

**RECLAMATION OPERATION
MAINTENANCE PLAN
FOR BLM-MANAGED PUBLIC LANDS
BIG SANDY ENERGY PROJECT**

Prepared for:

Bureau of Land Management
Kingman Field Office

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TABLE OF CONTENTS

<i>RECLAMATION OPERATION MAINTENANCE PLAN</i>	<i>BIG SANDY ENERGY PROJECT</i>
.....	1
1.0 INTRODUCTION.....	1
1.1 Analysis Area/Location.....	1
1.2 Site Description.....	1
2.0 RECLAMATION OF AFFECTED BLM LANDS	1
3.0 PLANT SALVAGE REQUIREMENTS.....	4
3.1 Plant Salvage Criteria	6
3.2 Plant Density Estimates and Methodology.....	7
4.0 STAKING, FLAGGING, AND PRE-CONSTRUCTION SURVEYS	7
5.0 ACCESS ROAD AND NURSERY PREPARATION	8
6.0 WORK AND WATER PLANS.....	8
6.1 Work Plan.....	8
6.2 Water Plan.....	9
7.0 SALVAGE, STORAGE, AND TRANSPLANTING METHODOLOGY	9
7.1 General Salvage and Transplant Methodology.....	9
7.2 General Procedures.....	10
7.3 Species Specific Information.....	11
7.4 Transplant Spacing.....	13
8.0 PIPELINE CONSTRUCTION	14
8.1 Grading, Trenching, and Backfilling.....	15
8.2 Regrading and Rock Placement	15
9.0 REVEGETATION	16
9.1 Seed Mixtures and Rates.....	16
9.2 Seedbed Preparation.....	16
9.3 Seeding and Mulching	17
10.0 POST-RECLAMATION MONITORING.....	17
11.0 PIPELINE MAINTENANCE.....	18
12.0 REFERENCES	18

Figures

Figure 1	Project Area	2
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Tables

Table 1	Cacti and Other Succulent Species Along the Proposed Natural Gas Pipeline Construction Corridor	5
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RECLAMATION OPERATION MAINTENANCE PLAN FOR PUBLIC LANDS BIG SANDY ENERGY PROJECT

1.0 INTRODUCTION

Caithness Big Sandy, LLC proposes to develop, construct, own, and operate the Big Sandy Energy Project (Project), a natural gas-fired, combined-cycle power plant (Plant) near the unincorporated community of Wikieup, approximately 40 miles southeast of the city of Kingman, along U.S. Highway 93 in Mohave County, Arizona. Please refer to the Big Sandy Energy Project Description for a detailed description of the Project.

1.1 Analysis Area/Location

The project area (**Figure 1**) includes: 1) the 120-acre Plant site (Township 15 North, Range 12 West, Section 5); 2) the access road to the Plant site (200 feet in width); 2) the proposed natural gas pipeline route that generally parallels U.S. Highway 93 and Hackberry Road; 3) the alternative natural gas pipeline route that generally parallels the Mead-Phoenix 500 kV transmission line; and 4) several variations of the two basic pipeline route alternatives. All pipeline alternatives will require approximately 36 miles of pipe to connect natural gas sources to the power plant. Salvageable plant surveys will be conducted after the pipeline route is chosen. This analysis begins in the Knight Creek/Big Sandy River Corridor north of Interstate 40 (Township 21North, Range 13West) and follows U.S. Highway 93 and the Mead-Phoenix 500 kV transmission line south to the proposed Plant site.

1.2 Site Description

The area supports a complex mosaic of upland Sonoran and Mojave Desert vegetation with xeroriparian vegetation along several washes, and small areas of agricultural and developed lands. The proposed Plant site is located near the transition between Sonoran Desert and Mojave Desert vegetation. Several washes with varying densities of xeroriparian vegetation, including the Big Sandy River, are found in the vicinity of the Plant site and access road. Agricultural and developed areas are very limited within the area and are found primarily near Wikieup. Non-native, weedy, and crop species are typically dominant in these areas.

2.0 RECLAMATION OF AFFECTED BLM LANDS

The goal of this Reclamation Operation Maintenance Plan (ROMP) is to define appropriate measures for the stabilization of surface materials that will be disturbed by pipeline construction, and for the revegetation of the pipeline right-of-way (ROW). These measures are consistent with the maintenance requirements for the pipeline and with BLM's management goals and objectives for the affected area. Disturbances for new temporary access roads, passing areas, borrow areas, and staging areas within, and where necessary outside of, the 50-foot pipeline ROW will be reclaimed by the use of appropriate techniques.

The overall intent of reclamation activities is to reestablish a vegetative cover that is similar to pre-construction conditions and adjacent vegetation communities, ultimately restoring vegetative productivity for wildlife habitat, livestock grazing, visual resources, and recreation. Reclamation efforts will include the salvage and protection of plant species designated by the state of Arizona as “Highly Safeguarded” or “Salvage Restricted,” as well as BLM designated Sensitive plant species, prior to pipeline construction. As the access road will be maintained for the life of the Project, reclamation activities for areas of temporary disturbance adjacent to the access road will be directed toward final surface stabilization and re-establishment of vegetation with productivity levels comparable to the surrounding area.

The reclamation process will follow the basic steps outlined below and will be monitored by an independent Third Party Monitor (Monitor) acting on behalf of the BLM. The Monitor will be responsible for ensuring that the specifications included in the ROMP are followed, and that if any deficiencies are noted, the appropriate parties are notified and the necessary steps are taken to correct these deficiencies. Funding for the monitor will be provided by Caithness Big Sandy, LLC. The BLM, along with Caithness Big Sandy, LLC, will be involved in the selection process for hiring the Monitor.

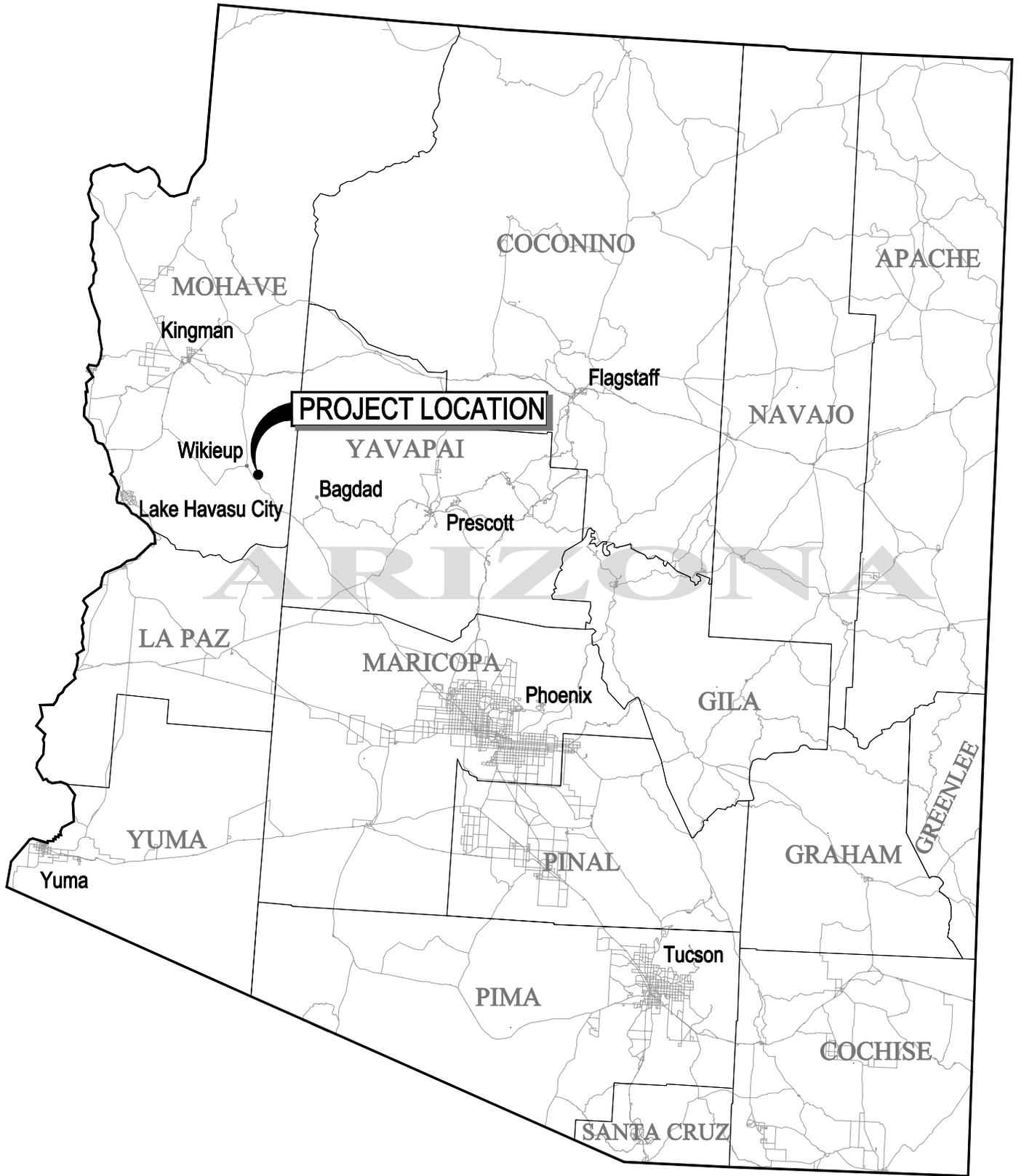
Survey, Staking, and Selection of Salvageable Plants - The process will begin with surveying and staking the pipeline ROW to mark the limits of the disturbance area. With BLM concurrence, areas for temporary nurseries, staging areas, access routes, and other needs, as discussed in the Big Sandy Energy Project EIS, will be selected and staked. Representatives of the project, in conjunction with the BLM, will select and mark all native plants that will be salvaged. Selection of plants will be based upon viability criteria, target final densities, and the species list included in this ROMP.

Access Road and Nursery Preparation - Access is required to prepare temporary nurseries and perform salvage work by multiple crews. Following inspection for the presence of desert tortoises, an access road will be constructed along the length of the corridor, approximately 12 to 14 feet wide. Nurseries will be prepared to receive salvaged plants. All salvageable protected species will be removed from the roadway and into nursery areas prior to blading. Other species will be treated as excess plant material.

Plant Salvage - All selected plants will be salvaged following the BLM approved harvesting and handling methods described in this ROMP. To meet the target revegetation plant densities, the number of plants salvaged will include an allowance for the expected mortality from the double shock of moving plants to nurseries and then final transplantation back into the reclamation areas. Landscape contractors and civic organizations will be contacted in order to promote the utilization of excess plant materials for commercial harvest, landscaping, or local beautification projects in surrounding communities, including Kingman, Wickenburg, and Wickenburg.

Nursery Maintenance - Native plants will be stored, watered, handled, and otherwise cared for in the temporary nurseries in accordance with the procedures described in this ROMP. Maintenance will focus on minimizing mortality and preparing the plants for successful transplants to disturbed areas during the reclamation process.

Figure 1 Project Area



APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATABILITY	
BIG SANDY ENERGY PROJECT	
FIGURE 1 PROJECT LOCATION MAP	
ANALYSIS AREA KINGMAN TO WIKIEUP, MOHAVE COUNTY, ARIZONA	
DATE: 10/11/00	AutoCAD File: 891-LOC.DWG
SCALE: AS NOTED	DRAWN BY: EC

Grading - The pipeline constructor will grade as necessary to provide access and clear the trenching area. Topsoil from the trenching area will be stockpiled for future redistribution over areas to be reclaimed. Upon completion of pipeline construction, the corridor will be graded as necessary to minimize erosion and restore pre-disturbance surface contours. The original topsoil will be spread over the disturbed area. Grubbed, excess, and non-viable plant materials will be chipped and shredded for use as mulch on reclaimed areas, or buried in appropriate locations along the corridor.

Reseeding, Transplantation and Maintenance - The recontoured corridor, including the twenty (20) foot access road, will be reseeded using a BLM approved commercially available native seed mix. Seeding will take place between June 15 and February 15, and will be timed to take advantage of precipitation patterns. If sufficient seasonal precipitation is lacking, seeding will be postponed until a more favorable time for reclamation species establishment. Hydro-seeding is the preferred seeding method, although seeding may be accomplished by broadcast seeding or seed drilling in areas where hydro-seeding is not appropriate. If employed, broadcast seeding will be followed by harrowing to minimize seed loss. Following seeding, one hundred (100) percent of salvaged plants will be transplanted back to the pipeline corridor outside of the twenty (20) foot maintenance road. Handling methods, plant spacing, clustering, orientation, watering and other details will be as described later in this ROMP. Plants will be watered periodically for one year after transplantation to promote successful re-establishment.

The remainder of this document provides detailed descriptions of the mitigation measures to be used. These procedures are integrated with the pipeline construction process, and include the following activities:

- Plant Salvage Requirements
- Salvage Criteria
- Plant Density Estimates and Methodology
- Staking, Flagging, and Preconstruction Surveys
- Access Road and Nursery Preparation
- Work and Water Plans
- Plant Salvage, Storage, and Transplanting Methodology
- Grading, Trenching, and Backfilling
- Regrading and Rock Replacement
- Seed Mixtures and Rates
- Seedbed Preparation
- Seeding and Mulching
- Post-Mitigation Monitoring
- Pipeline Maintenance

3.0 PLANT SALVAGE REQUIREMENTS

Highly safeguarded protected native plants (includes parts of plants, seeds and fruit) are species which prospects for survival in Arizona are in jeopardy or which are in danger of extinction. This category also includes plants federally-listed as endangered or threatened. *Salvage restricted* protected native plants are not included in the highly safeguarded category but are subject to damage by theft or vandalism. All species in the Agavaceae, Cactaceae, Liliaceae, and Orchidaceae families are salvage restricted, as are individual species in a number of other families (ADA 1997).

On private lands, such as the Plant site, salvage of these species is not required; however, notification of intent to clear land is required by the Arizona Department of Agriculture. Private landowners have the right to destroy or remove plants growing on their land, but 20 to 60 days prior to the destruction of any protected native plants, landowners are required to notify the ADA. Private landowners also have the right to sell or give away any plant growing on their lands although protected native plants may not be legally possessed, taken, or transported from the growing site without a permit from the ADA (ADA 1997).

No highly safeguarded plants from the ADA’s List of Protected Native Plants were observed in the vicinity of the Project area (ADA 1999). Several salvage restricted species are common in the proposed ROW. Fourteen (14) cacti and other succulent species occurring within the proposed natural gas pipeline construction corridor are presented in **Table 1**. Several species known to occur in the Project area, but not along any of the alternative pipeline corridors are not included in **Table 1**, but would be included in salvage operations if discovered along the selected corridor. The saguaro (*Carnegiea gigantea*) grows near the Plant site but has not been observed along any of the pipeline corridors. The Joshua tree (*Yucca brevifolia*) occurs in a small area near Wikieup that will not be crossed by any of the pipeline corridors. During the selection and tagging process for plant species to be salvaged, any other species that are not included in **Table 1**, but that are on the Arizona state lists of highly safeguarded or salvage restricted plant species, or that is BLM Sensitive species, will also be salvaged in accordance with this ROMP.

<p align="center">Table 1 Cacti and Other Succulent Species Along the Proposed Natural Gas Pipeline Construction Corridor</p>	
Common Name	Scientific Name
Engelmann hedgehog cactus	<i>Echinocereus engelmannii</i>
Barrel cactus	<i>Ferocactus wislizenii</i>
Ocotillo	<i>Fouquieria splendens</i>
Fishhook cactus	<i>Mammillaria microcarpa</i>
Buckhorn cholla	<i>Opuntia acanthocarpa</i>
Beavertail cactus	<i>Opuntia basilaris</i>
Teddybear cholla	<i>Opuntia bigelovii</i>
Silver cholla	<i>Opuntia echinocarpa</i>
Engelmann’s prickly pear	<i>Opuntia engelmannii</i>

Table 1
Cacti and Other Succulent Species Along
the Proposed Natural Gas Pipeline Construction Corridor

Common Name	Scientific Name
Mohave prickly pear	<i>Opuntia erinacea</i>
Christmas cholla	<i>Opuntia leptocaulis</i>
Diamond cholla	<i>Opuntia ramosissima</i>
Banana yucca	<i>Yucca baccata</i>
Mohave yucca	<i>Yucca schidigera</i>

3.1 Plant Salvage Criteria

Plant salvage criteria, developed utilizing information from the BLM’s Kingman Field Office, various landscape contractors, and botanists from Greystone Environmental Consultants, Inc., are based on published research from similar re-vegetation projects, landscape contractor experience, and BLM requirements for transplantation of cactus and other succulent species occurring within the proposed Big Sandy Energy natural gas pipeline corridor. The number of plants per species selected for salvage will be determined based on the transplant spacing criteria described in a later section of this ROMP. The selection criteria presented below for each species are intended to focus salvage efforts on only those specimens that have the vigor to survive a double transplant.

Mohave Yucca and Banana Yucca

- Plant vigor is ascertained by looking for new healthy center leaf growth within the past growing season. If the stem is forked, both rosettes must be healthy;
- Leaves will typically exhibit rust colored spots and yellowing and may not be an indicator of overall plant health;
- Root or main stem damage caused by small mammals, disease, or other factors will negate salvage of the plant;
- Plant must demonstrate upright positioning and firm attachment to the soil or ground;
- No size limitation of plants was developed; however, individuals shorter than 48" will have a longer life expectancy after transplant.

Buckhorn, Christmas, Diamond, Silver, and Teddy Bear Chollas

- Salvaged plants shall be determined by a twelve (12) inch minimum height and a maximum height and width not to exceed 36 inches;
- Plants must exhibit new growth within the past growing season, with 75 percent of the plant living; and
- Plants exhibiting excessive dead material, indications of disease, and/or damage to the stem base will not be salvaged. Small segments or “pups” at the base of a mature plant will not be salvaged.

Barrel Cactus

- Salvaged plants shall be less than 28 inches in height;
- Plants exhibiting excessive damage to the root or main structure caused by small mammal borings, disease, or other will not be salvaged;
- Plants must be exhibiting new growth within the past growing season; and
- Plants will be marked, tagged, or flagged with southerly orientation on the plant.

Beavertail and Prickly Pear Cactus

- Plant must be exhibiting new growth within the past growing season, with 50 percent of the plant living;
 1. Plants may be segmented prior to transplant, moving only the viable portion of the plant; and
 2. Plants must have 5 or more actively growing paddles.

Engelmann Hedgehog and Fishhook Cactus

- Plant vigor is ascertained by looking for new healthy growth within the top three- to six-inches of the plant; and
- Plant exhibiting excessive damage caused by small mammals, disease, or other factors will not be salvaged.

Ocotillo

- Plants must have 5 or more canes;
- Plants with numerous dead or partially dead canes, or excessively old or desiccated canes, will not be salvaged; and
- Plants exhibiting excessive damage caused by small mammals, disease, or other factors will not be salvaged.

3.2 Plant Density Estimates and Methodology

Density estimates of salvageable cacti and other designated succulent species on the selected pipeline corridor to the Big Sandy Energy Plant site will be determined by the following methods. Survey transects will be selected along the corridor to provide representative samples of the vegetation series found within the entire length of the proposed pipeline construction corridor. The transects will be 50 feet in width and 75 feet in length. The 50 foot width is the anticipated construction ROW width for the proposed project. Within each transect, all cacti and succulents will be identified. Individual stems on all yucca plants deemed salvageable will be counted and recorded. For ocotillo, cacti, and all other selected species one central and/or main stem will be counted as one plant.

To determine salvage plant density, the following methodology will be utilized. The number of cacti and succulents recorded within each transect will be totaled. The total area of the transects will be determined.

The total area will be divided by the total number of plants to obtain an estimate of plants per unit area. An estimated total of cacti and other succulents that occur on the pipeline ROW will be based on a 38 mile pipeline route with a 50-foot construction ROW.

4.0 STAKING, FLAGGING, AND PRE-CONSTRUCTION SURVEYS

Prior to construction, the pipeline corridor will be surveyed and staked to mark the extent of the 50 foot wide ROW and any areas of environmental concern using a multi-colored flagging system. Surveyors will limit vehicular travel to area inside of the ROW. All areas of environmental concern will be field verified. In conjunction with BLM, multiple temporary nurseries, staging areas, and equipment storage areas will be selected and marked outside the 50 foot corridor.

After the ROW has been staked and flagged, a plant survey will be conducted by representatives of the project and the BLM or its representative (the Monitor) to identify plants that meet the salvage criteria. The total number of plants to be flagged will be calculated as described above, plus all additional plants that will be either commercially harvested or will be utilized by local interest groups as approved by BLM.

5.0 ACCESS ROAD AND NURSERY PREPARATION

A road approximately 12 to 14 feet wide will be cut into the 50 foot ROW to provide access for the plant salvage crews and their heavy equipment, water trucks, and supplies which are required for the salvage of vegetation within the corridor. Concurrently with construction of the access road, multiple temporary nurseries will be created, in locations approved by BLM, adjacent to and outside of the 50 foot ROW to receive the salvaged plants. Ocotillo and other Arizona state protected plant species will be salvaged in advance of blading the road. Other plants will be treated as excess and will be made available for commercial harvest or for civic organizations to utilize in local beautification projects as approved by the BLM. Blading will only be performed to the extent required for reasonable access by conventional landscaping and earthmoving equipment. Topsoil removed by the blading operation will be stockpiled adjacent to the 50 foot ROW for redistribution on completion of the pipeline construction.

With the access road in place, multiple salvage crews will begin the clearing of the pipeline corridor. Flagged plants will be dug up and moved to the temporary nurseries in accordance with the handling procedures outlined in this ROMP.

6.0 WORK AND WATER PLANS

6.1 Work Plan

After the preferred pipeline route is determined, and surveys have identified quantities of species, a supplemental work plan will be prepared by Big Sandy Energy LLC for review and approval by the BLM. The work plan may include additional information concerning the planned methods for selection and tagging of plants to be transplanted, creation of an access road along the length of the pipeline corridor, preparation of one or more temporary nurseries, movement of selected plants to the nursery(s), caring for the plants

while in the nursery(s), transplanting the plants in the pipeline corridor at the completion of pipeline construction, re-seeding the disturbed area, and caring for the plants for the required period of time after transplant. The work plan should describe planned labor and equipment to be used, temporary sanitary facilities, and provisions for adequate insurance. The work plan should also describe to methods to be employed for removing or otherwise properly disposing of all construction equipment and debris, and leaving the site clean.

A salvage and reclamation contractor will be selected subject to approval of Caithness Big Sandy, LLC and the BLM. The BLM will be advised as to the name of the responsible individual who will act as the contractor superintendent. This individual will carry a suitable means of communication during the course of the work. A Monitor will be employed to observe the contractors' work, and will always be on-site when construction or salvage work is conducted. They will be empowered to issue stop work notices and to resolve issues that may arise during the work.

6.2 Water Plan

A detailed plan will be developed for watering salvaged plants during storage in the nursery and during the re-establishment period following transplantation, subject to review and approval by Caithness Big Sandy, LLC and the BLM. The plan will detail estimated watering amounts for each species, a watering schedule, and a description of the planned watering methods. The watering plan may be adjusted due to weather conditions and the condition of the plants at the time of salvage, storage, and transplantation. In general, salvaged species will receive no water during the first two weeks after harvest to allow time for root callusing.

Banana yucca, Mohave yucca, Joshua tree and *Nolina* spp. will be planted immediately after uprooting, but no later than the same day, and will be watered immediately upon placement in the nursery without callusing time. They should be lightly watered two times per week for the first two months using deep soakings that reach the root zone. Watering frequency will be once per week through the warm season (mid-March to mid-October), then once per month in the cool season (mid-October to mid-March).

All species will be inspected at least bi-weekly while in the nursery. A drip system will be used for watering to ensure that plants are deeply soaked. Watering frequency will be twice monthly for the first two months and throughout the warm season (mid-March to mid-October). Watering frequency will be once a month during the cool season (mid-October to mid-March) after the first tow months since transplantation.

Saguaros should be water lightly once per week the first month to promote root hair development, but only in well drained soils. If soils are not well drained, make sure that the soil dries out between waterings. Then water every other week in the warm season (mid-March to mid-October) and once per month in the cool season (mid-October to mid-March).

The same watering frequency will be used after the final transplantation until the end of the re-establishment period. Watering frequency and amounts may be adjusted based on weather, plant conditions, and water retention of the soils. Water will be conveyed in trucks from the well field owned by Caithness Big Sandy, LLC in Section 7, adjacent to plant site.

7.0 SALVAGE, STORAGE, AND TRANSPLANTING METHODOLOGY

7.1 General Salvage and Transplant Methodology

Chalk, paint, black marker, or flagging material typically will be utilized for marking each plant. Roots will be cut approximately 6- to 18-inches away from the plant, dependent upon the size of the plant. Roots will be pruned as needed to remove damaged roots. Powdered sulphur may be applied to the roots to restrict root rot. Plants will not be stacked in the storage area, but may be laid upon their sides to aid in root callusing. During callusing, roots will be protected with 40 percent shade cloth. The water stored inside the plant will enable it to survive and the drying out process will enable any cut or bruised roots to heal by forming a callous over any injuries.

South will be marked on plant species subject to sunburn (barrel, beavertail, fishhook, hedgehog, and prickly pear cactus). When the pipeline corridor is ready for replanting, shallow holes will be dug and the plants will be placed upright, with the same orientation. A mound of earth will be built up around the plant to prevent water from pooling. Cacti will be replanted in dry soil and will not be watered. It is important that the plants establish a new root system in dry soil conditions. Watering of cacti will commence one week after transplantation.

7.2 General Procedures

1. Do not transplant plants that are diseased or stressed in any way.
2. Plants removed from the ROW will be stored in a temporary nursery or other suitable location. Plants subject to sunburn will be placed with the marked south side facing the correct direction to prevent sunburn and added stress.
3. Cactus species may be handled by the roots when moved.
4. Plants may be transplanted using heavy equipment or by hand.
5. Replant at the same depth of root establishment.
6. Take as much of the lateral roots, which will number 3 to 5 or more, as possible, ensuring that no primary roots are lost or damaged. Take as much soil as possible with the roots to minimize disruption of the mycorrhizal relationships. Cut lateral roots approximately 1.5 times the plant radius away from the center of the plant. Roots should be cut approximately 6 inches beyond the perimeter of the plant for small plants and 12 to 18 inches beyond the perimeter for large plants.
7. Chollas and other *Opuntia* spp. will be transplanted as whole plants with complete root systems only. Salvage of cuttings of these species in lieu of whole plant salvage will not be allowed.

8. Mimic the original layout as closely as possible when replanting.
9. Transplant spacing of large plants should be no closer than 20 feet from the nearest large neighbor for individuals, and 50 to 100 feet for clusters of large plants to allow for an adequate water and nutrient collection area. Fill in the spaces with smaller cacti, such as hedgehog and beavertail cactus.
10. Water pits are not necessary or even desirable for the group of cactus plants. Although the best individual success will result from transplanting at the beginning of the rainy season, the actual timing of transplanting will be based on the project schedule.
11. A flat surface with a slight slope will provide the best habitat for the transplanted individual. Avoid depressions where water can collect and contribute to root rot.
12. Roots of cacti will be air dried by placing the excavated plants under cover of shade for 1-2 weeks. This is particularly important if the roots were bruised or broken, as immediate replanting of such plants can greatly increase the risk of infection and failure of the transplant.

7.3 Species Specific Information

Hedgehog Cactus *Echinocereus engelmannii*

Fishhook Cactus *Mammillaria microcarpa*

Younger mature hedgehog and fishhook cactus plants do best in transplants. All viable plants three (3) inches or greater in size will be transplanted. Although they will be solitary, in terms of spacing of plants of this species, it's not uncommon to find an ocotillo and hedgehog side-by-side with branches and stems overlapping. When transplanting, however, allow a spacing of 5 to 10 feet between the plant and its nearest succulent neighbor, following the pattern of the surrounding vegetation. Cut roots approximately 6 to 12 inches beyond the perimeter of the plant, and dig down approximately 6 to 15 inches when removing the plant. Mark the orientation relative to the sun.

Beavertail Cactus *Opuntia basilaris*

Engelmann's Prickly Pear *Opuntia engelmannii*

Mohave Prickly Pear *Opuntia erinacea*

Mature beavertail and prickly pear plants are generally a cluster of stems covering a 4 to 6 square foot area, and can be successfully transplanted into the interspaces between other larger plants. Allow a spacing of 5 to 10 feet between these plants and their nearest succulent neighbors, following the pattern of the surrounding vegetation. Split the plant as needed to select only the viable growing portion. Cut roots approximately 6 to 12 inches beyond the perimeter of the plant, and dig down approximately 6 to 15 inches when removing the plant. Mark the orientation relative to the sun.

Buckhorn Cholla *Opuntia acanthocarpa*
Silver Cholla *Opuntia echinocarpa*
Diamond Cholla *Opuntia ramosissima*

Buckhorn cholla is well represented in the Project area. Silver cholla and diamond cholla habits are very similar to those of buckhorn cholla, although not nearly as common in the Project area. Mature plants, those 2 to 3 feet tall, are most successful in re-establishment. Cholla re-establishes best with clusters which each contain 5 to 10 individuals spaced 15 to 20 feet apart. The clusters should be spaced 50 to 100 feet (or more) apart. The spacing between the clusters should mimic that of the surrounding undisturbed cholla clusters. Select only plants that are greater than 12 inches in size. Cut roots approximately 6 to 12 inches beyond the perimeter of the plant, and dig down approximately 6 to 15 inches when removing the plant.

Teddy Bear Cholla *Opuntia bigelovii*

Teddy bear cholla is a clonal plant, reproducing vegetatively. For the greatest success, plants selected for salvage should be 2 to 3 feet tall and should be replanted in clusters of 5 to 10 plants spaced 2 to 3 feet apart on hills or mounds to allow for adequate drainage. The clusters should be spaced 50 to 100 feet (or more) apart. It is likely that the extremities will suffer some attrition; however, such die-off does not indicate failure to reestablish. Select only plants that are 12 inches or greater in size. Cut roots approximately 6 to 12 inches beyond the perimeter of the plant, and dig down approximately 6 to 15 inches when removing the plant.

Christmas Cholla *Opuntia leptocaulis*

Young Christmas cholla, plants 2 feet and under in height, must have nurse plants like bursage and creosote to provide protection. When mature, these plants prefer not to be crowded. Successful transplants involve two to three foot plants spaced 10 to 20 feet apart. Cut roots approximately 6 to 12 inches beyond the perimeter of the plant, and dig down approximately 6 to 15 inches when removing the plant.

Barrel Cactus *Ferocactus wislizenii*

Barrel cactus 1 to 2 feet tall should be spaced 15 to 20 feet from any other large plant and should be replanted in a pattern which mimics the surrounding population. Cut roots approximately 6 to 10 inches beyond the perimeter of the plant, and dig down approximately 12 to 18 inches when removing the plant. Mark the south side of the plants.

Ocotillo *Fouquieria splendens*

Younger ocotillo plants, those with canes 3/4 to 1 inch in diameter, do better as transplants. Ocotillo transplants are more likely to die as a result of insufficient water. Aerial water applications through the reestablishment period greatly increase transplant success. Leaf attrition should be expected, and the reappearance of leaves indicate that reestablishment has occurred. Ocotillos may take up to a year to re-

leaf following transplantation, due to slow re-establishment of a root system. One plant spaced 15 to 20 feet from its nearest large neighbor should provide adequate space needs for the transplant. The nearest ocotillo should be no closer than 15 to 20 feet.

Canes of plants chosen for transplanting should be bundled and tied before moving to minimize cane damage. Cut roots 12 to 24 inches beyond the perimeter of the plant trunk, and dig down approximately 12 to 15 inches when removing the plant. The plant, along with soil from approximately 12 inches in depth should be taken with the plant, although dry soil from around the roots may fall away from the roots and be lost. The plants may be left to air dry, with the roots covered with 40 percent shade cloth, or treated with sulphur and planted in the temporary nursery. Pruning is not needed nor desirable.

When replanting ocotillos, a hole will be dug that is approximately twice as large as the rootball and filled with water. The water will be allowed to seep into the ground. Rock collars 1 to 2 feet high around the base of the transplants will help the plant remain stable by anchoring the plant in the ground and providing peripheral support.

Mohave Yucca *Yucca schidigera*

Banana Yucca *Yucca baccata*

Yuccas can be difficult to manage, so rosettes are more easily moved, although smaller plants with established trunks may also do well in some transplant situations. Optimal spacing will mimic the undisturbed vegetation, in this case 3 to 5 individuals spaced 3 to 5 feet apart with clusters spaced 30 to 100 feet apart.

These plant species will be salvaged bare root

Only two viable rosettes out of every cluster of banana yucca will be salvaged. All viable rosettes of Mohave yucca will be salvaged. Rosettes of either species smaller than 8 inches will not be salvaged. Mark south on all yuccas and excavate a hole approximately 12 to 15-inches in depth under the plant. Salvage the plant in a bare root condition by digging a hole approximately 15 inches deep and approximately 12 inches around the plant, if possible. Yuccas may be moved in clusters with several growing heads, however, the cluster may separate during handling. When replanting, a hole twice the size of the root ball will be dug and filled with water. The water will be allowed to seep into the ground. Plants will be placed in the hole with the marked side facing south side and the hole will be filled with dirt. A basin around the plant will be made and filled with water.

7.4 Transplant Spacing

The cumulative effects of construction, operation, and maintenance of pipeline, power line, highway, mining, housing, and other land and resource development projects have resulted in the on-going loss of Arizona state protected plant species. In order to mitigate this loss, projects subject to state or federal jurisdiction are required to salvage and use for reclamation as much living plant material of Arizona state protected plant

species as possible. Transplant spacing of salvaged plants should result in a restored area that appears similar to the surrounding undisturbed areas within a reasonable time period after restoration is complete.

Plant spacing is not expected to be a substantial issue during salvage and restoration activities associated with this Project. Plant densities along the pipeline route are generally low. Plant mortality may occur during each phase of the project, including salvage, maintenance in nurseries, re-planting, and post-restoration maintenance, and may result in loss of 20 percent or more of affected plants. In addition, many plants currently living along the construction ROW will likely not be salvaged because they do not meet the salvage viability criteria. It is estimated that only 40 to 80 percent of the individuals of any plant species will be salvaged. Considering all of these factors, it appears unlikely that overcrowding of plants will be an issue, even when plants are not replaced within the 20 foot maintenance road corridor.

All selected viable plants within the 50 foot construction ROW will be salvaged, kept alive, and replanted during restoration activities, except that no plants will be replanted within the 20 foot maintenance road that will be left within the construction ROW. Plant spacing within the replanted areas will attempt to mimic the surrounding undisturbed plant communities. Plants will be spaced randomly, avoiding a grid or other symmetrical planting pattern. Because the maintenance road will not be replanted, initial densities of restored plants may exceed natural, pre-disturbance plant densities, although this is unlikely considering the potential for mortality of a substantial proportion of the salvaged plants.

A goal of no more than 20 percent mortality of all species of cactus, ocotillo, and agave has been set. A goal of no more than 30 percent mortality of all species of yucca and nolina has been set. In the unlikely event that post-transplant monitoring shows mortality exceeding these standards, the affected species will be replanted using replacement stock obtained from sources within Caithness owned lands or from Arizona licensed landscape contractors.

8.0 PIPELINE CONSTRUCTION

After de-vegetation of the pipeline corridor, pipeline construction will commence. This phase includes grading the surface, removing obstacles such as large rocks, and removing woody shrubs from the 50 foot temporary construction work space to provide sufficient area for all construction activities. The 20 foot area where the pipeline trench will be created will be completely grubbed of all remaining vegetation to ensure that no organic matter is included in the trench backfilling operation. Topsoil graded from the trenching area will be stockpiled along the edge of the construction ROW for redistribution following pipeline construction. Topsoil stockpile will not exceed four feet in depth in order to keep soil micro-organisms alive.

Vegetation clearing shall be conducted in accordance with the following guidelines:

- Erosion and sediment control measures will be implemented during clearing and grading operations to prevent accelerated erosion by diverting and controlling surface runoff;

- Temporary and permanent erosion control measures such as sediment barriers, water bars, erosion control and mulching will be implemented in all phases of construction;
- ROW boundaries will be clearly marked and only those areas of temporary and permanent easement will be cleared;
- Steep areas will be graded to allow passage by construction vehicles;
- The roots of existing vegetation will be left in place as practicable to facilitate plant regrowth after construction activities;
- Grubbed, excess, and non-viable plant materials will be chipped and shredded for use as mulch on reclaimed areas, or buried in appropriate locations along the corridor; and
- The top 4 to 6 inches of topsoil in graded areas will be salvaged and stockpiled within the ROW for replacement/respread upon completion of grading, trenching, and backfilling activities.

8.1 Grading, Trenching, and Backfilling

Minimal grading will be required over areas where the terrain is flat or gently sloping. On steep side slopes that require extensive cuts, “two-toning” will be utilized to reduce the amount of grading. The “two-tone” method requires two smaller cut and fills rather than one large cut and fill. Cut material is used as fill on the working side on the down slope and then switched to the spoil side on the up slope. This procedure allows a relatively smooth transition on steep slopes and limits the amount of fill material that may be susceptible to erode downstream in a precipitation event.

The trench will be excavated approximately 36 inches wide and to a depth necessary to provide a minimum of 48 inches of cover over the buried pipeline. Materials removed during trenching will be stockpiled next to the trench. The pipe will then be lowered into the trench by the pipe-handling tractors. The trench will generally be open for approximately one week at most locations. Standard erosion control practices will be employed to minimize erosion during trenching.

After pipe placement, the trench will be back-filled with previously excavated materials and the ROW re-graded to its approximate pre-construction contour, except for a slight crown of soil to compensate for the natural settling of the back-fill. Trench back-fill will be compacted to approximate preconstruction conditions to allow normal surface drainage.

8.2 Regrading and Rock Placement

After the pipeline trench is backfilled, all disturbed areas including temporary work space, passing areas, and boring sites will be returned to approximate pre-construction contours with all disturbed drainage patterns restored. Washes encountered along the corridor will be stabilized with erosion control fabric,

mulch, rip-rap, or other materials. A clean-up crew will remove all construction materials and debris from the site.

Large rocks and other coarse fragments will be replaced on the construction ROW in a random pattern that mimics the natural conditions, in such a manner as to limit vehicular use of the pipeline ROW, except in the 20 foot wide area above the pipeline which will be left as an access road for pipeline maintenance and inspection. Excess rock may be utilized to “mulch” areas with high erosion potential, steep slopes, and within drainage basins.

9.0 REVEGETATION

9.1 Seed Mixtures and Rates

Selection of plant species for re-vegetation is based on existing species occurrence and community composition, establishment potential, growth characteristics, soil stabilizing qualities, palatability to wildlife and livestock, commercial availability, post-construction land use objectives, and agency recommendations. Information regarding the affected vegetative communities was obtained from soil surveys, site visits, photographs, Natural Resource Conservation Service (NRCS), USFWS, BLM, and Arizona State agency publications and contacts, and academic/scientific publications. The affected vegetation communities are described and mapped in the Vegetation Technical Report (Greystone 2000).

The proposed natural gas pipeline corridor along U.S. Highway 93 occurs within the Mohave and Sonoran desert scrub communities. The northern portion of the alternative pipeline route occurs in Great Basin communities, while the central and southern portions are within the Mohave and Sonoran desert scrub communities.

Existing soil survey information and corresponding NRCS range site guide information will be used to develop site-specific reclamation seed mixtures. After compilation of range site information, and mapping of range sites along the construction corridor, a project- and plant community-specific set of reclamation seed mixes will be developed and compared with ground-truthed plant community information collected by Greystone (2000) along the selected pipeline route. These seed mixes will be presented to BLM staff for final review and approval.

Commercially available, certified weed free seed will be utilized on all areas of disturbance. At a minimum, all seed and/or plant material should be of the varieties that are found within the project area. Native genotypes will be used where seed supply allows. Certified seed will be purchased in accordance with pure live seed (PLS) specifications for BLM-approved seed mixtures. All seed purchased as “certified” for use on federal BLM lands will conform to all requirements and standards for certified seed as specified by the Authorized Officer of the BLM. Samples of seed to be used in re-vegetation mixtures will be tested for purity, germination, and noxious weed seed. Seed will be tested a licensed laboratory approved by the Authorized Officer.

9.2 Seedbed Preparation

Approximate pre-construction topography will be restored following pipe installation and all other construction operations. The trench will be backfilled with the same soil materials that were originally excavated from the trench, and grades will be restored to approximate pre-excavation conditions. Stockpiled topsoil will be re-spread.

9.3 Seeding and Mulching

Restoration for the Big Sandy Energy Project will rely primarily on hydro-seeding techniques similar to those recently used by ADOT along U.S. Highway 93. Seeding will take place within 24 hours of seed bed preparation. If this schedule cannot be achieved, or if it rains within a 24 hour period prior to seeding, light harrowing or dragging (perpendicular to the slope on slopes above 10 percent) of the seed bed with chainlink or other similar material will be required to up any soil crust that may have formed. Where hydroseeding is utilized, seed and mulch will be sprayed in one application. A second application will spray the remainder of the required mulch and a tackifier at the recommended manufacturer's application rate. Where hydro-seeding is not appropriate or technically possible, broadcast seeding or seed drilling techniques will be utilized. Seed mixtures will be broadcast by cyclone-type bucket spreaders, mechanical seed blowers, or hand-broadcasting. Scarification with a wire harrow with tines at four inches in length is recommended following seed application. In addition, seeded areas may be cultipacked, mulched, or chained to properly cover the seed. Fall seeding is recommended to enhance germination success by planting before the winter and spring precipitation events.

Generally, broadcast planting will be conducted by hand or mechanical broadcaster near undisturbed edges to promote introduction of natural, endemic populations. Shrub seeds will be hand or mechanical broadcasted in patches rather than uniform distribution, and the open areas (between planted patches) will be seeded with the approved mitigation seed mixture. If necessary, a mechanical seed broadcaster will be used in conjunction with a pull-type rangeland seed drill. This procedure is typically used when the seeding rate of a forb and shrub species is greater than the normal seeding capacity of a conventional seed drill. The grass seed component is drilled into a mulch with the forb and shrub portion of the seed mixture being broadcast simultaneously.

10.0 POST-RECLAMATION MONITORING

Caithness Big Sandy, LLC will be responsible to ensure watering is performed per the scheduled watering plan following transplant operations. The watering schedule will cover a one year period after transplantation. A watering log will be maintained for inspection by BLM. At the completion of watering period, a copy of the daily watering log will be submitted to the BLM Authorized Officer.

Two follow-up inspections funded by Caithness Big Sandy, LLC will be performed by the Monitor after completion of re-seeding and transplantation. These inspections will be performed in consultation and coordination with the BLM and Caithness Big Sandy, LLC. The evaluations will focus on identifying failed seeding areas, failure/success ratios of salvaged plants, eroded/rill areas, plant vigor and regrowth in cleared areas, noxious weed infestations, and areas of successful re-vegetation. The first inspection will occur one

year after completion of reclamation and will focus on noxious weed infestations and adequacy of erosion control measures. The second inspection will occur two years after completion of reclamation and will assess the success of re-seeding efforts and the survival of salvaged plants. General observations regarding noxious weed infestation, grazing or browse problems, general success of planting/replanting areas, and overall establishment of forbs, grasses, and shrubs will be discussed and documented in the report. A general activity report will be prepared to document problem areas, identify preferred solution alternatives, and describe implementation of solutions.

The ROW will be considered stable if there are no large rills or gullies, perceptible soil movement or headcutting in drainage washes, slope instability, subsidence, slumping, or other signs of erosion that are inconsistent with adjacent areas. Any identified erosion problem areas will be evaluated and any measures deemed necessary will be implemented to control off-site sedimentation. Areas with poor germination and/or failed seeded areas will be re-seeded. If re-seeding is determined to be unsuccessful, a second round of seeding will occur. Results of this seeding will also be monitored for a two year period to determine success. Removal or management of noxious weed species will be addressed by specific BLM weed management protocols. Lastly, remedial measures will be implemented as soon as practicable at any identified problem area.

11.0 PIPELINE MAINTENANCE

A 20-foot wide corridor, 10-feet on either side of the pipeline centerline, will be utilized for vehicle travel or pipeline repair along the ROW. Post-maintenance reclamation and revegetation measures that are appropriate for the level of new disturbance will be implemented. Native plants will not be transplanted in this 20 foot roadway, but it will be re-seeded.

12.0 REFERENCES

- Arizona Department of Agriculture (ADA), Plant Services Division. 1999. Protected Native Plant List. Downloaded from the World Wide Web site Located at: <http://agriculture.state.az.us/PSD/protplantlst2.htm> on December 13, 2000.
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