Incoming
Annual Report
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From: Dennis Ware <dware@alphanr.com>
To: "ogmcoal@utah.gov" <ogmcoal@utah.gov>
CC: Steve Demczak <stevedemczak@utah.gov>
Date: 3/29/2012 10:38 AM
Subject: 2011 Annual Report of the Star Point Mine
Attachments: StarPointMine (2).pdf

Please find attached the 2011 Annual Report for the Star Point Mine. Also a part of this Annual Report is the year-nine vegetation study prepared by Mt. Nebo Scientific which is too large to send by email. Two copies of this year-nine vegetation study, on computer disc, were delivered to the Price Field Office (Steve Demczak) on Wednesday, March 28th.

Print Form | Submit by Email | Reset Form

Annual Report

This Annual Report shows information the Division has for your mine. Submit the completed document and any additional information identified in the Appendices to the Division by **March 30, 2012.** During a complete inspection an inspector will check and verify the information.

GENERAL INFORMATION

Company Name	Plateau Mining Corporation	Mine Name	Star Point Mine
Permit Number	C/007/0006	Permit expiration Date	January 28, 2016
Operator Name	Plateau Mining Corporation	Phone Number	+1 (435) 472-0475
Mailing Address	P.O. Box 30	Email	dware@alphanr.com
City	Helper		
State	Utah	Zip Code	84526

		DOGM File Location or Annual Report Location
Excess Spoil Piles	☐ Required ☒ Not Required	
Refuse Piles	☐ Required ☒ Not Required	
Impoundments	☐ Required ☒ Not Required	
Other:		

OPERATOR COMMENTS

REVIEWER COMMENTS ☐ Met Requirements ☐ Did Not meet Requirements

REPORTING OF OTHER TECHNICAL DATA

Please list other technical data or information that was not included in the form above, but is required under the approved plan, which must be periodically submitted to the Division.

Please list attachments:

Year nine vegetation study conducted by Mt. Nebo Scientific. This vegetation study is too large to send by email. Two copies of this vegetation study (on computer disc) were delivered to the office of Steve Demczak in the Price Field Office on Wednesday, March 28th.

Reviewer Comments

MAPS

Copies of mine maps, current and up-to-date through at least December 31, 2011, are to be provided to the Division as an attachment to this report in accordance with the requirements of R645-301-525.240. The map copies shall be made in accordance with 30 CFR 75.1200 as required by MSHA. Mine maps are not considered confidential.

Map Name	Map Number	Included		Confidential	
		Yes	No	Yes	No
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐
		☐	☐	☐	☐

Reviewer Comments ☐ Met Requirements ☐ Did Not Meet Requirements

Revegetation Monitoring
for
Phase III Bond Release
Year 1 (2011)

at the
Star Point Mine
for
Plateau Mining Corporation

Palmer penstemon *(Penstemon palmeri)*
at the Star Point Mine

Prepared by

MT. NEBO SCIENTIFIC, INC.
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by

Patrick Collins, Ph.D.

for

PLATEAU MINING CORPORATION
P.O. Box 92
Orangeville, Utah 84537

March 2012

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INTRODUCTION

The Star Point Mine is a reclaimed mine site located on the east side of the Wasatch Plateau on Gentry Mountain approximately 23 miles southwest of Price, Utah. Historically, coal mining at the Star Point Mine began in 1916. Coal was shipped to the town of Wattis by 1917 when a railroad was completed there. In 1967, a company called Plateau Limited opened a new mine in the area. By 1971, another company, United Nuclear, purchased the mine. Finally, in 1980, Plateau Mining Company bought and mined the properties. The current permittee, Plateau Mining Corporation, began final reclamation of the mine site in 2001, with final seeding for revegetation finalized by 2003.

Following reclamation and revegetation, restoration of the plant communities has been closely monitored to document the progress on those areas disturbed by the previous mining activities. Earlier documents submitted to the regulatory agencies reported updates on the revegetation process from sampling the area in 2006 (Year 4), 2008 (Year 6) and 2010 (Year 8).

Reclaimed mine sites are required to provide enough time for acceptable plant establishment before applications can be made for bond release. This time period, called the "*responsibility period*", prescribes at least 10 years before the mine operator can submit a request for *Final* or *Phase III Bond Release* through state and federal regulatory authorities. It has been estimated that this period of time is long enough to determine whether or not adequate re-establishment of a given reclaimed plant community has occurred on sites at this precipitation zone in the western United States. The vegetation of the reclaimed lands must meet specific state and federal requirements. Consequently, at the beginning of Year 9 of the 10-year period, intensive sampling can be initiated for two consecutive years to determine whether or not the reclaimed site has met pre-determined revegetation success standards.

The purpose of this document is to compare reclaimed areas of the mine site

with specific standards for revegetation success (more information about these standards are provided later in this document). The content of this report provides **Year 1** results of the two consecutive years of sampling required prior to submittal of an application for bond release by the mine operator through the State of Utah, Division of Oil, Gas & Mining (DOGM).

METHODS

Methodologies used for sampling were performed in accordance with the guidelines provided by DOGM. The reclaimed areas were sampled *between* vegetation types, and when the types were comprised of relatively large acreage, additional areas were further separated *within* the types. This method allows for closer scrutiny of the reclaimed mine site on a smaller, area-by-area basis.

Transect and Quadrat Placement

Random/regular placement of sample quadrats was designed as an attempt to provide unbiased accuracy of the data compiled. This was accomplished by establishing several transect lines through the entire length of each reclaimed and reference area. At regular intervals along the transect lines, random numbers were generated and used to measure distances at right angles from the line to determine sample locations. Whether these random numbers were odd or even determined which side of the transect line a given quadrat was placed. The random numbers selected were high enough to place quadrats to the lateral limits of each sample area and all areas in-between. This insured that the sample quadrats were placed randomly over the entire study area to adequately address and represent each study site as a whole.

Cover, Frequency and Composition

Cover estimates were made employing ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Additional information, when applicable, was also recorded on the raw data sheets such as: slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al. 2008).

Density

In nearly all areas, density estimates for woody plant species on the reclaimed and reference areas were made using a distance method called the *point-quarter*. In this method, random points were placed on the sample sites and divided into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

The one area where this method was not suitable due to its size and community structure was the Mudwater Canyon site. At this site 5x25 ft belt transects were employed. In this method individuals were counted in each transect, summarized for mean and standard deviation, then converted to the number of individuals per acre.

Biomass Production

Total annual biomass production was estimated by clipping, drying and weighing current annual growth in sample quadrats. "Double sampling" methods were employed by placing four additional quadrats around the clipped quadrat, then estimating the production of them relative to the clipped plot. Herbaceous and woody species production were clipped, weighed and recorded separately.

Sample Size & Adequacy

Sampling adequacy was calculated using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Confidence levels were calculated at 80% and 90% (t) with the desired change from the mean (d) placed at 0.10. Sample sizes were, however, also based on the size of each subdivision within each vegetation type, resulting in more samples taken in larger areas.

Photographs

Color photographs of each sample area were taken at the time of sampling; a subset of them have been submitted with this report.

Vegetation Sample Maps

The locations of the reclaimed sample areas were mapped during the field work. These locations were then placed on "as-built" reclamation maps prepared previously by *Earthfax Engineering*, resulting in three Vegetation Sample Area maps that have been submitted in this report.

RESULTS

Separation of Areas

The Star Point Mining & Reclamation Plan (MRP) divided the disturbed areas into three main types based on the native plant communities that existed in the area prior to their disturbance by coal mining and related activities. The three types now represent the "reclaimed areas" and are called: 1) **Sagebrush Areas**, 2) **Mountain Grassland Areas**, and 3) **Saltbush Areas**. During reclamation these sites were seeded with seed mixtures developed specifically for each area. Additionally, **reference areas**, or areas chosen in undisturbed plant communities to represent final revegetation success standards, were chosen for each disturbed (reclaimed) type. Reference areas were sampled in 2011 for comparisons with the reclaimed areas.

Reclaimed Areas

As mentioned above, there were three disturbance types delineated at the mine site. Additionally, these types were further subdivided into smaller areas to allow closer, independent evaluations for the specific sites (see *VEGETATION SAMPLE AREA MAPS* and *COLOR PHOTOGRAPHS OF THE SAMPLE AREAS*). The following table shows the three types and subdivisions within them.

Table 1: Sample area subdivisions of each reclaimed type.

Reclaimed Sagebrush	Reclaimed Mtn Grassland	Reclaimed Saltbush
Area A	Area E	Area I
Area B	Area F	
Area C	Area G (pre- & post-SMCRA)	
~~Area D~~ (*area was sold and removed from the permit area*)	Mudwater Canyon	
Area H	Corner Canyon	

Reference Areas

The three reference areas, or areas chosen previously to represent future standards for revegetation success, along with their corresponding reclaimed areas, are shown in Table 2. The reference areas data can be compared to the reclaimed areas and provide accompaniment for future the Phase III Bond Release application through the State of Utah.

Table 2: Reference areas and their respective reclaimed areas.

Reference Areas	**Reclaimed Areas**
Sagebrush	Area A Area B Area C Area H
Mountain Grassland	Area E Area F Area G Mudwater Canyon Corner Canyon
Saltbush	Area I

DATA SUMMARIES
(Areas Separated)

General comparisons *between* reclaimed types and *within* each community type for the 2011 datasets can be done by reviewing the summary tables that have been provided of the sample results for each reclaimed area as well as the reference areas (Tables 4 through 54). Table 3 shows the number of the appropriate table for each parameter in all sample areas of the study.

Table 3: Separated data locator at the Star Point Mine site (2011).

SAMPLE AREA	Sub-Division	Cover by Species	Total Cover	Composition	Woody Species Density	Production
Reclaimed Sagebrush	A	Table 4	Table 5 (A)	Table 5 (B)	Table 6	n/a
Reclaimed Sagebrush	B	Table 7	Table 8 (A)	Table 8 (B)	Table 9	n/a
Reclaimed Sagebrush	C	Table 10	Table 11 (A)	Table 11 (B)	Table 12	Table 13
Reclaimed Sagebrush	H	Table 28	Table 29 (A)	Table 29 (B)	Table 30	Table 31
Reclaimed Mountain Grassland	E	Table 14	Table 15 (A)	Table 15 (B)	Table 16	n/a
Reclaimed Mountain Grassland	F	Table 17	Table 18 (A)	Table 18 (B)	Table 19	Table 20
Reclaimed Mountain Grassland	G (pre-SMCRA) G (post-SMCRA)	Table 21 Table 24	Table 22 (A) Table 25 (A)	Table 22 (B) Table 25 (B)	Table 23 Table 26	n/a Table 27
Reclaimed Mountain Grassland	Mudwater Canyon	Table 36	Table 37 (A)	Table 37 (B)	Table 38	n/a
Reclaimed Mountain Grassland	Corner Canyon	Table 39	Table 40 (A)	Table 40 (B)	Table 41	Table 42
Reclaimed Saltbush	I	Table 32	Table 33 (A)	Table 33 (B)	Table 34	Table 35

Table 3: Separated data locator at the Star Point Mine site (2011).

Sagebrush Reference Area	n/a	Table 43	Table 44 (A)	Table 44 (B)	Table 45	Table 46
Mountain Grassland Reference Area	n/a	Table 47	Table 48 (A)	Table 48 (B)	Table 49	Table 50
Saltbush Reference Area	n/a	Table 51	Table 52 (A)	Table 52 (B)	Table 53	Table 54

Dominant Plant Species

For the reclaimed areas at the Star Point Mine site, the most important or dominant plant species by cover and frequency for the **Reclaimed Sagebrush Areas** were primarily the shrubs: big sagebrush *(Artemisia tridentata*), rubber rabbitbrush (*Chrysothamnus nauseosus*), fourwing saltbush (*Atriplex canescens*), shadscale (*A. confertifolia*) and winterfat (*Ceratoides lanata*). Dominant forbs here consisted of: Pacific aster (*Aster chilensis*), northern vetch (*Hedysarum boreale*), Lewis flax (*Linum lewisii*) and Palmer penstemon (*Penstemon palmeri*). The most important grasses in these reclaimed areas were thickspike wheatgrass (*Elymus lanceolatus*), bluebunch wheatgrass (*E. spicatus*), crested wheatgrass (*Agropyron cristatum*) and Indian ricegrass (*Stipa hymenoides*). All species present in the sample quadrats in the Reclaimed Sagebrush Areas have been provided on Tables 4, 7, 10 and 28.

The dominant shrub species for the **Reclaimed Mountain Grassland Areas** were comprised of big sagebrush, corymb buckwheat (*Eriogonum corymbosum*), Antelope bitterbrush (*Purshia tridentata*), rubber rabbitbrush and curl-leaf mountain mahogany (*Cercocarpus ledifolius*). The dominant forbs in this community were Lewis flax, Pacific aster and Palmer penstemon. The most important grasses here were: Great Basin wildrye (*Elymus cinereus*), mountain brome (*Bromus carinatus*), thickspike wheatgrass and bluebunch wheatgrass.

For a list of all species encountered in the Reclaimed Mountain Grassland Areas, refer to Tables 14, 17, 21, 24, 36 and 39.

Lastly, the dominant shrubs by cover and frequency in the **Reclaimed Saltbush Areas** consisted of: shadscale, rubber rabbitbrush and black sagebrush (*Artemisia nova*). The dominant forb here was cicer milkvetch (*Astragalus cicer*), and the most important grasses consisted of bluebunch wheatgrass, western wheatgrass (*Elymus smithii*), Salina wildrye (*Elymus salinus*) and thickspike wheatgrass). For cover and frequency values in the Reclaimed Saltbush Areas, refer to Tables 32.

In the reference areas, the most important shrub species in the **Sagebrush Reference Area** by a wide margin was big sagebrush. The only forbs present in the sample quadrats were milkvetch (*Astragalus* sp.), Palmer penstemon and hoary aster *(Machaeranthera canescens*). Dominant grasses in this community were: Indian ricegrass, created wheatgrass and Salina wildrye. For a list of the plants found in the Sagebrush Reference Area, refer to Table 43.

The dominant shrubs in the **Mountain Grassland Reference Area** were: corymb buckwheat and low rabbitbrush (*Chrysothamnus viscidiflorus*). Although forbs were relatively unimportant here, the dominants were: buckwheat (*Eriogonum* sp.) and hoary aster. The dominant grass by a very wide margin was Salina wildrye. For a list of all species in this reference area, refer to Table 47.

Lastly, for the reference areas, the most important shrub in the **Saltbush Reference Area** was Gardner saltbush (*Atriplex gardneri*). Forbs were again relatively unimportant here, but the dominant forb was the annual plant, brittle phacelia (*Phacelia demissa*). The only grasses present in the sample quadrats were: Salina wildrye and Indian ricegrass. For a list of all species present in this community, refer to Table 51.

Lifeform Composition

As a short summary on composition in the **Reclaimed Sagebrush Areas**, the three lifeforms represented here, shrubs, forbs and grasses were nearly equally represented at most sample sites. In all areas, and in descending order, grasses > shrubs > forbs by varying degrees. For lifeform composition percentages in these reclaimed areas, refer to Tables 5, 8, 11 and 29.

In the **Reclaimed Mountain Grassland Areas**, with only one exception, grasses had about twice the amount of forbs and shrubs, the later two demonstrated mixed proportions. For lifeform composition percentages in these areas, refer to Tables 15, 18, 22, 25, 37 and 40.

The composition order of the **Reclaimed Saltbush Areas** comprised of grasses > shrubs > forbs, with the grasses more that twice as much as the shrubs and forbs combined. For composition results in this reclaimed site, refer to Table 33.

In the **Sagebrush Reference Area**, grasses > shrubs > forbs, with grasses and shrubs relatively close in proportion, but followed distantly by forbs (Table 44).

The **Mountain Grassland Reference Area** was very much dominated by grasses (> 80%) as shown in the composition, but shrubs and forbs were also represented (Table 48).

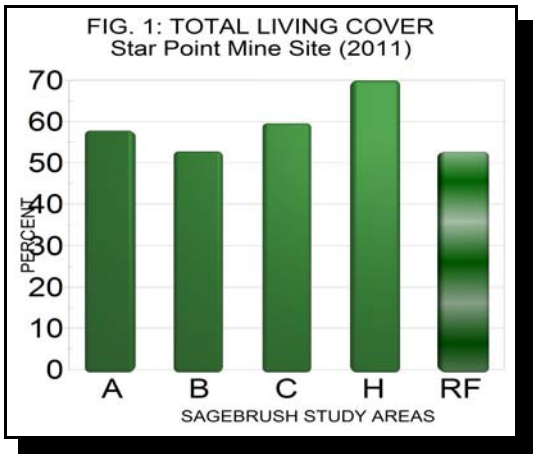
Finally, the composition of the **Saltbush Reference Area** was nearly equally represented by shrubs and grasses, with few forbs (Table 52).

The dominant species information as well as the lifeform composition results described above have been provided as additional information to further demonstrate the current condition of the vegetation at the Star Point Mine site. However, the primary parameters for comparing the reclaimed areas with the reference areas were: total living cover, woody species density, annual biomass

productivity and diversity. Therefore, these parameters are first shown graphical for the *separated data*, then compared statistically later in the report for the *lumped* (or *combined data*).

Total Living Cover

Total living cover, one of the key parameters in assessing revegetation success at the mine site, has been shown for individual areas in summary tables provided later in the report, and have also been shown graphically in figures here. Figure 1 illustrates the total living cover in each Reclaimed Sagebrush Area as well as the Sagebrush Reference Area (RF).



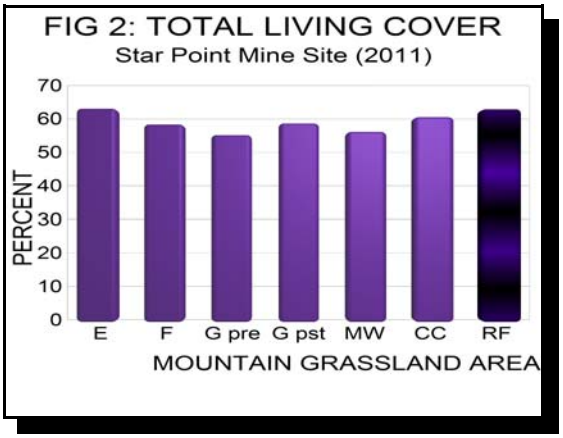
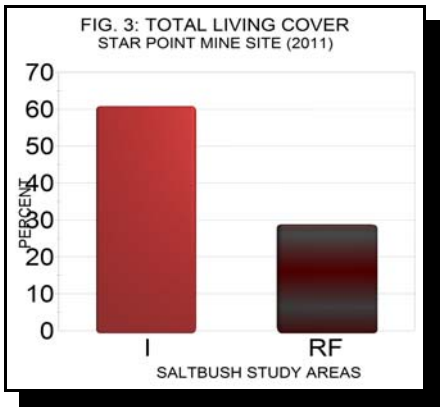


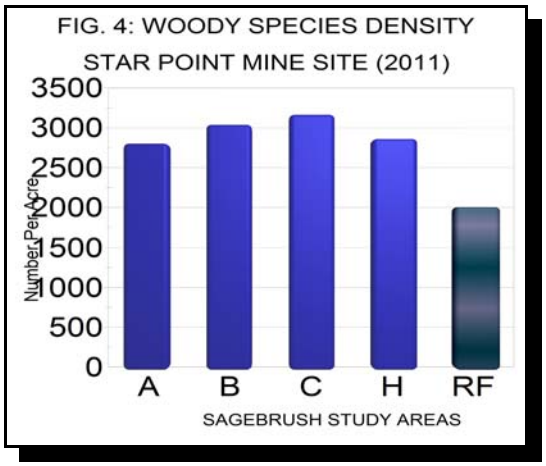
Figure 2 shows the same parameter, total living cover, for all the Reclaimed Mountain Grassland Areas as well as the Mountain Grassland Reference Area.

Figure 3 illustrates total living cover for the Reclaimed Saltbush Area along with the Saltbush Reference Area.

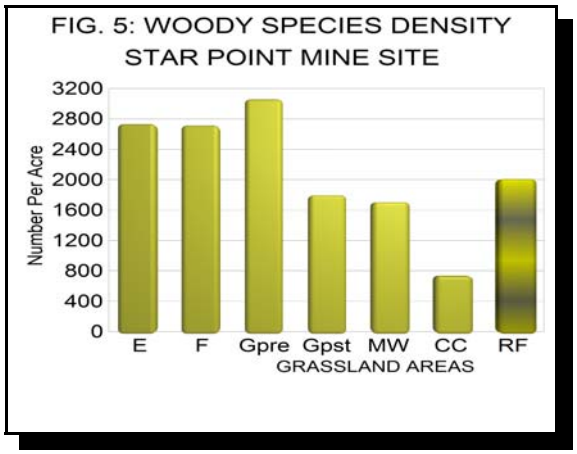


Woody Species Density

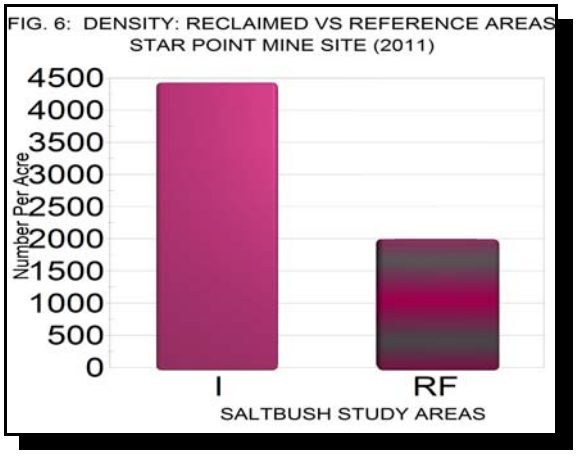
Woody species density values, or the total number of individuals per acre, for each Reclaimed Sagebrush Area as well as the Sagebrush 'standard' [a pre-determined number, *not* the reference area value (further explained later)] are shown in Figure 4.



This same parameter for each Reclaimed Grassland Area and its density standard are shown in Figure 5 (in the figure, pre=pre-SMCRA; pst=post SMCRA).

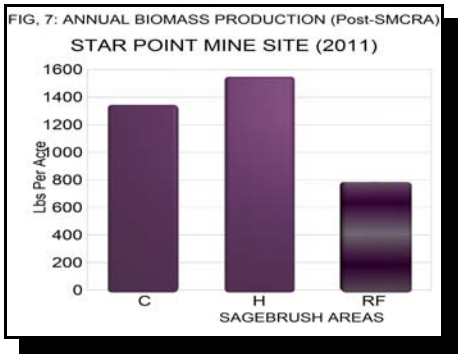


Finally, the woody species density for the Reclaimed Saltbush Areas along with the Saltbush density standard are shown in Figure 6.

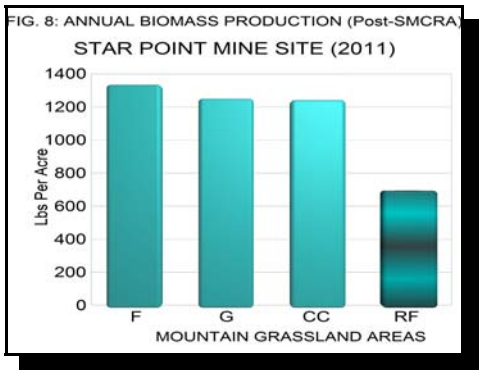


Annual Biomass Production

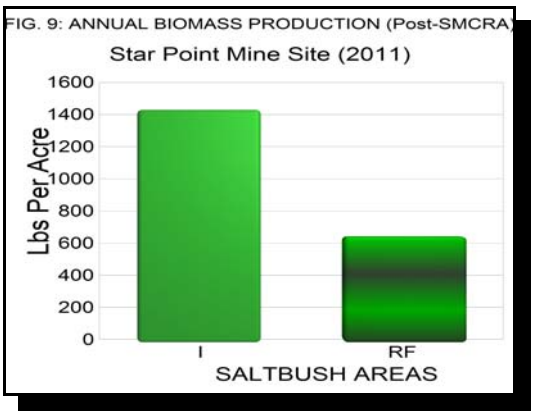
As dictated by the final revegetation success standards in the Star Point Mine's MRP, total annual biomass production was only measured and compared with reference areas in the post-SMCRA sites. The production shown in pounds per acre for the Reclaimed Sagebrush Areas and Sagebrush Reference Area are shown in Figure 7.



Next, the production of the Reclaimed Mountain Grasslands and its associated reference area are shown graphically in Figure 8.



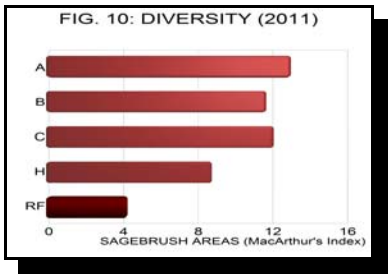
Lastly, the production of the Reclaimed Saltbush Areas can be compared to the Saltbush Reference Area in Figure 9.

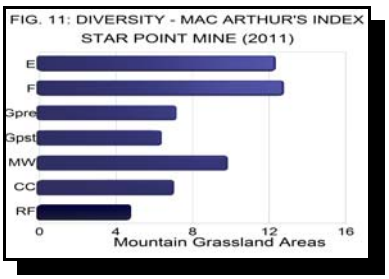


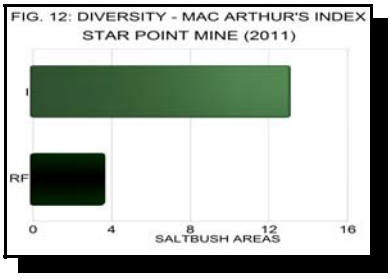
Diversity

Two different diversity measurements have been applied to the reclaimed and reference areas – MacArthur's Index and the Average Number of Species per Quadrat. Graphical representations of these diversity indices are shown below.

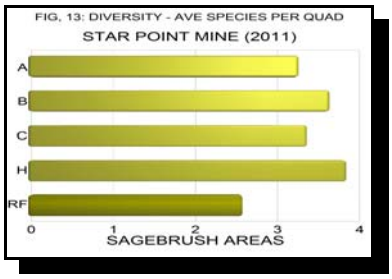
MacArthur's Index

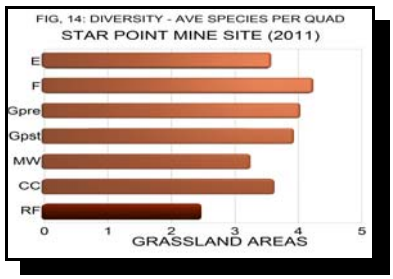


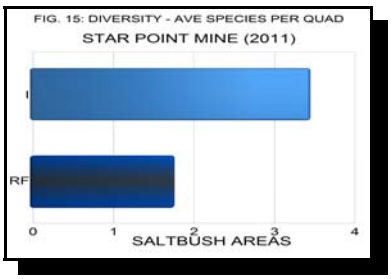




Average Species Per Quadrat







DATA SUMMARIES

(Areas Lumped/Combined)

As the reviewer has observed by now, there has been a lot of vegetation data collected at the Star Point Mine site in 2011 as a means to assess the revegetation success. The goal will ultimately be to submit an application for Phase III Bond Release through the State of Utah. This, of course, can only be accomplished if the restored plant communities have met final revegetation success standards as dictated in the MRP.

Even though much data has been recorded in the area, the author has tried to find a logical and straightforward method to compare the *applicable parameters* to assess revegetation success (or those required by state and federal regulations), yet also provide other meaningful data (that cannot readily be compared using statistics). In this attempt, the following section discusses the methods used to compare key parameters with the reclaimed areas and their respective reference areas.

Separating vs. Lumping Data

The RESULTS section above provides the data for each sample area including the Reclaimed Areas and Reference Areas along with the subdivisions within the larger reclaimed vegetation types. As explained, this design enables the reviewer to observe the successes (or failures) of individual areas even within each reclaimed vegetation type. For example, Areas A, B, C and H are all within the Sagebrush type, yet sample data were first summarized separately for these areas in 2011 (as well as previous monitoring years) for closer scrutiny of the revegetated landscapes. However, because the objective of this report is NOT to compare each individual sample site within each type for bond release separately, but rather to provide some means for logical comparisons of the reclaimed vegetation with the respective reference areas (or revegetation success standards). That said, to make these comparisons, "*lumping*" or

combining some data would seem appropriate for future bond release applications. Combined dataset summaries are provided in Tables 55 through 67).

Pre-SMCRA vs. Post-SMCRA

At first it would seem logical to simply lump all the Reclaimed Sagebrush sites together into one dataset; then all the Reclaimed Mountain Grassland sites to another dataset and so forth – then compare these datasets with the appropriate Reference Area. However, different revegetation success standards have been assigned to reclaimed areas – even though they may be in the same vegetation type. Reasons for the dissimilar standards was based on whether or not a given reclaimed area was disturbed prior to, or after, the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Those areas disturbed after, or post-SMCRA, have more stringent revegetation success standards than those disturbed pre-SMCRA. (More information and justification for this distinction can be found in the Star Point Mine's MRP).

With that in mind, the datasets have been lumped (combined) by vegetation type and the SMCRA time-frame. The outline in Table 4 summarizes this treatment of datasets. The following

Table 4: Reclaimed Areas divided by vegetation type and Surface Mining Control and Reclamation Act.

1. **Pre-SMCRA**
   - a. Reclaimed Sagebrush
     - i. Area A
     - ii. Area B
   - b. Reclaimed Mountain Grassland
     - i. Area E
     - ii. Area G
     - iii. Mudwater Canyon

2. **Post-SMCRA**
   - a. Reclaimed Sagebrush
     - i. Area C
     - ii. Area H
   - b. Reclaimed Mountain Grasslands
     - i. Area F
     - ii. Area G (Area G has both pre- and post-SMCRA areas)
     - iii. Corner Canyon
   - c. Reclaimed Saltbush
     - i. Area I

describes the sample results for combined datasets.

Pre-SMCRA

Total Living Cover

The total living cover (combined) for the pre-SMCRA Reclaimed Sagebrush Areas (Areas A & B) was estimated at 56.19% (Table 55). The total living cover for the Reclaimed Mountain Grassland Areas (Areas E, G & Mudwater Canyon) was estimated at 60.10% (Table 60). There were no pre-SMCRA Reclaimed Saltbush Areas at the site.

Woody Species Density

The pre-SMCRA woody species density for the Reclaimed Sagebrush Areas (Areas A & B) combined was estimated at 2,907 individuals per acre (Table 56). The pre-SMCRA density in for the Reclaimed Mountain Grasslands Areas (Areas E, G & Mudwater Canyon) was estimated at 2,328 plants per acre (Table 61). Again, there were no pre-SMCRA Reclaimed Saltbush Areas at the site.

Post-SMCRA

Total Living Cover

Next, the total living cover of the post-SMCRA Reclaimed Sagebrush Areas (Areas C & H) was estimated at 64.25% (Table 57). The total living cover for the Reclaimed Mountain Grassland Areas (Areas F, G & Corner Canyon) was estimated at 58.25% (Table 62). And finally, the post-SMCRA Saltbush Area (Area I) had a total living cover of 60.40% (Table 65).

Woody Species Density

The density for the post-SMCRA Reclaimed Sagebrush Areas (Areas C & H) was estimated at 3,080 plants per acre (Table 58). The density for the Reclaimed

Mountain Grassland Areas (Areas F, G & Corner Canyon) was estimated at 1,893 plants per acre (Table 63). Lastly, the post-SMCRA Saltbush Area (Area I) had a density 4,391 (Table 66).

Annual Biomass Production

(Post-SMCRA only)

The annual biomass production for the post-SMCRA Reclaimed Sagebrush Areas (Areas C & H) was estimated at 1,437.38 pounds per acre (Table 59). The production for the Reclaimed Mountain Grassland Areas (Areas F, G & Corner Canyon) was estimated at 1,227.88 pounds per acre (Table 64). Lastly, the post-SMCRA Saltbush Area (Area I) had a productivity estimate of 1,419.29 pounds per acre (Table 67).

Reference Areas

Total Living Cover

The total living cover for the Sagebrush Reference Area was estimated at 52.40% (Table 44). The total living cover for the Mountain Grassland Reference Area was estimated at 62.33% (Table 48). And finally, the Saltbush Reference Area had a total living cover of 28.90% (Table 52).

Woody Species Density

The density for the Sagebrush Reference Area was estimated at 5,854 plants per acre (Table 45), but the pre-determined success standard for this parameter was 2,000 plants per acre [(1)]. The density for the Mountain Grassland Reference Area was estimated at 1,171 plants per acre (Table 49), but the pre-determined success standard for this parameter was also 2,000 plants per acre. Lastly, the Saltbush Reference Area had a density 3,647 (Table 53), and again the pre-determined success standard for this parameter was 2,000 plants per acre.

[(1)] The pre-determined density standard here (and in the other reclaimed communities) was determined more appropriate than the reference area for wildlife habitat by state biologists.

Annual Biomass Production

The annual biomass production for the Sagebrush Reference Area was estimated at 786.81 pounds per acre (Table 46). The production for the Mountain Grassland Reference Area was estimated at 695.88 pounds per acre (Table 50). Lastly, the Saltbush Reference Area had a productivity estimate of 644.30 pounds per acre (Table 54).

CONCLUSIONS

Summary of Revegetation Success Standards

A summary of the revegetation success standards for the Star Point Mine has been provided in Table 68. Statistical comparisons between the reclaimed and reference areas are shown in Tables 69 through 71. Some success standards required Natural Resources Conservation Service (NRCS) estimates. For the USDA information required, refer to the Appendix of this report.

Statistical Comparisons

Reclaimed Sagebrush vs. Reference Area

When the **total living cover** of the pre-SMCRA Reclaimed Sagebrush Areas *combined* was compared to Sagebrush Reference Area, the reclaimed area had a higher cover, but the difference was not significant statistically [Table 69 (A)].

A **woody species density** comparison of the pre-SMCRA Reclaimed Sagebrush Areas *combined* and the pre-set standard of 2,000 indicated that the density of the former was greater than the standard [Table 69 (A)].

An **annual biomass productivity** standard was not given to the pre-SMCRA sites.

In a comparison of the **total living cover** of the post-SMCRA Reclaimed Sagebrush Areas *combined*, again the reclaimed areas value was greater and in this case the difference was statistically significant [Table 69 (B)]. In other words, the reclaimed areas' total living cover was significantly higher than its revegetation success standard.

A **woody species density** comparison of the post-SMCRA Reclaimed Sagebrush Areas *combined* and the pre-set standard of 2,000 indicated that the density of the reclaimed areas was greater [Table 69 (B)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Sagebrush Areas *combined* was compared statistically with the Sagebrush Reference Area, the difference was statistically significant – the reclaimed areas had more production [Table 69 (B)].

Reclaimed Mountain Grasslands vs. Reference Area

When the **total living cover** of the pre-SMCRA Reclaimed Mountain Grassland Areas *combined* was compared to Mountain Grassland Reference Area, the reference area had a slightly higher cover, but the difference was non-significant statistically [Table 70 (A)].

A **woody species density** comparison of the pre-SMCRA Reclaimed Mountain Grassland Areas *combined* and the pre-set standard of 2,000 indicated that the density of the former was greater than the standard [Table 70 (A)].

An **annual biomass productivity** standard was not given to the pre-SMCRA sites.

In a comparison of the **total living cover** of the post-SMCRA Reclaimed Mountain Grassland Areas *combined*, the reference areas value was greater,

but the difference was non-significant statistically [Table 70 (B)].

A **woody species density** comparison of the post-SMCRA Reclaimed Mountain Grassland Areas *combined* and the pre-set standard of 2,000 indicated that the density of the reclaimed areas was only slightly less, or the reclaimed areas had 95% as many plants per acre as the standard [Table 70 (B)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Mountain Grassland Areas *combined* was compared statistically with the Mountain Grassland Reference Area, the difference was statistically significant – the reclaimed areas had much more annual biomass production [Table 70 (B)].

Reclaimed Saltbush vs. Reference Area

There were no pre-SMCRA sites in the Reclaimed Saltbush Areas.

A comparison of the **total living cover** of the post-SMCRA Saltbush Areas, revealed that the reclaimed area value was significantly greater statistically when compared to the Saltbush Reference Area [Table 71 (A)].

A **woody species density** comparison of the post-SMCRA Reclaimed Saltbush Areas and the pre-set standard of 2,000 indicated that the density of the reclaimed areas was much greater than the standard [Table 71 (A)].

When the **annual biomass productivity** of post-SMCRA Reclaimed Saltbush Areas was compared statistically with the Saltbush Reference Area, the difference was statistically significant – the reclaimed areas had much more annual biomass production here too [Table 71].

Future Studies

In conclusion, the **Year 2** vegetation sampling for the second consecutive year will be conducted in 2012. Results from that study will be summarized as a companion to this 2011 study. If the results so warrant it, both sample years will be submitted with an application for Phase III Bond Release at the Star Point Mine site in the future.

SUMMARY

In 2011, quantitative vegetation sampling was conducted within areas that were once disturbed by coal mining and related activities at the Star Point Mine site. Subsequent to the long history of mining in the area, these disturbances were reclaimed and revegetated according the Mining & Reclamation Plan. Accordingly, specific standards for revegetation success were determined prior to the reclamation activities. This report provides the findings for the vegetation sampling in 2011; the sampling was necessary for conducting **Year 1** of two consecutive years to ascertain whether or not the mine site has met revegetation success standards, thus meeting requirements needed to ultimately apply for Phase III or Final Bond Release.

At the Star Point Mine, there are three vegetation types that were restored including Sagebrush, Mountain Grasslands and Saltbush Areas. Accordingly, there were also three reference areas of similar vegetation types chosen previously to be used for revegetation success standards.

As a means to compare data for specific sites within each reclaimed area, datasets were first *separated* and summarized into smaller reclaimed sites. Later the data were *lumped* (combined) into larger datasets more amenable to be used for comparisons with the reference areas.

The report shows that in 2011 the summaries of the combined datasets for the reclaimed vegetation types, when compared to the applicable reference areas, have met or exceeded those standards set for revegetation success.

DATA SUMMARY TABLES

Table 4: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Sagebrush Area A			n=60
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Amelanchier utahensis	0.58	3.17	3.33
Artemisia tridentata	2.25	8.29	8.33
Atriplex canescens	0.83	3.31	6.67
Atriplex confertifolia	3.25	9.35	15.00
Ceratoides lanata	1.08	3.99	8.33
Cercocarpus ledifolius	1.58	4.52	13.33
Cercocarpus montanus	0.83	6.40	1.67
Chrysothamnus nauseosus	7.92	14.09	36.67
Purshia tridentata	1.17	5.80	5.00
FORBS			
Artemisia dracunculus	0.67	2.95	6.67
Aster chilensis	1.83	7.07	8.33
Bassia scoparia	0.25	1.42	3.33
Grindelia squarrosa	0.67	2.95	5.00
Hedysarum boreale	2.33	7.16	10.00
Linum lewisii	0.83	3.67	6.67
Machaeranthera canescens	0.25	1.92	1.67
Melilotus officinalis	0.50	1.98	6.67
Penstemon palmeri	4.20	6.67	36.67
Viguiera multiflora	0.08	0.64	1.67
GRASSES			
Agropyron cristatum	3.00	6.00	25.00
Elymus cinereus	1.33	4.73	8.33
Elymus junceus	0.17	1.28	1.67
Elymus lanceolatus	9.67	12.51	50.00
Elymus salinus	1.50	10.30	3.33
Elymus smithii	1.30	6.91	3.33
Elymus spicatus	6.42	11.00	33.33
Stipa comata	0.75	5.76	1.67
Stipa hymenoides	2.17	7.32	11.67

Table 5: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Sagebrush Area A		n=60
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	57.42	12.02
Litter	8.17	3.87
Bareground	16.33	9.78
Rock	18.08	10.25
B. % COMPOSITION		
Shrubs	34.60	31.38
Forbs	21.12	22.18
Grasses	44.28	28.31

Table 6: Star Point Mine . Woody Species Density (2011).

SPECIES	**Individuals Per Acre**
Reclaimed Sagebrush Area A	n=60
Amelanchier utahensis	150.67
Artemisia tridentata	243.39
Atriplex canescens	197.03
Atriplex confertifolia	254.98
Ceratoides lanata	278.16
Cercocarpus ledifolius	139.08
Cercocarpus montanus	46.36
Chrysothamnus nauseosus	1390.79
Eriogonum corymbosum	11.59
Purshia tridentata	34.77
Symphoricarpos oreophilus	34.77
TOTAL	**2781.58**

Table 7: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Sagebrush Area B			n=20
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Atriplex canescens	2.00	7.65	10.00
Atriplex confertifolia	1.75	5.31	10.00
Ceratoides lanata	2.50	6.98	15.00
Chrysothamnus nauseosus	7.25	14.36	25.00
Purshia tridentata	1.00	4.36	5.00
FORBS			
Achillea millefolium	0.75	2.38	10.00
Artemisia dracunculus	0.25	1.09	5.00
Grindelia squarrosa	1.00	2.55	15.00
Hedysarum boreale	3.75	8.20	20.00
Linum lewisii	4.25	4.82	50.00
Medicago sativa	0.75	3.27	5.00
Penstemon palmeri	2.00	3.32	30.00
GRASSES			
Agropyron cristatum	4.25	6.57	35.00
Elymus lanceolatus	9.50	10.94	55.00
Elymus salinus	3.00	6.20	20.00
Elymus spicatus	2.50	5.59	20.00
Stipa hymenoides	6.00	9.82	30.00

Table 8: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Sagebrush Area B		n=20
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	52.50	12.20
Litter	7.75	3.70
Bareground	29.50	11.72
Rock	10.25	5.58
B. % COMPOSITION		
Shrubs	25.27	29.41
Forbs	24.77	21.33
Grasses	49.96	28.38

Table 9: Star Point Mine . Woody Species Density (2011).

Reclaimed Sagebrush Area B	n=20
SPECIES	**Individuals Per Acre**
Artemisia tridentata	37.69
Atriplex canescens	75.38
Atriplex confertifolia	904.57
Ceratoides lanata	188.45
Cercocarpus ledifolius	37.69
Cercocarpus montanus	75.38
Chrysothamnus nauseosus	1620.69
Eriogonum corymbosum	37.69
Purshia tridentata	37.69
TOTAL	**3015.23**

Table 10: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Sagebrush Area C			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	0.90	3.76	6.67
Atriplex canescens	2.50	8.83	10.00
Atriplex confertifolia	0.17	0.90	3.33
Ceratoides lanata	5.60	12.71	26.67
Chrysothamnus nauseosus	4.83	11.51	26.67
FORBS			
Achillea millefolium	0.50	1.98	6.67
Artemisia dracunculus	2.67	7.27	16.67
Bassia scoparia	0.17	0.90	3.33
Ceratoides lanata	0.33	1.80	3.33
Grindelia squarrosa	1.83	4.56	16.67
Hedysarum boreale	1.00	5.39	3.33
Linum lewisii	2.17	5.87	20.00
Machaeranthera canescens	0.33	1.25	6.67
Medicago sativa	0.17	0.90	3.33
Melilotus officinalis	0.17	0.90	3.33
Penstemon palmeri	1.00	2.71	13.33
Viguiera multiflora	0.33	1.80	3.33
GRASSES			
Agropyron cristatum	8.67	9.83	56.67
Bromus carinatus	1.67	6.75	6.67
Elymus cinereus	0.83	4.49	3.33
Elymus lanceolatus	12.17	16.47	46.67
Elymus salinus	1.00	3.74	6.67
Elymus smithii	0.33	1.80	3.33
Elymus spicatus	8.50	15.23	30.00
Stipa comata	1.00	5.39	3.33
Stipa hymenoides	0.33	1.80	3.33

Table 11: Star Point Mine. Total Cover and Composition (2011).

Reclaimed Sagebrush Area C		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	59.17	9.32
Litter	10.33	4.27
Bareground	18.80	10.67
Rock	11.70	4.45
B. % COMPOSITION		
Shrubs	23.73	28.88
Forbs	17.76	19.53
Grasses	58.51	31.45

Table 12: Star Point Mine . Woody Species Density (2011).

Reclaimed Sagebrush Area C	n=30
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	52.30
Artemisia tridentata	392.23
Atriplex canescens	366.08
Atriplex confertifolia	78.45
Ceratoides lanata	1072.10
Cercocarpus ledifolius	0.00
Chrysothamnus nauseosus	1176.69
TOTAL	**3137.85**

Table 13: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Sagebrush Area C

(n=30; double sampling n=120)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	908.66	441.34
Woody	429.09	470.61
TOTAL	**1337.75**	**450.74**

Table 14: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Area E			n=100
	Mean Percent	Standard Deviation	Percent Frequency
TREES & SHRUBS			
Artemisia tridentata	5.19	9.71	31.00
Cercocarpus ledifolius	0.40	2.71	3.00
Cercocarpus montanus	0.08	0.80	1.00
Chrysothamnus nauseosus	0.68	2.58	6.00
Chrysothamnus viscidiflorus	0.07	0.70	1.00
Eriogonum corymbosum	6.18	12.45	25.00
Gutierrezia sarothrae	0.50	2.60	4.00
Pseudotsuga menziesii	0.55	3.31	3.00
Purshia tridentata	1.15	4.17	9.00
Ribes sp.	0.05	0.50	1.00
Symphoricarpos oreophilus	0.45	4.48	1.00
FORBS			
Achillea millefolium	1.35	5.09	13.00
Artemisia dracunculus	0.75	4.32	3.00
Aster chilensis	4.90	10.61	25.00
Astragalus cicer	0.50	4.97	1.00
Cynoglossum officinale	0.05	0.50	1.00
Grindelia squarrosa	0.20	1.21	3.00
Linum lewisii	3.05	5.52	35.00
Machaeranthera canescens	0.20	0.98	4.00
Machaeranthera grindelioides	0.25	1.30	4.00
Medicago sativa	1.05	5.40	5.00
Penstemon palmeri	0.55	2.33	7.00
GRASSES			
Agropyron cristatum	0.65	2.71	6.00
Bromus carinatus	4.75	9.91	27.00
Elymus cinereus	12.40	18.20	49.00
Elymus junceus	0.25	2.49	1.00
Elymus lanceolatus	6.75	13.65	35.00
Elymus salinus	1.15	4.99	6.00
Elymus spicatus	7.45	11.63	40.00
Stipa comata	0.25	2.49	1.00
Stipa hymenoides	0.70	4.00	4.00

Table 15: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Mountain Grassland Area E		n=100
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	62.50	9.96
Litter	8.33	3.34
Bareground	13.19	7.77
Rock	15.98	8.57
B. % COMPOSITION		
Trees/Shrubs	25.30	24.80
Forbs	20.31	21.99
Grasses	54.39	28.71

Table 16: Star Point Mine . Woody Species Density (2011).

Reclaimed Mountain Grassland Area E	n=100
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	27.11
Artemisia tridentata	1070.66
Cercocarpus ledifolius	115.20
Cercocarpus montanus	13.55
Chrysothamnus nauseosus	426.91
Chrysothamnus viscidiflorus	20.33
Eriogonum corymbosum	474.34
Gutierrezia sarothrae	115.20
Populus tremuloides	13.55
Purshia tridentata	311.71
Pseudotsuga menziesii	54.21
Ribes sp.	6.78
Symphoricarpos oreophilus	60.99
TOTAL	**2710.53**

Table 17: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Area F			n=40
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Amelanchier utahensis	0.13	0.78	2.50
Artemisia tridentata	3.50	7.52	22.50
Cercocarpus ledifolius	1.13	4.40	7.50
Chrysothamnus nauseosus	2.88	6.70	20.00
Pseudotsuga menziesii	0.50	1.87	7.50
Purshia tridentata	2.50	6.71	15.00
Symphoricarpos oreophilus	0.13	0.78	2.50
FORBS			
Achillea millefolium	2.25	6.02	20.00
Artemisia dracunculus	0.13	0.78	2.50
Aster chilensis	6.50	10.44	40.00
Grindelia squarrosa	0.13	0.78	2.50
Hedysarum boreale	5.25	10.84	25.00
Iva axillaris	0.50	1.87	7.50
Linum lewisii	4.45	6.17	42.50
Medicago sativa	1.00	6.24	2.50
Melilotus officinalis	6.75	10.46	47.50
Penstemon palmeri	0.68	1.81	12.50
Viguiera multiflora	0.13	0.78	2.50
GRASSES			
Bromus carinatus	3.13	5.56	30.00
Elymus cinereus	10.75	13.40	60.00
Elymus lanceolatus	2.25	6.80	12.50
Elymus smithii	0.50	3.12	2.50
Elymus spicatus	2.75	5.47	32.50

Table 18: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Mountain Grassland Area F		n=40
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	57.88	10.42
Litter	9.00	3.20
Bareground	16.25	7.31
Rock	16.88	8.99
B. % COMPOSITION		
Trees/Shrubs	18.71	23.49
Forbs	47.74	21.14
Grasses	33.55	22.99

Table 19: Star Point Mine . Woody Species Density (2011).

Reclaimed Mountain Grassland Area F	n=40
SPECIES	**Individuals Per Acre**
Acer glabrum	84.09
Amelanchier utahensis	33.63
Artemisia tridentata	975.41
Cercocarpus ledifolius	235.44
Chrysothamnus nauseosus	756.79
Eriogonum corymbosum	33.63
Pseudotsuga menziesii	84.09
Purshia tridentata	454.07
Rosa woodsii	33.63
TOTAL	**2690.79**

Table 20: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Mountain Grassland
Area F

(n=40)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	1045.47	363.56
Woody	278.70	381.90
TOTAL	**1324.16**	**350.20**

Table 21: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)			n=20
	Mean Percent	Standard Deviation	Percent Frequency
TREES & SHRUBS			
Artemisia tridentata	6.75	8.41	50.00
Cercocarpus ledifolius	4.00	8.60	25.00
Chrysothamnus nauseosus	0.50	2.18	5.00
Purshia tridentata	1.00	3.39	10.00
Symphoricarpos oreophilus	1.25	2.68	20.00
FORBS			
Achillea millefolium	0.50	1.50	10.00
Aster chilensis	2.00	4.85	20.00
Astragalus cicer	1.00	3.39	10.00
Linum lewisii	5.50	4.97	65.00
Penstemon palmeri	0.75	2.38	10.00
GRASSES			
Bromus carinatus	0.75	2.38	10.00
Elymus cinereus	19.00	13.29	85.00
Elymus spicatus	11.75	9.12	80.00

Table 22: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)		n=20
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	54.75	11.01
Litter	11.25	3.83
Bareground	13.50	6.73
Rock	20.50	9.34
B. % COMPOSITION		
Shrubs	25.36	24.53
Forbs	19.80	17.13
Grasses	54.84	29.91

Table 23: Star Point Mine . Woody Species Density (2011).

Reclaimed Mountain Grassland Area G (Pre-SMCRA)	n=20
SPECIES	**Individuals Per Acre**
Artemisia tridentata	1741.64
Acer glabrum	37.86
Cercocarpus ledifolius	302.89
Chrysothamnus nauseosus	75.72
Pseudotsuga menziesii	113.59
Purshia tridentata	340.76
Symphoricarpos oreophilus	416.48
TOTAL	**3028.94**

Table 24: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Area G (Post SMCRA)			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	2.33	7.16	13.33
Chrysothamnus nauseosus	0.83	3.67	6.67
Eriogonum corymbosum	0.17	0.90	3.33
Pseudotsuga menziesii	0.33	1.80	3.33
Purshia tridentata	1.67	5.06	10.00
Symphoricarpos oreophilus	0.50	2.69	3.33
FORBS			
Achillea millefolium	0.17	0.90	3.33
Aster chilensis	5.00	9.92	26.67
Astragalus cicer	0.67	3.59	3.33
Hedysarum boreale	0.17	0.90	3.33
Linum lewisii	6.77	5.37	73.33
Penstemon palmeri	4.70	4.29	66.67
Viguiera multiflora	0.50	1.98	6.67
GRASSES			
Bromus carinatus	0.83	4.49	3.33
Elymus cinereus	23.60	11.95	93.33
Elymus lanceolatus	0.20	0.91	6.67
Elymus spicatus	9.73	9.04	63.33

Table 25: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Mountain Grassland Area G (Post SMCRA)		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	58.17	10.61
Litter	12.67	4.03
Bareground	12.50	6.68
Rock	16.67	7.78
B. % COMPOSITION		
Shrubs	9.84	14.87
Forbs	31.65	18.90
Grasses	58.52	18.86

Table 26: Star Point Mine . Woody Species Density (2011).

Reclaimed Mountain Grassland Area G (Post SMCRA)	n=30
SPECIES	**Individuals Per Acre**
Artemisia tridentata	462.21
Cercocarpus ledifolius	342.93
Chrysothamnus nauseosus	342.93
Eriogonum corymbosum	59.64
Prunus virginiana	29.82
Pseudotsuga menziesii	14.91
Purshia tridentata	372.75
Symphoricarpos oreophilus	164.01
TOTAL	**1789.19**

Table 27: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Mountain Grassland
Area G (Post SMCRA)

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	1131.50	578.31
Woody	109.99	189.26
TOTAL	**1241.50**	**646.97**

Table 28: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Sagebrush Area H			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia tridentata	0.83	4.49	3.33
Atriplex canescens	2.67	10.06	6.67
Ceratoides lanata	1.83	6.39	10.00
Chrysothamnus nauseosus	14.50	17.14	50.00
FORBS			
Bassia scoparia	3.50	7.65	23.33
Descurainia pinnata	0.33	1.80	3.33
Lactuca tartarica	0.83	1.86	16.67
Medicago sativa	1.50	3.69	16.67
Penstemon palmeri	0.33	1.25	6.67
GRASSES			
Agropyron cristatum	15.83	14.03	76.67
Bromus tectorum	12.67	15.53	56.67
Elymus lanceolatus	1.50	4.50	16.67
Elymus smithii	4.00	6.63	33.33
Elymus spicatus	7.67	9.81	46.67
Stipa comata	1.00	3.00	10.00
Stipa hymenoides	0.33	1.80	3.33

Table 29: Star Point Mine.
Total Cover and Composition (2011).

Reclaimed Sagebrush Area H		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	69.33	8.73
Litter	8.70	3.87
Bareground	14.07	8.13
Rock	7.90	5.71
B. % COMPOSITION		
Shrubs	29.67	25.12
Forbs	9.10	11.82
Grasses	61.24	22.38

Table 30: Star Point Mine . Woody Species Density (2011).

Reclaimed Sagebrush Area H	n=30
SPECIES	**Individuals Per Acre**
Artemisia tridentata	70.97
Atriplex canescens	189.26
Atriplex confertifolia	189.26
Ceratoides lanata	827.99
Chrysothamnus nauseosus	1561.36
TOTAL	**2838.83**

Table 31: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Sagebrush
Area H

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	848.23	480.34
Woody	688.79	581.77
TOTAL	**1537.02**	**322.46**

Table 32: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Saltbush Area I			n=50
	Mean Percent	Standard Deviation	Percent Frequency
TREES & SHRUBS			
Artemisia nova	2.00	5.48	14.00
Artemisia tridentata	0.20	1.40	2.00
Atriplex canescens	1.66	4.80	16.00
Atriplex confertifolia	5.14	10.06	30.00
Atriplex corrugata	0.40	2.20	4.00
Atriplex gardneri	0.90	3.11	8.00
Chrysothamnus nauseosus	3.70	7.93	26.00
Eriogonum corymbosum	1.10	3.78	10.00
Purshia tridentata	0.70	3.74	4.00
FORBS			
Astragalus cicer	2.26	8.55	12.00
Grindelia squarrosa	0.10	0.70	2.00
Halogeton glomeratus	0.20	1.40	2.00
Hedysarum boreale	0.20	1.40	2.00
Linum lewisii	0.40	1.69	6.00
Malcomia africana	0.50	1.80	8.00
Penstemon palmeri	0.20	0.98	4.00
GRASSES			
Agropyron cristatum	2.90	8.31	20.00
Bromus carinatus	0.20	1.40	2.00
Elymus junceus	1.30	7.13	6.00
Elymus lanceolatus	5.30	9.19	34.00
Elymus salinus	7.60	17.27	18.00
Elymus smithii	8.70	11.61	44.00
Elymus spicatus	11.64	15.91	48.00
Elymus trachycaulus	0.60	4.20	2.00
Stipa hymenoides	2.50	5.94	18.00

Table 33: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Saltbush Area I		n=50
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	60.40	11.66
Litter	11.26	4.91
Bareground	21.84	13.39
Rock	6.50	5.05
B. % COMPOSITION		
Shrubs	25.90	20.08
Forbs	6.25	13.64
Grasses	67.85	21.20

Table 34: Star Point Mine. Woody Species Density (2011).

Reclaimed Saltbush Area I	n=50
SPECIES	**Individuals Per Acre**
Artemisia nova	614.75
Artemisia tridentata	65.87
Atriplex canescens	329.33
Atriplex confertifolia	1624.70
Atriplex corrugata	65.87
Atriplex gardneri	307.38
Cercocarpus montanus	43.91
Ceratoides lanata	43.91
Chrysothamnus nauseosus	944.08
Eriogonum corymbosum	219.55
Purshia tridentata	131.73
TOTAL	**4391.09**

Table 35: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Saltbush Area I

(n=50)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	920.20	293.51
Woody	499.09	478.02
TOTAL	**1419.29**	**487.57**

Table 36: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Mudwater Canyon Area			n=30
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Acer glabrum	2.00	6.14	13.33
Chrysothamnus nauseosus	0.17	0.90	3.33
Ribes aureum	0.33	1.80	3.33
Ribes sp.	2.83	10.62	6.67
Rosa woodsii	3.00	9.97	13.33
Rubus idaeus	1.83	5.40	6.67
Symphoricarpos oreophilus	0.17	0.90	3.33
FORBS			
Achillea millefolium	0.17	0.90	3.33
Aster glaucodes	0.90	2.74	10.00
Chaenactis douglasii	0.17	0.90	3.33
Cynoglossum officinale	0.23	0.96	6.67
Erigeron sp.	0.17	0.90	3.33
Fragaria vesca	0.17	0.90	3.33
Geranium viscosissimum	7.10	8.75	53.33
Senecio integerrimus	0.67	1.70	10.00
Veratrum californicum	0.17	0.90	3.33
GRASSES			
Bromus carinatus	2.50	5.44	20.00
Dactylis glomeratus	2.33	7.04	10.00
Elymus hispidus	2.33	8.73	10.00
Elymus lanceolatus	9.83	22.19	26.67
Elymus smithii	14.67	15.38	70.00
Phleum pratense	2.10	4.19	23.33
Poa pratensis	1.83	4.37	16.67

Table 37: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Mountain Grassland Mudwater Canyon Area		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	55.67	14.59
Litter	8.67	2.87
Bareground	12.67	6.55
Rock	23.00	11.22
B. % COMPOSITION		
Trees/Shrubs	17.72	26.86
Forbs	19.20	16.80
Grasses	63.08	26.11

Table 38: Star Point Mine . Woody Species Density (2011).

Reclaimed Mountain Grassland Mudwater Canyon Area	n=21
SPECIES	**Individuals Per Acre**
Acer glabrum	199.08
Lonicera involucrata	33.18
Pseudotsuga menziesii	33.18
Ribes aureum	82.95
Rosa woodsii	248.85
Rubus idaeus	464.52
Symphoricarpos oreophilus	82.95
TOTAL	**1144.71**
sd	1700.89

Table 39: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Grassland Corner Canyon Area			n=10
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Mahonia repens	2.50	5.12	20.00
Rosa woodsii	1.00	3.00	10.00
FORBS			
Carduus nutans	1.00	3.00	10.00
Cirsium sp.	0.20	0.60	10.00
Cynoglossum officinale	0.70	2.10	10.00
Geranium viscosissimum	4.10	5.05	50.00
Melilotus officinalis	1.70	3.47	20.00
Smilacina stellata	2.50	6.02	20.00
Tragopogon dubius	1.00	2.00	20.00
GRASSES			
Agropyron cristatum	1.00	3.00	10.00
Bromus carinatus	0.50	1.50	10.00
Elymus smithii	37.50	21.59	100.00
Phleum pratense	5.30	6.15	60.00
Poa pratensis	1.00	3.00	10.00

Table 40: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Reclaimed Grassland Corner Canyon Area		n=10
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	60.00	14.14
Litter	8.90	1.97
Bareground	8.60	4.32
Rock	22.50	16.62
B. % COMPOSITION		
Shrubs	6.98	16.74
Forbs	20.16	18.87
Grasses	72.85	25.33

Table 41: Star Point Mine . Woody Species Density (2011).

Reclaimed Grassland Corner Canyon Area Area	n=10
SPECIES	**Individuals Per Acre**
Chrysothamnus nauseosus	18.56
Lonicera involucrata	18.56
Mahonia repens	92.80
Populus tremuloides	37.12
Pseudotsuga menziesii	37.12
Rosa woodsii	37.12
Symphoricarpos oreophilus	501.12
TOTAL	**742.40**

Table 42: Star Point Mine . Annual Biomass Production (2011).

Reclaimed Grassland
Corner Canyon Area

(n=10)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	869.52	900.37
Woody	363.18	946.35
TOTAL	**1232.70**	**1383.71**

Table 43: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Sagebrush Reference Area			n=50
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Amelanchier utahensis	0.30	2.10	2.00
Artemisia nova	0.70	4.90	2.00
Artemisia tridentata	22.00	12.88	92.00
Chrysothamnus viscidiflorus	0.10	0.70	2.00
Gutierrezia sarothrae	0.40	1.36	8.00
FORBS			
Astragalus sp.	1.40	5.20	8.00
Machaeranthera canescens	0.10	0.70	2.00
Penstemon palmeri	0.10	0.70	2.00
GRASSES			
Agropyron cristatum	7.26	11.96	36.00
Bromus tectorum	0.70	2.83	6.00
Elymus salinus	3.10	12.36	6.00
Hordeum jubatum	2.10	5.84	18.00
Stipa hymenoides	14.14	12.85	72.00

Table 44: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Sagebrush Reference Area		n=50
Understory	52.40	12.26
Litter	14.06	6.17
Bareground	31.54	13.95
Rock	2.00	2.14
B. % COMPOSITION		
Shrubs	44.81	24.29
Forbs	3.76	12.79
Grasses	51.43	24.32

Table 45: Star Point Mine . Woody Species Density (2011).

Sagebrush Reference Area	n=50
SPECIES	**Individuals Per Acre**
Amelanchier utahensis	58.54
Artemisia nova	58.54
Artemisia tridentata	5620.16
Cercocarpus montanus	29.27
Chrysothamnus nauseosus	29.27
Chrysothamnus viscidiflorus	29.27
Gutierrezia sarothrae	29.27
TOTAL	**5854.33**

Table 46: Star Point Mine . Annual Biomass Production (2011).

Sagebrush Reference Area

(n=50)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	462.75	337.38
Woody	324.06	236.64
TOTAL	**786.81**	**292.57**

Table 47: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Mountain Grassland Reference Area			n=30
TREES & SHRUBS	**Mean Percent**	**Standard Deviation**	**Percent Frequency**
Artemisia tridentata	0.83	3.67	6.67
Chrysothamnus viscidiflorus	2.93	5.64	26.67
Eriogonum corymbosum	3.40	8.52	16.67
Gutierrezia sarothrae	0.33	1.25	6.67
Mahonia repens	0.17	0.90	3.33
FORBS			
Achillea millefolium	0.33	1.80	3.33
Allium sp	0.50	1.98	6.67
Eriogonum sp.	1.67	4.15	16.67
Linum lewisii	0.67	2.13	10.00
Machaeranthera canescens	1.00	2.00	20.00
GRASSES			
Elymus salinus	46.00	13.44	100.00
Koeleria macrantha	3.50	6.47	26.67
Poa secunda	1.00	5.39	3.33

Table 48: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Mountain Grassland Reference Area		n=30
A. TOTAL COVER	**Mean Percent**	**Standard Deviation**
Understory	62.33	5.28
Litter	17.50	5.12
Bareground	10.07	5.27
Rock	10.10	4.58
B. % COMPOSITION		
Shrubs	11.98	16.90
Forbs	7.01	10.08
Grasses	81.01	18.06

Table 49: Star Point Mine . Woody Species Density (2011).

Mountain Grassland Reference Area	n=30
SPECIES	**Individuals Per Acre**
Artemisia tridentata	156.16
Chrysothamnus depressus	48.80
Chrysothamnus viscidiflorus	488.00
Eriogonum corymbosum	380.64
Gutierrezia sarothrae	97.60
TOTAL	**1171.20**

Table 50: Star Point Mine . Annual Biomass Production (2011).

Mountain Grassland Reference Area

(n=30)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	556.22	194.45
Woody	139.66	195.05
TOTAL	**695.88**	**233.47**

Table 51: Star Point Mine . Woody Species Density (2011).

Saltbush Reference Area			n=50
	Mean Percent	**Standard Deviation**	**Percent Frequency**
TREES & SHRUBS			
Artemisia nova	0.20	1.40	2.00
Atriplex confertifolia	1.90	5.65	12.00
Atriplex gardneri	11.14	10.62	56.00
Chrysothamnus nauseosus	0.20	0.98	4.00
Eriogonum corymbosum	0.76	3.70	6.00
FORBS			
Malcomia africana	0.10	0.70	2.00
Phacelia demissa	1.34	2.86	20.00
Stanleya pinnata	0.10	0.70	2.00
GRASSES			
Elymus salinus	12.76	11.17	68.00
Stipa hymenoides	0.40	2.20	4.00

Table 52: Star Point Mine. Living Cover and Frequency by Plant Species (2011).

Saltbush
Reference Area

n=50

A. TOTAL COVER	Mean Percent	Standard Deviation
Understory	28.90	5.50
Litter	8.82	3.10
Bareground	47.70	14.67
Rock	14.58	11.31
B. % COMPOSITION		
Shrubs	50.58	36.45
Forbs	5.05	10.36
Grasses	44.38	38.34

Table 53: Star Point Mine . Woody Species Density (2011).

Saltbush
Reference Area

n=50

SPECIES	Individuals Per Acre
Artemisia nova	328.19
Atriplex canescens	18.23
Atriplex confertifolia	856.95
Atriplex gardneri	2242.66
Chrysothamnus nauseosus	54.70
Ephedra viridis	36.47
Eriogonum corymbosum	109.40
Gutierrezia sarothrae	0.00
TOTAL	**3646.60**

Table 54: Star Point Mine . Annual Biomass Production (2011).

Saltbush
Reference Area

(n=50)

LIFEFORM	Pounds/Acre MEAN	STD. DEV.
Herbaceous	178.72	193.79
Woody	465.58	385.05
TOTAL	**644.30**	**296.97**

COMBINED BY TIME PERIOD (PRE-SMCRA VS. POST-SMCRA)

Table 55: Star Point Mine. *Combined* Data for Total Cover and Composition (2011).

Pre-SMCRA **Reclaimed Sagebrush Areas** (Includes: Area A & Area B)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	56.19	12.25
Sample size (n) = 80 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 8 samples 90%± 0.10 = 13 samples		

Table 56: Star Point Mine . *Combined* Data for Woody Species Density (2011).

Pre-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area A & Area B)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	2907.45	1436.21
Sample size (n) = 80 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 40 samples 90%± 0.10 = 66 samples		

Table 57: Star Point Mine. *Combined* Data for Total Cover and Composition (2011).

Post-SMCRA **Reclaimed Sagebrush Areas** (Includes: Area C & Area H)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	64.25	10.36
Sample size (n) = 60 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 4 samples 90%± 0.10 = 7 samples		

Table 58: Star Point Mine . *Combined* Data for Woody Species Density (2011).

Post-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area C & Area H)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	3080.23	1491.60
Sample size (n) = 60 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 38 samples 90%± 0.10 = 63 samples		

Table 59: Star Point Mine . *Combined* Data for Annual Biomass Production (2011).

Post-SMCRA

Reclaimed Sagebrush Areas

(Includes: Area C & Area H)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	878.44	462.24
Woody	558.94	544.82
TOTAL	**1437.38**	**681.39**

Sample size (n) = 60
SAMPLE ADEQUACY (nMIN)
80%± 0.10 = 37 samples
90%± 0.10 = 61 samples

Table 60: Star Point Mine. *Combined* Data for Total Cover and Composition (2011).

Pre-SMCRA **Reclaimed Mountain Grassland Areas** (Includes: **Area E**, **Area G & Mudwater Canyon**)		
	Mean Percent	**Standard Deviation**
TOTAL LIVING COVER	60.10	11.68
Sample size (n) = 150 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 6 samples 90%± 0.10 = 10 samples		

Table 61: Star Point Mine . *Combined* Data for Woody Species Density (2011).

Pre-SMCRA

Reclaimed Mountain Grassland Areas

(Includes: **Area E**, **Area G & Mudwater Canyon**)

Number of Individuals Per Acre	**Mean**	**Standard Deviation**
TOTAL	2328.29	1519.76
Sample size (n) = 150 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 70 samples 90%± 0.10 = 115 samples		

Table 62: Star Point Mine. *Combined* Data for Total Cover and Composition (2011).

Post-SMCRA
Reclaimed Mountain Grassland Areas
(Includes: Area F, Area G & Corner Canyon)

	Mean Percent	Standard Deviation
TOTAL LIVING COVER	58.25	11.04
Sample size (n) = 80		
SAMPLE ADEQUACY (nMIN)		
80%± 0.10 = 6 samples		
90%± 0.10 = 10 samples		

Table 63: Star Point Mine . *Combined* Data for Woody Species Density (2011).

Post-SMCRA
Reclaimed Mountain Grass Land Areas
(Includes: Area F, Area G & Corner Canyon)

Number of Individuals Per Acre	Mean	Standard Deviation
TOTAL	1893.23	1304.96
Sample size (n) = 80		
SAMPLE ADEQUACY (nMIN)		
80%± 0.10 = 78 samples		
90%± 0.10 = 129 samples		

Table 64: Star Point Mine . *Combined* Data for Annual Biomass Production (2011).

Post-SMCRA
Reclaimed Mountain Grass Land Areas
(Includes: Area F, Area G & Corner Canyon)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	1019.95	478.49
Woody	207.93	354.86
TOTAL	**1227.88**	**701.70**
Sample size (n) = 80		
SAMPLE ADEQUACY (nMIN)		
80%± 0.10 = 54 samples		
90%± 0.10 = 88 samples		

Table 65: Star Point Mine. *Combined* Data for Total Cover and Composition (2011).

Post-SMCRA
Reclaimed Saltbush Areas
(Includes: **Area I**)

	Mean Percent	Standard Deviation
TOTAL LIVING COVER	60.40	11.66
Sample size (n) =50 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 6 samples 90%± 0.10 = 10 samples		

Table 66: Star Point Mine . *Combined* Data for Woody Species Density (2011).

Post-SMCRA
Reclaimed Saltbush Areas
(Includes: **Area I**)

Number of Individuals Per Acre	Mean	Standard Deviation
TOTAL	4391.09	2084.73
Sample size (n) = 50 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 37 samples 90%± 0.10 = 61 samples		

Table 67: Star Point Mine . *Combined* Data for Annual Biomass Production (2011).

Post-SMCRA
Reclaimed Saltbush Areas
(Includes: Area I)

	Pounds/Acre	
LIFEFORM	**MEAN**	**STD. DEV.**
Herbaceous	920.20	293.51
Woody	499.09	478.29
TOTAL	**1419.29**	**685.47**
Sample size (n) = 50 SAMPLE ADEQUACY (nMIN) 80%± 0.10 = 38 samples 90%± 0.10 = 63 samples		

Table 68: Summary of revegetation success standards for success at the Star Point Mine.					
SEEDED AREA	**DISTURBANCE**	**COVER**	**DENSITY**	**DIVERSITY**	**PRODUCTION**
SALTBUSH	Pre-SMCRA	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)	(no pre-SMCRA)
	Post-SMCRA	Saltbush Reference Area	2,000 plants/ac	Saltbush Reference Area	Saltbush Reference Area
SAGEBRUSH	Pre-SMCRA	Sagebrush Reference Area	2,000 plants/ac	(no standard)	NRCS estimates
	Post-SMCRA	Sagebrush Reference Area	2,000 plants/ac	Sagebrush Reference Area	Sagebrush Reference Area
MOUNTAIN GRASSLAND	Pre-SMCRA	Mtn. Grassland Reference Area	2,000 plants/ac	(no standard)	NRCS estimates
	Post-SMCRA	Mtn. Grassland Reference Area	2,000 plants/ac	Mtn. Grassland Reference Area	Mtn. Grassland Reference Area

TABLE 69: Statistical summary sheet comparing the Reclaimed Sagebrush areas and Sagebrush Reference Area at the Star Point Mine site (2011).

A. SAGEBRUSH AREAS (Pre-SMCRA)			
Reclaimed Area A & Area B (Combined)			
Total Living Cover	$\bar{x}$=56.19	s=12.25	n=80
Density	$\bar{x}$=2907.45	s=1436.21	n=80
Sagebrush Reference Area			
Total Living Cover	$\bar{x}$=52.40	s=12.26	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
STATISTICAL ANALYSES			
Total Living Cover	t=1.7156	df=128	SL=N.S.
Density	t=n/a	df=n/a	SL=n/a
B. SAGEBRUSH AREAS (Post-SMCRA)			
Reclaimed Area C & Area H (Combined)			
Total Living Cover	$\bar{x}$=64.25	s=10.36	n=60
Density	$\bar{x}$=3080.23	s=1491.60	n=60
Production	$\bar{x}$=1437.38	s=681.39	n=60
Sagebrush Reference Area			
Total Living Cover	$\bar{x}$=52.40	s=12.26	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=786.81	s=292.57	n=50
STATISTICAL ANALYSES			
Total Living Cover	t=5.4951	df=108	SL=p<.001
Density	t=n/a	df=n/a	SL=n/a
Production	t=6.2870	df=108	SL=p<.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

TABLE 70: Statistical summary sheet comparing the Reclaimed Mountain Grassland areas and Mountain Grassland Reference Area at the Star Point Mine site (2011).

A. MOUNTAIN GRASSLAND AREAS (Pre-SMCRA)

Reclaimed : Area E, Area G & Mudwater Canyon (Combined)			
Total Living Cover	$\bar{x}$=60.10	s=11.68	n=150
Density	$\bar{x}$=2328.29	s=1519.76	n=150
Mountain Grassland Reference Area			
Total Living Cover	$\bar{x}$=62.33	s=5.28	n=30
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a

STATISTICAL ANALYSES			
Total Living Cover	t=1.0232	df=178	SL=N.S.
Density	t=n/a	df=n/a	SL=n/a

B. MOUNTAIN GRASSLAND AREAS (Post-SMCRA)
Area F, Area G & Corner Canyon (Combined)

Total Living Cover	$\bar{x}$=58.25	s=11.04	n=80
Density	$\bar{x}$=1893.23	s=1304.96	n=80
Production	$\bar{x}$=1227.88	s=701.70	n=80
Mountain Grassland Reference Area			
Total Living Cover	$\bar{x}$=62.33	s=5.28	n=30
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=695.88	s=233.47	n=30

STATISTICAL ANALYSES			
Total Living Cover	t=1.9386	df=108	SL=N.S
Density	t=n/a	df=n/a	SL=n/a
Production	t=4.0590	df=108	SL=p<.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

TABLE 71: Statistical summary sheet comparing the Reclaimed Saltbush areas and Saltbush Reference Area at the Star Point Mine site (2011).

A. SALTBUSH AREAS (Post-SMCRA)			
Area I			
Total Living Cover	$\bar{x}$=60.40	s=11.66	n=50
Density	$\bar{x}$=4391.09	s=2084.73	n=50
Production	$\bar{x}$=1419.29	s=685.47	n=50
Saltbush Reference Area			
Total Living Cover	$\bar{x}$=28.90	s=5.50	n=50
Density	$\bar{x}$=2000.00*	s=n/a	n=n/a
Production	$\bar{x}$=644.30	s=296.97	n=50
STATISTICAL ANALYSES			
Total Living Cover	t=17.2772	df=98	SL=p<.001
Density	t=n/a	df=n/a	SL=n/a
Production	t=7.3357	df=98	SL=p<.001

$\bar{x}$= sample mean, s = sample standard deviation, n = sample size,
NS = non-significant, t = Student's t-value, df = degrees of freedom,
SL = significance level, p = probability level, *= pre-determined standard

COLOR PHOTOGRAPHS
OF THE
SAMPLE AREAS

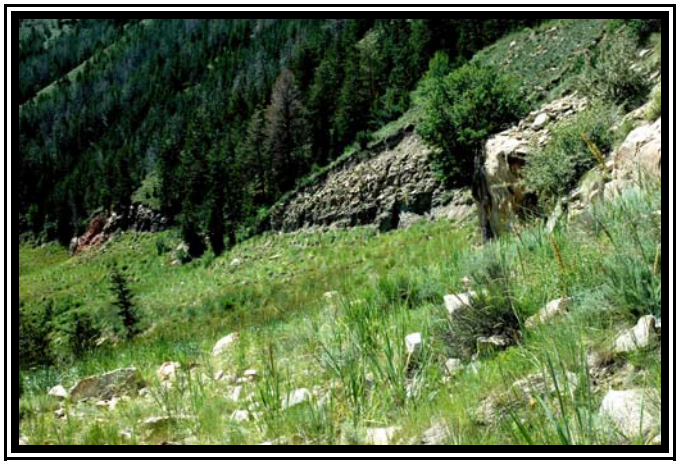
Reclaimed Area A

Reclaimed Area A (continued)

Reclaimed Area B

Reclaimed Area C

Reclaimed Area E



Reclaimed Area E (continued)

Reclaimed Area F

Reclaimed Area G (Pre-SMCRA)

Reclaimed Area G (Post-SMCRA)

Reclaimed Area H

Reclaimed Area I

MUDWATER CANYON AREA

CORNER CANYON AREA

SAGEBRUSH REFERENCE AREA

MOUNTAIN GRASSLAND REFERENCE AREA

SALTBUSH REFERENCE AREA

E2,129,000 E2,130,000 E2,131,000 E2,132,000 E2,133,000 E2,134,000 E2,135,000

N437,000 N436,000 N435,000 N434,000

SAMPLE AREA G

SAMPLE AREA F

SWALE 17a SWALE 17b SWALE 19a SWALE 19b SWALE 20a

SPRD-17a SPRD-17b SPRD-18b SPRD-19a SPRD-19b SPRD-20a SPRD-20b SPRD-21 SPRD-22a SPRD-23 SPRD-24 SPRD-25a SPRD-25b SPRD-26 SPRD-26a SPRD-31 SPRD-45 SPRD-16 SPRD-14a SPRD-15

SPRC-22 SPRC-44

RETAINED PRE-SMCRA CUTSLOPE NOT RECLAIMED

COUNTY ROAD 290

P1-1 P1-2 P1-3

A A' B B' C C' D D' E E' F F' G G' H H' I I' J J' K K' L L' M M'

EL. 8368.06 EL. 8573.82 EL. 8003.38 EL. 7796.70 EL. 8696.63

VEGETATION SAMPLE AREAS 2011 MAP A

by
MT. NEBO SCIENTIFIC, INC.
Springville, UT
March 2012
Base Map
by
EARTHFAX ENGINEERING
Midvale, UT

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PARTIALLY BACKFILLED PRE-SMCRA HIGHWALL
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- PARTIALLY BACKFILLED POST-SMCRA CUTSLOPE
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- SECTION CORNER
- AREA OF COAL REFUSE BURIAL. COAL REFUSE BURIED WITH A MIN. OF 4' OF COVER MATERIAL. (APPROX. 113,532 CY HAULED TO THE LION'S DECK)
- AREA PROVIDING COVER MATERIAL FOR COAL REFUSE PLACED ON THE LION'S DECK (APPROX. 14,700 CY WAS USED TO FILL THE STOPE HOLE AND 54,502 CY WAS USED TO COVER THE COAL REFUSE)
- Sample Transect Lines

NOTES:
1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LION'S DECK, PONDS 1 AND 2, AND THE LOWER FACILITIES AREAS BEGAN IN APRIL, 2002 AND WERE COMPLETED IN NOVEMBER, 2002. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH
200' 100' 0 200'

FILE: G:\UC779\07\DWG\542200a-AB\ 08-08-03

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RAG

REVISION/HISTORY

BY	DATE	DESCRIPTION
LDJ	05-05-02	RESPOND TO TA COMMENTS
LDJ	10-10-03	AS-BUILT
LDJ	02-05-04	RESPOND TO TA COMMENTS
PDC	02-27-07	VEGETATION SAMPLE LOCATIONS ADDED

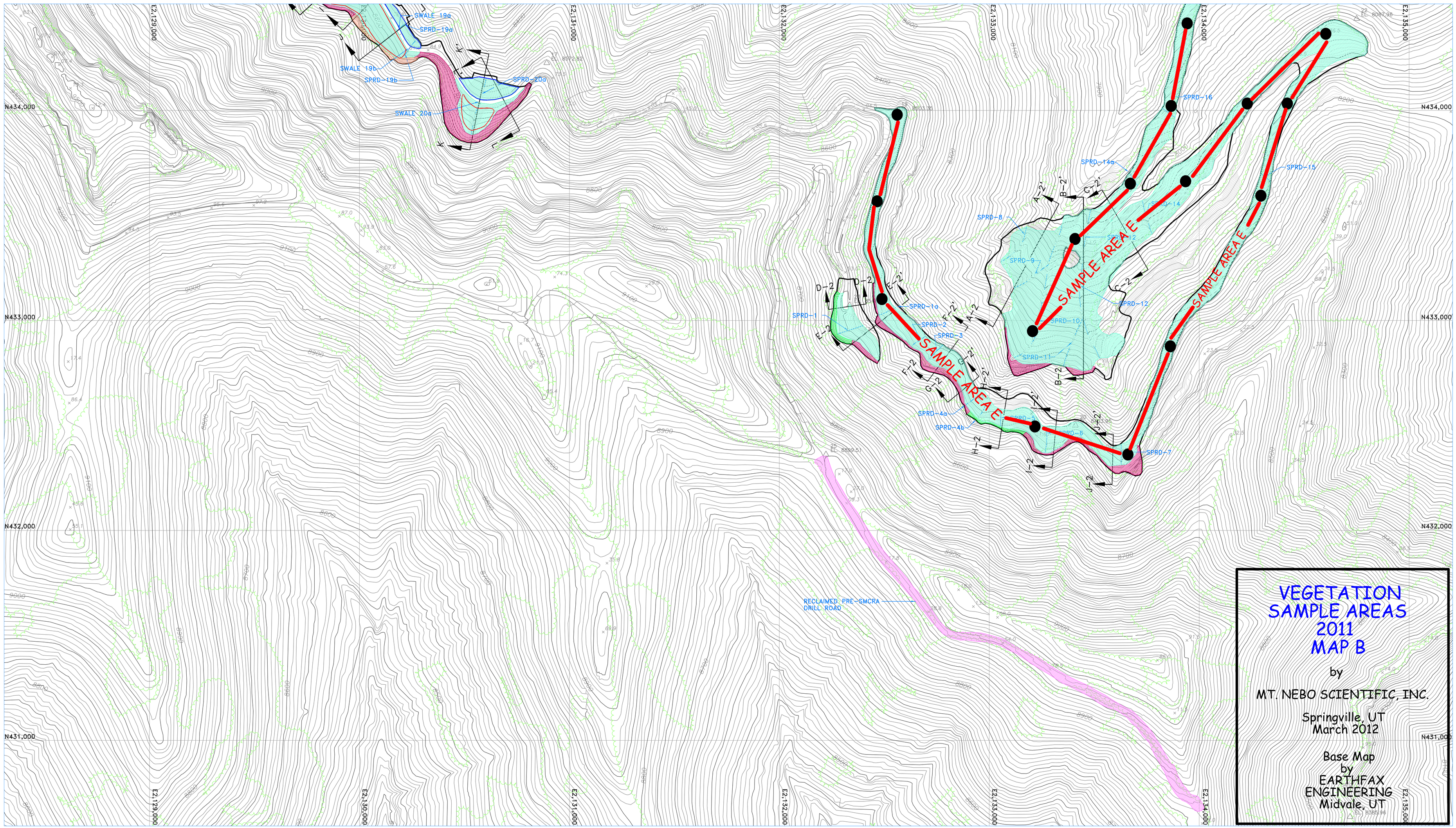
STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP

SHEET 1

PLATEAU MINING CORPORATION
847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

MAP 542.200a



VEGETATION SAMPLE AREAS 2011 MAP B

by

MT. NEBO SCIENTIFIC, INC.

Springville, UT
March 2012

Base Map
by
EARTHFAX ENGINEERING
Midvale, UT

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PARTIALLY BACKFILLED PRE-SMCRA HIGHWALL
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- PARTIALLY BACKFILLED POST-SMCRA CUTSLOPE
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- DEEP GOUGED SURFACE LAST AUGMENTED SEEDING FALL 2003
- SAMPLE TRANSECT LINES
- SECTION CORNER (10 | 11 / 15 | 14)
- AREA OF COAL REFUSE BURIAL. COAL REFUSE BURIED WITH A MIN. OF 4' OF COVER MATERIAL. (APPROX. 113,532 CY HAULED TO THE LION'S DECK)
- AREA PROVIDING COVER MATERIAL FOR COAL REFUSE PLACED ON THE LION'S DECK (APPROX. 14,700 CY WAS USED TO FILL THE STOPE HOLE AND 54,502 CY WAS USED TO COVER THE COAL REFUSE)

NOTES:

1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LION'S DECK, PONDS 1 AND 2, AND THE LOWER FACILITIES AREAS BEGAN IN APRIL, 2002 AND WERE COMPLETED IN NOVEMBER, 2002. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH

200' 100' 0 200'

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RAG

FILE: G:\UC779\07\DWG\542200B-AB\ 08-08-03

REVISION/HISTORY

BY	DATE	DESCRIPTION
RBW	10-99	RESPOND TO TA COMMENTS
1		
LDJ	10-10-03	AS-BUILT
2		
LDJ	02-05-04	RESPOND TO TA COMMENTS
3		
PDC	03-27-07	VEGETATION SAMPLE LOCATIONS ADDED
4		
5		
6		

STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP

SHEET 2

PLATEAU MINING CORPORATION

847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

2 of 3

MAP 542.200b

SAMPLE AREA A

SAMPLE AREA B

SAMPLE AREA C

SAMPLE AREA H

SAMPLE AREA I

SCA PERMIT AREA
PERMIT C/007/042
NOVEMBER, 2003

AREAS WHERE POCKETS OF COAL REFUSE WERE LEFT IN-PLACE AND COVERED WITH A MINIMUM OF 4' OF SOIL

PHILLIPS UTILITY CORRIDOR.
PHASE III BOND RELEASE
DECEMBER, 2003

SOURCE OF TOPSOIL TO COVER POCKETS OF COAL REFRUSE LEFT IN PLACE IN THE FACILITIES AREA (APPROX. 13,300 CY)

WELL NO. 10-525

WELL NO. 10-526

SPRD-22a, SPRD-24, SPRD-26, SPRD-26a, SPRD-27, SPRD-28, SPRD-29, SPRD-29a, SPRD-31, SPRD-33, SPRD-35, SPRD-35a, SPRD-36a, SPRD-40, SPRD-46, SPRD-47, SPRD-47a, SPRD-48, SPRD-49, SPRC-22

E2,135,000 E2,136,000 E2,137,000 E2,138,000 E2,139,000 E2,140,000 E2,141,000

N437,000 N436,000 N435,000 N434,000

VEGETATION SAMPLE AREAS 2011 MAP C

by
MT. NEBO SCIENTIFIC, INC
Springville, UT
March 2012

Base Map
by
EARTHFAX ENGINEERING
Midvale, UT

LEGEND

- PRIMARY ROAD
- SECONDARY ROAD
- TRAIL
- BRIDGE, CULVERT
- RAILROAD
- BUILDINGS, STRUCTURES
- LAKE, POND
- RIVER, STREAM
- FENCE
- ASBUILT CONTOURS
- TREE LINES
- RECLAMATION DISTURBED AREA BOUNDARY
- CROSS SECTION
- PERMIT BOUNDARY
- PHILLIPS GAS WELLS AND UTILITY CORRIDOR (11.77 ACRES POST MINING LAND USE CHANGE AND PHASE III BOND RELEASED IN DECEMBER 2003)
- SECTION CORNER
- PARTIALLY BACKFILLED PRE-SMCRA CUTSLOPE
- SCA PERMIT BOUNDARY AND PERMIT C/007/042 NOVEMBER, 2003
- RECLAMATION CHANNEL
- DEEP GOUGED SURFACE (HAY AND STRAW MULCH) LAST AUGMENTED SEEDING FALL 2002
- SAMPLE TRANSECT LINES

NOTES:
1. PHASE 1 BOND RELEASE FOR 93.77 ACRES.
2. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE MINE #1 AND MINE #2 AREAS BEGAN IN AUGUST, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
3. BACKFILL, GRADING AND GROWTH MEDIA/TOPSOIL PLACEMENT FOR THE LOADOUT AREA BEGAN IN SEPTEMBER, 2001 AND WERE COMPLETED IN DECEMBER, 2001. GROWTH MEDIA/TOPSOIL PLACEMENT OCCURRED CONCURRENTLY WITH BACKFILLING AND GRADING AS AREAS ACHIEVED FINAL GRADE.
4. ALL EXCESS COAL REFUSE FROM THE MAIN CHANNEL AREA, NOT USED AS BACKFILL, WAS PLACED ON THE REFUSE PILE.
5. TOWNSHIP 15 SOUTH, RANGE 8 EAST.

NORTH

200' 100' 0 200'

FILE: G:\UC779\07\DWG\542200C-AB\ 08-08-03

REGISTERED PROFESSIONAL ENGINEER
No. 189797
LAYNE D. JENSEN
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RAG

REVISION/HISTORY

BY	DATE	DESCRIPTION
LDJ	10-10-03	AS-BUILT
LDJ	02-05-04	RESPOND TO TA COMMENTS
PDC	03-27-07	VEGETATION SAMPLE LOCATIONS ADDED

STARPOINT MINE

AS-BUILT RECLAMATION TOPOGRAPHY AND TREATMENT MAP SHEET 3

PLATEAU MINING CORPORATION
847 NW HIGHWAY 191 HELPER, UTAH 84526
PHONE: (435) 472-0475

3 OF 3

MAP 542.200c

APPENDIX

(NRCS Information)

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
540 West Price River Drive
Area Office
Price, UT 84501
(435) 637-0041
FAX (435) 637-3146

September 14, 2011

Patrick D. Collins, Ph.D.
Mt. Nebo Scientific, Inc.
Research & Consulting
P.O. Box 337
330 East 400 South, Suite 6
Springville, UT 84663

Dear Mr. Collins:

Following our visit on September 6, 2011 to the four reclamation sites at the Star Point Mine and our visit on September 8, 2011 to the reclamation site in Mudwater Canyon, I was able to summarize my findings in regards to vegetation establishment and soil stability.

Star Point Mine (Site E)
Township 15 South, Range 8 East, Section 16 SWNE

The first site we examined within Site E was on an east aspect and occurs at 8,483 feet in elevation. This site occurs on the Doney-Toze Families Soil Complex (50-90% slopes) and on a Mountain Very Steep Loam (Salina Wildrye) Ecological Site (Soil Survey of Carbon Area Utah, June 1988). On an average year, the site will produce approximately 1,100-1,200 pounds/acre of air-dry herbage. The primary grass species on the site are comprised of Salina wildrye (*Leymus salinus*) and slender wheatgrass (*Elymus trachycaulus*) and the primary shrubs are mountain big sagebrush (*Artemisia tridentate vaseyana*) and mountain snowberry (*Symphoricarpos oreophilus*).

The reclamation area contained a very diverse mixture of grasses, forbs and shrubs with no noxious or invasive species detected. Native tree species were also re-establishing on the site. Some of the species identified included basin wildrye (*Leymus cinereus*), Salina wildrye (*Leymus salinus*), crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Pseudoroegneria spicata*), thickspike wheatgrass (*Elymus lanceolatus*), Indian ricegrass (*Achnatherum hymenoides*), yellow sweet clover (*Melilotus officinalis*), Lewis flax (*Linum lewisii*), Palmer's penstemon (*Penstemon palmeri*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), mountain big sagebrush (*Artemisia tridentate vaseyana*), antelope bitterbrush (*Purshia tridentata*), fringed sage or prairie sagewort (*Artemisia frigida*), rubber rabbitbrush (*Ericameria nauseosa*), mountain snowberry (*Symphoricarpos oreophilus*) and Douglas fir (*Pseudotsuga menziesii*). Overall, the plant species diversity, plant production and plant health and vigor were very good on the site, particularly considering the very rocky structure of the soil surface. All of the plants examined exhibited good seed production, a good indicator of future plant recruitment. Soil stability also appeared to be good overall, as erosion problems were not apparent and vegetative ground cover was persistent throughout a majority of the area. Areas where vegetative cover was not as persistent contained heavy amounts of larger-sized rocks across the soil surface. Vegetative production varied to some degree throughout the entire Site E depending on aspect, slope, soil surface rock content

and other variables, but vegetative re-establishment was good overall. In my opinion, it is not fair to compare the production of the current vegetative community to the production of the natural ecological site plant community production based on some of the species used in rehabilitation efforts (i.e. basin wildrye). It is apparent that species such as basin wildrye were very well established and produce a much greater amount of annual herbage than the primary, natural species which occur on the ecological site such as Salina wildrye. On those sites adjacent to the reclamation sites, ecological sites appeared to be in overall good condition (healthy stands of Salina wildrye and other perennial grasses and shrubs). Based on my visual estimation, the herbage production throughout Site E averaged approximately 2,000-2,200 pounds/acre.

Star Point Mine (Site E)

Star Point Mine (Site G)
Township 15 South, Range 8 East, Section 16 NWNW

The second site we examined within Site G was on a north aspect and occurs at 8,559 feet in elevation. This site also occurs on the Doney-Toze Families Soil Complex (50-90% slopes) and on a Mountain Very Steep Loam (Salina Wildrye) Ecological Site (Soil Survey of Carbon Area Utah, June 1988). On an average year, the site will produce approximately 1,100-1,200 pounds/acre of air-dry herbage. The primary grass species on the site are comprised of Salina wildrye (*Leymus salinus*) and slender wheatgrass (*Elymus trachycaulus*) and the primary shrubs are mountain big sagebrush (*Artemisia tridentate vaseyana*) and mountain snowberry (*Symphoricarpos oreophilus*).

The vegetation at Site G was similar to that at Site E, although an additional species in northern sweetvetch (*Hedysarum boreale*) was identified. As with Site E, the overall plant species diversity, plant production and plant health and vigor were very good on the sites examined within Site G, particularly considering the very rocky structure of the soil surface. All of the plants examined exhibited good seed production, a good indicator of future plant recruitment.Soil stability also appeared to be good overall, as erosion problems were not apparent and vegetative ground cover was persistent throughout a majority of the area. Again, based on my visual estimation, the herbage production throughout Site G averaged approximately 2,000-2,200 pounds/acre.

Star Point Mine (Site G)

Star Point Mine (Site A)
Township 15 South, Range 8 East, Section 10 SESW

The third site we examined within Site A was on a south aspect and occurs at 7,437 feet in elevation. This particular site was not given a specific soil series classification or ecological site description in the 1988 Soil Survey of Carbon Area, Utah. The site was classified as a "Dumps/Mine" site which considered the area as piles of waste material from coal mines.

The reclamation area contained a very diverse mixture of grasses, forbs and shrubs. Some cheatgrass or downy brome (*Bromus tectorum*) and musk thistle (*Carduus nutans*) were present, but neither species were persistent. Some of the species identified included basin wildrye, salina wildrye, bluebunch wheatgrass, crested wheatgrass, Indian ricegrass, Utah serviceberry (*Amelanchier utahensis*), curl-leaf

mountain mahogany, shadscale (*Atriplex confertifolia*), rubber rabbitbrush, Wyoming big sagebrush (*Artemisia tridentate wyomingensis*), winterfat (*Krascheninnikovia lanata*), four-wing saltbush (*Atriplex canescens*), antelope bitterbrush, elderberry (*Sambucus* sp.), alfalfa (*Medicago sativa*), northern sweetvetch, Lewis flax, Palmer's penstemon, western yarrow (*Achillea millefolium*), fringed sage or prairie sagewort and curlycup gumweed (*Grindelia squarrosa*). Overall, the plant species diversity, plant production and plant health and vigor were very good on the site, particularly considering the very rocky structure of the soil surface. Soil stability also appeared to be good overall, as new erosion problems were not apparent, past erosion indicators were healing and vegetative ground cover was persistent throughout a majority of the area. As the vegetation establishment continues and plant recruitment increases (evident by good plant seed production), the potential for future erosion further decreases. Based on my visual estimation, the herbage production throughout Site A averaged approximately 800-1,000 pounds/acre.

Star Point Mine (Site A)

Star Point Mine (Site B)
Township 15 South, Range 8 East, Section 10 NESW

The fourth and final site we examined within Site B was on a south aspect and occurs at 7,424 feet in elevation and was immediately adjacent to Site A. This site occurs on the Gerst-Strych-Badland Soil Complex (3-50% slopes) and on an Upland Shallow Clay Loam and Upland Stony Loam (Utah Juniper/Pinyon) ecological sites (Soil Survey of Carbon Area Utah, June 1988). On an average year, the

Upland Shallow Clay Loam site will produce approximately 300-400 pounds/acre of air-dry herbage. The primary grass species on the site are comprised of Salina wildrye and Indian ricegrass and the primary shrubs are birchleaf mountain mahogany (*Cercocarpus montanus*) and Utah serviceberry. On an average year, the Upland Stony Loam site will produce approximately 700-800 pounds/acre of air-dry herbage. The primary grass species on the site is comprised of bluebunch wheatgrass and the primary shrubs are black sagebrush (*Artemisia nova*) and birchleaf mountain mahogany. Overall, the plant species diversity, plant production and plant health and vigor were very good on the site, particularly considering the very rocky structure of the soil surface. Soil stability also appeared to be good overall, as new erosion problems were not apparent, past erosion indicators were healing and vegetative ground cover was persistent throughout a majority of the area. As the vegetation establishment continues and plant recruitment increases (evident by good plant seed production), the potential for future erosion further decreases. Based on my visual estimation, the herbage production throughout Site B averaged approximately 1,000-1,200 pounds/acre.

Star Point Mine (Site B)

Star Point Mine (Site B)

Mudwater Canyon
Township 15 South, Range 8 East, Section 8 SWNW

The site we examined was on a northeast aspect and occurs at 8,680 feet in elevation. This site occurs on the Midfork-Comodore-Northorn complex (50-70% slopes) and on a High Mountain Very Steep Loam (Douglas Fir) ecological site. On an average year, the High Mountain Very Steep Loam site will produce approximately 300 pounds/acre of air-dry herbage.

The reclamation area contained a very diverse mixture of grasses, forbs and shrubs. Some Canada thistle (*Cirsium arvense*) was present, but not persistent. Some of the species identified included western wheatgrass (*Pascopyrum smithii*), mountain brome (*Bromus marginatus*), timothy (*Phleum pratense*), intermediate wheatgrass (*Thinopyrum intermedium*), thickspike wheatgrass, orchardgrass (*Dactylis glomerata*), sheep fescue (*Festuca ovina*), Kentucky bluegrass (*Poa pratensis*), western yarrow, Aster (*Aster sp.*), goatsbeard (*Tragopogon* sp.), fleabane (*Erigeron sp.*), wild cabbage (*Caulanthus sp.*), geranium (*Geranium sp.*), strawberry (*Fragaria sp.*), currant (*Ribes spp.*), mountain snowberry, woods rose (*Rosa woodsii*), elderberry (*Sambucus spp.*), raspberry (*Rubus sp.*) and Douglas fir. Overall, the plant species diversity, plant production and plant health and vigor were very good on the site, particularly considering the very rocky structure of the soil surface. All of the plants examined exhibited good seed production, a good indicator of future plant recruitment. Soil stability also appeared to be good overall, as erosion problems were not apparent and vegetative ground cover was persistent

throughout a majority of the area. Areas where vegetative cover was not as persistent contained heavy amounts of larger-sized rocks across the soil surface. Based on my visual estimation, herbage production throughout the site averaged approximately 800-1,000 pounds/acre.

Mudwater Canyon

Mudwater Canyon

If you have any questions or comments, please feel free to contact me at (435) 637-0041, Ext. 120.

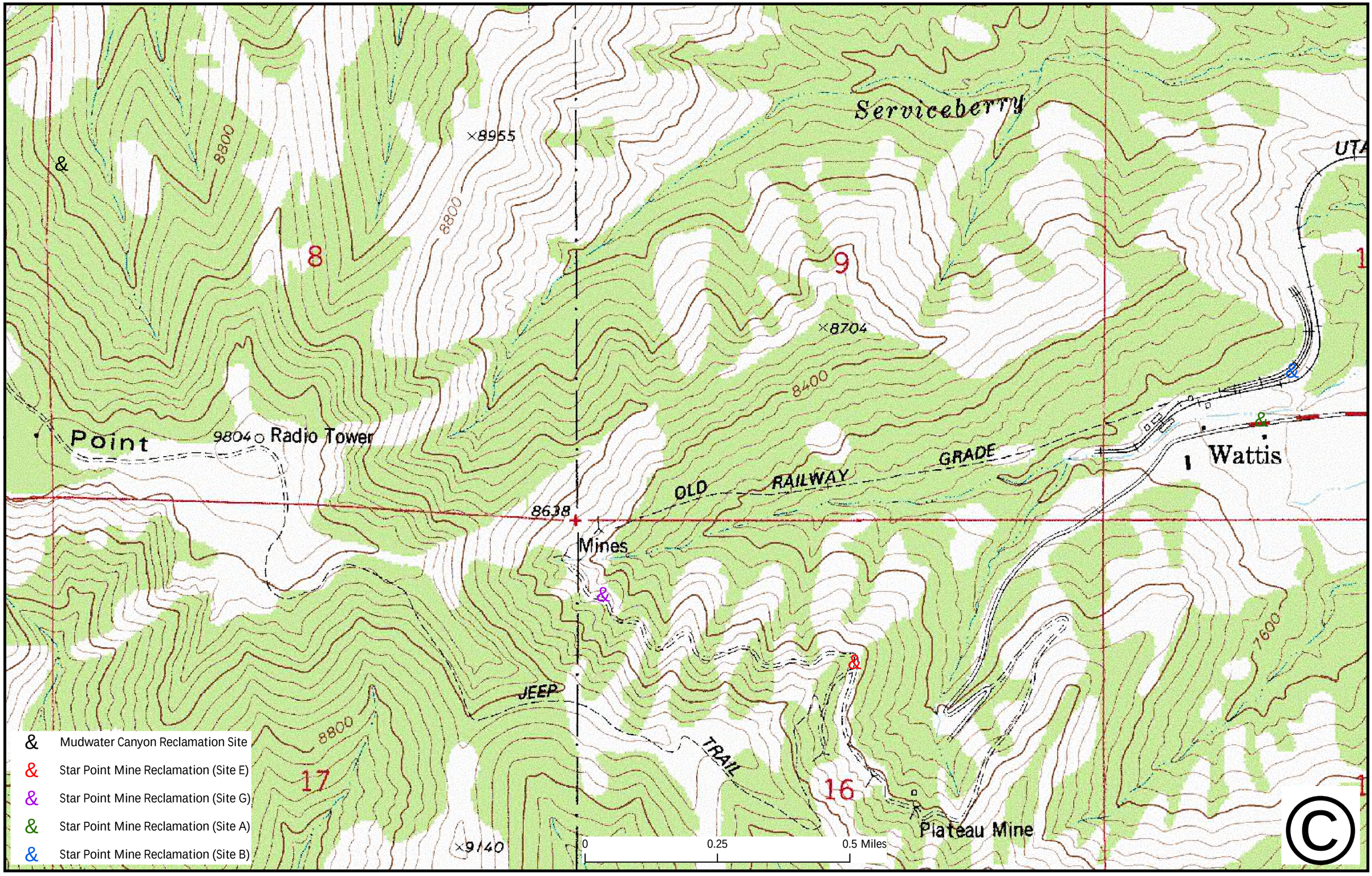
Sincerely,

/s/

Jeff Fenton
Rangeland Management Specialist
USDA – NRCS
Price, Utah

cc: Barry A. Hamilton
Assistant State Conservationist for Field Operations

Jay Howard
Acting District Conservationist


Serviceberry
×8955
8800
8800
8
9
×8704
8400
UTA
1
&
Point
9804 Radio Tower
Wattis
OLD
RAILWAY
GRADE
8638
Mines
&
7600
&
JEEP
TRAIL
8800
17
16
×9140
Plateau Mine
0
0.25
0.5 Miles
& Mudwater Canyon Reclamation Site
& Star Point Mine Reclamation (Site E)
& Star Point Mine Reclamation (Site G)
& Star Point Mine Reclamation (Site A)
& Star Point Mine Reclamation (Site B)
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