Appendix A- Baseline Vegetation and Soil Assessment at Rocky Point Gravel Mine

Baseline Vegetation and Soil Assessment at Rocky Point Gravel Mine

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Prepared for:
Marriott Rock Products
5238 W 2150 N
Ogden, UT 84404

Prepared by:

WP Natural Resource Consulting, Inc
PO Box 520604
SLC, UT 84152
(801) 699-5459

INTRODUCTION

Marriott Rock Products has been requested to submit a Large Mining Operation (LMO) permit for the Rocky Pointe gravel mine in Weber and Box Elder Counties, sections 11,12,13,and 14 in Township 7 North, Range 2 West. The LMO is needed to bring Marriott Rock Products into regulatory compliance with the Utah Division of Oil Gas and Mining (DOGM). The purpose of this report is to provide a baseline characterization of soils and vegetation according to the requirements of DOGM. This information will assist in the design of a site appropriate and effective reclamation plan.

SITE DESCRIPTION

The area straddles the border of Weber and Box Elder Counties adjacent to Interstate 15. The elevation of the area is about 4300 to almost 5000 feet and averages about 16 inches of precipitation annually. The highest precipitation month in this area is April at about 1.5 inches of precipitation during the month. The freeze free season is about 156 days (NRCS, 1975).

VEGETATION

The slopes of the Rocky Point Mine boundary range from 2 to about 55 degrees. Slight variations in geology and topography, as well as past and present land use and disturbances within the area, are major determinants of soil and vegetation type. The area has a history of agriculture as some of the property has remains of orchards on it. Furthermore, it appears the area has burned in relatively recent history. As a result of this agricultural and fire history, the area is covered chiefly by early seral vegetation communities with some native bunchgrasses, abundant cheatgrass and other annual weeds (Figure 1).

Figure 1. Overview of early seral vegetation at Rocky Pointe Gravel Mine, June 2007.

Figure 2. Remainder of a sagebrush dominated area

However, in other areas of the mine where disturbance has been kept to a minimum, the land is dominated by sagebrush with a relatively sparse understory (Figure 2).

According to the NRCS (1984), the potential vegetation cover is various amounts of sagebrush, bunchgrasses, lupine, annual weeds and balsam root, and the proportion of each varies according to slope, aspect and underlying soil type. However, the historic land uses of the area have dramatically changed much of the native vegetation communities.

GEOLOGY AND SOILS

This area consists mostly of lake terraces and alluvial fans adjacent to the Wasatch Mountains that were formed during the Pleistocene Epoch during the Quaternary Period by Lake Bonneville and other lakes. In addition, sediment carried by the Weber River provided the material that formed the extensive lake terraces around ancient Lake Bonneville and other more recent flood plains.

The NRCS soil survey delineates six soil types in and around the mine location (See Figure 7). The soil survey for the Eastern part of Box Elder County (1975) as well as the soil survey for the Davis-Weber (1968) were used to help describe the soil types present at the mine. The following soil types are found on the mine property.

<u>RrE- Ridd Rock outcrop complex, 10-30 percent slopes</u>
In this soil type, at least 20 feet of lacustrine gravel-bearing deposits have been laid down from millennia of deposition and reworking from water along ancient lake shorelines. The Ridd Rock outcrop complex is found in the north region of the property and generally on slopes and alluvial fans formed in colluvium and alluvium derived from quartzite, gneiss and schist. Some of this soil type is currently being used for landscape rock. As the name implies, this soil types consists of a combination of Ridd stony sandy loam (about 75% of the area), 15% rock outcrop, and the remainder on slopes. The surface layer is generally gravelly sandy loam to heavy sandy loam down to about 24 inches in depth. Organic matter averages about 1%, Cation exchange capacity (CEC) is about 10.4 meq/gm, electric conductivity (EC) is about 0.6Mmhos/cm and pH is around 7.2. The native vegetation consists of Bluebunch wheatgrass (*Pseudoroegneria spicata* var *spicat*a), lupine (*Lupinus* spp), sagebrush (*Artemisia tridentata*) and

balsamroot (*Balsamorhiza saggitata*). There are inclusions of other soils in the area and they include Wasatch cobbly sandy loam (gravelly subsoil variant, 10-20% slopes), and stony alluvial land.

SsF- Sterling gravelly loam 20-30% slopes.
These soils are found on alluvial fans, lake terraces, escarpments and mountain foot slopes, and were formed in very gravelly and cobbly calcareous alluvium, colluvium and mixed lake sediments derived from limestone, dolomite, sandstone and quartzite. Only a small area in the western region of the property is this soil type. The surface layer is about 16 inches deep and is a gravelly loam. Organic matter averages about 2%, CEC is about 17.5 meq/gm, EC is 0.6 Mmhos/cm, and pH is about 8.4. The subsoil is cobbly loam down to about 27 inches, and turns to very cobbly loam down to 60 inches. The potential native vegetation consists of Bluebunch wheatgrass, western wheatgrass (*Pascopyrum smithii*), sagebrush, Sandberg's bluegrass (*Poa sandbergii*), purple three awn (*Aristida purpurea*), cheatgrass (*Bromus tectorum*) and annual weeds.

Bp- Borrow pits
The material remaining is often cobbly, stony or gravelly and ranges in texture from clay loam to sand.

MbE – Manila loam 10-25% slopes
Geologically, these soils were formed as deposits from Lake Bonneville (as well as deeper water deposits) were worked and reworked in a relatively gentle manner. These lacustrine fine-grained deposits are about 20 feet thick. These soils are found on mountain slopes and high lake terraces and were formed in colluvium, residuum, and alluvium derived mainly from sandstone, limestone and quartzite. The northern most region of the property is this soil type. The surface layer is a loam about 13 inches thick. Organic matter is about 2.5% in these upper layers, CEC is about 25 meq/gm of soil, EC about 0.6 Mmhos/cm, and pH is about 7.7. The subsoil is a silty clay loam in the upper 7 inches and a silty clay to clay in next 12 inches, and silty clay in lower 10 inches, for a total subsoil depth of about 32 inches. The substratum is a cobbly silt loam to weathered sandstone and fractured limestone to 57 inches deep. The native vegetation of this soil type consists of Bluebunch wheatgrass, sagebrush, Great Basin Wildrye (*Elymus cinereus*), serviceberry (*Amelanchier utahensis*), snowberry (*Symphorocarpos oreophilus*), and bitterbrush (*Pushia tridentata*).

MgE2 – Marriott Series,
These soils can be indicative of younger alluvial fan deposits during the Holocene Epoch. They are generally a mixture of sand and gravel and some larger cobbles deposited by streams and these deposits are about 20 feet thick. These soils are relatively high in calcium carbonate that occur on alluvial and colluvial fans on high lake terraces because they were formed in gravelly calcareous alluvium and colluvium. The surface layer is 11 to 19 inches thick of gravelly sandy loam, and gravelly sandy loam is present to 60 inches. This soil is located in the central region of the property. Organic matter is about 0.9%, pH is about 8.8, CEC is about 9.2 meq/gm, EC is 0.5 Mmhos/cm. This soil has historically been used for orchards as it can hold a fair amount of moisture.

RkE2 – Ridd rocky sandy loam 10-30 slopes
These soils are similar to the Ridd stony sandy loam described above in the Ridd Rock Outcrop Complex. The Ridd rocky sandy loam is located in the southern region of the property.

ShF2 – Sterling very rocky loam 6-50% slopes
Sterling very rocky loam is similar to the Sterling gravelly loam, however, Sterling very rocky loam generally occurs at higher elevations and is more eroded. Sterling very rocky loam is located in the central region of the property. It consists of alluvium and colluvium of weathered limestone. This soil has a stony surface layer and is cobbly and stony throughout the profile (to 60 inches).

GP- Gravel Pits

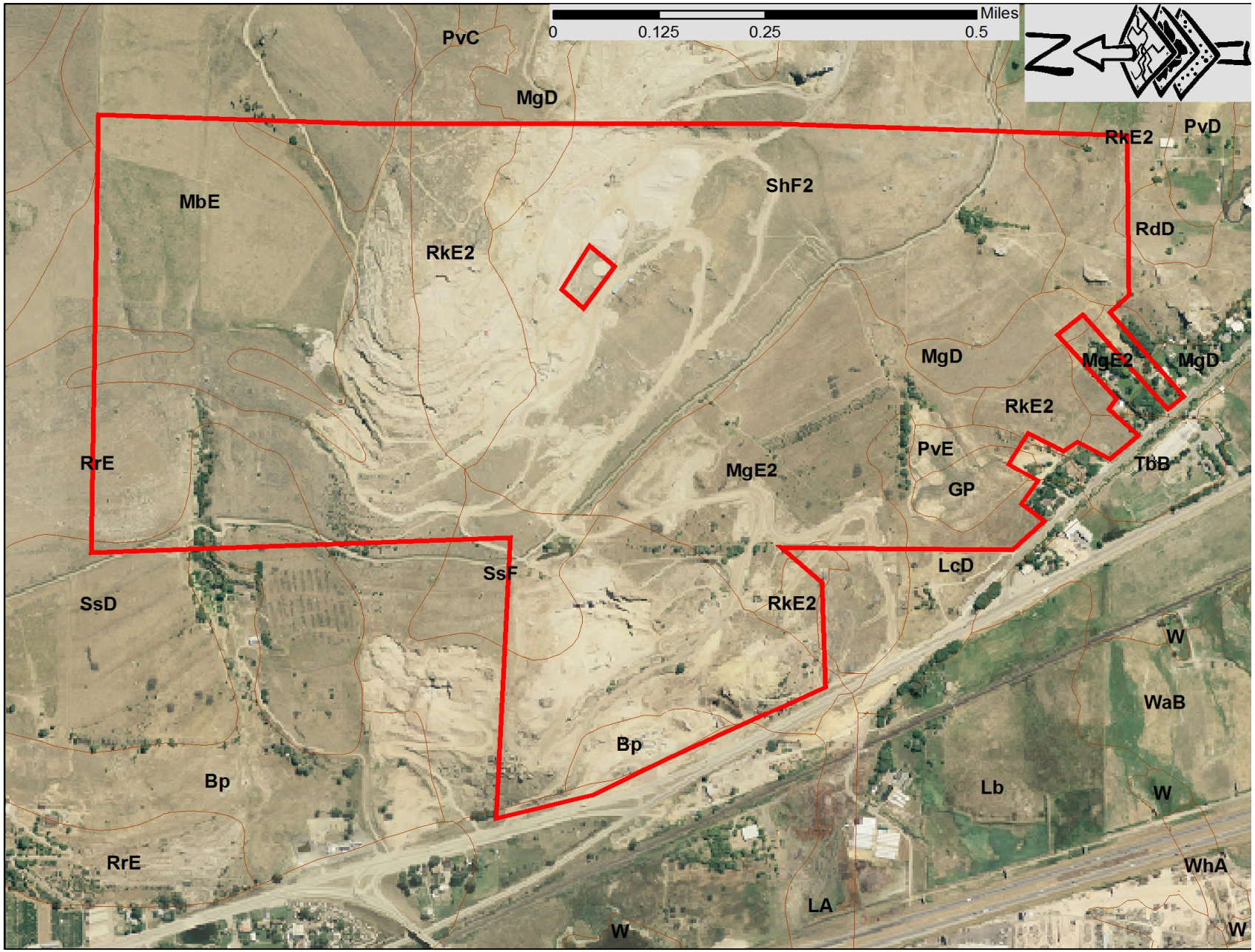
Operational gravel pits.

LcD- Layton loamy fine sand 6 – 10% slopes
Layton loamy fine sands are deep, well drained coarse textured soils that are formed in coarse textured sediments that have been reworked by wind. They generally occur on strongly sloping terraces and escarpments. A small area in the southwest corner of the property has this type of soil. The surface layer is a loamy fine sand about 10-14 inches thick. Organic matter is about 0.6%, CEC averages around 6 meq/gm of soil, pH is 7.8, and EC is 0.9 Mmhos/cm. The subsoil is a loamy sand to about 29 inches in depth. A brown loamy fine sand that is moderately calcareous and strongly alkaline exists to about 66 inches in depth. Potential native vegetation consists of Gambel oak, bunch grasses, sagebrush and rabbitbrush.

PvE- Pleasant View loam 10-20% slopes.
These soils are deep, well drained soils that are on gently sloping to moderately steep slopes. They are found mainly on high alluvial fans, and were formed in noncalcareous or slightly calcareous alluvium that was derived from gneiss, schist, shale, and argillite. A small area in the south west corner of the property has this type of soil. The surface layer is a loam to gravelly sandy loam that ranges from 9 to 25 inches thick, and by volume, about 10 to 30% is fine chep like gravel. The percentage of gravel increases with depth. Calcium carbonate accumulates between 30 and 35 inches below the surface. Organic matter is about 1%, CEC about 13.5 meq/gm, EC 0.8 Mmhos/cm, and pH about 8.2. Potential native vegetation is sand dropseed, sagebrush and bunch grasses.

SsD-Sterling gravelly loam 6-20% slopes
These soils are very similar to the Sterling gravelly loam on 20-30% slopes as described above, although these soils are found on gentler slopes A small area in the northwest region of the property has this soil type.

Figure 3. Soil types at Rocky Pointe



METHODS

To ascertain the range of variability for vegetation cover, ground cover, and species composition, 10 transects of 100 feet each were established in areas determined to be representative of the vegetation of the area. Once within a stand of typical vegetation, a pin was spun to randomly determine the azimuth of the transect. At each foot, vegetation (by species), litter, rock, gravel, or bare ground was recorded. The ten transects were placed in areas of the mine that would reveal the various condition and/or seral stages of vegetation at the mine.

RESULTS

As mentioned earlier, vegetation communities at the site are in various stages of recovery/regneration and/or degeneration according to past disturbance histories and land use practices. As such, at this point in time, it is difficult to accurately characterize the vegetation at the Rocky Pointe Gravel Mine site for reclamation goals. It is believed that an average of all vegetation transects will suffice for a vegetation cover estimate.

Table 1 shows the tabulated results of the vegetation cover at the Rocky Point Gravel Mine. The average vegetation cover is 46% +/- 10%. This estimate includes non-native annual grasses as well as other non-native species. Bare soil averaged at most 2%. Therefore, the revegetation goal for the area post mining would be 32% vegetation cover.

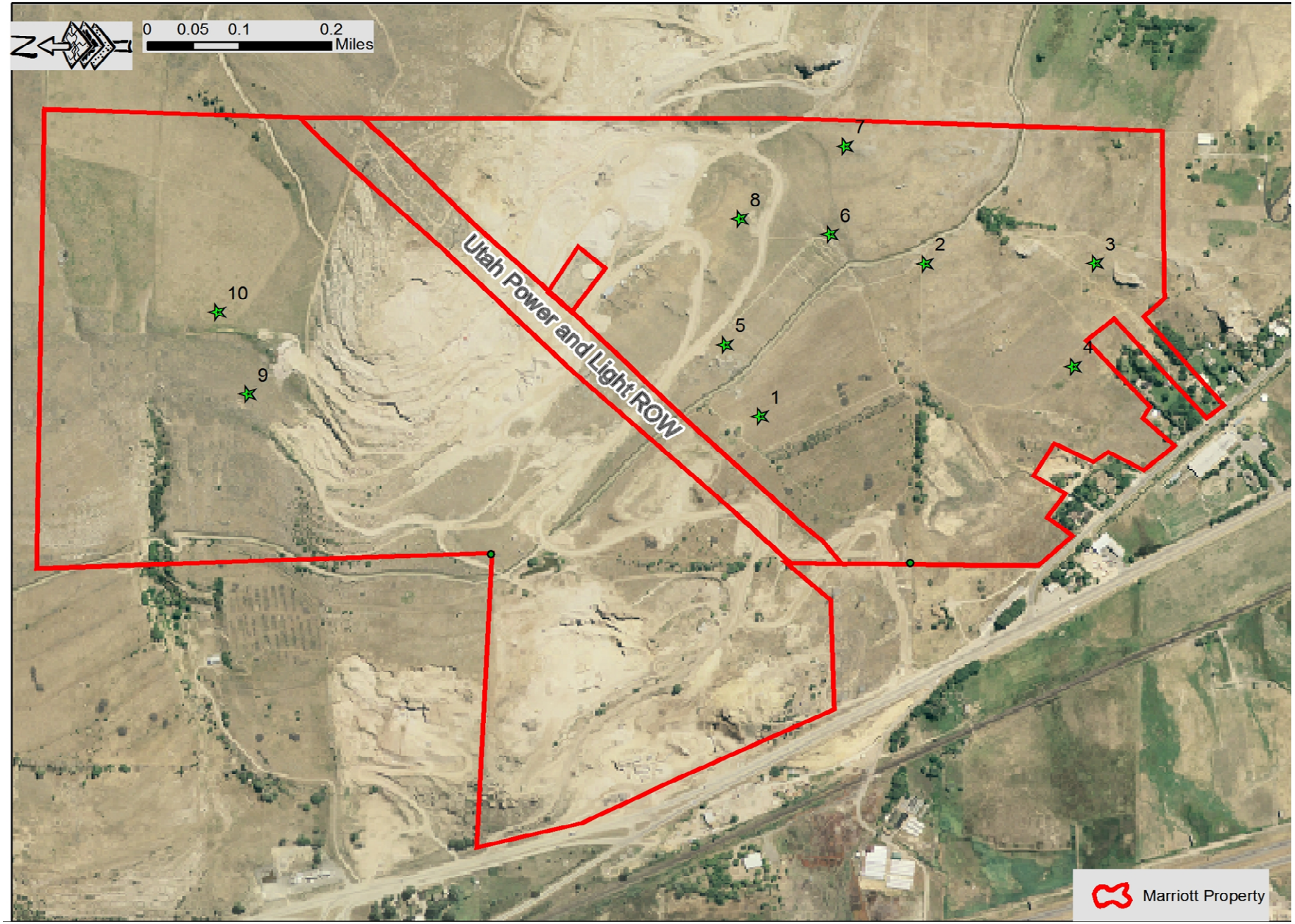
Table 1. Tabulated results for vegetation cover at the Rocky Point Gravel Mine.

Marriott Rock Products
Rocky Point Gravel Mine n=10

Common Name	ScientificName	Avg	StDev	StError	Low	High	Rel Cover	Frequency
Total Vegetation Cover	Total Vegetation Cover	45.600	9.755	3.085	30.000	61.000		100.00
Litter	Litter	45.700	9.844	3.113	31.000	60.000		100.00
Rock	Rock	4.500	4.726	2.363	1.000	11.000	0.00	100.00
Gravel	Gravel	7.250	9.285	3.283	1.000	30.000	0.00	100.00
Bare Soil	Bare Soil	1.714	0.756	0.286	1.000	3.000	0.00	100.00
Total Ground Cover	Total Cover	98.800	1.033	0.327	97.000	100.000		100.00
Cool season perennial grasses								
Bluebunch wheatgrass	Agropyron spicatum	<1					<1	10.00
Sandberg's bluegrass	Poa sandbergii	<1					<1	20.00
Warm season perennial grasses								
Purple three awn	Aristida purpurea	1.600	2.119	0.670	0.000	5.000	3.55	40.00
Sand dropseed	Sporobolus cryptandrus	1.600	2.757	0.872	0.000	8.000	3.55	40.00
Introduced perennial grasses								
Intermediate wheatgrass	Agropyron intermedium	4.900	10.546	3.335	0.000	29.000	10.86	20.00
Bulbous bluegrass	Poa bulbosa	4.400	5.317	1.681	0.000	15.000	9.76	60.00
Annual grasses								
Jointed goat grass	Aegilops cylindricum	6.100	12.441	3.934	0.000	41.000	13.53	80.00
Cheatgrass	Bromus tectorum	13.900	11.638	3.680	2.000	41.000	30.82	100.00

Common Name	ScientificName	Avg	StDev	StError	Low	High	Rel Cover	Frequency
Perennial forbs								
Western yarrow	Achillea millefolium	<1					<1	10.00
Ragweed	Ambrosia psilostachya	0.700	0.675	0.213	0.000	2.000	1.55	70.00
Milkweed	Asclepias sp	0.200	0.632	0.200	0.000	2.000	0.44	20.00
Utah lady finger	Astragalus utahensis	<1					<1	10.00
Sego lily	Calochortus nuttallii	<1					<1	20.00
Bindweed	Convovulus arvensis	2.700	6.075	1.921	0.000	18.000	5.99	20.00
Spring parsley	Cymopterus longipes	0.700	1.337	0.423	0.000	4.000	1.55	30.00
Curly cup gumweed	Grindelia squarrosa	0.200	0.422	0.133	0.000	1.000	0.44	20.00
Northern sweet vetch	Hedysarum boreale	<1					<1	10.00
Gray's lomatium	Lomatium grayii	0.300	0.949	0.300	0.000	3.000	0.67	10.00
Alfalfa	Medicago sativa	0.300	0.675	0.213	0.000	2.000	0.67	70.00
Long leaved phlox	Phlox longifolia	0.400	1.265	0.400	0.000	4.000	0.89	10.00
Cinquefoil	Potentilla sp	0.200	0.632	0.200	0.000	2.000	0.44	10.00
Death camas	Zigadenus paniculatus	<1					<1	20.00
Annual and biennial forbs								
Alyssum	Alyssum alyssoides	0.200	0.632	0.200	0.000	2.000	0.44	10.00
Crane's bill	Erodium cicutarium	1.700	3.199	1.012	0.000	10.000	3.77	40.00
Sunflower	Helianthus annuus	<1					<1	10.00
Dyer's Woad	Isatis tinctoria	0.100	0.316	0.100	0.000	1.000	0.22	60.00
Western salsify	Tragopogon dubius	0.300	0.675	0.213	0.000	2.000	0.67	70.00
Sub-shrubs								
Louisiana sage	Artemisia ludoviciana	0.300	0.675	0.213	0.000	2.000	0.67	40.00
Broom snake weed	Gutierrezia sarothrae	1.400	2.119	0.670	0.000	5.000	3.10	40.00
Shrubs								
Sagebrush	Artemisia tridentata	2.600	5.337	1.688	0.000	16.000	5.76	40.00
Rabbitbrush	Chrysothamnus viscidiflorus	0.300	0.675	0.213	0.000	2.000	0.67	20.00

Figure 4. Locations of vegetation transects



The following are photos of each transect:

Figure 5. Transect 1 (pointing SSE)

Figure 6. Transect 2 (pointing WSW)

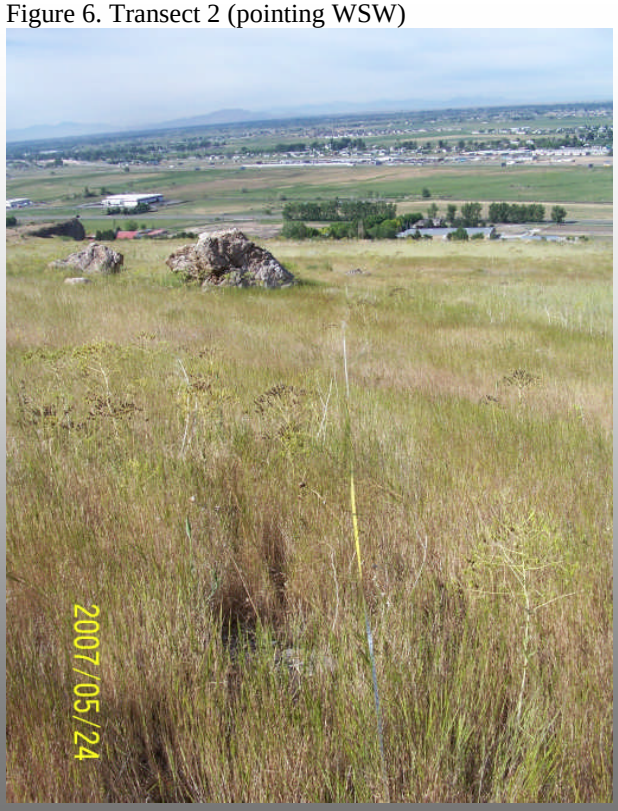


Figure 7. Transect 3 (pointing SSW)

Figure 8. Transect 4 (pointing NNW)

Figure 8. Transect 5 (pointing S)

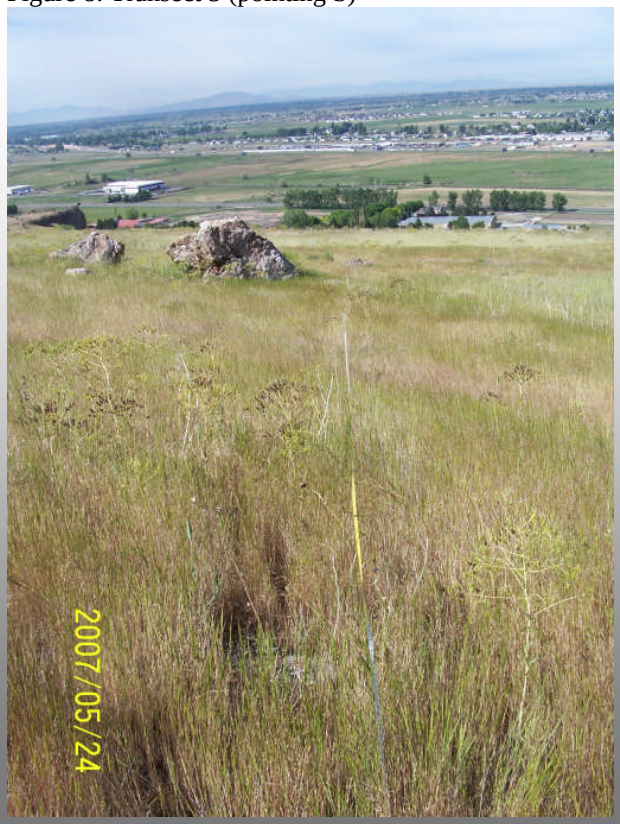


Figure 9. Transect 6 (pointing E)

Figure 10. Transect 7 (pointing SSW)

Figure 11. Transect 8 (pointing W)

Figure 12. Transect 9 (pointing NNE)

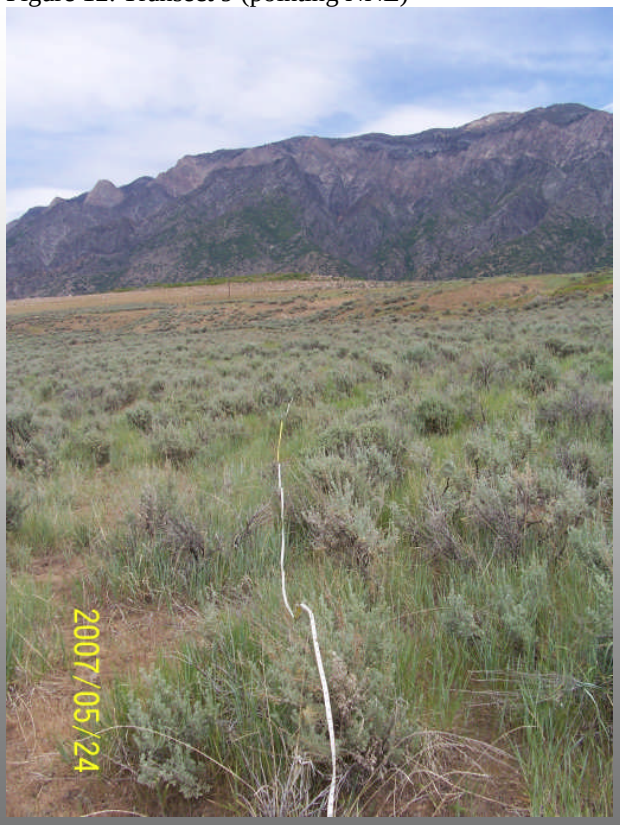


Figure 13. Transect 10 (pointing E)

DISCUSSION

The present vegetation reflects the long history of different land uses around the Rocky Point Gravel Pit. A combination of agriculture, mining and range fires has shaped the condition of the current vegetation communities. As a result, much of the vegetation at the mine consists of early seral and weedy vegetation species. The potential native vegetation communities include species such as sagebrush (about 20-30% cover), arrow leaf balsamroot, Sandberg's bluegrass and bluebunch wheatgrass.

However, since the post mining land use of this area is projected to be a subdivision, much of the reclamation and revegetation in the area will likely be intensively landscaped areas. However, there will likely be some areas that will need to be reclaimed until the area is ready for home construction or to be landscaped.

An appropriate reclamation seed mix for this area can be:

Common Name	**Scientific Name**	**Rate (per acre)**
Grasses		
Indian ricegrass	*Oryzopsis hymenoides*	4
Bluebunch wheatgrass	*Pseudoroegneria spicata ssp. spicata*	4
Sandberg's bluegrass	*Poa secunda*	0.5
Bottlebrush squirreltail	*Elymus elymoides*	2
Forbs		
Globemallow	*Sphaeralcea coccinea*	0.5
Shrubs		
Rabbitbrush	*Chyrsothamnus nauseosus*	0.5
Sagebrush	*Artemisia tridentata var vaseyana*	0.1
TOTAL		11.4 lbs/ acre or 58 seeds/ sq ft