CHAPTER 2.0
PROPOSED ACTION AND ALTERNATIVES

2.0 PROPOSED ACTION AND ALTERNATIVES

The National Environmental Policy Act (NEPA) requires that a practical range of reasonable alternatives be considered and evaluated; these alternatives must meet the project's purpose and need while minimizing or avoiding environmental impacts. This practical range of reasonable alternatives is formulated to address issues and concerns raised by the public and by agencies during scoping. The alternatives represent other means (methods, processes, locations, times, sequences, etc.), besides the Proposed Action, of satisfying the stated purpose and need for the federal action. Reasonable alternatives are defined by the Council on Environmental Quality (CEQ) as those that are technically, economically, and environmentally practical and feasible. NEPA also requires that a No Action Alternative be evaluated for comparison to the other alternatives analyzed in the environmental impact statement (EIS). If unreasonable alternatives or alternatives that do not meet purpose and need are suggested, a detailed analysis of these alternatives is not required. However, the rationale for eliminating them from detailed analysis must be explained.

This chapter presents six alternatives that were considered in detail for this EIS:

- Alternative A: The (applicant's) Proposed Action,
- Alternative B: Reduced Development
- Alternative C: Full Development
- Alternative D: No Action
- Alternative E: Reduced Development with Directional Drilling
- Alternative F: The Agency Preferred Alternative

Alternative A is the applicant's Proposed Action for extracting natural gas. Alternatives B, C, E, and F were developed in response to issues raised during the agency and public scoping process. These alternatives would generally incorporate the same construction, operational, decommissioning, and reclamation components as the Proposed Action, but with additional considerations applied to actions taking place on federal lands. The Bureau of Land Management (BLM) has identified Alternative F as the Agency Preferred Alternative because it best addresses issues raised in scoping and public comments on the Draft EIS about impacts to a number of resources, while meeting the purpose and need for the project. It was designed to avoid impacts to the Green River and Nine Mile Canyon and to reduce other surface impacts through directional drilling and through a reduced number of produced water evaporative ponds.

Under the No Action Alternative natural gas exploration and development would continue on federal, state, and private lands, albeit at a much smaller scale than under the action alternatives. Activity on federal lands would come from exploratory projects previously approved by BLM, and it is assumed that they would also come from other subsequent authorizations by BLM, such as approval of wells to meet unit and/or lease obligations. In addition, development would likely continue on State of Utah and private lands, subject to the approval of Utah Division of Oil, Gas, and Mining (UDOGM) and the appropriate landowner. Reasonable access across public lands to proposed well pads and facilities on state and private lands could also occur under the No Action Alternative.

Several other alternatives were identified and considered but were eliminated from detailed analysis. These alternatives are described in Section 2.8 along with the rationale for eliminating them from detailed analysis.

2.1 MANAGEMENT ACTIONS COMMON TO ALL ALTERNATIVES

Table 2-1 provides a description of regulatory requirements, standard operating practices, and applicant-committed best management practices (BMPs) that would be applied under all alternatives. As these requirements and BMPs are generally specific to a particular stage of oil and gas development, the table is subdivided by requirements and commitments specific to predrilling, construction, drilling, completion, production and maintenance, and final reclamation and abandonment. The measures listed under each of these stages are then further subdivided into either a list of regulatory requirements or applicant-committed oil and gas BMPs.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
PRE-DRILLING	
Regulatory Requirements and BLM Policy Guidelines	
Environmental Protection Agency (EPA) Spill Prevention Control and Countermeasures (SPCC) Regulations (40 Code of Federal Regulations [CFR] 112)	Gasco would implement and adhere to SPCC plans and provide an orientation to personnel to ensure they are aware of the potential effects of accidental spills, as well as the appropriate recourse if a spill does occur (40 CFR 112). Where applicable and/or required by law, streams at pipeline crossings would be protected from contamination by pipeline shutoff valves or other systems capable of minimizing accidental discharge. Gasco would maintain a complete copy of the applicable SPCC plan at each facility, if the facility is normally attended at least 8 hours per day, or at the nearest field office (FO).
Section 404, Federal Water Pollution Control Act (Clean Water Act) (33 United States Code [USC] 1251, et seq.)	Any disturbances to wetlands and/or waters of the United States would be authorized by the Utah Department of Environmental Quality/Division of Water Quality (UDEQ/DWQ) in cooperation with the U.S. Army Corps of Engineers (USACE) State Engineer's Office. Section 404 permits would be secured as necessary prior to disturbance.
Occupational Safety and Health Administration (OSHA) Regulations (29 CFR 1910.1200)	Gasco would institute a Hazard Communication Program for its personnel and require that subcontractor programs be in accordance with the regulations of OSHA (29 CFR 1910.1200). In addition, a Material Safety Data Sheet (MSDS) for every chemical or hazardous material brought on-site would be kept on-site or on file at Gasco's FO.
BLM Manual 1745, Introduction, Transplant, Augmentation, and reestablishment of Fish, Wildlife, and Plants; Executive Order No. 11987, Exotic Organisms	Seed mixtures for reclaimed areas would be site-specific as directed by the authorizing officer (AO), would favor native species, and would include species promoting soil stability. Livestock palatability and wildlife habitat needs would be given consideration during seed mix formulation. BLM Manual 1745 and Executive Order No. 11987 would be used as guidance.
BLM/U.S. Forest Service (USFS) Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 4	Gasco would use existing topography to screen roads, pipeline corridors, drill rigs, wells, and production facilities from view where practical. Gasco would paint all aboveground production facilities with appropriate colors (or specified standard environmental colors) to blend with adjacent terrain, except for structures that require safety coloration in accordance with OSHA requirements.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
BLM Condition of Approval (COA) for Right-of-Way Grant, and Utah Division of Oil, Gas and Mining (UDOGM) (Utah Administrative Code R649-9-1)	Evaporation pond facilities would require site-specific hydrologic site characterization prior to permitting by the UDOGM and BLM. The UDOGM and BLM would require compliance with all specifications contained in Utah Administrative Code R649-9-3, and would require that evaporation ponds be lined and incorporate leak detection to be permitted by UDOGM. Pits constructed in relatively impermeable soils would have an underlying gravel-filled sump and lateral system or a suitable leak detection system. Pits constructed in relatively permeable soils would have a secondary liner underlying the leak detection system that is graded to direct leaks to the observation sump.
Applicant-committed BMPs	
Applicant-committed measures and design features	Pipeline construction methods and practices would be planned and conducted with the objective of enhancing reclamation and reestablishment of the native plant community. Gasco would inform its personnel, contractors, and subcontractors of relevant federal regulations intended to protect archaeological and cultural resources. Gasco would require that personnel, contractors, and subcontractors abide by all state and federal laws and regulations regarding hunting.
CONSTRUCTION	
Regulatory Requirements and BLM Policy Guidelines	
Onshore Oil and Gas Order No. 1 (43 CFR 3152)	On federal land, operators would prepare and submit individual comprehensive drill-site design plans for BLM approval. These plans would show the drill location layout over the existing topography; dimensions of the locations, volumes, and cross sections of cut and fill; location and dimensions of reserve pits; existing drainage patterns; and access road egress and ingress. Plans would be submitted and approved prior to initiation of construction. Well pads and associated roads and pipelines would be located to avoid or minimize impacts in areas of important ecological value (e.g., sensitive species habitats and wetland/riparian areas).
BLM Manual 9113—Roads	Roads on BLM surface would be constructed as described in BLM Manual 9113. Running surfaces of roads may be graveled if the road base does not already contain sufficient aggregate. Existing roads would be used when the alignment is acceptable for the proposed use. Generally, roads would be required to follow natural contours and provide visual screening by constructing curves, etc. All roads would be reclaimed to BLM standards.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
BLM Manual, Section 8400 (43 CFR 2802); BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 4	Pipeline rights-of-way (ROWs) would be located within existing ROWs whenever possible and aboveground facilities not requiring safety coloration would be painted with appropriate non-reflective standard environmental colors, as specified by AO. Topographic screening, vegetation manipulation, project scheduling, and traffic-control procedures may all be employed as specified by the AO to further reduce visual impacts.
BLM Regulations (43 CFR 2802) regarding applications for ROWs; BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 4	Salvage and subsequent replacement of topsoil would occur for surface-disturbing activities wherever practical.
Section 404, Federal Water Pollution Control Act (Clean Water Act) (33 USC 1251, et seq.)	Where disturbance of regulated U.S. waters cannot be avoided, Gasco would obtain Clean Water Act (CWA) Section 404 permits as required. Operations would be conducted in conformance with the requirements of the approved permits.
Uniform Building Code Standards	Wells, pipelines, and ancillary facilities would be designed and constructed such that they would not be damaged by moderate earthquakes. Any facilities defined as critical according to the Uniform Building Code would be constructed in accordance with applicable Uniform Building Code Standards for Seismic Risk Zone 28.
BLM Regulations (36 CFR 800) implementing Section 106; National Historic Preservation Act (NHPA) (16 USC 470, et seq.)	If cultural resources are located within frozen soils or sediments that preclude the possibility of adequately recording or evaluating the find, construction would cease and the site would be protected for the duration of frozen soil conditions. Recordation, evaluation, and recommendations concerning further management would be made to the AO following natural thaw. The AO would consult with the affected parties, and construction would resume once management of the threatened site has been finalized and a Notice to Proceed has been issued.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
BLM Manual 9112 (Bridges and Major Culverts) and Manual 9113 (Roads); BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 4	Streams/channels crossed by roads would have culverts installed at all appropriate locations as specified in BLM Manuals 9112 and 9113. Low-water crossings can be effectively accomplished by dipping the road down to the bed of the drainage.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 4	Prudent use of erosion-control measures, including diversion terraces, riprap, matting, temporary sediment traps, and water bars would be employed by Gasco as necessary and appropriate to control surface runoff generated at well pads. If necessary, Gasco would treat diverted water in detention ponds prior to release to meet applicable state or federal standards. Reserve pits would be constructed to ensure protection of surface water and groundwater. All reserve pits would be lined, using liners of at least 16-mil thickness. Additional felt padding would be used as necessary, at the discretion of the AO. Appropriate erosion control and revegetation measures would be employed. Grading and landscaping would be used to minimize slopes, and slope stabilizers would be installed on disturbed slopes in areas with unstable soils where seeding alone may not adequately control erosion. Erosion-control efforts would be monitored by Gasco, and necessary modifications made to control erosion. Diversion structures, mulching, and terracing would be installed as needed to minimize erosion. In-stream protection structures (e.g., drop structures) in drainages crossed by a pipeline would be installed as appropriate to prevent erosion. Gasco would incorporate proper containment of condensate and produced water in tanks and drilling fluids in reserve pits, and would locate staging areas for storage of equipment away from drainages to prevent potential contaminants from entering surface waters.
Applicant-committed BMPs	
Applicant-committed measures and design features	Gasco would construct roads on private surface to essentially the same specifications as those on federal surfaces, considering the specifications of landowners.
	Gasco would not import or use any discarded asphalt or fill that may leech nutrients or organic chemicals in the construction of roads and/or locations.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
	Existing roads would be used when the alignment is acceptable for the proposed use. Roads would be constructed to minimize visual impacts by following natural contours, utilizing curves, etc.
	Available topsoil would be stripped from all road corridors prior to commencement of construction and would be redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction. Borrow ditches would be reseeded in the first appropriate season after initial disturbance.
	Unnecessary topographic alterations would be mitigated by avoiding, where possible, steep slopes, rugged topography, and perennial and ephemeral/intermittent drainages, and by minimizing the area disturbed.
	Gasco would be responsible for necessary preventative and corrective road maintenance to project roads for the duration of the project. Maintenance responsibilities may include, but are not limited to, blading, gravel surfacing, cleaning ditches and drainage facilities, dust abatement, noxious weed control, or other measures as deemed appropriate.
	Pipeline ROWs would be located to minimize soil disturbance as specified by the AO. Mitigation would include locating pipeline ROWs adjacent to access roads to minimize ROW disturbance widths, or routing pipeline ROWs directly to minimize disturbance lengths. Pipeline ROWs would also be managed for noxious weeds.
	Existing crowned and ditched roads would be used for access where possible to minimize surface disturbances. Where topsoil removal is necessary, it would be windrowed (i.e., stockpiled/accumulated along the edge of the ROW and in a low row/pile parallel with the ROW) and respread over the disturbed area after construction and backfilling are complete. Vegetation removed from the ROW would also be respread to provide protection, nutrient recycling, and a seed source.
	To promote soil stability, backfill over the trench would be compacted so as not to extend above the original ground level after the fill has settled. Compacting the backfill would reduce trench settling and water channeling.
	If paleontological resources are uncovered during surface-disturbing activities, Gasco would suspend operations at the site that would further disturb such resources, and immediately contact the AO, who would arrange for a determination of scientific importance and, if necessary, recommend a recovery or avoidance plan.
	Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements and limiting the size of any equipment/materials storage yard and staging area, etc.).
	Pipelines within channel crossings or in mapped flood hazard areas would be constructed such that the pipe is buried at least 3 feet below the channel bottom and in conformance with hydrological design practices.
	Roads and pipelines would be located adjacent to existing linear facilities wherever practical.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
	Gasco and/or its contractors would post appropriate warning signs and require project vehicles to adhere to appropriate speed limits on project-related roads, as appropriate.
	Gasco would restrict off-highway vehicle (OHV) activity by personnel and contract workers to the immediate area of authorized activity or existing roads and trails.
DRILLING	
Regulatory Requirements and BLM Policy Guidelines	
Utah Department of Transportation Standards and Specifications	Load limits would be observed at all times to prevent damage to existing road surfaces. Special arrangements would be made with the Utah Department of Transportation to transport oversize loads to the project area.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book") Chapter 5; BLM Notice to Lessees 3-A (NTL 3-A); BLM WO Instruction Memorandum 99-061 Onsite Bioremediation of Exploration and Production Wastes or Spills of Crude Oil – Development of State Office Level Policies	Any accidental soil contamination by spills of petroleum products or other hazardous materials would be reported to the appropriate authorities and cleaned up by Gasco. The soil would be disposed of or remediated according to applicable rules.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book") Chapters 4 and 5; U.S. Migratory Bird Treaty Act (16 USC 703-712)	Pits would be fenced as specified in individual authorizations. Any pit containing hazardous fluids would be maintained in a manner that would prevent migratory bird mortality.
BLM COA of Application for Permit to Drill (APD)	If reserve pit leakage is detected, operations at the site would be curtailed as directed by the BLM until the leakage is corrected.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
Utah Division of Water Rights (Utah Administrative Code, Title 73)	All water used in association with this project would be obtained from sources approved by the Utah State Engineer's Office.
Regulations (40 CFR 335) implementing Title III, Superfund Amendments and Reauthorization Act of 1986 (42 USC 103)	Chemicals and hazardous materials would be inventoried and reported by Gasco in accordance with the Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III. If quantities exceeding the threshold planning quantity are to be produced or stored at any time within the project area, Gasco would submit appropriate Section 311 and 312 forms at the required times to the State Emergency Response Commission, Local Emergency Planning Committees, and the local fire departments.
EPA Resource Conservation and Recovery Act (42 USC 6901, et seq.), DOT (49 CFR 177)	Gasco would transport and/or dispose of any hazardous wastes as defined by the Environmental Protection Agency (EPA) Resource Conservation and Recovery Act of 1976, as amended, in accordance with all applicable federal, state, and local regulations.
Applicant-committed BMPs	
Applicant-committed measures and design features	Gasco would require drilling contractors to meet Tier II or better (low nitrogen oxide [NO_x] emissions engines) emissions for all drill rig engines, with phase-in of Tier IV engines or equivalent emission reduction technology as soon as possible thereafter, but no later than 2018. Based on the predicted 1-hour nitrogen dioxide (NO_2) exceedance at distances less than 200 meters (m) from the drill rig location for all spacing scenarios modeled, and because these emission sources would be mobile, temporary, and operated at least 1 mile from any populated area, one of the following two measures would be implemented: • Gasco would employ measures to mitigate the modeled exceedance of the 1-hour NO_2 standard during drilling operations by employing effective public health buffer zones out to 200 m from the nearest emission source. Examples of an effective public health protection buffer zone include demarcation of a public access exclusion zone by signage at intervals of every 250 feet that is visible from a distance of 125 feet during daylight hours, and a physical buffer such as active surveillance to ensure the property is not accessible by the public during drilling operations. • The proponent may demonstrate compliance with the 1-hour NO_2 National Ambient Air Quality Standards (NAAQS) with appropriate and accepted near-field modeling. As part of this demonstration, the proponent may propose alternative mitigation that could include but is not limited to natural gas–fired drill rigs, installation of NO_X controls, time/use restrictions, and/or drill rig spacing.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
COMPLETION	
Regulatory Requirements and BLM Policy Guidelines	
BLM Onshore Oil and Gas Order No. 2 (43 CFR 3163 and 3165)	Gasco would case and cement all gas wells to protect subsurface mineral and fresh water zones. The BLM will require an operator to conduct cement bond log surveys to verify cement adequacy.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 6; and Onshore Oil and Gas Order No. 1 (43 CFR 3152)	Unproductive wells and wells that have completed their intended purpose would be properly abandoned and plugged according to regulations governing plugging and abandonment identified by the BLM and/or UDOGM for state and private mineral estate.
BLM COA for APD (for wells/reserve pits located on BLM lands), and UDOGM (Utah Administrative Code R649-3-16) (for wells/reserve pits located on state and private lands)	Following drilling and completion of the well, the reserve pit must be closed within one year, unless permission is granted by the BLM and/or UDOGM for a longer period. The pit contents must meet the UDOGM 's Cleanup Levels (guidance document for numeric cleanup levels) or background levels prior to burial. The contents may require treatment to reduce mobility and/or toxicity to meet cleanup levels. The alternative to meeting cleanup levels would be transporting material to an appropriate disposal facility. BLM would generally defer to UDOGM's preference, which would be for materials to remain onsite if possible (personal communication between Brad Hill, Utah Division of Oil, Gas, and Mining, and Chris Garrett, SWCA, April 26, 2011).

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
PRODUCTION AND MAINTENANCE	
Regulatory Requirements and BLM Policy Guidelines	
BLM Onshore Oil and Gas Order No. 7 (43 CFR 3160)	Produced water from oil and gas operations would be disposed of in accordance with the requirements of Onshore Oil and Gas Order No. 7.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 6; and Onshore Oil and Gas Order No. 1 (43 CFR 3152)	At producing wells, Gasco would reduce slopes to original contours (not to exceed 3:1 slopes where feasible). Areas not used for production purposes would be reclaimed, blended into the surrounding terrain, and reseeded, with erosion control measures installed. Erosion control measures may be necessary after slope reduction. Mulching, erosion control measures, and fertilization may be necessary to achieve acceptable stabilization.
BLM SPCC Regulations (40 CFR 112)	All storage tank batteries, treaters, dehydrators, and other production facilities that have the potential to leak or spill any oil, glycol, or other fluid that may constitute a hazard to public health or safety would be surrounded by an appropriate secondary containment system capable of holding the entire contents of the largest single tank in use plus freeboard, or to contain a minimum of 110% of the capacity of the largest vessel, or placed on or within a diversionary structure to prevent spilled or leaking fluid from reaching ground or surface waters. The appropriate containment and/or diversionary structures or equipment would be constructed to help prevent discharges from a primary containment system from draining, infiltrating, or otherwise escaping to ground or surface waters prior to completion of cleanup.
BLM SPCC Regulations (40 CFR 112); Notice to Lessees 3-A (NTL 3-A)	Notice of any spill or leakage, as defined in the BLM Notice to Lessees (NTL) 3A, would be immediately reported to the AO by Gasco as well as to such other federal and state officials as required by law. Oral notice would be given as soon as possible, but within no more than 24 hours, and those oral notices would be confirmed in writing within 72 hours of any such occurrence.
EPA	Gasco would obtain all necessary air quality permits from the EPA to construct, test, and operate facilities.
Utah Department of Environmental Quality, Division of Air Quality	Gasco would obtain all necessary air quality permits from Utah Division of Air Quality to construct, test, and operate facilities.
Applicant-committed BMPs	
Applicant-committed measures and design	Gasco would use radio telemetry to monitor well site operations and production in order to minimize the amount of vehicle traffic required for operations and the resulting impacts. Telemetry would be used to reduce the number of

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Implementing Authority/ Regulation/Statute	Description of Requirement
features	trips required to monitor operations and haul produced water and condensate. Gasco would implement a wet gas central gathering system. Gasco would voluntarily reduce ozone precursor volatile organic compound (VOC) emissions through the following: • Low-bleed pneumatic devices would be installed at all new compressor stations and production facilities. Within six months of publication of the record of decision, all existing high-bleed pneumatic devices would be replaced with low-bleed pneumatic devices. High-bleed devices may be allowed to remain in service for critical safety and/or process reasons. • Stock tank emission controls would be installed at new facilities with condensate throughput of 14 barrels per day or greater. • Emission controls having a control efficiency of 95% would be used on existing condensate tanks with a potential to emit greater than 20 tons per year, and on new condensate tanks with a potential to emit greater than 5 tons per year VOCs. • Glycol dehydration equipment would be constructed only at central facilities, where storage tank and dehydrator VOC emissions would be controlled by a minimum of 95%. • Glycol dehydrators would not be used at well sites. • Solar-powered chemical pumps (e.g., methanol pumps) would be used in place of VOC-emitting pneumatic pumps at new facilities. • Green completions would be used for all well completion activities. • Electric compression would be used if and where feasible. • Lean-burn natural gas–fired stationary compressor engines or equipment with equivalent emission rates would be used. • Catalysts would be installed on natural gas–fired compressor engines to reduce VOC and CO emissions. • Dry seals would be used on new centrifugal compressors. • An annual inspection and maintenance program would be implemented to reduce VOC emissions, to include ▪ performing inspections of thief hatch seals and Enardo pressure relief valves to ensure proper operations, and ▪ reviewing gathering system pressures to evaluate any areas where gathering pressure may be reduced, resulting in lower flash losses from the condensate storage tanks. • To reduce air pollutant emissions from the evaporation basins, produced water would be treated via dissolved air flotation (or equally effective method) before being routed into an evaporation basin. Treatment would have a control efficiency of at least 60% for VOC and HAP constituents. • HAP emissions from compressor engines would be reduced via an oxidation catalyst. • Emissions from glycol dehydrator reboilers would be reduced via a thermal oxidizer. Gasco would voluntarily reduce ozone precursor NOx emissions through the following: • The commitment to use only central compression facilities, thereby allowing compression performance and emission controls to be optimized (no well site compression facilities will be constructed) • The use of Tier II or better diesel drill rig engines, with phase-in of Tier IV engines or equivalent emission reduction technology as soon as possible, but no later than 2018 In addition, Gasco would comply with the air quality mitigation measure requirements of the 2008 approved Vernal Resource Management Plan (Vernal RMP). These measures specify the following:

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
	♦ New and replacement internal combustion gas field engines less than or equal to 300 horsepower (hp) must not emit more than 2 grams of NO_x per hp hour. ♦ New and replacement internal combustion gas field engines greater than 300 design-rated hp must not emit more than 1.0 grams of NO_x per hp hour (BLM 2008c).
FINAL RECLAMATION AND ABANDONMENT	
Regulatory Requirements and BLM Policy Guidelines	
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 6; Onshore Oil and Gas Order No. 1 (43 CFR 3152)	Abandoned sites would be reclaimed in accordance with the approved APD and the Subsequent Report of Abandonment (sundry) process.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 3	All disturbances would be managed and reclaimed to minimize runoff from the well pads or other facilities until the area is stabilized.
BLM/USFS Surface Operating Standards for Oil and Gas Exploration and Development ("Gold Book"), Chapter 6; Onshore Oil and Gas Order No. 1 (43 CFR 3152)	All excavations and pits would be closed by backfilling and contouring to conform to surrounding terrain. The Surface Use Plan would outline objectives for successful reclamation of well pads and other facilities, including soil stabilization, plant community composition, and desired vegetation density and diversity.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
BLM COA for APD, and UDOGM (Utah Administrative Code R649-9-7)	A final closure plan would be submitted to BLM and UDOGM prior to closure of the evaporation basin facilities. This plan would include 1) provisions for removal and proper disposal of all equipment at the site, 2) a plan for sampling and testing soil and groundwater at the project site, with soil samples analyzed at the levels outlined by UDOGM's Cleanup Levels for Contaminated Soils or background levels, whichever is less stringent, 3) provisions for future monitoring plans, if required by BLM and UDOGM, and 4) considerations for post-disposal land use and landowner requests upon completion of closure. Closure procedures would include the following: The pits would be pumped dry with all debris and any solid waste removed. The pit liner would then be folded over into the pit and the pit backfilled. The backfilled area would then be recontoured with top soil and reseeded. Any waste and solids removed would be transported to an approved disposal site and disposed of according to BLM, UDOGM, and/or EPA regulations.
Applicant-committed BMPs	
Applicant-committed measures and design features	All reclamation would be accomplished as soon as practical after the disturbance occurs, with efforts continuing until a satisfactory revegetation cover is established.
	Interseeding, secondary seeding, or staggered seeding may be used to accomplish revegetation objectives. During rehabilitation of areas in important wildlife habitat, provisions would be made for the establishment of native browse and forb species. Follow-up seeding or corrective erosion control measures would occur on areas where initial reclamation efforts were unsuccessful, as determined by the appropriate Surface Management Agency. Any mulch used by Gasco would be weed-free and free from mold, fungi, or noxious weed seeds. Mulch may include weed-free hay, small grain straw, wood fiber, live mulch, cotton, jute, synthetic netting, and rock. Gasco would reshape disturbed channel beds to their approximate original configuration. All state- and county-listed noxious weeds (and those identified by the AO) would be controlled if introduced by project-related activity. Site-specific preinventories would be used to determine the need for the control of noxious weeds. Reclamation of abandoned roads would include reshaping, recontouring, resurfacing with topsoil, installation of water bars, and seeding on the contours. Road beds, well pads, and other compacted areas would be ripped to a depth of approximately 1.0 foot on 1.5-foot centers to reduce compaction prior to spreading the topsoil across the disturbed area. Stripped vegetation would be spread over the disturbance area for nutrient recycling, where practical. Additional erosion control measures (e.g., fiber matting) and road barriers to discourage travel may be constructed if appropriate. Graveled roads, well pads, and other sites would be stripped of usable gravel prior to ripping as deemed necessary. Culverts, cattle guards, and signs would be removed as roads are abandoned.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
COMMON TO ALL PROJECT PHASES	
Regulatory Requirements and BLM Policy Guidelines	
Section 7(a) of the Endangered Species Act of 1973 (ESA), as amended	Section 7(a) of the ESA requires federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened, and with respect to its critical habitat, if any has been designated. Regulations implementing this interagency cooperation provision of the ESA are codified at 50 CFR 402. Section 7(a)(2) requires federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a federally listed species, or result in the adverse modification or destruction of its critical habitat. The responsible federal agency must enter into formal consultation with the U.S. Fish and Wildlife Service (USFWS). Section 7 Consultation would be conducted as necessary.
BLM Regulations (36 CFR 800) implementing Section 106, NHPA (16 USC 470, et seq.)	Gasco would conduct all operations in conformance with Section 106 regulations (36 CFR 800) of the NHPA, as amended.
BLM Handbook (H-8270-1), General Procedural Guidance for Paleontological Resource Management	Gasco would conduct all operations in conformance with BLM Handbook (H-8270-1).
BLM Handbook 9011-1, Exec Order 13112, Carlson-Foley 1968, and the Plant Protection Act of 2000, Public Law 106-224, and Fed Noxious Weed Act of 1974 as amended	Gasco would obtain a Pesticide Use Proposal (PUP) prior to applying herbicides or pesticides. Gasco would treat project-related noxious weeds as required by all applicable regulations.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
Clean Air Act (CAA), as amended, and the Federal Land Policy and Management Act (FLPMA)	As needed, the BLM, with input from UDAQ and EPA as appropriate, will refine the NOx and volatile organic compound (VOC) emissions inventory. The BLM, in coordination with UDEQ-DAQ and EPA as appropriate, will ensure that new modeling includes all best air quality control technology (BACT) requirements and a sensitivity analysis to determine appropriate reductions in ozone precursor emissions. The BLM, in coordination with UDEQ-DAQ and EPA as appropriate, will evaluate the modeling results. As soon as possible, and if needed following evaluation of the modeling results, the BLM, in coordination with UDEQ-DAQ and EPA as appropriate, will use their respective authorities to implement emission control strategies and/or operating limitations necessary to ensure compliance with applicable ambient air quality standards for ozone. Absent an effective technology to implement, reductions in the pace of development may be used to ensure ambient air quality standards are met. Potential mitigation measures include but are not limited to ♦ natural gas–fired drilling rig engines; ♦ fuel additives; ♦ gas turbines rather than internal combustion engines for compressors; ♦ reduction in the number of storage tanks containing VOCs; ♦ reduction in the number of drilling rigs; ♦ selective catalytic reduction on drilling rig engines; ♦ electric drilling rigs; ♦ centralization of gathering facilities to reduce truck traffic, including the liquids gathering system; ♦ treatment of produced water to meet permitting regulations; ♦ cleaner technologies on completion activities, and other ancillary sources; ♦ advancements in drilling technology; ♦ reduction in the pace of development; and ♦ surfacing (covering of piles where appropriate, graveling, applying water or surfactants) of roads, well-pad construction, and other development-related disturbances in areas with soils susceptible to wind erosion, as directed by the AO to reduce fugitive dust generated by traffic and related activities. Such treatments would also be applied as directed by the AO on local and resource roads that represent a dust problem. The BLM will work with the appropriate regulatory agency to ensure monitoring and enforcement of mitigation measures occurs.
BLM MOU WO-230-2010-04, MOU between the U.S. Department of the Interior BLM and the USFWS to Promote the Conservation of Migratory Birds	BLM shall implement the MOU to the extent permitted by law and in harmony with agency missions, subject to the availability of appropriations and budgetary limits. At the project level, BLM will evaluate the effects of agency actions on migratory birds during the NEPA process, if any, and identify where take reasonably attributable to agency actions may have a measurable, negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors. In such situations, BLM will implement approaches lessening such take.

Table 2-1. Regulatory Requirements, BLM Policy Guidelines, Standard Operating Practices, and Applicant-committed Best Management Practices (BMPs) Common to All Alternatives

Implementing Authority/ Regulation/Statute	Description of Requirement
Applicant-committed BMPs	
Applicant-committed measures and design features	Gasco will enter into road maintenance and improvement agreements with Duchesne and Uintah Counties to ensure county roads connecting the gas field to Highway 40 are maintained to support additional truck traffic associated with the project. These agreements will include provisions for the maintenance and upkeep of county roads by Gasco in order to enhance their functional use and safety.

2.2 ALTERNATIVE A: PROPOSED ACTION

Under Alternative A (the Proposed Action), Gasco would drill 1,491 new natural gas production wells and construct associated access roads, water supply pipelines, and gathering lines within the Riverbend, Wilkin Ridge, and Gate Canyon areas (see Map 3). Gasco currently operates approximately 80 wells in the project area, and proposes to drill additional wells at an average rate of 100 wells per year until the resource base is fully developed. Based on this drilling rate and assuming that the drilling program would begin in 2011, it is anticipated that the 1,491 proposed wells would be drilled by approximately 2026. The total number of wells would depend largely on geology, economic factors, and lease restrictions. The wells would be drilled to recover gas reserves from the Wasatch, Mesaverde, Blackhawk, Mancos, Dakota, and Green River formations at depths of 5,000–20,000 feet. At the end of each well's productive life (approximately 30 years), it would be plugged and abandoned and the affected area reclaimed (see Section 2.2.6). Thus, the total life of the project would be up to approximately 45 years. Although some wells may be drilled directionally from the same pad, each well was conservatively assumed to have its own pad for the purposes of analysis.

The extent of this proposed development and prospective nature of the natural gas resources is based on two-dimensional (2D) seismic data, geologic information, and data derived from exploratory wells drilled to date. The well density needed to develop the resource is expected to vary depending on the geologic characteristics of the formation being developed. The highest surface density assumed for this EIS's programmatic analysis is one well pad per 40 acres (in some areas of the Wasatch and Mesaverde formations), but the exact surface density would be defined during on-site review and permitting.

Approximately 325 miles of new road would be constructed to access the proposed wells. Gas would be transported via pipeline and related facilities to either intrastate or interstate pipelines. Depending on site-specific conditions, pipelines and collector lines would either be laid on the ground surface, typically next to a road, or trenched and buried. If dry, the wells would be plugged and abandoned as required by the surface management agency (SMA) and Authorized Officer (AO). The construction of new compressor facilities is not proposed as part of the Proposed Action. However, gas treatment capacity would be expanded by a total of approximately 21,000 horsepower (hp) at two existing gas plants to handle the increased production. Any produced water would be disposed of in a licensed evaporative facility proposed as part of this action (see Section 2.2.4).

2.2.1 ACCESS ROADS

2.2.1.1 LAND REQUIREMENTS

Existing roads and newly constructed roads would provide access to the proposed wells. Almost all the estimated 325 miles of new roads would be access (or spur) roads. The total surface disturbance associated with the construction of access roads would be approximately 1,182 acres.

Average construction disturbance widths would be approximately 45 feet for collector roads, 33 feet for local or secondary roads, and 25 feet for access (or spur) roads into well sites. However, the roads constructed in the project area would almost exclusively be spur roads from existing county or well field roads constructed to access well sites, since more than 560 miles of roads

(including a large number of collector and secondary roads) already exist in the project area, and would generally be used to access the required new service roads. Collector roads normally connect to, or are extensions of, a public road system and provide access to larger blocks of land. Local roads usually provide the internal access network within a well field. Individual well access (or spur) roads would provide entry to well-pad sites. For the purposes of analyzing impacts that would occur under this alternative, it is assumed that surface disturbances due to constructed roads would average 30 feet wide.

The primary arteries for project-related transportation are shown in Map 26 and described in Table 2-2, which includes the length of each of the (existing) artery road segments that would be used in the project area. These main roads include the Sand Wash Road, Wells Draw Road, Eightmile Flat Road, Fourmile Wash Road, and Wrinkle Road.

Table 2-2. Main Access Routes in the Project Area

Road Segment	Length (Miles)
Sand Wash Road—Highway 40 to Wells Draw Road	2
Sand Wash Road—Wells Draw Road to Pariette Bench Road	10
Sand Wash Road—Pariette Bench Road to Big Wash Road	6
Sand Wash Road—Eightmile Flat Road to Desert Spring Wash Road	7
Sand Wash Road—Desert Spring Wash Road to cutoff to Wrinkle Road	7
Wells Draw Road—Sand Wash Road to Wrinkle Road	25
Eightmile Flat Road—Sand Wash Road to Pariette Bench Road via cutoff	11
Eightmile Flat Road—Pariette Bench Road to cutoff to Pariette Bench Road	4
Pariette Bench Road—Sand Wash Road to Eightmile Flat Road	14
Fourmile Wash Road	8
Wrinkle Road—Wells Draw Road to Franks Road	11
Wrinkle Road—Cut-off from Sand Wash Road to Franks Road	11
Gate Canyon Road—Wrinkle Road to Gate Canyon Upper Bench	1

Proposed roads would generally include an additional 30- to 40-foot-wide utility corridor that could contain gas pipelines and other utilities. Because utility corridors would primarily contain only surface-collection pipelines (since approximately 90% of all lines would not be buried or would be buried within the roadway), and most surface lines would be constructed on the road and then moved into the utility corridor, these analyses assume that surface disturbances due to pipelines and other utilities would average 10 feet wide. This assumption is based on the fact that only a portion of the 40-foot utility corridor width would typically be disturbed, and only approximately 10% of lines would require disturbance for burial. It is assumed that surface pipelines would average approximately 7 feet of disturbance, and buried pipelines would average approximately 40 feet of disturbance, most of which would be temporary disturbance due to equipment access.

2.2.1.2 ROAD CONSTRUCTION

All access roads would be constructed out of native material and to the standards outlined in the BLM and Forest Service Publication "Surface Operating Standards for Oil and Gas Exploration and Development" (USDI and USDA 2007). This publication, known as "the Gold Book," provides practices and standards to guide compliance with all applicable agency policies, operating guidelines, and BMPs. Following staking of the road ROW and on-site review, the road design plan would be approved and the need for an engineered road would be specified. After Application for Permit to Drill (APD) approval, standard cut and fill construction methods and construction equipment (such as crawler tractors, graders, and scrapers) would be used to construct new roads. A well field access road and the associated well pad typically take approximately 10 days to construct. In steep terrain, a construction technique known as side casting (using the material taken from the cut portion of the road to construct the fill portion) would be used. Slightly less than half of the roadbed would be placed on a cut area; the remainder would be placed on a fill area. Soil texture, steep road grades, and moisture conditions would dictate whether the well access road was surfaced with shale or commercial roadbase. Generally, shale or roadbase is only used in selected sections where soil conditions or erosion hazards compel its use, and not for the entire road length. Water would be used to control dust during construction. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field. These agreements would include provisions for the maintenance and upkeep of county roads by Gasco in order to enhance their functional use and safety. All roads would at a minimum meet Gold Book standards for construction, except as directed by the authorizing officer (AO).

Once road construction is complete, damage to adjacent areas from erosion or construction-related causes would be repaired. Repair activities may include filling gullies, repairing incidental damage, and reseeding. Surfaces would be scarified immediately prior to reseeding, either along their length or, where feasible, at right angles to the slope plane. All areas incidentally disturbed in the course of construction or maintenance would be reseeded with a seed mix approved by the AO.

2.2.2 WELL DRILLING AND COMPLETION

2.2.2.1 LAND REQUIREMENTS

The well site disturbance for most wells would average approximately 3.8 acres, with shape depending on terrain and layout. This disturbance total includes an approximately 225 × 400–foot pad area, stockpile areas, side slopes, and a reserve pit measuring approximately 150 × 100 feet. Pads constructed on steeper slopes may require more than this average due to larger cuts and fills, while pads on flat ground may require less than this average. Although some wells may be drilled directionally from the same pad, each well was conservatively assumed to have its own pad for the purposes of analysis. Over the life of the project, collectively, approximately 5,666 acres of land would be disturbed under the Proposed Action. Of the 5,666 acres disturbed by well pads, approximately 385 acres used as reserve pits would be reclaimed after the completion of drilling operation, following the procedures described in Section 2.2.6.1. Figure 2-1 is an example well-pad layout. It is important to note that the dimensions presented above reflect average conditions, and that site-specific layouts such as Figure 2-1 vary between sites depending on access and topography.

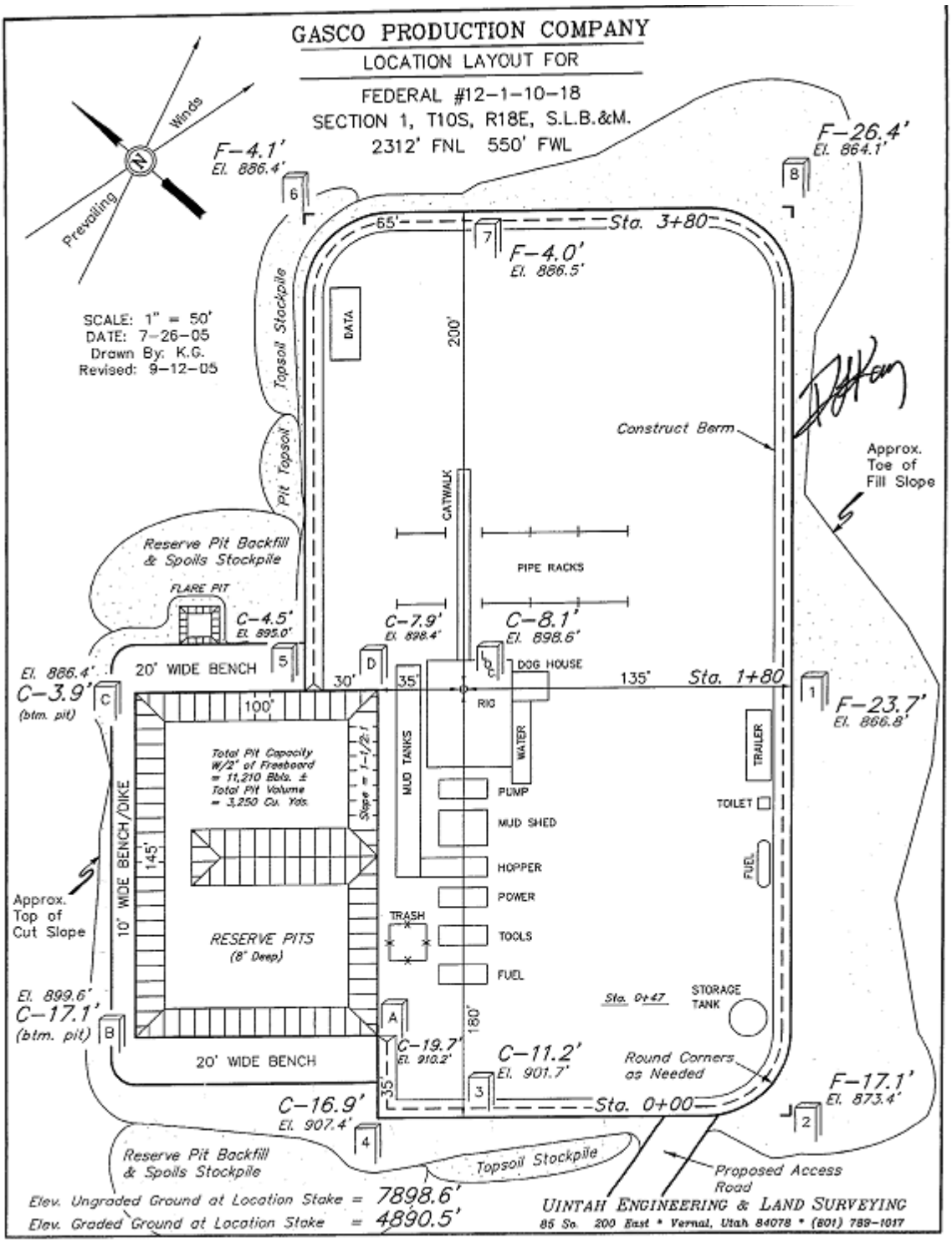

Figure 2-1. Example of a well pad layout.

2.2.2.2 WELL PAD CONSTRUCTION

Construction of well pads would typically begin with stripping and stockpiling topsoil. The top 6 inches of topsoil material suitable for plant growth would be removed from areas to be disturbed and stockpiled in a designated area, usually adjacent to the pad. The stockpiled topsoil would be seeded (with the interim seed mixes specified in Section 2.2.6.1) and left in place for the life of the well, for eventual use in reclamation. Track-mounted and rubber-tired bulldozers, scrapers, and road graders then grade and level the site. Water would be used to control dust during construction.

The well pad would be constructed so that the drilling rig sits on solid ground (cut material) and not on fill. This location procedure ensures that the foundation of the drilling substructure does not lean or topple due to settling of soil that has not been compacted.

In addition to the drilling platform, a rectangular reserve pit would be constructed. Reserve pits would be used to store produced water, drilling fluid, and drill cuttings. Generally, the reserve pit would be approximately 0.34 acre in size. If possible, reserve pits would be constructed in cut material and not in fill material. Where cut material locations were not possible, tanks would be considered at the discretion of the AO. All reserve pits would be lined to prevent loss of drilling water. The pits would be lined with a synthetic reinforced liner a minimum of 16 mils thick, with sufficient bedding used to cover any rocks. The liner would overlap the pit walls and be covered with dirt and/or rocks to hold it in place. No trash or scrap that could puncture the liner would be disposed of in the pit. In some instances, removal of bedrock through pulverizing may be required to construct the pit. Pits may be divided into compartments separated by berms for the proper management of derived waste (e.g., drill cuttings, mud, and produced water).

2.2.2.3 WELL DRILLING

Drilling would begin as soon as practical after the well pad and access roads are constructed. A drilling rig and its associated equipment would be moved to the location and erected. Drilling rig installation would require moving approximately 30–50 truckloads of equipment over public highways and private roads. Special transportation permits for oversize loads would need to be obtained from the U.S. Department of Transportation (USDOT) prior to transport. The derrick, when erected, could be up to 140 feet high; derrick heights vary depending on the depth and weight capacity of the rig.

The drilling operation would be conducted in two phases. The first phase would use a small drilling rig (similar to a water-well drilling rig) to drill to a depth of approximately 200 feet. The AO would be notified within 24 hours if any aquifers are encountered. This shallow hole would be cased with steel casing and cemented in place from the surface to approximately 200 feet total depth (TD). This surface casing serves the dual purpose of providing protection for any fresh water aquifers present and, as a safety feature, containing any abnormal pressure that may be encountered while drilling deeper. Phase 1 drilling operations normally take 2–3 days and involve notification of the AO so he or she can monitor operations if desired. Following the first phase of drilling operations, a large drilling rig (depth rated to 4,000 feet minimum) would be mobilized to drill to a TD of about 3,500 feet. At this point, surface casing would be run to approximately 3,500 feet and cemented in place along this entire length. Prior to drilling below the surface casing, a blowout preventer would be installed on the surface casing, and both would be tested for pressure integrity.

Finally, the large drilling rig would finish drilling the well from 3,500 feet to a TD of up to 20,000 feet. The rig pumps fresh water as a circulating fluid to drive the mud motor, cool the drill bit, and remove cuttings from the wellbore. In order to achieve borehole stability and minimize possible damage to the hydrocarbon producing formations, a potassium chloride substitute, usually a fertilizer known as diammonium phosphate, and commercial clay stabilizer would be added to the drilling fluid. Also, a polyacrylamide polymer would be added to the drilling fluid to provide adequate viscosity to carry the drill cuttings out of the wellbore. From time to time, other materials may be added to the fluid system, such as sawdust, natural fibers, or paper flakes, to reduce downhole fluid losses. No potassium chloride, chromates, or any hazardous materials would be mixed in the drilling fluid.

When used properly, drilling mud additives are considered to have low toxicity. Gasco has identified four specific drilling fluid additives that would be commonly used: PolyPlus, DRILZONE L, M-I Gel, and hydrated lime.

- PolyPlus is a polyacrylamide polymer that also contains mineral oil. It is used to increase viscosity in drilling mud. This drilling fluid additive is considered ecologically toxic at certain concentrations due to the mineral oil additive. Typical application would be less than 1% by volume of drilling mud, which is considered by the manufacturer to be low toxicity.
- DRILZONE L is a mixture of surfactants that is used to increase rate of penetration and to keep the drilling bit clear of debris. This drilling fluid additive is considered ecologically toxic at certain concentrations with a potential for bioaccumulation. According to manufacturer specifications, DRILZONE L is typically added to drilling mud in concentration equaling 1%–2% of drilling mud by volume. Drilling mud concentrations up to 5%–7% will not affect environmental toxicity.
- M-I Gel is primarily a bentonite/silica mixture used to increase viscosity and develop filter cake on borehole walls. Bentonite and silica are not considered ecologically toxic.
- Hydrated lime is an alkaline pH-control agent. The primary ecological toxicity concern is high pH; in typical applications, drilling mud would be held to a pH of 10–11.

Water would be hauled to the rig storage tanks. During drilling operations, water would be continually transported to the rig location. Water demand would vary depending on the specific subsurface conditions encountered during drilling. The total water requirement to support the drilling operation would be approximately 12,000 barrels of recycled and treated production water per well (1 barrel = 42 gallons). Approximately 10% of this total could be recovered and transferred to subsequent drill sites. An additional 1,500 barrels of fresh water would be used per well for cementing casing strings, rig washing, and other drilling- and construction-related activities. In accordance with Environmental Protection Agency (EPA) criteria, all additives in this drilling fluid system would meet requirements for discharge into the environment.

The primary purpose of the reserve pit is to receive the drill cuttings from the wellbore (mainly shale, sand, and miscellaneous rock minerals). A secondary purpose of the reserve pit is to contain drilling fluids carried over with the cuttings, and fluids that are periodically discharged from the rig's steel "mud pits" (usually to flush out cuttings that have settled in these "mud pits"). No hazardous materials would be placed in the reserve pit.

Upon reaching TD, a series of geophysical logging tools would be run in the well to evaluate the potential hydrocarbon resource. If the evaluation concludes that adequate hydrocarbons are present and recoverable, steel production casing would be run and cemented in place in accordance with the well design, as approved by the AO in the APD and any applicable Condition of Approval (COA). The casing and cementing program is designed to isolate and protect the various formations encountered in the wellbore, and to prohibit pressure communication or fluid migration between zones. If dry, the well(s) would be plugged and abandoned as per BLM and State of Utah requirements (see Section 2.2.6). The average time to drill a hole would be 30–40 days, not including pad construction, and would occur around the clock until completion.

2.2.2.4 WELL COMPLETION AND PRODUCTION

After the production casing is cemented into place, the drilling rig would be moved off-site and tank battery construction would occur. Production facilities would include two 400-barrel tanks (approximately 12 feet in diameter and 20 feet tall) and an indirect-fired separator housed in a building (approximately 14 × 8 feet and 10 feet tall). Because of the risk of explosion and fire due to their lower venting point and less atmospheric dispersion of flammable gasses, low-profile tanks would be used only when required (and indemnified from these accidents) by the AO. In general, pumpjacks would not be used, except at the discretion of the AO in rare cases when plunger lift is not sufficient for water removal. Centralized water and condensate tank batteries would be used as BMPs where on-site review indicates these measures would reduce overall environmental impact or impacts to sensitive environmental resources (see Section 2.2.9.1). In addition, tank batteries would be centralized where multiple wells are drilled directionally from a single pad (Section 2.2.9.1). This EIS conservatively assumes for the purposes of analysis that none of the tanks would be centralized under this alternative; actual project impacts may be reduced where central batteries are used. Berms would be placed around the perimeter of the tank batteries to confine any spills of produced water or natural gas condensate from the storage tanks. All permanent (on-site for six months or longer) above-ground structures constructed or installed, including pumping units, would be painted a flat, non-reflective, earth-tone color to match one of the standard environmental colors that are described by the five-state Rocky Mountain Inter-Agency Committee. The facilities would be painted within six months of installation. The required color for the facilities would be specified by the AO. (Facilities required to be painted a different color to comply with Occupational Safety and Health Administration [OSHA] would be exempt.)

During the completion process, the well casing and adjacent gas-producing formation would be perforated so that gas could flow into the well casing. Perforation would be accomplished by firing bullet-like projectiles or, more commonly, exploding shaped-charges to create holes that extend several feet through the casing, cement, and into the formation sands. Normal to over-pressured formations at the bottom of the well would allow multiple completion opportunities. Initial completion of these over-pressured formations would allow gas production for six to 12 months as the reservoir drops in pressure. Once the pressure was reduced in the downhole formations, lower pressure uphole formations would be recompleted. This would improve production success in the uphole reservoirs. A service rig would then drill out any flow through fracturing plugs, and leave tubing in the well at an appropriate depth for production. Completion operations would normally take five to seven days per mobilization to perform.

Generally, most wells would require stimulation to enhance the transmissibility of gas. Stimulation would be accomplished through hydraulic fracturing of the producing zone using a slurry of sand suspended in a viscous fluid (gelled water). The slurry would be pumped into the producing formation with sufficient hydraulic pressure to fracture the rock formation. The sand in the slurry would act as a proppant to keep the cracks open after the fracture treatment, thereby allowing reservoir fluids to move more readily into the well. The fluids from the fracturing would be recovered (flowed back) and the proppant would remain in the fractures. The water used for fracturing stimulation would be 100% recycled produced water. Once a well is hydraulically fracture stimulated, the fracturing fluid would be produced back to a tank within a closed-loop system. The fracturing fluid would never go to the reserve pit. The fluid would then be transported by water trucks to the recycling and or evaporative pond facilities and could be reused for future drilling and completion operations. At the surface, wellhead equipment would be installed on the casing to control pressure and the flow of the production stream to processing equipment. Although certain chemical components of fracturing fluids would require handling as hazardous materials, these fluids would be at all times confined to storage tanks while on site, with any excess used in other drilling or completion operations or transported to a licensed commercial hazardous disposal facility. The typical fracturing fluid that would be used by Gasco would be water based and would consist of a 2% KCL (potassium chloride) substitute (clay stabilizer), limited use of gels or cross-linkers (to control viscosity), surfactants (to reduce friction), corrosion inhibitors, and biocides. Although some hydraulic fracturing fluids use diesel as a fluid base or additive, no diesel would be used by Gasco in fracturing operations.

2.2.3 PIPELINES

Gasco captures methane and/or all produced gases within a closed loop system equipped with leak detection systems. Produced gas gathering lines for new development would be integrated into the existing gas pipeline network. These pipelines contain natural gas and condensate. New lines would be laid aboveground in rocky areas where trenching would not be practical, or buried in non-rocky areas where a trencher would be able to operate effectively in existing utility corridors. The produced gas gathering lines would normally be steel pipes 4–8 inches in diameter. The main gas transmission system would consist of steel lines ranging in size from 16 to 20 inches in diameter.

Produced gas would be transported by pipeline to existing compression facilities located in or near the project area. Gas would be shipped from the compression facilities via high-pressure steel pipelines through Gasco's gas conditioning plant to the existing Questar Exploration and Production transportation and sales pipeline, which delivers gas to consumers along the Wasatch Front (Salt Lake City and the surrounding area). Gas would be delivered to additional sales lines as they become available.

The total length of gas pipeline would be approximately 2,275,680 feet (431 miles). Depending on site-specific conditions, pipelines and collector lines would either be laid on the ground surface, typically next to a road, or trenched and buried. Analysis assumed that approximately 2,048,112 feet (388 miles) of surface and 227,568 feet (43 miles) of buried gas lines would be laid along existing and proposed access roads. Gasco would bury pipelines within or adjacent to roadways as an applicant-committed BMP where on-site review indicates that continuous solid bedrock is not exposed at the surface and where trenching would not impact sensitive environmental resources (see Section 2.2.9). Surface placement would result in approximately a 7-foot or less disturbance width. Pipelines that could be buried entirely within a roadway would not result in additional disturbance,

while pipelines buried beyond the roadway or where roadways are constructed to the minimum allowable standards would disturb up to an approximately 40-foot width for primary pipeline corridors, and much less for flowlines. Because buried pipelines would be used as a BMP to reduce impacts, the analysis assumptions described above are conservative, and therefore represent the greatest potential impacts from pipeline construction.

Installation of the surface gas lines would follow access roads except in areas where the system layout may require the pipeline to go cross country to the nearest pipeline tie-in point, a situation anticipated for fewer than 5% of pipelines. Cross-country pipelines would require a 30–40 foot disturbance, depending on the whether they are a surface or buried line. Roadside pipelines would be installed outside the traveling surface to avoid interference with the normal travel and maintenance of the roadway. Given the assumptions above, the average disturbance width used to calculate disturbance from pipelines in the project area is 10 feet, and a total of approximately 522 acres would be disturbed under the Proposed Action.

2.2.4 WATER SUPPLY AND DISPOSAL

Producing formations in the project area produce waters with high levels of dissolved solids. Produced water from the alternatives considered by this EIS would be predominantly Mesaverde, Blackhawk, and Wasatch Formation water that are incompatible and that form heavy precipitates when mixed. Therefore, these waters are generally unsuitable for reuse and the project would require both the importation of water for drilling and the disposal of produced water.

The primary source of water for drilling would be recycled and treated production water. Water for drilling would also come from a Newfield pipeline supplied by a Green River well (Water Right No. 41-3530), the Myton water dock facility (Temporary Water Right Application No. 001458BWHITE), the Duchesne Valley Water Treatment Plant, recycled drilling water, and other sources as they become available and are needed. The source being used would have prior approval by the AO. The volume of water to be recycled would be dependent on the amount of drilling and completion activity in the field. Water from each source would be trucked to the locations where it is needed. Spill and leak prevention would be addressed within Gasco's Spill Prevention, Control, and Countermeasure (SPCC) plans for each facility and location.

The total water requirement to support the drilling operation would be approximately 12,000 barrels of recycled and treated production water per well (1 barrel=42 gallons). In addition, each well would require approximately 2,000 barrels of recycled and treated production water for workovers and 9,000—10,000 barrels of recycled and treated production water for hydraulic fracturing. Therefore, drilling and completion of each well would require approximately 24,000 barrels of recycled and treated production water. Approximately 1,500 barrels of fresh water would also be used per well for cementing casing strings, rig washing, and other drilling- and construction-related activities. With 1,491 wells proposed under this alternative, approximately 4,439 acre-feet, or approximately 3.09 acre-feet per well, would be required during the 15-year drilling and completion phase of the project. Of this total, approximately 4,151 acre-feet would be reclaimed produced water or water recovered from previous drilling operations. Only 6% (288 acre-feet, or 0.19 acre-feet per well) would be fresh water.

At each production site or central tank battery, produced formation water would be stored in a steel tank before being trucked to an evaporative surface-disposal facility constructed in the well field (see Map 3). At peak development, the 1,491 wells proposed under this alternative are

expected to produce approximately 19,570 barrels of water per day. In order to dispose of this water, up to twenty 450 × 650–foot evaporation basins would be constructed on BLM land within a single facility of approximately 143 acres, which would include associated roads, tanks, headworks, and other facilities (see Map 3). An estimated 700 barrels of drilling mud would remain in the reserve pits after drilling operations. This mud would be typically allowed to settle and evaporate, although minor amounts of fluid may be transferred to the evaporation ponds if they are still remaining at the time of reclamation. No surface discharge of produced formation water is proposed or anticipated at this time under any of the alternatives.

Gasco preliminarily identified (as have other operators) some limited zones that may be suitable for disposal on a well-by-well basis (see Section 2.9.2). For instance, water injection to the Garden Gulch member of the Green River Formation has been identified as a potential disposal target; however, it would require additional analysis prior to implementation, because current feasibility is unproven. Gasco is currently working on several Underground Injection Control (UIC) program permits for future disposal wells in the project area, in coordination with EPA. The success of these wells will not be known until permitting is completed and wells are developed and tested. Where suitable reservoir formations exist, subsurface water disposal wells would be used in conjunction with, or instead of, evaporative facilities for produced water disposal. As development continues and additional well data become available, formations discovered in the project area would be considered potentially suitable where: a) their fracture gradient would not be exceeded by disposal, or if exceeded, waters would not migrate vertically or into other formations; b) they are suitably large to accept economically feasible quantities of water; c) scaling of the wellbore and disposal formation could be prevented through economically feasible chemical treatment; and d) injection would be permitted by the UDOGM and/or EPA. Because the available data are inadequate to assess the impacts or feasibility of disposal wells, this EIS uses the conservative assumption for its impacts analysis that only evaporative facilities would be used.

To reduce air pollutant emissions from the evaporation basins, produced water would be treated before being routed into an evaporation basin. The produced water would be processed to reduce the amount of hazardous air pollutant (HAP) VOCs introduced into the evaporation basins. Treatment would have a control efficiency of at least 60% for VOC and HAP constituents once sufficient production is reached to make treatment economically and technologically feasible. Some treatment processes may increase the quality of the produced water to the point where it could be reused in a beneficial manner. The overall volume of produced water disposed of in the evaporation basins is assumed to be unaffected by the control treatment.

The profile of the evaporative basins would typically be less than 6 feet above existing ground level, with the majority of the disturbance below ground level. Each pond would have a total capacity of approximately 250,000 barrels, and would be able to evaporate approximately 365,000 barrels of water per year (thereby averaging 1,000 barrels per day over the year). The most noticeable feature of the evaporative basins would be the dikes/retaining walls, which would surround the approximately 143-acre facility, and would also be covered with impermeable liners. The ponds would be double-lined with a 60-mil high-density polyethylene (HDPE) primary liner and a 40-mil HDPE secondary liner, which would sandwich a 1/4-inch leak-detection system layer. The basins would be graded prior to lining to remove irregularities that could cause puncture, and the liners would be padded with excelsior as needed. During winter periods, the total capacity of the ponds would be great enough to accommodate incoming

produced waters until evaporation resumed. During times of the year when natural evaporation occurs, mechanical evaporators may also be used within the evaporative basins. Use of these evaporators would be centralized in the evaporative basins so any water that is not evaporated would fall back to the ground within the impermeable, lined areas. Where dictated by topography and required by the AO, a secondary backup berm would surround these facilities. In all cases, berms would be engineered to prevent failure due to ice buildup, surface runoff, or other causes.

Although located on federal lands and subject to a BLM site-specific permitting process, the evaporative basins would also require permitting by UDOGM because they would likely receive produced waters from wells located on state or private lands. Specific UDOGM requirements (Utah Administrative Code R649-9) are as follows, and they would be met by the above-described facility:

- The basins shall be located on level, stable ground, and an acceptable distance away from any established or intermittent drainage.
- The basins shall not be located in a geologically and hydrologically unsuitable area, such as aquifer recharge areas, floodplains, drainage bottoms, and areas near faults.
- The basins shall have adequate storage capacity to safely contain all produced water even during those periods when evaporation rates are at a minimum.
- The basins shall be designed and constructed to prevent the entrance of surface water.
- The basins shall be designed, maintained, and operated to prevent unauthorized surface or subsurface discharge of water.
- The basins shall be fenced and maintained to prevent access by livestock, wildlife, and unauthorized personnel and if required, equipped with flagging or netting to deter entry by birds and waterfowl.
- The basin levees for produced water pits receiving volumes in excess of five barrels per day shall be constructed so that the inside grade of the levee is no steeper than 3:1 and the outside grade no steeper than 2:1. The top of the levee shall be level and of sufficient width to allow for adequate compaction.
- All approved, produced water basins not located at a well site shall be identified with a suitable sign.
- The artificial materials used in lining basins shall be impervious and resistant to weather, sunlight, hydrocarbons, aqueous acids, alkalies, salt, fungi, or other substances that might be contained in the produced water.
- If rigid materials are used, leak-proof expansion joints shall be provided, or the material shall be of sufficient thickness and strength to withstand expansion, contraction, and settling movements in the underlying earth, without cracking. If flexible materials are used, they shall be of sufficient thickness and strength to be resistant to tears and punctures.
- Lined basins constructed in relatively impermeable soils shall have an underlying gravel-filled sump and lateral system or a suitable leak-detection system.

- Lined basins constructed in relatively permeable soils shall have a secondary liner underlying the leak detection system. This liner would be graded so as to direct leaks to the observation sump.
- Test borings shall be taken in sufficient quantity and to an adequate depth to satisfactorily define subsurface conditions and assure that the liner will be placed on a firm, stable base, and to determine the appropriate leak detection system.

In addition to the requirements placed by UDOGM, BLM would also evaluate evaporative basin design during its site-specific permitting and would require the following or similar design elements that would be equally effective:

- The synthetic or fabricated liner shall cover the bottom and interior sides of the pit, with the edges secured with at least a 12-inch-deep anchor trench around the pit perimeter. The anchor trench shall be designed to secure and prevent slippage or destruction of the liner materials.
- The foundation for the liner shall be constructed with soil having a minimum thickness of 24 inches after compaction and covering the entire bottom and interior sides of the pit. The foundation shall be constructed so that the hydraulic conductivity shall not exceed $1.0 \times 10\text{-}7$ cm/sec after testing and compaction. Compaction and permeability test results measured in the laboratory and field must be maintained by the operator and provided to BLM upon request. As an alternative to the soil foundation, a geosynthetic clay liner may be used as a foundation. A geosynthetic clay liner is a manufactured hydraulic barrier typically consisting of bentonite clay or other very low permeability material, supported by geotextiles or geomembranes, which are held together by needling, stitching, or chemical adhesives.

BLM would also request and consider the following site characterization information during the site-specific permitting process:

- Geologic data, including, but not limited to
  - type and thickness of unconsolidated soils;
  - type and thickness of consolidated bedrock if applicable;
  - local and regional geologic structures; and
  - any geologic hazards that may affect the design and operation of the facility.
- Hydrologic data, including, but not limited to
  - surface water features within 2 miles;
  - depth to shallow groundwater and major aquifers;
  - water wells within 1 mile of the site boundary and well depth, depth to water, screened intervals, yields, and aquifer name;
  - hydrologic properties (e.g., flow direction, flow rate, and potentiometric surface) of shallow groundwater and major aquifers;
  - site location in relation to the floodplain of nearby surface water features;
  - existing quality of shallow groundwater; and
  - an evaluation of the potential for impacts to nearby surface water and groundwater.

Between two and four storage tanks would be associated with each group of four ponds. These would typically be a maximum of 20 feet tall, and be painted a neutral color (as required by the AO) to blend in with the natural landscape. Tanks would be clustered together within secondary containment berms. The bermed area would have sufficient volume to contain the contents of the largest liquid hydrocarbon storage tank (or connected series of tanks) within it.

A gas-fired, electrical generating facility would be housed in a structure approximately 30 feet wide, 90 feet long and 12 feet tall. It would be able to generate the approximately 1,800 kilowatts (kW) needed to power the mechanical evaporators and lights required at the facility. It would house a total of approximately 2,700 hp worth of generators, which would be installed in phases over the 15-year development of the well field. The structure would be painted like the tanks (as required by the AO) to blend in with the natural landscape. If electrical service became available at this location from a third-party source, this aforementioned structure and generating capacity would not be necessary. (Trucking requirements for water disposal are included in Table 2-5.)

Miscellaneous other water-treating equipment such as separators and heaters may be required. The size and quantity of this equipment would be small relative to the aforementioned items (approximately 6–7 feet tall). It would be painted like the other equipment.

The construction and operation of these facilities would meet all minimum standards in BLM Onshore Order No. 7, including the construction of fencing to exclude wildlife and unauthorized waste disposal, minimization of oil on the free water surface to a negligible amount, installation and operation of a leak detection system, and prevention of surface water ingress or discharges to surface waters or drainages. Although the ponds would not be netted to prevent entry by waterfowl due to their size, mitigation measures including gas-operated exploders, electronically produced bird distress calls, and visual deterrents such as scarecrows, flagging, lights, and balloons would be used to deter birds from utilizing the ponds as required by the AO. All headworks (which remove oil to prevent it from reaching the ponds) would be netted or enclosed to prevent entry by wildlife or birds. In addition to the installation of headworks and tanks to capture oil, absorbent booms would also be deployed to ensure that the ponds were not contaminated by oil.

2.2.5 WASTE DISPOSAL

Produced wastewater stored on the site would be confined to the reserve pit for a period not to exceed 90 days after final completion. Remaining water would be trucked to the proposed evaporative facilities. Trash would be confined in a covered container and hauled to the Duchesne County landfill. There would be no burning of waste or oil. Human waste would be contained within a chemical portable toilet and be disposed of at the Duchesne City sewage treatment facility.

Solid waste created in tank bottoms of individual well sites would range from 5 to 15 barrels of material every 3 to 5 years. The amount of solids and/or sludge generated at the evaporative facility's headworks would average from 100 to 200 barrels per month. All wastes from the well facilities would be handled and disposed of in accordance with BLM regulations governing on-shore oil and gas operations, as noted in Section 1.4.2, Other Regulations (Onshore Oil and Gas Orders). General requirements include compliance with applicable laws and regulations, the lease terms, Onshore Oil and Gas Orders, Notices to Lessees and Operators (NTLs), and other orders and instructions of the authorized officer. All operations would be conducted in a manner

that ensures the proper handling, measurement, disposition, and site security of leasehold production, and protects other natural resources and environmental quality, as well as life and property (43 CFR 3162.1(a)). All wastes associated with the evaporation pond facilities would be handled as per the regulations of the BLM and UDOGM and/or the EPA or other applicable agency.

2.2.6 ABANDONMENT AND RECLAMATION

Both the BLM and UDOGM prescribe procedures for well plugging and abandonment at the end of the life of a particular well, as well as site restoration procedures. Prior to abandonment of any well location, access drive, or other facility, Gasco would file a Notice of Intent to Abandon, which details the proposed abandonment procedures.

2.2.6.1 INTERIM RECLAMATION

Interim reclamation consists of minimizing the footprint of disturbance by reclaiming all portions of the well site not needed for production operations. The portions of the cleared well site not needed for operational and safety purposes are recontoured to a final or intermediate contour that blends with the surrounding topography as much as possible. Sufficient level area would remain for setup of a workover rig and to park equipment. In some cases, rig anchors may need to be pulled and reset after recontouring to allow for maximum reclamation. Stockpiled topsoil is respread over areas not needed for all-weather operations. When practical, topsoil would be respread over the entire location and revegetated to within a few feet of the production facilities, unless an all-weather, surfaced, access route or turnaround is needed. Production facilities would be clustered or placed off-site at a centralized production facility to maximize the opportunity for interim reclamation. In order to inspect and operate the well or complete workover operations, it may be necessary to drive, park, and operate on restored, interim vegetation within the previously disturbed area. This damage would be repaired and reclaimed following use. Under some situations, such as the presence of moist, clay soils, vegetation and topsoil may be removed during workover operations and restored following operations to prevent soil compaction.

On a producing location, the reserve pit would be reclaimed within 120 days of final well completion, weather permitting. Prior to reclamation, the reserve pit would be pumped dry and all debris removed. The liner would be folded into the reserve pit and the pit backfilled. The reserve pit and that portion of the location not needed for production facilities/operations would be recontoured to the approximate natural contours and reseeded. This would include recontouring the pad back to the "deadman," thus creating a teardrop. The reserve pit is approximately 0.3 acre in size, leaving a producing well-pad size of 3.5 acres or less. The pit would be crowned to prevent water from standing. Topsoil would be spread over the recontoured area, and then seeded. Seed would be broadcasted and walked in with a dozer to plant the seed. Water would be used to control dust during interim reclamation. All disturbed areas would be reclaimed with a seed mixture of pure live seed (PLS) accepted and approved by the AO. The seed specified in Table 2-3 would be used on the topsoil during interim reclamation, unless otherwise specified by the AO:

Table 2-3. Seed Used on the Topsoil during Interim Reclamation

Seed	Scientific Name	Lbs/acre (PLS)
Crested Wheatgrass (var. *Hycrest*)	*Agropyron cristatum*	4
Needle and Thread Grass	*Hesperostipa comata*	4
Western Wheatgrass	*Pascopyrum smithii*	4

2.2.6.2 DRY HOLE/ABANDONED LOCATIONS

Upon approval of the AO, wellbores would be plugged with cement as necessary to prevent fluid or pressure migration and to protect mineral and/or water resources. Wellheads would be removed, with both the surface and production casings being cut off below ground level, and an appropriate dry hole marker set in compliance with federal and state regulations. All surface equipment, including the tank battery, pumping unit, heater-treater (used to prevent water and ice formation in the wellhead or flowlines), and aboveground flow lines and gas system pipelines would be removed from the site. Underground pipelines would be abandoned in place, unless otherwise directed by the AO. Unneeded surface lines would be removed.

Abandoned well sites, roads, and other disturbed areas would be restored as near to their original condition as practical and as accepted by the AO. Stockpiled topsoil would be spread across the recontoured area, then seeded with the recommended seed mixture. Seeding would be performed immediately after dirt work is completed or in the fall, as directed by the AO. Seeding would be accomplished by either drilling or broadcasting the seed and walking it in with a dozer. All surface disturbances would be planted with a seed mixture appropriate for the site, as specified by the AO. The seed mix for final reclamation would be determined when notification of final abandonment occurs.

2.2.6.3 EVAPORATION PONDS

A final closure plan would be submitted prior to closure of the evaporation pond facilities. This plan would include 1) provisions for removal and proper disposal of all equipment at the site, 2) a plan for sampling and testing soil and groundwater at the project site, with soil samples analyzed at the levels outlined by UDOGM's Cleanup Levels for Contaminated Soils or background levels, whichever is less stringent, 3) provisions for future monitoring plans, if required by UDOGM, and 4) considerations for post-disposal land use and landowner requests upon completion of closure.

Closure procedures would include the following: The pits would be pumped dry with all debris and any solid waste removed. The pit liner would then be folded over into the pit and the pit backfilled. The backfilled area would then be recontoured with top soil and reseeded. Any waste and solids removed would be transported to an approved disposal site and disposed of according to BLM, UDOGM, and/or the EPA regulations.

2.2.7 WORKFORCE REQUIREMENTS

Estimated worker days and vehicle roundtrips per well under the Proposed Action are shown in Tables 2-4 and 2-5. Assuming the development of 1,491 wells, approximately 6,715 worker years and 2,534,700 roundtrips are projected for the Proposed Action over the 45-year lifetime of the project.

Table 2-4. Estimated Worker Days per Well

Employment Category	(a) Average Days	(b) Workers per Shift	(c) Number of Shifts/Day	(a × b × c) Worker Days/Well
Well Pad Construction	4	5	1	20
Drilling (all phases)	35	15	2	1,050
Completion	14	12	1	168
Pipelines	1.5	6	1	9
Production (30 years, 4.5 days/week, 35 wells per trip)	201	1	1	201
Workovers (2 × 7 days)	14	12	1	168
Plugging and Abandonment	2	4	1	8
Reclamation	5	4	1	20
Total				**1,644**

Table 2-5. Estimated Vehicle Roundtrips per Well

Employment Category	(a) Passenger Truck[1]	(b) Semi-truck[2]	(c) Special[3]	(d) Water Truck	(e) Oil Tanker	(a+b+c+d+e) Roundtrips/ Well
Well Pad Construction	10	5	0	1	0	16
Drilling (all phases)	80	70	10	75	0	235
Completion	56	32	14	157	0	259
Pipelines	4	2	20	0	0	26
Production (assumes 35 wells visited per roundtrip)	402	0	0	580	64	1,046
Workovers	56	8	14	8	0	86
Plugging and Abandonment	4	6	1	4	2	17
Reclamation	10	4	0	1	0	15
Total	**622**	**127**	**59**	**826**	**66**	**1,700**

[1] Passenger vehicle assumed to transport 3 workers.

[2] Semi-truck transports used to haul drilling rigs, pipe, heavy equipment, etc.

[3] Special trucks designed for a particular purpose such as a welding truck, sand truck, pump truck, etc.

2.2.8 WORKOVERS

Workovers would be performed on an as-needed basis to repair worn downhole equipment, sustain existing production rates, or to rework a well to enhance its productivity. Completion rigs would be used to perform the workovers. Routine repairs typically take 1–2 days, and rework operations typically take 5–10 days. Workover operations generally occur once or twice during the life of each operating well location, and would be identical to those described for well completion (Section 2.2.2.4). For workover operations associated with a

well upon any federal lease, prior approval is not required from the AO for routine fracturing or acidizing jobs, unless additional surface disturbance is required. This is also applicable for well cleanouts, routine well maintenance, or bottom hole surveys (see 43 CFR 3162.3-2).

2.2.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES AND BMPS

Under the Proposed Action, Gasco would implement the applicant-committed environmental protection measures and BMPs described below to minimize adverse impacts of the proposed project to sensitive environmental resources.

2.2.9.1 MULTIPLE RESOURCES

Several applicant-committed BMPs would be applied as necessary to reduce or minimize potentially adverse impacts to multiple environmental resources. These BMPs include the use of directional drilling, the burial of collector and transmission pipelines under or adjacent to roadways, and the centralization of water and condensate facilities.

Directional drilling and drilling of multiple wells from single pads would occur on a limited site-specific basis where technologically and economically feasible, and as necessary to reduce or eliminate impacts to sensitive resources of particular concern identified by the AO. The deep tight gas formations that Gasco seeks to develop present numerous operational challenges with respect to directional drilling due to the fluvial nature of the pay zones within the various potential producing horizons. Operation challenges also include the potential for getting the drill pipe stuck in wells directionally drilled at depths exceeding 14,500 feet. Because the feasibility of directional drilling is site specific, depending upon underlying geologic conditions, and also dependent upon current economic conditions, such as the price of natural gas, analysis of the Proposed Action conservatively assumes that one pad would be required for each well proposed.

Gasco would bury pipelines within or adjacent to roadways and/or centralize water and condensate tank batteries where on-site review indicates these measures would reduce overall environmental impacts or impacts to particular sensitive resources. Resources that may be considered during on-site review of buried pipelines and centralized tanks include: visual resources, access by vehicles and fire crews, wildlife resources (e.g., sage-grouse and prairie dog habitat), and other locally sensitive resources. These measures would be applied at the site-specific level and at the discretion of the AO. In addition, tank batteries would be centralized where multiple wells are drilled directionally from a single pad (Section 2.2.9.1).

In order to account for the application of these BMPs, the analysis in Chapter 4 conservatively assumes that the road shoulder surface disturbance caused by pipeline construction would average 10 feet wide from the edge of the road. This roadside disturbance width was assumed in order to include the impacts of surface pipeline placement, pipeline burial within the roadway, and roadside burial (see Section 2.2.3).

The site-specific application of these BMPs would depend upon a number of factors, including the nature of the landscape (i.e., landforms, vegetation, and existing structures), local geology and soils, well spacing, the use of existing roads versus the need to construct new roads, and the presence of sensitive resources that may be adversely or beneficially affected by any of these BMPs. These factors would be considered at the implementation level through on-site review during the APD process. As practicable, Gasco would submit APDs in groups (of nearby wells) in order to facilitate the BLM's analysis regarding the application of these BMPs across larger areas.

2.2.9.2 CULTURAL RESOURCES

A Class III cultural resources survey would be conducted by a qualified archaeologist over all areas proposed for surface disturbance that have not been previously surveyed. If these surveys identify areas with a high probability of encountering potentially scientifically important subsurface archaeological sites, a qualified archaeologist would monitor surface disturbance during construction.

Gasco and its contractors would use BLM outreach opportunities to educate their employees on the value and sensitivity of cultural resources, and relevant laws and regulations that protect them.

Equipment operators would be informed that if a site were uncovered during construction, activities in the vicinity would immediately cease, and the AO would be notified.

Historic properties considered eligible for the National Register of Historic Places (NRHP) would be avoided or mitigated through an approved data recovery plan.

2.2.9.3 PALEONTOLOGICAL RESOURCES

Surveys for paleontological resources would be conducted on those areas where bedrock excavation into sensitive (PFYC IV and V) formations would occur. Areas with sandstone outcrops would be surveyed for paleontological resources by a qualified paleontologist. The survey would determine fossil localities and the sensitivity of the area for fossil resources. These actions would determine the necessity of having a qualified paleontologist on site during construction.

If paleontological resources were uncovered during ground-disturbing activities, Gasco would immediately suspend all operations that would further disturb such materials and contact the AO, who would arrange for a determination of importance and, if necessary, recommend a recovery or avoidance plan.

2.2.9.4 INVASIVE WEEDS

In coordination with the AO, Gasco would implement its Plan for Surface Reclamation and Monitoring (Appendix G) to maximize the success of the reclamation program. If reclamation was not successful for both herbaceous and woody species, Gasco would coordinate with the AO on appropriate remedial measures. In addition, Gasco would develop and implement an AO-approved noxious weed inventory, monitoring, and control program for the project disturbance areas.

The operator would control all noxious/invasive weeds along ROWs for roads, pipelines, well sites, or other applicable facilities by the application of herbicides or by mechanical removal. A list of noxious weeds would be obtained from the BLM or appropriate County Extension Office.

2.2.9.5 SPECIAL STATUS PLANTS

In order to minimize the effects on federally threatened or endangered plant species, a number of avoidance and minimization measures would be employed to protect the Uinta Basin hookless cactus, Pariette hookless cactus, Ute ladies'-tresses, clay reed-mustard, and shrubby reed-mustard, and Graham's penstemon. The measures are included in Appendix B. In addition, surveys and monitoring would be conducted in compliance with the BLM Manual 6840 for Untermann daisy (*Erigeron untermanii*).

If populations of other threatened, endangered, or BLM sensitive plants are identified in the future, avoidance and mitigation measures would be addressed at the site-specific level during the APD process, which may include site-specific NEPA and consultation with the USFWS, as necessary.

2.2.9.6 RAPTOR NESTS

No new construction or surface-disturbing activities would be conducted within a specified buffer of known active raptor nests from courtship through fledging (Table 2-6). Activity surveys of known nest locations would be conducted each year, with the surveys' timing determined in coordination with the AO to account for annual climate fluctuations. These surveys would be conducted by the AO, the Utah Division of Wildlife Resources (UDWR), or a qualified biologist approved by the AO, and the survey results would be reported to the AO. Active nests are defined as currently occupied nests or those that have been occupied for nesting activities within the previous two nesting seasons; inactive nests are those that have not been occupied for nesting activities within the previous two nesting seasons. If active nests were documented during the activity survey, new construction or surface-disturbing activities within the specified buffer (Table 2-6) of those nests would be avoided during the nesting period identified by the AO.

Table 2-6. Raptor Nest Buffers and Timing Constraints

Species	Distance from Active Nest	Timing Constraints
American Kestrel	--[1]	Apr 1–Aug 15
Burrowing Owl	0.25 mile	Mar 1–Aug 31
Cooper's Hawk	0.50 mile	Mar 15–Aug 31
Great Horned Owl	0.25 mile	Feb 1–Sep 31
Long-eared Owl	0.25 mile	Feb 1–Aug 15
Merlin	0.50 mile	Apr 1–Aug 31
Mexican Spotted Owl (MSO)	0.50 mile	Mar 1–Aug 31
Northern Goshawk	0.50 mile	Jan 1–Aug 15
Northern Harrier	0.50 mile	Apr 1–Aug 15
Osprey	0.50 mile	Apr 1–Aug 31
Peregrine Falcon	0.25 mile	Feb 1 – Aug 31
Prairie Falcon	0.25 mile	Apr 1–Aug 31
Red-tailed Hawk	0.50 mile	Mar 15–Aug 15
Sharp-shinned Hawk	0.50 mile	Mar 15–Aug 31
Short-eared Owl	0.25 mile	Mar 1–Aug 1
Swainson's Hawk	0.50 mile	Mar 1–Aug 31
Turkey Vulture	0.50 mile	May 1–Aug 15

[1] Due to apparent high population densities and ability to adapt to human activity, a spatial buffer is not currently considered necessary for maintenance of American kestrel populations. Actions resulting in direct mortality of individual birds or take of known nest sites are unlawful.

Ferruginous hawk and golden eagle nest sites within the project area have been identified as sensitive resources requiring special protection. To promote continued nest-site selection and nesting activities within the project area, applicant-committed protection measures would be implemented for all ferruginous hawk and golden eagle nests that have been active within the past two years. These are detailed in Sections 2.2.9.6.1 and 2.2.9.6.2, below.

2.2.9.6.1 Active Ferruginous Hawk and Golden Eagle Nests

No new construction or surface-disturbing activities would be conducted within a 0.5-mile buffer of active nests during courtship, nest building, egg laying, incubation, hatching, or fledging periods (February 1 through July 15 for ferruginous hawks and golden eagles). Between August 1 and January 31 (outside the courtship to fledging period), new construction or drilling activities could be conducted within a 0.5-mile buffer of active nests subject to these restrictions:

- No well pad would be constructed within 0.5 mile of an active nest where any portion of its permanent facilities would be visible from the nest.
- Under no circumstances would construction or surface-disturbing activities take place within 0.25 mile of an active nest.
- All access roads to well pads would be designed to avoid line-of-site visibility from active nests to the maximum extent practical.

2.2.9.6.2 Inactive Ferruginous Hawk and Golden Eagle Nests

Between May 30 and January 31 (outside the courtship to fledging period), new construction or surface-disturbing activities could be conducted within a 0.5-mile buffer of inactive nests only if permanent facilities are not visible from the nest.

2.2.9.6.3 Artificial Nests

One artificial nesting structure (ANS) will be constructed and positioned carefully, in coordination with the BLM, UDWR, and the USFWS, for each existing artificial ferruginous hawk nest site (active or inactive) that is located within 0.5 mile of a new project-related surface-disturbing activity. These new ANSs will be afforded the same protection as natural raptor nests for the life of the project. Existing ANSs that are encroached upon will be left in place, but would not be treated as natural raptor nests. Monitoring of new ANSs will be conducted by the AO annually to determine nesting activity.

2.2.9.7 Greater Sage-grouse Leks and Nesting Areas

On BLM land, new construction and surface-disturbing activities would be avoided year-round within 0.25 mile of active greater sage-grouse strutting grounds (leks), as well as those previously identified by the BLM as being historically located in the area. No permanent facilities will be constructed within 2 miles of active strutting grounds when possible.

No new construction or surface-disturbing activities would be conducted between March 1 and June 15 each year within greater sage-grouse nesting areas (a 2-mile radius of strutting grounds in areas of sagebrush vegetation) until an activity survey was completed. The survey would be conducted by a qualified biologist to determine the presence or absence of nesting greater sage-grouse. The activity survey would be conducted each year between April 1 and April 15, or as

determined in coordination with the AO, to account for annual climate fluctuations, and the results would be reported to the AO. If active nesting areas are documented during the annual survey, no new construction and surface-disturbing activities would take place within 0.5 mile of those nesting areas during the nesting period identified by the AO.

Within 0.5 mile of known active leks, the best available technology will be used to reduce noise, e.g., installation of multi-cylinder pumps, hospital sound-reducing mufflers, and placement of exhaust systems.

2.2.9.8 Bald Eagle Wintering Areas

No construction or surface disturbing activity would occur within 0.5 mile of a roost site from November 1st through March 31st. Temporary actions may occur within this 0.5-mile buffer outside of this seasonal restriction. If temporary actions must occur within the seasonal restrictions, then they would occur between 9am (typically after a bald eagle leaves a roost for the day) and 5pm (typically before a bald eagle returns to the roost site for the day).

2.2.9.9 Mountain Plover Breeding Habitat

Mountain plover breeding habitat has been identified within the project area by the BLM. On BLM land in areas containing suitable mountain plover breeding habitat (as identified by the AO during the on-site inspection), presence/absence surveys would be conducted according to the USFWS plover survey protocol prior to beginning new construction or surface-disturbing activities. No new construction or surface-disturbing activities would be conducted during the mountain plover breeding and fledging season (March 15–June 15) in areas known to contain mountain plover or active mountain plover nest sites. Motorized travel in plover breeding habitat areas would take place only on designated routes with no cross-country travel permitted, and speed limits would be posted as no more than 35 mph in identified plover habitat. As possible, vehicle trips within habitat areas would be limited to daylight hours. Road maintenance would be avoided between May 1 and June 15 to avoid hazards to chicks. Reclamation of surface disturbance would be implemented as described in Section 2.2.6.1. However, reclamation mixes in mountain plover habitat would be designed to include low-growing native grasses and forbs such as galleta grass (*Pleuraphis jamesii*) and globe mallow (*Sphaeralcea* spp.) to promote better nesting habitat.

2.2.9.10 Mexican Spotted Owl (MSO) Habitat

Good and fair Mexican spotted owl (MSO) habitat has been identified in the project area by BLM (SWCA 2005a). Gasco would avoid all fair and good MSO habitat currently mapped (SWCA 2005a) below the rim of Nine Mile Canyon (see Map 40).

2.2.9.11 Range Resources

Gasco would adjust final placement of well locations to avoid stock ponds, guzzlers, or wells currently established for watering livestock. Existing range study plots, corrals, and rain gages also would be avoided.

2.2.9.12 HAZARDOUS MATERIALS AND EMERGENCY RESPONSE

Gasco would maintain a file containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds, and/or substances used during construction, drilling, completion, production, and gas-gathering operations. Gasco has reviewed the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 (as amended) to identify any hazardous substances proposed for use in this project, as well as the EPA's List of Extremely Hazardous Substances as defined in 40 CFR 355, as amended.

Gasco and its contractors would comply with all applicable federal laws and regulations existing or hereafter enacted or promulgated. Gasco and its contractors would locate, handle, and store hazardous substances in an appropriate manner that would prevent them from contaminating soil and water resources or otherwise sensitive environments. Any release (e.g., leaks, spills, etc.) of hazardous substances in excess of the reportable quantity as established by 40 CFR 117, would be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. If the release of a hazardous substance in a reportable quantity were to occur, a copy of a report would be furnished to the AO and all other appropriate federal and state agencies.

Gasco has evaluated its overall well field operations and has prepared and implemented a SPCC plan; copies are kept at Gasco's Roosevelt, Utah field office (FO) and would be available at facilities if they are operated at least eight hours per day. The plan includes accidental-discharge reporting procedures, spill response and cleanup measures, and maintenance of dikes. A sample SPCC plan is provided as Appendix N. Specific components of the SPCC plan include the following:

- Specific information for each site, including professional engineer certification, management approval and review, substantial harm criteria checklist, secondary containment calculations, and facility diagrams (including topography and surface flow direction)
- Emergency contact information and procedures, including emergency response and public safety contacts, verbal notification of agencies (EPA, the Utah Department of Environmental Quality [UDEQ], UDOGM, counties), and written notification of agencies (UDEQ and UDOGM)
- Design, operation, and inspection requirements for tanks, pipes, valves, and pressure tanks (separators, knockout tanks, heater-treaters)
- Operational requirements for common spill-producing activities, including loading and removing excess water from tanks
- Requirements for annual and routine inspections, including inspection of facility containment and drainage, facility bulk storage containers, facility piping, facility transfer operations, and pumping equipment

- Personnel training requirements, including training on spill control equipment; equipment operation and maintenance; containment, vessel, tank, and piping inspection and maintenance; spill response, containment, and cleanup; company policies on reporting and responding to spills; and other facility-specific information required in the SPCC plan
- A specific Oil Contingency Plan (as an appendix) with response guidelines for controlling and containing oil discharges

A Hazard Communication Program (as required by 29 CFR 1910.1200) is also kept at Gasco's Utah FO, and SARA Title III (a.k.a., the Emergency Planning and Community Right-to-Know Act information is submitted yearly as required; copies are kept in Gasco's Denver, Colorado, office, as well as in Gasco's Utah FO. Gasco has a written Confined Space Entry Procedure that is kept in the Utah FO.

Gasco would complete record keeping and reporting (as required under 40 CFR 262.41) regarding waste volume and toxicity as necessary according to operations. Gasco is bonded for facility closure upon termination of public land use authorization, and a copy of the bonding is kept in Gasco's Utah FO.

2.3 Alternative B: Reduced Development

Alternative B was developed to respond to sensitive resource and land use issues in the project area expressed during public and agency scoping. Under Alternative B, natural gas development on federal leases would be implemented in a phased manner through surface disturbance restrictions imposed by the BLM. Maximum new annual surface disturbance would be limited to approximately 485 acres per year on federal land. Under Alternative B, Gasco would drill 1,114 new gas production wells and construct associated access roads, water supply pipelines, and natural gas gathering lines (see Map 4). Unless otherwise noted, management actions under this alternative would be the same as the Proposed Action. However, well-pad locations would be either precluded from development, or developed at a lower density in sensitive areas. These exclusions or reduced development densities include the following:

- No well pads would be located within 0.5 mile of known active raptor nests.
- No well pads would be located within 1,000 feet of an active sage-grouse lek.
- No well pads would be located within the existing Pariette and Lower Green River areas of critical environmental concern (ACECs).
- No well pads would be located below the rim of Nine Mile Canyon within Nine Mile Canyon ACEC, or in areas of Nine Mile Canyon ACEC where no valid existing oil and gas leases are present.
- 160-acre surface spacing would be used for wells in all areas of Nine Mile Canyon ACEC where the above provision does not apply, and within areas proposed for the expansion of Nine Mile Canyon ACEC during the resource management plan (RMP) revision process.
- 160-acre surface spacing would be used for wells within the Four Mile Wash area proposed as an ACEC during the Vernal RMP revision process.
- 160-acre surface spacing would be used for wells within the Myton Bench/Coyote Basin area proposed as an ACEC during the Vernal RMP revision process.

- No well pads would be located in areas currently managed under the BLM's Visual Resource Management (VRM) system as Class II.
- No well pads would be located on BLM-administered land within approximately 0.25 mile of river segments deemed suitable for designation under the Wild and Scenic Rivers Act, as measured from the high water mark on each bank.
- No wells would be located in areas previously inventoried as having an appearance of naturalness and that offer opportunities for solitude and primitive/unconfined recreation (BLM 2007e).

The construction of new compressor facilities is not proposed as part of this alternative. However, treatment capacity would be expanded by a total of approximately 15,600 hp at two existing gas plants to handle the increased production.

2.3.1 ACCESS ROADS

2.3.1.1 LAND REQUIREMENTS

Existing roads and newly constructed roads would provide access to the proposed wells. It is estimated that approximately 274 miles of new road would be required to access the proposed wells. The total surface disturbance associated with the construction of access roads would be 996 acres. The average construction disturbance widths of each road type and associated utility corridors would be the same as those described for the Proposed Action in Section 2.2.1.1.

2.3.1.2 ROAD CONSTRUCTION

Roads would be constructed as described for the Proposed Action in Section 2.2.1.2. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field.

2.3.2 WELL DRILLING AND COMPLETION

2.3.2.1 LAND REQUIREMENTS

The well site disturbance and well-pad layout would be consistent with that described for the Proposed Action in Section 2.2.2.1 (see also Figure 2-1). Collectively, approximately 4,233 acres of land would be disturbed by well pads under Alternative B.

2.3.2.2 WELL PAD CONSTRUCTION

Construction of well pads would follow the same procedures as those described for the Proposed Action in Section 2.2.2.2.

2.3.2.3 WELL DRILLING

Well drilling procedures would be the same as those described for the Proposed Action in Section 2.2.2.3.

2.3.2.4 WELL COMPLETION AND PRODUCTION

Well completion and production procedures would be the same as those described for the Proposed Action in Section 2.2.2.4.

2.3.3 PIPELINES

The following procedures would be the same as those described for the Proposed Action in Section 2.2.3: the construction and placement of pipelines; the ratio of pipelines on the surface versus buried; the typical amount of cross-country lines; and the pipeline disturbance widths. The total length of gas pipeline for Alternative B would be approximately 2,075,040 feet (393 miles), and approximately 476 acres would be disturbed across the project area.

2.3.4 WATER SUPPLY AND DISPOSAL

Water for drilling would be from the same authorized sources indicated for the Proposed Action in Section 2.2.4. A total of 3,317 acre-feet of treated and recycled water would be required under this alternative. Of this total, 3,102 acre-feet (94%) would be treated and recycled production water and 215 acre-feet (6%) would be fresh water.

Similarly, produced water would be disposed of as described under the Proposed Action. At peak development, the 1,114 wells proposed under this alternative would be expected to produce approximately 18,840 barrels of water per day. In order to dispose of this water, the evaporative facility constructed would incorporate 20 basins, and occupy approximately 135 acres with basins and associated roads, tanks (2–4 per every group of four ponds), headworks, a power-generation building enclosing 1,320 kW (1,980 hp) of generating capacity, and other facilities. These facilities would be the same as those described under the Proposed Action, but would be scaled to accommodate the lesser amount of produced water from this alternative's smaller number of wells.

2.3.5 WASTE DISPOSAL

All waste would be disposed according to the procedures described for the Proposed Action in Section 2.2.5.

2.3.6 ABANDONMENT AND RECLAMATION

The abandonment procedures described for the Proposed Action in Section 2.2.6.

2.3.6.1 INTERIM RECLAMATION

As described for the Proposed Action in Section 2.2.6.1, the reserve pit would be reclaimed within 120 days of final well completion, weather permitting. All restoration procedures, including seed mixture, would be the same as described under the Proposed Action.

2.3.6.2 DRY HOLE/ABANDONED LOCATION

Wellbore and abandoned well-site reclamation procedures would be the same as described for the Proposed Action in Section 2.2.6.2.

2.3.7 WORKFORCE REQUIREMENTS

Assuming the development of 1,114 wells under Alternative B, approximately 5,018 worker years and 1,893,800 roundtrips are projected over the 45-year lifetime of the project (see Tables 2-4 and 2-5).

2.3.8 WORKOVERS

Workovers would be performed on an as-needed basis as described for the Proposed Action in Section 2.2.8.

2.3.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

Unless otherwise noted below, the applicant-committed measures for this alternative would be the same as those described for the Proposed Action in Section 2.2.9.

2.3.9.1 RAPTOR NESTS

No wells would be located within a 0.5-mile buffer of known active raptor nests as part of this Reduced Development Alternative. The restrictions for new construction or surface-disturbing activities within buffers around raptor nests, and applicant-committed measures, would be the same as those described under the Proposed Action.

2.3.9.2 GREATER SAGE-GROUSE LEKS AND NESTING AREAS

No well pads or other surface disturbances would be located within 1,000 feet of active greater sage-grouse strutting grounds (leks) or those identified by the BLM as being historically located in the area. The temporal restrictions regarding new construction or surface-disturbing activities within greater sage-grouse nesting areas, and the required activity surveys, would be the same as those described under the Proposed Action.

2.3.9.3 AESTHETICS

As part of this Reduced Development Alternative, no wells would be located on BLM-administered lands within areas currently managed as VRM Class II.

Several segments of the Green River are deemed suitable for designation under the Wild and Scenic Rivers Act in the Vernal RMP (BLM 2008c). The Lower Green River segment has a tentative classification of "scenic," and 19 of its shoreline miles are on BLM-administered land. No wells would be located on BLM-administered land within approximately 0.25 mile of this suitable river segment's high water marks along each bank.

2.3.9.4 ACECs

As part of this Reduced Development Alternative, no wells would be located within the following areas:

- All of the existing Pariette ACEC
- All of the existing Lower Green River ACEC
- Areas below the rim of Nine Mile Canyon within Nine Mile Canyon ACEC
- Areas within Nine Mile Canyon ACEC that do not have valid existing oil and gas leases

Previously leased areas above the canyon rim within Nine Mile Canyon ACEC would use 160-acre spacing to reduce their overall well density.

2.4 ALTERNATIVE C: FULL DEVELOPMENT

Alternative C (Full Development) was developed to analyze the effects of a maximum development scenario in the project area. Because of the programmatic nature of this analysis, it was assumed that all leases would be developed, with well pads located across the project area in a more-or-less evenly spaced (40–160 acre) pattern capitalizing on existing roads where possible. Under Alternative C, it is estimated that 1,887 new gas production wells would be drilled, and associated access roads, water supply pipelines, and natural gas gathering lines would be constructed. Well pad spacing in a given area would vary based on terrain and sensitive resources; however, it is assumed that areas meeting one or more of the following criteria would generally be developed at a lower surface spacing (typically 160-acre) than the rest of the project area (see Map 5):

- Topographically rough terrain with slopes in excess of 40°
- Areas within 0.5 mile of known active raptor nests
- Areas within 1,000 feet of an active sage-grouse lek
- Lands that fall within the existing Pariette and Lower Green River ACECs
- Lands that fall within the Four Mile Wash area proposed as an ACEC during the Vernal RMP revision process
- Areas classified as VRM Class II
- Areas within approximately 0.25 mile of the banks' high water marks along segments deemed suitable for designation under the Wild and Scenic Rivers Act
- Lands estimated to have a high probability of cultural sensitivity based on the predictive modeling used for the Vernal RMP (BLM 2008c)

It is assumed that no surface disturbance would occur in areas identified in the lease terms and conditions as No Surface Occupancy (NSO) or closed to oil and gas leasing. The construction of new compressor facilities is not proposed as part of this alternative. However, treatment capacity would be expanded by a total of approximately 26,400 hp at two existing gas plants to handle the increased production.

2.4.1 ACCESS ROADS

2.4.1.1 LAND REQUIREMENTS

Existing roads and newly constructed roads would provide access to the proposed wells. It was estimated that a total of approximately 526 miles of new road would be required to access the proposed wells. The total surface disturbance associated with the construction of access roads would be approximately 1,913 acres. The average construction disturbance widths of road types and associated utility corridors are similar to those described for the Proposed Action in Section 2.2.1.1.

2.4.1.2 ROAD CONSTRUCTION

Roads would be constructed as described for the Proposed Action in Section 2.2.1.2. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field.

2.4.2 WELL DRILLING AND COMPLETION

2.4.2.1 LAND REQUIREMENTS

The well site disturbance and pad layout would be as described for the Proposed Action in Section 2.2.2.1 (see also Figure 2-1). Collectively, approximately 7,171 acres of land would be disturbed by well pads under Alternative C.

2.4.2.2 WELL PAD CONSTRUCTION

Construction of well pads would follow the same procedures as described for the Proposed Action in Section 2.2.2.2.

2.4.2.3 WELL DRILLING

Well drilling procedures would be the same as those described for the Proposed Action in Section 2.2.2.3.

2.4.2.4 WELL COMPLETION AND PRODUCTION

Well completion and production procedures would be the same as those described for the Proposed Action in Section 2.2.2.4.

2.4.3 PIPELINES

The following procedures would be the same as those described for the Proposed Action in Section 2.2.3: The construction and placement of pipelines; the ratio of pipelines on the surface versus buried; the typical amount of cross-country lines; and pipeline disturbance widths. The total length of gas pipeline for Alternative C would be approximately 4,546,080 feet (861 miles), and approximately 1,044 acres would be disturbed within the project area.

2.4.4 WATER SUPPLY AND DISPOSAL

Water for drilling would be from the same authorized sources indicated for the Proposed Action in Section 2.2.4. A total of 5,619 acre-feet of water would be required under this alternative. Of this total, 5,254 acre-feet (94%) would be treated and recycled production water and 365 acre-feet (6%) would be fresh water.

Similarly, produced water would be disposed of as described under the Proposed Action. At peak development, the 1,887 wells proposed under this alternative would be expected to produce approximately 24,560 barrels of water per day. In order to dispose of this water, the evaporative facility constructed would incorporate up to approximately 38 basins, and occupy approximately 271 acres with basins and associated roads, tanks (2–4 per every group of four ponds), headworks, a power-generation building enclosing 2,280 kW (3,420 hp) of generating capacity, and other facilities. These facilities would be the same as those described under the Proposed Action, but would be scaled to accommodate the higher amount of produced water from this alternative's greater number of wells.

2.4.5 WASTE DISPOSAL

All waste would be disposed according to the procedures described for the Proposed Action in Section 2.2.5.

2.4.6 ABANDONMENT AND RECLAMATION

The abandonment procedures outlined for the Proposed Action in Section 2.2.6 would be followed.

2.4.6.1 INTERIM RECLAMATION

As described under the Proposed Action, the reserve pit would be reclaimed within 120 days of final well completion, weather permitting. All restoration procedures, including seed mixture, would be the same as described for the Proposed Action in Section 2.2.6.1.

2.4.6.2 DRY HOLE/ABANDONED LOCATION

Wellbore and abandoned well-site reclamation procedures would be the same as those described for the Proposed Action in Section 2.2.6.2 for the Proposed Action.

2.4.7 WORKFORCE REQUIREMENTS

Assuming the development of 1,887 wells under Alternative C, approximately 8,499 worker years and 3,207,900 roundtrips are projected over the 45-year lifetime of the project (see Tables 2-4 and 2-5).

2.4.8 WORKOVERS

Workovers would be performed on an as-needed basis as described for the Proposed Action in Section 2.2.8.

2.4.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The applicant-committed measures for this alternative would be the same as those described under the Proposed Action.

2.5 ALTERNATIVE D: NO ACTION

Under the No Action Alternative, the proposed natural gas development on BLM lands as described in the Proposed Action would not be implemented. However, under this alternative, natural gas exploration and development is assumed to continue on federal, state, and private lands, albeit at a much smaller scale. Activity on federal lands would come from exploratory projects previously approved by BLM, and is assumed to also come from other subsequent authorizations by BLM, such as approval of wells to meet unit and/or lease obligations, authorization of single-well Environmental Assessments, and approval of wells that meet the requirements of APD approval via Categorical Exclusions under the Energy Policy Act of 2005. In addition, some development is assumed to continue on State of Utah and private lands, subject to the approval of UDOGM or the appropriate private landowner. Reasonable access across public lands to proposed well pads and facilities on state and private lands could also occur under the No Action Alternative.

The No Action Alternative forms the baseline against which the potential impacts of the Proposed Action and the other action alternatives are compared. Thus, although it includes actions assumed to occur in the absence of approval of any of the action alternatives, it does not authorize any of the development assumed for the purposes of analysis.

This alternative mirrors past production trends and mineral development activities in the project area, except for areas where previously approved projects are in place, which assume higher density drilling. For purposes of analysis in this EIS, it is assumed that under the No Action Alternative approximately 368 new wells, including necessary facilities, would be developed within the project area in the next 15 years. For the sake of conservative analysis, it is assumed that each well would be placed on an individual pad; no directional drilling is anticipated. The construction of new compressor facilities is not expected as part of this alternative. However, treatment capacity would be assumed to expand by approximately 5,200 hp at existing gas plants to handle the increased production. As with the other alternatives, the average productive life of each well is assumed to be 30 years.

The primary elements composing this alternative are very similar to those of the Proposed Action Alternative (see Map 6). The same construction, operational, and reclamation components would occur as described for the Proposed Action, but at a proportionately lower rate. Table 2-7 shows a comparison of this alternative with the Proposed Action, Alternative B, and Alternative C.

2.5.1 ACCESS ROADS

2.5.1.1 LAND REQUIREMENTS

Existing and newly constructed roads would provide access to new wells. It is estimated that a total of approximately 72 miles of new road would be required to access the wells. The total surface disturbance associated with the construction of access roads would be approximately 262 acres. Currently, there are approximately 420 miles of roads, which service existing well locations within the project area.

2.5.1.2 ROAD CONSTRUCTION

Roads would be constructed as those described for the Proposed Action in Section 2.2.1.2. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field.

2.5.2 WELL DRILLING AND COMPLETION

2.5.2.1 LAND REQUIREMENTS

The well site disturbance and pad layout would be consistent with that outlined for the Proposed Action in Section 2.2.2.1 (see also Figure 2-1). Collectively, approximately 1,398 acres of land would be disturbed under the No Action Alternative.

2.5.2.2 WELL PAD CONSTRUCTION

Construction of well pads would follow the same procedures as those described under Section 2.2.2.2 of the Proposed Action.

2.5.2.3 WELL DRILLING

Well-drilling procedures would be the same as those described under Section 2.2.2.3 of the Proposed Action.

2.5.2.4 WELL COMPLETION AND PRODUCTION

Well completion and production procedures would be the same as those described under Section 2.2.2.4 of the Proposed Action.

2.5.3 PIPELINES

The following procedures would be the same as those described under Section 2.2.3 of the Proposed Action: The construction and placement of pipelines; the ratio of pipelines on the surface versus buried; the typical amount of cross-country lines; and pipeline disturbance widths. The total length of gas pipeline for the No Action Alternative would be approximately 1,668,480 feet (316 miles), and approximately 383 acres would be disturbed within the project area.

2.5.4 WATER SUPPLY AND DISPOSAL

Water for drilling is assumed to be from the same authorized sources indicated under Section 2.2.4 of the Proposed Action. A total of 1,096 acre-feet of water would be required under this alternative. Of this total, 1,025 acre-feet (94%) would be treated and recycled production water and 71 acre-feet (6%) would be fresh water.

Similarly, produced water is assumed to be disposed of as described under the Proposed Action. At peak development, the 368 wells expected under the No Action Alternative would be expected to produce approximately 4,780 barrels of water per day. In order to dispose of this water, the evaporative facility constructed would incorporate up to approximately eight basins, and occupy approximately 57 acres with basins and associated roads, tanks (2–4 per every group of four ponds), headworks, a power-generation building enclosing 480 kW (720 hp) of generating capacity, and other facilities. These facilities would be the same as those described under the Proposed Action, but would be scaled to accommodate the lesser amount of produced water from this alternative's smaller number of wells.

2.5.5 WASTE DISPOSAL

It is assumed that all waste would be disposed according to the procedures described under Section 2.2.5 of the Proposed Action.

2.5.6 ABANDONMENT AND RECLAMATION

The abandonment procedures outlined under Section 2.2.6 of the Proposed Action would be followed.

2.5.7 WORKFORCE REQUIREMENTS

Ongoing well development practices under the No Action Alternative are assumed to be the same as anticipated for Section 2.2.7 of the Proposed Action (see Tables 2-2 and 2-3). Assuming the additional development of 368 wells under Alternative D (No Action), approximately 1,658 worker years and 625,600 roundtrips are projected over the lifetime of the project (see Tables 2-4 and 2-5).

2.5.8 WORKOVERS

Workovers would be performed on an as-needed basis as described under Section 2.2.8 of the Proposed Action.

2.5.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The applicant-committed measures for this alternative would be as prescribed by the AO, as described in other approved documents, and as provided for in lease terms and conditions. However, for the purposed of analysis they are assumed to be the same as described under Section 2.2.9 of the Proposed Action.

2.6 ALTERNATIVE E: REDUCED DEVELOPMENT WITH DIRECTIONAL DRILLING

Alternative E was developed to respond to sensitive resource and land use issues in the project area expressed during public and agency scoping. Under Alternative E, well-pad locations would be precluded from sensitive areas or occur at a lower density in those areas, and surface impacts would be reduced throughout the field by developing multiple gas wells from each well pad. Like Alternative B, natural gas development on federal leases would be implemented in a phased manner. Under Alternative E, Gasco would drill 1,114 new gas production wells from a total of 328 pads and construct associated access roads and natural gas gathering lines (see Map 7). Unless otherwise noted, management actions under this alternative would be the same as those described under the Proposed Action. However, well pad locations would be either precluded from, or developed at a lower density in, sensitive areas. These exclusions or reduced development densities include the following:

- No well pads would be located within 0.5 mile of known active raptor nests.
- No well pads would be located within 1,000 feet of an active sage-grouse lek.
- No well pads would be located within the existing Pariette and Lower Green River ACECs.
- No well pads would be located below the rim of Nine Mile Canyon within the existing Nine Mile Canyon ACEC, or in areas of Nine Mile Canyon ACEC where no valid existing oil and gas leases are present.
- 160-acre downhole spacing, or approximately 540-acre surface spacing, would be used for wells in all areas of Nine Mile Canyon ACEC where the above provision does not apply, and within areas proposed for the expansion of Nine Mile Canyon ACEC during the Vernal RMP revision process.
- 160-acre downhole spacing, or approximately 540-acre surface spacing, would be used for wells within the Four Mile Wash area proposed as an ACEC during the Vernal RMP revision process.
- 160-acre downhole spacing, or approximately 540-acre surface spacing, would be used for wells within the Myton Bench/Coyote Basin area proposed as an ACEC during the Vernal RMP revision process.
- No well pads would be located in areas currently managed under the BLM's VRM system as Class II.
- No well pads would be located on BLM-administered land within approximately 0.25 mile of river segments deemed suitable for designation under the Wild and Scenic Rivers Act, as measured from the high water mark on each bank.

No wells would be located in areas that the BLM has inventoried and found to have wilderness characteristics (BLM 2007e).The construction of new compressor facilities is not proposed as part of this alternative. However, treatment capacity would be expanded by a total of approximately 15,600 hp at two existing gas plants to handle the increased production.

2.6.1 ACCESS ROADS

2.6.1.1 LAND REQUIREMENTS

Existing roads and newly constructed roads would provide access to the proposed wells. It is estimated that approximately 106 miles of new road would be required to access the proposed wells. The total surface disturbance associated with the construction of access roads would be 386 acres. The average construction disturbance widths of road types and associated utility corridors would be the same as those described for the Proposed Action in Section 2.2.1.1.

2.6.1.2 ROAD CONSTRUCTION

Roads would be constructed as described for the Proposed Action in Section 2.2.1.2. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field.

2.6.2 WELL DRILLING AND COMPLETION

2.6.2.1 LAND REQUIREMENTS

The total disturbance area from each well site under Alternative E would be approximately 4.2 acres, although that would vary slightly depending on the number of wells drilled from each pad. Otherwise, the pad layout would generally be consistent with that outlined for the Proposed Action in Section 2.2.2.1 (see also Figure 2-1), except that it would accommodate an average of 3.4 wells, which would require the movement of the drill rig and equipment around the pad as each well was drilled. Collectively, approximately 1,370 acres of land would be disturbed by well pads under Alternative E.

2.6.2.2 WELL-PAD CONSTRUCTION

Construction of well pads would follow the same procedures as those described for the Proposed Action in Section 2.2.2.2.

2.6.2.3 WELL DRILLING

Well-drilling procedures would be the same as those described under Section 2.2.2.3 of the Proposed Action, except that multiple wells would be drilled from the same pad, and both drilling and completion may occur on a single pad simultaneously.

Directional drilling requires subsurface geological control of target locations in three dimensions. Initial vertical drilling within the project area would enable Gasco to obtain data on appropriate drilling and completion techniques, as well as knowledge about potential safety concerns that may exist in the project area, especially in the south and east portions of project area. Should technical and/or economic limitations present themselves during initial vertical drilling that preclude directional drilling, additional vertical drilling would be considered on a case-by-case basis pending additional NEPA analysis.

2.6.2.4 WELL COMPLETION AND PRODUCTION

Well completion and production procedures would be the same as those described for the Proposed Action in Section 2.2.2.4.

2.6.3 PIPELINES

The following procedures would be the same as those described for the Proposed Action in Section 2.2.3: the construction and placement of pipelines; the ratio of pipelines on the surface versus buried; the typical amount of cross-country lines; and pipeline disturbance widths. The total length of gas pipeline for Alternative E would be approximately 1,140,480 feet (216 miles), and approximately 262 acres would be disturbed within the project area.

2.6.4 WATER SUPPLY AND DISPOSAL

Water for drilling would be from the same authorized sources indicated for the Proposed Action in Section 2.2.4. A total of 3,317 acre-feet of water would be required under this alternative. Of this total, 3,102 acre-feet (94%) would be treated and recycled production water and 215 acre-feet (6%) would be fresh water.

Similarly, produced water would be disposed of as described under the Proposed Action. At peak development, the 1,114 wells proposed under this alternative would be expected to produce approximately 19,220 barrels of water per day. In order to dispose of this water, the evaporative facility constructed would incorporate 19 basins, and occupy approximately 135 acres with basins and associated roads, tanks (2–4 per every group of four ponds), headworks, a power-generation building enclosing 1,320 kW (1,980 hp) of generating capacity, and other facilities. These facilities would be the same as those described under the Proposed Action, but would be scaled to accommodate the lesser amount of produced water from this alternative's smaller number of wells.

2.6.5 WASTE DISPOSAL

All waste would be disposed according to the procedures described for the Proposed Action in Section 2.2.5.

2.6.6 ABANDONMENT AND RECLAMATION

The abandonment procedures outlined for the Proposed Action in Section 2.2.6 would be followed.

2.6.6.1 INTERIM RECLAMATION

As described for the Proposed Action in Section 2.2.6.1, the reserve pit would be reclaimed within 120 days of final well completion, weather permitting. All restoration procedures, including seed mixture, would be the same as those described under the Proposed Action.

2.6.6.2 DRY HOLE/ABANDONED LOCATION

Wellbore and abandoned well site reclamation procedures would be the same as those described for the Proposed Action in Section 2.2.6.2.

2.6.7 WORKFORCE REQUIREMENTS

Assuming the development of 1,114 wells under Alternative E, approximately 5,018 worker years and 1,893,800 roundtrips are projected over the 45-year lifetime of the project (see Tables 2-4 and 2-5).

2.6.8 WORKOVERS

Workovers would be performed on an as-needed basis as described for the Proposed Action in Section 2.2.8.

2.6.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The applicant-committed measures for this alternative would be the same as those described for the Proposed Action in Section 2.2.9.

2.7 ALTERNATIVE F: AGENCY PREFERRED ALTERNATIVE

Alternative F was developed in response to comments received during the public comment period. It was designed to incorporate directional drilling to reduce surface impacts while still allowing the proponent to use some vertical drilling by careful planning of the placement of surface facilities to obtain data in areas where formation details are lacking, especially in the southern and western portions of the project area. It was also designed to avoid development in the Green River's floodplain and Nine Mile Canyon, and to restrict evaporative pond acreage for water disposal. The elements and impacts of this alternative are contained entirely within the range of Alternatives A through E, so adding it does not introduce significant new information that would require the preparation of a supplemental EIS.

Under Alternative F, Gasco would drill approximately 1,298 new gas production wells from a total of 575 pads and construct associated access roads and natural gas gathering lines (see Map 8). Unless otherwise noted, management actions under this alternative would be the same as those described under the Proposed Action.

The following limitations on development and surface disturbance would apply:

- No well pads would be located within any of the 100-year floodplains shown in Map 29.
- No well pads would be located within 0.5 mile or line of sight of the Green River, whichever is less.
- No well pads would be located within 2 miles of the Sand Wash campground/boat launch or Desolation Canyon.
- No surface disturbance would be permitted in riparian or wetland areas.
- No well pads or surface disturbance would be located below the rim of Nine Mile Canyon within the existing Nine Mile Canyon ACEC.

- No well pads or surface disturbance would be located inside core conservation areas that were developed in 2009 for the cactus species *Sclerocactus brevispinus* as a result of the Castle Peak/Eightmile Flat EIS consultation (hereafter referred to as the 2009 core conservation areas). The USFWS and BLM are currently developing new core conservation areas for *Sclerocactus* species. No more than five new well pads may be developed within level 1 core areas (as defined in November 2011). Should this development in level 1 areas be necessary, Gasco and the BLM would consult with USFWS on the feasibility, placement, and development of these new pads and associated infrastructure to ensure compliance with the ESA.

Surface spacing would be no denser than one pad per approximately 160 acres in areas where the above provisions do not apply.

Gasco would construct evaporative ponds of sufficient capacity to dispose of water from the first five years of proposed development. For the purposes of this analysis, it is assumed that this would include approximately 78 acres of evaporative ponds. At the end of five years, the ponds would be revisited to determine if they can be reclaimed or will have to exist into the future. However, it is assumed at this time that they would remain in operation for the life of the project.

Water disposal needs above the capacity of the above mentioned evaporative ponds would be addressed through scaled back drilling (to stay within what the ponds can handle) or through alternative water disposal methods. These could include treatment for waterflood (enhanced oil recovery) operations by other operators, subsurface injection, or other methods. The methods used would depend on the feasibility of alternative disposal methods at the end of the five year interim disposal period, as determined through negotiation with providers and other operators and analysis of disposal zones during the first five years of the drilling program.

Compressor facilities treatment capacity would be expanded by a total of approximately 18,200 hp at two existing gas plants to handle the increased production. No new compressor stations would be built.

2.7.1 Access Roads

2.7.1.1 Land Requirements

Existing roads and newly constructed roads would provide access to the proposed wells. It is estimated that approximately 198 miles of new road would be required to access the proposed wells. The total surface disturbance associated with the construction of access roads would be approximately 720 acres. The average construction disturbance widths of road types and associated utility corridors would be the same as those described for the Proposed Action in Section 2.2.1.1.

2.7.1.2 Road Construction

Roads would be constructed as described for the Proposed Action in Section 2.2.1.2. All necessary county planning and zoning permits would be secured prior to road construction, and maintenance agreements would be signed with the county where Class B and Class D county roads would be used to service daily operations in the energy field.

2.7.2 WELL DRILLING AND COMPLETION

2.7.2.1 LAND REQUIREMENTS

The total disturbance area from each well site under Alternative F would be approximately 4.2 acres, although that would vary slightly depending on the number of wells drilled from each pad. Otherwise, the pad layout would generally be consistent with that outlined for the Proposed Action in Section 2.2.2.1 (see also Map 3 and Map 8) except that it would accommodate an average of 2.25 wells, which would require the movement of the drill rig and equipment around the pad as each well was drilled. Collectively, approximately 2,415 acres of land would be disturbed by well pads under Alternative F.

2.7.2.2 WELL-PAD CONSTRUCTION

Construction of well pads would follow the same procedures as those described for the Proposed Action in Section 2.2.2.2.

2.7.2.3 WELL DRILLING

Well-drilling procedures would be the same as those described for Alternative E in Section 2.6.2.3, with multiple wells drilled from the same pad, and both drilling and completion activities potentially occurring on a single pad simultaneously.

Directional drilling requires subsurface geological control of target locations in three dimensions. Initial vertical drilling within the project area would enable Gasco to obtain data on appropriate drilling and completion techniques, as well as knowledge about potential safety concerns that may exist in the Project area, especially in south and west portions of project area. Should technical and/or economic limitations present themselves during initial vertical drilling that precludes immediate directional drilling, additional vertical drilling would be considered on a case-by-case basis pending any necessary additional NEPA analysis.

2.7.2.4 WELL COMPLETION AND PRODUCTION

Well completion and production procedures would be the same as those described for the Proposed Action in Section 2.2.2.4.

2.7.3 PIPELINES

The following procedures would be the same as those described for the Proposed Action in Section 2.2.3: the construction and placement of pipelines; the ratio of pipelines on the surface versus buried; the typical amount of cross-country lines; and pipeline disturbance widths. The total length of gas pipeline for Alternative F would be approximately 1,668,480 feet (316 miles), and approximately 383 acres would be disturbed within the project area.

2.7.4 WATER SUPPLY AND DISPOSAL

Water for drilling would be from the same authorized sources indicated for the Proposed Action in Section 2.2.4. A total of 3,865 acre-feet of water would be required under this alternative. Of this total, 3,614 acre-feet (94%) would be treated and recycled production water and 251 acre-feet (6%) would be fresh water. Produced water disposal needs would be similar to those under the Proposed Action. As under the Proposed Action, trucks would be used to transport water throughout the field.

The five-year discharge (the maximum allowed under this alternative) would be expected to produce approximately 10,492 barrels of water per day.

Like the Proposed Action, an evaporative facility, including 12 basins and associated roads, tanks (2–4 per every group of four ponds), headworks, a power-generation building enclosing approximately 1,630 kW (1,080 hp) of generating capacity, and other facilities, would be constructed to dispose of drilling water. However, maximum evaporative pond capacity would be limited to approximately 78 acres. Gasco would construct ponds of sufficient capacity to dispose of water from the first five years of proposed development.

Water disposal above this interim capacity would be addressed through scaled back drilling (to stay within what the ponds can handle) or through alternative water disposal methods. These could include treatment for waterflood (enhanced oil recovery) operations by other operators, subsurface injection, or other methods. The methods used would depend on the feasibility of alternative disposal methods at the end of the five year interim disposal period, as determined through negotiation with providers and other operators and analysis of disposal zones during the first five years of the drilling program. Water injection to the Garden Gulch member of the Green River Formation has been identified as a potential disposal method following the five-year period; however, it would require additional analysis prior to implementation, because current feasibility is unproven. Gasco is currently working on several Underground Injection Control (UIC) program permits for future disposal wells in the project area, in coordination with EPA. The success of these wells will not be known until permitting is completed and wells are developed and tested. However, should they prove effective, they could be a primary method of water disposal under Alternative F.

If any of these other options appreciably differ from current EIS analyzed conditions (such as dramatically increasing the estimated number of truck trips for hauling water or surface disturbance), additional NEPA analysis would be required before approval and use of the water source. Should surface discharge of the water be proposed, additional NEPA analysis would also be required.

2.7.5 WASTE DISPOSAL

All waste would be disposed according to the procedures described for the Proposed Action in Section 2.2.5.

2.7.6 ABANDONMENT AND RECLAMATION

The abandonment procedures outlined for the Proposed Action in Section 2.2.6 would be followed.

2.7.6.1 INTERIM RECLAMATION

As described for the Proposed Action in Section 2.2.6.1, the reserve pit would be reclaimed within 120 days of final well completion, weather permitting. All restoration procedures, including seed mixture, would be the same as those described for the Proposed Action.

2.7.6.2 DRY HOLE/ABANDONED LOCATION

Wellbore and abandoned well site reclamation procedures would be the same as those described for the Proposed Action in Section 2.2.6.2.

2.7.7 WORKFORCE REQUIREMENTS

Assuming the development of 1,298 wells under Alternative F, approximately 5,846 worker years and 2,206,600 roundtrips are projected over the 45-year lifetime of the project (see Tables 2-4 and 2-5).

2.7.8 WORKOVERS

Workovers would be performed on an as-needed basis as described for the Proposed Action in Section 2.2.8.

2.7.9 APPLICANT-COMMITTED ENVIRONMENTAL PROTECTION MEASURES

The applicant-committed measures for this alternative would be the same as those described for the Proposed Action in Section 2.2.9.

2.8 COMPARISON OF ALTERNATIVES

The following table compares the primary elements that constitute each of the alternatives analyzed in this document.

Table 2-7. Comparison of Alternatives

	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Proposed new wells	1,491	1,114	1,887	368	1,114	1,298
Proposed new well pads	1,491	1,114	1,887	368	328	575
Proposed new roads (miles)	325	274	526	72	106	198
Proposed new pipeline (miles)	431	393	861	316	216	316
Water use over life of plan (acre-feet) (*treated-recycled water / fresh water)*	4,439 (4,151/288)	3317 (3,102/215)	5,619 (5,254/365)	1,096 (1,025/71)	3,317 (3,102/215)	3,865 (3,614/251)
Well pad surface disturbance (acres)[1]	5,666	4,233	7,171	1,398	1,370	2,415
New road disturbance (acres)	1,182	996	1,913	262	386	720

Table 2-7. Comparison of Alternatives

	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
New pipeline disturbance (acres)	522	476	1,044	383	262	383
Evaporative facility surface disturbance (acres)	143	135	271	57	135	78
Evaporative ponds (#)	20	20	38	8	19	12
Generator size at evaporative facility (hp)	2,700	1,980	3,420	720	1,980	1,084
Maximum new compression requirements (hp)	21,325	15,608	26,439	5,156	15,608	18,186
Total Disturbance (acres)[2]	**7,584**	**5,685**	**9,982**	**2,055**	**2,174**	**3,604**

[1] Surface disturbance for Alternatives A, B, C, and D, the vertical drilling alternatives is calculated at 3.8 acres per well. Surface disturbance for Alternatives E and F, the directional drilling alternatives, is calculated at 4.2 acres per well.

[2] Slightly less than total of separate disturbances due to overlapping in calculation of road and pipeline disturbance areas with well site surface-disturbance areas in the geographic information system (GIS) database.

2.9 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

2.9.1 TOTAL AVOIDANCE OF DEVELOPMENT IN SENSITIVE AREAS

Recommendations were made in public scoping that would preclude all development on the following lands in the project area:

- BLM-administered lands near or within view of the Green River
- Areas proposed for special designations
- ACECs
- Non–Wilderness Study Area (WSA) lands with wilderness characteristics
- Special Recreation Management Areas (SRMAs)
- Eligible Wild and Scenic Rivers (WSRs)
- Suitable habitat for special status species
- Areas within Nine Mile Canyon with numerous cultural resources

These recommendations are referred to as the "Total Avoidance of Development in Sensitive Areas alternative." This alternative was not carried forward for analysis because it would not meet the purpose and need of the project, which is for the BLM to allow, in an environmentally sound manner, the development of lease rights held by Gasco and other operators. In addition, this alternative was not carried forward because it is not feasible and would not serve to reduce the impacts of the development from those of the Proposed Action or resource protection alternatives, which must comply with laws protecting endangered species, archaeological resources, etc. These reasons are discussed in greater detail in the following paragraphs.

First, protection of many of these lands is provided for under the Vernal RMP, terms and conditions of leases, the Endangered Species Act (1973), or the Archaeological Resources Protection Act (1979). For example, areas within special designations (such as ACECs and WSRs) or within special management areas (such as SRMAs) already have protective management prescriptions in place through the Vernal RMP. These management prescriptions were designed by BLM resource specialists to minimize or eliminate impacts to the resources for which the designation was made. Protective management prescriptions were incorporated into each of the proposed alternatives in this EIS as necessary to ensure land use plan conformance. For example, the Vernal RMP does not allow surface disturbance when management objectives for other resource values and uses are not compatible with surface disturbance, including areas along the Green River and in Nine Mile Canyon; thus, no well-pad development would occur in those areas under any of this EIS's alternatives. Additional protection for some of the resources or areas of concern, such as areas with suitable habitat for special status plant species, is addressed in the applicant-committed measures under all alternatives. Note that no WSAs or BLM natural areas are located within the project area.

Second, the project area includes state and private lands where development is proposed to occur, regardless of the federal decision resulting from this EIS. Although BLM retains regulatory authority to condition access or development, it must provide reasonable access to non-federal lands as necessary to allow the owner the reasonable use and enjoyment of those lands. This includes access needed to produce oil and gas reserves under those lands. Avoiding development on federal lands will not serve to prevent, for example, habitat fragmentation, where roads and pipelines will be built to serve the development of the state and private minerals. Cultural resources, special status species and their habitat, and the viewshed from the river are all found on private and state lands in the project area to some degree; therefore, any state or private decision affecting those resources without a BLM nexus (such as a BLM access right-of-way) is outside of the BLM's control.

Third, although the BLM may require lessees to relocate proposed wells, lessees have a reasonable contractual expectation that they may engage in development somewhere on their lease, subject to the terms and conditions of that lease.[1] At least 11 leases within the project area are located entirely within sensitive areas or special designations (e.g., ACECs, SRMAs, WSRs) that were established through the Vernal RMP. The distance between these 11 leases and potential well pad locations outside of the sensitive areas and special designations is great enough (0.25 mile or greater) that the leases may not be reasonably reached through directional drilling.

Fourth, denial of development on federal lands could lead to the drainage of federal reserves by wells on adjacent state and private lands. Drainage by offset non-federal wells would result in a loss of federal royalties. A drainage stipulation designed to protect the federal mineral estate is included in the terms of the lease contracts for all federally leased lands in the project area.

[1] An oil and gas lease grants the lessee the "…right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold subject to: Stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statues; and such reasonable measures as may be required by the authorized office to minimize adverse impacts to other resource values, lands uses or users not addressed in the lease stipulations at the time operations are proposed" (43 CFR 3101.1-2).

In conclusion, this alternative was not carried forward for analysis because it would not meet the purpose and need, which is for the BLM to allow, in an environmentally sound manner, the development of lease rights held by Gasco and other operators. Given the high proportion of the area that is already subject to lease, or is administered by the state or a private individual, this alternative could not be implemented on an adequate amount of acreage to achieve a reduction in impacts greater than will be achieved by compliance with the Endangered Species Act, the National Historic Preservation Act, and Alternatives B and E of this EIS, which were carried forward for detailed analysis.

2.9.2 WELLS FOR SUBSURFACE WATER DISPOSAL

An alternative considering solely the use of wells for the subsurface disposal of produced water was eliminated from detailed analysis.

Due to the limitations on disposal wells described below, they are not currently considered viable as an alternative to evaporative facilities, although they may be used to augment evaporation as a means of water disposal, particularly under Alternative F (the Agency Preferred Alternative). In addition, impacts from disposal wells cannot be reasonable analyzed because no reliable data exist to estimate the volume of water each well could accept or the lifespan over which to analyze each well's impacts. Therefore, the analyses in Chapter 4 of this EIS generally use the conservative assumption that only evaporation facilities would be used, although disposal wells may be used where suitable formations and conditions are discovered.

Gasco preliminarily identified (as have other operators) some limited zones that may be suitable for disposal on a well-by-well basis. Disposal wells are a preferred method of water disposal by the project proponent. If the proponent identifies a feasible formation during production, and obtains sufficient data, disposal well locations would be examined and implemented when technically feasible (see Section 2.2.4). As development continues and additional well data become available, formations discovered in the project area would be considered potentially suitable where

- their fracture gradient would not be exceeded by disposal, or if exceeded, waters would not migrate vertically or into other formations;
- they are suitably large to accept economically feasible quantities of water;
- scaling of the wellbore and disposal formation could be prevented through economically feasible chemical treatment; and
- injection would be permitted by UDOGM and/or EPA.

For instance, water injection to the Garden Gulch member of the Green River Formation has been identified as a potential disposal target; however, it would require additional analysis prior to implementation because the current feasibility is unproven. Gasco is currently working on several Underground Injection Control (UIC) program permits for future disposal wells in the project area, in coordination with EPA. The success of these wells will not be known until permitting is completed and wells are developed and tested.

2.9.2.1 ASSESSMENT OF FORMATION SUITABILITY FOR DISPOSAL

A geologic formation is considered suitable for consideration for disposal of produced water if it meets five general characteristics:

- Good reservoir characteristics (porosity and permeability) to allow for injection
- Good lateral extent and thickness to allow for the disposal of large volumes of fluid
- Underpressured to normally pressured to allow for injection
- Shallow depth for operational efficiency
- Contains saline water, greater than 10,000 milligrams per liter (mg/L) of dissolved solids, for regulatory approval

Several specific geologic formations have been suggested as acceptable for disposal based on their use as such in nearby fields. These include the Sego Sandstone, the Castlegate Sandstone, and various sand zones within the Tertiary Green River Formation, including the units comprising the Bird's Nest aquifer. These formations and others are assessed below in ascending order of occurrence.

Mississippian Madison Limestone. This unit occurs at a depth of approximately 19,600 feet. It is relatively deep and has unproven reservoir characteristics.

Pennsylvanian Weber Sandstone. This unit occurs at a depth of approximately 18,900 feet. It is relatively deep and has unproven reservoir characteristics.

Jurassic Navajo Sandstone. This unit occurs at a depth of approximately 17,500 feet. It is relatively deep and has unproven reservoir characteristics.

Jurassic Entrada Sandstone. This unit occurs at a depth of approximately 17,300 feet. It is relatively deep and has unproven reservoir characteristics.

Cretaceous Dakota Sandstone. This unit occurs at a depth of approximately 16,200 feet. It consists of lenticular channel sands and some thin marine sands. The unit as a whole generally has poor reservoir characteristics. This unit is overpressured.

Cretaceous Blackhawk Formation Sandstones. These units occur at a depth of approximately 11,500 feet. They consist of thin marine sands and lenticular channel sands. These units combined generally have poor reservoir characteristics. These units are overpressured and are also known gas producers.

Cretaceous Castlegate Sandstone. This unit occurs at a depth of approximately 11,000 feet. This unit is 250-feet thick and consists of braidplain sands with generally poor reservoir characteristics. This unit is overpressured.

Cretaceous Blackhawk Formation Sandstones. These units occur at a depth of approximately 11,500 feet. They consist of thin marine sands and lenticular channel sands, These units combined generally have poor reservoir characteristics. These units are overpressured and are also known gas producers.

Cretaceous Castlegate Sandstone. This unit occurs at a depth of approximately 11,000 feet. This unit is 250-feet thick and consists of braidplain sands with generally poor reservoir characteristics. This unit is overpressured.

Cretaceous Sego Sandstone. This unit is not continuous across the region. Although it occurs near the base of the Price River Formation (Lower Mesaverde) in the Piceance Basin and eastern Uinta Basin, it is absent in the western Uinta Basin. This unit is up to 200 feet thick where present and consists of estuarine sandstone, siltstone, and mudstone. The pinchout of the Sego

Formation has been identified in the eastern part of the Natural Buttes field, which is located east of the Gasco project area. This formation is absent in the project area.

Cretaceous Mesaverde Formation. This unit occurs at a depth of approximately 7,000–11,000 feet. This unit is 2,500 feet thick and consists of lenticular coastal plain sands, shales, and carbonaceous shales. This unit is a tight gas sand and has poor reservoir characteristics. In the Natural Buttes field, this unit has been developed with 10-acre spacing due to the lenticular nature. This unit is overpressured.

Cretaceous Dark Canyon Conglomerate. This unit occurs at a depth of approximately 7,000–8,500 feet. This unit is 50- to 200-feet thick and consists of sandstone, shale, and conglomerate. Like the Mesaverde, it is a tight gas sand with poor reservoir characteristics. This unit is overpressured.

Tertiary Wasatch Formation. This unit occurs at a depth of approximately 3,500–8,000 feet. This unit is 3,500-feet thick and consists of lacustrine and fluvial sands, shales, and limestones. The eastern portions of the unit are productive for gas. The sands are lenticular and discontinuous with poor reservoir characteristics, and like the *Cretaceous Mesaverde Formation*, this is evidenced by the necessary 10-acre spacing in the Natural Buttes field. This unit is normally pressured to slightly underpressured.

Tertiary Green River Formation – Douglas Creek Member. This unit occurs at a depth of approximately 1,000–4,500 feet. This unit is 1,200-feet thick and consists of lacustrine shales, limestones, and fluvial sands. This unit is a minor producer in Gasco's acreage, but it is the main oil producer in the Monument Butte and Uteland Butte fields. The sands are thin and lenticular with poor reservoir characteristics, requiring 10-acre spacing in the Monument Butte field. This unit is normally pressured.

Tertiary Green River Formation – Garden Gulch Member. This unit occurs at a relatively shallow depth of approximately 500–4,000 feet. This unit consists of lacustrine shales and fluvial sands. Although lacking the capacity for large-scale disposal, this unit may have the potential for small disposal wells.

2.9.2.2 COMPARISON TO OTHER OPERATORS IN BASIN

Although disposal wells are successfully used elsewhere in the Uinta Basin, the project area has considerable differences in geology that limit their implementation. First, the disposal zones used most successfully elsewhere in the basin, such as the "Birds Nest" zone of the Green River Formation, do not occur in the Gasco project area or are located in formations far deeper than any wells proposed or drilled to date (e.g., the Entrada, Ferron, and Navajo sandstones). The only permeable, extensive sandstone formations suitable for injection in the project area are found in the Green River Formation.

All known water disposal wells in or near the project area are used by other operators to dispose of only produced Green River Formation water into depleted areas of the Green River Formation. These wells are primarily converted oil wells that are either depleted or produced with a high water cut, making them good candidates for disposal wells. In addition, these wells do not experience the problems associated with incompatible waters, which are described in detail below. Operators in the Gate Canyon area (in the southwestern part of the project area) use

evaporation facilities for their water disposal, which also involves the disposal of mixed waters from a variety of deeper formations.

2.9.2.3 ASSESSMENT OF SUITABILITY OF WATER CHEMISTRY FOR DISPOSAL

Despite the proponent's readiness to use disposal wells in lieu of evaporation pits, there are several other factors that make such use entirely speculative at this time. In addition to a lack of suitable disposal reservoirs, producing formations in the project area produce waters with high levels of dissolved solids. Produced water from the alternatives considered by this EIS would be predominantly Mesaverde, Blackhawk, and Wasatch Formation water that has a very high scaling tendency as well as total dissolved solids (TDS) in excess of 50,000 parts per million (ppm). Waters from these formations are incompatible, and form heavy precipitates when mixed. Gasco's water quality testing data for the two major scaling constituents in disposed water from current wells in the project area are shown in Table 2-8 below.

Table 2-8. Project Area Average Produced Water Scaling Constituents

	Calcite	Siderite
Saturation Index*	45.90	157.10
Momentary Excess** (lbs/1,000 barrels)	3.54	1.70

*The Saturation Index is calculated for each mineral species independently and is a measure of the degree of supersaturation (driving force for precipitation) under the conditions modeled. This value ranges from 0 to infinity with 1.0 representing a condition of equilibrium where scale will neither dissolve nor precipitate. Values less than 1.0 are undersaturated and values greater than 1.0 are supersaturated. The scale is logarithmic, i.e., a Saturation Index of 3 is 10 times more saturated than a value of 2.

**The Momentary Excess is a measure of how much scale would have to precipitate to bring the system back to a non-scaling condition. This value ranges from negative (dissolving) infinity to positive (precipitating) infinity. The Momentary Excess represents the amount of scale possible while the Saturation Level represents the probability that scale will form.

Although unconfirmed by a water compatibility study, the high concentration and momentary excess of these constituents increase the risk that subsurface disposal of these waters could result in scale within wellbores and/or affect disposal formation porosity. In its ongoing production operations (within the same formations proposed for production in this EIS), Gasco has found that it is necessary to pump scale inhibitors in fracture treatments. This has been of limited effectiveness, and the wells have generally scaled off if waters from various formations are mixed together. In response, Gasco has been forced to insert a capillary string next to the production tubing so that scale inhibitors can be pumped continuously to the bottom of the wells to provide scale protection throughout the wellbore. Gasco has been unable to dispose of its water through other operators' disposal wells due to the owners' concerns that precipitate would plug the accepting formations. A future water compatibility study may be helpful as Gasco continues to develop water treatment and disposal methods, and those technologies evolve.

2.9.3 COMPLETE RELIANCE ON BURIED PIPELINES AND CENTRALIZED TANK BATTERIES

An alternative that proposed burying all pipelines and centralizing all produced water and condensate tank facilities was considered, but was eliminated from further analysis because its implementation and effectiveness in reducing impacts on a project-wide basis are speculative at this time due to numerous site-specific variables. These factors include the nature of the landscape (i.e., landforms, vegetation, and existing structures), local geology and soils, well spacing, and the use of existing roads versus the need to construct new roads. Burying pipelines and centralizing tank batteries, as a means of reducing overall environmental impact, will therefore be determined on a site-specific basis since the factors above will be better defined and understood for each particular site. As explained below, these measures will be included as BMPs based on site-specific conditions and on-site review.

Gas collector lines are typically steel lines that are 4–8 inches in diameter, and main gas transmissions lines are typically steel lines that are 16–20 inches in diameter. Although burying gas lines would potentially reduce the adverse impacts to some resources (i.e., visual resources, vehicle access, some wildlife, and human health and safety) in some locations, it would increase adverse impacts to other resources in other locations.

In some cases, the impacts from burying pipelines would be greater in severity or extent, or would persist longer, than those impacts resulting from the surface placement of pipelines. Although rock saws can be used to cut through rocky soils and bedrock to bury pipelines, such excavation would result in a substantial amount of additional surface and subsurface disturbance, particularly in those areas where placement within the roadway would not be feasible due to operational constrains, or where the roadway itself would cause minimal surface disturbance because it is constructed to the minimum allowable standards (i.e., a small two-track access road with minimal grading).

If trench backfilling were conducted in areas where subsurface material was a different color or texture than surface material, then it is likely that color and linear visual contrasts would be created on the landscape and would likely persist well beyond the typical disturbance from a surface pipeline. Extremely shallow soils of less than 10 inches to bedrock occur on about 36% of the project area, or 75,059 acres (NRCS 2006). However, soils data for the project area do not document divisions in soil depth greater than 10 inches. Given that over 1/3 of the project area has soils less 10 inches deep, it is likely that a far larger area has soils over 10 inches deep, but shallower than the frost line. These areas would therefore require a rock saw for pipeline burial and be at risk for poor reclamation. Once disturbed, shallow soils over bedrock are not conducive to vegetation reestablishment and are therefore prone to wind and water erosion. Further, where pipeline burial increased the percentage of coarse fragments in the soil, the reclamation potential of the disturbed area would be reduced due to a limited water-holding capacity. Both of these factors would limit the reclamation potential of areas where pipelines were buried and result in long-term, adverse impacts to the landscape, to soils, and to vegetation.

Because surface pipelines are typically assembled on existing roads and placed to the side of the road, they generally create roadside surface disturbances of less than 10 feet wide during their placement and removal. Therefore, the primary long-term impacts of surface pipeline placement would be to visual resources (from color and line contrasts) and limitations on off-highway vehicle (OHV) travel opportunities, rather than physical disturbance of the ground surface. In

comparison, trenched and buried pipelines that could not be placed in disturbed roadways would produce a greater area of surface disturbance because of the disturbances caused by trenching and pipeline laying equipment, as well as the severity of disturbances described above. Resources that would potentially be more adversely impacted by pipeline burial (when compared to surface placement) would include vegetation, soils, water quality, cultural resources, paleontological resources, geological and mineral resources, special status plants and animal habitat, and wildlife habitat. Where visible impacts from buried pipelines persisted beyond the life of the project due to disturbed geological formations or impeded reclamation, visual resources would also be more adversely affected in the long term.

As discussed for pipeline burial, the centralization of water and condensate tank facilities throughout the proposed project area would increase the level of adverse impacts to some resources. Because collection pipelines from the wellhead to central condensate tanks carry high levels of water and condensate, they must be buried to prevent plugging and freezing at wellhead spacing greater than 20 acres. Therefore, centralization of these facilities would require a great deal of buried pipelines to be constructed, resulting in the same environmental impacts described above for buried pipelines. In addition, centralized facilities would require additional leveling and grading. Because the well pads associated with the central facility may not be reduced proportionally due to the area required for drilling, workover, and recompletion equipment, the centralization of tank facilities would not always result in a decrease in the total area of surface disturbance.

Where determined to be appropriate, effective, and feasible within the proposed project area, burying pipelines and centralizing tank facilities would be applied as BMPs to reduce environmental impacts under all alternatives (see Section 2.2.9.1). The site-specific application of these BMPs would depend upon a number of factors, including the nature of the landscape (i.e., landforms, vegetation, and existing structures), local geology and soils, well spacing, the use of existing roads versus the need to construct new roads, and the presence of sensitive resources that may be adversely or beneficially affected by either of these BMP measures.

2.10 SUMMARY OF IMPACTS

Table 2-9 summarizes the impacts that would occur under each alternative. A full analysis of the impacts under each alternative is provided in Chapter 4.

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Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
AIR QUALITY						
Air Quality	Under the Proposed Action, up to 1,491 wells and associated infrastructure are expected for the life of the project. All predicted criteria pollutant concentrations would remain below the National Ambient Air Quality Standards (NAAQS), but predicted particulate matter (PM_{10}) concentrations would be above prevention of significant deterioration (PSD) Class II increments. The maximum PM_{10} impacts result from truck traffic, and as PSD increments do not apply to mobile sources, PSD Class II increments are not exceeded by Alternative A. Implementation would cause increases in hazardous air pollutant (HAP) concentrations. None of the predicted HAP levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. Project greenhouse gas (GHG) development emissions would be 74,727 tons per year carbon dioxide equivalent (CO_2e). GHG emissions from project operations would be 532,305 tons per year CO_2e.	Under this alternative, up to 1,114 wells and associated infrastructure are expected for the life of the project. All predicted criteria pollutant concentrations remain below the NAAQS, but predicted PM_{10} concentrations would be above the PSD Class II increments. The maximum PM_{10} impacts result from truck traffic, and as PSD increments do not apply to mobile sources, PSD Class II increments are not exceeded by Alternative B. Implementation would cause increases in HAP concentrations. None of the predicted HAP levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. Project GHG development emissions would be 59,153 tons per year CO_2e. GHG emissions from project operations would be 389,673 tons per year CO_2e.	Under this alternative, up to 1,887 wells and associated infrastructure are expected for the life of the project. Predicted PM_{10} concentrations exceed the NAAQS and would be above the PSD Class II increments. The maximum PM_{10} impacts result from truck traffic, and as PSD increments do not apply to mobile sources, PSD Class II increments are not exceeded by Alternative C. Implementation would cause increases in HAP concentrations. None of the predicted HAP levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. Project GHG development emissions would be 82,185 tons per year CO_2e. GHG emissions from project operations would be 660,299 tons per year CO_2e.	Under the No Action Alternative, up to 368 wells and associated infrastructure are expected for the life of the project. All predicted criteria pollutant concentrations remain below the NAAQS. Predicted PM_{10} concentrations are below the NAAQS and the PSD Class II increments. Implementation would cause increases in HAP concentrations. None of the predicted HAP levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. GHG emissions would be tons per year 30,991 CO_2e. GHG emissions from project operations would be 129,267 tons per year CO_2e.	Under this alternative, up to 1,114 wells and associated infrastructure are expected for the life of the project. Alternative E impacts are the same as Alternative B because the number of wells is the same for both alternatives. Implementation would cause increases in HAP concentrations. None of the predicted HAP levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. GHG emissions would be 98,100 tons per year CO_2e. GHG emissions from project operations would be 389,673 tons per year CO_2e.	Under this alternative, up to 1,298 wells and associated infrastructure are expected for the life of the project. Impacts under this alternative are assumed to be equal to or less than impacts from Alternative A. All predicted criteria pollutant concentrations would remain below the NAAQS, but predicted PM_{10} concentrations would be above the PSD Class II increments. The maximum PM_{10} impacts would result from truck traffic, and because PSD increments do not apply to mobile sources, PSD Class II increments would not be exceeded under Alternative F. Implementation would cause increases in HAP concentrations. None of the predicted pollutant levels exceed the Toxic Screening Levels for the State of Utah for any of the alternatives. Project GHG development emissions would be 74,727 tons per year CO_2e. GHG emissions from project operations would be 557,276 tons per year CO_2e.
CULTURAL RESOURCES						
Direct Impacts from Surface Disturbance	Approximately 1,358 acres of surface disturbance in high probability zones and 6,226 acres in low probability zones would result in increased risk of adverse effects to cultural resources, although this risk would be largely mitigated by applicant-committed measures. No acres of surface disturbance would occur below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would impact 1,124 acres in high probability zones and 4,562 acres in low probability areas. No wells would occur below the rim of Nine Mile Canyon; however there would be 17 acres of surface disturbance below the rim of Nine Mile Canyon due to roads or pipelines.	Impacts would be similar to those described under the Proposed Action, but would impact 1,936 acres in high probability zones and 8,045 acres in low probability areas. 562 acres of surface disturbance would occur below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would impact 613 acres in high probability zones and 1,442 acres in low probability areas. No development would occur below the rim of Nine Mile Canyon and there would be no surface disturbance due to roads or pipelines.	Impacts would be similar to those described under the Proposed Action, but would impact 429 acres in high probability zones and 1,745 acres in low probability areas. No well development would occur below the rim of Nine Mile Canyon; however, there would be 9 acres of surface disturbance within Nine Mile Canyon due to roads or pipelines.	Impacts would be similar to those described under the Proposed Action, but would impact 657 acres in high probability zones and 2,944 acres in low probability areas. No well development would occur below the rim of Nine Mile Canyon, and there would be no surface disturbance due to roads or pipelines.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Indirect Effects of New Roads and Increased Access	Approximately 60 miles of roads in high probability zones and 266 miles in low probability zones would be developed. No miles of roads would be developed below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would involve the development of 60 miles of roads in high probability zones and 214 miles of roads in low probability areas. 2 miles of roads would be below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would involve the development of 116 miles of roads in high probability zones and 421 miles of roads in low probability areas. 37 miles of roads would be developed below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would involve the development of 25 miles of roads in high probability zones and 47 miles of roads in low probability areas. No roads would be developed below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would involve the development of 24 miles of roads in high probability zones and 82 miles of roads in low probability areas. One mile of road would be developed below the rim of Nine Mile Canyon.	Impacts would be similar to those described under the Proposed Action, but would involve the development of 40 miles of roads in high probability zones, and 157 miles of roads in low probability areas. No miles of road would be developed below the rim of Nine Mile Canyon.
GEOLOGY AND MINERALS						
Geology and Minerals	Direct, adverse impacts to geology and mineral resources would occur from the development of 1,491 wells, but would be minor because of the limited number of acres impacted by well development activities on oil shale, gilsonite, tar sands, locatable minerals, and salable minerals. Impacts to surface resources include reduced access and surface disturbance. Impacts to subsurface resources include potential contamination of the resource from drilling fluids and physical obstructions from well casings. Approximately1. 57 trillion cubic feet (Tcf) of natural gas would be extracted over the life of the project, decreasing the presumed total available reserves of the Uinta Basin by approximately 7.1%, and 6,213 acres open to oil and gas leasing would be disturbed.	Impacts would be of the same nature as those described for the Proposed Action, but would result from 1,114 wells. Approximately 1.17 Tcf (5.3% of total reserves in the Uinta Basin) of natural gas would be extracted over the life of the project, and 4,475 acres open to oil and gas leasing would be disturbed.	Impacts would be of the same nature as those described for the Proposed Action, but would result from 1,887 wells. Approximately 1.99 Tcf (9.0% of total reserves in the Uinta Basin) of natural gas would be extracted over the life of the project, and 8,423 acres open to oil and gas leasing would be disturbed.	Impacts would be of the same nature as those described for the Proposed Action, but would result from 368 wells. Approximately 0.4 0.39 Tcf (1.8% of total reserves in the Uinta Basin) of natural gas would be extracted over the life of the project, and 1,535 acres open to oil and gas leasing would be disturbed.	Impacts would be of the same nature as those described for the Proposed Action, but would result from 1,114 wells on 328 well pads. Approximately 1.17 Tcf (5.3% of total reserves in the Uinta Basin) of natural gas would be extracted over the life of the project, and 1,737 acres open to oil and gas leasing would be disturbed.	Impacts would be of the same nature as those described for the Proposed Action, but would result from 1,298 wells on 575 well pads. Approximately 1.37 Tcf (6.2% of total reserves in the Uinta Basin) of natural gas would be extracted over the life of the project, and 2,971 acres open to oil and gas leasing would be disturbed.
LAND USE AND TRANSPORTATION						
New Roads and Increased Access	The Proposed Action would add approximately 325 miles of new roads within the project area, resulting in increased maintenance needs, as well as an increased risk of accidents and wildlife collisions. There would be a long-term beneficial impact of expanded access to parts of the project area for resource extraction activities, livestock grazing, and recreational activities.	Impacts would be similar to those described under the Proposed Action, but would occur over approximately 274 miles of new roads.	Impacts would be similar to those described under the Proposed Action, but would occur over approximately 526 miles of new roads.	Impacts would be similar to those described under the Proposed Action, but would occur over approximately 72 miles of new roads.	Impacts would be similar to those described under the Proposed Action, but would occur over approximately 106 miles of new roads.	Impacts would be similar to those described under the Proposed Action, but would occur over approximately 198 miles of new roads.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Traffic	A maximum of 385 vehicles per day would be expected to make trips within and to the project area, with corresponding localized delays and increased risk of accidents and wildlife collisions. Up to 385 vehicles/day (100% of max. project traffic) would travel on Hwy 40, a 4.9% increase over 2009 average daily traffic volume on Hwy. 40. The Nine Mile Canyon Backcountry Byway would experience no project traffic below the rim of Nine Mile Canyon. Above the rim, Nine Mile Canyon Backcountry Byway would experience the following: ♦ Up to 12 additional vehicles/day (3% of max. project traffic) between Gate Canyon/ Wrinkle Road and the Gate Canyon upper bench. ♦ Up to 119 additional vehicles/day (31% of max. project traffic) between Gate Canyon and the Sand Wash Road. ♦ Up to 385 additional vehicles/day (100% of max. project traffic) between Sand Wash Road and Highway 40. Sand Wash Road segments would experience the following: ♦ Up to 265 additional vehicles/day (69% of max. project traffic) between Wells Draw Road and Eightmile Flat Road. ♦ Between 27 and 142 additional vehicles/day (8%–37% of max. project traffic) between Eightmile Flat Road and Wrinkle Road. ♦ No traffic between Wrinkle Road and the Green River.	Impacts would be similar to those described under the Proposed Action, but Alternative B would have a maximum of 375 vehicles per day: Up to 375 additional vehicles/day (100% of project traffic) would travel on Highway 40, a 4.8% increase in traffic volume over 2009 daily averages. The Nine Mile Canyon Backcountry Byway would experience no project traffic below the rim of Nine Mile Canyon. Above the rim, Nine Mile Canyon Backcountry Byway would experience the following: ♦ Up to 11 additional vehicles/day (3% of max. project traffic) between Gate Canyon/ Wrinkle Road and the Gate Canyon upper bench. ♦ Up to 116 vehicles/day (31% of max. project traffic) between Gate Canyon and Sand Wash Road. ♦ Up to 375 vehicles/day (100% of project traffic) would travel between Sand Wash Road and Highway 40. Sand Wash Road segments would experience the following: ♦ Up to 259 vehicles/day (69% of project traffic) between the Wells Draw Road intersection and Eightmile Flat Road. ♦ Between 15 and 135 vehicles/day (4%–36% of project traffic) between Eightmile Flat Road and Wrinkle Road. ♦ No traffic between Wrinkle Road and the Green River.	Impacts would be similar to those described under Proposed Action, but Alternative C would have a maximum of 487 vehicles per day: Up to 487 additional vehicles/day (100% of project traffic) would travel on Highway 40, a 6.2% increase in traffic volume over 2009 daily averages. The Nine Mile Canyon Backcountry Byway would experience slightly increased project traffic below the rim of Nine Mile Canyon: ♦ Up to one vehicle/day (0.1% of max. project traffic) on Franks Road–Nine Mile Canyon Road to the east of Franks Road. ♦ Up to 12 vehicles/day (0.6% of max. project traffic) on Nine Mile Canyon Road from Gate Canyon Road to the west. ♦ Up to 18 vehicle/day (1% of max. project traffic) on Gate Canyon Road/Gate Canyon Upper Bench to Nine Mile Canyon Road. Above the rim, Nine Mile Canyon Backcountry Byway would experience the following: ♦ Up to 15 additional vehicles/day (3% of max. project traffic) between Gate Canyon/ Wrinkle Road and the Gate Canyon upper bench. ♦ Up to 175 vehicles/day (36% of project traffic) between Gate Canyon and the Sand Wash Road. ♦ Up to 487 vehicles/day (100% of project traffic) between Sand Wash Road and Highway 40. Sand Wash Road segments would experience the following: ♦ Up to 312 vehicles/day (64% of project traffic) between the Wells Draw Road intersection and Eightmile Flat Road. ♦ Between 44 and 141 vehicles/day (9%–29% of project traffic) between Eightmile Flat Road and Wrinkle Road. ♦ No traffic between Wrinkle Road and the Green River.	Impacts would be similar to those described under Proposed Action, but the No Action Alternative would have a maximum of 95 vehicles per day: Up to 95 additional vehicles/day (100% of max. project traffic) would travel on Highway 40, a 1.2% increase in traffic volume over 2009 daily averages. ♦ The Nine Mile Canyon Backcountry Byway would experience no project traffic below the rim of Nine Mile Canyon. Above the rim, Nine Mile Canyon Backcountry Byway would experience the following: ♦ Up to one additional vehicle/day (1% of max. project traffic) between Gate Canyon/ Wrinkle Road and the Gate Canyon upper bench. ♦ Up to 26 vehicles/day (27% of max. daily project traffic) between Gate Canyon and Sand Wash Road. ♦ Up to 95 vehicles/day (100% of project traffic) would travel between Sand Wash Road and Highway 40. ♦ Sand Wash Road segments would experience the following: ♦ Up to 69 vehicles/day (73% of project traffic) between the Wells Draw Road intersection and Eightmile Flat Road. ♦ Between 4 and 14 vehicles/day (4%–15% of project traffic) would travel between the Eight Mile Flat Road and Wrinkle Road. ♦ No traffic between Wrinkle Road and the Green River.	Same as Alternative B, except approximately 1.4% fewer vehicle trips would be required on all road segments due to the slightly fewer vehicles required for well pad construction and reclamation.	Impacts would be similar to those described under the Proposed Action, but Alternative F would have a maximum of 351 vehicles per day. Up to 351 additional vehicles/ day (100% of max. project traffic) would travel on Highway 40, a 4.5% increase over 2009 daily averages. The Nine Mile Canyon Backcountry Byway would experience no project traffic below the rim of Nine Mile Canyon. Above the rim, Nine Mile Canyon Backcountry Byway would experience the following: ♦ Up to 11 additional vehicles/day (3% of max. project traffic) between Gate Canyon/ Wrinkle Road and the Gate Canyon upper bench. ♦ Up to 116 vehicles/day (33% of max. project traffic) would travel between Gate Canyon and Sand Wash Road. ♦ Up to 351 vehicles/day (100% of project traffic) would travel between Sand Wash Road and Highway 40. Sand Wash Road segments would experience the following: ♦ Up to 235 additional vehicles/day (67% of max. project traffic) would travel south of the Wells Draw Road. ♦ Between 28 and 144 additional vehicles/day (8%–41% of max. project traffic) would travel between Eight Mile Flat Road and Wrinkle Road.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
LIVESTOCK MANAGEMENT						
Livestock	Direct, adverse impacts to livestock under the Proposed Action would include the potential reduction in forage by 740 total Animal Unit Months (AUMs) (1.6% total adjudicated AUMs) and increased risk of livestock collisions due to the 325 new miles of road. Indirect impacts could include reduced forage palatability or loss of forage due to noxious weeds and increased dust from construction activities.	Impacts would be similar to those described under the Proposed Action. However, there would be 274 miles of roads and 554 impacted AUMs (1.2%), which would result in greater impacts than the No Action Alternative.	Impacts would be similar to those described under the Proposed Action. However, there would be 526 miles of roads and 972 impacted AUMs (2.1%), which would result in greater impacts than the No Action Alternative.	Impacts would be similar to those described under the Proposed Action However, there would be 72 miles of roads and 200 impacted AUMs (0.4%), which would result in fewer impacts than any of the other alternatives.	Impacts would be similar to those described under the Proposed Action. However, there would be 106 miles of roads and 219 impacted AUMs (0.5%), which would result in slightly greater impacts than the No Action Alternative.	Impacts would be similar to those described under the Proposed Action. However, there would be 198 miles of roads and 369 impacted AUMs (0.8%), which would result in greater impacts than the No Action Alternative.
PALEONTOLOGICAL RESOURCES						
Paleontological Resources	Adverse direct impacts would include an increased risk of destruction of fossils during ground-disturbing activities. Beneficial impacts may also result from the unearthing of fossils during ground-disturbing activities. Surface disturbance would occur on: Condition 1: 6,906 acres (3.6%) Condition 3: 678 acres (3.9%) PFYC Class 2: 678 acres (3.9%) PFYC Class 5: 6,906 acres (3.6%)	Impacts would be of the same in nature as described for the Proposed Action, but would occur over: Condition 1: 5,213 acres (2.8%) Condition 3: 472 acres (2.7%) PFYC Class 2: 472 acres (2.7%) PFYC Class 5: 5,213 acres (2.8%)	Impacts would be the same in nature as the Proposed Action, but differ in magnitude based on acres of surface disturbance. Condition 1: 8,911 acres (4.7%) Condition 3: 1,067 acres (6.1%) PFYC Class 2: 1,067 acres (6.1%) PFYC Class 5: 8,911 acres (4.7%)	Impacts would be the same in nature as the Proposed Action but, differ in magnitude based on acres of surface disturbance. Condition 1: 1,748 acres (0.9%) Condition 3: 308 acres (1.8%) PFYC Class 2: 308 acres (1.8%) PFYC Class 5: 1,748 acres (0.9%)	Impacts would be the same in nature as the Proposed Action, but differ in magnitude based on acres of surface disturbance. Condition 1: 1,902 acres (1.0%) Condition 3: 272 acres (1.6%) PFYC Class 2: 272 acres (1.6%) PFYC Class 5: 1,902 acres (1.0%)	Impacts would be the same in nature as the Proposed Action, but differ in acres of surface disturbance. Condition 1: 3,367 acres (1.8%) Condition 3: 234 acres (1.3%) PFYC Class 2: 234 acres (1.3%) PFYC Class 5: 3,367 acres (1.8%)
Paleontological Resources	Greater access for illegal fossil collection would occur due to 325 miles of new roads.	Greater access for illegal fossil collection would occur due to 274 miles of new roads.	Greater access for illegal fossil collection would occur due to 526 miles of new roads.	Greater access for illegal fossil collection would occur due to 72 miles of new roads.	Greater access for illegal fossil collection would occur due to 106 miles of new roads.	Greater access for illegal fossil collection would occur due to 198 miles of new roads.
RECREATION						
General	Short-term adverse effects on recreation due to increased noise levels of up to 88 decibels (dBA) at 50 feet during construction. Long-term adverse impacts to recreational opportunities due to the direct conversion of 5,880 acres of land to well pads, evaporation facilities, roads, and pipelines. Long-term beneficial effects to some recreation (particularly motorized and mechanized) due to 325 miles of new OHV roads providing increased recreational access.	Impacts would be the same as the Proposed Action, but would result from the following: 4,390 acres of disturbance 274 miles of new OHV roads	Impacts would be the same as the Proposed Action, but would result from the following: 7,442 acres of disturbance 526 miles of new OHV roads	Impacts would be the same as the Proposed Action, but would result from the following: 1,455 acres of disturbance 72 miles of new OHV roads	Impacts would be the same as the Proposed Action, but would result from the following: 1,527 acres of disturbance 106 miles of new OHV roads	Impacts would be the same as the Proposed Action, but would result from the following: 2,501 acres of disturbance 198 miles of new OHV roads

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Nine Mile Canyon SRMA	Long-term adverse impacts to recreation from the development of 146 wells and direct conversion of 792 acres (1.8% of SRMA) to well pads, roads, and pipelines within the SRMA. Long-term beneficial effects from 46 miles of new roads allowing for increased access and recreational opportunities within the Nine Mile Canyon SRMA.	Impacts would be of the same as the Proposed Action, but would result from the following: 43 wells 32 miles of new roads 283 acres of disturbance within 0.6% of Nine Mile Canyon SRMA	Impacts would be the same as the Proposed Action, but would result from the following: 182 wells 79 miles of new roads 1,114 acres of disturbance within 2.5% of Nine Mile Canyon SRMA	Impacts would be the same as the Proposed Action, but would result from the following: 17 wells 5 miles of new roads 104 acres of disturbance within 0.2% of Nine Mile Canyon SRMA	Impacts would be the same as the Proposed Action, but would result from the following: 14 wells 7 miles of new roads 107 acres of disturbance within 0.2% of Nine Mile Canyon SRMA	Impacts would be the same as the Proposed Action, but would result from the following: 134 wells (78 well pads) 31 miles of new roads 491 acres of disturbance within 1.1% of Nine Mile Canyon SRMA
Extensive Recreation Management Area (ERMA)	Within the area of the ERMA that provides opportunities for primitive recreation, 729 acres would be directly impacted; 15,173 acres would be within 0.5 mile of direct disturbance; and 5,742 acres would be segregated into parcels of less than 5,000 acres.	Within the area of the ERMA that provides opportunities for primitive recreation, 6 acres would be directly impacted; 7,009 acres would be within 0.5 mile of direct disturbance; and 8 acres would be segregated into parcels of less than 5,000 acres.	Within the area of the ERMA that provides opportunities for primitive recreation, 533 acres would be directly impacted; 17,905 acres would be within 0.5 mile of direct disturbance; and 8,894 acres would be segregated into parcels of less than 5,000 acres.	Within the area of the ERMA that provides opportunities for primitive recreation, 82 acres would be directly impacted; 9,700 acres would be within 0.5 mile of direct disturbance; and 3,808 acres would be segregated into parcels of less than 5,000 acres.	Within the area of the ERMA that provides opportunities for primitive recreation, 4 acres would be directly impacted; 4,299 acres would be within 0.5 mile of direct disturbance; and 5 acres would be segregated into parcels of less than 5,000 acres.	Within the area of the ERMA that provides opportunities for primitive recreation, 376 acres would be directly impacted; 12,105 acres would be within 0.5 mile of direct disturbance; and 5,245 acres would be segregated into parcels of less than 5,000 acres.
River Recreation	Long-term direct adverse impacts may result from wells visible and audible to river recreationists along the Nine Mile Creek and Green River corridors and large truck traffic on the Wrinkle and Sand Wash Roads. There would be no wells or roads visible from Nine Mile Creek. 11 wells and 1 mile of new road would be visible within the Green River viewshed.	Impacts would be of the same nature as the Proposed Action, but would result from the following: No wells and no miles of roads in the Nine Mile viewshed. 15 wells and 3 miles of new roads in the Green River viewshed.	Impacts would be of the same nature as the Proposed Action, but would result from the following: 12 wells and 3 miles of roads in the Nine Mile viewshed. 26 wells and 5 miles of new roads in the Green River viewshed.	Impacts would be of the same nature as the Proposed Action, but would result from the following: No wells and no miles of roads in the Nine Mile viewshed. 11 wells and 2 miles of new roads in the Green River viewshed.	Impacts would be of the same nature as the Proposed Action, but would result from the following: No wells and no miles of roads in the Nine Mile viewshed. 4 wells and 1 mile of new roads in the Green River viewshed.	Impacts would be of the same nature as the Proposed Action, but would result from the following: No wells and no miles of roads in the Nine Mile viewshed. No wells and 1 mile of new roads in the Green River viewshed.
Hunting	Long-term direct beneficial effects from expanded road network (325 miles) allowing increased access to hunting grounds. Long-term indirect adverse impacts to hunters from reduced elk and deer habitat, habitat fragmentation, lower forage productivity, noise, and persistent human presence (see Chapter 4, Wildlife section).	Impacts would be the same as the Proposed Action, but would occur due to 274 miles of new roads.	Impacts would be the same as the Proposed Action, but would occur due to 526 miles of new roads.	Impacts would be the same as the Proposed Action, but would occur due to 72 miles of new roads.	Impacts would be the same as the Proposed Action, but would occur due to 106 miles of new roads.	Impacts would be the same as the Proposed Action, but would occur due to 198 miles of new roads.
OHV	Long-term direct adverse impacts to OHV users from lands being altered for well development and production facilities on 6,281 acres (3.5%) of lands designated as OHV Limited. Long-term beneficial effects with the addition of 269 miles of new roads in OHV Limited areas.	Impacts would be the same as the Proposed Action, but would occur due to the following: 4,475 acres (2.5%) of disturbance in lands designated as OHV Limited. Long-term beneficial effects with the addition of 188 miles of new roads in areas where OHV designation is Limited.	Impacts would be the same as the Proposed Action, but would occur due to the following: 8,442 acres (4.8%) of disturbance in lands designated as OHV Limited. Long-term beneficial effects with the addition of 371 miles of new roads in areas where OHV designation is Limited.	Impacts would be the same as the Proposed Action, but would occur due to the following: 1,534 acres (0.9%) of disturbance in lands designated as OHV Limited. Long-term beneficial effects with the addition of 52 miles of new roads in areas where OHV designation is Limited.	Impacts would be the same as the Proposed Action, but would occur due to the following: 1,737 acres (1.0%) of disturbance in lands designated as OHV Limited. Long-term beneficial effects with the addition of 83 miles of new roads in areas where OHV designation is Limited.	Impacts would be the same as the Proposed Action, but would occur due to the following: 2,978 acres (1.7%) of disturbance in lands designated as OHV Limited. Long-term beneficial effects with the addition of 162 miles of new roads in areas where OHV designation is Limited.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Wetlands Recreation	Adverse impacts would occur due to disturbance of 11 acres within the borders of the Pariette Wetlands area of critical environmental concern (ACEC) from well activities.	No surface disturbance impacts within Pariette Wetlands ACEC.	Adverse impacts to recreation from disturbance of 4 acres within the borders of the Pariette Wetlands ACEC from well activities.	Same Impacts as Alternative B.	Same Impacts as Alternative B.	Same impacts as Alternative B.
Hiking	Impacts would be adversely minor due to low use of the project area for this activity. Adverse impacts would occur to the wilderness therapy group, Second Nature, from the development of 231 wells and 58 miles of new roads (1,192 acres of disturbance) within 3 miles (east and west) of Wells Draw.	Impacts would be the same as the Proposed Action, due to the following impacts within 3 miles of Wells Draw: 226 wells 58 miles of new roads 1,175 acres of disturbance	Impacts would be the same as the Proposed Action, due to the following impacts within 3 miles of Wells Draw: 419 wells 100 miles of new roads 2,184 acres of disturbance	Impacts would be the same as the Proposed Action, due to the following impacts within 3 miles of Wells Draw: 76 wells 16 miles of new roads 450 acres of disturbance	Impacts would be the same as the Proposed Action, due to the following impacts within 3 miles of Wells Draw: 69 wells 29 miles of new roads 460 acres of disturbance	Impacts would be the same as the Proposed Action, due to the following impacts within 3 miles of Wells Draw: 129 wells 50 miles of new roads 819 acres of disturbance
SOCIOECONOMICS						
Employment and Revenue	Beneficial impacts from the creation of approximately 227 jobs (adding to a 2004 non-agricultural workforce of 16,286) and $42 million in revenue to the Uinta Basin counties throughout the life of the project.	Beneficial impacts from the creation of approximately 170 jobs and $31.4 million in local revenue.	Beneficial impacts from the creation of approximately 257 jobs and $53.2 million in local revenue.	Beneficial impacts from the creation of approximately 56 jobs and $10.4 million in local revenue.	Impacts would be to the same as Alternative B because the same number of wells is proposed throughout the life of the project.	Beneficial impacts from the creation of approximately 195 jobs and $36.6 million in local revenue.
Public Services	Impacts under the Proposed Action would include an increased need for social services and infrastructure.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but greater, as more wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but far reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to Alternative B because the same numbers of wells is proposed throughout the life of the project.	Impacts would be similar to the Proposed Action, but reduced because fewer wells would be developed under this alternative.
Housing	Adverse shortage of hotel accommodation and housing during "boom times". Additionally the short term nature of much of the employment would lead to housing solutions not suitable for a long term population.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but greater, as more wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but far reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to Alternative B because the same numbers of wells is proposed throughout the life of the project.	Impacts would be similar to the Proposed Action, but reduced because fewer wells would be developed under this alternative.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Tourism and Recreation	Tourism development would be adversely impacted due to the increased demand for short-term lodging competing with tourism-related services in the Uinta Basin. Wilderness therapy groups would also be adversely impacted since they would have to modify their usage or relocate. Continued decreases in cultural and heritage tourism and associated revenue due to presence of oil and gas development in close proximity to Nine Mile Canyon. Potential decrease to river recreation above the Sand Wash put-in due to sights and sounds of oil and gas development. No change to Desolation Canyon recreation.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but greater, as more wells would be developed under this alternative.	Impacts would be similar to the Proposed Action, but far reduced, as fewer wells would be developed under this alternative.	Impacts would be similar to Alternative B because the same number of wells is proposed throughout the life of the project.	Impacts would be similar to the Proposed Action, but reduced because fewer wells would be developed under this alternative.
Development Costs and Return on Investment	Total estimated drilling and completion costs would be $2,903,920 per well. The use of directional drilling as an applicant-committed or mitigation measure would increase the price at which there would be a return on investment.	Development and completion costs and return on investment would be the same per well as under the Proposed Action, because Alternative B would also be drilled vertically and to the same depth.	Development and completion costs and return on investment would be the same per well as under the Proposed Action, because Alternative B would also be drilled vertically and to the same depth.	Development and completion costs and return on investment would be the same per well as under the Proposed Action, because Alternative B would also be drilled vertically and to the same depth.	The directional drilling specified under Alternative E would require an increase over the other alternatives in development and completion costs. Total drilling and completion costs would be $3,183,146 per well (for 20-acre spacing offset), $3,200,741 (for 40-acre spacing offset) or $4,002,344 (for 160-acre spacing offset). Due to the higher cost of drilling a single well, the range of economic conditions under which Alternative E would result in a return on investment would be narrower than any other alternative.	Development and completion costs for the directional drilling specified under Alternative F would be the same per well as under Alternative E. Some vertical drilling would also be conducted under this Alternative; vertical drilling costs would be the same per well as under the Proposed Action. The combination of directional and vertical drilling would make the project more feasible under certain economic conditions than Alternative E.
Environmental Justice	Potential for impacts to air quality, climate, cultural resources, transportation, livestock grazing, recreation, and socioeconomics of the low-income communities of Myton, Randlett, Fort Duchesne, and Whiterocks. These impacts would not disproportionately affect these communities.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed.	Impacts would be similar to the Proposed Action, but greater, as more wells would be developed.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed.	Impacts would be similar to the Proposed Action, but reduced, as fewer wells would be developed.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
SOILS						
Soils	A total of 7,584 acres of soils would be disturbed, at least 75% of which would have at least one factor limiting their reclamation. The most highly impacted soils with restrictive features would be those with high excess sodium, alkalinity, droughty conditions, and poor reclamation potential.	A total of 5,685 acres of soils would be disturbed, at least 75% of which would have at least one factor limiting their reclamation. The most highly impacted soils would be the same as under the Proposed Action.	A total of 9,982 acres of soils would be disturbed, at least 76% of which would have at least one factor limiting their reclamation. The most highly impacted soils would be the same as under the Proposed Action.	A total of 2,055 acres of soils would be disturbed, at least 86% of which would have at least one factor limiting their reclamation. The most highly impacted soils would be the same as under the Proposed Action.	A total of 2,174 acres of soils would be disturbed, at least 75% of which would have at least one factor limiting their reclamation. The most highly impacted soils would be the same as under the Proposed Action.	A total of 3,602 acres of soils would be disturbed, at least 67% of which would have at least one factor limiting their reclamation. The most highly impacted soils would be the same as under the Proposed Action.
Biological Soils	A total of 1,143 acres of pinyon-juniper woodland and shrubland and 3,028 acres of sagebrush community types would be disturbed. These communities are associated with biological soil crusts.	Approximately 974 acres of pinyon-juniper woodland and shrubland and 2,123 acres of sagebrush would be disturbed.	Approximately 1,717 acres of pinyon-juniper woodland and shrubland and 3,535 acres of sagebrush would be disturbed.	Approximately 278 acres of pinyon-juniper woodland and shrubland and 652 acres of sagebrush would be disturbed.	Approximately 126 acres of pinyon-juniper woodland and shrubland and 776 acres of sagebrush would be disturbed.	Approximately 706 acres of pinyon-juniper woodland and shrubland and 1,508 acres of sagebrush would be disturbed.
Erosion Potential and Steep Slopes	Construction on slopes >30% would take place on approximately 839 acres. Construction on slopes greater that 40% would take place on approximately 452 acres. Approximately 539,593 tons of excess sediment would be produced over the life of the project.	Approximately 603 acres of surface disturbance would take place on slopes >30%. Approximately 276 acres of surface disturbance would take place on slopes >40%. Approximately 531,797 tons of excess sediment would be produced over the life of the project.	Approximately 1,125 acres of surface disturbance would take place on slopes >30%. Approximately 605 acres of surface disturbance would take place on slopes >40%. Approximately 682,905 tons of excess sediment would be produced over the life of the project.	Approximately 148 acres of surface disturbance would take place on slopes >30%. Approximately 62 acres of surface disturbance would take place on slopes >40%. Approximately 133,179 tons of excess sediment would be produced over the life of the project.	Approximately 209 acres of surface disturbance would take place on slopes >30%. Approximately 93 acres of surface disturbance would take place on slopes >40%. Approximately 136,382 tons of excess sediment would be produced over the life of the project.	Approximately 215 acres of surface disturbance would take place on slopes >30%. Approximately 221 acres of surface disturbance would take place on slopes >40%. Approximately 239,085 tons of excess sediment would be produced over the life of the project.
SPECIAL DESIGNATIONS						
Pariette Wetlands ACEC	A total of 74 acres within the ACEC (0.7% of the entire ACEC and 1.5% of ACEC within project area) and 11 acres of riparian habitat would be disturbed. No highly erosive soils would be directly affected. 47 acres within 0.25 mile of waterfowl habitat would be affected. Approximately 74 acres of potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC. No acres of Pariette cactus would be disturbed.	A total of 2 acres within the ACEC would be disturbed (0.01% of the entire ACEC and 0.04% of ACEC within project area). No riparian habitat or highly erosive soils would be directly affected. 1 acre within ¼ mile of waterfowl habitat would be affected. Approximately 2 acres of potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC.	A total of 26 acres within the ACEC (0.2% of the entire ACEC and 0.5% of ACEC within project area) and 4 acres of riparian habitat would be disturbed under this alternative. No highly erosive soils would be directly affected. 18 acres within ¼ mile of waterfowl habitat would be affected. Approximately 3 acres of potential habitat for Pariette cactus and 25 acres of potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC.	A total of 3 acres within the ACEC would be disturbed under this alternative (0.03% of the entire ACEC and 0.66% of ACEC within project area). No riparian habitat or highly erosive soils would be directly affected. One acre within ¼ mile of waterfowl habitat would be affected. Approximately 1 acre of potential habitat for Pariette cactus and 1 acre of potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC.	A total of 0.4 acre within the ACEC would be disturbed under this alternative. No riparian habitat or highly erosive soils would be directly affected. No acres within ¼ mile of waterfowl habitat would be affected Approximately 0.4 acre of potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC. No acres of Pariette cactus would be disturbed.	No acres within the ACEC would be disturbed under this alternative. No riparian habitat or highly erosive soils would be directly affected. No potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC. No acres of Pariette cactus would be disturbed.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Lower Green River ACEC	A total of 45 acres would be disturbed under this alternative (0.5% of the entire ACEC and 1.4% of ACEC within project area). No riparian habitat would be directly affected. Due to development patterns, a total of 7 wells would be located within 0.25 mile of the river and 11 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river. The alternative would also affect 49 acres of potential Uinta Basin hookless cactus habitat and 1 acre within the 0.5-mile buffer around known raptor nests.	A total of 38 acres would be disturbed under this alternative (0.4% of the entire ACEC and 1.2% of ACEC within project area). No riparian habitat would be directly affected. Due to development patterns, a total of 8 wells would be located within 0.25 mile of the river and 15 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river. The alternative would also affect 40 acres of potential Uinta Basin hookless cactus habitat and no acres within the 0.5-mile buffer around known raptor nests.	A total of 23 acres would be disturbed under this alternative (0.3% of the entire ACEC and 0.7% of ACEC within project area). No riparian habitat would be directly affected. Due to development patterns, a total of 3 wells would be located within 0.25 mile of the river and 26 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river. The alternative would also affect 29 acres of potential Uinta Basin hookless cactus habitat and 1 acre within the 0.5-mile buffer around known raptor nests.	A total of 17acres would be disturbed under this alternative (0.2% of the entire ACEC and 0.6% of ACEC within project area). No riparian habitat would be directly affected. Due to development patterns, a total of 2 wells would be located within 0.25 mile of the river and 11 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river. The alternative would also affect 21 acres of potential Uinta Basin hookless cactus habitat and no acres within the 0.5-mile buffer around known raptor nests.	A total of 13 acres would be disturbed under this alternative (0.2% of the entire ACEC and 0.3% of ACEC within project area). No riparian habitat would be directly affected. Due to development patterns, a total of 3 wells would be located within 0.25 mile of the river and 4 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river. The alternative would also affect 15 acres of potential Uinta Basin hookless cactus habitat and no acres within the 0.5-mile buffer around known raptor nests.	No acres within the ACEC would be disturbed under this alternative. No riparian habitat would be directly affected. No wells would be situated within 0.25 mile of the Green River. No wells or miles of road would be located within line of sight of the Green River. No potential habitat for Uinta Basin hookless cactus would be disturbed in the ACEC. No acres within the 0.5-mile buffer around known raptor nests would be disturbed.
Nine Mile Canyon ACEC	A total of 844 acres would be disturbed under this alternative (1.9% of the entire ACEC and 2.4% of ACEC within project area). A total of 89 acres of high cultural probability would also be disturbed. A total of 170 wells would be located within 0.25 mile of the ACEC, which could increase noise and impact recreational values. No wells or roads will be within the line of sight of the creek. The alternative would also affect 791 acres of Uinta Basin hookless cactus, 27 acres of shrubby reed-mustard, 0.3 acre of Graham's beardtongue, and 151 acres of Untermann daisy habitat. The alternative would also affect 650 acres of crucial or high priority of winter elk range, 438 acres of crucial or high priority winter deer range, no acres of crucial year-round deer range, 829 acres of potential bighorn sheep range, and 614 acres of crucial or high priority year-round antelope range.	A total of 310 acres would be disturbed under this alternative (0.6% of the entire ACEC and 0.4% of ACEC within project area). A total of 51 acres of high cultural probability would also be disturbed. A total of 47 wells would be located within 0.25 mile of the ACEC and no wells within line of sight of the Canyon, which could increase noise and impact recreational values. The alternative would also affect 281 acres of Uinta Basin hookless cactus, 19 acres of shrubby reed-mustard, 0.3 acre of Graham's beardtongue, and 109 acres of Untermann daisy habitat. The alternative would also affect 170 acres of crucial or high priority of winter elk range, 171 acres of crucial or high priority winter deer range, 3 acres of crucial year-round deer range, 294 acres of potential bighorn sheep range, and 179 acres of crucial or high priority year-round antelope range.	A total of 1,186 acres would be disturbed under this alternative (2.7% of the entire ACEC and 3.4% of ACEC within project area). A total of 278 acres of high cultural probability would also be disturbed. A total of 192 wells would be located within 0.25 mile of the ACEC and 12 wells within line of sight of the Canyon, which could increase noise and impact recreational values. The alternative would also affect 1,115 acres of Uinta Basin hookless cactus, 26 acres of shrubby reed-mustard, 0.3 acre of Graham's beardtongue, and 219 acres of Untermann daisy habitat . The alternative would also affect 630 acres of crucial or high priority of winter elk range, 367 acres of crucial or high priority winter deer range, 28 acres of crucial year-round deer range, 1,163 acres of potential bighorn sheep range, and 597 acres of crucial or high priority year-round antelope range.	A total of 105 acres would be disturbed under this alternative (0.2% of the entire ACEC and 0.3% of ACEC within project area). A total of 18 acres of high cultural probability would also be disturbed. A total of 17 wells would be located within 0.25 mile of the ACEC and no wells within line of sight of the Canyon, which could increase noise and impact recreational values. The alternative would also affect 103 acres of Uinta Basin hookless cactus, <1acre of shrubby reed-mustard, no Graham's beardtongue , and 27 acres of Untermann daisy habitat. The alternative would also affect 61 acres of crucial or high priority of winter elk range, 44 acres of crucial or high priority winter deer range, no crucial year-round deer range, 100 acres of potential bighorn sheep range, and 60 acres of crucial or high priority year-round antelope range.	A total of 120 acres would be disturbed under this alternative (0.3% of the entire ACEC and 0.4% of ACEC within project area). A total of 53 acres of high cultural probability would also be disturbed. A total of 16 wells would be located within 0.25 mile of the ACEC and no wells within line of sight of the Canyon, which could increase noise and impact recreational values. The alternative would also affect 115 acres of Uinta Basin hookless cactus, 9 acres of shrubby reed-mustard, no Graham's beardtongue, and 25 acres of Untermann daisy habitat. The alternative would also affect 61 acres of crucial or high priority of winter elk range, 64 acres of crucial or high priority winter deer range, 2 acres of crucial year-round deer range, 115 acres of potential bighorn sheep range, and 71 acres of crucial or high priority year-round antelope range.	A total of 516 acres would be disturbed under this alternative (1.2% of the entire ACEC and 1.5% of ACEC within the project area). A total of 58 acres of high cultural probability would also be disturbed. A total of 54 well pads would be located within 0.25 mile of the ACEC, and no wells within line of sight of the Canyon, which could increase noise and impact recreational values. This alternative would also affect 499 acres of Uinta Basin hookless cactus, 32 acres of shrubby reed-mustard, no Graham's beardtongue, and 170 acres of Untermann daisy habitat. This alternative would also affect 378 acres of crucial or high-priority winter elk range, 271 acres of high-priority winter deer range, 500 acres of potential bighorn sheep range, and 365 acres of crucial or high-priority year-round antelope range.
Suitable Lower Green River WSR	A total of 61 acres would be disturbed under this alternative. A total of 7 wells would be located within 0.25 mile of the river and 28 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river.	A total of 56 acres would be disturbed under this alternative. A total of 8 wells would be located within 0.25 mile of the river and 15 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river.	A total of 36 acres would be disturbed under this alternative. A total of 3 wells would be located within 0.25 mile of the river and 26 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river.	A total of 25 acres would be disturbed under this alternative. A total of 2 wells would be located within 0.25 mile of the river and 11 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river.	A total of 14 acres would be disturbed under this alternative. A total of 3 wells would be located within 0.25 mile of the river and 4 wells within line of sight of the river, which could increase noise and decrease wild and scenic qualities along the river.	No acres of suitable Lower Green River WSR would be disturbed under this alternative.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
SPECIAL STATUS SPECIES*						
Clay Reed-mustard	No occupied or suitable clay reed-mustard habitat areas would be directly impacted by implementation of the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.
Shrubby Reed-mustard	Direct disturbance of 27 acres (1.9%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 271 acres (18.7%) of the Badlands Cliff shrubby reed-mustard habitat area. Applicant-committed measures would minimize direct impacts to occupied habitat or to individual plants.	Same as Proposed Action, except direct disturbance of 19 acres (1.3%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 174 acres (12.0%) of the Badlands Cliff shrubby reed-mustard habitat area.	Same as Proposed Action, except direct disturbance of 26 acres (1.8%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 258 (17.8%) of the Badlands Cliff shrubby reed-mustard habitat area.	Same as Proposed Action, except disturbance of <0.1 acre (≤0.01%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 108 (7.5%) of the Badlands Cliff shrubby reed-mustard habitat area.	Same as under the Proposed Action, except direct disturbance of 9 acres (0.6%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 111 (7.7%) of the Badlands Cliff shrubby reed-mustard habitat area.	Same as under the Proposed Action, except direct disturbance of 32 acres (2.5%) of the Badlands Cliff shrubby reed-mustard habitat area, and indirect disturbance to 296 (20.4%) of the Badlands Cliff shrubby reed-mustard habitat area.
Pariette Cactus	No direct disturbance to potential habitat areas in the project area. Potential for indirect impacts to 598 acres of potential habitat within 300 feet of proposed roads from fugitive dust, proliferation of noxious weeds, illegal collection, OHV access, and direct and indirect impacts to the species' pollinators and seed dispersers. Indirect impacts would occur on 29.8% of the approximately 2,010 acres of potential habitats in the project area. Dust and weed impacts would be minimized by applicant-committed measures. No direct disturbance to 2009 core conservation areas; indirect disturbance to approximately 24 acres of 2009 core conservation areas within 300 feet of roads.	Same as Proposed Action.	Same as Proposed Action, except direct disturbance to 27 acres including 0.3 mile of new roads, or 1.3%, of potential habitat in the project area. Indirect impacts would occur on 621 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 30.9% of the approximately 2,010 acres of potential habitats in the project area.	Same as Proposed Action, except direct disturbance to 6 acres including 1.5 miles of new roads, or 0.3%, of potential habitat in the project area. Indirect impacts would occur on 602 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 30.0% of the approximately 2,010 acres of potential habitats in the project area.	Same as Proposed Action, except for potential for indirect impacts to 597 acres of potential habitat (29.7% of the approximately 2,010 acres of potential habitats in the project area).	Same as Proposed Action, except for potential for indirect impacts to 579 acres of potential habitat (28.8% of the approximately 2,010 acres of potential habitats in the project area).

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Uinta Basin Hookless Cactus	Direct disturbance of 4,089 acres, or 4.2%, including 162.2 miles of new roads, in potential habitat in the project area. Potential for indirect impacts to 26,410 acres of potential habitat within 300 feet of proposed roads from fugitive dust, proliferation of noxious weeds, illegal collection, OHV access, and direct and indirect impacts to the species' pollinators and seed dispersers. Indirect impacts would occur on 27% of the approximately 98,417 acres of potential habitat in the project area. Applicant-committed measures would minimize direct impacts to plants and occupied habitat.	Same as Proposed Action, except direct disturbance of 2,674 acres, including 106.3 miles of new roads, or 2.7%, of the potential habitat in the project area. Indirect impacts would be of the same nature as under the Proposed Action, but would affect 22,664 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 23.0% of the approximately 98,417 acres of potential habitat in the project area.	Same as Proposed Action, except direct disturbance of 4,830 acres, including 210.3 miles of new roads, or 4.9%, of the potential habitat in the project area. Indirect impacts would be of the same nature as under the Proposed Action, but would affect 30,494 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 31.0% of the approximately 98,417 acres of potential habitat in the project area.	Same as Proposed Action, except direct disturbance of 974 acres, including 94.0 miles of new roads, or 1.0%, of the potential habitat in the project area. Indirect impacts would be of the same nature as under the Proposed Action, but would affect 17,409 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 18% of the approximately 98,417 acres of potential habitat in the project area.	Same as Proposed Action, except direct disturbance of 1,097 acres, including 49.7 miles of new roads, or 1.1% of potential habitat in the project area. Indirect impacts would be of the same nature as under the Proposed Action, but would affect 18,750 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 19% of the approximately 98,417 acres of potential habitat in the project area.	Same as Proposed Action, except direct disturbance of 499 acres, including 92 miles of new roads or 0.9% of potential habitat in the project area. Indirect impacts would be of the same nature as under the Proposed Action, but would affect 21,581 acres of potential habitat within 300 feet of proposed roads. Indirect impacts would occur on 22% of the approximately 98,417 acres of potential habitat in the project area.
Graham's Beardtongue	Disturbance of 0.5 acre, or 0.6%, of occupied habitat in the project area.	Same as Proposed Action.	Same as Proposed Action.	No impacts to occupied habitat.	No impacts to occupied habitat.	No impacts to occupied habitat.
Ute Ladies'-tresses	Potential habitats could coincide with 11 acres of proposed disturbance within riparian areas; however, the species' habitats would be included in existing protection for wetlands and floodplains, and under the Clean Water Act (Section 404). Direct impacts to the orchid would be minimized by applicant-committed avoidance and mitigation measures implemented in occupied habitats.	No impacts to native riparian habitats where the species potentially occurs.	Same as under the Proposed Action, but would impact 4 acres of native riparian habitats where the species potentially occurs.	No impacts to native riparian habitats where the species potentially occurs.	No impacts to native riparian habitats where the species potentially occurs.	No impacts to native riparian habitats where the species potentially occurs.
MSO	Disturbance of 17 acres (0.9%) of habitat classified as "good" in the project area and 108 acres (0.7%) of "poor" habitat. Disturbance of 92 acres within the 0.5-mile buffer surrounding MSO habitat in the project area. Applicant-committed mitigation measures would minimize impacts to the MSO during the breeding season.	Same as Proposed Action, but disturbance of 4 acres (0.2%) of habitat classified as "good" in the project area; 0 acres (0%) of "fair" habitat; 92 acres (0.6%) of "poor" habitat. Disturbance of 25 acres within the 0.5-mile buffer surrounding MSO habitat in the project area.	Same as Proposed Action, but disturbance of 62 acres (3.5%) of habitat classified as "good" in the project area; 6 acres (1.3%) of "fair" habitat; 431 acres (2.8%) of "poor" habitat. Disturbance of 260 acres within the 0.5-mile buffer surrounding MSO habitat in the project area.	Same as Proposed Action, but disturbance of 0 acres (0%) of habitat classified as "good" in the project area; 10 acres (2.1%) of "fair" habitat; 16 acres (0.1%) of "poor" habitat. Disturbance of 5 acres within the 0.5-mile buffer surrounding MSO habitat in the project area.	Same as Proposed Action but disturbance of 0 acres (0%) of habitat classified as "good" in the project area; 0 acres (0%) of "fair" habitat; 41 acres (0.3%) of "poor" habitat. Disturbance of 8 acres within the 0.5-mile buffer surrounding MSO habitat in the project area.	Same as Proposed Action but disturbance of 0 acres (0%) of habitat classified as "good" in the project area; 0 acres (0%) of "fair" habitat; 80 acres (0.5%) of "poor." Disturbance of 42 acres within the 0.5-mile buffer surrounding MSO habitat in the project area.
Greater Sage-grouse	Disturbance of 841 acres, or 10.5%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 2,800 acres, or 4.2%, of potential brooding habitat in the project area. Disturbance of 2,267 acres, or 5.9%, of potential wintering habitat in the project area. Contribute to fragmentation of 83% of brooding habitat.	Disturbance of 744 acres, or 9.3%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 2,092 acres, or 3.1%, of potential brooding habitat in the project area. Disturbance of 1,593 acres, or 4.1%, of potential wintering habitat in the project area. Contribute to fragmentation of 75% of brooding habitat.	Disturbance of 473 acres, or 5.9%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 3,108 acres, or 4.6%, of potential brooding habitat in the project area. Disturbance of 1,894 acres, or 4.9%, of potential wintering habitat in the project area. Contribute to fragmentation of 96% of brooding habitat.	Disturbance of 47 acres, or 0.6%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 700 acres, or 1.0%, of potential brooding habitat in the project area. Disturbance of 196 acres, or 0.5%, of potential wintering habitat in the project area. Contribute to fragmentation of 70% of brooding habitat.	Disturbance of 241 acres, or 3.0%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 751 acres, or 1.1%, of potential brooding habitat in the project area. Disturbance of 538 acres, or 1.4%, of potential wintering habitat in the project area. Contribute to fragmentation of 70% of brooding habitat.	Disturbance of 295 acres, or 3.7%, of nesting habitat within a 2-mile buffer around an inactive lek. Disturbance of 1,899 acres, or 2.2%, of potential brooding habitat in the project area. Disturbance of 1,035 acres, or 2.7%, of potential wintering habitat in the project area. Contribute to fragmentation of 96% of brooding habitat.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Yellow-billed Cuckoo	Disturbance of 29 acres (2.4%) of riparian potential habitat.	Same as under the Proposed Action, however 19 acres (1.6%) of riparian habitat would be disturbed.	Same as under the Proposed Action, however only 9 acres (0.7%) of riparian habitat would be disturbed.	Same as under the Proposed Action, however only 8 acres (0.7%) of riparian habitat would be disturbed.	Same as under the Proposed Action, however only 6 acres (0.5%) of riparian habitat would be disturbed.	No impacts to suitable riparian habitat under this alternative.
Colorado River Endangered Fish (Bonytail Chub, Colorado Pikeminnow, Humpback Chub, and Razorback Sucker)	Total of 288 acre-feet of Green River water depletion over the 45 year life of project. Sedimentation risk from disturbance of 30 acres of highly erosive soils. Slight toxicity risk from 743 pipeline crossings of ephemeral streams. Toxicity risk and impacts to critical habitat from 11 wells in the Green River floodplain.	Total of 215 acre-feet of Green River water depletion over the 45-year life of project. Sedimentation risk from disturbance of 28 acres of highly erosive soils. Slight toxicity risk from 600 pipeline crossings of ephemeral streams. Toxicity risk and impacts to critical habitat from 8 wells in the Green River floodplain.	Total of 365 acre-feet of Green River water depletion over the 45-year life of project. Sedimentation risk from disturbance of 37 acres of highly erosive soils. Slight toxicity risk from 1,253 pipeline crossings of ephemeral streams. Toxicity risk and impacts to critical habitat from 4 wells in the Green River floodplain.	Total of 71 acre-feet of Green River water depletion over the 45-year life of project. Sedimentation risk from disturbance of 10 acres of highly erosive soils. Slight toxicity risk from 473 pipeline crossings of ephemeral streams. Toxicity risk and impacts to critical habitat from 4 wells in the Green River floodplain.	Total of 215 acre-feet of Green River water depletion over the 45-year life of project. Sedimentation risk from disturbance of 1.4 acres of highly erosive soils. Slight toxicity risk from 347 pipeline crossings of ephemeral streams. Toxicity risk and impacts to critical habitat from 7 wells (from 2 pads) in the Green River floodplain.	Total of 251 acre-feet of Green River water depletion over the 45-year life of project. Sedimentation risk from disturbance of 21 acres of highly erosive soils. Slight toxicity risk from 744 pipeline crossings of ephemeral streams. No wells in the Green River floodplain.
Untermann Daisy	Disturbance of 1,701 acres, or 3.7%, of the potential habitat in the project area.	Disturbance of 1,608 acres, or 3.5%, of the potential habitat in the project area.	Disturbance of 2,174 acres, or 4.7%, of the potential habitat in the project area.	Disturbance of 281 acres, or 0.6%, of the potential habitat in the project area.	Disturbance of 597 acres, or 1.3%, of the potential habitat in the project area.	Disturbance of 1,152 acres, or 2.5%, of the potential habitat in the project area.
Sterile Yucca	Disturbance of 0.21 acres of known sterile yucca habitat; 2.5% of its known habitat in the project area.	Disturbance of 0.15 acres of known sterile yucca habitat; 1.8% of its known habitat in the project area.	Disturbance of 0.15 acres of known sterile yucca habitat; 1.8% of its known habitat in the project area.	Disturbance of 3.06 acres of known sterile yucca habitat; 36.4% of its known habitat in the project area.	Disturbance of 0.15 acres of known sterile yucca habitat; 1.8% of its known habitat in the project area.	Disturbance of 0.29 acres of known sterile yucca habitat; 3.5% of its known habitat in the project area.
Graham's Catseye, Barneby's Catseye, Goodrich's Blazingstar, Goodrich's Columbine, and Uinta Greenthread	No mapped potential, or suitable habitats for these species would be affected; however, all have the potential to occur based on project area vegetation communities and elevation ranges. Avoidance and minimization measures would be addressed at the site-specific level.					
White-tailed Prairie Dog	Disturbance of 481 acres, or 3.1%, of known prairie dog habitat in the project area.	Disturbance of 224 acres, or 1.4%, of known prairie dog habitat in the project area.	Disturbance of 982 acres, or 6.3%, of known prairie dog habitat in the project area.	Disturbance of 337 acres, or 2.2%, of known prairie dog habitat in the project area.	Disturbance of 176 acres, or 1.1%, of known prairie dog habitat in the project area.	Disturbance of 147 acres, or 0.9%, of known prairie dog habitat in the project area.
Big Free-tailed Bat	Disturbance of 156 acres (3.9%) of potential roosting habitat and 5,445 acres (4.2%) of potential foraging habitat.	Disturbance of 119 acres (3.0%) of potential roosting habitat and 3,958 acres (3.1%) of potential foraging habitat.	Disturbance of 163 acres (4.1%) of potential roosting habitat and 6,794 acres (5.3%) of potential foraging habitat.	Disturbance of 31 acres (0.8%) of potential roosting habitat and 1,541 acres (1.2%) of potential foraging habitat.	Disturbance of 46 acres (1.2%) of potential roosting habitat and 1,535 acres (1.2%) of potential foraging habitat.	Disturbance of 107 acres (2.7%) of potential roosting habitat and 2,366 acres (1.8%) of potential foraging habitat.
Spotted Bat	Disturbance of 156 acres (3.9%) of potential roosting habitat and 7,066 acres (3.7%) of potential foraging habitat.	Disturbance of 119 acres (3.0%) of potential roosting habitat and 5,302 acres (2.7%) of potential foraging habitat.	Disturbance of 163 acres (4.1%) of potential roosting habitat and 9,383 acres (4.9%) of potential foraging habitat.	Disturbance of 31 acres (0.8%) of potential roosting habitat and 1,933 acres (1.0%) of potential foraging habitat.	Disturbance of 46 acres (1.2%) of potential roosting habitat and 1,792 acres (0.9%) of potential foraging habitat.	Disturbance of 107 acres (2.7%) of potential roosting habitat and 3,468 acres (1.8%) of potential foraging habitat.
Burrowing Owl	Disturbance of 107 acres, or 7.0%, of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 481 acres.	No disturbance of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 224 acres.	Disturbance of 63 acres, or 4.1%, of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 982 acres.	Disturbance of 14 acres, or 0.9%, of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 337 acres.	Disturbance of 2 acres, or 0.1%, of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 176 acres.	Disturbance of 8 acres, or 0.5%, of nesting habitat within 0.5 mile of known nests in the project area. Impacts to potential nesting habitat (prairie dog habitat) would be 147 acres.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Ferruginous Hawk	Disturbance of 585 acres, or 4.2%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 5,958 acres, or 4.1%, of potential foraging habitat in the project area.	Disturbance of 515 acres, or 3.7%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 4,329 acres, or 3.0%, of potential foraging habitat in the project area.	Disturbance of 677 acres, or 4.9%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 7,534 acres, or 5.1%, of potential foraging habitat in the project area.	Disturbance of 172 acres, or 1.2%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 1,701 acres, or 1.2%, of potential foraging habitat in the project area.	Disturbance of 184 acres, or 1.3%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 1,679 acres, or 1.2%, of potential foraging habitat in the project area.	Disturbance of 258 acres, or 1.8%, of nesting habitat within 0.5 mile of known nests in the project area. Disturbance of 2,628 acres, or 1.8%, of potential foraging habitat in the project area.
Bald Eagle	Disturbance of 91 acres (2.2%) of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 325 miles of new roads.	Disturbance of 63 acres (1.5%) of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 274 miles of new roads.	Disturbance of 68 acres (1.6%) of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 526 miles of new roads.	Disturbance of 50 acres (1.2%) of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 72 miles of new roads.	Disturbance of 24 acres (0.6%) of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 106 miles of new roads.	No disturbance of winter roosting habitat within 0.5 mile of known winter roosts. Increased risk of vehicle strike along 198 miles of new roads.
Golden Eagle	Potential disturbance of 557 acres of nest buffer area.	Potential disturbance of 507 acres of nest buffer area.	Potential disturbance of 558 acres of nest buffer area.	Potential disturbance of 141 acres of nest buffer area.	Potential disturbance of 204 acres of nest buffer area.	Potential disturbance of 224 acres of nest buffer area.
Short-eared Owl	Disturbance of 5,958 acres, or 4.1%, of potential habitat in the project area.	Disturbance of 4,329 acres, or 3.0%, of potential habitat in the project area.	Disturbance of 7,534 acres, or 5.1%, of potential habitat in the project area.	Disturbance of 1,701 acres, or 1.2%, of potential habitat in the project area.	Disturbance of 1,679 acres, or 1.1%, of potential habitat in the project area.	Disturbance of 2,178 acres, or 1.8%, of potential habitat in the project area.
Lewis' Woodpecker	Disturbance of 1,174 acres, or 2.8% of potential habitat in the project area.	Disturbance of 996 acres, or 2.4% of potential habitat in the project area.	Disturbance of 1,740 acres, or 4.2% of potential habitat in the project area.	Disturbance of 287 acres, or 0.7% of potential habitat in the project area.	Disturbance of 134 acres, or 0.3% of potential habitat in the project area.	Disturbance of 706 acres, or 1.7% of potential habitat in the project area.
Colorado River Sensitive Fish (Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker)	Impacts would be the same as Colorado River Endangered Fish (above).	Impacts would be the same as Colorado River Endangered Fish (above).	Impacts would be the same as Colorado River Endangered Fish (above).	Impacts would be the same as Colorado River Endangered Fish (above).	Impacts would be the same as Colorado River Endangered Fish (above).	Impacts would be the same as Colorado River Endangered Fish (above).
Mountain Plover	Disturbance of 720 acres, or 3.2%, of potential breeding habitat in the project area.	Disturbance of 487 acres, or 2.2%, of potential breeding habitat in the project area.	Disturbance of 1,326 acres, or 5.8%, of potential breeding habitat in the project area.	Disturbance of 499 acres, or 2.2%, of potential breeding habitat in the project area.	Disturbance of 284 acres, or 1.2%, of potential breeding habitat in the project area.	Disturbance of 236 acres, or 1.0%, of potential breeding habitat in the project area.
Raptors	Surface disturbance of 1,745 acres, or 4.6% of nesting habitat (0.5-mile radius of nest sites) and 93 miles of new roads.	Surface disturbance of 1,348 acres, or 3.6% of nesting habitat (0.5-mile radius of nest sites) and 68 miles of new roads.	Surface disturbance of 1,711 acres, or 4.5% of nesting habitat (0.5-mile radius of nest sites) and 90 miles of new roads.	Surface disturbance of 417 acres, or 1.1% of nesting habitat (0.5-mile radius of nest sites) and 15 miles of new roads.	Surface disturbance of 489 acres, or 1.3% of nesting habitat (0.5-mile radius of nest sites) and 27 miles of new roads.	Surface disturbance of 779 acres, or 2.1%, of nesting habitat (0.5-mile radius of nest sites) and 44 miles of new roads.
Migratory Birds	Disturbance of 7,583 acres, or 3.7% of the total migratory bird habitat in the project area. Contribute to fragmentation of 77% of habitat.	Disturbance of 5,685 acres, or 2.8% of the total migratory bird habitat in the project area. Contribute to fragmentation of 74% of habitat.	Disturbance of 9,979 acres, or 4.8% of the total migratory bird habitat in the project area. Contribute to fragmentation of 94% of habitat.	Disturbance of 2,053 acres, or 1% of the total migratory bird habitat in the project area. Contribute to fragmentation of 66% of habitat.	Disturbance of 2,174 acres, or 1.1% of the total migratory bird habitat in the project area. Contribute to fragmentation of 68% of habitat.	Disturbance of 3,601 acres, or 1.7%, of the total migratory bird habitat in the project area. Contribute to fragmentation of 75% of habitat.
VEGETATION						
Vegetation	A total of 7,584 acres of vegetation would be disturbed or removed by activities proposed under the Proposed Action. Most of this impact (4,879 acres) would occur in scrub/shrub vegetation types.	Approximately 5,679 acres of vegetation would be disturbed under Alternative B, including 3,494 acres of scrub/shrub vegetation.	Approximately 9,977 acres of vegetation would be disturbed under Alternative C, including 6,224 acres of scrub/shrub vegetation.	Approximately 2,051 acres of vegetation would be disturbed under The No Action Alternative, including 1,428 acres of scrub/shrub vegetation.	Approximately 2,173 acres of vegetation would be disturbed under Alternative E, including 1,369 acres of scrub/shrub vegetation.	Approximately 3,601 acres of vegetation would be disturbed under Alternative F, including 2,165 acres of scrub/shrub vegetation.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Weeds	The 7,584 acres of disturbed vegetation would also be at increased risk of noxious weed invasion. An additional 15,757 acres (or 7% of the project area), would have an elevated risk of cheatgrass invasion, and approximately 1,812 acres (or 1% of the project area) would be susceptible to invasion by halogeton, Russian thistle, and other species. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.	Areas at risk of noxious weed invasion under Alternative B would include 5,679 acres of disturbed vegetation, 13,285 acres susceptible to cheatgrass, and 1,528 acres susceptible to other weeds. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.	Areas at risk of noxious weed invasion under Alternative C would include 9,977 acres of disturbed vegetation, 25,503 acres susceptible to cheatgrass, and 2,933 acres susceptible to other weeds. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.	Areas at risk of noxious weed invasion under The No Action Alternative would include 2,051 acres of disturbed vegetation, 3,491 acres susceptible to cheatgrass, and 401 acres susceptible to other weeds. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.	Areas at risk of noxious weed invasion under Alternative E would include 2,173 acres of disturbed vegetation, 5,139 acres susceptible to cheatgrass, and 591 acres susceptible to other weeds. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.	Areas at risk of noxious weed invasion under Alternative F would include 3,601 acres of disturbed vegetation, 10,466 acres susceptible to cheatgrass, and 1,114 acres susceptible to other weeds. Applicant-committed measures to inventory and treat all noxious weeds within and adjacent to areas disturbed by project activities would greatly reduce this risk.
Impacts from Roads (Dust and Fire Risk)	The Proposed Action would include 325 miles of new roadways within the project area. These would generate dust that would adversely affect vegetation, increase OHV impacts to vegetation, and increase access by firefighting equipment and personnel over its length. The Proposed Action would result in the disturbance and repeated use of approximately 7,584 acres, which would increase the risk of human-caused wildfire starts over this area.	Other impacts of roadways and disturbance would be the same as under the Proposed Action, but would occur on 274 miles of new roadways and 5,679 acres of surface disturbance.	Other impacts of roadways and disturbance would be the same as under the Proposed Action, but would occur on 526 miles of new roadways and 9,977 acres of surface disturbance.	Other impacts of roadways and disturbance would be the same as under the Proposed Action, but would occur on 72 miles of new roadways and 2,051 acres of surface disturbance.	Other impacts of roadways and disturbance would be the same as under the Proposed Action, but would occur on 106 miles of new roadways and 2,173 acres of surface disturbance.	Other impacts of roadways and disturbance would be the same as under the Proposed Action, but would occur on 198 miles of new roadways and 3,601 acres of surface disturbance.
VISUAL RESOURCES						
Visual Resource Management (VRM) Class	Adverse impacts to visual resources and scenic quality from equipment, facilities, surface disturbance, and infrastructure-related visual intrusions from 1,491 proposed wells. However, impacts in designated VRM Class II, III, and IV areas would be in compliance with VRM objectives except for some areas where valid and existing leases predate the current RMP.	Same impacts as the Proposed Action, except that 1,114 wells would be proposed for drilling.	Same impacts as the Proposed Action, except that 1,887 wells would be proposed for drilling.	Same impacts as the Proposed Action, except that under the No Action Alternative, 368 wells would be proposed for drilling in the project area.	Visual impacts the same as Alternative D because clustering of the proposed 1,114 wells would reduce surface disturbances and infrastructure impacts to be a degree similar to Alternative D. Compliance with VRM objectives would be the same as Alternative A.	Same as the Proposed Action, except that 1,298 wells would be proposed for drilling, and clustering of the wells on 598 well pads would reduce surface disturbances and infrastructure impacts. Compliance with VRM objectives would be the same as Alternative A.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Key Observation Points (KOPs)	Based on geographic information system (GIS) viewshed and contrast analyses: 2–4 wells and infrastructure would be visible from KOP 1 (on state-administered lands within the Green River corridor) with short-term adverse impacts from nearby sites in VRM Class II areas. Mitigation applied to VRM Class II sites would likely reduce impacts to meet VRM objectives. No impacts to visual resources from KOP 2 (Fourmile Bottom along VRM Class II Green River shoreline). No impacts to visual resources from KOP 3 (VRM Class III in Nine Mile Canyon). KOP 4 (Wild Horse Bench) would permit long distance, background views of well development visual contrasts in VRM Class II, III, and IV areas, but the long-distance views of impacts would be indistinct and in compliance with VRM objectives. There would be the potential for indirect impacts from well pad night-lighting. 3 wells and infrastructure would be visible from KOP 5 (Sand Wash Road). Mitigation would likely reduce impacts to meet VRM III objectives. Visual impacts to VRM III areas near KOP 6 (Wrinkle Road); mitigation would reduce impacts to meet VRM III objectives. Long-term adverse impacts (visible surface disturbance on well and infrastructure visibility) and short-term adverse impacts (nighttime lighting and vehicle presence and movement) to nearby sites in VRM Class II. Mitigation would likely not reduce impacts to meet VRM II objectives. Well and infrastructure visible from KOP 7 (Wrinkle Road and Devils Canyon). Mitigation would reduce impacts to meet VRM III objectives.	Same impacts as Alternative A, except 1–2 wells potentially visible on state lands from or near KOP 1 and mitigation would likely reduce impacts to meet VRM objectives on VRM Class II lands near KOP 6.	Similar impacts as Alternative A, except 1–3 proposed well pads on state lands would be visible from or near KOP 1, up to 5 well pads would be visible at KOP 5, and up to 6 well pads would be visible from KOP 6. Mitigation applied would likely not reduce impacts to meet class objectives in VRM II and VRM III lands in or near KOP 6 and KOP 7.	Same impacts as Alternative A, except 2–3 proposed well pads on state lands would be visible from or near KOP 1, and mitigation would likely reduce impacts to meet VRM objectives on VRM Class II lands near KOP 6	Same impacts as Alternative A, except no well pad would be visible on state lands near KOP 1.	Same impacts as Alternative A, except no well pad would be visible on state lands near KOP 1, and would not meet VRM II objectives at KOP 6 and KOP 7 if mitigation was not successful.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
WATER RESOURCES						
Consumptive use of groundwater	20,319 acre-feet of produced groundwater over the life of the plan resulting in a 0.07% decrease in water stored in Uinta Basin aquifers.	15,181 acre-feet of produced groundwater over the life of the plan resulting in a 0.05% decrease in water stored in Uinta Basin aquifers.	25,715 acre-feet of produced groundwater over the life of the plan resulting in a 0.087% decrease in water stored in Uinta Basin aquifers.	5,015 acre-feet of produced groundwater over the life of the plan resulting in a 0.02% decrease in water stored in Uinta Basin aquifers.	15,181 acre-feet of produced groundwater over the life of the plan resulting in a 0.05% decrease in water stored in Uinta Basin aquifers.	18,040 acre-feet of produced groundwater over the life of the plan resulting in a 0.06% decrease in water stored in Uinta Basin aquifers.
Consumptive use of surface water	Total withdrawals of 288 acre-feet; peak of 23.20 acre-feet annual withdrawal from the Green River system resulting in a 0.000006% decrease in Green River flow.	Total withdrawals of 215 acre-feet; same peak annual withdrawal as Alternative A.	Total withdrawals of 365 acre-feet; same peak annual withdrawal as Alternative A.	Total withdrawals of 71 acre-feet; Peak of 5 acre-feet annual withdrawal from the Green River system resulting in a 0.000001% decrease in Green River flow.	Total withdrawals of 215 acre-feet; same peak annual withdrawal as Alternative A.	Total withdrawals of 251 acre-feet; same peak annual withdrawal as Alternative A.
Sedimentation and turbidity	568 road crossings of ephemeral/ intermittent streams; 107,919 tons of sediment delivered to the Green River resulting in a 0.03% increase in sediment loading to the Green River. Includes: 19,331 tons to Lower Nine Mile Creek subbasin; 11,439 tons to Lower Pariette Draw subbasin; 11,005 tons to Upper Pariette Draw subbasin; and 66,174 tons to Sheep Wash-Green River subbasin.	440 road crossings of ephemeral/ intermittent streams; 106,359 tons of sediment delivered to the Green River resulting in a 0.03% increase in sediment loading to the Green River. Includes: 10,353 tons to Lower Nine Mile Creek subbasin; 9,629 tons to Lower Pariette Draw subbasin; 11,005 tons to Upper Pariette Draw subbasin; and 49,666 tons to Sheep Wash-Green River subbasin.	805 road crossings of ephemeral/ intermittent streams; 136,581 tons of sediment delivered to the Green River resulting in a 0.04% increase in sediment loading river. Includes: 22,516 tons to Lower Nine Mile Creek subbasin; 28,453 tons to Lower Pariette Draw subbasin; 15,928 tons to Upper Pariette Draw subbasin; and 69,721 tons to Sheep Wash-Green River subbasin.	153 road crossings of ephemeral/ intermittent streams; 26,636 tons of sediment delivered to the Green River resulting in a 0.01% increase in sediment loading to the Green River. Includes: 1,882 tons to Lower Nine Mile Creek subbasin; 6,299 tons to Lower Pariette Draw subbasin; 3,113 tons to Upper Pariette Draw subbasin; and 15,349 tons to Sheep Wash-Green River subbasin.	190 road crossings of ephemeral/intermittent streams; 27,276 tons of sediment delivered to the Green River resulting in a 0.01% increase in sediment loading to the Green River. Includes: 3,661 tons to Lower Nine Mile Creek subbasin; 3,578 tons to Lower Pariette Draw subbasin; 3,827 tons to Upper Pariette Draw subbasin; and 16,390 tons to Sheep Wash-Green River subbasin.	384 road crossings of ephemeral/ intermittent streams; 47,817 tons of sediment delivered to the Green River resulting in a 0.01% increase in sediment loading to the Green River. Includes: 11,981 tons to Lower Nine Mile Creek subbasin; 5,658 tons to Lower Pariette Draw subbasin; 6,656 tons to Upper Pariette Draw subbasin; and 23,546 tons to Sheep Wash-Green River subbasin.
Salinity and selenium	547 acres of disturbance in soils with excess salts.	294 acres of disturbance in soils with excess salts.	682 acres of disturbance in soils with excess salts.	134 acres of disturbance in soils with excess salts.	107 acres of disturbance in soils with excess salts.	146 acres of disturbance in soils with excess salts.
Spill risk	431 miles of new pipeline and 743 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 0.83 mile ♦ Pariette Draw: 1.47 miles ♦ Nine Mile Creek: 1.07 miles	393 miles of new pipeline and 600 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 0.8 mile ♦ Pariette Draw: 13.21 miles ♦ Nine Mile Creek: 0.16 mile	861 miles of new pipeline and 1,253 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 0.82 mile ♦ Pariette Draw: NA ♦ Nine Mile Creek: 0.14 mile	316 miles of new pipeline and 473 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 0.81 mile ♦ Pariette Draw: 3.04 miles ♦ Nine Mile Creek: 4.68 miles	216 miles of new pipeline and 347 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 0.80 mile ♦ Pariette Draw: 12.71 miles ♦ Nine Mile Creek: 2.90 miles	316 miles of new pipeline and 744 pipeline stream crossings. Closest pipeline stream crossings to: ♦ Green River: 1.1 mile ♦ Pariette Draw: 1.2 miles ♦ Nine Mile Creek: 0.6 mile
Direct disturbance to wetlands/riparian areas	11 acres of disturbance in wetlands and riparian areas (0.88% of total wetlands and riparian areas in the project area).	No acres of disturbance in wetlands and riparian areas.	4 acres of disturbance in wetlands and riparian areas (0.32% of total wetlands and riparian areas in the project area).	No acres of disturbance in wetlands and riparian areas.	No acres of disturbance in wetlands and riparian areas.	No acres of disturbance in wetlands and riparian areas.
Floodplain impacts[†]	223 acres of surface disturbance in 100-year floodplains. 48 wells sited in 100-year floodplains. 8.4 miles of road and pipeline in 100-year floodplains.	152 acres of surface disturbance in 100-year floodplains. 32 wells sited in 100-year floodplains. 6.3 miles of road and pipeline in 100-year floodplains.	238 acres of surface disturbance in 100-year floodplains. 42 wells sited in 100-year floodplains. 16.2 miles of road and pipeline in 100-year floodplains.	63 acres of surface disturbance in 100-year floodplains. 11 wells sited in 100-year floodplains. 4.4 miles of road and pipeline in 100-year floodplains.	65 acres of surface disturbance in 100-year floodplains. 10 wells sited in 100-year floodplains. 5.6 miles of road and pipeline in 100-year floodplains.	No acres of surface disturbance in 100-year floodplains. No wells sited in 100-year floodplains. No miles of road and pipeline in 100-year floodplains.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
WILDLIFE RESOURCES						
Mule Deer	7,582 acres of BLM-designated habitat disturbed, representing 4% of total BLM-designated habitat in the project area. 325 miles of new roads in BLM-designated habitat. 2,224 acres of Utah Division of Wildlife Resources (UDWR) habitat disturbed, representing 3% of total UDWR habitat in the project area. 111 miles of new roads in UDWR habitat.	5,685 acres of BLM-designated habitat disturbed, representing 3% of total BLM-designated habitat in the project area. 273 miles of new roads in BLM-designated habitat. 1,583 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 90 miles of new roads in UDWR habitat.	9,977 acres of BLM-designated habitat disturbed, representing 5% of total BLM-designated habitat in the project area. 537 miles of new roads in BLM-designated habitat. 3,168 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 203 miles of new roads in UDWR habitat.	2,054 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 71 miles of new roads in BLM-designated habitat. 476 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 19 miles of new roads in UDWR habitat.	2,173 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 106 miles of new roads in BLM-designated habitat. 597 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 33 miles of new roads in UDWR habitat.	3,600 acres of BLM-designated habitat disturbed, representing 2% of total BLM-designated habitat in the project area. 197 miles of new roads in BLM-designated habitat. 1,355 acres of UDWR habitat disturbed, representing 2% of total UDWR habitat in the project area. 80 miles of new roads in UDWR habitat.
Rocky Mountain Elk	7,582 acres of BLM-designated habitat disturbed, representing 4% of total BLM-designated habitat in the project area. 325 miles of new roads in BLM-designated habitat. 2,911 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 149 miles of new roads in UDWR habitat.	5,685 acres of BLM-designated habitat disturbed, representing 3% of total BLM-designated habitat in the project area. 275 miles of new roads in BLM-designated habitat. 2,292 acres of UDWR habitat disturbed, representing 2% of total UDWR habitat in the project area. 131 miles of new roads in UDWR habitat.	9,977 acres of BLM-designated habitat disturbed, representing 5% of total BLM-designated habitat in the project area. 536 miles of new roads in BLM-designated habitat. 4,861 acres of UDWR habitat disturbed, representing 4.4% of total UDWR habitat in the project area. 302 miles of new roads in UDWR habitat.	2,055 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 73 miles of new roads in BLM-designated habitat. 675 acres of UDWR habitat disturbed, representing 0.6% of total UDWR habitat in the project area. 27 miles of new roads in UDWR habitat.	2,173 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 106 miles of new roads in BLM-designated habitat. 951 acres of UDWR habitat disturbed, representing 1% of total UDWR habitat in the project area. 52 miles of new roads in UDWR habitat.	3,600 acres of BLM-designated habitat disturbed, representing 2% of total BLM-designated habitat in the project area. 197 miles of new roads in BLM-designated habitat. 1,846 acres of UDWR habitat disturbed, representing 2% of total UDWR habitat in the project area. 112 miles of new roads in UDWR habitat.
Pronghorn Antelope	7,580 acres of BLM-designated habitat disturbed, representing 4% of total BLM-designated habitat in the project area. 325 miles of new roads in BLM-designated habitat. 4,728 acres of UDWR habitat disturbed, representing 5% of total UDWR habitat in the project area. 184 miles of new roads in UDWR habitat.	5,681 acres of BLM-designated habitat disturbed, representing 3% of total BLM-designated habitat in the project area. 273 miles of new roads in BLM-designated habitat. 3,513 acres of UDWR habitat disturbed, representing 3.3% of total UDWR habitat in the project area. 153 miles of new roads in UDWR habitat.	9,925 acres of BLM-designated habitat disturbed, representing 5% of total BLM-designated habitat in the project area. 535 miles of new roads in BLM-designated habitat. 5,875 acres of UDWR habitat disturbed, representing 5.6% of total UDWR habitat in the project area. 285 miles of new roads in UDWR habitat.	2,055 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 72 miles of new roads in BLM-designated habitat. 1,472 acres of UDWR habitat disturbed, representing 1.4% of total UDWR habitat in the project area. 48 miles of new roads in UDWR habitat.	2,174 acres of BLM-designated habitat disturbed, representing 1% of total BLM-designated habitat in the project area. 106 miles of new roads in BLM-designated habitat. 1,346 acres of UDWR habitat disturbed, representing 1.3% of total UDWR habitat in the project area. 59 miles of new roads in UDWR habitat.	3,600 acres of BLM-designated habitat disturbed, representing 2% of total BLM-designated habitat in the project area. 197 miles of new roads in BLM-designated habitat. 1,901 acres of UDWR habitat disturbed, representing 2% of total UDWR habitat in the project area. 95 miles of new roads in UDWR habitat.
Rocky Mountain Bighorn Sheep	3,050 acres of BLM-designated habitat disturbed, representing 4% of total BLM-designated habitat in the project area. 162 miles of new roads in BLM-designated habitat. 1,170 acres of UDWR habitat disturbed, representing 3% of total UDWR habitat in the project area. 53 miles of new roads in UDWR habitat.	1,780 acres of BLM-designated habitat disturbed, representing 2% of total BLM-designated habitat in the project area. 101 miles of new roads in BLM-designated habitat. 688 acres of UDWR habitat disturbed, representing 1.8% of total UDWR habitat in the project area. 36 miles of new roads in UDWR habitat.	3,194 acres of BLM-designated habitat disturbed, representing 4% of total BLM-designated habitat in the project area. 219 miles of new roads in BLM-designated habitat. 1,570 acres of UDWR habitat disturbed, representing 4% of total UDWR habitat in the project area. 104 miles of new roads in UDWR habitat.	356 acres of BLM-designated habitat disturbed, representing 0.44% of total BLM-designated habitat in the project area. 17 miles of new roads in BLM-designated habitat. 216 acres of UDWR habitat disturbed, representing 0.6% of total UDWR habitat in the project area. 8 miles of new roads in UDWR habitat.	667 acres of BLM-designated habitat disturbed, representing ≤1% of total BLM-designated habitat in the project area. 36 miles of new roads in BLM-designated habitat. 242 acres of UDWR habitat disturbed, representing 0.6% of total UDWR habitat in the project area. 11 miles of new roads in UDWR habitat.	1,703 acres of BLM-designated habitat disturbed, representing 2% of total BLM-designated habitat in the project area. 101 miles of new roads in BLM-designated habitat. 571 acres of UDWR habitat disturbed, representing 1% of total UDWR habitat in the project area. 34 miles of new roads in UDWR habitat.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Mountain Lion (Cougar)	Assumed to be the same as for mule deer.	Assumed to be the same as for mule deer.	Assumed to be the same as for mule deer.	Assumed to be the same as for mule deer.	Assumed to be the same as for mule deer.	Assumed to be the same as for mule deer.
Upland Game	7,584 acres of habitat converted to well pads, roads, and evaporative facilities. 325 miles of new roads.	5,685 acres of habitat converted to well pads, roads, and evaporative facilities. 274 miles of new roads.	9,982 acres of habitat converted to well pads, roads, and evaporative facilities. 526 miles of new roads.	2,055 acres of habitat converted to well pads, roads, and evaporative facilities. 72 miles of new roads.	2,173 acres of habitat converted to well pads, roads, and evaporative facilities. 106 miles of new roads.	3,602 acres of habitat converted to well pads, roads, and evaporative facilities. 198 miles of new roads.
Reptiles, Amphibians, and Other Non-game Species	7,584 acres of habitat converted to well pads, roads, and evaporative facilities. 11 acres of disturbance in riparian areas (0.88% of total riparian area present) 325 miles of new roads.	5,685 acres of habitat converted to well pads, roads, and evaporative facilities. 0 acres of disturbance in riparian areas 274 miles of new roads.	9,982 acres of habitat converted to well pads, roads, and evaporative facilities. 4 acres of disturbance in riparian areas (0.32% of total riparian area present) 526 miles of new roads.	2,055 acres of habitat converted to well pads, roads, and evaporative facilities. No acres of disturbance in riparian areas. 72 miles of new roads.	2,173 acres of habitat converted to well pads, roads, and evaporative facilities. No acres of disturbance in riparian areas. 106 miles of new roads.	3.602 acres of habitat converted to well pads, roads, and evaporative facilities. 0 acres of disturbance in riparian areas. 198 miles of new roads.
Aquatic Species	Green River depletions, increased soil erosion and sedimentation (including associated salinity and selenium impacts), and an increased contamination risk would impact aquatic species. These impacts are addressed in the Water Resources and Special Status Species section.	Impacts would be the same as the Proposed Action but reduced given the smaller number of well pads, miles of pipelines, and miles of new roads Also see: Water Resources Special Status Species	Impacts would be the same as the Proposed Action but reduced given the smaller number of well pads, miles of pipelines, and miles of new roads Also see: Water Resources Special Status Species	Impacts would be the same as the Proposed Action but reduced given the smaller number of well pads, miles of pipelines, and miles of new roads Also see: Water Resources Special Status Species	Impacts would be the same as the Proposed Action but reduced given the smaller number of well pads, miles of pipelines, and miles of new roads Also see: Water Resources Special Status Species	Impacts would be the same as the Proposed Action but reduced given the smaller number of well pads, miles of pipelines, and miles of new roads. Also see: Water Resources Special Status Species
Effects of Evaporative Facilities on Wildlife	Approximately 143 acres of evaporative facilities would result in an increased risk of waterfowl entrapment, predation, and mortality or injury due to ingestion of toxic quantities of salts or gas production chemicals. However, impacts are expected to be minimal due to compliance with BLM Onshore Order #7.	Same impacts discussed under the Proposed Action, but would occur over 135 acres of evaporative facilities.	Same impacts discussed under the Proposed Action, but would occur over 271 acres of evaporative facilities.	Same impacts discussed under the Proposed Action, but would occur over 57 acres of evaporative facilities.	Same impacts discussed under the Proposed Action, but would occur over 135 acres of evaporative facilities.	Same impacts as the Proposed Action, but would occur over 78 acres of evaporative facilities.
Effects of Habitat Fragmentation on Wildlife	Roads associated with natural gas development fragment adjacent (undisturbed) habitat, thereby degrading its value to wildlife.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.	Same as the Proposed Action.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Mule Deer Habitat Fragmentation	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 87% (178,806 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 82% (65,312 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 84% (173,079 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 77% (62,011 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 97% (199,636 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 93% (75,393 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 76% (156,910 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 67% (53,829 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 80% (164,795 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 71% (57,208 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	71% (145,939 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 84% (174,372 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 62% (49,858 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 79% (64,148 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.
Elk Habitat Fragmentation	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 78% (161,570 acres) of habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 73% (81,078 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 75% (154,350 acres) of habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 71% (78,662 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 93% (192,880 acres) of habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 93% (104,076 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 66% (135,678 acres) of habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 57% (63,585 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 68% (141,413 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 62% (69,168 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.	60% (124,188 acres) of BLM-designated habitat is currently unsuitably fragmented due to existing roads. 75% (154,120 acres) of BLM-designated habitat would be unsuitably fragmented due to existing and proposed new roads in BLM-designated habitat. 53% (58,882 acres) of UDWR habitat is currently unsuitably fragmented due to existing roads. 70% (77,473 acres) of UDWR habitat would be unsuitably fragmented due to existing and proposed new roads in UDWR habitat.

Table 2-9. Summary of Impacts

Resource	Alternative A (Proposed Action)	Alternative B (Reduced)	Alternative C (Full)	Alternative D (No Action)	Alternative E (Directional)	Alternative F (Agency Preferred)
Bighorn Sheep Habitat Fragmentation	Under current conditions all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under the Proposed Action all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented as there would be no habitat patch sizes greater than 159 km^2.	Under current conditions all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under Alternative B, all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented since there would be no habitat patch sizes greater than 159 km^2.	Under current conditions all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under Alternative C all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented as there would be no habitat patch sizes greater than 159 km^2.	Under current conditions all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under the No Action Alternative all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented as there would be no habitat patch sizes greater than 159 km^2.	Under current conditions all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under Alternative E all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented since there would be no habitat patch sizes greater than 159 km^2.	Under current conditions, all BLM-designated and UDWR bighorn sheep habitat is unsuitably fragmented. Under Alternative F all BLM-designated and UDWR bighorn sheep habitat would continue to be unsuitably fragmented because there would be no habitat patch sizes greater than 159 km^2.
WILDERNESS CHARACTERISTICS						
Wilderness Characteristics	Drilling approximately 222 wells in the Desolation Canyon non-WSA lands with wilderness characteristics would result in surface disturbance that would degrade the natural characteristics of 1,183 acres of the non-WSA lands (3% of the non-WSA lands within the project area). Ongoing well drilling activities would diminish opportunities for solitude and primitive recreation in proximity to the operations during the life of the project. Approximately 6,405 acres of the non-WSA lands with wilderness characteristics (16% of the area) would be segmented into areas of less than 5,000 acres, resulting in the loss of remoteness, sense of solitude, and opportunities for primitive recreation in these areas during the life of the project.	No wells would be drilled in the Desolation Canyon non-WSA lands with wilderness characteristics. Development of access roads to wells on state lands and related infrastructure would result in surface disturbance that would degrade the natural characteristics of 22 acres of the non-WSA lands (0.05% of the non-WSA lands within the project area). Ongoing well drilling activities would diminish opportunities for solitude and primitive recreation in proximity to the operations during the life of the project. About 28 acres of the non-WSA lands with wilderness characteristics (0.07% of the area) would be segmented into areas of less than 5,000 acres, resulting in the loss of remoteness, sense of solitude, and opportunities for primitive recreation in these areas during the life of the project.	Same as the Proposed Action, except that approximately 214 wells would be drilled in Desolation Canyon non-WSA lands resulting in the loss of wilderness characteristics on 1,248 acres (3% of the area). Approximately 13,965 acres of the non-WSA lands with wilderness characteristics (35% of the non-WSA lands within the project area) would be segmented into areas of less than 5,000 acres, with impacts as described under the Proposed Action.	Same as the Proposed Action, except that approximately 20 wells would be drilled in Desolation Canyon non-WSA lands resulting in the loss of wilderness characteristics on 118 acres (0.3% of the area). Approximately 3,808 acres of the non-WSA lands with wilderness characteristics (10% of the non-WSA lands within the project area) would be segmented into areas of less than 5,000 acres, with impacts as described under the Proposed Action.	No wells would be constructed in the Desolation Canyon non-WSA lands with wilderness characteristics. However, there would be surface disturbance on approximately 21 acres of non-WSA lands (0.05% of the area) from construction of access routes and pipelines, with impacts to wilderness characteristics as described under the Proposed Action. Approximately 6 acres of the non-WSA lands with wilderness characteristics (0.02% of the non-WSA lands within the project area) would be segmented into areas of less than 5,000 acres, with impacts as described under the Proposed Action.	Same as the Proposed Action, except that approximately 215 wells would be drilled in Desolation Canyon non-WSA lands, resulting in the loss of wilderness characteristics on 608 acres (1.5% of the area). Approximately 9,466 acres of the non-WSA lands with wilderness characteristics (24% of the area) would be segmented into areas of less than 5,000 acres, with impacts as described under the Proposed Action.

*Determinations for all special status species can be found in Appendix F.

† Due to the programmatic nature of this document, exact locations of infrastructure are not known at this time. On-site review, at a later date, would determine if individual well pads would be allowed within the 100-year floodplain. This analysis would require that any proposed work comply with Executive Order 11988.