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Change History

Change #2 1985 Update	Change #3 1986 Update
Change #4 1986 Exception Status	Change #5 1987 Update
Change #9 1988 Update	Change #10 1989 Update
Change #15 1990 Update	Change # 14 1991 Update
Change #18 1997 Update	Change #19 1997 Update
Change #21 1998 Update	Change #24 Amendment 1
Change #25 Amendment 2	Change #26 Amendment 3
Change #29 Pierce Update	Change #31 Amendment 4 Raber
Change #32 Jolley 6 & Miller Reed Update	Change #33 2006 Update
Change #37 Amendment 5	Change #40 Jolley Edsall Update/IBR
Change#45 Joy Bell 5 Amendment	Change#46 Ten Deep Update
Change#48 Wolff Larson Amendment/Keystone 1 Update	Change#49 Miller Read Scoggins Busenitz Update/Busenitz Amendment
Change#50 Maurer Lease 20 (NW)	Change #51 Ridinger Amendment
Change#52 Proctor Update	Change#53 Maurer Lease Well IBR
Change#54 Jolley 12 & Jolley 13 Update	Change#56 Keystone 8 Update
Change#59 Proctor Jolley Fee Border	Change#60 Ten Deep Update
Change#61 Daisy 3 Daisy 8 Border	Change#63 Joy Bell 12 Joy Bell 13
Change#65 Apogee	Change#66 State Lease 14 2013
Change#67 FAB 5 FAB 6 Joy Bell 3	

Permit Volume 1

Adjudication Information

BPM 118

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Items in RED are under WDEQ/LQD review and have NOT been approved as June 2015.

Permit Volume 17

Permit Volume 14

LQD Restricted Public Access Material

Section 2.8.8.45 Wyoming State Lease 42804 (WSL04) Amendment Vegetation Report

This section and associated Vegetation Map and Data Table comprise the vegetation baseline study for the WY State Lease 42804 permit area. The methodology and data presented conform to those specified in Section 2.8.1 through 2.8.8.

The claims that are included in WSL 04 permit area are as follows (also refer to the Project Boundary Map 1.7-1)

Amendment Areas	Legal	Total Acres
	SE4SW4, SW4SE4 Section 30 T57N R62W	80
Wyoming State Lease 42804	NE4, E2NW4, SW4, NW4SE4 Section 31T57N R62W	440
	W2NW4 Section 32 T57N R62W	80
		600

The vegetation information for the WY State Lease 42804 permit area was prepared by Amber Travsky of Real West Natural Resource Consulting, in 2014.

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1.0 INTRODUCTION

Bentonite Performance Minerals (BPM) proposes to amend their existing 267C mine permit to include the Wyoming State Lease 42804 claim. This 600-acre site is approximately 8 miles west of the BPM plant at Colony. It is located in T57N, R62W, SE ¼ SW ¼ and SW ¼ SE ¼ Section 30; W ½ NW ¼ Section 32; and most of Section 31. The purpose of this report is to document the pre-mining vegetation on the site. This data provides a baseline to assess successful reclamation once mining is completed.

2.0 METHODS

Amber Travsky, a biologist with Real West Natural Resource Consulting (Real West), conducted vegetation sampling on June 17 and 18, 2014. Prior to the sampling, a vegetation sampling plan was submitted to the Wyoming Department of Environmental Quality (WDEQ). Approval for the plan was received from Stacy Page with WDEQ on May 7, 2014 and signed by Jennifer Hartman with BPM on May 13, 2014.

A site reconnaissance was conducted in May 15, 2014 to verify the habitats stated in the sampling plan and to also identify early-blooming plant species. Sampling intensity, as indicated in Table 2-1, required 20 transects in both the woodland and the mixed grass prairie habitat types. After 20 transects were completed, the data was checked for sample adequacy. The statistical formula used to determine sample adequacy follows WDEQ_LQD Guideline No. 2, Vegetation (Rules updated 8/94, page 21). The formula is provided below.

$$nmin = \frac{2\,(sz)^2}{(dx)^2}$$

Where:

nmin = the number of sample points needed in a given vegetation parcel
s = standard deviation of the sample
x = sample mean for plant cover or total cover
d = 0.1 (acceptable amount of inherent variability determined from formula chart)
z = 1.28 (number determined from formula chart)

Table 2-1. WDEQ Baseline Sampling Size for BPM sites.

Acreage of Habitat Type	Sampling Size
< 2 acres	Describe and list species – no sampling
2 to 10 acres	5 sample points
10 to 40 acres	10 sample points
40 to 80 acres	15 sample points
80 to 160 acres	20 sample points
> 160 acres	Minimum 20 points, then to sample adequacy

Sample sites in the mixed grass prairie and the woodland understory were located randomly using the standard grid system and numbers from a random numbers table generated by computer. Two sets of numbers were generated with one set corresponding to the x-axis of a grid and the other corresponding to the y-axis. Grid intervals extended 30 meters. Transect directions were selected using computer-generated random compass bearings from 1 to 360 degrees. If a transect exited a designated sample area, a new random compass direction was chosen until the transect returned into the sample area.

With all sample points, absolute cover was estimated from five 20 cm by 50 cm plots evenly spaced along a 30 meter transect at the 6m, 12m, 18m, 24m, and 30m marks. Vegetation cover was estimated as canopy cover with the addition of any understory vegetation that is covered by the overstory canopy cover. This value was added to the cover values of lichens, litter, rock and bare ground.

Tree density in the woodland habitat was quantified using the Point-Quarter method. In the sampling plan, a belt transect method was described but it was determined by the biologist when in the field that the Point-Quarter method would be more practical based on tree spacing. This method was approved by WDEQ in previous surveys conducted at BPM sites.

For the Point-Quarter method, each of the 20 sample points corresponded with the starting point of each of the vegetation sampling transects. At the sample point, the area was divided into four

imaginary quadrates. Within each quadrant, the distance from the random point to the center of the nearest tree was measured. This was repeated in each of the four quadrants. For each individual tree, the species type, the diameter at 4 ft above the ground (DBH – diameter at breast height), and circumference at DBH were recorded. To calculate the density of all species, the distanced to all trees were summed up and a mean was calculated. The square of this number is equal to the mean area of each tree. Density was determined using the following equations:

Equation #1:
Density (all species) = 1 ÷ mean point-to-plant distance^2

Equation #2:
Relative Density = # individuals of a species ÷ Total # of individuals (all species) X 100

Equation #3:
Density = (Relative density of a species÷100) X Density of all species

3.0 RESULTS

3.1 Plant Community Types

Plant community types were identified using the definitions in the *Bentonite Regional Vegetation Study* (Keammerer 1987). Photographs of each community type are in Addendum A, data summaries are in Addendum B, and a plant species list is in Addendum C. Representative photos of the sample points are in Addendum D. A map with vegetation types, sample points, and photo points is attached.

The Wyoming State Lease 42804 amendment covers 600 acres on rolling to hilly terrain approximately 8 miles west of the BPM processing plant at Colony. The Belle Fourche River is located 0.6 miles to the east, 1.35 miles to the north and 1.6 miles to the northeast since it forms an inverted U-shaped meandering corridor near the permit area. Green Mountain is located in the northwest quarter of the amendment area where the elevation rises to 3,754 feet at the summit. The lowest elevation on the site is 3,585 feet at the southern edge of the site.

Table 3-1. Approximate acreages and percentages for the vegetation community types on the WY State Lease 42804 Amendment Area.

Vegetative Community Type	Acreage on Amendment Area		Disturbance Acres
	Acres	Percentage	
Mixed Grass Prairie Community	196.9	32.8%	89.00
Woodland Community	390.63	65.1%	86.23
Bottomland Meadow Community	2.8	0.4%	0.23
Open Water/Marsh Community	3.32	0.5%	0.20
Disturbed Community	6.35	1.0%	1.34
TOTAL	600.0 acres	100%	177.0

As shown in Table 3-1, the dominant habitat on the site is woodland community. The woodland community is found throughout the amendment area but is most prevalent on steeper hillsides and hill summits. The mixed grass prairie community is found in the basins between the timbered hillsides. A large reservoir is located in the center of the site along the eastern border while three small ponds are also on the site, with one in the north, one in the south, and one on the west-central boundary. Marsh habitat is found on the perimeter of the four reservoirs. A strip of bottomland meadow follows the drainage bottom as it exits the larger reservoir. A second strip of bottomland meadow is in another drainage bottom near the southern boundary of the amendment area. A small patch of disturbed habitat from previous mining is found in the extreme southeastern corner of the site. Each of these communities is described in more detail below.

3.1.1 Woodland Community Type

The woodland community covers approximately 390.63 acres or 65.1 % of the amendment area. This habitat is dominated by an overstory of bur oak (*Quercus macrocarpa*), Rocky Mountain juniper (*Juniperus scopulorum*), and ponderosa pine (*Pinus ponderosa*). Shrubs are sparse but

include currant (*Ribes* spp.) and snowberry (*Symphoricarpos albus*). Forbs in the woodland understory include bastard toadflax (*Comandra umbellata*), western yarrow (*Achillea millefolium*), American vetch (*Vicia americana*), threadleaf phacelia (*Phacelia linearis*), and rose pussytoes (*Antennaria rosea*). Grasses include sandberg bluegrass (*Poa secunda*), prairie junegrass (*Koeleria macrantha*), and slender wheatgrass (*Elymus trachycaulus*).

Vegetation cover and ground cover summaries of the woodland community transect data (Table 3-2) show a vegetation cover mean of 41.40%; mean total ground cover of 97.85%; mean cover by lichens, litter and rock of 56.45%; and mean bare ground of 5.30%. The detailed data summary is in Addendum B.

Table 3-2. Summary of Vegetation Cover Data Collected in 2014 on the Woodland Community on the WSL04 Amendment Area.

	Woodland Community
Number of Transects (Total number of samples)	20
Mean and Standard Deviation for % Absolute Vegetation Cover	41.40% 9.92
Mean and Standard Deviation for % Absolute Bare Ground	5.30% 4.39
Mean and Standard Deviation for % Absolute Lichen, Litter and Rock	56.45% 10.26
Mean and Standard Deviation for % Absolute Litter and Rock	56.35% 10.30
Mean and Standard Deviation for % Absolute Total Ground Cover (Vegetation, Lichen, Litter and Rock)	97.85% 5.45

Ponderosa pine is the dominant tree species within the woodland habitat, as shown in Table 3-3. Ponderosa pine comprises 72.5% of the trees sample with bur oak comprising 22.5% and Rocky Mountain juniper comprising 5% of the trees. Overall density of trees within the habitat type was 126.83 trees per acre. The detailed data summary is in Addendum B.

Table 3-3. Tree density in the woodland community type.

Species	Number of Trees Sampled	Mean Diameter (cm)	Basal Area (m^2)	Relative Density	Density (per acre)
Pine	58	16.22	0.021	72.5	91.95
Oak	18	17.44	0.024	22.5	28.53
Juniper	4	7.0	0.004	5.0	6.34
All Species	80	16.03	0.048	100	126.83

3.1.2 Mixed Grass Prairie Community

The mixed grass prairie community covers approximately 196.9 acres or 32.8% of the amendment area. Big sagebrush (*Artemisia tridentata*) is the most common shrub in this habitat type, although it comprises less than 2% of the coverage. There are scattered patches with higher density sagebrush but these patches were not prevalent and therefore did not constitute a separate community type. Grasses include sandberg bluegrass, slender wheatgrass, prairie junegrass, and buffalograss (*Buchloe dactyloides*). Forbs include bastard toadflax, common yarrow, silvery lupine (*Lupinus argenteus*), and American vetch (*Vicia americana*).

Vegetation cover and ground cover summaries of the mixed grass prairie community transect data (Table 3-4) show a vegetation cover mean of 77.50%; mean total ground cover of 94.73%; mean cover by lichens, litter and rock of 17.23%; and mean bare ground of 9.41%. The detailed data summary is in Addendum B.

Table 3-4. Summary of Vegetation Cover Data Collected in 2014 on the Mixed Grass Prairie Community on the State 42805 Amendment Area.

	Mixed Grass Prairie Community
Number of Transects (Total number of samples)	22
Mean and Standard Deviation for % Absolute Vegetation Cover	77.50% 10.05
Mean and Standard Deviation for % Absolute Bare Ground	9.41% 8.30
Mean and Standard Deviation for % Absolute Lichen, Litter and Rock	17.23% 6.35
Mean and Standard Deviation for % Absolute Litter and Rock	16.27% 6.46
Mean and Standard Deviation for % Absolute Total Ground Cover (Vegetation, Lichen, Litter and Rock)	94.73% 8.53

Bottomland Meadow Community Type

The bottomland meadow community covers approximately 2.8 acres or 0.4% of the amendment area. It is found along three drainage bottoms. One drainage bottom runs parallel to and then diagonally to the south along the southern amendment area boundary approximately 120 meters north of the boundary. The second can be found along the west-central edge of the permit boundary. The final strip of bottomland meadow is found on the west side of the dam that creates the largest reservoir on the amendment area. The bottomland meadow follows the drainage bottom for approximately 300 meters. As the drainage banks steepen and the drainage bottom narrows, the bottomland meadow habitat disappears or becomes a narrow strip, less than a yard wide, alongside the rill of water that might be flowing or small pool patches that might persist into the summer.

Due to the small acreage of this community type, sampling was not conducted but plant species were documented. The bottomland meadow is dominated by hydrophytic plant species including sedges (*Carex* spp.) with Baltic rush (*Juncus balticus*) and patches of bulrush (*Scirpus* spp.). Other species include redtop (*Agrostis gigantea*), meadow foxtail (*Alopecurus pratensis*), and sandberg bluegrass.

3.1.4 Open Water/Marsh Community

There are four reservoirs on the amendment area covering a total of 3.32 acres. The largest, covering approximately 2.72 acres, is located near the east-central boundary of the site. The three additional stock ponds cover 0.23, 0.20 and 0.17 acres. The largest of the three is located in the northern portion of the site while the 0.17-acre pond is on the west-central edge of the amendment area and the 0.20 acre pond is in the southern portion. All four reservoirs support emergent vegetation and a perimeter of marsh habitat. This perimeter vegetation is minimal on the three small stock ponds but is significant on the large reservoir. Coverage of open water versus marsh habitat varies not only seasonally but also from year to year. Plant species in the marsh habitat include sedges, Baltic rush, bulrush, and broadleaf cattail (*Typha latifolia*). As the water depth decreases and becomes more variable, the plant species are less water-dependent and include foxtail barley (*Hordeum jubatum*), sandberg bluegrass, common dandelion (*Taraxacum officinale*), and redtop.

3.1.5 Disturbed Community

Approximately 6.35 acres of the amendment area have been previously disturbed by mining. This community is along the southeast boundary. This area includes both bare ground and patches of reclaimed vegetation. Plant species present include yellow sweetclover (*Melilotus officinalis*), slender wheatgrass (*Elymus trachycaulus*), needle-and-thread (*Stipa comata*), sandberg bluegrass, and smooth brome (*Bromus inermis*).

3.2 Proposed Mining Disturbance

The proposed mining is planned in the mixed grass prairie community, with approximately 89 acres being disturbed. As well as, 86 acres of woodland habitat will be disturbed by the proposed mining and access road construction. Disturbance per each habitat type is listed in Table 3-1.

3.3 Extended Reference Area

The proposed mining will disturb 89.00 acres of mixed grass prairie and 86.23 acres of woodland habitat. The Extended Reference Area is that area of these community types that will be undisturbed by mining operations. The entire mixed grass prairie and woodland habitats within the amendment area were included in the selection of random sample points. Postmining, the unaffected areas constitute the area to be used for a comparison to the reclaimed area. Prior to conducting bond-release surveys, BPM will contact WDEQ to verify suitable comparison areas.

3.4 Noxious Weeds

There are currently 25 plants listed on the Wyoming Weed and Pest Control Act Designated List (Wyoming Weed and Pest Council 2014). The species and their observed abundance on the amendment area are listed in Table 3-5.

Qualitative descriptor categories, as designated by the WDEQ, are: very rare, rare, infrequent, abundant and very abundant. Those species listed as "very rare" were not seen on the site, but that is the lowest ranking provided by the WDEQ categories.

Additional weed and pest species listed for Crook County (Wyoming Weed and Pest Council 2014) include the following:

- Black henbane (*Hyoscyamus niger*)
- Bull thistle (*Cirsium vulgare*)
- Great plains yucca (*Yucca glauca*)
- Wild licorice (*Glycyrrhiza lepidota*)
- Common mullein (*Verbascum thapsus*)
- Sulphur cinquefoil (*Potentilla recta*)

Of the weeds listed, quackgrass and Canadian thistle were observed on the amendment area and both were in limited quantities. Cheatgrass, while not included on the lists, is also found on the area.

Table 3-5. 2014 Noxious Weed List for the State of Wyoming and Their Observed Occurrence on the Amendment Site.

Scientific Name	Common Name	Occurrence
Convolvulus arvensis	Field bindweed	Very rare
Cirsium arvense	Canada thistle	Rare
Euphorbia esula	Leafy spurge	Very rare
Sonchus arvensis	Perennial sowthistle	Very rare
Agropyron repens	Quackgrass	Rare
Cardaria draba	Hoary cress	Very rare
Lepidium latifolium	Perennial pepperweed	Very rare
Chrysanthemum leucanthemum	Ox-eye daisy	Very rare
Franseria discolor	Skeletonleaf bursage	Very rare
Centaurea repens	Russian knapweed	Very rare
Linaria vulgaris	Yellow toadflax	Very rare
Linaria dalmatica	Dalmatian toadflax	Very rare
Onopordum acanthium	Scotch thistle	Very rare
Carduus nutant	Musk thistle	Very rare
Arctium minus	Common burdock	Very rare
Carduus acanthoides	Plumeless Thistle	Very rare
Isatis tinctoria	Dyers Woad	Very rare
Cynoglossum officinale	Houndstongue	Very rare
Centaurea maculosa	Spotted knapweed	Very rare
Centaurea diffusa	Diffuse knapweed	Very rare
Lythrum salicaria	Purple loosestrife	Very rare
Tamarix spp.	Saltcedar	Very rare
Hypericum perforatum	Common St. Johnswort	Very rare
Tanacetum vulgare	Common Tansy	Very rare
Elaeagnus augistifolium	Russian Olive	Very rare

3.5 Threatened and Endangered Species

A listing of all potential T&E and candidate species on and in the vicinity of the amendment area was obtained from the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) website (USFWS 2014). In addition, the USFWS was contacted to obtain information on wildlife species and habitats of concern on the amendment area. Their response letter is in Appendix D9 - Wildlife, Addendum B.

While no vegetative specie were indicated on the IPaC website, the correspondence from the USFWS listed the Ute ladies'-tresses (*Spiranthes diluvialis*) as potentially occurring in the area. This plant is endemic to moist soils near springs, lakes, or perennial streams. The elevation range of known orchid occurrences is 4,200 to 7,000 feet. Most of the occurrences are in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows in the floodplains of perennial streams (USFWS 1995).

Suitable potential habitat is typically found along streams that experience heavy spring runoff of sufficient magnitude to create movement and reshaping of the stream channel. The orchid is generally intolerant of deep shade and strongly alkaline or clay soils and cannot compete with aggressive rhizomatous species such as reed canarygrass (*Phalaris arundinacea*) and cattails (*Typha latifolia*), or introduced species such as Canada thistle.

Suitable habitat is lacking on the amendment area. The occurrence of this species on the site or in the vicinity is unlikely and the proposed mining will have "no effect" on this species.

3.7 Wetlands

The National Wetland Inventory (NWI) map of the amendment area (Addendum E) identifies the four reservoirs discussed under Section 3.1.5. The total wetland acreage identified on the NWI is 3.43 acres. This is slightly more than the Open Water/Marsh community discussed in Section 3.1.4 where 3.32 acres are identified. The difference between the two is due to the large reservoir on the site. The area of marsh and open water is 3.32 acres rather than the 3.43 acres

indicated on the NWI map. Each of the reservoirs is classified as a palustrine wetland with an aquatic bed that is semi-permanently flooded and created by a dike or impoundment. There are no additional wetlands indicated on the NWI map for the amendment area.

4.0 SUMMARY

Based on the vegetation sampling conducted by Real West in 2014, the mixed grass prairie community has a vegetative ground cover of 77.50%, bare ground of 9.41%, and overall ground cover of 94.73%. Sandberg bluegrass and prairie junegrass are the dominant grass species with bastard toadflax and common yarrow being the dominant forbs. The woodland community has a vegetation cover mean of 41.40%; mean total ground cover of 97.85%; mean cover by lichens, litter and rock of 56.45%; and mean bare ground of 5.30%. Sandberg bluegrass is the dominate grass species in this community while bastard toadflax, common yarrow, narrow-leafed phacelia, and American vetch are the dominant forbs. Tree density overall in the woodland habitat is 126.8 trees per acre with ponderosa pine being the most common, followed by bur oak. Other vegetative communities on the amendment area include bottomland meadow, open water/marsh, and disturbed.

5.0 LITERATURE CITED

Keammerer, W.R. 1987. *Bentonite Regional Vegetation Study*. Unpublished report prepared for the Wyoming Department of Environmental Quality.

U.S. Fish and Wildlife Service. 1995. Recommendations and Guidelines for Ute Ladies' Tresses Orchid (*Spiranthes diluvialis*) Recovery and Fulfilling Section 7 Consultation Responsibilities. Memo dated June 1, 1995.

U.S. Fish and Wildlife Service. 2014. Information, Planning and Conservation System listing of Threatened and Endangered Species potentially occurring on the permit area. Website (http://www.fws.gov/) accessed on October 28, 2014.

Wyoming Weed and Pest Council. 2014. WYOMING WEED & PEST CONTROL ACT DESIGNATED LIST, Designated Noxious Weeds .S. 11-5-102 (a)(xi) and Prohibited Noxious Weeds W.S. 11-12-104

ADDENDUM A

Photographs of the Plant Communities

Photo A-1. The WSL04 amendment site is dominated by a combination of mixed grass prairie and woodland communities. (*Looking southeast at Photo Point 1 on Vegetation map)*

Photo A-2. Mixed grass prairie and woodland habitats dominate the WSL04 amendment area. (*Looking southwest at Photo Point 1, as indicated on the Vegetation map.*

Photo A-3. The woodland habitat varies in tree density across the amendment site. Stands of bur oak tend to have higher density in areas of new growth.

Photo A-4. Tree density is typically more open in woodland areas dominated by ponderosa pine.

Photo A-5. Patches of mixed grass prairie include big sagebrush.

Photo A-6. Disturbed habitat is found along the southern boundary of the amendment area.

Photo A-7. Bottomland meadow habitat is found immediately west of the largest reservoir on the amendment area.

Photo A-8. A narrow strip of bottomland meadow is found within two drainage bottoms within the amendment area.

Photo A-9. Open water is found in several reservoirs on the amendment area that also support a perimeter of marsh and emergent vegetation.

Photo A-10. The largest reservoir on the site covers 3.76 acres and includes open water as well as marsh habitat around the perimeter.

ADDENDUM B

Vegetation Sampling Species Summary

Table B-1. 2014 Bentonite Performance Mineral WSL04 Amendment Area Cover Summary for the Mixed Grass Prairie Community.

Category/ Species	Transect																						Total	Mean	SD
Transect Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22			
Perennial Grasses																									
BOGR	0	0	5	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	4	0	0	13	0.59	1.37
BUDA	0	0	4	2	0	0	0	0	2	0	0	0	0	1	0	3	3	0	27	3	0	0	45	2.05	5.73
ELTR	8	5	2	5	1	3	3	2	3	6	2	1	5	1	3	2	3	5	0	5	1	2	68	3.09	2.00
KOMA	14	28	30	35	18	19	41	26	33	1	34	17	2	16	8	1	5	11	0	0	40	33	412	18.73	14.02
POBU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	4	1	0	0	17	0.77	2.00
POSE	28	25	0	5	12	28	17	17	16	50	15	53	18	32	29	51	41	43	12	52	6	13	563	25.59	16.47
STCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	2	13	0.59	2.36
STVI	0	0	0	0	21	13	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	38	1.73	5.17
Perennial Forbs																									
ACMI	5	8	4	0	1	8	1	7	5	0	0	0	0	0	0	4	0	1	0	0	0	6	50	2.27	2.96
ALTE	1	1	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	7	0.32	0.72
ANRO	1	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.27	0.88
ARSO	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.18	0.59
CIAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.05	0.21
COUM	13	5	16	7	8	6	8	5	2	23	31	1	6	21	6	7	1	8	0	10	15	23	222	10.09	8.23
CYAC	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	5	0	0	0	9	0.41	1.14
GETR	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.21
LUAR	0	0	0	0	0	2	0	0	8	3	0	2	0	0	0	0	4	8	0	4	0	0	31	1.41	2.52
MITR	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0.14	0.35
PHHO	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.14	0.47
PHLO	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.21
PLPA	0	0	0	0	0	1	0	0	0	0	0	1	1	4	0	2	0	0	1	0	0	0	10	0.45	0.96
RAGL	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0.09	0.29
SECA	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.21
SPCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3	0.14	0.47
TAOF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	4	0.18	0.50
Perennial Forbs (Cont.)																									
TRDU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.05	0.21

Category/ Species	Transect																						Total	Mean	SD
Transect Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22			
VIAM	0	0	0	0	0	0	0	6	0	0	0	0	8	0	0	1	0	0	0	0	0	0	15	0.68	2.08
Annual Grasses																									
BRIN	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0.14	0.64
BRTE	2	4	0	0	1	0	0	0	0	0	0	2	3	0	1	3	0	0	0	2	1	1	20	0.91	1.23
Grass- like																									
Carex	0	0	1	3	0	0	0	1	0	3	0	6	0	0	0	2	0	0	3	0	0	0	19	0.86	1.58
CAFI	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0.14	0.64
Fern Like																									
SEDE	5	1	4	0	3	1	0	15	3	0	0	0	2	0	15	2	0	0	7	0	0	0	58	2.64	4.45
Annual Forb																									
ALDE	2	1	2	0	0	0	0	2	1	1	2	3	2	2	0	0	0	2	0	1	2	2	25	1.14	0.99
Succulents																									
OPPO	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.21
Shrub and Sub-shrub																									
ARLU	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.21
ARTR	3	0	2	0	0	0	0	0	0	0	0	0	0	0	10	3	0	0	6	8	0	0	32	1.45	2.89
Total Veg Cover	**85**	**81**	**73**	**63**	**68**	**81**	**76**	**81**	**74**	**87**	**88**	**90**	**48**	**82**	**75**	**82**	**71**	**85**	**66**	**90**	**76**	**83**	1705	77.50	10.05
Lichens	0	3	4	12	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	21	0.95	2.68
Litter	14	14	8	10	30	17	26	17	26	12	12	8	17	9	26	13	8	17	22	8	22	14	350	15.91	6.78
Rock	0	0	6	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	8	0.36	1.29
Lichens, Litter, Rock	14	17	18	22	30	18	26	17	26	12	12	8	18	10	26	13	9	17	22	8	22	14	379	17.23	6.35

Category/ Species	Transect																						Total	Mean	SD
Transect Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22			
Litter and Rock	14	14	14	10	30	17	26	17	26	12	12	8	17	10	26	13	9	17	22	8	22	14	358	16.27	6.46
Total Ground cover	99	98	91	85	98	99	102	98	100	99	100	98	66	92	101	95	80	102	88	98	98	97	2084	94.73	8.53
Bare ground	6	9	12	20	3	5	5	6	5	5	10	2	36	9	5	9	25	5	17	3	6	4	207	9.41	8.30

Table B-2. 2014 Bentonite Performance Mineral WSL04 Amendment Area Cover Summary for the Woodland Community.

Category/Species	Transect																				Total	Mean	SD
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Perennial Grasses																							
ELTR	0	2	4	0	0	1	0	2	1	0	0	0	0	1	0	0	1	1	0	0	13	0.65	1.04
KOMA	3	0	0	0	10	1	1	0	0	2	0	0	0	0	0	1	0	0	3	0	21	1.05	2.33
POSE	22	18	32	30	28	34	23	29	30	28	40	18	8	22	40	17	31	25	21	5	501	25.05	9.14
STVI	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	4	0.20	0.41
Fern and Fern-like																							
SEDE	0	0	0	0	3	0	0	0	6	0	0	7	0	0	0	8	6	0	0	7	37	1.85	3.03
Fungi																							
MUSH	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.10	0.45
Grass-like																							
CAFI	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	8	0	0	0	0	13	0.65	1.95
Carex	3	0	1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	23	1.15	3.82
Perennial Forbs																							
ACMI	2	0	0	1	5	4	0	0	0	0	0	1	0	1	0	2	0	0	4	6	26	1.30	1.92
ALTE	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	5	0.25	0.44
ANRO	0	0	0	0	2	0	0	0	1	0	0	6	0	0	0	0	1	0	0	6	16	0.80	1.85
ARSO	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.22
CEAR	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	1	0	0	5	0.25	0.72
COUM	1	1	3	0	4	4	0	1	7	3	1	1	4	0	4	5	3	0	1	4	47	2.35	2.01
ERUM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	3	0.15	0.37
LUAR	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0.05	0.22
PENS	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.05	0.22
PHLI	0	0	2	0	0	0	1	5	1	2	4	0	2	0	0	0	0	0	0	0	17	0.85	1.46
PLPA	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0.10	0.31
RAGL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0.05	0.22
SECA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.22
SPCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
TAOF	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0.10	0.31
Perennial Forbs (Cont.)																							
THLA	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	4	0.20	0.52

Category/Species	Transect																				Total	Mean	SD
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
VIAM	1	0	7	0	2	0	0	0	1	0	1	0	0	1	0	0	2	3	0	0	18	0.90	1.68
Annual Grasses																							
BRTE	0	0	1	0	2	0	0	0	6	0	3	0	3	0	0	0	1	1	0	2	19	0.95	1.57
Annual Forbs																							
ALDE	0	1	3	0	0	0	1	1	1	1	3	0	3	0	0	0	1	3	0	1	19	0.95	1.15
Shrubs and Sub-shrubs																							
RIBE	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.20	0.89
SYAL	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.05	0.22
Trees																							
JUCO	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	15	0.75	3.35
PIPO	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0.25	0.79
QUMA	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05	0.22
Total Veg Cover	**32**	**30**	**53**	**50**	**59**	**47**	**28**	**39**	**54**	**38**	**54**	**36**	**25**	**44**	**45**	**46**	**48**	**35**	**31**	**34**	828	41.40	9.92
Lichens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	0.10	0.31
Litter	63	67	35	51	37	56	70	55	52	54	47	72	67	55	56	58	45	64	67	52	1123	56.15	10.26
Rock	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	0.20	0.70
Lichens, Litter, Rock	63	68	35	51	37	56	70	55	52	57	47	72	67	55	56	58	46	64	67	53	1129	56.45	10.23
Litter and Rock	63	68	35	51	37	56	70	55	52	57	47	72	67	55	56	58	45	64	67	52	1127	56.35	10.30
Total Ground cover	95	98	88	101	96	103	98	94	106	95	101	108	92	99	101	104	94	99	98	87	1957	97.85	5.45
Bare ground	7	4	16	1	11	2	2	8	4	6	4	2	8	1	2	2	8	2	2	14	106	5.30	4.39

Table B-3. Tree Density Data in the Woodland Community.

Transect	Species	Distance (m)	Diameter (cm)	Circumference (cm)
1	pine	6	33	130
	oak	8	20	55
	oak	6	24	72
	pine	7.5	25	80
2	oak	5.5	14	44
	pine	4	3	5
	pine	6	6	17
	pine	5	8	19
3	juniper	17	11	27
	pine	7.5	34	115
	pine	9	24	85
	oak	5	12	42
4	oak	4	28	89
	oak	5	26	81
	oak	6.5	25	78
	oak	5	17	45
5	pine	5.5	22	64
	pine	6	17	52
	pine	4	3	6
	juniper	6.5	4	6
6	pine	3	4	7
	juniper	5	3	6
	pine	6	7	20
	oak	7	18	47
7	pine	2	2	4
	oak	7	12	40
	pine	4	31	93
	oak	4	20	54
8	pine	5	5	14
	pine	9.5	8	18
	pine	3	7	16
	pine	2.5	3	6
9	pine	4	24	104
	pine	6	34	28
	pine	4.5	9	23
	pine	8	8	36
10	pine	5	13	36
	pine	6	20	64
	pine	3.5	20	60
	pine	4	12	31
11	oak	11	6	15
	pine	3.5	35	116

Transect	Species	Distance (m)	Diameter (cm)	Circumference (cm)
	pine	6	33	105
	pine	6.5	23	72
12	pine	2	6	14
	pine	3	12	33
	pine	3.5	7	16
	pine	3	6	14
13	pine	5	33	106
	pine	2.5	32	97
	pine	4	2	4
	oak	3	3	6
14	pine	4	3	5
	pine	4.4	4	8
	pine	5	7	16
	pine	4	7	20
15	pine	4	4	7
	pine	8	27	77
	pine	8.5	33	116
	pine	3	3	6
16	pine	10	5	12
	pine	3.5	27	94
	pine	4	48	149
	oak	18	15	43
17	pine	5.5	29	100
	oak	3.5	16	44
	pine	14.5	23	66
	pine	5.5	20	65
18	oak	2.5	23	65
	oak	6	13	37
	oak	5.5	22	66
	pine	7	18	52
19	pine	3.5	7	20
	pine	5.5	40	145
	pine	4.5	11	29
	pine	7	4	13
20	juniper	6	10	25
	pine	6.5	8	21
	pine	5	7	14
	pine	6.5	35	109
	Average	5.64875	16.0375	48.0125

ADDENDUM C

Plant Species List

Addendum C-1. Plant Species Observed on the State WSL04 Amendment Site in 2014.

Species	Common Name	ID name
Perennial Grasses		
Agropyron cristatum	Crested wheatgrass	AGCR
Agrostis gigantea	Redtop	AGGI
Alopecurus pratensis	Meadow foxtail	ALPR
Bouteloua gracilis	Blue gramma	BOGR
Buchloe dactyloides	Buffalo grass	BUDA
Elymus trachycaulus	Slender wheatgrass	ELTR
Elymus repens	Quackgrass	ELRE
Hordeum jubatum	Foxtail barley	HOJU
Koeleria macrantha	Junegrass	KOMA
Pascopyrum smithii	Western wheatgrass	PASM
Phleum pratense	Timothy	PHPR
Poa bulbosa	Bulbous bluegrass	POBU
Poa secunda	Sandberg bluegrass	POSE
Schizachyrium scoparium	Little bluestem	SCSC
Stipa comata	Needle-and-thread	STCO
Stipa viridula	Green needlegrass	STVI
Grass-like		
Carex duriuscula	Needleleaf sedge	CADU
Carex filifolia	Threadleaf sedge	CAFI
Carex spp.	Sedges	CAREX
Juncus balticus	Baltic rush	JUBA
Scirpus spp.	Bulrush	SCIRP
Typha latifolia	Broadleaf cattail	TYLA
Annual Grass		

Species	Common Name	ID name
Bromus inermis	Smooth brome	BRIN
Bromus tectorum	Cheatgrass	BRTE
Perennial Forb		
Achillea millefolium	Common yarrow	ACMI
Allium textile	Wild onion	ALTE
Antennaria rosea	Rose pussytoes	ANRO
Arnica sororia	Arnica	ARSO
Astragalus spp.	Milkvetch	ASTR
Calochortus nuttallii	Sego lily	CANU
Cerastium arvense	Field chickweed	CEAR
Chrysopsis villosa	Hairy goldaster	CHVI
Cirsium arvense	Canada thistle	CIAR
Comandra umbellata	Bastard toad flax	COUM
Cymopterus acaulis	Plains spring parsley	CYAC
Cryptantha celosioides	Miner's candle	CRCE
Erigeron ochroleucus	Fleabane	EROC
Eriogonum multiceps	Wild buckwheat	ERMU
Eriogonum umbellatum	Sulpher-flower buckwheat	ERUM
Erysimum asperum	Wallflower	ERAS
Fragaria virginiana	Wild strawberry	FRVI
Geum triflorum	Old man's beard	GETR
Lupinus argenteus	Silvery lupine	LUAR
Melilotus officinalis	Yellow sweetclover	MEOF
Microseris troximoides	False dandelion	MITR
Penstemon spp.	Penstemon	PENS

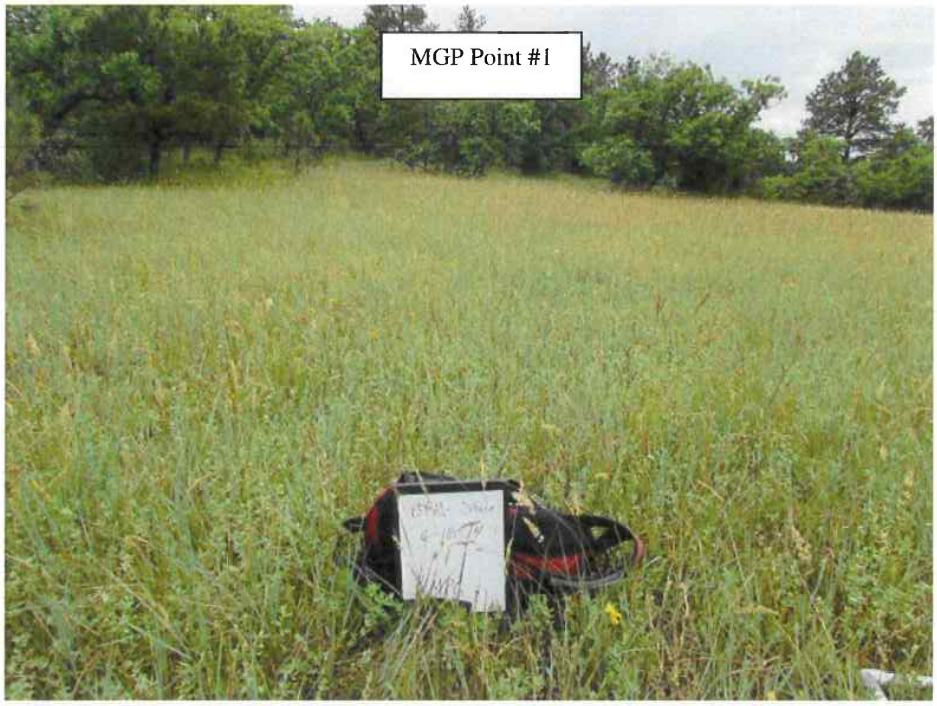
Species	Common Name	ID name
Phacelia linearis	Narrow-leafed phacelia	PHLI
Phlox hoodii	Hood's phlox	PHHO
Phlox longifolia	Long-leaf phlox	PHLO
Plantago patagonica	Woolly plantain	PLPA
Psoralea argophylla	Silver leaf scurf pea	PSAR
Ranunculus glaberrimus	Sagebrush buttercup	RAGL
Sedum lanceolatum	Stonecrop	SELA
Senecio canus	Gray groundsel	SECA
Sphaeralcea coccinea	Scarlet globemallow	SPCO
Taraxacum officinale	Dandelion	TAOF
Thermopsis lanceolata	Golden banner	THLA
Tragopogon dubius	Salsify	TRDU
Trifolium pratense	Red clover	TRPR
Vicia americana	American vetch	VIAM
Viola nuttallii	Yellow prairie violet	VINU
Annual Forbs		
Alyssum desertorum	Desert madwort	ALDE
Descurainia sophia	Flixweed	DESO
Iva axillaris	Povertyweed	IVAX
Fern and Fern-like		
Selaginella densa	Club moss	SEDE
Succulent		
Opuntia polyacantha	Prickly pear cactus	OPPO
Mammillaria vivipara	Ball cactus	MAVI

Species	Common Name	ID name
Fungi		
Mushrooms	Mushroom	MUSH
Sub-shrub		
Artemisia frigida	Fringed sagebrush	ARFR
Artemisia ludoviciana	White sagebrush	ARLU
Shrub		
Artemisia tridentata	Big sagebrush	ARTR
Chrysothamnus vicidiflorus	Green rabbitbrush	CHVI
Ribes spp.	Currant	RIBE
Symphoricarpos albus	Snowberry	SYAL
Trees		
Fraxinus pennsylvanica	Green ash	GRPE
Juniperus copulorum	Rocky Mountain Juniper	JUCO
Pinus ponderosa	Ponderosa pine	PIPO
Quercus macrocarpa	Bur oak	QUMA

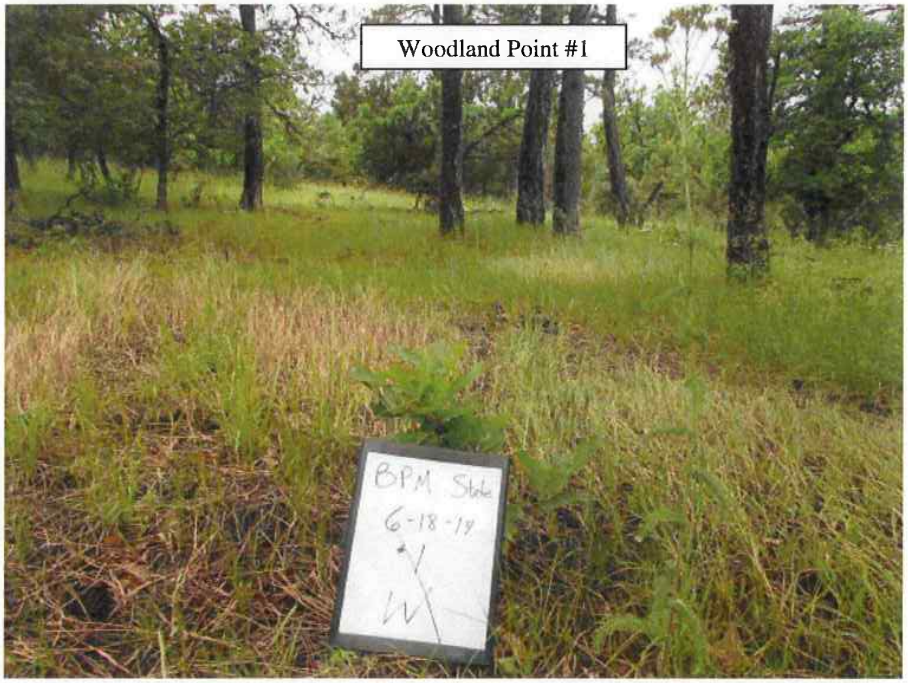
ADDENDUM D

Representative Sample Point Photographs

Mixed Grass Prairie Sample Points 1, 10 and 20
Woodland Sample Points 1, 10 and 20


MGP Point #1


MGP Point #10



2.8.8.45-36


Woodland Point #10


Woodland Point #20