# Biological Assessment for the Little Canyon Project Area Natural Gas Development Plan

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**February 2008**

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# INTRODUCTION

The purpose of this Biological Assessment (BA) is to review the proposed Little Canyon Project Area (LCPA) Natural Gas Development Plan in sufficient detail to determine whether the Conservation Alternative (Alternative B of the Environmental Assessment, UT-080-05-249) may affect any of the threatened or endangered species listed below. This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536 (c)).

Federally threatened or endangered species that may be impacted by implementation of the LCPA Natural Gas Development Plan are summarized below in **Table 1**.

**Table 1. Federally Threatened or Endangered Species Potentially Impacted by the Implementation of LCPA Natural Gas Development Plan**

| Common Name | Scientific Name | Federal Status |
|---|---|---|
| **Plant Species** | | |
| Shrubby reed-mustard | *Schoenocrambe suffrutescens* | Endangered |
| Clay reed-mustard | *Schoenocrambe argillacea* | Threatened |
| Uinta Basin hookless cactus | *Sclerocactus wetlandicus* | Threatened |
| **Wildlife Species** | | |
| Colorado pikeminnow | *Ptychochelius lucius* | Endangered |
| Razorback sucker | *Xyrauchen texanus* | Endangered |
| Bonytail | *Gila elegans* | Endangered |
| Humpback chub | *Gila cypha* | Endangered |

Although additional Bureau of Land Management (BLM) or Utah Division of Wildlife Resources (UDWR) special status species may occur in the LCPA, these species do not receive protection under the ESA and therefore, are not included in this BA.

# CRITICAL HABITAT

Surface disturbance proposed under the Conservation Alternative does not fall within critical habitat for any of the Federally-listed species identified in **Table 1**. However, portions of the Green River and its 100-year floodplain, located approximately 11.5 miles downstream from the LCPA, have been designated as critical habitat for the Colorado pikeminnow (*Ptychochelius lucius*) and razorback sucker (*Xyrauchen texanus*). Critical habitats for the bonytail (*Gila elegans*) and humpback chub (*Gila cypha*) have also been designated further downstream in the Green River and its 100-year floodplain. Final ruling on critical habitat for the Colorado pikeminnow, razorback sucker, bonytail, and humpback chub (collectively known as the Colorado River fish) was established by U.S. Fish and Wildlife Service (USFWS) on March 21, 1994 (59 FR 13374). Any water depletions from the Upper Colorado River Basin adversely affect designated critical habitats for the Colorado River fish.

# CONSULTATIONS TO DATE

## ***Project-Specific Consultation***

During the internal scoping process for the EA, several meetings were held between the BLM Vernal Field Office, USFWS, XTO, and a third-party contractor to discuss the proposed natural gas development project, including potential impacts to the shrubby reed-mustard (*Schoenocrambe suffrutescens*), clay reed-mustard (*Schoenocrambe argillacea*), Uinta Basin hookless cactus (*Sclerocactus wetlandicus*), and Colorado River fish. In September 2006, a meeting was held at the BLM's Vernal Field Office to discuss the first internal Draft EA, during which the USFWS commented that the revised draft EA needed to include the conservation measures developed for the shrubby reed-mustard, clay reed-mustard, Uinta Basin hookless cactus (see **Appendices A**, **B**, and **C**). These measures were incorporated into a revised internal Draft EA, which was submitted to the BLM and USFWS on June 1, 2007. On June 25, 2007, another meeting was held at the BLM's Vernal Field Office to review the revised internal Draft EA. During the June 25 meeting, the USFWS indicated that despite application of the conservation measures, additional detail would be needed on dust abatement, weed monitoring, shrubby reed-mustard plant monitoring, and a commitment to fund a seed bank for the shrubby reed-mustard. During this meeting, the USFWS also advocated that the BLM should prepare a separate BA for the proposed project in order to expedite Section 7 consultation. On July 11, 2007, a meeting was held at the BLM's Vernal Field Office to discuss the specific details of what the USFWS needed in the BA in order to conduct formal Section 7 consultation. The internal Draft BA was then prepared and submitted to the USFWS on August 21, 2007. On September 10, 2007, the BLM received the USFWS' comments on the internal draft BA, and this current document reflects edits and revisions made as a result of those comments.

Although the majority of LCPA-specific meetings discussed above focused on the reed-mustards, potential mitigation and avoidance measures for the Uinta Basin hookless cactus and Colorado River fish were discussed as well.

## ***Programmatic Consultation***

### Shrubby Reed-Mustard

In December 2004, the Utah BLM and USFWS completed a programmatic Section 7 consultation regarding the development and implementation of lease notices for oil and gas leases proposed for sale. In June 2007, the Utah BLM and USFWS completed an extensive programmatic Section 7 consultation on existing land use plans within the State. The terms and conditions resulting from that consultation are in the process of being implemented. On July 30, 2007, the BLM requested re-initiation of Section 7 consultation with the USFWS for listed plant species, including the shrubby reed-mustard. In the re-initiation request, the BLM provided species-specific conservation measures to replace the existing lease notices and conservation measures developed in previous Section 7 consultations (BLM 2007). The USFWS concurred with the conservation measure amendments on August 8, 2007 (USFWS 2007a). These amended species-specific conservation measures are provided in **Appendix A** of this BA

### Clay Reed-Mustard

In December 2004, the Utah BLM and USFWS completed a programmatic Section 7 consultation regarding the development and implementation of lease notices for oil and gas leases proposed for sale. In June 2007, the Utah BLM and USFWS completed an extensive programmatic Section 7 consultation on existing land use plans within the State. The terms and conditions resulting

from that consultation are in the process of being implemented. On July 30, 2007, the BLM requested re-initiation of Section 7 consultation with the USFWS for listed plant species, including the clay reed-mustard. In the re-initiation request, the BLM provided species-specific conservation measures to replace the existing lease notices and conservation measures developed in previous Section 7 consultations (BLM 2007). The USFWS concurred with the conservation measure amendments on August 8, 2007 (USFWS 2007a). These amended species-specific conservation measures are provided in **Appendix B** of this BA

### Uinta Basin Hookless Cactus

In December 2004, the Utah BLM and USFWS completed a programmatic Section 7 consultation regarding the development and implementation of lease notices for oil and gas leases proposed for sale. In June 2007, the Utah BLM and USFWS completed an extensive programmatic Section 7 consultation on existing land use plans within the State. The terms and conditions resulting from that consultation are in the process of being implemented. On July 30, 2007, the BLM requested re-initiation of Section 7 consultation with the USFWS for listed plant species, including the Uinta Basin hookless cactus. In the re-initiation request, the BLM provided species-specific conservation measures to replace the existing lease notices and conservation measures developed in previous Section 7 consultations (BLM 2007). The USFWS concurred with the conservation measure amendments on August 8, 2007 (USFWS 2007a). These amended species-specific conservation measures are provided in **Appendix C** of this BA

### Colorado River Fish

In order to address depletion (and other) impacts on the Colorado River fish species a Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) was initiated on January 22, 1988. Under the 1988 Recovery Program, any water depletions from tributary waters within the Colorado River drainage are considered to "*jeopardize the continued existence"* of these fish. In order to further define and clarify the recovery processes in the Recovery Program, a Section 7 agreement was implemented on October 15, 1993, by Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP). The RIPRAP identifies actions currently believed required to recover the endangered fish species in the most expeditious manner (USFWS 2007b). Included in the RIPRAP was the requirement that a one-time depletion fee would be paid to help support the Recovery Program for water depletions from the Upper Colorado River Basin. These depletion fees were intended to be a reasonable and prudent alternative to avoid the likelihood of jeopardy to the continued existence of the endangered fishes and to avoid the likely destruction or adverse modification of critical habitat caused by depletions to the Upper Colorado River Basin. On July 5, 1994, and later amended in December 1994, March 1995, and most recently in July 1997, the USFWS completed an intra-Service biological opinion that exempted the water depletion fee for projects depleting 100 acre-feet or less per year from the Upper Colorado River Basin (USFWS 1997). However, as average annual depletions in the LCPA would be greater than 100 acre-feet per year, XTO (or their municipal water supplier) would be responsible for paying water depletion fees associated with the Conservation Alternative. The FY08 (October 1, 2007 – September 30, 2008) water depletion fee is $17.79 per acre-foot (USFWS 2007b).

# CURRENT MANAGEMENT DIRECTIONS

Current management directions or strategies for the Federally-listed plant and fish species analyzed in this BA are outlined in various documents including USFWS recovery plans. Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect the identified species. Plans are prepared by the USFWS, sometimes with the assistance of recovery teams, contractors, State agencies, or other organizations. These documents generally identify population recovery criteria in order to downlist or delist the species.

## ***Special Status Plant Species***

Recovery objectives from the recovery plans for the special status plant species identified in **Table 1** are summarized below. For full details on these recovery objectives, please refer to the Reed Mustards and Uinta Basin hookless cactus recovery plans (USFWS 1994; USFWS 1990a):

- The recovery objective for delisting the clay reed-mustard is set at 10 separate populations with 2,000 or more individuals per population. In addition, delisting can be considered if long term protection of populations through a formal land management designation is provided (USFWS 1994). Current population numbers for the species are unknown.
- The recovery objective for delisting the shrubby reed-mustard is the same as for the clay reed-mustard above. Objectives for downlisting the shrubby-reed mustard is set at 5 separate populations with 2,000 or more individuals per population. In addition, downlisting can be considered if long term protection of populations through a formal land management designation is provided (USFWS 1994). Current population numbers for the species are unknown.
- The recovery objective for the Uinta Basin hookless cactus is an overall population of 30,000 or more total individuals in 6 separate populations. In addition, delisting can be considered if long term protection of populations through a formal land management designation is provided (USFWS 1990a). Current population numbers for the species are unknown.

## ***Colorado River Fish***

The objectives of Recovery Goals for the Colorado pikeminnow (USFWS 2002a), razorback sucker (USFWS 2002b), bonytail (USFWS 2002c), and humpback chub (USFWS 2002d) are to sufficiently recover populations so that the fish may be downlisted and then delisted, according to Section 4(f)(1) of the ESA. These Recovery Goals provide site-specific management actions and objectives, measurable recovery criteria to minimize or remove threats to the Colorado River fish, and an estimated timeframe for recovery. These actions are a response to identified threats that include but are not limited to streamflow regulation, habitat modification, competition with and predation by non-native fishes, pesticides, and pollutants. Recovery objectives for downlisting and delisting the Colorado River fish are summarized below. Specific management actions identified by the Recovery Goals as necessary for recovery of the Colorado River fish are summarized in **Table 2**. For full details on these recovery objectives and management actions, please refer to species-specific recovery plans (USFWS 2002a; USFWS 2002b; USFWS 2002c; and USFWS 2002d):

- Recovery objectives for downlisting the Colorado pikeminnow include, over a 5-year period, achieving certain target population numbers in the Green River sub-basin, upper

Colorado River sub-basin, and the San Juan River sub-basin. In addition, downlisting could be considered if, over a 5-year period, certain site-specific management tasks to minimize or remove threats to the species have been identified, developed, and implemented. Delisting of the Colorado pikeminnow could occur if the aforementioned objectives are met over a 7-year period beyond downlisting (USFWS 2002a).

- Recovery objectives for downlisting the razorback sucker include, over a 5-year period, achieving certain target population numbers in the Green River sub-basin, the upper Colorado River sub-basin or the San Juan River sub-basin, and the lower basin recovery unit, and maintaining a genetic refuge in Lake Mohave of the lower basin recovery unit. In addition, downlisting could be considered if, over a 5-year period, certain site-specific management tasks to minimize or remove threats to the species have been identified, developed, and implemented. Delisting of the razorback sucker could occur if the aforementioned objectives are met over a 3-year period beyond downlisting (USFWS 2002b).
- Recovery objectives for downlisting the bonytail include, over a 5-year period, achieving certain target population numbers in the Green River sub-basin, upper Colorado River sub-basin, and lower basin recovery unit, and maintaining a genetic refuge in a suitable location in the lower basin recovery unit. In addition, downlisting could be considered if, over a 5-year period, certain site-specific management tasks to minimize or remove threats to the species have been identified, developed, and implemented. Delisting of the bonytail could occur if the aforementioned objectives are met over a 3-year period beyond downlisting (USFWS 2002c).
- Recovery objectives for downlisting the humpback chub include, over a 5-year period, achieving certain target stable populations with specific recruitment levels. In addition, downlisting could be considered if, over a 5-year period, certain site-specific management tasks to minimize or remove threats to the species have been identified, developed, and implemented. Delisting of the humpback chub could occur if the aforementioned objectives are met over a 3-year period beyond downlisting (USFWS 2002d).

**Table 2. Recovery Goal Management Actions for the Colorado River Fish**

| Recovery Goal Management Actions | Colorado Pikeminnow | Razorback Sucker | Bonytail | Humpback Chub |
|---|---|---|---|---|
| Provide and legally protect habitat (including flow regimes necessary to restore and maintain required environmental conditions) necessary to provide adequate habitat and sufficient range for all life stages to support recovered populations | X | X | X | X |
| Provide passage over barriers within occupied habitat to allow adequate/unimpeded movement and, potentially, range expansion | X | X | X | |
| Investigate options for providing appropriate water temperature in the Gunnison River | X | X | X | |
| Minimize entrainment of subadults and adults in diversion/take-out structures | X | X | X | |
| Ensure adequate protection from overutilization | X | X | X | X |
| Ensure adequate protection from diseases and parasites | X | X | X | X |
| Regulate non-native fish releases and escapement into the main river, floodplain, and tributaries | X | X | X | X |
| Control problematic non-native fishes as needed | X | X | X | X |
| Minimize the risk of hazardous-materials spills in critical habitat | X | X | X | X |
| Remediate water-quality problem | X | X | X | |

| Recovery Goal Management Actions | Colorado Pikeminnow | Razorback Sucker | Bonytail | Humpback Chub |
|---|---|---|---|---|
| Provide for the long-term management and protection of populations and their habitats beyond delisting (i.e., conservation plans) | X | X | X | X |
| Re-establish populations with hatchery-produced fish | | X | X | |
| Identify and maintain genetic variability of razorback sucker in Lake Mohave | | X | | |
| Minimize the threat of hybridization with white sucker | | X | | |
| Identify genetic variability of bonytail and maintain a genetic refuge in suitable location in the lower basin | | | X | |
| Investigate habitat requirements for all life stages and provide those habitats | | | X | |
| Minimize the risk of increased hybridization among *Gila* spp. | | | X | X |
| Investigate the role of the mainstem Colorado River in maintaining the Grand Canyon population | | | | X |
| Investigate the anticipated effects of and options for providing warmer water temperatures in the mainstem Colorado River through Grand Canyon | | | | X |

Source: (USFWS 2002a; USFWS 2002b; USFWS 2002c; USFWS 2002d)

# DESCRIPTION OF THE CONSERVATION ALTERNATIVE

The LCPA is located about 32 miles south of Vernal, Utah, and encompasses about 33,240 acres of land. The LCPA includes Hill Creek Unit (HCU), Little Canyon Unit (LCU), and Big Pack Unit (BPU), plus numerous gas line and road rights-of-way (ROW) that extend out of the LCPA to provide access to and connection within the area. Hill Creek and Willow Creek bound the west and east side of the LCPA respectively, as shown in **Figure 1**. Surface ownership within each unit and for the entire LCPA is provided below in **Table 3**.

**Table 3. Surface Ownership of the Hill Creek, Little Canyon, and Big Pack Units[1]**

| Ownership | Hill Creek Unit (acres) | Little Canyon Unit (acres) | Big Pack Unit (acres) | Total (acres) |
|---|---|---|---|---|
| BLM | 1,064 (20%) | 6,126 (76%) | 17,082 (86%) | 24,272 (73%) |
| SITLA | 0 | 1,384 (17%) | 1,893 (10%) | 3,277 (10%) |
| Ute Tribe | 3,993 (75%) | 343 (4%) | 388 (2%) | 4,724 (14%) |
| Private | 291 (4%) | 269 (3%) | 408 (2%) | 968 (3%) |
| Total | 5,348 (100%) | 8,122 (100%) | 19,771 (100%) | 33,241 (100%) |

[1]The acreage is approximate, based on GIS data.

The EA for the proposed natural gas development project (see EA #UT-080-05-249) analyzes three alternatives: Alternative A – Proposed Action, Alternative B – Conservation Alternative, and Alternative C – No Action. Surface disturbance under Alternative B would be identical to the Proposed Action as set out in Section 2.4 of the EA (including surface disturbance calculations outlined in **Table 5)**. The operational aspects of the Conservation Alternative would be identical to the Proposed Action. However, under the Conservation Alternative, the operator would adhere to additional environmental protection measures (AEPMs) (such as the BLM and

USFWS jointly developed conservation measures for the shrubby reed-mustard) in order to reduce direct and indirect impacts to natural resources from development. As such, the BLM has preliminarily identified the Conservation Alternative as the agency preferred alternative for the Little Canyon Project Area Natural Gas Development Plan, which explains why the BLM has requested that the USFWS consult on the Conservation Alternative rather than the Proposed Action. Implementation of the Conservation Alternative would occur in three primary phases: construction, drilling, and completion; production and maintenance; and decommissioning and reclamation. These three development phases are discussed below.

### ***Construction, Drilling, and Completion***

Construction activities on Federal lands would follow guidelines set out in the *Surface Operating Standards for Oil and Gas Exploration and Development, 4th edition* (also known as the "Gold Book") (BLM and USFS 2007), as well as other applicable guidelines, including the American Petroleum Institute 1104 *Welding of Pipelines and Related Facilities*, dated September 1999, or the most recent edition. Construction activities on State and private lands would follow UDOGM guidelines.

Under the Conservation Alternative, XTO proposes to drill up to 510 natural gas wells from 362 well pads, to the Wasatch Formation or Mesaverde Group on 40-acre downhole spacing. About 29 percent of the 510 wells, or 148 wells, would be directionally drilled from the 362 well pads. As such, some proposed well pads would accommodate multiple wells. Approximately 77 miles of new access roads co-located with pipelines would be constructed to service the proposed wells. In addition, approximately 32 miles of new pipeline would be placed adjacent to existing roads. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate surface management agency (SMA), dictate the necessity for a surface-laid pipeline. For the purposes of surface disturbance calculations, it is assumed that the entire length of pipeline would be buried.

Development of the proposed wells, pipelines, access roads, and ancillary facilities is expected to be completed over a 7-year period. However, favorable economic conditions and evaluation of preliminary drilling results would determine the actual drilling timeframe, as well as the total number of wells drilled and the total acres of disturbance required for construction.

## Well Pads

Prior to well pad construction or surface-disturbing activities, the lessee or operator would obtain approval of an application for permit to drill (APD) or other surface use permit by the appropriate SMA or private land owner. Each permit would contain site-specific conditions of approval (COAs) that would apply to construction and well operations.

Well pad construction would consist of roughing in an access road to the well pad location and then leveling a roughly rectangular pad by balancing cut and fill areas. Well pads would be constructed from the native sand/soil/rock materials present. Stockpiles for both topsoil and subsoil would be established and maintained for future use in rehabilitating the location upon abandonment. Depending on the amount of cut and fill required to level each site, these stockpiles would occupy about 0.5 acre along the edge of the well pad.

A small reserve pit would be excavated opposite to the working area of each well pad. To assure stability, the pit would be constructed on the cut portion of the pad. Again, topsoil would be stockpiled for future redistribution. The pit would not be constructed in a natural drainage, where flood hazards exist, or where surface run-off could enter the pit or damage the pit walls. To avoid

impacts to soils and shallow groundwater, the pit would be lined with a synthetic liner with a minimum of 16-mm thickness. If bedrock is encountered during excavation, a felt liner pad would be used to protect the liner from puncture. The depth of the pit would be about 12 feet, with a minimum of 2 feet of freeboard maintained at all times. Three sides of the reserve pit would be fenced before drilling, and the fourth side would be fenced as soon as drilling is completed. Reserve pits would be reclaimed within 180 days from the date of well completion or as soon as practical based on, for example, weather conditions or other site-specific timing constraints. The subsoil and liner would be pushed back into the pit, and the topsoil would be respread and reseeded.

Size of well pads would vary depending upon the number of wells to be drilled from the pad, but would be constructed to safely accommodate drill rigs, associated equipment, vehicles, and ancillary facilities needed for construction, drilling and completion. However, each newly constructed well pad would initially occupy approximately 2.5 acres. In addition, each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directionally drilled well. This acreage would include reopening previously utilized reserve pits (i.e., about 0.4 acres), and expanding the existing pads to accommodate drilling equipment and additional well heads and production facilities. Based on these assumptions, the average initial well pad size would be approximately 2.7 acres[1]. Following all drilling and completion activities, portions of well pads not needed for production activities would be reclaimed in accordance with the standards of the appropriate SMA.

## Drilling and Completion Operations

Drilling operations would be conducted in compliance with all Federal Oil and Gas Onshore Orders, all UDOGM rules and regulations, and all applicable local rules and regulations. The alternatives include a combination of vertical and directional wells. The time required to drill a single vertical well would be about 10 to 15 days. The time required to drill a single directional well varies based upon the geologic characteristics of the location, but generally takes longer than vertical wells, or about 15 to 20 days.

Drilling operations would be conducted in two phases. The first phase would utilize a surface-hole rig and an air mist system to drill to a depth of about 2,000 feet. During the second phase, a larger rotary drill rig with conventional mud system would be mobilized to drill the remainder of the hole, the total depth of which would be determined by the target formation. The larger rig would pump fresh water as a circulating fluid to drive the mud motor, cool the drill bit, and remove cuttings from the wellbore. Prior to drilling below the surface casing, a blowout preventer (BOP) would be installed on the surface casing and both the BOP and surface casing would be tested for pressure integrity. The BOP and related equipment would meet the minimum requirements of Onshore Oil and Gas Order No. 2.

Drill cuttings from the wellbore (mainly shale, sand, and miscellaneous rock minerals) and drilling fluids carried over with the cuttings would be held in the reserve pit.

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[1] The following assumptions were used to calculate the average initial well pad size of 2.7 acres. As each well pad would initially occupy about 2.5 acres, surface disturbance associated with drilling 362 vertical wells would be about 905 acres. In addition, as each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directionally drilled well, surface disturbance associated with drilling 148 directional wells would be about 74 acres. Therefore, the total surface disturbance associated with drilling up to 510 wells from 362 well pads would be about 979 acres, or approximately 2.7 acres per well pad (i.e., 979 acres ÷ 362 well pads ≈ 2.7 acres per well pad).

Upon drilling the hole to total depth, a series of data-logging tools would be run in the well to evaluate the potential hydrocarbon resource. If the evaluation concludes that adequate hydrocarbon resources are present and recoverable, then steel production casing would be run and cemented in place in accordance with the well design, as approved in the APD, and any applicable COAs. The types of casing used, and the depths to which they are set, would depend upon the physical characteristics of the formations that are drilled. The casing and cementing program would be designed to isolate and protect the various formations encountered in the wellbore and to prohibit pressure communication or fluid migration between zones. Once production casing has been cemented in place, the drill rig would be released and a completion rig would be moved in.

Well completion consists of running a Cement Bond log to evaluate the cementing integrity, correlating (on depth) the cased hole logs to the open hole logs, perforating the casing across the hydrocarbon producing zones, and initiating a stimulation treatment of the formation to enhance its transmissibility of oil and gas. The typical stimulation used in the area is a hydraulic fracture treatment of the reservoir, wherein freshwater/sand slurry is pumped into the producing formation with sufficient hydraulic horsepower to fracture the rock formation. The sand serves as a proppant to keep the created fractures open, thereby allowing reservoir fluids to move more readily into the well.

## Water Use

Water required for the drilling and completion of the proposed gas wells would be hauled by truck from a combination of the permitted water sources described below in **Table 4**. The water volume needed to drill and complete an individual well is dependent upon the depth of the well and any losses that might occur during drilling. However, based on the operator's previous experience with wells drilled in the area, approximately 21,000 barrels (2.7 acre-feet) of water would be needed to drill and complete each well. While a portion of the water used for drilling and completion of wells would be recycled from other XTO wells, the majority of water used would be fresh water hauled to the wells. The drilling and completion of all 510 proposed wells would therefore consume about 1,377 acre-feet of water over a period of 7 years, or about 196 acre-feet per year.

**Table 4. Water Sources for Drilling, Completion, and Dust Suppression**

| Water Right Number | Filing Date | Source | Location | Allowed Annual Withdrawal |
|---|---|---|---|---|
| 43-10991 | December 17, 1999 | Underground Water Well | N 1,160 ft.; W 500 ft. from NE corner Section 9, T8S, R20E | 183.9 acre-feet |
| 49-1645 | December 6, 2001 | Underground Water Well | N 300 ft.; E 400 ft. from W ¼ Section 9, T8S, R20E | 50 acre-feet |
| 49-2262 | May 25, 2007 | Ponds | N 4,820 ft.; W 1,200 ft. and N 4,850 ft.; W 700 ft. from S1/4 Section 33, T8S, R20E | 20 acre-feet |
| 49-2158 | April 8, 2003 | Green River | S 570 ft.; W 3,150 ft. from NE corner Section 33, T8S, R20E | 20 acre-feet |
| 49-2189 | October 6, 2004 | Green River | S 570 ft.; W 3,150 ft. from NE corner Section 33, T8S, R20E | 20 acre-feet |

| Water Right Number | Filing Date | Source | Location | Allowed Annual Withdrawal |
|---|---|---|---|---|
| Tribal Resolution 06.183 | August 15, 2006 | Willow Creek | NE Section 22, T10S, R20E | Not Specified |

In addition to water for drilling and completion, approximately 1,000 barrels (0.13 acre-feet) of water per well pad and associated access road would be utilized for general dust abatement each year for the life of the project. As such, water utilized for general dust abatement for a maximum of 362 well pads and associated roads would be approximately 47 acre-feet per year over the 25-year project life (1,175 acre-feet).

In addition, because of the enhanced dust abatement that would be required under the Conservation Alternative, an additional 31 acre-feet of water[1] (approximately 4.4 acre-feet per year over the 7-year development phase) would be needed for dust abatement activities during construction near known plants of the shrubby reed-mustard and clay reed-mustard.

Thus, water usage for the 7-year development phase would be approximately 248 acre-feet per year (drilling and completion, general dust abatement, as well as enhanced dust abatement) or 1,734 acre-feet total for the first 7 years. Water usage for the remaining 18 years of the life of the project would be approximately 47 acre-feet per year (general dust abatement) or 846 acre-feet total for the remaining 18 years. The total water usage for the entire project over the estimated 25 year life of the project would be approximately 2,580 acre-feet.

## Access Roads

Under all alternatives, existing roadways would be used where possible and new roads would be constructed where needed. Existing roads in the area would provide the primary trunk roads for access to the new well pads. Proposed roads, which would consist of spurs connecting the trunk roads to the well pads, are expected to cross all surface owners' lands. Prior to any construction, improvement, or maintenance on County-claimed roads, lessees or operators would coordinate with the Uintah County Road Department to obtain appropriate permits for road use, construction, and maintenance.

New access roads would be built in accordance with the "Gold Book" (BLM and USFS 2007). However, site-specific requirements for road construction would be determined according to the specifications of the appropriate SMA or private land owner.

New roads would be constructed within a 75-foot wide ROW which would accommodate both new access roads and proposed pipelines; however, the travel width of the road would only occupy a 22-foot wide running surface. Construction materials necessary for the proposed new and upgraded access roads would consist of native borrow and soil accumulated during road construction. Access roads would be constructed using standard equipment and techniques. Bulldozers and/or road graders would first clear vegetation and topsoil from the ROW. These materials may be windrowed for future redistribution during the reclamation process. The surface would be crowned to facilitate drainage to a borrow ditch designed to minimize erosion potential. New access roads would be crowned (2 to 3 percent), ditched, and constructed to meet the

[1] Conservatively assumes that approximately 1/3 of the proposed well pads would occur within 300 feet of known plants of the shrubby reed-mustard and/or clay reed-mustard. Further assumes that to meet the enhanced dust abatement requirement within these areas, three times as much water would be needed for dust abatement.

standards of the anticipated traffic flow, all weather requirements, and to provide a well-constructed and safe road. Surface materials would consist of native soil whenever possible. Graveling or capping the roadbed may be performed as necessary to provide a well constructed, safe road. If additional surfacing materials are required beyond those available during excavation and construction, they would be purchased from a local contractor having a permitted source of materials. Prior to construction, the ground would be allowed to dry completely, and no road construction would take place when soils are frozen.

Timing of new road construction would be dependent upon the drilling schedule, topographic constraints, and weather conditions. Roads would generally be constructed two to three weeks prior to well pad construction. The roads would have a design speed of approximately 20 miles per hour (mph).

Dust suppression would occur throughout the LCPA. Water would be utilized for both general and enhanced dust suppression. Other dust suppressants could be used, if determined to be more effective and/or appropriate by the SMA or land owner (refer to AEPMs for details on dust suppression within occupied habitat for special status plant species).

**Pipelines**

Gathering (ancillary) pipelines with a 4 to 12-inch outside diameter (OD) would be installed to transport produced gas from the wells to larger lateral (or trunk) lines. Lateral pipelines with up to 30-inch OD would also be installed as needed, depending on well performance and gathering system requirements, to transport gas from the LCPA to sales points outside the LCPA. Both gathering pipelines and lateral pipelines would be placed within the 75-foot ROW adjacent to new access roads, or within a 45-foot wide ROW along existing roads. Pipelines would be buried where operationally and topographically feasible, unless resource considerations, as determined by the appropriate SMA, dictate the necessity for surface-laid pipeline. For the purposes of surface disturbance calculations, it is assumed that the entire length of pipeline would be buried.

To ensure safe operation of the pipelines, pipeline systems would be designed to operate at a Maximum Allowable Working Pressure of 913 pounds per square inch (psi) for low-pressure (ancillary) lines and 1,262 psi for high-pressure (trunk) lines. After construction is complete, pipelines would be pressure tested using either established air or water methods to verify the pipeline's integrity. The appropriate SMA would approve the water testing and methods to discharge test water through the site-specific applications.

Equipment needed to bury the proposed pipeline would include trucks and flat bed trailers for stringing, a bending machine, welding rigs, side-booms, backhoes, and pick-up trucks. This equipment may be present on LCPA roads as each step of the construction process is completed. All equipment used to install the pipelines would use the adjacent access roads as a working surface. The pipelines would be installed to avoid interference with normal travel and maintenance of the roadway. Aggregate material to pad pipeline trenches would primarily be obtained onsite, via the use of materials collected during trench excavation. If additional padding materials are needed, they would be acquired from an approved aggregate borrow site or facility.

## ***Production and Maintenance***

New gas production under the Conservation Alternative would require the installation of approximately 11,500 hp of new compression at the existing LCU compressor station located in Section 36 T10S, R20E. The existing station would be expanded to a total of about 15 acres in size in order to accommodate the additional compressor engines. Additional equipment to be

installed at the existing LCU compressor station would include a 50-MMscf dehydrator unit, dewpoint control, four 400-barrel (bbl) atmospheric production tanks, and one water scrubber. Produced gas would then be transported via pipeline to the existing LCU compressor station and then onto the existing Questar, Comet Gas, or Canyon Gas pipelines.

### Well Production

Generally, once producing, a completed well pad could include a well head, a separator, tanks for storing condensate and water, a dehydration unit, a pumping unit, and a meter house. Exact facilities and equipment may vary slightly and additional facilities would be necessary for well pads from which multiple wells are drilled.

During production operations, lessees or operators would maintain a Spill Prevention, Control and Countermeasure (SPCC) Plan, that outlines the methodology to be used in the event of a spill. If any spills of oil, gas, salt water, or other fluids of reportable quantities occur, lessees or operators would immediately contact the appropriate SMA, or private land owner, and any other appropriate regulatory agencies. Cleanup efforts would be initiated immediately in accordance with appropriate regulations. In occupied habitats for special status plant species, any spills, regardless of volume, would be reported to the BLM and USFWS.

In general, XTO would use remote telemetry to monitor daily well operations, which would reduce the need for daily visits by pumpers. However, for the purposes of providing a conservative analysis for this project, it is assumed that each well (particularly during initial production) could be visited by a pumper on a daily basis. If workovers are needed, additional vehicles and equipment would be onsite during the workover process.

Currently produced water and condensate within the LCPA is decanted into external steel tanks that are located on existing well pads. Containment dikes constructed either of compacted subsoil or metal barriers currently surround these facilities and hold 110 percent of the capacity of the largest tank. Currently each tank is pumped periodically as needed, and water is transported to certified disposal sites or existing water injection wells in other lease areas.

As additional wells come online in the LCPA, the amount of water produced from downhole formations would increase. To decrease the amount of truck traffic that would be needed to transport and dispose of such water, XTO proposes to install produced water pipelines from existing and proposed well pads to two proposed salt water disposal wells where produced water would be reinjected: the HCU 1-28F 28-10S-20E and the LCU 1-2H 2-11S-20E. Permitting requirements for these SWD wells is ongoing.

Produced water pipelines would be buried adjacent to the proposed gas pipelines, within the ROW for co-located roads and pipelines.

### Project Area Maintenance

Trash containers and portable toilets would be located at construction sites during the construction, drilling, and completion phase. Toilet holding tanks would be regularly pumped and their contents disposed of at the Vernal municipal sewage facility, in accordance with applicable rules and regulations regarding sewage treatment and disposal. Accumulated trash and nonflammable waste materials would be hauled to the Uintah County landfill once a week or as often as necessary. All debris and waste materials not contained in the trash containers would be cleaned up, removed from the ROW, and disposed of at the Uintah County landfill, as needed.

No potentially harmful materials or substances would be left in the LCPA. Scrap metal and other recyclable refuse would be hauled to the XTO yard on a regular basis.

Any hydrocarbons remaining in the reserve pit would be removed as soon as possible and processed or disposed of at an appropriate offsite commercial facility. Drilling mud/water would be allowed to evaporate in the reserve pit for a maximum of 180 days, and any remaining fluids would be hauled offsite to a licensed, commercial disposal facility. Cuttings generated during the drilling process would be buried in the reserve pit following the removal of any excess liquids.

Chemicals subject to reporting under SARA Title III (hazardous materials including diesel fuel, produced hydrocarbons, drilling fluids, etc.) would be present during various phases of the project including drilling, testing, completion, and production. Annual Tier II chemical inventory reports would be prepared and submitted to emergency response agencies per Federal and State requirements.

Sanitary facilities would be onsite at all times during drilling and completion operations. Sewage would be placed in a portable chemical facility and disposed of periodically in an approved sewage disposal facility in Vernal, Utah.

New gas production under the Conservation Alternative would require the installation of approximately 11,500 hp of new compression at the existing LCU compressor station located in Section 36 T10S, R20E. The existing station would be expanded to a total of about 15 acres in size in order to accommodate the additional compressor engines. Additional equipment to be installed at the existing LCU compressor station would include a 50-MMscf dehydrator unit, dewpoint control, four 400-bbl atmospheric production tanks, and one water scrubber. Produced gas would then be transported via pipeline to the existing LCU compressor station and then onto the existing Questar, Comet Gas or Canyon Gas pipelines.

### Noxious and Invasive Weed Control

Noxious and invasive weed infestations on disturbed surfaces would be controlled by spraying or mechanical removal. Approval by the appropriate SMA or private land owner would be obtained prior to any application of herbicides, pesticides, or other potentially hazardous chemicals. On BLM-administered land, a Pesticide Use Permit (PUP) would be submitted and approved by the BLM prior to the application of herbicides, pesticides, or other hazardous chemicals.

## ***Decommissioning and Reclamation***

### Interim Reclamation

Following completion activities, the lessee or operator would reduce the size of each well pad to the minimum surface area needed for production activities, while providing for adequate safety. All disturbed areas not necessary for drilling and production operations would undergo the following reclamation standards after completing dirt work and operations:

- Portions of well pads and ROWs not utilized for the operational phase of the project would be reseeded using seed mixtures determined by the appropriate SMA or private land owner (refer to AEPMs regarding details on revegetation within special status plant occupied habitat).

- Post construction seeding applications and reclamation practices would continue as needed, until 70 percent of vegetative cover in a comparative or adjacent area has been

re-established in the revegetated area. For more detailed reclamation actions, see the Reclamation Plan (**Appendix D**) written for this BA.

## Well Abandonment and Final Reclamation

Dry holes would be plugged immediately after receiving authorization and plugging instructions from the appropriate mineral estate agency. Well pads, associated roads, and other facilities would be reclaimed as soon as feasible after plugging to minimize erosion.

The life span of individual producing wells may vary. However, the typical life span of a well is estimated to be 20 to 30 years (average of 25 years assumed for analysis purposes). Abandonment of a well and its facilities would be performed in compliance with all applicable regulations. All hydrocarbon- and water-bearing horizons in an abandoned well bore would be isolated via cement plugs. At the time of final abandonment, all aboveground facilities would be removed.

Abandoned well pads, roads, or other disturbed areas would be restored to near original condition. Reclamation includes re-establishing soil conditions and ensuring revegetation of the disturbed areas to the specifications of the appropriate SMA or private land owner at the time of abandonment. All disturbed surfaces would be re-contoured to the approximate natural contours, with reclamation of the well pad and access road performed as soon as practical after final abandonment. Seed mixtures used in the reclamation process would be approved by the appropriate SMA or private land owner. Reclamation practices would continue as needed, until determined successful by the appropriate SMA or the private land owner. For more detailed reclamation actions, see the Reclamation Plan (**Appendix D**) written for this BA.

## ***Summary of Estimated Surface Disturbance Associated with the Conservation Alternative***

On average, each newly constructed well pad would initially occupy approximately 2.5 acres. Each well pad utilized for proposed directional drilling would be expanded by about 0.5 acres for each additional directional well. This acreage would include reopening previously utilized reserve pits (i.e., about 0.4 acres), and expanding the existing pads to accommodate drilling equipment and additional well heads and production facilities. As the proposed well locations are conceptual in nature, initial disturbance for the 362 well pads was calculated at an average of 2.7 acres per pad. Based on these assumptions, the Conservation Alternative would result in about 977 acres of initial disturbance from well pad construction.

Under the Conservation Alternative, approximately 77 miles of co-located pipelines and roads would be constructed. As previously described, a ROW width of approximately 75 feet would be needed to construct and install co-located pipelines and roads, resulting in initial disturbance of approximately 715 acres. The proposed 32 miles of new pipelines installed along existing access roads would require a 45-wide ROW, resulting in initial surface disturbance of approximately 175 acres. The expansion of the existing LCU compressor station would occupy an additional 15 acres.

In total, the well pads, associated road and pipelines, and expanded compressor station would result in about 1,882 acres of initial disturbance occupying about 5.7 percent of the LCPA. **Table 5** summarizes estimated surface disturbance associated with the Conservation Alternative.

**Table 5. Estimated Surface Disturbance Resulting from the Conservation Alternative**

| Proposed Structure | Number of Well Pads/Miles of Road/Pipeline | Width of ROW or size of Well Pads | Surface Disturbance[1] |
|---|---|---|---|
| Well Pads | 362 | 2.7 acres | 977 acres |
| Co-located Access Road and Pipeline | 77 miles | 75 feet | 715 acres |
| Pipeline along Existing Road | 32 miles | 45 feet | 175 acres |
| Existing LCU Compressor | NA | NA | 15 acres |
| **Totals** | **NA** | **NA** | **1,882** |
| **Percent of Total LCPA[2]** | **NA** | **NA** | **5.7%** |

[1]Calculations are approximate based upon GIS calculation and rounded to the nearest whole number.
[2]LCPA ≈ 33,240 acres

## ***Required Environmental Protection Measures***

Under the Conservation Alternative, XTO would adhere to all appropriate statutory and non-discretionary regulatory requirements. The following section includes but is not limited to required environmental protection measures that would be implemented to help eliminate or minimize impacts to resources within the LCPA. Onsite inspections by the appropriate SMA for each new well pad, road, pipeline, or other activity would identify the need for each measure listed below, and may identify additional site-specific environmental protection measures necessary to protect sensitive resources.

### Water Resources

- As required under 40 CFR 112.3(e), XTO would revise and update all existing SPCC plans. In addition, XTO would prepare SPCC plans for all new proposed well pads. XTO would also maintain a copy of the newly created or revised SPCC plan at each facility, if the facility is normally attended at least eight hours per day, or at the nearest field office if the facility is not attended. XTO would also implement and adhere to SPCC plans in a manner such that any spill or accidental discharge of oil or condensate would be reported and remediated.

## ***Additional Environmental Protection Measures***

The following AEPMs were developed during internal scoping to reduce and/or mitigate potential impacts of the proposed natural gas development. These AEPMs would be applied under the Conservation Alternative.

### Construction and Operations

- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.

### Road Usage Monitoring

- If new road construction would replace an existing road, the operator would reclaim the existing road in accordance with the requirements of the appropriate SMA.

- If it is determined by all parties that a certain access road is no longer used or needed, the operator would reclaim and reseed the road in accordance with the requirements of the ROW owner.

## Floodplains

- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.

- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.

- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.

## Invasive and Noxious Species

- All construction equipment and vehicles coming into the LCPA from outside the Uinta Basin would be power-washed prior to entering the LCPA.

- Prior to any surface-disturbing activities, the BLM would conduct a pre-disturbance baseline, inventory for noxious and invasive weeds along proposed roadways, pipeline routes, well sites, and other facilities within the LCPA. This inventory, which could be completed on a site-by-site basis during the APD process, would form the basis for subsequent monitoring and control actions by the operator in the LCPA. As determined necessary by the BLM, during the life of project, the operator would complete noxious and invasive weed inventories along project-related roadways, pipeline routes, well sites, and other facilities within the LCPA on an annual basis.

## Vegetation (Including Special Status Plant Species)

AEPMs designed to reduce direct and indirect impacts to vegetation would include, but not be limited to, the following:

<u>General</u>

- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g. using previously disturbed areas and existing easements where feasible, placing pipelines adjacent to roads, limiting well pad size, etc.).

- Sufficient topsoil or other suitable materials to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with seed mixtures approved by the appropriate SMA.

<u>Shrubby Reed-Mustard</u>

- Measures that would specifically serve to protect the shrubby reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix A**. The most salient of these measures would include as feasible avoidance of surface disturbance within areas that fall within 300 feet of known

plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:

- Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.

- Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of invasive and noxious weed infestations. The monitoring plan would include a study that would identify a representative sample of sites on Federal lands within the LCPA where surface-disturbing activities occur within 300 feet of known plants, as well as a control site where no surface-disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of shrubby reed-mustard, general status of the individuals/population, species composition and density of noxious and invasive weeds and if additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the shrubby reed-mustard individuals/populations. For example, if the study indicates that noxious and invasive weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the shrubby reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.

- In addition to adherence to the conservation measures, the operator would fund the collection of shrubby reed-mustard seed in order to partially mitigate potential seed bank loss that could occur as a result of surface disturbance within suitable or occupied habitat for the species. Seeds collected would be used to aid in final reclamation efforts of the LCPA. Specifically, the operator would fund a seed bank collection to be conducted by Red Butte Botanical Garden (RBG) in Salt Lake City, Utah. Field work for the collection would require approximately 3 - 4 visits to the LCPA by qualified specialists at RBG to 1) assess the population, 2) determine flowering period/optimal time for seed collection, and 3) conduct the seed collection(s). RBG's current USFWS permit allows for them to collect up to 1,000 seeds of a listed species (but less than 10 percent of total seed). If, during coordination with the USFWS, it is determined that additional seeds are needed

for this effort, RBG would need an additional permit or an amendment to their existing permit from the USFWS. Specific details of the seed collection effort would be determined by the USFWS and BLM in coordination with RBG and the operator.

- In shrubby reed-mustard occupied habitat any spills, regardless of volume, would be reported to the BLM and USFWS.

Clay Reed-Mustard

- Measures that would specifically serve to protect the clay reed-mustard include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix B**. The most salient of these measures would include as feasible avoidance of surface disturbance within areas that fall within 300 feet of known plants. Where no other option exists and surface disturbance is necessary within 300 feet of known plants, the operators would:

    - Implement enhanced dust abatement techniques during construction activities that occur within 300 feet of known plants. Enhanced dust abatement would specifically entail watering (or the use of other dust suppressants approved by the appropriate SMA and USFWS) on disturbed surfaces every two hours (or as determined necessary by the appropriate SMA and USFWS for other dust suppressants) during active surface-disturbing activities. Exceptions (i.e., when dust suppression would not be necessary) would include periods within 12 hours of a precipitation event or if there is snow cover on the ground where construction activities are occurring.

    - Implement a long-term adaptive monitoring plan that would attempt to document population trends of the plants, and how these populations/plants are affected by construction, drilling, completion, and production activities, including monitoring of invasive and noxious weed infestations. The monitoring plan would include a study that would identify a representative sample of sites on Federal lands where surface disturbance occurs within 300 feet of known plants, as well as a control site where no surface-disturbing activities have occurred within 300 feet of known plants. Qualified biologists would monitor these sites on an annual basis for at least three years after surface-disturbing activities during the flowering period to document density of clay reed-mustard, general status of the individuals/population, and species composition and density of noxious and invasive weeds, and if additional monitoring is needed. After the first three years of monitoring, the BLM and USFWS would jointly determine on a site-specific basis if additional monitoring is needed. Data collected from these monitoring efforts would be provided to both the BLM and USFWS in an annual formal report. The reports would also include any corrective actions needed to remedy perceived impacts on the clay reed-mustard individuals/populations. For example, if the study indicates that noxious and invasive weed infestations are occurring or increasing, the BLM and USFWS would collaborate on the most effective way for the operator to eliminate weeds without affecting the clay reed-mustard. Furthermore, if the monitoring efforts indicate that development within 300 feet of known plants appears to be adversely affecting the species, the BLM would re-initiate Section 7 consultation with the USFWS. Specific details of the monitoring plan (e.g., number of survey locations, type of survey technique used, timing of survey, etc.) would be determined by the USFWS and BLM in coordination with the operator.

- Where surface disturbance is proposed within occupied clay reed-mustard habitat, enhanced erosion control and revegetation measures would be employed. The location of occupied habitat would be accounted for such that erosion and runoff control measures would be developed specifically to avoid or minimize sedimentation or runoff into occupied habitat. As is necessary in order for erosion control measures to work effectively, specific erosion control measures within occupied clay reed-mustard habitat would be developed on a site-specific basis. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

- In clay reed-mustard occupied habitat (if any occur within the LCPA) any spills, regardless of volume, would be reported to the BLM and USFWS.

Uinta Basin Hookless Cactus

- Measures that would specifically serve to protect the Uinta Basin hookless cactus include adherence to USFWS and BLM jointly developed conservation measures for the species, which are provided in **Appendix C.** The most salient of these measures includes the requirement to avoid surface disturbance within 100 feet of known plants, which would eliminate direct impacts on the species.

Reclamation and Monitoring

- In occupied habitat for all special status plant species, seed mixtures for interim and final reclamation would be determined jointly by the BLM and USFWS on a site-specific basis. These mixtures would consist of native, indigenous species. Based on monitoring, if revegetation with native, indigenous species is not successful, other seed mixtures including non-native seed mixtures would be considered.

- On Federal lands within the LCPA, the operator would work with the BLM to monitor the success of interim and final vegetation reclamation. The operator would monitor sites that have been reclaimed two years prior, as agreed upon by the BLM. The two-year gap would allow seeded areas to become established with vegetation and provide vegetation two full growing seasons for a better measure of success. If the BLM determines that reclamation has not been successful, the operator would reseed the location.

## Wildlife (Including Special Status Wildlife)

General

- As feasible, production facilities would be located outside the 100-year floodplains of project area drainages. Where well pads are proposed near project area drainages, shallow groundwater, or floodplains (i.e., where no option exists to locate surface facilities outside of these areas), closed-loop drilling systems, leak detection devices, or self-contained mud systems would be installed.

Colorado River Endangered Fish Species

As appropriate (i.e., if water is pumped directly from the Green River, Willow Creek, or perennial drainages), the following measures would be applied to reduce or eliminate direct impacts to habitat for the Colorado River fish species.

- To avoid entrainment, water should be pumped from an off-channel location (i.e., one that does not connect to the river during high spring flows). An infiltration gallery constructed in a BLM and USFWS-approved location would be best.

- If the pump head is located in the river channel where larval fish are known to occur, the following measures would apply:

    - The pump would not be situated in a low-flow or no-flow area as these habitats tend to concentrate larval fishes;

    - The amount of pumping would be limited, to the greatest extent possible, during that period of the year when larval fish may be present (see above); and

    - The amount of pumping would be limited, to the greatest extent possible, during the pre-dawn hours as larval drift studies indicate that this is a period of greatest daily activity.

- All pump intakes would be screened with ¼ inch mesh material.

- Any fish impinged on the intake screen would be reported to the USFWS (801.975.3330) and the Utah Division of Wildlife Resources.

- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.

- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.

- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.

- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.

- Appropriate erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

## Water Resources

- On a site-specific basis, berms would be constructed on the side(s) of well pads potentially affected by surface water runoff to minimize the possibility of contaminants entering the floodplains for Hill and Willow Creeks.

- Closed-loop drilling would be utilized for any wells within the 100-year floodplains for Hill and Willow Creeks.

- Production facilities (e.g., well pads, tanks, pipelines, roads, etc.,) would be located outside of the active channels of Willow and Hill Creeks within the LCPA on a site-specific basis.

- Where directed by the appropriate SMA, the operator would construct erosion control devices (e.g., riprap, bales, and heavy vegetation) at culvert outlets. All construction activities would be performed to retain natural water flows.

- Enhanced erosion control and revegetation measures would be employed. In areas with unstable soils where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes. Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

- Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g. using previously disturbed areas and existing easements where feasible, placing pipelines adjacent to roads, limiting well pad size, etc.).

**Soil Resources**

- Prior to any surface disturbance, site-specific topsoil depths and topsoil storage locations would be determined. Topsoil would be stockpiled for later use.

- Topsoil stockpiles would also be designed to maximize surface area in order to reduce impacts to soil microorganisms.

- Areas used for spoil storage would be stripped of topsoil before soil placement.

- Construction would not occur during periods of saturated soil conditions, when surface ruts greater than four inches would occur along straight vehicle routes.

- Appropriate erosion control and revegetation measures would be employed in accordance with applicable regulations and in coordination with the appropriate SMA. In areas with unstable soils, where seeding alone may not adequately control erosion, grading would be used to minimize slopes and water bars would be installed on disturbed slopes.

- Erosion control efforts would be monitored by the operator and necessary modifications would be made to control erosion.

# SPECIES ACCOUNTS

## ***Shrubby Reed-Mustard***

The shrubby reed-mustard (*Schoenocrambe suffrutescens*) was Federally-listed as endangered under the ESA on October 6, 1987, under the name toad-flax cress (*Glaucocarpum suffrutescens*) (52 FR 37416). The name was changed to shrubby reed-mustard (*Schoenocrambe suffrutescens)* on January 14, 1992 (USFWS 1994).

Shrubby reed-mustard occurs in the Uinta Basin in Duchesne County and Uintah County, Utah. A member of the mustard family, this species is a perennial, clump-forming herb that produces yellow flowers. Shrubby reed-mustard grows along semi-barren, white-shale layers of the Evacuation Creek Member of the Green River Formation, where it is found in xeric, shallow, and fine-textured soils intermixed with shale fragments. The species grows in mixed desert shrub and pinyon-juniper communities, at elevations ranging from 5,100 to 6,700 feet above mean sea level (amsl). Dominant shrub species associated with shrubby reed-mustard populations include pygmy sagebrush (*A. pygmaea*) and saltbush (*Atriplex spp*.).

Flowering generally occurs from April to May and fruiting occurs from May to June for shrubby reed-mustard. Reproduction is sexual; however, the factors that govern the distribution and long-term population dynamics are unknown. The effects of natural factors such as disease, parasitism, grazing, erosion, and vegetative competition on the viability of the species population are also unknown. Pollination exclusion experiments demonstrated that shrubby reed-mustard is capable of automatic self-pollination, but that significantly fewer seeds are successful than when open pollination occurs. The following ground nesting bee species have been captured while foraging on shrubby reed-mustard flowers: *Dialictus perdifficilis*, *D. sedi*, *Evilness pulveris* (all Halicatidae), and *Andrena walleyi* (Andrenidae) (USFWS 1994). As such, these species may possibly facilitate the cross-pollination of shrubby reed-mustard.

### ***Clay Reed-Mustard***

The clay reed-mustard (*Schoenocrambe argillacea*) was Federally-listed as threatened under the ESA on January 14, 1992 (57 FR 1398). The species is a perennial herbaceous plant, with sparsely leafed stems 6 to 12 inches long and small flowers that are pale-lavender to whitish with prominent purple veins (USFWS 1994).

Clay reed-mustard is endemic to the Uinta Basin in Uintah County, Utah, and typically grows on exposed bedrock, scree, and fine-textured soils derived from the Evacuation Creek Member of the Green River Formation. The species has also been documented below the rocky contact zone of the Uinta Formation and the Evacuation Creek Member. The species most commonly occurs on steep north-facing slopes, at elevations ranging from 4,721 to 5,790 feet amsl (UDWR 2004). Clay reed-mustard is associated with the mixed desert shrub community. Dominant shrub species associated with clay reed-mustard populations include Utah serviceberry (*Amelanchier utahensis*), black sagebrush (*Artemisia nova*), Castle Valley clover (*Atriplex gardneri cuneata*), shadscale saltbush (*Atriplex confertifolia)*, and green rabbitbrush (*Chrysothamnus viscidiflorus*) (USFWS 1994; UDWR 2004).

Flowering occurs from April to May and fruiting occurs from May to June for clay reed-mustard. Reproduction is sexual; however, the factors that govern the distribution and long-term population dynamics are unknown. The effects of natural factors such as disease, parasitism, grazing, erosion, and vegetative competition on the viability of the species population are also unknown. The specific pollination mechanism and vectors for clay reed-mustard are not known.

### ***Uinta Basin Hookless Cactus***

The Uinta Basin hookless cactus (*Sclerocactus glaucus*) was listed as threatened under the ESA on October 11, 1979 (USFWS 1979). Recently, *S. glaucus* has been reclassified and three species, which were collectively recognized as S. *glaucus* during the time of its listing, are now

recognized separately as *S. glaucus, S. brevispinus and S. wetlandicus* (USFWS 2007c). Of these three species, *S. glaucus* occurs only in Colorado and *S. brevispinus* is thought to only occur in the area surrounding the Pariette Wetland ACEC and Pariette Draw, and therefore these species are not discussed in this BA. However, *S. wetlandicus* is discussed in this BA as it potentially occurs within the LCPA.

Habitat for Uinta Basin hookless cactus generally consists of gravelly or rocky surfaces on river terrace deposits and lower mesa slopes (USFWS 1990a). The species occurs on varying exposures, but is more abundant on south-facing exposures on slopes to about 30 percent grade, and where terrace deposits break from level tops to steeper side slopes. Uinta Basin hookless cactus is found at an elevation range of 4,400 to 6,200 feet amsl within the desert scrub vegetation community (USFWS 2006a). Species in the surrounding plant communities include the prickly pear cactus (*Opuntia polyacantha*), winterfat (*Ceratoides lanata*), yucca (*Yucca harrimaniae*), snakeweed (*Guiterrezia saroithrae*), low rabbitbrush (*Chrysothamnus viscidiflorus*), sand dropseed (*Sporobolus cryptandrus*), and Salina wildrye (*Elymus salinus*).

The Uinta Basin hookless cactus reproduction is sexual. Flowering occurs from April to May and fruiting occurs from May to June. Bees, flies, beetles, and ants have all been observed visiting hookless cactus flowers; however, the effective pollination vectors are not specifically known. Uinta Basin hookless cactus seeds are small and dense with no surface structures to facilitate dispersal. Seeds are dispersed by gravity, water flow, and possibly by insects and/or birds. Seed dispersal is possibly a limiting factor in the distribution of the species. The factors which govern long-term population dynamics are unknown. The relative size of the individual plants within a population covering one habitat type is considered to be primarily a function of the age of the individual plant and only secondarily a function of relative site quality (USFWS 1990a).

### ***Colorado Pikeminnow***

The Colorado pikeminnow (*Ptychocheilus lucius*) is Federally-listed as endangered under the ESA (32 FR 4001). The Colorado pikeminnow is endemic to the Colorado River Basin where it has adapted to rivers with seasonally variable flow, high silt loads, and turbulence. Historically in Utah, the Colorado pikeminnow was found in the Colorado, Green, Duchesne, San Juan, White, and Dolores Rivers, and probably numerous smaller streams (Holden and Stalnaker 1975; USFWS 1990b). Recently, occupied habitats of wild Colorado pikeminnow in Utah have been identified in the Green River (from Lodore Canyon to the confluence of the Colorado River), the White River (downstream of the Taylor Draw Dam and Kenny Reservoir), the lower 88.7 miles of the Price River, the lower Duchesne River, and the lower 1.2 miles of the Dolores River (USFWS 2002a).

Natural reproduction of Colorado pikeminnow in Utah is currently known from the Green and San Juan Rivers. A recent report on the status of Colorado pikeminnow in the Green River sub-basin (Bestgen et al. 2005) presented population estimates for adult and recruit-sized Colorado pikeminnow. The report suggests that over the study period (2001 to 2003) there was a decline in abundance of Colorado pikeminnow in the Green River sub-basin from 3,338 fish in 2001 to 2,324 fish in 2003. In the White River, abundance estimates for adults ranged from 1,100 fish in 2000 to 407 fish in 2003. This decline constituted 63 percent of the population (Bestgen et al. 2005). These estimates are lower than the preliminary population estimates presented in the Recovery Goals for this species, which ranged from approximately 6,600 to 8,900 wild adults: Green River sub-basin, 6,000–8,000 (Nesler 2000; USFWS 2002a); Upper Colorado River sub-basin, 600–900 (Nesler 2000; Osmundson 2002); and San Juan River sub-basin, 19–50 (Holden 1999; USFWS 2002a). Studies indicate that significant recruitment of Colorado pikeminnow

may not occur every year, but rather occur in episodic intervals of several years (Osmundson and Burnham 1998).

As an obligate warm-water species, the Colorado pikeminnow requires relatively warm temperatures for spawning, egg incubation, and survival of young. The species spawns during the spring and summer over riffle areas with gravel or cobble substrate at temperatures typically between 18 and 23ºC (64 and 73ºF) (USFWS 1990b; USFWS 2002a). Two principal spawning sites have been identified in the Green River sub-basin (Tyus 1990). Crowl and Bouwes (1998) estimated that 1,000 adults were associated with the spawning site near Three Fords Canyon in Gray Canyon of the lower Green River, and 1,400 adults were associated with the spawning site in the lower 19.8 miles of the Yampa River. Subadult Colorado pikeminnows move considerable distances upstream as they mature (USFWS 1990b; USFWS 2002a). Young produced in the lower Yampa River drift downstream to nurse in alluvial backwaters upstream of Desolation/Gray Canyons, while young produced in Gray Canyon nurse primarily in alluvial backwaters downstream of Desolation/Gray Canyons (USFWS 2002a). As the two stocks mix, they become undistinguishable. Therefore, there is only one mixed population in the Green River sub-basin, although two separate spawning sites exist (USFWS 2002a).

Throughout its historic range, major declines in Colorado pikeminnow populations occurred during the dam-building era (i.e., 1930s through the 1960s). Behnke and Benson (1983) found that dams drastically modified river hydrology throughout the Colorado River Basin by segmenting river ecosystems and altering stream flow. In addition, dams reduced water temperatures downstream of the dam, created lacustrine habitat, blocked native fish migrations, and improved conditions for non-native fish species. As such, the primary threats to Colorado pikeminnow are stream flow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by non-native fish species; and pesticides and pollutants (USFWS 2002a). Areas of existing habitat for Colorado pikeminnow have been modified to the extent that it impairs breeding, feeding, and sheltering behaviors (USFWS 2006b).

### ***Razorback Sucker***

The razorback sucker (*Xyrauchen texanus*) is Federally-listed under the ESA as endangered (56 FR 54957). The razorback sucker was once widely distributed and abundant in warm-water mainstream and major tributary rivers of the Colorado River Basin (Jordan and Evermann 1896; Minckley 1973; Minckley 1983). However, razorback sucker populations declined markedly in the last 50 years. Currently, razorback sucker are found in the Green River, upper Colorado River, and San Juan River sub-basins; lower Colorado River between Lake Havasu and Davis Dam; reservoirs of Lakes Mead and Mohave; and in small tributaries of the Gila River (USFWS 2002b).

In the Upper Colorado River Basin, the largest population of razorback sucker exists in low-gradient, flat-water reaches of the middle Green River between the Duchesne and Yampa Rivers (Tyus 1987; Bestgen 1990; Muth et al. 2000). Tag-recapture and telemetry data indicate that razorback sucker in the middle Green River constitute a single reproducing population. Known spawning sites have been located in the lower Yampa River and in the Green River near Escalante Ranch (about 308 miles upstream from the Colorado River confluence), but other less-used sites are also likely (Tyus and Karp 1990; Modde and Wick 1997; Modde and Irvin 1998). Bestgen et al. (2002) estimated the current population of wild adult razorback sucker in the middle Green River is about 100 adults. This reflects a dramatic decrease from the previous middle Green River population estimate of 948 adults, estimated by Lanigan and Tyus (1989).

The primary threats to the razorback sucker are similar to those identified above for the Colorado pikeminnow (USFWS 2006b). Stream flow regulation and associated habitat modification, following a period of dam construction throughout the Colorado River Basin, are identified as the primary threats to the razorback sucker, as the species is closely tied to variable streamflow conditions (USFWS 2002b). The construction of dams in existing razorback sucker habitats have generally reduced the magnitude of spring peak flow and increased the magnitude of summer-winter base flow. This loss or reduction of spring peak flows, along with channelization of the river corridor, has greatly reduced floodplain nurseries, which has greatly reduced reproductive success and recruitment of razorback suckers (USFWS 2002b). As such, areas of existing razorback sucker habitat have been modified to the extent that it impairs breeding, feeding, and sheltering behaviors (USFWS 2006b).

### ***Bonytail***

The bonytail (*Gila elegans*) is Federally-listed under the ESA as an endangered species (45 FR 27713). Historically, the bonytail was common in the warm-water reaches of the Green River below the Yampa River (BLM and USFWS 2006); however, currently there are no self-sustaining populations of bonytail in the wild, and very few bonytail have recently been captured in the Upper Colorado River Basin in Utah (USFWS 2002c). Research on the specific habitat requirements of the bonytail is limited because the species was extirpated from much of its historical range prior to extensive population studies (USFWS 2002c). The bonytail is considered to be adapted to mainstem rivers, where it has been observed in pools and eddies (Minckley 1973; Vanicek 1967). In the Green River, Vanicek (1967) reported that bonytails were generally found in pools and eddies in the absence of, although occasionally adjacent to, strong current and at varying depths generally over silt and silt-boulder substrates. Similar to other *Gila* species, bonytail probably spawn in the spring over rocky substrates in rivers; spawning has been observed in reservoirs over rocky shoals and shorelines (USFWS 2006b). As such, it has been hypothesized that flooded bottomlands may provide important bonytail nursery habitat (USFWS 2006b). Releases of hatchery-reared bonytail into the Upper Basin have resulted in low survival, with no evidence of reproduction or recruitment (USFWS 2002c).

The primary threats to bonytail are stream flow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by non-native fishes; hybridization with other native *Gila* spp.; and pesticides and pollutants (USFWS 2002c). With the exception of threats to bonytail related to hybridization, these threats are essentially the same as those discussed previously for the Colorado pikeminnow and razorback sucker. As such, areas of existing bonytail habitat have been modified to the extent that it impairs breeding, feeding, and sheltering behaviors (USFWS 2006b).

### ***Humpback Chub***

The humpback chub (*Gila cypha*) is Federally-listed under the ESA as an endangered species (32 FR 4001). Although the original distribution of the species is not known in great detail, humpback chub historically inhabited portions of the mainstem of the Colorado River and four of its tributaries: the Green, Yampa, White, and Little Colorado Rivers (USFWS 1990c). Today, six self-sustaining populations of humpback chub are known to exist, of which three occur in Utah. Populations in Utah are located in Westwater Canyon on the Colorado River, in Desolation/Gray Canyon on the Green River, and in Cataract Canyon on the Colorado River (USFWS 2002d). The following are preliminary population estimates for humpback chub populations in Utah: 2,000 to 5,000 fish in Westwater Canyon; 1,500 fish in Desolation/Gray Canyons; and 500 fish in Cataract Canyon (USFWS 2002d).

The humpback chub prefers deep, fast-moving, turbid waters often associated with large boulders and steep cliffs. Spawning occurs between April and July during high flows from snowmelt (Sigler and Sigler 1996). Tyus and Karp (1989) found that humpback chub occupy and spawn in and near shoreline eddy habitats, and that peak flows are important for reproductive success. Spring-runoff peak flows may be important for reproductive success as they create suitable spawning sites near shoreline eddy habitats.

The primary threats to the humpback chub are most similar to those identified above for the bonytail. The primary threats to humpback chub populations are streamflow regulation and habitat modification (including cold-water dam releases and habitat loss), competition with and predation by non-native fish species, parasitism, hybridization with other native *Gila* species, and pesticides and pollutants. As such, areas of existing humpback chub habitat have been modified to the extent that it impairs breeding, feeding, and sheltering behaviors (USFWS 2006b).

# HABITAT STATUS

## ***Shrubby Reed-Mustard***

Oil and gas exploration, drilling, and production, oil shale mining and processing, grazing, and off-road vehicle use are past, existing, and potential threats to shrubby reed-mustard habitat (USFWS 1994). All known populations of shrubby reed-mustard occur on lands leased for oil and gas exploration, drilling, and production (USFWS 1994). In addition, the entire range of the species is underlain by oil shale, which may be mined when economic conditions favor it. Therefore, the species is vulnerable to surface-disturbing activities associated with energy development within suitable and occupied habitats.

In addition to energy development, trampling of populations from vehicles and equipment is another potential threat to occupied shrubby reed-mustard habitats. Shrubby reed-mustard habitat is associated with commercially valuable native building stone composed of clasts of volcanic ash deposited in the prehistoric Uinta Lake during the Eocene epic. Previous commercial stone excavation has apparently caused the extirpation of a portion of the species population in the vicinity of Big and Little Pack Mountains.

Historically, sheep and cattle grazing may have also had an impact on shrubby reed-mustard (USFWS 1994).

According to Utah Natural Heritage Program (UNHP) 2003 data, approximately 12 distinct populations of shrubby reed-mustard have been documented. Potential habitat for the shrubby reed-mustard exists throughout the LCPA. BLM data show shrubby reed-mustard habitat in the western portion of the LCPA, west of Big Pack Mountain (BLM 2002a). Field surveys have been conducted for shrubby reed-mustard in portions of the LCPA by Buys & Associates (B&A) in 2006 and 2007 (see **Appendix E** for detailed methods).

In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWs in the HCU and LCU portions of the LCPA (B&A 2006a). Numerous wells and associated ROWs were cleared of occupied habitat, but several populations of shrubby reed-mustard were documented during the survey (B&A 2006a). Due to the high density of plants in the western portion of the LCU, block surveys were conducted in these areas. During the block

surveys, approximately 1,389 acres (or approximately 4% of the LCPA) were surveyed for occupied shrubby reed-mustard habitat (see **Appendix E** for detailed locations and survey methods). Approximately 26 acres of occupied habitat were identified in the block surveyed areas (B&A 2006b). Although this study was not designed to inventory the population of shrubby reed-mustard within the LCPA, field notes roughly estimate a minimum of 1,820 plants within the block surveyed area. All populations of the shrubby reed-mustard populations were buffered by 300 feet, and locations of proposed well pads and associated road and pipeline ROWs were relocated to avoid these areas.

In 2007, B&A conducted block surveys on approximately 10,454 acres (or approximately 31% of the LCPA) in the northern portions of the BPU of the LCPA (see **Appendix E** for detailed locations and survey methods). These block surveys were conducted to identify suitable habitat for shrubby reed-mustard. Of the 10,454 acres surveyed, approximately 1,680 acres of suitable habitat were identified during the survey (B&A 2007). Under the Conservation Alternative, well pads and associated ROWs would be situated to avoid suitable habitat, as feasible; however, if these areas cannot be avoided, the suitable habitat would be surveyed for occupied habitat.

### ***Clay Reed-Mustard***

As currently understood, clay reed-mustard grows in steep, nearly inaccessible sites which are unlikely to have been altered to a great extent by recent human activity. However, energy development and grazing are considered to be past, existing, and potential threats to clay reed-mustard habitat (USFWS 1994). All known populations of clay reed-mustard are on lands leased for oil and gas exploration, drilling, and production (USFWS 1994). In addition, the entire range of the species is underlain by oil shale, which may be mined when economic conditions favor it. Therefore, the species is vulnerable to surface-disturbing activities associated with energy development within suitable and occupied habitats.

Historically, sheep and cattle grazing may have had an impact on clay reed-mustard (USFWS 1994). However, based on the steep habitat in which the clay reed-mustard is found, grazing activity is somewhat limited within the habitat, and thus, grazing is not likely to have a substantial impact on the species.

Potential habitat for the clay reed-mustard exists throughout the LCPA. BLM data show areas of clay reed-mustard habitat throughout the LCPA (BLM 2002a). In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWS in the HCU and LCU portions of the LCPA (B&A 2006a). All surveyed locations were cleared of clay reed-mustard occupied habitat (B&A 2006a). In 2007, B&A conducted surveys for suitable clay reed-mustard habitat in the entire BPU of the LCPA (see **Appendix E** for detailed locations and survey methods). Of the approximately 19,690 acres assessed (or approximately 59% of the LCPA), about 1,177 acres were identified as suitable clay reed-mustard habitat (B&A 2007). Under the Conservation Alternative, well pads and associated ROWs would be situated to avoid suitable habitat as feasible; however, if these areas cannot be avoided, the suitable habitat would be surveyed for occupied habitat.

### ***Uinta Basin Hookless Cactus***

In Utah, range and population reductions of Uinta Basin hookless cactus from agricultural and water development may have occurred along river corridors within the Uinta Basin. However, there is no direct evidence that the range of Uinta Basin hookless cactus is any more restricted today than in the recent past.

Threats to the species include illegal collection, mineral and energy development activities, off-road vehicle use and recreational impacts, and pesticide use. The species is prized among collectors for its purplish-red flowers (USFWS 1979). When listing the species, the USFWS identified energy development and mining as adversely affecting the species (USFWS 1990a). Livestock also threatens Uinta Basin hookless cactus habitats. Uinta Basin hookless cactus may be vulnerable to various rangeland treatments used to control noxious and invasive weeds; either directly impacted by herbicides or indirectly affected as a result of effects on its pollinators (USFWS 1990a). Natural threats, such as disease, parasitism, or predation, are not thought to be significant (USFWS 1990a).

Although potential habitat for the Uinta Basin hookless cactus exists within the LCPA, the quality of potential habitat is considered poor for the species with largely sandy soils that lack a cobble surface (B&A 2006a). BLM data show only a small area of Uinta Basin hookless cactus habitat present in the southwestern portion of the LCPA (BLM 2002a).

Field surveys have been conducted for Uinta Basin hookless cactus and its suitable habitat in portions of the LCPA by B&A (see **Appendix E** for detailed locations and survey methods). In 2006, B&A conducted site-specific clearances for proposed well pads and associated road and pipeline ROWS in the HCU and LCU of the LCPA (B&A 2006a). All surveyed locations were cleared of Uinta Basin hookless cactus occupied habitat (B&A 2006a). Also in 2006, B&A conducted a block survey on approximately 1,389 acres of the western portion of LCU. Neither populations nor suitable habitat of the Uinta Basin cactus were identified during the block survey (B&A 2006b). In 2007, a block survey was conducted on approximately 10,454 acres in the northern portion of the BPU, which was designed to document suitable habitat of the cactus. Suitable habitat for the cactus was not identified during this survey (B&A 2007).

### ***Colorado River Fish***

The USFWS has identified three primary constituent elements determined necessary for survival and recovery of the Colorado River fish: water, physical habitat, and biological environment (59 FR 13374). Water includes a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species (59 FR 13374). The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding, and rearing habitats, or access to these habitats (59 FR 13374). Food supply, predation, and competition are important elements of the biological environment (59 FR 13374).

Critical habitat was designated for the Colorado River fish on March 21, 1994 (59 FR 13374). Details regarding the amount and specific locations of designated critical habitats for the four endangered Colorado River fish in Utah are provided below.

- ***Colorado Pikeminnow*** – A total of 726 river miles in Utah has been designated as critical habitat for the Colorado pikeminnow in portions of the Green, Colorado, White, and San Juan Rivers, and their 100-year floodplains (59 FR 13374).

- ***Razorback Sucker*** – A total of 688 river miles in Utah has been designated as critical habitat for the razorback sucker in portions of the Green, Colorado, Duchesne, White, and San Juan Rivers, and their 100-year floodplains (59 FR 13374).

- ***Bonytail*** – A total of 139 river miles in Utah has been designated as critical habitat for the bonytail in portions of the Green River and Colorado River, and their 100-year floodplains (59 FR 13374).

- ***Humpback Chub*** – A total of 139 river miles in Utah has been designated as critical habitat for the humpback chub in portions of the Green River and Colorado River, and their 100-year floodplains (59 FR 13374).

The LCPA, which contains portions of Hill Creek, Willow Creek, and several, small ephemeral drainages, does not contain critical habitat for any of the Colorado River fish. However, critical habitat for the Colorado pikeminnow and razorback sucker is located approximately 11.5 miles downstream from the LCPA (i.e., Willow Creek) in the Green River and its 100-year floodplain. As shown in **Figure 2**, critical habitat for the Colorado pikeminnow and razorback sucker is located at the confluence of Willow Creek with the Green River. Critical habitats for the bonytail and humpback chub are located further downstream in the Green River and its 100-year floodplain.

### ***Existing Environment***

The LCPA currently contains 94 producing natural gas and oil wells, and approximately 37 miles of roads and pipelines (UDOGM 2007). None of these wells are located within shrubby reed-mustard occupied habitat identified by B&A during the 2006 block surveys. The LCPA is drained by two perennial streams: Willow Creek and Hill Creek. Hill Creek flows north into Willow Creek, and Willow Creek reaches its confluence with the Green River near Ouray, Utah (approximately 11.5 miles from the LCPA). The Green River flows south through Desolation Canyon and down to the Colorado River.

The LCPA contains portions of eight grazing allotments on BLM, State, and private lands. All eight allotments in the LCPA are grazed by sheep or cattle during various grazing periods.

## EFFECTS

### ***Shrubby Reed-Mustard***

As previously discussed, suitable and occupied habitats of shrubby reed-mustard have been identified within the LCPA (B&A 2006b; B&A 2007). Proposed facility locations have been relocated to avoid identified occupied shrubby reed-mustard habitat during the planning process, and therefore as proposed, activities under the Conservation Alternative would not disturb any occupied shrubby reed-mustard habitats identified by B&A during the 2006 block surveys. However, as proposed, surface-disturbing activities under the Conservation Alternative could disturb approximately 84 acres of suitable shrubby reed-mustard habitat. In addition, potential habitat is found throughout much of the LCPA and it is likely that undocumented plants or populations could be scattered or could establish in the future within this habitat.

Where surveys have not already been completed, prior to any surface disturbance, all well pad sites, access roads, and any other areas to be disturbed in potential shrubby reed-mustard habitat would be examined by a botanist approved by the appropriate SMA to determine if suitable or occupied habitat is present. These surveys would be conducted during the growing season, at a time when the plant can be detected (from April 15th to August 1st), unless extended by the appropriate SMA. No disturbance of individual plants would occur. If shrubby reed-mustard plants are identified during these inventories, proposed facilities would be relocated in coordination with the appropriate SMA so as to avoid direct impacts to plants. Furthermore, as feasible, surface-disturbing activities would also be relocated to avoid direct impacts to occupied and suitable habitats.

Where surface-disturbing activities cannot be relocated (and therefore would be necessary in occupied or suitable habitats), the Conservation Alternative includes AEPMs designed to reduce or eliminate direct and indirect impacts of the proposed natural gas development. Measures that would specifically serve to protect the shrubby reed-mustard include funding of a shrubby reed-mustard seed bank and adherence to species-specific conservation measures for the shrubby reed-mustard (USFWS 2007a; see **Appendix A**), which include implementation of enhanced dust abatement techniques and a monitoring plan for activities that occur within 300 feet of known plants (i.e., where no alternate routes/locations are available). Implementation of these AEPMs would 1) avoid direct disturbance and minimize indirect impacts to populations and individual plants in occupied habitat and 2) minimize or offset direct and indirect impacts to suitable habitat.

Despite the implementation of the AEPMs discussed above, the construction of new roads and pipelines could potentially affect suitable shrubby reed-mustard habitat as described below.

The zone of impact from road construction is generally many times wider than the road surface and roadsides (Forman and Alexander 1998; Forman 2000). Roadside areas have been shown to have lower soil nutrient levels, reduced species richness, and a predominance of invasive species (Auerbach et al. 1997; Forman and Alexander 1998). Increased roadway access and vehicle traffic in the LCPA could also result in the spread of invasive and noxious weed species. Weed species compete with native plants and result in a deterioration of ecological conditions. Weed infestation can interfere with interim reclamation potential and can lead to weed encroachment into undisturbed areas, which could include suitable and occupied shrubby reed-mustard habitat. However, the likelihood of weed invasion in shrubby reed-mustard habitats would be minimized as the operator would implement noxious and invasive weed control techniques in disturbed areas throughout the life of the project, including enhanced weed monitoring in areas of surface disturbance within 300 feet of known plants.

Increased construction and vehicle use in the LCPA could lead to increased levels of dust in suitable shrubby reed-mustard habitat, despite enhanced dust abatement techniques. Dust is generally defined as fine, solid matter small enough to be raised and carried by the wind (Farmer 1993). Increased dust deposition on individual plants has been found to reduce photosynthesis, transpirations, and leaf conductance (Sharifi et al. 1997; Forman and Alexander 1998; Farmer 1993). Additionally, increased levels of airborne dust may change the overall habitat of the surrounding area by changing soil nutrient levels (Reynolds et al. 2001).

Changes in the water regime resulting from sedimentation could impact suitable shrubby reed-mustard habitat by changing soil nutrients and water availability. However, during construction, erosion control measures (i.e., non-structural controls and structural controls) would be implemented to ensure that impacts to habitat from changes in water flow and erosion would be

limited. Additionally, the operator would implement and adhere to SPCC plans to reduce impacts that could result in the event of a spill.

Despite the requirements to fund and initiate a seed bank collection, surface disturbance within suitable shrubby reed-mustard habitat could result in the loss of genetic integrity and disruption of seed dispersal and colonization processes. These impacts could occur as a result of loss of seed, fragmentation of suitable habitat, or physical and chemical changes to the habitat, as described above. Other impacts from development may include the loss of pollinators in the area. Fragmentation of pollinator habitat has been shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001; Donaldson et al. 2002).

### ***Clay Reed-Mustard***

As previously discussed, clay reed-mustard habitats have been identified within the LCPA (BLM 2002a; B&A 2007). B&A (2007) identified areas of suitable habitat within the northern portion of the BPU of the LCPA. As proposed, surface-disturbing activities under the Conservation Alternative could disturb approximately 10 acres of this suitable clay reed-mustard habitat. In addition, potential habitat is found throughout much of the LCPA and it is likely that undocumented plants or populations could be scattered or could establish in the future within this habitat.

Given the steep slopes on which the species occurs, it is unlikely that direct impacts to suitable or occupied clay reed-mustard habitat would occur. However, if any surface-disturbing activities are proposed within suitable habitat, prior to any surface disturbance, all proposed locations in suitable clay reed-mustard habitat would be examined by a botanist approved by the appropriate SMA to determine if plants are present. In areas where habitat is too steep to be surveyed safely, identified suitable habitat would be treated as occupied habitat and afforded the same protections. These surveys would be conducted within the proper seasonal timeframe when plants are most visible (usually May 1$^{st}$ to June 5$^{th}$). No disturbance of individual plants would occur. If clay reed-mustard plants are identified during these inventories, proposed facilities would be relocated in coordination with the appropriate SMA so as to avoid direct impacts to plants. Furthermore, as feasible, surface-disturbing activities would also be relocated to avoid direct impacts to occupied and suitable habitats.

Where surface-disturbing activities cannot be relocated (and therefore would be necessary in occupied or suitable habitat), the Conservation Alternative includes AEPMs designed to reduce or eliminate direct and indirect impacts of the proposed natural gas development. Measures that would specifically serve to protect the clay reed-mustard include adherence to species-specific conservation measures for the clay reed-mustard (USFWS 2007a; see **Appendix B**), which include implementation of enhanced dust abatement techniques and a monitoring plan for activities that occur within 300 feet of known plants (i.e., where no alternate routes/locations are available), and enhanced erosion control measures for surface-disturbing activities that occur within 300 feet of known plants. These enhanced erosion control measures within occupied habitat, which would serve to minimize or avoid project-related erosion or runoff into occupied habitats. Implementation of these AEPMs would 1) avoid direct disturbance and minimize indirect impacts to populations and individual plants in occupied habitat and 2) minimize direct and indirect impacts to suitable habitat.

As previously discussed, suitable clay reed-mustard habitat occurs on steep slopes, where due to the topography little development is practical or feasible. Therefore, direct impacts to suitable habitat for the clay reed-mustard would not likely occur. However, despite the low likelihood of direct and/or indirect impacts to clay reed-mustard suitable habitat and use of AEPMs discussed above, the construction of new roads and pipelines could potentially affect clay reed-mustard habitat within the LCPA, as described below.

The zone of impact from road construction is generally many times wider than the road surface and roadsides (Forman and Alexander 1998; Forman 2000). Reed et al. (1996) found that roads added to forest fragmentation more than clearcuts by increasing the amount of edge habitat. Roadside areas have been shown to have lower soil nutrient levels, reduced species richness, and a predominance of invasive species (Auerbach et al. 1997; Forman and Alexander 1998). Increased roadway access and vehicle traffic in the LCPA could also result in the spread of invasive and noxious weed species. Weed species compete with native plants and result in a deterioration of ecological conditions. Weed infestation can interfere with interim reclamation potential and can lead to weed encroachment into undisturbed areas, which could include suitable and occupied clay reed-mustard habitat. However, the likelihood of weed invasion in clay reed-mustard habitats would be minimized as the operator would implement noxious and invasive weed control techniques in disturbed areas throughout the LOP, including enhanced weed monitoring in areas of surface disturbance within 300 feet of known plants.

Additionally, increased construction and vehicle use in the LCPA could lead to increased levels of dust in suitable clay reed-mustard habitat, despite enhanced dust abatement techniques. Dust is generally defined as fine, solid matter small enough to be raised and carried by the wind (Farmer 1993). Increased dust deposition on individual plants has been found to reduce photosynthesis, transpiration, and leaf conductance (Sharifi et al. 1997; Forman and Alexander 1998; Farmer 1993). Additionally, increased levels of airborne dust may change the overall habitat of the surrounding area by changing soil nutrient levels (Reynolds et al. 2001).

Surface disturbance within suitable clay reed-mustard habitat, although unlikely, could include the loss of genetic integrity and disruption of seed dispersal and colonization processes. These impacts could occur as a result of loss of seed, fragmentation of suitable habitat, or physical and chemical changes to the habitat, as described above. Other impacts from development may include the loss of pollinators in the area. Fragmentation of pollinator habitat has been shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001; Donaldson et al. 2002).

### ***Uinta Basin Hookless Cactus***

A small area of Uinta Basin hookless cactus habitat was identified within the LCPA by the BLM in 2002 (BLM 2002a). However, during two years of habitat evaluations, no suitable or occupied habitat for the species was identified in the LCPA (B&A 2006; B&A 2007). The Conservation Alternative includes AEPMs designed to reduce or eliminate direct and indirect impacts of the proposed natural gas development in the LCPA. Measures that would specifically serve to protect the Uinta Basin hookless cactus include adherence to species-specific conservation measures (USFWS 2007a; see **Appendix C**). Based on these measures, direct impacts to Uinta Basin hookless cactus individuals or populations would not occur. The potential effects of the Conservation Alternative would therefore be limited to loss, fragmentation, or modification of

suitable or occupied habitat, should those habitats exist within the LCPA. Potential indirect effects are discussed below.

Illegal collection of the Uinta Basin hookless cactus is the primary threat to the conservation and recovery of the species on Utah BLM-administered lands. BLM land uses that may indirectly contribute to the illegal collection of the Uinta Basin hookless cactus include tracks created by seismic exploration buggies, road construction for oil and gas leases, and OHV use. Under the Conservation Alternative, approximately 77 miles of new roads would be constructed. Increased access to the LCPA via proposed roads could result in increased visitation by the public, increased access to occupied Uinta Basin hookless cactus habitats (should it occur there), and consequently, could potentially result in illegal collection of cactus individuals (should the species occur there).

A second concern related to increased roadway access and vehicle traffic in the LCPA is the potential for the introduction and spread of invasive and noxious weed species, and the potential for dust deposition on cactus, which can directly affect transpiration rates of the species. Weed species compete with native plants and result in a deterioration of ecological conditions (Gelbard and Belnap 2003). Weed infestation can interfere with reclamation potential and can lead to weed encroachment into undisturbed areas, including T&E plant species habitats such as that of the Uinta Basin hookless cactus. Based on this information, the potential for weed invasion into Uinta Basin hookless cactus habitat is a potential impact of the Conservation Alternative. However, based on the conservation measures in **Appendix C**, which include a requirement for enhanced weed monitoring and dust abatement within 100 feet of known plants, effects of weed invasion and dust deposition on the species would be reduced or eliminated.

Surface-disturbing activities would result in losses of vegetation, thereby potentially reducing habitat for pollinator species of Uinta Basin hookless cactus. Fragmentation of pollinator habitat has been shown to reduce the viability of pollinator populations and reproductive success (Murren 2002). Additional studies have suggested that pollination may be reduced because of reduced pollinator activity in disturbed and fragmented habitat (Moody-Weis and Heywood 2001; Donaldson et al. 2002).

Another potential indirect impact includes changes in surface water flow regimes associated with sedimentation and precipitation. Many of the known Uinta Basin hookless cactus populations are associated with small, ephemeral drainages or areas where stormwater flows across slopes. Surface disturbance associated with the construction of well pads, access roads, pipelines, etc., can lead to increased soil erosion, and stormwater runoff with heavy concentrations of sediment. The Uinta Basin hookless cactus is not tolerant of heavy sedimentation. Therefore sedimentation resulting from surface disturbance under the Conservation Alternative is a concern. However, environmental protection measures have been incorporated into the Conservation Alternative in order to reduce erosion and subsequent sediment yield. These measures would serve to reduce and partially mitigate the potential effects of sedimentation on Uinta Basin hookless cactus habitats, should surface disturbance occur within or near any suitable or occupied habitats.

### ***Colorado River Fish***

For the purposes of this BA, impacts to the Colorado River fish are analyzed collectively, as these species are all affected by activities that deplete and/or degrade the flow of downstream waters to the Upper Colorado River Basin, including portions of the Green River that contain designated

critical habitat. Implementation of development activities in the LCPA could affect Colorado River fish and their designated critical habitats downstream of the LCPA in the Green River by: 1) depleting water from the Upper Colorado River Basin; 2) increasing erosion and sediment deposition to Hill Creek, Willow Creek, and area drainages; and 3) potentially exposing fish to contaminants from accidental spills/leaks of pipelines, equipment, and production facilities.

The total estimated water use for the 510 proposed wells (from 362 well pads) during the seven-year drilling and completion phase would be about 1,734 acre-feet, or about 248 acre-feet per year. Beyond the drilling and completion phase (i.e., for the remainder of the LOP), the total estimated water use for dust suppression activities in the LCPA would be about 846 acre-feet, or about 47 acre-feet per year. Thus, for the entire LOP, the total estimated water use for construction, drilling, and dust abatement in the LCPA would be about 2,580 acre-feet.

Water would be obtained from several sources (see **Table 4** of this BA), all of which draw water directly from the Green River, a tributary to the Green River, or from alluvial deposits adjacent to the Green River. Therefore it is assumed that all water sources used for the proposed activities would draw water, directly or indirectly, from the Green River, and therefore from the Upper Colorado River Basin. The average annual flow in the Green River at Ouray is about 4,064,290 acre-feet (based on flow data from the USGS gauging station at Ouray). As such, the Conservation Alternative would deplete the average annual flow in the Green River by a maximum of about 0.003 percent.

The USFWS has determined that water depletions reduce flow throughout the Upper Colorado River Basin, leading to habitat losses that jeopardize the continued existence of the endangered Colorado River fish and modify or adversely affect their critical habitats. In addition, the USFWS has determined that new water depletions greater than 100 acre-feet can be offset by the water project proponent's one-time contribution to the Recovery Program. Payments are based on the project's average annual depletion and the rate is adjusted annually for inflation[1]. As such, based on the anticipated average annual water depletion to the Upper Colorado River Basin described above, Section 7 consultation with the USFWS and payment of a water depletion fee would be required to evaluate and offset impacts from water depletion to the Colorado River fish and their critical habitats in the Green River.

In addition, increased erosion and sediment deposition to Hill Creek, Willow Creek, and area drainages due to development activities (i.e., surface disturbance due to development of 362 well pads and associated roads and pipelines) in the LCPA could result in habitat degradation for Colorado River fish in the Green River. Specifically, degradation of critical habitat for the Colorado pikeminnow and razorback sucker could occur approximately 11.5 miles downstream of the LCPA in the Green River (i.e., at Willow Creek's confluence with the Green River). Degradation of critical habitats for the bonytail and humpback chub could also occur further downstream of the LCPA in the Green River. Soil loss calculations indicate that an estimated 5,388 tons per year of additional erosion could be expected to occur in the LCPA as a result of the Conservation Alternative; however, this erosion estimate is subject to considerable uncertainty. With the proper application and maintenance of erosion control measures (i.e., non-structural controls and structural controls), the actual amount of sediment that could potentially be transported to Hill Creek, Willow Creek, and the Green River would be much less than the erosion estimate listed above. For the purposes of estimating the amount of increased sediment

[1] The FY08 (October 1, 2007 – September 30, 2008) depletion fee is $17.79 per acre-foot. The greatest annual water depletion for this project is 248 acre-feet. Therefore, 248 acre-feet of water depletion multiplied by $17.79 per acre foot equals a water depletion fee of $4,411.92.

delivery, it is assumed that erosion controls would be 70 percent effective. As such, 30 percent of the increased erosion calculated (or 1,616 tons per year) could be expected to eventually be delivered to Hill Creek, Willow Creek, and eventually the Green River. Following interim reclamation, the additional sediment delivery would be reduced to about 1,173 tons per year.

Based on data collected at the USGS gauging stations (the median of the calculated sediment loadings in tons/year), existing sediment loading in Hill Creek near the mouth averages about 7,665 tons/year, and existing sediment loading in Willow Creek is considerably higher and averages about 91,615 tons/year. Annual sediment loading in the Green River at Ouray, Utah, is about 6,789,000 tons. The highest sediment loading occurs during the months of May and June from snowmelt runoff. If it is assumed that all sediment from the construction of pipelines and project facilities would eventually be transported to the Green River, the average annual sediment loading to the Green River would increase by about 0.02 percent.

Habitat degradation, including degradation of critical habitat for the Colorado River fish, could also result if a spill or leak from a pipeline or production facility were to occur. As proposed under the Conservation Alternative, 25 well pads[1] would be constructed within the 100-year floodplains of Hill and Willow Creeks. If a spill or leak were to enter Hill Creek, Willow Creek, or an area ephemeral drainage (such as during a storm event), contaminants would eventually enter the Green River where they would likely accumulate in backwater/depressional areas that have reduced dilution and less flushing capacity (Woodward et al. 1985). This could reduce habitat values (i.e., water quality and the biological environment) for Colorado River fish that utilize those sites for cover and food sources. Such contaminants have been shown to affect behavioral functions that impair feeding behavior (Woodward et al. 1985). Early life stages of all fish are generally more sensitive to environmental contaminants than juveniles or adults (Mayer and Ellersieck 1986) and disruption of behavioral functions can result in population declines or changes in year-class strength if enough individuals are affected (Little et al. 1993). However, it should be noted that impacts to critical habitat for the Colorado River fish due to potential chemical exposure would be reduced as the operator would implement and adhere to SPCC plans and would utilize closed-loop drilling within the 100-year floodplains of Hill and Willow Creeks.

# CUMULATIVE EFFECTS

The ESA defines cumulative effects (50 CFR 402.2) as the additive effects of State, Tribal, and private activities that are reasonably certain to occur in the area where the Federal action is proposed. This chapter discusses cumulative impacts as the incremental effects to specific resources or issues that would occur from the Conservation Alternative, in conjunction with other cumulative actions. Activities that have occurred or are reasonably foreseeable in the LCPA vicinity include recreation, livestock grazing, and oil and gas exploration, drilling, and production. **Table 6** provides the existing and reasonably foreseeable oil and gas development in the LCPA.

As of October 2007, approximately 117 wells had been drilled in the LCPA on non-Federal lands. Of these wells, 114 wells (about 97 percent) are currently active (i.e., producing; shut-in; drilling commenced), leaving 3 wells (about 3 percent) that have been plugged and abandoned (UDOGM

[1] A minimum of 25 wells (i.e., one vertical well per well pad) would be located within the floodplains of Hill and Willow Creeks within the LCPA. However, the total number of wells within these floodplains could not be determined as the locations of directionally-drilled wells within the LCPA are unknown.

2007). In addition, approximately 24 wells have been approved for drilling or have been submitted for a new permit to drill (UDOGM 2007). To estimate surface disturbance regarding existing and reasonably foreseeable oil and gas development in the LCPA, the following assumptions have been applied[1]:

Surface disturbance for a well pad: 2.4 acres;
Surface disturbance for an access road, assuming 0.73 acres/well; and
Surface disturbance for pipelines and flowlines: 0.47 acres/well.

Based on these assumptions, surface disturbance associated with existing and reasonably foreseeable oil and gas development would be approximately 507 acres, or 1.5% of the LCPA. The details are shown below in **Table 6.**

**Table 6. Surface Disturbance Associated with Existing, and Reasonably Foreseeable Oil and Gas Development in the LCPA**

| Existing Wells[1] | RFD Wells[1,2] | Total Existing and RFD Wells[3] | Well Pads (acres)[4] | Access Roads (acres)[4] | Pipelines (acres)[4] | Total Existing and Reasonably Foreseeable Surface Disturbance in the LCPA (acres)[5,6] | % of Total Acreage within LCPA |
|---|---|---|---|---|---|---|---|
| 117 | 24 | 141 | 338 | 103 | 66 | 507 | 1.5% |

[1] Source for well count: UDOGM 2007. Excludes all wells on Federal land.
[2] Number of RFD wells does not include those proposed under the Conservation Alternative.
[3] Sum of Existing Active Wells and RFD Wells.
[4] Calculated using assumptions discussed above.
[5] Calculated by adding well pad, access road, and pipeline acreages together
[6] Well pad disturbance is overestimated because it assumes one well per pad. In some cases, two or more wells may be drilled from a single well pad (i.e., directional drilling may be utilized).

**Table 7** shows the surface disturbance associated with the Conservation Alternative in relation to the cumulative surface disturbance within the LCPA.

**Table 7. Cumulative Oil and Gas Development Surface Disturbances in the LCPA, including the Conservation Alternative.**

| Total Existing and Reasonably Foreseeable Surface Disturbance in the LCPA (acres) | Total Surface Disturbance in the LCPA from the Conservation Alternative (acres) | Cumulative Surface Disturbance in the LCPA (acres) | Total Surface Disturbance in the LCPA from the Conservation Alternative as a % of Cumulative Surface Disturbance in the LCPA | Cumulative Surface Disturbance in the LCPA as a % of Total Acreage within the LCPA[1] |
|---|---|---|---|---|
| 507 | 1,882 | 2,389 | 78.8% | 7.2% |

[1] LCPA ≈ 33,240 acres

[1] Source for assumptions: (BLM 2002b)

**Plant Species**
The Cumulative Impact Analysis Area (CIAA) for threatened and endangered plant species is the LCPA. However, as the habitats have not been fully mapped, population estimates are unknown, and specific locations of other State or private land activities are not available, cumulative disturbance to threatened and endangered plant habitats in the CIAA cannot be quantified.

The Conservation Alternative could impact plants and suitable habitat which would incrementally contribute to cumulative impacts affecting habitats and populations of these special status plant species. Existing and reasonably foreseeable oil and gas projects have and would continue to contribute to incremental loss and fragmentation of suitable plant habitat within the LCPA and surrounding areas for these plant species. These activities would also have indirect effects such as sedimentation and weed invasion, and would cumulatively decrease the plants' recovery potentials. In addition, forage use by livestock grazing, wild horses, wildlife, and additional recreational use of habitats would also potentially disturb threatened and endangered plant habitat in and near the LCPA. These reductions of habitat could be compounded by other losses resulting from non-human induced conditions such as prolonged drought conditions.

**Fish Species**
Water depletions associated with the proposed natural gas development in the LCPA, in combination with water depletions from other activities in the surrounding area, would reduce the ability of the Upper Colorado River Basin to create and maintain the physical habitat and biological environment for the endangered Colorado River fish. In addition, increased erosion, sedimentation, and potential for contamination could eliminate spawning sites and thus decrease reproductive success. This would incrementally and cumulatively add to the degradation of designated critical habitat for these species in the Green River.

# CONCLUSIONS AND DETERMINATIONS

## ***Shrubby Reed-Mustard***

Based on the small number of known populations, limited extent of suitable habitat, and potential impacts to populations and habitat, the Conservation Alternative, even with adherence to AEPMs and creation of a seed bank, "***may affect, is likely to adversely affect***" the shrubby reed-mustard.

## ***Clay Reed-Mustard***

Based on the steep and mainly inaccessible habitat and the adherence to AEPMs, implementation of the Conservation Alternative "***may affect, is not likely to adversely affect***" the clay reed-mustard.

## ***Uinta Basin Hookless Cactus***

Given that the species' suitable and/or occupied habitat has not been documented in the LCPA, and furthermore that conservation measures in **Appendix C** would eliminate direct impacts to the species, and reduce or eliminate indirect impacts, implementation of the Conservation Alternative "***may affect, is not likely to adversely affect***" the Uinta Basin hookless cactus.

## ***Colorado River Fish***

Based on the estimated water depletion to the Upper Colorado River Basin and the increased potential for erosion, sedimentation, and contamination to Hill Creek and Willow Creek within the LCPA, implementation of the Conservation Alternative "***may affect, is likely to adversely affect***" the endangered Colorado River fish and "***may affect, is likely to adversely affect***" their designated critical habitats in the Green River.

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# APPENDIX A

## Shrubby Reed-Mustard Conservation Measures

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## Shrubby Reed-mustard *Schoenocrambe (=Glaucocarpum) suffrutescens*

In order to minimize effects to the Federally endangered shrubby reed-mustard, the BLM in coordination with the USFWS developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable shrubby reed-mustard habitat is present.

2. Within suitable habitat[2], site inventories will be done to determine occupancy. Inventories:

    a. Must be conducted by qualified individual(s) and according to BLM and Service accepted survey protocols,
    b. Will be conducted in suitable and occupied[3] habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected (April 15th to August 1st, unless extended by the BLM),
    c. Will occur within 300' from the centerline of the proposed right-of-way for surface pipelines or roads; and within 300' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until April 15th the following year.

3. Design project infrastructure to minimize impacts within suitable habitat[2]:

    a. Reduce well pad size to the minimum needed, without compromising safety,
    b. Limit new access routes created by the project,
    c. Roads and utilities should share common right-of-ways where possible,
    d. Reduce the width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    e. Place signing to limit off-road travel in sensitive areas, and
    f. Stay on designated routes and other cleared/approved areas.

4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:

    a. Follow the above (#3) recommendations for project design within suitable habitats,

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[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* is defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain shrubby reed-mustard; habitat descriptions can be found in the Federal Register 52(193):37416-37420 and in the USFWS' 1994 Utah Reed-Mustards Recovery Plan (http://www.fws.gov/endangered/wildlife.html).

[3] *Occupied habitat* is defined as areas currently or historically known to support shrubby reed-mustard; synonymous with "known habitat."

b. Construction of roads will occur such that the edge of the right of way is at least 300' from any plant,
c. Roads will be graveled within occupied habitat; the operator is encouraged to apply water for dust abatement to such areas from April 15th to May 30th (flowering period); dust abatement applications will be comprised of water only,
d. The edge of the well pad should be located at least 300' away from plants,
e. Surface pipelines will be laid such that a 300 foot buffer exists between the edge of the right of way and the plants, use stabilizing and anchoring techniques when the pipeline crosses the white shale strata to ensure the pipelines don't move towards the population,
f. Construction activities will not occur from April 15th through May 30th within occupied habitat,
g. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
h. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
i. Designs will avoid concentrating water flows or sediments into occupied habitat,
j. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
k. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied shrubby reed-mustard habitats within 300' of the edge of the surface pipeline right of ways, 300' of the edge of the road right of ways, and 300' from the edge of well pads shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the USFWS. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the Service.

6. Reinitiation of Section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the shrubby reed-mustard is anticipated as a result of project activities.

Additional site-specific measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the USFWS to ensure continued compliance with the ESA.

# APPENDIX B

## Clay Reed-Mustard Conservation Measures

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**Clay reed-mustard (*Schoenocrambe argillacea*)**

In order to minimize effects to the Federally threatened clay reed-mustard, the BLM in coordination with the USFWS developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100 percent of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable clay reed-mustard habitat is present.
2. Site inventories will be conducted within suitable habitat[2] to determine occupancy. Where standard surveys are technically infeasible and otherwise hazardous due to topography, slope, etc., suitable habitat will be assessed and mapped for avoidance (hereafter, "avoidance areas"); in such cases, in general, 300' buffers will be maintained between surface disturbance and avoidance areas. However, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat. Where conditions allow, inventories:
    a. Must be conducted by qualified individual(s) and according to BLM and USFWS accepted survey protocols,
    b. Will be conducted in suitable and occupied habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected (usually May 1st to June 5th, in the Uintah Basin; however, surveyors should verify that the plant is flowering by contacting a BLM or USFWS botanist or demonstrating that the nearest known population is in flower),
    c. Will occur within 300' from the right-of-way for surface pipelines or roads; and within 300' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until May 1st the following year.
3. Design project infrastructure to minimize impacts within suitable habitat[2]:
    a. Where standard surveys are technically infeasible, infrastructure and activities will avoid all suitable habitat (avoidance areas) and incorporate 300' buffers, in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
    b. Reduce well pad size to the minimum needed, without compromising safety,
    c. Limit new access routes created by the project,
    d. Roads and utilities should share common right-of-ways where possible,
    e. Reduce the width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    f. Place signing to limit off-road travel in sensitive areas, and
    g. Stay on designated routes and other cleared/approved areas.
4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:

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[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain clay reed-mustard; habitat descriptions can be found in Federal Register Notice and species recovery plan links at <http://www.fws.gov/endangered/wildlife.html>.

[3] *Occupied habitat* is defined as areas currently or historically known to support clay reed-mustard; synonymous with "known habitat."

a. Where standard surveys are technically infeasible, infrastructure and activities will avoid all suitable habitat (avoidance areas) and incorporate 300' buffers, , in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
b. Follow the above recommendations (#3) for project design within suitable habitats,
c. To avoid water flow and/or sedimentation into occupied habitat and avoidance areas, silt fences, hay bales, and similar structures or practices will be incorporated into the project design; appropriate placement of fill is encouraged,
d. Construction of roads will occur such that the edge of the right of way is at least 300' from any plant and 300' from avoidance areas,
e. Roads will be graveled within occupied habitat; the operator is encouraged to apply water for dust abatement to such areas from May 1st to June 5th (flowering period); dust abatement applications will be comprised of water only,
f. The edge of the well pad should be located at least 300' away from plants and avoidance areas, in general; however, site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
g. Surface pipelines will be laid such that a 300' buffer exists between the edge of the right of way and plants and 300' between the edge of right of way and avoidance areas; use stabilizing and anchoring techniques when the pipeline crosses suitable habitat to ensure pipelines don't move towards the population ; site specific distances will need to be approved by USFWS and BLM when disturbance will occur upslope of habitat,
h. Construction activities will not occur from May 1st through June 5th within occupied habitat,
i. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
j. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
k. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
l. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied clay reed-mustard habitats within 300' of the edge of the surface pipelines' right of ways, 300' of the edge of the roads' right of ways, and 300' from the edge of the well pad shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the USFWS. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the USFWS.

6. Reinitiation of Section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the shrubby reed-mustard is anticipated as a result of project activities.

Additional site-specific measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the USFWS to ensure continued compliance with the ESA.

# APPENDIX C

## Uinta Basin Hookless Cactus Conservation Measures

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## Uinta Basin Hookless Cactus (*Sclerocactus glaucus (= brevispinus* and *wetlandicus*)

In order to minimize effects to the Federally threatened Uinta Basin hookless cactus, the BLM in coordination with the USFWS, developed the following avoidance and minimization measures. Integration of and adherence to these measures will help ensure the activities carried out during oil and gas development (including but not limited to drilling, production, and maintenance) are in compliance with the ESA. The following avoidance and minimization measures should be included in the Plan of Development:

1. Pre-project habitat assessments will be completed across 100% of the project disturbance area within potential habitat[1] prior to any ground disturbing activities to determine if suitable Uinta Basin hookless cactus habitat is present.
2. Within suitable habitat[2], site inventories will be done to determine occupancy. Inventories:
    a. Must be conducted by qualified individual(s) and according to BLM and USFWS accepted survey protocols,
    b. Will be conducted in suitable and occupied[3] habitat for all areas proposed for surface disturbance prior to initiation of project activities and within the same growing season, at a time when the plant can be detected, and during appropriate flowering periods:
        i. *Sclerocactus brevispinus* surveys should be conducted March 15th to June 30th, unless extended by the BLM
        ii. *Sclerocactus wetlandicus* surveys can be done any time of the year, provided there is no snow cover,
    c. Will occur within 115' from the centerline of the proposed right-of-way for surface pipelines or roads; and within 100' from the perimeter of disturbance for the proposed well pad including the well pad,
    d. Will include, but not be limited to, plant species lists and habitat characteristics, and
    e. Will be valid until March 15th the following year for *Sclerocactus brevispinus* and one year from the survey date for *Sclerocactus wetlandicus*.
3. Design project infrastructure to minimize impacts within suitable habitat[2]:
    a. Reduce well pad size to the minimum needed, without compromising safety,
    b. Limit new access routes created by the project,
    c. Roads and utilities should share common right-of-ways where possible,
    d. Reduce width of right-of-ways and minimize the depth of excavation needed for the road bed; where feasible, use the natural ground surface for the road within habitat,
    e. Place signing to limit off-road travel in sensitive areas,
    f. Stay on designated routes and other cleared/approved areas, and
    g. All disturbed areas will be re-vegetated with native species comprised of species indigenous to the area and non-native species that are not likely to invade other areas.
4. Within occupied habitat[3], project infrastructure will be designed to avoid direct disturbance and minimize indirect impacts to populations and to individual plants:
    a. Follow the above (#3) recommendations for project design within suitable habitats,
    b. Buffers of 100 feet minimum between the edge of the right of way (roads and surface pipelines) or surface disturbance (well pads) and plants and populations will be incorporated,

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[1] *Potential habitat* is defined as areas which satisfy the broad criteria of the species habitat description; usually determined by preliminary, in-house assessment.

[2] *Suitable habitat* is defined as areas which contain or exhibit the specific components or constituents necessary for plant persistence; determined by field inspection and/or surveys; may or may not contain Uinta Basin hookless cactus. Habitat descriptions can be found in the U.S. Fish and Wildlife Service's 1990 Recovery Plan and Federal Register Notices for the Uinta Basin hookless cactus (http://www.fws.gov/endangered/wildlife.html).

[3] *Occupied habitat* is defined as areas currently or historically known to support Uinta Basin hookless cactus; synonymous with "known habitat."

c. Surface pipelines will be laid such that a 100 foot buffer exists between the edge of the right of way and the plants, use stabilizing and anchoring techniques when the pipeline crosses the habitat to ensure the pipelines don't move towards the population,
d. Before and during construction, areas for avoidance should be visually identifiable in the field, e.g., flagging, temporary fencing, rebar, etc.,
e. Where technically and economically feasible, use directional drilling or multiple wells from the same pad,
f. Designs will avoid concentrating water flows or sediments into occupied habitat,
g. Place produced oil, water, or condensate tanks in centralized locations, away from occupied habitat, and
h. Minimize the disturbed area of producing well locations through interim and final reclamation. Reclaim well pads following drilling to the smallest area possible.

5. Occupied Uinta Basin hookless cactus habitats within 100' of the edge of the surface pipelines' right-of-ways, 100' of the edge of the roads' right-of-ways, and 100' from the edge of the well pad shall be monitored for a period of three years after ground disturbing activities. Monitoring will include annual plant surveys to determine plant and habitat impacts relative to project facilities. Annual reports shall be provided to the BLM and the Service. To ensure desired results are being achieved, minimization measures will be evaluated and may be changed after a thorough review of the monitoring results and annual reports during annual meetings between the BLM and the Service.

6. Reinitiation of Section 7 consultation with the Service will be sought immediately if any loss of plants or occupied habitat for the Uinta Basin hookless cactus is anticipated as a result of project activities.

Additional measures may also be employed to avoid or minimize effects to the species. These additional measures will be developed and implemented in consultation with the USFWS to ensure continued compliance with the ESA.

# APPENDIX D

## Reclamation Plan for the Little Canyon Project Area Natural Gas Development Plan

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# Reclamation Plan for Little Canyon Project Area Natural Gas Development Plan[1]

This Reclamation Plan outlines measures to be taken to reclaim areas that would be disturbed by the implementation of the development proposed by XTO in the Hill Creek, Little Canyon, and Big Pack Units, referred to as the LCPA. The objectives of this reclamation plan are to re-establish vegetation, reduce dust and erosion, compliment the visual resources of the surrounding area, and generally minimize impacts to the environment.

The "Gold Book" calls for a reclamation plan that includes both interim and final reclamation (BLM and USFS 2007). Interim reclamation refers to measures applied to stabilize disturbed areas and to control runoff and erosion during time periods when application of final reclamation measures is not feasible or practicable. Interim reclamation would be implemented within 90 days after drilling of each well is complete on all disturbed areas that are not needed for production activities (this includes unused portions of road and pipeline ROWs, well pads, compressor stations, and any other disturbed areas). Final reclamation refers to measures that would be applied after well abandonment and at the end of the project. The lifespan of individual producing wells may vary; however, the typical lifespan of a well is estimated to be 20 to 30 years. For the purposes of this BA, the lifespan was assumed to be 25 years.

The reclamation plan follows the progression of proposed activities, which would occur in three main phases: 1) construction, drilling, and completion; 2) production and maintenance; and 3) decommissioning and reclamation. Reclamation activities that would occur during or following each of the three phases are discussed below.

## Phase I: Construction, Drilling, and Completion

Surface Disturbance:

- All surface disturbance would be kept to a minimum (i.e. existing roads would be utilized where possible, well pads would be constructed to minimize the size of the pad, while allowing for safe construction, drilling, and completion activities).

Fugitive Dust Control:

- XTO would use water or other approved dust suppressants approved by the appropriate SMA and USFWS at construction sites and along roads, as necessary, to abate fugitive dust.

Topsoil and Surface Preparations:

- At all construction sites, topsoil would be stockpiled separately from other soil materials and maintained for future use in rehabilitating the location. In most cases, drilling activities would be completed in approximately 20 days; therefore it is unlikely that lengthy topsoil stockpiling would be necessary.
- After well completion, salvaged topsoil would be evenly re-spread over disturbed surfaces not actively used during the production phase. Topsoil would be spread as thinly as possible in order to preserve soil microorganisms.

[1] This plan is a general reclamation plan developed for the LCPA. It does not include extra measures within occupied special status species habitat.

Reserve Pit Reclamation:

- After well completion, reserve pits would be refilled. Prior to filling, reserve pits would be dry and free of oil and other liquid or solid wastes. The liner would be pushed back into the pit and buried with previously excavated soil.

Interim Revegetation:

- After well completion, all disturbed areas not needed for the operation of the well would be reseeded. The interim seed mixture to be used would consist mainly of grass species and would be determined by the appropriate SMA's Authorized Officer during the ADP process. **Table 1** below provides an example interim seed mixture with suggested application rates.
- Private, State, and Tribal lands would be seeded with a similar seed mixture, unless the landowner requests a different seed mixture.
- Late fall is typically a good time of year to seed; however, timing of seeding would be adjusted depending upon weather, soil moisture conditions, and the plant species being used.
- Depending on topography and/or timing, seeding would be accomplished either by drill seeding or broadcasting. If the broadcast method is used, the seed rates established for drill seeding would be doubled.

### Table 1. Interim Reclamation Seed Mixture for the LCPA

| Common Name | Scientific Name | Rate [1,2] |
|---|---|---|
| **GRASSES** | | |
| Crested wheatgrass | *Agropyron cristatum* 'Hycrest'[3] | 4.0 lbs/acre |
| Bottlebrush squirreltail | *Elymus elymoides* | 4.0 lbs/acre |
| Needle and thread grass | *Stipa comata* | 4.0 lbs/acre |
| **FORBS** | | |
| Globemallow | *Sphaeralcea parvifolia* | 0.5 lbs/acre |
| **Pure Live Seed Total** | | **12.5 lbs/acre** |

[1] Rate numbers are in Pure Live Seed (PLS).
[2] Seed rates are specific to the drill seeding method. If broadcasting is used to disperse the seed, the seed rates above would be doubled.
[3] Either Hycrest variety would be used, or a more drought tolerant variety.

## Phase II: Production and Maintenance

Access:

- If necessary for safe access and operation during production, gravel or similar reinforcing material would be used on access routes and necessary portions of well pads (such as in clay soils) to stabilize these areas.

Noxious and Invasive Weeds:

- XTO would control noxious and invasive weeds along access roads, pipeline routes, well sites, or other applicable facilities by spraying or mechanical removal. A list of noxious weeds may be obtained from the BLM or the appropriate County Extension Office. On BLM-administered land, it is required that a Pesticide Use Proposal be submitted and approved prior to the application of herbicides, pesticides, or possibly hazardous chemicals.

Fugitive Dust Control:

- XTO would use water or other approved dust suppressants as approved by the appropriate SMA and USFWS at construction sites and along roads, as necessary, to abate fugitive dust.

## Phase III: Decommissioning and Reclamation

Plugging the Well:

- Prior to well abandonment, the operator shall submit and receive approval for the Sundry Notices and Reports on Wells (Form 3160-5) from the appropriate SMA's Authorized Officer.

Topsoil and Final Surface Preparation:

- After well plugging, all disturbed areas would be recontoured back to the original contour or a contour that blends with the surrounding landform (roads must also be reclaimed unless the appropriate SMA or surface owner requests that they be left unreclaimed).
- To achieve final reclamation of an area previously reclaimed using interim reclamation methods, all topsoil and vegetation must be restripped from areas that were not previously reshaped.
- The appropriate SMA's Authorized Officer would determine if any gravel or similar materials used to reinforce an area are to be removed or buried in place during final reclamation.
- Salvaged topsoil would be respread evenly over the surfaces to be revegetated.
- The soil surface would be prepared to provide a seedbed for re-establishment of desirable vegetation. Site preparation may include gouging, scarifying, dozer track-walking, mulching, or fertilizing. The appropriate seedbed preparations would be determined by the appropriate SMA's Authorized Officer at the time of final reclamation.

Final Revegetation:

- All disturbed and recontoured areas would be reseeded. The final seed mixture to be used would be similar to the vegetation of the surrounding areas and may consist of grasses, forbs, or shrubs. **Table 2** below provides an example final seed mixture with suggested application rates. Final determination of the appropriate seed mixture would be developed by the appropriate SMA's Authorized Officer on a site-specific basis at the time of field review of the facility.
- Private, State, and Tribal lands would be seeded with a similar seed mixture, unless the landowner requests a different seed mixture.
- Late fall is typically a good time of year to seed; however, timing of seeding would be adjusted depending upon weather, soil moisture conditions, and the plant species being used.
- Depending on topography or timing, seeding would be accomplished either by drill seeding or broadcasting. If the broadcast method is used, seed rates established for drill seeding would be doubled.
- Reclamation would be deemed successful when 70 percent of vegetative cover in a comparative or adjacent area has been re-established in the revegetated area.

### Table 2. Final Reclamation Seed Mixture for the LCPA

| Common Name | Scientific Name | Rate [1,2] |
|---|---|---|
| **GRASSES** | | |
| Bottlebrush squirreltail | *Elymus elymoides* | 1.5 lbs/acre |
| Galleta grass | *Hilaria jamesii* | 1.5 lbs/acre |
| Indian rice grass | *Achnatherum hymenoides* | 1.5 lbs/acre |
| Western wheatgrass | *Pascopyrum smithii* | 1.5 lbs/acre |
| Needle and threadgrass | *Stipa comata* | 1.5 lbs/acre |
| **FORBS** | | |
| Yellow beeplant | *Cleome lutea* | 0.3 lbs/acre |

| Common Name | Scientific Name | Rate [1,2] |
|---|---|---|
| Prostrate kochia | *Kochia prostrate* | 0.3 lbs/acre |
| Globemallow | *Sphaeralcea parvifolia* | 0.3 lbs/acre |
| **SHRUBS** | | |
| Fourwing saltbush | *Atriplex canescens* | 2 lbs/acre |
| Shadscale | *Atriplex confertifolia* | 1.5 lbs/acre |
| **Pure Live Seed Total** | | **11.9 lbs/acre** |

[1]Rate numbers are in Pure Live Seed (PLS).
[2] Seed rates are specific to the drill seeding method. If broadcasting is used to disperse the seed, the seed rates above would be doubled.

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# APPENDIX E

## Buys & Associates'
## LCPA T&E Plant Survey Methods

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**Buys & Associates'**
**LCPA T&E Plant Survey Methods**

## Shrubby Reed-mustard (*Schoenocrambe suffrutescens*):

**2006 Site-Specific Clearances**

- Location: all areas of proposed development (including access roads, pipelines, and well pads) within the LCU and HCU of the LCPA. T10S, R20E: Sections 27–34, 36, and those portions of Section 35 that fall within the LCPA. T11S, R20E: Sections 1–3, 9–12, 16, 17, and those portions of Sections 4 and 8 that fall within the LCPA. T11S, R21E: Section 6.

***Methods for 2006 Site-Specific Clearances:***
Buys & Associates (B&A) conducted surveys and habitat assessments for three threatened and endangered plant species (i.e., the Uinta Basin hookless cactus [*Sclerocactus wetlandicus*], shrubby reed-mustard, and clay reed-mustard [*Schoenocrambe argillacea*]) simultaneously[1]. Ground cover, topography, soils, and other habitat requirements were considered for each plant at all locations. All surveys took place between May and July, 2006, except for surveys conducted in T11S, R20E: Section 16, which were performed in August 2006.

All areas inside of and within 300 feet of proposed well pads, access roads, and pipelines were surveyed for shrubby reed-mustard plants. Ground cover was inspected for suitable habitat (semi-barren, white shale layers with xeric, shallow, fine-textured soils intermixed with shale fragments) and plant populations. Biologists walked transect lines spaced 30 feet apart at approximately 1.5 to 2.5 miles per hour, inspecting the ground cover for shrubby reed-mustard.

**2006 Block Survey**

- Location: T11S, R20E: Sections 9,17, and those portions of Section 8 that fall within the LCPA.

***Methods for 2006 Block Survey:***
B&A performed a block survey on these areas between July 25th and August 5th, 2006. A total of approximately 1,389 acres were surveyed. All areas were canvassed with north-south trending transects spaced 30 feet apart. These transects were created using GIS software and were denoted alphabetically in order to be unique to each section. Sections 9 and 17 each contained 176 transects 1 mile in length, and those portions surveyed in Section 8 contained 44 transects, each ¾ mile in length. In portions of the survey area where slopes were too steep for biologists to safely traverse the topography, transects were not walked.

Ten biologists were on the ground at all times during the block surveys. Each biologist carried a handheld GPS unit (Garmin E-trex or Garmin Rhino) loaded with coordinates denoting transect lines. Biologists used the GPS units to determine if they were located on their transect line. However, in order to decrease the amount of time spent navigating, two biologists acted as anchors and all other biologists spaced themselves approximately 30 feet apart based on those

[1] Refer to species-specific sections in this Appendix for methods used for Uinta Basin hookless cactus and clay reed-mustard surveys.

two individuals. Two-way radios were used for communication between biologists. Transects were walked at approximately 2 to 3 miles per hour.

When shrubby reed-mustard plants were identified, all ten biologists stopped and placed a marker at the point along their transect line where they stopped. All ten biologists then worked together to survey the area of occupied habitat in which the plant was identified. For small populations, all individual plants were marked with pin flags located within 1 meter of the plant, but not within the plant's root system. For larger populations, pin flags were placed around the outside boundary of the population. All pin flags were left in place after the survey. The perimeter of the plant population was recorded using a handheld GPS unit. Notes on the number of plants (estimated for larger populations), plant characteristics (e.g., average size, condition, and aspect or slope), habitat characteristics (e.g., soils, vegetation, and topography), and population location were recorded in field notebooks. Photographs were taken of plants and habitat.

Information stored within GPS units and in digital cameras was downloaded on a daily basis. Field notes were collected at the end of the survey. All location data were transferred into a GIS program.

**2007 Block Survey**

- Location: T11S, R20E: Sections 13-15, 20-29, 32, 33, and those portions of Sections 19, 30, and 31.

***Methods for 2007 Block Survey:***

At the request of XTO (formerly Dominion), B&A performed a shrubby reed-mustard habitat assessment for portions of the BPU (Uinta Basin hookless cactus habitat assessments were also performed concurrently). The intent of the survey was to map all suitable habitat for the shrubby reed-mustard within the area listed above.

Approximately 10,454 acres were surveyed. All areas were canvassed with east-west trending transects spaced 100 feet apart. These transects were created using GIS software and were denoted numerically. In portions of the survey area where slopes were too steep for biologists to safely traverse the topography, transects were not walked.

Five to ten biologists were on the ground at all times during the block surveys. Each biologist carried a handheld GPS unit (Garmin 60CSx) loaded with coordinates denoting transect lines. Biologists used the GPS units to determine if they were located on their transect line. Two-way radios were used for communication among biologists. Transects were walked at approximately 2 to 3 miles per hour.

Shrubby reed-mustard suitable habitat was characterized by the following parameters: semi-barren, white shale layers derived from the Evacuation Creek Member of the Green River Formation, in xeric, shallow, fine-textured soils intermixed with shale fragments.

When a biologist entered shrubby reed-mustard suitable habitat, he/she stopped and marked a waypoint location in their GPS unit. Items denoted in the waypoint name included: the direction being walked, ID of the person recording the point, and the letter B (denoting the beginning of suitable habitat). After entering this waypoint, the biologist continued walking his/her transect. When the biologist exited shrubby reed-mustard suitable habitat, he/she repeated the above denotation system except he/she used the letter E (denoting the end of habitat) instead of the letter B. If small areas of suitable habitat were identified, biologists marked an area on their GPS unit

to represent the perimeter of this habitat polygon. Additional waypoints were recorded when biologists stopped due to topography.

Data collected in handheld GPS units were downloaded on a daily basis. When all data had been collected for the survey area, the waypoints were displayed on large scale aerial photographs. Senior biologists, with the assistance of field crew leaders, drew in habitat polygons by hand based upon the waypoints displayed on the aerial photographs. These were in turn digitized by GIS Specialists to create shapefiles.

## Clay Reed-mustard (*Schoenocrambe argillacea*):

### 2006 Site-Specific Clearances

- Location: all areas of proposed development (including access roads, pipelines, and well pads) within the LCU and HCU of the LCPA. T10S, R20E: Sections 27–34, 36, and those portions of Section 35 that fall within the LCPA. T11S, R20E; Sections 1–3, 9–12, 16, 17, and those portions of Sections 4 and 8 that fall within the LCPA. T11S, R21E: Section 6.

***Methods for 2006 Site-Specific Clearances:***

B&A conducted surveys and habitat assessments for three threatened and endangered plant species (i.e., the Uinta Basin hookless cactus, shrubby reed-mustard, and clay reed-mustard) simultaneously[1]. Ground cover, topography, soils, and other habitat requirements were considered for each plant at all locations. All surveys took place between May and July, 2006, except for surveys conducted in T11S, R20E: Section 16, which were performed in August 2006.

All areas inside of and within 300 feet of proposed well pads, access roads, and pipelines were surveyed for clay reed-mustard plants. Ground cover was inspected for suitable habitat (clay soils rich in gypsum, overlain with sandstone talus, that are derived from a mixture of shales and sandstones from the zone of contact between the Uinta and Green River geologic formations) and plant populations. In areas where topography was too steep to safely walk transects, biologists walked as close as possible to habitat and utilized binoculars to identify mustards and/or mustard-like plants. If mustard or mustard-like plants were identified, where feasible, biologists walked to the plants and identified them using a dichotomous key.

### 2007 Habitat Assessment

- Location: T11S R20E: Sections 13-15, 20-29, 32-36, and those portions of Sections 19, 30, and 31 that fall within the LCPA. T12S R20E: Sections 1-5, 7, 18, and those portions of Sections 6, 8-10, and 12 that fall within the LCPA.

***Methods for 2007 Habitat Assessment:***

At the request of XTO (formerly Dominion), B&A performed a clay reed-mustard habitat assessment of the BPU of the LCPA. The intent of the survey was to map all suitable habitat for the clay reed-mustard in this area.

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[1] Refer to species-specific sections in this Appendix for methodologies used for Uinta Basin hookless cactus and shrubby reed-mustard surveys.

Approximately 19,690 acres were surveyed. Clay reed-mustard habitat is highly restricted to certain areas on the landscape and is visually quite distinct from a distance. Habitat characteristics include: gullies, overhangs, and bases of shrubs and grasses on clay soils rich in gypsum, overlain with sandstone talus that are derived from a mixture of shale and sandstone from the zone of contact between the Uinta and Green River geologic formations.

Clay reed-mustard habitat is located in an area that is too steep to safely survey by foot. Therefore, two biologists drove (or walked if necessary) through the BPU identifying suitable habitat (i.e., the contact zone of the Uinta and Green River formations) from a distance. While one biologist identified suitable habitat, a second biologist drew the suitable habitat location on an electronic topographical map in the Topo!Pro software program available from National Geographic. All existing roads within and around the BPU were traveled during the survey and some areas inaccessible to motorized vehicles were reached by walking. Data stored in the Topo!Pro software were then downloaded into a GIS program and converted into a shapefile.

## Uinta Basin Hookless Cactus (*Sclerocactus wetlandicus*):

**2006 Site-Specific Clearances**

- Location: all areas of proposed development (including access roads, pipelines, and well pads) within the LCU and HCU of the LCPA. T10S, R20E: Sections 27–34, 36, and those portions of Section 35 that fall within the LCPA. T11S, R20E; Sections 1–3, 9–12, 16, 17, and those portions of Sections 4 and 8 that fall within the LCPA. T11S, R21E: Section 6.

***Methods for the 2006 Site-Specific Clearances:***

B&A conducted surveys and habitat assessments for three threatened and endangered plant species (i.e., the Uinta Basin hookless cactus, shrubby reed-mustard, and clay reed-mustard) simultaneously. Ground cover, topography, soils, and other habitat requirements were considered for each plant at all locations. All surveys took place between May and July, 2006, except for surveys conducted in T11S, R20E: Section 16, which were performed in August 2006.

All areas of and within 100 feet of proposed development were surveyed for the presence of Uinta Basin hookless cacti. Where surface soil characteristics for the cactus were considered marginal, biologists walked transects spaced at 30 feet apart. However, in areas where clay soils laden with cobbles were present, biologists walked transects spaced between 6 to 8 feet apart. Biologists walked transect lines simultaneously at approximately 1.5 to 2.5 miles per hour, inspecting the ground cover for Uinta Basin hookless cactus.

**2006 Block Survey**

- Location: T11S, R20E: Sections 9, 17, and those portions of Section 8 that fall within the LCPA.

***Methods for the 2006 Block Survey:***

B&A performed a block survey on these areas between July 25$^{th}$ and August 5$^{th}$, 2006. A total of approximately 1,389 acres were surveyed. All areas were canvassed with north-south trending transects spaced 30 feet apart. These transects were created using GIS software and were denoted alphabetically in order to be unique to each section. Sections 9 and 17 each contained 176 transects one mile in length, and those portions surveyed in Section 8 contained 44 transects, each

¾ mile in length. In portions of the survey area where slopes were too steep for biologists to safely traverse the topography, transects were not walked.

Ten biologists were on the ground at all times during the block surveys. Each biologist carried a handheld GPS unit (Garmin E-trex or Garmin Rhino) loaded with coordinates denoting transect lines. Biologists used the GPS units to determine if they were located on their transect line. However, to decrease the amount of time spent navigating, two biologists acted as anchors and all other biologists spaced themselves approximately 30 feet apart based on those two individuals. Two-way radios were used for communication among biologists. Transects were walked at approximately 2 to 3 miles per hour.

Uinta Basin hookless cactus suitable habitat was characterized by the following parameters: river benches, valley slopes, and rolling hills of the Duchesne River, Green River and Mancos formations in xeric, fine-textured clay soils overlain with cobbles and pebbles in sparsely vegetated communities.

If Uinta Basin hookless cactus suitable habitat had been identified during the survey, biologists would have abandoned the 30 foot transects and concentrated on surveying these habitats using 15 foot transect spacing. At this time, biologists would have searched for individual Uinta Basin hookless cactus plants. If plants were identified, all ten biologists would have stopped and placed a marker at the point along their transect line where they stopped. All ten biologists would have then worked together to survey the area in which the plant was identified. All individual plants would have been marked with pin flags located within 1 meter of the plant, but not within the plant's root system. All pin flags would have been removed prior to completion of the survey. The perimeter of the plant population would have been marked using a handheld GPS unit. Notes on the number of plants (estimated for larger populations), plant characteristics (e.g., average size, condition, and aspect or slope), habitat characteristics (e.g., soils, vegetation, and topography), and population location would have been recorded in field notebooks. Photographs would have been taken of the plants and surrounding habitat. When all of the above had been accomplished for each population, biologists would have returned to their transect lines and continued surveying from where they left off.

Information stored within GPS units and in digital cameras was downloaded on a daily basis. Field notes were collected at the end of the survey. All location data for Uinta Basin hookless cactus occupied habitat would have been transferred in to a GIS program for mapping purposes.

**2007 Block Survey**

- Location: T11S, R20E: Sections 13-15, 20-29, 32, 33, and those portions of Sections 19, 30, and 31 that fall within the LCPA.

***Methods for 2007 Block Survey:***

At the request of XTO (formerly Dominion), B&A performed a Uinta Basin hookless cactus habitat assessment for portions of the BPU (shrubby reed-mustard habitat assessments were also performed at the same time). The intent of the survey was to map all suitable habitat for the Uinta Basin hookless cactus within the area listed above.

Approximately 10,454 acres were surveyed. All areas were canvassed with east-west trending transects spaced 100 feet apart. These transects were created using GIS software and were

denoted numerically. In portions of the survey area where slopes were too steep for biologists to safely traverse the topography, transects were not walked.

Five to ten biologists were on the ground at all times during the block surveys. Each biologist carried a handheld GPS unit (Garmin 60CSx) loaded with coordinates denoting transect lines. Biologists used the GPS units to determine if they were located on their transect line. Two-way radios were used for communication among biologists. Transects were walked at approximately 2 to 3 miles per hour.

Uinta Basin hookless cactus suitable habitat was characterized by the following parameters: river benches, valley slopes, and rolling hills of the Duchesne River, Green River, and Mancos formations in xeric, fine-textured clay soils overlain with cobbles and pebbles in sparsely vegetated communities.

If a biologist had entered Uinta Basin hookless cactus suitable habitat during the survey, he/she would have stopped and marked a waypoint location in their GPS unit. Items denoted in the waypoint name would have included: the direction being walked, ID of the person recording the point, and the letter B (denoting the beginning of suitable habitat). After entering this waypoint, the biologist would have continued walking his/her transect. When the biologist exited Uinta Basin hookless cactus suitable habitat, he/she would have repeated the above denotation system except he/she would have used the letter E (denoting the end of habitat) instead of the letter B. If small areas of suitable habitat had been identified, biologists would have marked an area on their GPS units to represent the perimeter of this habitat polygon. Additional waypoints would have been recorded when biologists stopped due to topography.

Data collected in handheld GPS units were downloaded on a daily basis. All waypoints for Uinta Basin hookless cactus suitable habitat would have been displayed on large scale aerial photographs. Senior biologists, with the assistance of field crew leaders, would have drawn in habitat polygons by hand based upon the waypoints displayed on the aerial photographs. These would have in turn been digitized by GIS Specialists to create shapefiles.