overburden) is achieved and when no additional overburden grading is anticipated. All topsoil placement will be in the final location. Topsoil will not be placed while saturated. Topsoil shall be replaced along the contour, whenever feasible, to minimize potential erosion and topsoil/spoil interface slippage problems. This practice will be discontinued on steep slopes where the safety of the equipment operator is in jeopardy.

10.1 Mitigation of Friable Rock Deposits

It has been noted by DRMS and WFC that occasional deposits of friable shale or claystone deposits are encountered in the Bench 1 overburden during stripping. Since these rock types are undesirable in the Bench 1 material that is placed below the topsoil and subsoil.

During the stripping of topsoil and Bench 1 material, if any areas of consolidated, but friable rock deposits are encountered, WFC operators performing topsoil stripping will follow the following procedure:

1) If the deposits are less than one truck load in size, the shovel operator will load the rock into a haul truck, and instruct the haul truck driver to place the rock material in the backfill area at least eight feet below the topsoil layer.

2) If the deposits are greater than one truck load in size, the shovel operator will leave the rock deposit in place. It will than be removed during overburden stripping and placed in the backfill area at least eight feet below the topsoil layer.

Rock deposits identified during stripping are buried immediately. However, during the placement of Bench 1 that has been stockpiled, further rocks may be identified. These are separated and buried the same as during stripping, but may be temporarily piled near the Bench 1 stockpile for efficient transport. All rock deposits identified within the Bench 1 are separated from the Bench 1 and buried at least eight feet below the topsoil layer.

10.2 Subsoil and Topsoil Placement Equipment and Practices

Subsoil (Lift B or Mixed) material will be placed via haul truck and dozer. Prior to the placement of any material, stakes will be placed in the Bench 1 overburden and marked with the height that subsoil must be placed to. These stakes will be placed in the overburden on a grid of 100' x 100'. Dozer operators will then spread the subsoil over the area to the height marked on the stakes. This will ensure that subsoil is placed at the appropriate thickness. These stakes will be removed after all subsoil has been placed on a 10 acre area. This same procedure will be repeated for topsoil (Lift A or Mixed).

Each topsoil and subsoil lift will be placed at its final thickness over whatever area a single truck load can cover at a given time. When a truck load is dumped onto an area, the dozer operator will only spread the material out over an area that can be covered at the required thickness. This will minimize compaction, since the dozer will not be retreading over previously placed material to place a new layer. This process will take place for each lift placed.

11.0 Topsoil Replacement

The topsoil replacement for the mine is divided into the three original topsoil study areas. These are discussed in the following subsections.

11.1 Topsoil Replacement - 1988 and 1995 Study Areas (East of 2700 Road)

These study areas are located east of 2700 Road. As of February, 2008, this area has been stripped, replaced and reclaimed. The various tracts had different topsoil placement thicknesses depending upon landowner and land use. The material replaced, as reported in the Annual Reports, is shown on Map 2.05.4-4. As is seen from the Map, most of the area was stripped and replaced in 2 lifts. In some cases, the combined lift thickness is reported on the Map.

During the topsoil stripping, a deficit was encountered in the amount stripped compared to the amount predicted from the soil survey. WFC proposed the use of selected overburden or interburden materials, approximately 33,600 cubic yards as topsoil substitutes or plant seedbed media for this area, which is 9.7 acres immediately north and west of Pond 07. See Map 2.05.4-4. This is based on the fact that this area had poor topsoil in the beginning (Soil Unit 810), and the lower than anticipated recovery of 80 percent for the remaining Soil Units 1E, 1EW, 808, 30C in the surrounding area. The substitute soil was shown to be acceptable for reclamation. This change was approved and the replacement work was completed. As of February, 2008, these reclaimed areas appear to be doing well and will meet the bond release criteria.

As of June 2010, much of the area has obtained or is about to obtain Phase 2 bond release.

12.0 Topsoil Balance and Replacement on Areas West of 2700 Road

This section describes the topsoil balance calculations for all areas west of 2700 Road, including discussions on the sequence and volumes needed to provide the required thicknesses. Procedures for the placement of topsoil can be found in subsection 10.1.

12.0.1 Prime Farmland Soils Balance, Sequence and Volumetrics

All prime farmland elements of the permit can be found in Section 2.06.6. However, since the areas of prime farmland and non-prime farmland will draw their soils from the same stockpiles, all discussion regarding soil balance will be found here, in Section 2.05.4(2)(d). Specific information regarding the prime farmland soil redistribution can be found in subsection 3.0 of Section 2.06.6

12.1 Morgan Property

By February of 2008, 7.8 acres of the eastern portion of the Morgan property had received a Mixed Topsoil lift placed on top of Bench 1 subsoil. Re-evaluation of the soil needs on the Morgan Property has led to the determination that there is sufficient Lift A and Mixed Topsoil material to cover the entirety of the area that Bench 1 subsoil has been placed on, and still provide a quality soil profile for revegetation. Therefore, the Bench 1 subsoil will now be treated as no more than Bench 1 spoil, and ignored in terms of soil calculations and redistribution plans.

Map 2.05.4-6 shows the status of the Morgan Property topsoil and subsoil replacement as of PR 08. This map also shows the topsoil and subsoil stockpile amounts and balance calculations for the entire Morgan Property. All soil has been stripped from the Morgan Property, so no calculations of undisturbed soil available for redistribution have been conducted or included. All soil reclamation on the Morgan Property will be accomplished with the remaining soil stockpiles.

The Morgan property topsoil replacement is broken down into four different zones, three of which will have topsoil placed on them. The fourth zone is the undisturbed area to be used as the Irrigated Cropland reference area. The four zones are described specifically below and shown on Map 2.05.4-6.

Non-Prime Farmland (NPF)

- **Zone 1** is a 7.81 acre field that currently has 14 inches of Mixed Topsoil overlying 33 plus inches of Bench 1 material. 12 additional inches of Mixed Topsoil will be placed atop 11 inches of WFC Extra and the current 14 inches of Mixed Topsoil to complete a 37 inch subsoil layer. 14 inches of Lift A Topsoil will be placed on top of this subsoil layer to give a total soil depth of 51 inches. The post mine use of this zone is Irrigated Cropland, but it is not Prime Farmland.

- **Zone 2** is a 12.21 acre field that will receive 14 inches of Lift A Topsoil on top of 26 inches of Mixed Topsoil and 11 inches of WFC Extra, for a total soil depth of 51 inches. The post mine use of this zone is Irrigated Cropland, but it is not Prime Farmland.

Prime Farmland (PF)

- **Zone 3** is a 85.10 acre area that will be reclaimed as Prime Farmland. This zone will consist of 15 inches of Lift A Topsoil atop 7 inches of Mixed Topsoil atop 34 inches of Lift B Topsoil. This create a total soil depth of 56 inches. The post mine land use of this zone is Irrigated Cropland. It is Prime Farmland.

- **Zone 4** is a 1.90 acre piece that was left undisturbed because it was needed as a blasting buffer zone around Frank Morgan's home. Combined with Zone 3, this makes up the 87 acres of Prime Farmland on the Morgan Property. No soil will be placed in this area. This zone will be used as the Irrigated Cropland Reference area. It is Prime Farmland.

The topsoil and subsoil balance for the Morgan property prime farmland can be seen on Map 2.04.5-6 and Table 2.05.4(2)(d)-3. As of PR 08 some material is stockpiled and some material is already placed in its appropriate location. All soil has been stripped from the Morgan Property.

Map 2.04.5-6 and Table 2.05.4(2)(d)-3 are designed to show that the above discussed topsoil replacement plan for each zone can be accomplished with the stockpiled and placed soils. All of the soil listed as available will be used in reclamation. For the purpose of practicality, soil thicknesses are designed to the nearest inch, multiplied by the area of application, and then the resulting volume compared to the amount of said soil that is available. If this comparison shows there is not enough soil to accomplish the design thickness, then the design thickness is lowered until the Total to be Placed is less than the Total Available

(see the table on Map 2.05.4-6). While this makes it appear as if there is leftover soil, there is not: all soil will be used in reclamation.

Table 2.05.4(2)(d)-3 Topsoil and Subsoil Balance on Morgan Property

Topsoil/Subsoil Requirements								
			Mixed Topsoil[1]		Lift A Topsoil		Lift B Topsoil	
Zone		Area (acres)	CY	Thick (in.)	CY	Thick (in.)	CY	Thick (in.)
Zone 1	NPF	7.81	38,850	37	14,700	14	0	0
Zone 2	NPF	13.12	65,265	37	24,695	14	0	0
Zone 3	PF	85.10	80,089	7	171,618	15	389,002	34
Zone 4	PF	1.90	N/A	N/A	N/A	N/A	N/A	N/A
Undisturbed		0.03	N/A	N/A	N/A	N/A	N/A	N/A
Total		**107.96**	**184,204**		**211,013**		**389,002**	

Note: The volumes calculated above are based on the listed thickness applied to the each area evenly. As of PR 08, Zone 1 has 14 inches of Mixed Topsoil placed already.

[1]Includes the WFC Extra values shown on Map 2.05.4-6 where applicable.

Topsoil/Subsoil Available			
	Mixed Topsoil	Lift A Topsoil	Lift B Topsoil
Already Placed	17,850		
Stockpile 6		185,491	
Stockpile 7		9,007	
Stockpile 8		17,067	
Stockpile 9	129,670		
Stockpile 10	9,279		
Stockpile 11			392,463
WFC Extra	32,800		
Total	**189,599**	**211,565**	**392,463**

Note: Topsoil stockpile volumes based on surveys from 2011, 2012, and 2013. Already placed soil based on known placed thickness (14 inches) over Zone 1 (7.81 acres). WFC Extra value based on requirements of Morgan Property

legal settlement.

Topsoil/Subsoil Balance (CY)			
	Mixed Topsoil[4]	Lift A Topsoil	Lift B Topsoil
Zone 1	38,850	14,700	0
Zone 2	65,265	24,695	0
Zone 3	80,089	171,618	389,002
Zone 4	0		0
Soil to be placed	184,204	211,013	389,002
Already Placed[1]	14,700	0	0
Stockpiled[1]	138,949	211,565	392,463
Soil Available[2]	186,449	211,565	392,463
Soil Balance[3]	**2,245**	**552**	**3,461**

[1]From Topsoil/Subsoil Available table.

[2]Combintation of Already Placed and Stockpiled categories.

[3]Soil Available minus Soil to be placed. This shows that the plan can be accomplished with the soil on site, but it does not mean that there will be soil left over. All soil will be used to reclaim according to this plan..

[4]Includes the WFC Extra values shown on Map 2.05.4-6 where applicable.

As can be seen from Table 2.05.4(2)(d)-3, there is sufficient topsoil and subsoil volume in the stockpiles to complete the topsoil redistribution plan. Since stockpiled soil had rock fragments removed during stripping, the recovery from stockpiles is treated as 100%. The basic calculation of the topsoil required in a given zone is:

$$Topsoil\ Needed = \frac{Zone\ Area\ (ac) * 43{,}560\ {}^{ft^2}\!/_{ac} * Soil\ Thickness\ (in)}{12\ {}^{in}\!/_{ft} * 27\ {}^{ft^3}\!/_{yd^3}}$$

The size of the stockpiles is determined via detailed surveys conducted on site. All soil thicknesses are designed to the nearest inch, since this is the practical measurement limit for the scale of equipment used at the New Horizon Mine.

12.2 North of BB Road/West 2700 Road

These lands include all lands north of BB Road and west of 2700 Road except for the 4.76 acres of prime

farmland soils (WFC Prime Farmland). As of June 2012, there is approximately 107 acres of land that has been backfilled and topsoiled with Mixed Topsoil that covers all of Benson West and about half of the Lloyd (WFC) property. These area is shown on Map 2.05.4-7 as Zone 5. Mixed Topsoil was placed atop of Bench 1 material in Zone 5. Some samples of the Bench 1 material were taken in 2008 from this area and tested, however, no additional testing will be done on this material in this area.

Once spoil has been placed and graded, it will be ripped to at least 24 inches below grade before the Mixed Topsoil placement. Map 2.05.4-7 shows these areas with the calculated acreage and replacement thicknesses.

The calculations for the replacement of the these areas are shown below:

- **Zone 5** (109.51 acres) - Topsoil: 15 to 24 inches (21 in. avg.) of Mixed Topsoil over at least 30 inches of Bench 1 Surface Spoil.

- **Zone 6** (23.61 acres) - Topsoil: 12 to 20 inches (13 in. avg.) of Mixed Topsoil over at least 24 inches of Bench 1 Surface Spoil.

- **Zone 7** (79.01) - Topsoil: 8 inches of Mixed Topsoil over at least 18 inches of Bench 1 Substitute Subsoil.

- **Zone 8** (2.83) - Topsoil: 38 inches of Mixed Topsoil over at least 18 inches of Bench 1 Surface Spoil.

Topsoil Stockpile #12 will be used to reclaim the last 3 cuts of the mining area and Pond 013, once the area has been backfilled from Mount Nucla and the Bench 1 material has been placed.

Table 2.05.4(2)(d)-4

Topsoil Balance for Area North of 2700 Road (Johnson, Lloyd, & Benson West)

Non-Prime Farmland Area						
		Topsoil Required		Stockpiled Topsoil	Directly Placed Topsoil	Net
Zone	Area (acres)	CY	Thick (inches)	CY	CY	CY
Zone 5	109.5	309,184	21	133,187	301,645	
Zone 6	23.6	41,265	13		41,265	
Zone 7	77.0	74,357	7		0	
Zone 8	2.83	14,458	38		0	
Total		**439,264**		**100,387**	**342,910**	4,033

*Stockpiled topsoil volumes for all ponds are present as of June 2012.

The area north of 2700 Road is divided into zones for the purpose of topsoil replacement planning, as can be seen on Map 2.05.4-7. Zones 5-7 are not Prime Farmland areas, while Zone 8 is a small Prime Farmland area. For more details on the WFC Prime Farmland (Zone 8) near Pond 013, see Map 2.05.4-8.

All of the topsoil discussed above is Mixed Topsoil stripped in a single lift.

13.0 Topsoil Preparation Procedures Prior to Seeding

This discussion has been divided into each of the three main post-mine land uses: Dryland Pasture (DP), Irrigated Pasture (IP), and Irrigated Cropland (IC). Irrigated Cropland covers both prime and non-prime farmland areas.

13.1 Irrigated Cropland Topsoil Preparation Procedures (Prime and Non-prime)

Topsoil replacement operations may be carried out during most of the year, the exception being those periods when wet conditions would preclude handling of the topsoil materials.

1A - Deep ripping of the subsurface - Upon successful completion of placing the subsoil as described in

the soil redistribution plan WFC will deep rip the subsoil to a minimum depth of 24 inches to alleviate the compaction from heavy equipment traffic. The soil will be ripped during dry soil conditions.

1B - Deep ripping of topsoil - Upon successful completion of placing topsoil on the ripped subsoil the newly place soil will be ripped to a depth of at least 2 inches greater than the depth of topsoil. This will alleviate compaction of the topsoil and assist in the removal of any boundaries between the ripped subsoil and topsoil.

2 - Land leveling - WFC uses a blade pulled behind a farm tractor to level the topsoil surface and allow a smoother surface for seeding.

3 -Rock picking - WFC will use mechanical devices that are pulled behind a tractor that windrows rocks and then another device that picks up large rocks over approximately 2.5 inches in diameter. Rocks up to approximately 24" diameter can be picked up by the device. Sandstone lenses that are identified in any topsoil, subsoil, or Bench 1 Surface Spoil will be buried in lower Bench 1 overburden, at least eight feet below the topsoil level.

4 - Fertility testing - Three soil samples will be obtained in the field to be tested. The field is defined as that area that has recently been topsoiled. Samples will be taken and analyzed by a lab using the standard soil test for pH, salts, organic matter, nitrogen, potassium, and phosphorous. The lab will be informed that the desired crop is irrigated alfalfa and that the tonnage rate is 5.5 tons per acre. The reference area will be sampled separately.

5 - Disking - Prior to final seedbed preparation, soil conditioning and weed control tillage will be carried out through disking or other standard agricultural practice. Disking will be used to condition soil, break up clods, and control weeds prior to seeding. If annual weeds are a problem, several tillage operations may be required to get adequate control.

6 - Final Seedbed Preparation -(For irrigated areas) Cultipacking prior to seeding will be conducted if land leveling did not provide a smooth soil surface for seeding. The best period for tillage in these areas may be in the early spring prior to the irrigation season.

For flood irrigated areas - A standard marker will create furrows of approximately 4" to 6" depth on 30" centers, which is standard for the gated pipe used for the flood irrigation.

7 - Fertilizer Application - Based on the results of fertility testing, fertilizer of the designated type will be applied at the rate specified from the lab testing. Fertilizer applications may be delivered through the irrigation system, by tractor with a broadcast spreader, or alternate method. The fertilizer will be applied in the same year that the fertility testing is done. Ongoing fertility testing after initial seeding is described in Section 2.05.4(2)(e) Revegetation.

13.2 Reclaimed Irrigated Pastureland Topsoil Preparation Procedures

Topsoil replacement operations may be carried out during most of the year, the exception being those periods when wet conditions would preclude handling of the topsoil materials.

1A - Deep ripping of the subsurface - Upon successful completion of placing the subsoil as described in the soil redistribution plan WFC will deep rip the subsoil to a minimum depth of 24 inches to alleviate the compaction from heavy equipment traffic. The soil will be ripped during dry soil conditions.

1B - Deep ripping of topsoil - Upon successful completion of placing topsoil on the ripped subsoil the newly place soil will be ripped to a depth of at least 2 inches greater than the depth of topsoil. This will alleviate compaction of the topsoil and assist in the removal of any boundaries between the ripped subsoil and topsoil.

2 - Land leveling - WFC uses a blade pulled behind a farm tractor to level the topsoil surface and allow a smoother surface for seeding.

3 -Rock picking - WFC will use mechanical devices that are pulled behind a tractor that windrows rocks and then another device that picks up large rocks over approximately 2.5 inches in diameter. Rocks up to approximately 24" diameter can be picked up by the device. Sandstone lenses that are identified in any topsoil, subsoil, or Bench 1 Surface Spoil will be buried in lower Bench 1 overburden, at least eight feet below the topsoil level.

4 - Fertility testing - Three soil samples will be obtained in the field to be tested. The field is defined as that

area that has recently been topsoiled. Samples will be taken and analyzed by a lab using the standard soil test for pH, salts, organic matter, nitrogen, potassium, and phosphorous. The lab will be informed that the vegetation is irrigated pastureland. The reference area will be sampled separately.

5 - Disking - Prior to final seedbed preparation, soil conditioning and weed control tillage will be carried out through disking or other standard agricultural practice. Disking will be used to condition soil, break up clods, and control weeds prior to seeding. If annual weeds are a problem, several tillage operations may be required to get adequate control.

6 - Final Seedbed Preparation -(For irrigated areas) Cultipacking prior to seeding will be conducted if land leveling did not provide a smooth soil surface for seeding. The best period for tillage in these areas may be in the early spring prior to the irrigation season.

For flood irrigated areas - A standard marker will create furrows of approximately 4" to 6" depth on 30" centers, which is standard for the gated pipe used for the flood irrigation.

7 - Initial Fertilizer Application - Based on the results of the fertility testing, fertilizer of the designated type will be applied at the rate specified from the lab testing. Fertilizer applications may be delivered through the irrigation system, by tractor with a broadcast spreader, or alternate method. The fertilizer will be applied in the same year that the initial fertility testing is done. Ongoing fertility testing after initial seeding is described in Section 2.05.4(2)(e) Revegetation.

13.3 Dryland Pasture Seedbed Topsoil Preparation Procedures

For areas less than 15% slope, where irrigation may be used in the future if water becomes available, the following procedures will be followed:

1- Ripping - Prior to replacement of the single lift topsoil, the graded Bench 1 Surface Spoil will be ripped to reduce compaction. This will be done to a depth of 2 feet. This will be done by dozer with rippers or a chisel plow. The single lift topsoil will also be ripped or deep disked to the full depth of the lift following replacement.

2 - Land leveling - WFC uses a blade pulled behind a farm tractor to level the topsoil surface and allow a

smoother surface for seeding.

3 -Rock picking - WFC will use mechanical devices that are pulled behind a tractor that windrows rocks and then another device that picks up large rocks over approximately 2.5 inches in diameter. Rocks up to approximately 24" diameter can be picked up by the device. Sandstone lenses that are identified in any topsoil, subsoil, or Bench 1 Surface Spoil will be buried in lower Bench 1 overburden, at least eight feet below the topsoil level.

4 - Fertility testing - This test is conducted within 3 months of topsoil placement. Three soil samples will be obtained from the top 2 feet of soil in the field to be tested. This field is defined as that area that has recently been topsoiled. Samples will be taken and analyzed by a lab using the standard soil test for pH, salts, organic matter, nitrogen, potassium, and phosphorous. The lab will be informed that the land use is dryland pasture with a mixture of grasses and forbs.

5 - Disking - Prior to final seedbed preparation, soil conditioning and weed control tillage will be carried out through disking or other standard agricultural practice. Disking will be used to condition soil, break up clods, and control weeds prior to seeding. If annual weeds are a problem, several tillage operations may be required to get adequate control.

6 - Final Seedbed Preparation - Cultipacking prior to seeding will be conducted if land leveling did not provide a smooth soil surface for seeding. The best period for tillage in these areas will be immediately prior to seeding.

7 - Initial Fertilizer Application - Based on the results of the fertility testing, fertilizer of the designated type will be applied at the rate specified from the lab testing. The fertilizer is in solid form and will be applied by small tractor with a broadcast spreader. Phosphorus fertilizer will be applied in the Spring of the same year that the initial fertility testing is done, and will be tilled into the soil prior to seeding. Nitrogen fertilizer will be surface applied one time, if warranted based on initial testing, in the fall following the first full growing season.

For areas greater than 15% slope, the following procedures will be followed:

1 - Scarification - The single lift topsoil will be scarified (ripped) to its placement depth using a motor grader with rippers which will operate perpendicular to the slope, creating rough surfaces to trap moisture and prevent soil erosion along this slope. An example of an area where this would be employed is the north edge of the Benson West, the Lloyd and the WFC property, where there is a significant steeper slope in these areas.

13.4 Differential Settling Management Plan

In the event that small depressions develop in the irrigated areas west of 2700 Road due to differential settling, topsoil will be stripped from the area of the depression, and a layer of Bench 1 material will be placed underneath the topsoil. The topsoil will then be replaced and the area reseeded. Some Bench 1 material will be kept in a stockpile (1000 CY) for this purpose. This Bench 1 stockpile will be located on WFC owned or controlled property in the area west of 2700 Road.

Repair of small depressions will only take place on IP outside of the growing season of April to September. Repairs will not take place if it is determined that the soil is saturated or frozen. In general, small depression repairs will be conducted using the same procedures outlined for topsoil redistribution.

If excess topsoil material is available to directly backfill the depression without stripping the topsoil from said depression, this will be done instead of the Bench 1 placement method described above.

On the Morgan Property, if depressions develop that require the stripping of soil to facilitate Bench 1 placement, then topsoil and subsoil lifts will be stripped and stored separately. At all times subsoil and topsoil will be stored separate. The same process will be used if excavation is necessary for the installation or maintenance of any buried irrigation or utility lines on the Morgan Property.

14.0 Topsoil Suitability Criteria and Testing Plan for Reclaimed Soils

Prior to distribution of topsoil, all graded mined areas (on which topsoil is to be applied) will be sampled to confirm spoil suitability (see Regraded Spoil Monitoring Plan in subsection 4.0 of this section for more details). The density and physical characteristics of the replaced topsoil and upper spoil will be observed.

The suitability criteria is required to ensure that no poor topsoil or subsoil is placed near the surface of any reclaimed area and that prime farmlands are restored to strict standards for high productivity.

Soil suitability criteria for all non prime farmland areas west of 2700 Road are addressed in Table 2.05.4(2)(d)-1. Soil suitability for prime farmlands is addressed is Section 2.06.6.

Depth measurements shall be taken at the same locations as the original sample sites. The topsoil salvage and replacement depth information will be kept on file at the mine office and will be submitted with the Annual Topsoil Balance/Spoil Quality Report to DRMS. Topsoil recovery depths will be adjusted if warranted by the site conditions. Sample frequency is as shown in the table for each material type.

15.0 Topsoil Remediation Plans

In the event that any one soil sample result exceeds the limits, WFC will implement the topsoil remediation plan below.

If one or more parameters fall within the unsuitable range at a given grid point, a three-part mitigation plan will be implemented.

1. The area around a suspect hole will be sampled on a closer spacing interval in order to better define the lateral extent and variability of the unsuitable material. This sampling will be called the 2nd Phase sampling and the interval is one hole per 50 feet distance around the bad point in all directions for prime farmland, and one hole per 100 feet distance around the bad point in all directions for reclaimed irrigated pastureland and dryland pasture.

2. If 2nd phase sampling shows an exceedence, follow-up sampling will take place to delineate the area of exceedence. Delineated areas of exceedance that are larger than 0.1 acres for prime farmland, 0.25 acres for reclaimed irrigated pastureland or 0.50 acres for dryland pasture will be remediated.

3. For remediation, any area identified above which exceeds the acreages stipulated above for unsuitable topsoil material will be placed at least eight feet below the final soil surface. New soil material will be used in its place. This material will be tested according to the original grid (1 hole per 2.5 acres on prime farmland, 1 hole per 5 acres on non-prime farmland) to confirm its suitability.

4. If none of the above procedures satisfactorily mitigate a certain problem, the Division will be notified and recommended actions will then be implemented.

WFC will periodically review the existing quality control program used with topsoil handling activities at New Horizon Mine.

In the event that a parameter average threshold value for a particular landowner is exceeded based on the sample points for a given year, the outlier sample point will be further sampled as an individual point of exceedance. The second phase and further sampling would be applied to this outlier point to determine the area of influence. Once additional points were added, a new average of the parameter will be calculated for the landowner in question. In the event that remediation is determined to be necessary over an area to bring the parameter average to within the threshold, topsoil that has already been sampled and demonstrated compliant will be added to the outlier area. The outlier sample would then be sampled again following remediation to determine the success of remediation.

Any remedial backfilling and/or burial will be completed in a manner that results in final surface elevations and topography that are consistent with the approved reclamation plan and are compatible with the post mining land use for the remediated area.

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