Conservation Agreement and Strategy for Graham's Beardtongue (*Penstemon grahamii*) and White River Beardtongue (*P. scariosus* var. *albifluvis*)

MITIGATION PLAN

Prepared by the Penstemon Conservation Team

State of Utah School and Institutional Trust Lands Administration
Uintah County, Utah
Utah Public Lands Policy Coordination Office
Utah Division of Wildlife Resources
Rio Blanco County, Colorado
Bureau of Land Management
U.S. Fish and Wildlife Service

July 2015

SWCA
ENVIRONMENTAL CONSULTANTS

CONSERVATION AGREEMENT AND STRATEGY FOR GRAHAM'S BEARDTONGUE (*PENSTEMON GRAHAMII*) AND WHITE RIVER BEARDTONGUE (*P. SCARIOSUS* VAR. *ALBIFLUVIS*):

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INTRODUCTION AND PURPOSE

The monitoring and adaptive management approach prescribed here is intended to guide the development and implementation of this mitigation plan for Graham's beardtongue (*Penstemon grahamii*) and White River beardtongue (*P. scariosus* var. *albifluvis*); see section 6.5 of the *Conservation Agreement and Strategy for Graham's Beardtongue (*Penstemon grahamii*) and White River Beardtongue (*P. scariosus *var.* albifluvis*)* (Penstemon Conservation Team 2014), which is hereafter referred to as the Agreement. Implementation of adaptive management will be the responsibility of the Penstemon Conservation Team. Therefore, the Penstemon Conservation Team anticipates that changes to this plan may be required based on new information as it becomes available.

In July 2014, the Agreement was developed to identify, avoid, minimize, and mitigate the potential threats to Graham's and White River beardtongues and their habitats as identified in the U.S. Fish and Wildlife Service (USFWS) proposed rule to list Graham's beardtongue and White River beardtongue under the Endangered Species Act of 1973 (USFWS 2013) and to ensure the conservation of both species (Penstemon Conservation Team 2014). The signatories to the Agreement are the USFWS; the Utah and Colorado Bureau of Land Management (BLM); the Utah School and Institutional Trust Lands Administration; Uintah County, Utah; Rio Blanco County, Colorado; the Governor's Public Lands Policy Coordination Office, and the Utah Division Wildlife Resources.

This mitigation plan fulfills the Agreement commitment to provide standardized procedures for the development and implementation of appropriate mitigation for impacts to Graham's and White River beardtongues. Specific to avoidance, minimization, and mitigation, the Agreement signatories committed to the following:

- Avoid disturbance within 300 feet of Graham's beardtongue or White River beardtongue individuals. Surface-disturbing activities may occur within 300 feet of a plant if it benefits or reduces impacts to the species or habitat.
- On federal and non-federal lands where new surface disturbance will occur in a conservation area[1] within 300 feet of a Graham's beardtongue or White River beardtongue, the project proponent will mitigate for impacts. Examples of mitigation could include payments into a mitigation fund for minor impacts, protection of other occupied areas at a ratio specified by the Penstemon Conservation Team, or site-specific mitigation appropriate to each project as determined by the Penstemon Conservation Team.

An important objective of this mitigation plan is that neither the Graham's beardtongue population nor the White River beardtongue population exhibits a net loss of habitat or plants within conservation areas or on BLM lands. When project or land disturbances are proposed in Graham's beardtongue or White River beardtongue habitat, the priority is to first avoid impacts to local populations and habitat. Surface-disturbing activities may occur within 300 feet of plants if it benefits or reduces impacts to the species or habitat. For these situations, the objective is to minimize and mitigate the disturbance. Conservation measures that will be used when Graham's beardtongue or White River beardtongue plants are impacted include avoidance and minimization efforts, as described in the General Conservation Measures section below. Compensatory mitigation that will be used when Graham's beardtongue or White River beardtongue plants are impacted includes expanding conservation areas and monetary compensation.

[1] A total of 44,373.4 acres is protected under the Agreement, and an additional 3,359.5 acres on private and state lands will receive interim protections (defined below) as part of the Agreement (see Table 1 and Figure 1 in the Agreement).

IMPACTS TO THE SPECIES

The Agreement for Graham's and White River beardtongues addresses several threats to the species (see Table 4 in Penstemon Conservation Team 2014), including energy exploration and development, livestock grazing, road construction and maintenance, invasive weeds, small population size, climate change, wildfire, off-road vehicles, and inadequacy of regulatory mechanisms. Potential impacts to the species from these threats include plant mortality, reduced populations, altered population dynamics, habitat loss and fragmentation, natural community and habitat change or loss, restricted pollinator movement and scarcity, partial foliage and biomass loss, reduced vigor and reproduction, reduced available resources, inbreeding depression, lower genetic diversity, and increased physiological stress.

These impacts are greater when activities occur within 300 feet of plants. In some cases, project activities may occur within 300 feet of plants within conservation areas or on BLM lands, although, as previously described, these instances will be the exception and will occur when there are evident benefits to the population as a whole or when the action reduces impacts to the species or habitat. Activities within 300 feet of plants can reduce ecological functions and integrity by increasing dust, invasive weeds, and habitat fragmentation, which result in direct and indirect effects to the species as discussed in the paragraph above. The Penstemon Conservation Team has taken these impacts into account in order to develop mitigation measures that ensure the redundancy, resiliency, and representation of the species across their ranges.

The conservation actions outlined in the Agreement will reduce impacts and conserve the species. However, those activities approved to occur within 300 feet of plants will negatively impact Graham's and White River beardtongues unless adequately mitigated to ensure that impacts are offset by conservation measures that yield either no net loss or a net benefit to the conservation of the species. The avoidance, minimization, and mitigation measures, as outlined below, are designed to compensate for functional and ecological losses due to direct and indirect impacts to the species and their habitat so the Graham's and White River beardtongues are perpetually conserved.

CONSERVATION MEASURES TO REDUCE IMPACTS AND BENEFIT THE SPECIES

Graham's beardtongue and White River beardtongue plants are considered protected when they occur 1) within designated conservation areas on all land ownerships and 2) on BLM lands within and outside of conservation areas. The Penstemon Conservation Team hereafter describes these areas as "protected populations."

Compensatory mitigation will be initiated when surface disturbance occurs within 300 feet of Graham's beardtongue or White River beardtongue plants occurring in 1) the conservation areas on state or private lands and 2) on BLM managed lands where the plants occur. Conservation measures and mitigation will generally include 1) pre-construction surveys, 2) general conservation measures, and 3) compensatory mitigation for plants within 300 feet of disturbance, as described in the next sections.

Pre-Construction Surveys

In order to determine where mitigation is required, the following pre-construction survey guidelines will be applied to protected populations within suitable habitat.

1. Pre-construction surveys for Graham's beardtongue and White River beardtongue will occur where potential and suitable habitat is identified within the project area. Where feasible, surveys should be conducted early in the project planning phase to allow for avoidance of known plants and populations through project design.
    a. Pre-construction surveys will follow the USFWS's Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed, and Candidate Plants (UFSWS 2011) and local BLM field office guidelines (BLM 2008, 2015).
    b. Graham's beardtongue and White River beardtongue surveys must be conducted between May 1 and June 30 (i.e., plant flowering period), unless an extension is provided in writing by the botanist at the local BLM field office.
2. Surveys for Graham's beardtongue and White River beardtongue will be conducted by a qualified botanist. Qualifications are defined in the USFWS's *Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants* (USFWS 2011). Qualified botanists must have also attended the USFWS Uinta Basin Rare Plant Workshop prior to performing survey work; details on the workshop can be found at http://www.fws.gov/utahfieldoffice/UBRarePlants.html.
3. Surveys will be valid for 3 years from the survey date.
4. Noxious and invasive weed locations, species, and size observed during the surveys will be recorded and included in the survey report.
5. Graham's beardtongue and White River beardtongue surveys for access roads, buried pipelines, surface pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will include the project area, project right-of-way (ROW), and 300 feet from the edges of the project disturbance and ROW. For surface pipelines paralleling a road and remaining within 10 feet of the road edge, surveys are only required on the same side of the road as the pipeline.
6. Survey results along with geographic information system (GIS) information will be submitted to the permitting agency, the Penstemon Conservation Team, and the respective state's natural heritage program.
    a. GIS data will be submitted as electronic shapefiles in NAD 83 datum and will include the associated metadata.
    b. Survey reports will be submitted in electronic format, unless otherwise specified by the receiving party.

General Conservation Measures

The following general conservation measures will be applied to protected populations within suitable habitat where surface-disturbing activities occur.

1. Based on results of pre-construction surveys, project infrastructure will be redesigned to minimize impacts to Graham's beardtongue and White River beardtongue habitat and plants and to avoid them by 300 feet.
2. Access roads, buried pipelines, well pads, and other facilities requiring removal of vegetation (e.g., compressor stations) will be located a minimum distance of 300 feet from individual plants and/or populations where feasible.
3. Surface-disturbing activities may occur within 300 feet of protected populations if the activities benefit or reduce impacts to the species or habitat. On federal land, the BLM will first confer with the USFWS to assess these scenarios; on non-federal land, the activity would be approved by the Penstemon Conservation Team. For example, construction-related travel on an existing road would result in additional traffic and associated dust within 300 feet of plants but would create less disturbance than would traveling cross country or creating a new road to avoid plants by 300 feet.
4. No more than 5% of the Graham's beardtongue individuals per landowner in a given conservation unit and no more than 2.5% of the White River beardtongue individuals per landowner in a given conservation unit can be mitigated cumulatively on federal lands or by landowner on private land. These thresholds will be monitored by the Penstemon Conservation Team.
5. If activities are approved to occur within 300 feet of plants, a qualified botanist will be on-site during project activities to ensure the plants are avoided to the greatest extent practicable.
6. If surface pipelines are approved to occur within 300 feet of plants, pipelines will be stabilized or anchored to the ground in order to avoid movement of the pipeline that would result in habitat disturbance or damage to individual.
7. Where protected populations are within 300 feet, vehicle traffic for projects will obey a speed limit of 15 miles per hour (mph) from March 15 to October 15 on permitted dirt roads for the life of the project.
8. Dust abatement will be employed within protected populations during the time of the year when Graham's beardtongue and White River beardtongue are most vulnerable to dust- related impacts (March 15–October 15) and when active construction is taking place or when a dust plume is visible traveling farther than 50 feet. However, additional dust abatement is not required on roads where active dust abatement measures are being practiced and meet ongoing dust abatement criteria (e.g., see #9 below allowing only water for dust abatement in Graham's beardtongue or White River beardtongue habitat).
9. Only water (no chemicals, reclaimed production water, or oil field brine) will be used for dust abatement measures within suitable Graham's beardtongue and White River beardtongue habitat unless other methods are approved by the Penstemon Conservation Team.
10. Noxious weeds within Graham's beardtongue and White River beardtongue habitat will be treated according to guidelines outlined in the *Weed Management Plan* (Penstemon Conservation Team 2015) under the Agreement.

11. Erosion control measures (e.g., silt fencing) will be implemented to minimize sedimentation to Graham's beardtongue and White River beardtongue plants and populations located downslope of proposed surface-disturbance activities, and should only be implemented within the area proposed for disturbance.
12. All disturbed areas will be reclaimed with plant species native to Utah and/or Colorado and appropriate for the site, or with seed mixtures approved by the Penstemon Conservation Team and the BLM.
13. Mitigation measures will be described as applicant-committed conservation measures in project documents.

Compensatory Mitigation for Plants within 300 Feet of Disturbance

The following mitigation will apply to protected populations when surface-disturbing activities are approved to occur within 300 feet of Graham's beardtongue and White River beardtongue individuals. As described above, surface-disturbing activities will only occur within 300 feet of the plants when the action benefits the species or reduces impacts to the species or habitat. Project activities resulting in surface disturbance and therefore impacting the species include, but are not limited to, the following:

- Digging and excavation activities
- Buried pipelines
- Road construction (not regular road maintenance such as grading and dust abatement)
- Vegetation manipulation
- Vegetation removal
- Cross-country surface pipelines (farther than 10 feet from a road edge)
- Vegetation crushing
- Seismic activities
- General surface disturbance
- Well pad/facility construction

Conservation area expansion and monetary compensation are the two types of compensatory mitigation that can be used to offset surface-disturbing activities, and these are explained in detail in the sections below.

Mitigation Overview:

A. For projects with impacts to more than 25 White River or Graham's beardtongue plants:
   - Conservation area expansion: 3 to 1 acre ratio

B. For projects with impacts to 25 or fewer White River or Graham's beardtongue plants:
   - Monetary compensation: $7,510 per acre; or
   - Conservation area expansion: 3 to 1 acre ratio or
   - A combination of both mitigations may be used

CONSERVATION AREA EXPANSION

For any project causing impacts (i.e., within 300 feet of plants) to more than 25 White River beardtongue plants or more than 25 Graham's beardtongue plants, mitigation must include expanding conservation areas meeting the following criteria:

1. Conservation area expansions will include additional acreage of occupied habitat in the same conservation unit on a 3-to-1 ratio, where 3 acres are added to conservation areas for every 1 acre impacted, respectively. The 3-to-1 mitigation ratio for these impacts is needed in order to ensure that large populations of plants are not fragmented by surface-disturbing activities and remain intact. The intent is to protect large populations from habitat loss and fragmentation as large populations are the most likely to persist into the future (McCaffrey 2013, 2014).
2. Expansion areas must include at least the same number of Graham's beardtongue and White River beardtongue individuals as the impacted area, and habitat should be of similar quality as the original, impacted habitat.
3. Conservation area expansions will follow the guidance in the subsection titled "Incorporating new conservation areas" in section 6.2.2 of the Agreement.
4. Expansions must be approved by a majority of the Penstemon Conservation Team members.

MONETARY COMPENSATION

Monetary payments may be used as mitigation when 25 or fewer individuals of Graham's beardtongue or White River beardtongue are impacted. Payment amounts are based on the amount of acres of disturbance that occur within 300 feet of individual plants and will be calculated by the land management agency with assistance from the Penstemon Conservation Team. A conservation area expansion may also be used in lieu of monetary mitigation (see Conservation Area Expansion, above).

A cost per acre of disturbance will be based on a detailed cost analysis of ecological habitat restoration for Graham's beardtongue and White River beardtongue habitat. At this time, a restoration cost analysis for the two species has not been completed and is anticipated to be finalized in 2016. While this is being developed, the cost analysis previously developed for two Uinta Basin endemic *Sclerocactus* species will be used as a surrogate. The *Sclerocactus* mitigation calculation used the most relevant and recent information available to determine mitigation cost per acre. Because occupied habitat and the Graham's beardtongue and White River beardtongue conservation areas are identified in the Agreement as the most important areas necessary for the survival of the species, the corresponding high-value *Sclerocactus* mitigation cost of $7,510 per acre will be used for Graham's beardtongue and White River beardtongue mitigation calculations.

See Appendix A, "2014 Ecological Restoration Mitigation Calculation Guidelines for Impacts to *Sclerocactus wetlandicus* and *Sclerocactus brevispinus* Habitat" (USFWS 2014) for a detailed description of the cost analysis for the *Sclerocactus* species. Mitigation fees may be adjusted as needed to allow for changes in production and labor costs and new information about the species. Fee changes are subject to approval by a consensus of the Penstemon Conservation Team.

Payment Information:

Payments based on the acres of habitat disturbed within 300 feet of Graham's beardtongue and White River beardtongue will be determined by the land management agency, with the assistance of the Penstemon Conservation Team. Mitigation payments will be contributed to the Penstemon Mitigation Fund to aid in the recovery of *Penstemon* species impacted by surface-disturbing activities. Payment into the Penstemon Mitigation Fund is due at time of the decision record (BLM) or prior to initiation of ground-disturbing activity.

Funds will be paid to:

Utah School and Institutional Trust Lands Administration-Penstemon Mitigation Fund
Attn: Sonja Wallace
650 East 500 South
Salt Lake City, Utah 84102
801-538-5100

Use of Mitigation Funds:

Mitigation dollars will be used to fund projects that directly benefit the species as determined by the Penstemon Conservation Team. Only a consensus vote by the Penstemon Conservation Team can authorize expenditures from the mitigation fund. The vice-chair and Penstemon Conservation Team organizer are responsible for tracking payments to the Penstemon Mitigation Fund account and for communicating between the Penstemon Conservation Team and the account holder.
Potential projects may include, but are not limited to, the following:

- Occupied and suitable habitat acquisitions or easements with willing sellers
- *Penstemon* species propagation and introduction studies
- Seed collection for ex-situ seed bank efforts
- Suitable habitat enhancement such as weed management outside of project actions

When Compensatory Mitigation is Not Required

1. Compensatory mitigation is not required for conducting plant surveys or where Graham's beardtongue and White River beardtongue plants are within 300 feet of existing roads where travel is already open (as of July 22, 2014), designated, and authorized, and that are already improved (i.e., plowed or graveled) prior to the implementation of the Agreement. However, the following conservation measures will still apply:
    - Dust abatement protocols will be used to prevent impacts from dust from March 15 to October 15 for the life of the project. Only water (no chemicals, reclaimed production water, or oil field brine) will be used for dust abatement measures within Graham's beardtongue and White River beardtongue habitat unless other methods are approved by the Penstemon Conservation Team.
    - Vehicles for the project will obey a speed limit of 15 mph on dirt roads where Graham's beardtongue or White River beardtongue is within 300 feet.
2. Conservation easement and monetary mitigation are not required for conservation areas that are designated on privately owned ranches as long as the land continues to be used for livestock grazing and not for energy development or other major development. The Penstemon Conservation Team will determine appropriate avoidance, minimization, and mitigation for ranching projects (e.g., fence installation and water developments) on a case-by-case basis.
3. Mitigation is not required when a surface pipeline is located parallel to a road and is within 10 feet of the road edge.

Restoration and Reclamation as Mitigation

Successful ecological restoration (see *Ecological Restoration Plan*, in progress for 2016) may be used in conservation areas to offset disturbance limits within conservation areas (Penstemon Conservation Team 2014). Detailed guidance for ecological restoration implementation and measures of success will be found in the Agreement-related ecological restoration plan once it is developed in 2016.

ADAPTIVE MANAGEMENT

The Penstemon Conservation Team will review and utilize new information gathered from monitoring reports on intact and disturbed populations, restoration studies, pollinator studies, and other applicable research in order to revise this mitigation plan as needed. Sources of new information may be studies directly funded through the Agreement or outside research relevant to the ecology of the species.

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Appendix A:

2014 Ecological Restoration Mitigation Calculation Guidelines for Impacts to *Sclerocactus wetlandicus* and *Sclerocactus brevispinus* Habitat

2014 Ecological Restoration Mitigation Calculation Guidelines for impacts to *Sclerocactus wetlandicus* and *Sclerocactus brevispinus* Habitat

U.S. Fish and Wildlife Service, Utah Ecological Services Field Office
December 2014

Background:

The State of Utah ranks as the 10th and 11th largest producers nationally for gas and oil, and the majority of the state's production is centered in the Uinta Basin (Vanden Berg 2014). Total producing and active oil and gas wells in the Uinta Basin number more than 13,000, on 9,197 well pads (BLM 2012), with surface disturbance totaling more than 45,000 acres (assumes average of 5 acres of disturbance per well pad). Bureau of Land Management (BLM) analysis of 2011 data on pending NEPA projects forecasts more than 70,000 acres of additional oil and gas construction related disturbance in the next 15-20 years (BLM 2012). Current and projected energy development in the Uinta Basin overlaps with more than 90 percent of the range of the threatened Pariette cactus and Uinta Basin hookless cactus.

In 2012 we developed landscape scale conservation guidelines for the threatened Pariette cactus and Uinta Basin hookless cactus. The guidelines were developed to conserve and recover the species and prevent further habitat loss and fragmentation from energy development. Our strategy involved establishing core conservation areas (Core 1 and Core 2) that included dense aggregations of the threatened cactus species along with disturbance limits and pollinator buffers that allow for continued connectivity among these aggregations. The protection of pollinators and their habitat is important because these species depend primarily on pollination to produce seed. In order to further manage recovery of these cactus species across the landscape, our Core 1 and Core 2 areas are grouped geographically into 8 Conservation Units in order to ensure genetic and ecological representation over the range of the species.

Core 1 areas include the densest aggregations of known cactus locations and were delineated based on a 400 m buffer around known plant locations (the buffer distance is based on foraging distances of primary pollinators; Tepedino 2010). Within these Core 1 areas our goal is to have no new surface disturbance; well pad and road expansion may be considered, but only after avoidance and minimization efforts along with appropriate compensatory mitigation. Core 2 areas are adjacent to Core 1 areas and include less dense aggregations of cactus, but are still considered important for overall population and habitat connectivity in the Uinta Basin. Core 2 areas were developed using a 1,000 m buffer around plants to allow for genetic connectivity and pollinator travel between Core 1 areas, and to provide additional habitat for cactus expansion and recruitment (Service 2012). Our goal is to maintain no more than 5 percent total surface disturbance within these Core 2 areas (Service 2012). Disturbance over 5 percent in Core 2 areas can occur once ecological restoration of disturbed habitat is completed so that disturbance stays at or below 5 percent. We recognize that some of the Core 2 areas are already above 5 percent surface disturbance. For these areas, we recommend that any disturbance above 5 percent in Core 2 areas be reclaimed to keep total disturbance at or below 5 percent and cumulative disturbance including areas that are reclaimed stay below 25 percent (Service 2012).

Reclamation of arid lands is difficult and full ecological restoration within the habitat of listed cactus species in Utah has not been successful (Grossl et al. 2012). We define full ecological restoration as supporting appropriate native community components and structure, returning land to a state with moderate to high ecological function that can support most processes and components of the pre-disturbance natural community, integrating into the surrounding landscape, resilient to environmental stressors, similar to a reference ecosystem (Society for Ecological Restoration (SER) 2004) and especially supporting listed plants and their habitat. Avoidance and minimization of impacts to listed species and their habitat is the first step in offsetting impacts.

Where impacts to listed plants and their habitats cannot be avoided or minimized we will consider ecological restoration as mitigation to offset these impacts. However, because we are currently unable to ensure successful ecological restoration, initial efforts will focus on researching restoration methods that may lead to improved techniques. As methods and inputs improve the estimated costs for restoration may change correspondingly. We have based the following 2014 mitigation costs on available information of the components needed for ecological restoration.

Ecological Restoration Components and Costs:

The following components are needed for ecological restoration of oil and gas impacts in the Uinta Basin:

1. *Treatment of non-native and invasive plants for 2 years.* Treatment and control of non-native plants is vital to reducing competition prior to establishing native plants (Sieg et al. 2003). Non-native and invasive plants increase dramatically in response to soil disturbance so treatment needs to be conducted before and after grading and re-contouring of well pads, roads and other disturbed areas (Sieg et al. 2003). These activities are required by BLM's Green River Reclamation Guidelines (see Objective 6; Attachment 1 *in* BLM 2011) so although we recognize that this activity is an important component of restoration we are not including them in our mitigation costs as long as they are implemented as part of BLM's requirements. Where these measures are not required as part of BLM reclamation requirements, these costs will apply in our mitigation calculation. Cost estimates were determined at \$0.02- \$0.03 per ft^2 (Musich Custom Spraying, Oct 29, 2014, personal communication) for a cost of \$1,307 per acre.
2. *Grading and plowing of disturbed site (well pad, road).* Well pads, roads and other disturbed sites result in soil loss and compaction (Buto et al. 2010). In addition, many sites are leveled so that the topography no longer matches the surrounding area thus leading to wind and water erosion, disruption of weathering processes, water path, sedimentation, barriers to species movement (Service 2010). Re-contouring disturbed sites to match surrounding topography integrates the restored area into the larger landscape and reduces negative impacts to ecological communities. Subsequent plowing is necessary to ensure a favorable recipient site prior to planting native seed or plants.

Re-contouring of disturbed sites is required by the BLM Green River District's Reclamation Guidelines (see Objective 2 and 3: Attachment 1 *in* BLM 2011). Where these measures are not required as part of BLM reclamation requirements, these costs will apply in our mitigation calculation.

Plowing of the site or similar soil improvement immediately prior to seeding is not required by BLM so we have incorporated it into our costs. We estimate that plowing costs will be $500 per acre given that heavy equipment will be needed to loosen soil in preparation for direct seeding and to provide necessary aeration and sufficient drainage for *Sclerocactus* species (J&L Oilfield Service Inc., Josh Justice, Oct 2, 2014, personal communication) and the low end cost for leveling well pads (~4 acres) is estimated at $2000 per acre but average costs are $6025 per acre (or $24,100 per well pad) which is the cost we are using for the mitigation calculation.

3. *Soil amendments including cobble, topsoil, char, wood chips, biological soil crust inoculant or other nutrients/minerals.* Restoring soils in arid lands is an important component for restoring and supporting native plant communities. Topsoil development in arid lands is an extremely slow process so once topsoil is removed amendments may be necessary to provide the appropriate organic and inorganic soil constituents needed support the biological community. (Whisenant 1995; Eldridge et al. 2012). In addition, we know that biological soil crusts are an important component of these arid ecosystems so restoration will include re-establishment of biological soil crusts (Rosentreter and Belnap 2001; Bowker et al. 2005). This is an ongoing area of restoration ecology and we will likely learn more through experimentation and analysis. Current cost estimates for soil amendment were estimated to range from $1,200 to $6,000 per acre (Schneider 2014, Western States Reclamation, Inc,), and adding local topsoil would cost $300 per dump truck load (12 yards which covers 3600 ft^2 at 1 inch depth) (All Red Paving, KW Trucking, Tri-County Concrete, Oct 2014, personal communication). Eleven truck loads are needed to cover one acre with one inch of soil amendment, costing $3,300 per acre. We are using the $3,300 per acre cost for our mitigation estimates.

4. *Collecting seed from a diversity of native plants.* Full restoration includes restoring the entire plant species composition that supports ecological functions and processes. Seed from native flowering plants will help increase diversity, and support pollinators with floral resources that are available at different times of year. Seed also needs to be collected from *Sclerocactus* in order to be able to propagate them for outplanting. Costs are estimated at $1500 per acre as knowledgeable botanists and multiple trips are needed to gather seed from a diversity of species that best mimics intact site conditions.

5. *Planting seed from habitat specific native plants including wildflowers.* Establishing specific target native plants from the natural community where restoration is to occur is important in establishing the community components and processes (*i.e.,* pollination) important for a functioning ecosystem. Seed will be hand planted or drill seeded immediately after plowing or tilling of the site to ensure good seed-soil contact. Costs for this activity were estimated from two different sources ranging from $1,250 to $2,500 per acre (Schneider 2014) and $500 to $1000 per acre, or a median cost of $750 per acre (Mike Thomas, Great Bear Restoration, MT, Mar 2014, personal communication). We are using the $750 per acre cost for our mitigation estimates.

6. *Listed Sclerocactus species propagation.* Propagating and planting juvenile to young adult plants will help establish cactus on the restored area. *Sclerocactus* species can take 4-6 years from seed propagation before it can outplanted on a restoration site. Costs for propagating cactus were estimated by Red Butte Garden (R. Reisor, Feb 11, 2014, personal communication), and total $100 per cactus.
7. *Planting propagated Sclerocactus plants.* *Sclerocactus* that are propagated will be planted at 10 cacti per acre in Core 1 areas and 5 cacti per acre in Core 2 areas to establish listed *Sclerocactus* species at the restored site. We expect mortality and reduced reproduction from planted *Sclerocactus* so we anticipate final survival and reproduction of 8 *Sclerocactus* in Core 1 areas and 4 *Sclerocactus* per acre in Core 2 areas. Costs for planting cactus were estimated by Red Butte Garden (R. Reisor, Feb 11, 2014, personal communication) and total $42 per cactus. For restoration activities, five *Sclerocactus* plants would be planted per acre for a cost of $210 per acre.
8. *Planting commercially available habitat specific native plant species seed (twice) including grasses and shrubs.* This task would lead to the establishment of the portion of native plant community that would integrate formerly disturbed areas into the landscape, support ecosystem functions and stabilize the site. The BLM requires establishment of a desired self-perpetuating plant community in their Green River District Reclamation Guidelines (see Objective 1; Attachment 1 *in* BLM 2011) so we have not included these requirements in our mitigation costs. Where these measures are not required as part of BLM reclamation, these costs will apply in our mitigation calculation. In addition, only native, habitat specific plant species will be allowed in listed *Sclerocactus* habitat in order to achieve full ecological restoration. Costs include seed mix purchase and planting of seed. Costs for purchasing an appropriate seed mix are $500 per acre and include *Artemisia nova*, *Atriplex canescens*, *Pleuraphis jamesii*, *Achnatherum hymenoides*, *Linum lewisii* and *Sphaeralcea munroana* (J. Poulos Apr. 2014, personal communication). Costs for direct seeding are $750 per acre and are discussed above in number 5.
9. *Monitoring.* Monitoring of the restoration site is necessary to determine if the site is proceeding toward ecological restoration goals and to help inform management decisions to ensure restoration goals are met. Monitoring is required as part of BLM's Green River District Reclamation Guidelines (Objective 8) so we have not included them in our mitigation costs. However, we will work with BLM on a project-specific basis to determine the goals, objectives, and requirements of restoration monitoring plans. Where these measures are not required as part of reclamation these costs will apply in our mitigation calculation.

Calculating Acres to be Mitigated:

Mitigation costs are based on the amount of habitat impacted and the quality of that habitat as determined by the U.S. Fish and Wildlife Service and delineated into 3 strata: Core 1 Conservation Areas, Core 2 Conservation Areas, and suitable habitat outside of the Core Conservation Areas. Mitigation is applied only where impacts cannot be avoided. Mitigation will occur for any impacts occurring with Core 1 Conservation Areas for any surface

disturbances. Mitigation will occur in Core 2 Conservation Areas where surface disturbance exceeds 5 percent. Mitigation will occur in suitable habitat where impacts are within 300 ft of listed *Sclerocactus* plants. This habitat mitigation approach does not apply to direct impacts to listed plants. Mitigation for direct impacts are addressed through another mitigation calculation as discussed below.

The amount of habitat impacted will be calculated as follows:

1. For Core 1 areas all disturbed acres inside designated Core 1 areas will be mitigated. To meet our objective of no disturbance in Core 1 areas, we anticipate the only additional disturbance will come from well expansions not new roads or well pads.
2. For Core 2 areas the number of acres currently disturbed that are not reclaimed, and exceed the 5 percent disturbance cap will be mitigated.
3. For impacts outside of Core 1 or Core 2 areas and within 300 ft of *Sclerocactus*:
    a. The total acreage of the well pad that is within 300 ft of *Sclerocactus* will be mitigated
    b. The distance of the Right-of-Way (ROW) where the edge is within 300 ft of *Sclerocactus* for buried and cross country pipelines and 50 ft for hand-laid surface pipelines adjacent to roads multiplied times the width for the stretch of ROW (for a pipeline or road) will be mitigated.

Summary of Mitigation Costs:

Mitigation costs include topographical contouring, soil preparation, seed collection and planting, cactus propagation and planting, and monitoring. These costs vary based on the importance of the three habitat areas for *Sclerocactus*—Core 1 Conservation Areas, Core 2 Conservation Areas, and Suitable Habitat outside of Core Conservation Areas.

Core 1 Conservation Areas: Mitigation costs per acre in Core 1 includes costs associated with plowing the soil, amending the soil, propagating *Sclerocactus* and planting at a density of 10 cacti per acre, and collecting seed and planting a diversity of native plant species from adjacent sites. Core 1 areas support the highest density of *Sclerocactus* thus we have included costs for restoring a high density at 10 *Sclerocactus* per acres assuming some mortality and reduced reproduction from transplanting and poor soils.

Core 2 Conservation Areas: Mitigation costs per acre in Core 2 areas includes costs associated with amending the soil, propagating *Sclerocactus* and planting at a density of 5 cacti per acre and collecting seed and planting a diversity of native plant species from adjacent sites.

Suitable habitat: Mitigation costs per acre in suitable habitat includes costs associated with collecting and planting a diversity of native seed and re-establishing biological soil crust by inoculation.

Other costs associated with restoration that are already required and included in BLM's Green River Reclamation Guidelines such as grading of site and seeding and establishment of common native plants commercially available are not included in our mitigation costs because we assume these restoration actions will be conducted as part of BLM's requirements. Where these actions are not required or completed these costs will be included in our total costs for mitigation.

Table 1. *Sclerocactus* compensatory mitigation calculation

Mitigation habitat type	Acres	Cost per acre	Acres *Cost	Explanation of restoration costs
Core 1 (any level of disturbance)	1.0	$7,510.00	$7,510.00	Includes amending soil, cactus propagation and planting (10 cacti per acre), and native species seed collection and planting. Assumes costs for BLM required measures are already being implemented.
Core 2 (over 5% disturbance or within 300 ft of cactus)	1.0	$6,260.00	$6,260.00	Includes amending soil, cactus propagation and planting (5 cacti per acre), and native species seed collection and planting. Assumes costs for BLM required measures are already being implemented.
Sclerocactus habitat (Disturbance within 300 ft of cactus)	1.0	$2,550.00	$2,550.00	Native species seed collection and planting and biological soil crust inoculation. Assumes costs for BLM required measures are already being implemented.

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