

4.0 Environmental Effects

Chapter 4.0 of this EA provides an analysis of the potential environmental impacts that could result from the implementation of the Proposed Action and the No Action alternatives. Narrative descriptions of potential impacts under these two alternatives are discussed for each environmental resource in Sections 4.1 through 4.17. An environmental impact is defined as a change in the quality or quantity of a given resource as a result of modification in the existing environment resulting from project-related activities. Beneficial or adverse impacts may be a primary result (direct) or secondary result (indirect) of an action, and may be permanent and long-term or temporary and short-term. This EA assumes that all applicant-committed measures described in Section 2.3 would be successfully implemented. Additional mitigation was recommended for environmental resources with impact concerns, based on guidance provided in Appendices 2 and 5-1 in the Green River Resource Management Plan (RMP) (BLM 1997) and Best Management Practices (BMPs) for developing fluid mineral resources (BLM 2013a,b, 2012c). Integration of BMPs also would occur at the APD process (BLM 2006b).

Section 4.2 of this chapter also discusses cumulative impacts to each resource. Cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative actions can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7). Where impacts are not fully mitigated or compensated, cumulative impacts can result. The boundaries of individual cumulative effects study areas (CESAs) for this EA are discussed separately for each resource in Chapter 4.0, Section 4.2.

Section 4.3 of this chapter provides a summary of protection measures for environmental resources that would be taken to avoid or minimize impacts. Implementation of applicant-committed measures would be part of the Proposed Action. Resource protection also would be provided by compliance with federal and state regulations, adherence to BLM policies and guidelines, and BMPs. Additional mitigation also is recommended for resources that warrant further reduction of impacts.

4.1 Direct and Indirect Effects

4.1.1 Geology, Geologic Hazards, and Minerals

4.1.1.1 Alternative I – No Action Alternative

Although development would continue as described for the No Action Alternative, no impacts to unique geologic features are expected. Geologic hazards present a low risk for No Action Alternative activities. Under the No Action Alternative, oil and natural gas wells would continue to be drilled and produced in accordance with the previously authorized Monell Unit EOR project. However, the No Action would result in reduced recovery of the fluid mineral resource, with the resulting indirect monetary losses to the applicant, royalty owners (primarily the federal government), the local economy, and tax revenues to governmental entities.

The No Action Alternative would have no impact on locatable minerals and relatively low level impacts to saleable mineral resources.

4.1.1.2 Alternative II – Proposed Action

Under the Proposed Action, no impacts to unique geological features are expected and there is low risk for geologic hazards. Under the Proposed Action, the additional production of oil and natural gas would be beneficial to the nation in that a resource that would otherwise be lost would be recovered plus the additional taxes, royalties and other economic benefits. However, the production of oil and natural gas

would be an irretrievable commitment of resources. The Proposed Action would not interfere with the development and extraction of other mineral resources given the lack of documented mineral resources in the project area. The Proposed Action is located east of the Known Coal Recoverable Coal Resource Area (BLM 1997). Coal bed methane may be prospective within the Monell and Arch units, but potential future development of coal bed methane resources would not be precluded by the Proposed Action.

The Proposed Action Alternative would have no impact on locatable minerals and relatively low level impacts to saleable mineral resources.

4.1.2 Paleontological Resources

4.1.2.1 Alternative I – No Action Alternative

The Wasatch and Green River formations that underlie the project area have the potential to yield fossils of important scientific significance value in the project area. If ongoing oil and gas activities occur in undisturbed areas, direct impacts could occur to paleontological resources, if surface disturbance associated with the No Action results in exposure and destruction of important fossil resources, along with associated loss of geologic information. Indirect adverse impacts to paleontological resources may occur as the result of ongoing geological investigations and disturbance through unauthorized collecting of accessible outcrops.

4.1.2.2 Alternative II – Proposed Action

Direct and indirect impacts could occur in the same manner as described for No Action impacts where proposed development would take place in previously undisturbed areas. Potential indirect impacts could result from increased accessibility to fossil localities from improved access. Early Tertiary age sedimentary deposits represented by the Wasatch and Fort Union formations underlie the project area. Both of these formations have produced vertebrate fossils of scientific significance either directly in the project area or surrounding area.

In accordance with BLM's procedures for surface-disturbing actions in formations with a high potential for paleontological resources, highly sensitive areas would be monitored during construction by a qualified paleontologist with a permit issued by the Wyoming State Office of the BLM. Should fossil materials of known or suspected scientific significance be encountered during excavation on the access roads, drill pads, or associated mud pits, the operator would stop work immediately in the vicinity of the discovery and the BLM Authorized Officer would be contacted. Activities would be redirected until the BLM Authorized Officer can assess the situation and advise on mitigation measure requirements before surface disturbing operations can continue. Construction personnel would be advised that removal and/or destruction of vertebrate fossils is illegal and that they and their company could face charges if they knowingly destroy or remove these fossils.

4.1.3 Soils

4.1.3.1 Alternative I – No Action Alternative

Under the No Action Alternative, the BLM would deny APC's proposal for development and would assume continuation of the present course of action and previously approved rate of development in the Monell Unit. Management of fluid mineral development would continue to be governed by current BLM policy and procedures with APDs approved on a case-by-case basis. Under this alternative, the existing currently authorized wells would continue to operate and impacts associated with operation and maintenance would continue. Approximately 1,450 acres of soil are currently disturbed for fluid mineral operations. Soil quality, productivity, and erosion rates associated with operation and maintenance would remain essentially static. There would be no new development in the Arch Unit. Current activities in the Arch Unit consist of vehicle traffic along CR-24 and CR-26. Some minor soil disturbance would occur in areas adjacent to the road due to road maintenance.

Under the No Action Alternative, APC would continue to construct and decommission wells as they have in the past. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells. Soils would be graded, compacted, and graveled, thereby reducing soil quality and productivity to these areas.

4.1.3.2 Alternative II – Proposed Action

APC proposes to minimize surface disturbance by utilizing existing well pads and co-locating new wells with existing wells or by establishing multi-well pads to the greatest extent possible. In the Monell Unit, all new wells would be located on existing pads, making use of existing access roads and other facilities in the unit. Because there is little existing development in the Arch Unit, new well pads, roads, power lines, and pipelines would be needed, but wells would be co-located on the same pad for approximately half of the proposed new wells. In the Arch Unit, most new pipelines would not be located in the same ROW as the new roads. The actual amount of new surface disturbance would depend on the terrain and whether nearby existing facilities can be utilized. APC would be required to comply with all BLM COAs and RMP requirements, which would help reduce impacts to soil resources. In addition, during the APD process, the High Desert District Instruction Memorandum (I.M.) No. WYD-2012-005 and BLM Wyoming Reclamation Policy I.M. No. WY-2012-032 requires a site-specific, project reclamation plan for all energy-related surface-disturbing activities.

Approximately 238 acres of soils would be impacted to varying degrees, as a result of proposed road construction and upgrading, construction and operation of well pads, pipelines, utility lines, and ancillary facilities. As described in Section 2.2, the power lines and associated utilities would be placed within existing ROWs or within new and existing roadways. Where surface disturbance is kept within existing roadways, additional impacts would be low. Some soil mixing of surface soils with unsuitable subsurface soils could occur. Impacts anticipated to occur on up to 5.5 miles of new road construction include soil rutting and mixing, compaction, increased erosion potential, and loss of soil productivity.

Much of the disturbance in the Monell Unit would occur on soils that have been previously disturbed by oil and gas activities. Much of the disturbance within the Arch unit will be new surface disturbance to soil resources. The majority of soils within the Monell Unit are shallow to bedrock, wind erodible and droughty. The highest majority of soils in the Arch Unit are moderately wind erodible.

Rutting may result if construction occurs on moist or saturated soils and causing soil mixing of topsoil and subsoil, thereby reducing soil productivity. Rutting also disrupts natural surface water hydrology by diverting and concentrating water flows creating accelerated erosion. Soil mixing typically results in a decrease in soil fertility and a disruption of soil structure. Compaction leads to a loss of soil structure; decreased infiltration, permeability, and soil aeration; as well as increased runoff and erosion. Increased erosion can lead to a decrease in soil fertility and an increase in sedimentation. The duration and intensity of these impacts would vary according to the type of construction activity to be completed and the inherent characteristics of the soils to be impacted. The duration and intensity of the impacts also would be determined, in part, by the site maintenance and reclamation activities.

The most notable impacts to soils would occur in association with the construction of new well pads. **Figure 2-1** displays the conceptual well pad locations. Proposed well locations may change during the APD process. Grading and leveling would be required to construct or expand existing well pads with the greatest level of effort required on more steeply sloping areas. During construction, the soil profiles would be mixed with a corresponding loss of soil structure. Soils would be compacted as a result of the construction of well and associated facilities with compaction maintained, at least in part, by continued vehicle and foot traffic as well as operational activities. The potential for erosion would increase through the loss of vegetation cover and soil structure as compared to an undisturbed state. Soil productivity would decrease, in like manner, primarily as a result of profile mixing and compaction along with the loss in vegetative cover. A decrease in soil productivity also would occur in association with planned soil salvage and stockpiling activities as microbial action is curtailed, at least to some degree, in the constructed long-term stockpiles. These impacts would begin immediately as the soils are subjected to

grading and construction activities and continue for the term of operations. The impacts on soils would move to a steady state as construction activities are completed and well production/maintenance operations begin. Soil productivity would slowly recover in locations where interim and final reclamation are successful.

The same categories of impacts to soils occur as a result of road construction and upgrading, but to a somewhat lesser degree of intensity. Indirect effects may include generation of side cast materials (sediment) and disruption and interception of subsurface flow of water that could alter soil moisture regimes upslope and down slope from the road. Where the topography is relatively flat and grading occurs, it would be limited to the upper subsurface soil horizons. As a result, subsurface soils would not be subject to profile mixing. Where cut and fill slopes occur, the soil profiles would be mixed with a corresponding loss of soil structure. Soil compaction would impact the upper profile subsoils immediately beneath the road surface but also would impact subsurface soils at a greater depth if fine textured soils are present. Soil compaction would result in a corresponding loss of infiltration, permeability, and soil aeration. Runoff and soil erosion may increase as a result of compaction. Where road surfacing is applied this impact would be reduced. These impacts, along with a loss in soil productivity, would occur for the duration of the project and until successful reclamation is achieved.

During construction activities, biological soil crusts may be disturbed by the Proposed Action. Biological soil crusts are very sensitive to any sort of surface disturbing activities. All biological soil crusts receive the same level of protection and are considered to be a valuable resource. The BLM mandates that a minimum of 6 inches of topsoil or suitable subsoil be salvaged from all areas that would be disturbed which would include salvage of lichen spores and cyanobacteria. It is unlikely that construction activities would be located on contiguous areas of biological soil crusts therefore, recolonization of disturbed areas could occur from adjacent, less-disturbed areas.

The type, intensity, and duration of the impacts associated with the installation of utility lines (electric, water, and pipeline) would be variable. Profile mixing and soil structure disruption would occur with trenching and backfilling. Erosion potential would increase while soils are loose with no protective cover. The linear nature of the disturbance, coupled with the presence of adjacent vegetation as described above, would serve to decrease wind and water erosion potential. Impacts to soil productivity are similarly limited corresponding to the limited time between disturbance and salvaged soil reapplication/revegetation.

Environmental protection measures, as listed in the Section 2.3, would help to reduce the impacts to soils and maintain soil productivity potential to the degree possible. During construction, APC has committed to reclaim all disturbed areas not needed for production to reduce site impacts. These actions would reduce the intensity of the impacts to soils as well as the time it would take to return the disturbed soils to a stable and productive state.

4.1.4 Water Resources

4.1.4.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the BLM would deny APC's proposal for development and would assume the present rate of development in the Monell Unit would continue. There would be no new development in the Arch Unit if the proposal is denied.

Management of fluid mineral development would continue to be governed by current BLM policy and procedures with APDs approved on a case-by-case basis. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells. Resulting impacts to surface water and groundwater are detailed in that EA and would be low level, assuming compliance with BLM policies and guidelines for road construction, erosion and sediment control, and reclamation.

4.1.4.2 Alternative 2 – Proposed Action

Impacts to surface water may occur during construction due to erosion and sedimentation, and then decrease with reclamation and revegetation during the operation phase of the project. Reclamation would take years to complete depending on weather and other factors contributing to the success of revegetation. Impacts are generally expected from surface disturbance during construction of access roads and well pads, and would be most likely to occur during construction of stream crossings for access roads and at well pad locations nearest streams. Erosion effects also may occur as sediment enters ephemeral drainages which may subsequently be carried downstream during seasonal events to perennial drainages.

Because the project would largely utilize the road network currently present in the area, stream crossings due to new road construction would be minimized. Since the existing road crossing of Bitter Creek would be utilized, no new Bitter Creek road crossings would be constructed. Installation of culverts or other stream crossing methods across intermittent streams with streamflow at or shortly after the time of construction would result in increases of sediment available for transport by the water. Drainage crossings on new roads would be installed in accordance with standards in the BLM/USFS Gold Book (U.S. Department of the Interior and USDA 2007) and BLM Manual 9113. Installations could result in elevated levels of total suspended sediment (TSS) and increases in turbidity at and downstream from the stream crossing during periods of streamflow. TSS and turbidity levels would be expected to decrease within several days of streamflow after the completion of in stream construction activities. Although the turbidity levels would decrease, TSS and turbidity levels would be expected to remain higher than baseline conditions due to the additional new disturbance, higher vehicle traffic, and removal of stabilizing vegetation.

There is a potential need for a production flowline to cross Bitter Creek. The crossing would be constructed by boring, which would avoid direct disturbance to the channel. Some localized soil disturbance would occur at the bore locations. APC would utilize erosion control measures at the bore locations to avoid sediment input to Bitter Creek.

Areas of disturbance adjacent to and directly upslope of intermittent streams, including access roads and well pads during operation, could contribute to impacts of surface water through increased rates of erosion that contribute sediment to the streams during storm runoff events. The BMPs contained in the SWPPP would be utilized during construction and reclamation to minimize these impacts. Specific areas of potential upland and streambank or channel erosion would be identified during the detailed design phase so site-specific protection measures can be designed and implemented. **Table 4-1** indicates the calculated disturbance from a conceptual project development footprint for both initial, temporary construction disturbance and for long-term, operational disturbance as compared to the existing amount of disturbance in the project area. The project would increase long-term disturbance in the project area from 7.7 percent to approximately 8.2 percent when including the Proposed Action disturbance.

Protective measures would be implemented in compliance with state and federal regulations, including preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan, to minimize potential leaks and require rapid clean up in the event of a spill before reaching waterbodies or drainageways. Any adverse impacts from leaks or spills would be dependent on the size and location of the spill in relation to nearby waterbodies and the absence or presence of streamflow at that time.

In addition the increase in traffic in the area as a result of construction and operation also will contribute to erosion. Erosion from roads would continue throughout the project. Water for well drilling, dust abatement, and other construction uses might temporarily impact groundwater levels through depletion during water withdrawals. Potential leaks or spills of petroleum products or other hazardous materials from construction and operation equipment and vehicles might impact surface water or groundwater.

Table 4-1 Initial and Long-term Surface Disturbance in Project Area by Subwatershed

Subwatershed	Project Area	Existing Disturbance		Initial Disturbance ¹		Long-term Disturbance ²	
	acres	acres	%	acres	%	acres	%
Table Rock - Bitter Creek	783	53	6.7	4	0.5	2	0.3
Lower Patrick Draw	8,918	793	8.9	61	0.7	40	0.4
Upper Patrick Draw	12,163	866	7.1	160	1.3	74	0.6
Town of Bitter Creek - Bitter Creek	575	33	5.7	0	0	0	0
Lower Salt Sage Draw	218	2	1.1	0	0	0	0
Total	22,657	1,747	7.7	225	1.0	117	0.5

¹ Acres and percent listed reflect project disturbance during construction, and do not include existing disturbance.

² Acres and percent listed reflect project disturbance after reclamation, and do not include existing disturbance.

Groundwater levels may be drawn down from production wells or may rise from injection wells, and injected water may alter groundwater quality. Water used for well construction would be obtained from onsite water-supply wells or other sources of water.

Water needs for project development would be obtained from groundwater sources and would be disposed of according to applicable federal, state, and local regulations. The deep aquifer targeted for extraction by the production wells is the Mesaverde aquifer, which contains Class IV water and may display some drawdown during extraction. The only uses of the groundwater in the project area at the depths of the new well development and water reinjection are industrial for oil and gas production; therefore no impacts to shallower stock wells from drawdown are expected.

Injection of produced water, which must occur in authorized Class II disposal wells approved through the State of Wyoming's Underground Injection Control (UIC) Program, may raise water levels in the targeted zones near the injection wells. The aquifer targeted for injection disposal is the Fox Hills, which is used for industrial, miscellaneous, or monitoring purposes. The aquifer targeted for reinjection is the Mesaverde (Almond Formation), which also is only used in the area for industrial use of oil and gas production. Wyoming's UIC Program requires a standard laboratory analysis of disposal water and the receiving formation water be conducted (WOGCC 2010), which would provide baseline information. Therefore, no impacts to shallower domestic or stock wells or other permitted wells from increased water levels are expected.

Because the Fox Hills aquifer and the deeper Mesaverde aquifer targeted by the project for both extraction and injection contain Class IV groundwater (see page 3-16 for definition) that is only suitable for industrial purposes, the injection of produced water is not expected to have an effect on the water quality of the receiving aquifer. These aquifers are separated from shallower aquifers by the Lance Formation and Lewis Shale, respectively, which prohibits upward migration and confine the deeper aquifers. No impacts to shallower aquifers are expected.

Water used by the project for well construction and development operations would come from existing water supply wells in the project area, and may be supplemented by an outside source if needed. A water quality analysis of all sources of water must be submitted for review by the WOGCC. It is estimated that a total of approximately 96.3 acre-feet (0.8 acre-foot per well) of water would be used for well drilling and development activities and dust control over the 9-year period of project development.

Table 4-2 estimates the annual usage of groundwater for well drilling operations.

Table 4-2 Annual Water Needs for Well Drilling, Development, and Dust Control

Year	Estimated Water Use	
	Barrels	Acre-feet
2013	84,000	10.78
2014	84,000	10.78
2015	84,000	10.78
2016	84,000	10.78
2017	84,000	10.78
2018	84,000	10.78
2019	84,000	10.78
2020	84,000	10.78
2021	78,000	10.01
Total	750,000	96.25

In summary, construction impacts to surface water resources would occur primarily at or near intermittent stream crossings by access roads, pipelines, and the buried power lines. The crossings would introduce sediment to the streams due to runoff-induced erosion of initial disturbance areas. This impact would dissipate downstream of the pipeline crossing and would begin decreasing within several days of the completion of construction activities. Once reclamation occurs, increased sediment delivery is expected to be relatively low, returning to near pre-disturbance amounts for all reclaimed areas.

Potential impacts to surface water in Bitter Creek from surface disturbance and to groundwater resources from injection of produced water would be mitigated by the following measures.

WR-1: Potential water quality and channel alteration impacts to streams would be avoided by implementing a 500-foot buffer distance from the edge of wetland/riparian areas and perennial streams. Surface disturbance could be allowed within this buffer with adequate measures to ensure that no runoff from disturbed areas entered the streams or wetland/riparian areas were not affected. Additional mitigation measures may be determined during the APD onsite process.

WR-2: Fuel or other chemicals would not be stored within 500 feet of Bitter Creek or other riparian areas and 100 feet from the edge of the inner gorge of intermittent or large ephemeral drainages. Exceptions would be considered on a case-by-case basis.

WR-3: Anadarko would coordinate and discuss with the BLM and WDEQ the baseline groundwater sampling required by the WOGCC and determine if any additional sampling is necessary prior to project development. Guidance would be provided by the *Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development* (McMahon et al. 2007). Copies of the findings should be provided to all appropriate agencies including the BLM and WDEQ.

In compliance with state and federal regulations and BLM policies, impacts to surface water would be minimized by implementation of the required environmental protection measures, applicant-committed measures listed in Section 2.3, and mitigation measures WR-1 and WR-2. Potential impacts to shallow groundwater quality due to leaks or spills of petroleum products or other hazardous materials used

during construction or operations into or near any streams, waterbodies, or other recharge areas would be minimized and mitigated by BMPs required for spill prevention and response plans.

4.1.5 Vegetation and Noxious Weeds

The primary issues associated with vegetation resources include the long-term removal of vegetation communities direct or indirect impacts to riparian/wetland habitats, and impacts associated with the introduction or spread of noxious weeds and invasive species.

4.1.5.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to lands and realty beyond the currently authorized activities. Currently, approximately 1,450 acres within the Monell Unit are disturbed for fluid mineral facilities and well pads. Within the Arch Unit, 297 total acres are disturbed from fluid mineral facilities and well pads. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells. There would be changes to vegetation as the additional 31 wells are developed for fluid mineral extraction.

4.1.5.2 Alternative II – Proposed Action

Potential impacts to vegetation resources as a result of project implementation would result in initial and long-term effects. Initial direct impacts would consist of temporary vegetation removal (i.e., vegetation and soil compaction and removal) associated with the construction and expansion of well pads, ancillary facilities, roads, and pipelines. Long-term direct impacts would consist of vegetation loss associated with operation and maintenance activities of aboveground facility footprints and roads. The extent of both initial and long-term impacts would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activities, and physical parameters (e.g., topography, cover, and forage). **Table 4-3** summarizes maximum initial and long-term acreage impacts to each vegetation cover type within the project area. APC proposes to minimize surface disturbance by co-locating new wells with existing wells or establishing multi-well pads to the greatest extent possible. In the Monell Unit, all new wells would be located on existing pads, making use of existing access roads and other facilities in the unit. In the Arch Unit, new well pads, roads, power lines, and pipelines would be needed, but wells would be co-located in the same pad for approximately half of the proposed new wells. When existing pads are used, pads would be enlarged where new wells are drilled to allow room for drill rigs, wellheads, and other equipment, as needed.

Potential indirect impacts to vegetation could include loss as a result of accidental spills of oil and lubricants, fugitive dust emissions, fragmentation of vegetative communities, and the introduction or spread of noxious weeds and invasive species (see Noxious Weed discussion below). In compliance with established regulations and policies to minimize the potential impacts from spills, site-specific SPCC Plan would be developed during the APD process.

Fugitive dust emissions would increase from the increased traffic on existing dirt roads associated with construction and operation activities resulting in an increase in the amount of dust deposited on the leaves of plants located along roadways. Fugitive dust accumulation on plants has been shown to adversely affect a variety of plant functions (USEPA 2008; USFWS 2008). Dust control measures would be implemented to minimize adverse impacts to vegetation from dust. Fragmentation of vegetative communities would result from the development of a network of access roads, utilities, and well pads, which could adversely impact native vegetative communities and native plant species. Impacts from fragmentation would include the loss of suitable habitat, more exposure to disturbances, and increased competition.

Table 4-3 Summary of Initial and Long-term Impacts per Vegetation Cover Type within the Project Area

Vegetation Cover Type	Monell Unit		Arch Unit	
	Initial Impacts (acres)	Long-term Impacts (acres)	Initial Impacts (acres)	Long-term Impacts (acres)
Desert Shrubland	39	26	63	26
Developed	0	0	<1	0
Dune	<1	<1	12	6
Grassland	0	0	1	1
Sagebrush Shrubland	36	24	75	30
Wetland/riparian ¹	3	2	9	3
TOTAL²	78	52	160	66

¹ Wetland and riparian acres are based on NW ReGAP (USGS 2004). Field surveys conducted as part of the 2006 Monell Enhanced Oil Recovery Project EA (BLM 2006a) found surface drainage features to predominantly consist of intermittent riverine systems and wetlands were present only along Bitter Creek.

² Discrepancies in totals due to rounding.

Source: USGS 2004.

Areas temporarily disturbed by construction would be reclaimed once construction is complete. Areas to be reclaimed would be graded and seeded to BLM standards. As part of the APD process, a reclamation plan with a designated reclamation seed mix would be prepared. Interim and final reclamation of surface disturbance areas would be completed in compliance with BLM policy. Vegetation cover types would recover at varying rates, herbaceous-dominated plant communities (i.e., grassland, barren, dune, and wetland/riparian cover types) would require a minimum of 5 years to establish adequate ground cover to minimize erosion and provide forage for wildlife species and livestock. Woody-dominated plant communities (i.e., shrubland cover type) would require approximately 20 or more years for shrubs of similar stature to reestablish in the area. Reclamation efforts may take longer in some areas due to poor soil conditions (see Section 4.2, Soils, for further discussion of low reclamation areas).

Noxious Weeds and Invasive Species

The prevention of the spread of noxious weeds and invasive plant species is a high priority throughout Wyoming. Following surface-disturbing activities, noxious weeds and invasive species may readily colonize areas that typically lack or have minimal vegetation cover. It is anticipated that populations of weedy annual species (e.g., halogeton, cheatgrass) may become established in localized areas for extended periods of time. Surface disturbance and increased vehicle travel along new routes may readily spread noxious weeds and invasive plant species and colonize areas that have minimal vegetation cover or areas that have been recently disturbed. Noxious weed species can degrade and modify native communities, reduce resources for native species, and adversely affect native pollinators.

Unwashed construction equipment or vehicles transporting noxious weeds in soil or plant materials into previously uninfested areas, off-road driving, and improper maintenance of temporary construction areas could result in the introduction or spread of noxious weeds and invasive species. In addition, the linear nature of the road and pipeline disturbances could increase the spread of noxious weeds and invasive species into adjacent native plant communities. Noxious weeds and invasive species generally are fast-growing and could displace native species and inhibit the reestablishment of native grass, forb, and shrub species within the disturbed areas.

To control the spread of noxious weeds and invasive species within the project area, control measures would be implemented in accordance with existing regulations, jurisdictional land management agency requirements, and landowner agreements.

The development and implementation of a site-specific reclamation plan including a site-specific Noxious Weed Management Plan (as required by the Wyoming Reclamation Policy) developed during the APD process would minimize the potential for the establishment of noxious weeds and invasive species.

Substantial increases in weed prevalence are not anticipated; however, despite efforts to prevent the proliferation of noxious weeds, it is possible that construction, operation, and maintenance activities would result in the spread or introduction of noxious weeds and invasive species within the project area or that weed species would be transported into areas that were relatively weed-free. Implementation of post-construction monitoring in consultation with the BLM would further minimize and mitigate the impacts associated with the introduction and/or spread of noxious weeds and invasive species.

4.1.6 Wetland and Riparian Resources

The primary impacts associated with wetland and riparian resources would include initial and long-term removal of these two types of vegetation.

4.1.6.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to lands and realty beyond the currently authorized activities. Currently, approximately 1,450 acres within the Monell Unit are disturbed for fluid mineral facilities and well pads. Within the Arch Unit, 297 total acres are disturbed from fluid mineral facilities and well pads. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells. There would be potential impacts to wetland and riparian resources as the additional 31 wells are developed for fluid mineral extraction.

4.1.6.2 Alternative II – Proposed Action

Potential impacts to wetland and riparian resources as a result of project implementation can be classified as initial or long term. BLM mitigation guidelines require special mitigation measures within 500 feet of riparian areas. Within the Monell Unit, wetlands are only located along Bitter Creek. If construction occurs within a wetland, initial direct impacts would consist of temporary vegetation removal (i.e., vegetation and soil compaction and partial removal of aboveground plant cover) associated with the construction of well pads, ancillary facilities, and road and pipeline construction. Long-term direct impacts would consist of vegetation loss associated with operation and maintenance activities of aboveground facilities and roads. The extent of both initial and long-term impacts would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of the project activities, physical parameters (e.g., topography, cover, and forage), and mitigation developed during the APD process. **Table 4-4** summarizes the maximum acreage of potential impacts to wetland and riparian resources within the project area.

Mitigation measure WR-1 and WR-2 (Section 4.1.4.2, Water Resources) would minimize impacts to wetlands and riparian areas.

With the implementation of WR-1, no initial or long-term surface disturbance areas would be located within a riparian area or wetland, therefore, no long-term impacts to riparian areas and wetlands are anticipated.

Table 4-4 Summary of Initial and Long-term Impacts to Wetland and Riparian Resources within the Project Area

Wetland Type	Monell Unit		Arch Unit	
	Initial Impacts (acres)	Long-term Impacts (acres)	Initial Impacts (acres)	Long-term Impacts (acres)
Freshwater Pond	0.1	0.1	0.3	0.2
Other ¹	0.7	0.7	2.0	0.5
TOTAL	0.8	0.8	2.3	0.7

Source: USGS 2004.

4.1.7 Wildlife and Aquatic Resources

The primary issues related to wildlife species include the loss or alteration of native habitats, increased habitat fragmentation or disruption, animal displacement, and direct loss of wildlife.

4.1.7.1 Alternative I – No Action Alternative

Under the No Action Alternative, the BLM would deny APC's proposal for development and would continue the present rate of development in the Monell Unit. Management of fluid mineral development would continue to be governed by current BLM policy and procedures with APDs approved on a case-by-case basis. There would be no new development in the Arch Unit, if the proposal is denied. Impacts to wildlife habitat under the No Action Alternative would mainly result from traffic and noise along Patrick Draw Road as vehicles access the Patrick Draw Gas Plant and the Monell Unit, as well as I-80. There would be no new disturbance in the Arch Unit on wildlife habitat. Previously approved well development would continue in the Monell Unit, as APC completes 31 wells over the next few years. Wildlife impacts from the completion of these wells were discussed in the Monell EA (BLM 2006a).

4.1.7.2 Alternative II – Proposed Action

Potential impacts to wildlife species from the project can be classified as short-term and long-term duration. Short-term impacts consist of temporary habitat removal and activities associated with construction prior to reclamation, and long-term impacts consist of changes to wildlife habitats associated with operation (e.g., graveled roads and pads, buildings, vehicle traffic, etc.). The extent of both short-term and long-term impacts would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of the project activities, and physical parameters (e.g., topography, cover, forage).

The project would result in both direct and indirect impacts to wildlife species. Direct and indirect impacts include wildlife mortalities or displacement related to construction and operation; habitat loss, alteration, and fragmentation; and increased levels of noise, activity, and human presence.

A total of seven habitat types, which correspond to the vegetation cover types described in Section 3.5, occur within the project area. Project construction would result in the disturbance of up to 238 acres (160 acres in the Arch Unit and 78 acres in the Monell Unit) of wildlife habitat over the 9-year period of project development, including 102 acres of desert shrubland, <1 acre identified as developed lands, 12 acres of dune, 1 acre of grassland, 111 acres of sagebrush shrubland, and 12 acres of riparian/wetland. This habitat disturbance would be reclaimed following completion of wellfield development activities (i.e., plugging and abandonment of wells).

Big Game Species

Impacts to big game species, primarily mule deer and pronghorn, include the short-term loss of potential forage and cover (native vegetation and previously disturbed vegetation) and an increase in habitat fragmentation within the project area. Due to the arid climate of southwestern Wyoming, the loss of available woody/shrubby vegetation would likely take 20 years or more to recover (WGFD 2009). However, herbaceous species may become established within 3 to 5 years, depending on reclamation success, weather conditions, and grazing management practices in the project area (WGFD 2009). In most instances, suitable habitat adjacent to disturbed areas would be available for big game species until grasses and woody vegetation were reestablished within the disturbance areas.

Additional impacts to big game species would result from increases in noise levels and human presence during construction and development activities. Studies have shown that big game species tend to move away from areas of human activity and roads, therefore, reducing habitat utilization near disturbance areas (Cole et al. 1997; Sawyer et al. 2009, 2006; Ward 1976). Mule deer and pronghorn appear to be more tolerant of human activity than elk. For mule deer, displacement distances ranged from 330 feet to 0.6 mile, depending on the presence of vegetative cover (Ward 1976). However, disturbance associated with construction activities would be short-term in duration, and it is assumed that animals would return to the area following the completion of project construction and drilling activities. This is especially true for pronghorn within the project area. As a result of the existing level of activity within the project area, most animals have been acclimated to the relatively low level of human activity associated with oil and gas operations.

To avoid direct impacts to big game species during sensitive periods in compliance with established regulations and policies, APC would be required to avoid surface use activities within crucial winter/yearlong range from November 15 to April 30. Based on this environmental protection measure, impacts to big game species would be minimal, limited primarily to displacement from areas of human activity and habitat alteration, as well as human presence from operation and maintenance activities from previously permitted actions. The impact conclusion also is based on the fact that the project area already has considerable development and human activity.

In addition to direct impacts to big game species, implementation of the project may result in indirect impacts to sensitive big game seasonal habitat (pronghorn crucial winter range). These impacts would include the loss of potential cover and forage consisting or primarily woody/shrubby vegetation such as sagebrush, bitterbrush, and winterfat. Loss of available forage (e.g., woody shrubs, such as sagebrush) may affect wintering big game species, particularly pronghorn. Project construction within the Arch unit would result in 160 acres of disturbance (including 66 acres of long-term disturbance) to pronghorn winter/yearlong range. Furthermore, the Monell Unit would have fewer acres of construction disturbance (78 acres of initial disturbance and 52 acres of long-term disturbance) to pronghorn winter/yearlong range because of the presence of existing infrastructure. Pronghorn winter/yearlong range is important to maintain pronghorn populations in Wyoming, especially during harsh winters. However, this disturbance acreage represents a relatively small percentage of the winter/yearlong range available in the project region.

Small Game Species

Direct and indirect impacts to small game species include potential wildlife mortalities or displacement related to construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. Project construction would result in the incremental loss of up to 238 acres of potential habitat, until reclamation has been completed and vegetation is reestablished. However, in most instances, suitable habitat adjacent to disturbed areas would be available for small game species until grasses and woody vegetation become reestablished within the disturbance areas.

Fragmentation impacts on some small game species have been shown to adversely impact populations. Small game, especially upland game birds, may experience increased mortality rates due to increased

vehicle traffic as a result of new and improved roads (Holbrook and Vaughan 1985). Vehicular traffic may injure or kill individuals, and local populations may experience higher levels of hunting and poaching pressure due to improved public access (Holbrook and Vaughan 1985). These temporary losses would reduce productivity for that breeding season. However, due to the large amount of suitable habitat in the surrounding project region, direct and indirect impacts to small game species are expected to be low.

Due to the lack of waterbodies within the project area, no impacts to waterfowl are anticipated from the proposed project.

Nongame Species

Direct and indirect impacts to nongame species include potential wildlife mortalities or displacement related to construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. Project construction would result in the incremental loss of up to 238 acres of potential habitat, until reclamation has been completed and vegetation is reestablished. Construction activities may result in mortalities of less mobile or burrowing nongame species (e.g., small mammals and reptiles) within the project surface disturbance area, as a result of potential crushing from construction vehicles and equipment.

Impacts also may include temporary displacement of more mobile species (medium sized mammals, adult birds) from the project area, due to the short-term loss of vegetation. The temporary displacement of some species would result until herbaceous vegetation returns to pre-construction conditions (approximately 3 to 5 years) (WGFD 2009). For those species dependent on the sagebrush-steppe habitat, displacement would occur until sagebrush shrubs become reestablished (greater than 20 years) (WGFD 2009).

A number of raptor species (golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, and burrowing owl) seasonally occupy the habitats within the project area. Impacts to raptor species can result from the loss or alteration of habitat, reduction in prey base, and increased human disturbance. The loss of native habitat to human development has resulted in declines of hawks and eagles throughout the West (Boeker and Ray 1971; Schmutz 1984). In some cases, habitat changes have not reduced numbers of raptors but have resulted in shifts in species composition (Harlow and Bloom 1987). Impacts to small mammal populations due to habitat loss and fragmentation can result in a reduced prey base for raptors, resulting in lower raptor densities. Thompson et al. (1982) and Woffinden and Murphy (1989) found that golden eagles and ferruginous hawks had lowered nesting success where native vegetation had been lost and was unable to support jackrabbit (prey) populations. Furthermore, raptors have a high potential of being disturbed from nests and roosts, thereby leading to displacement and reduced nesting success (Holmes et al. 1993; Postovit and Postovit 1987; Stalmaster and Newman 1978). Noise levels and human activity also can preclude otherwise acceptable raptor habitat from use.

In compliance with established regulations and policies to minimize the potential impact to nesting raptors and their habitat, raptor nest sites identified within the areas of disturbance would be avoided to prevent their removal. Because a number of variables (e.g., nest location, species' sensitivity, breeding, phenology, topographical shielding) determine the level of impact to a breeding pair, appropriate protection measures, such as seasonal constraints and establishment of No Surface Occupancy (NSO) buffer areas, would be implemented at active nest sites on a species-specific and site-specific basis, in coordination with the jurisdictional agencies (e.g., BLM, WGFD, or USFWS). As a result of these protection measures, construction-related impacts to raptor species are anticipated to be low and no damage to individuals is expected as a result of the proposed project.

Other avian species that may be impacted by construction activities and drilling operations include nesting passerines or songbirds that use the various habitats within the project area. According to the Wyoming Partners in Flight Bird Conservation Plan (Nicholoff 2003), the important dates for most breeding grassland bird species in Wyoming are May 15 to June 30. Direct and indirect impacts to other avian species, especially during the breeding season, include mortalities or displacement related to

construction and operation; habitat loss, alteration and fragmentation; and increased levels of noise, activity and human presence. However, the Monell Unit has been developed fairly extensively in recent years; therefore, levels of noise and human presence are currently at moderate to high levels. Nonetheless, project construction would result in the incremental loss or alteration of up to 216 acres of potential habitat. In addition to habitat loss, reductions in bird population densities in open grasslands and woodlands also may be attributed to a reduction in habitat quality due to elevated noise levels (Reijnen et al. 1997, 1995). Although increased visual stimuli in open landscapes may add to density effects at relatively short distances, the effects of noise appear to be the most critical factor because breeding birds of open grasslands (threshold noise range of 43 to 60 dBA) and woodlands (threshold noise range of 36 to 58 dBA) respond very similarly to disturbance from traffic (Reijnen et al. 1997). Reijnen et al. (1996) determined a threshold effect for bird species to be 47 dBA, while a New Mexico study in a pinyon-juniper community found that impacts of gas well compressor noise on bird populations were strongest in areas where noise levels were greater than 50 dBA. However, moderate noise levels (40 to 50 dBA) also showed some effect on bird densities in this study (LaGory et al. 2001). However, due to existing development activities in the field, the extent of suitable habitat adjacent to the disturbed areas, and the temporary nature of project construction, impacts to other avian species are expected to be relatively low. In addition, migratory bird nests would be identified prior to surface disturbing activities during the APD process and avoided.

Similar to the other nongame species, impacts to reptiles as a result of the project would include potential mortalities or displacement related to construction and operation and habitat loss, alteration, and fragmentation. Construction activities may result in direct mortalities as a result of crushing of burrows from vehicles and equipment. However, due to the extent of suitable habitat adjacent to the disturbed areas and the temporary nature of project construction, impacts to these species are expected to be relatively low. Traffic during project operation and management would result in a long-term risk to reptiles. However, the impact level is considered low due to reduced traffic levels as compared to construction.

Aquatic Resources

Impact issues evaluated for aquatic communities (i.e., fish, invertebrates, and amphibians) and sensitive fish species (flannelmouth sucker) included potential effects of project activities on water quality and quantity and habitat in the Bitter Creek drainage. The occurrence of nongame fish is limited to approximately a 3.3-mile perennial section of Bitter Creek within the project study area. The aquatic stages of amphibians could occur in Bitter Creek and playas or depressions that occasionally contain water. There would be no direct disturbance to instream habitat or adjacent riparian areas in Bitter Creek. Surface disturbance activities associated with construction of new roads, pipelines, and buried power lines in the Arch Unit could contribute sediment to the intermittent stream, Patrick Draw. Erosion control measures would be followed as part of the requirements under the APD process. Any sediment input to Patrick Draw and Bitter Creek would be considered to be of low magnitude. Sediment would be dispersed only during periods of water is flowing.

Vehicle traffic during construction could cause mortalities to amphibians during their occurrence in terrestrial habitats or movement to portions of Bitter Creek that contain water. Movements to wet portions of Bitter Creek likely would only occur in the Monell Unit.

Potential contaminant spills or leaks from well drilling are not expected to affect Bitter Creek. Wells would be located at least 350 feet from the Bitter Creek channel. Storage and containment measures would be used at the well pads to eliminate any chemicals entering the Bitter Creek drainage. In addition, refueling would not be allowed within 500 feet of Bitter Creek. Automatic shutoffs also would be used for the Bitter Creek fluid pipeline crossings to minimize spills or leaks.

Water use for drilling and completion activities, hydrostatic testing, and dust control would not affect flows in Bitter Creek, since water sources involve existing groundwater wells in the area. As discussed in Sections 3.4.2 and 4.4, Water Resources, water withdrawals would come from relatively deep aquifers,

which have no connectivity to surface flows in Bitter Creek. The impact discussion for the four federally fish species in the Upper Colorado River Basin is provided in Section 4.1.8.2.

Abandonment would involve leaving subsurface facilities such as injector lines and electrical line in place after the project is terminated; therefore, no new surface disturbance would affect aquatic biota and their habitat.

The following regulatory requirements or APD conditions would be used to minimize effects on aquatic communities and their habitat in Bitter Creek. In addition, mitigation measure WR-1 (Section 4.1.4, Water Resources) would require a 500-foot buffer near Bitter Creek.

- Erosion and potential contaminant input to Bitter Creek would be minimized by implementing erosion control measures in the SWPPP.
- Spill or hazardous material input to the Bitter Creek drainage would be minimized by implementing spill and containment measures contained in the SPCC Plan.
- Reclamation of all disturbed areas to minimize sediment input to Bitter Creek.

4.1.8 Special Status Species

This section focuses on the impact analyses of federally listed, federal candidate, and BLM sensitive wildlife species that were identified for the project by the BLM, USFWS, WGFD, and WYNDD. Special status wildlife species information presented in this section is based on available habitat and results of surveys conducted within and near the project area (AECOM 2012a; WYNDD 2012). This section also addresses special status plant species.

4.1.8.1 Alternative I – No Action Alternative

Under the No Action Alternative, the BLM would deny APC's proposal for development and would continue the present rate of development in the Monell Unit. Management of fluid mineral development would continue to be governed by current BLM policy and procedures with APDs approved on a case-by-case basis. There would be no new development in the Arch Unit if the proposal is denied. Impacts to wildlife habitat under the No Action Alternative would result from traffic and noise along Patrick Draw Road as vehicles access the Patrick Draw Gas Plant and the Monell Unit, as well as I-80. There would be no new disturbance in the Arch Unit on special status wildlife habitat. Previously approved well development would continue in the Monell Unit, as APC completes 31 wells over the next few years. Special status wildlife impacts from the completion of these wells were discussed in the Monell EA (BLM 2006a).

Potential impacts to special status plant species from surface disturbance-related activities may include the loss of individuals as a result of crushing or uprooting from construction vehicles and equipment. Because surface disturbance would be localized within a small geographic area, population-level impacts are not anticipated. Long-term direct impacts consist of suitable habitat loss associated with operation and maintenance activities of aboveground facility footprints and roads.

4.1.8.2 Alternative II – Proposed Action

Potential impacts to special status species from the project can be classified as short-term and long-term, as discussed for wildlife species. The project would result in both direct and indirect impacts to special status animal species. Direct and indirect impacts include mortalities or displacement related to construction and operation; habitat loss, alteration, and fragmentation; and increased levels of noise, activity, and human presence.

Potential impacts to special status plant species from surface disturbance-related activities may include the loss of individuals as a result of crushing or uprooting from construction vehicles and equipment. Because surface disturbance would be localized within a small geographic area, population-level

impacts are not anticipated. Long-term direct impacts consist of suitable habitat loss associated with operation and maintenance activities of aboveground facility footprints and roads.

Federally Listed and Candidate Wildlife Species

Black-footed Ferret (Federally Endangered)

Impacts to prairie dogs and their burrows may indirectly impact black-footed ferrets due to loss of habitat and prey. However, the proposed project would disturb approximately 114 acres of white-tailed prairie dog colonies within the Arch Unit of the project area and approximately an additional 10 acres in the Monell Unit (**Figure 3-5**). All prairie dog colonies in the State of Wyoming have received block clearance by the USFWS on March 6, 2013 (USFWS 2013). Field surveys were conducted in 2005 to document the extent of white-tailed prairie dog colonies within the portion of the Monell Unit that has not been block cleared at that time. Surveys also were conducted in September of 2012 in the Arch Unit of the project area. Based on the survey results and the lack of suitable white-tailed prairie dog colonies within the project area, it is unlikely that black-footed ferrets occur within the project area. Therefore, the proposed project would result in a "No Effect" determination for the black-footed ferret.

Greater Sage-grouse (Federal Candidate, BLM Sensitive)

There would be no disturbance of potentially suitable greater sage-grouse breeding habitat within either the Arch or Monell units. Although suitable greater sage-grouse habitat does exist within the project area, it would not be disturbed by construction; therefore, direct impacts to greater sage-grouse breeding habitat would be relatively low. Impacts to greater sage-grouse from the construction of power lines also would be minimized by burying the lines underground. Underground power lines remove perch points for predatory birds such as raptors and corvids and as a result, decreases hunting success on greater sage-grouse.

Impacts to greater sage-grouse habitat include increased fragmentation and disruption as a result of increased noise levels and human presence causing avoidance of habitat, potential dispersal of noxious weeds and invasive plant species, and dust from unpaved road traffic. Impacts also would include increased collision potential associated with power lines and vehicle traffic, as well as possible increased predation by raptors, corvids, and coyotes.

Greater sage-grouse studies show that development can negatively impact populations as a result of increased noise and human disturbance (Blomberg et al. 2012; Holloran 2005; Walker et al. 2007). Greater sage-grouse have been observed to abandon lek sites in areas with increased road development (Braun 1986; Holloran 2005; Walker et al. 2007). Greater sage-grouse hens that utilized nesting habitats further from roads had higher brood survivorship than those hens utilizing habitat near roads (Lyon and Anderson 2003). As described in Section 3.8, no greater sage-grouse leks occur within the project area, although 1,133 acres of suitable breeding habitat is present within the Arch Unit in the northern portion of the project area. All of the suitable breeding habitat, including the lek itself, occur north of I-80, which could effectively function to mask noise created through construction activities that would entirely be taking place south of I-80. In addition to the interstate, the distance between the lek and the nearest construction would be approximately 2.1 miles, also reducing potential impacts to greater sage-grouse in the project area. In accordance with BLM I.M. 2010-012, no surface disturbing and/or disruptive activities are allowed within 0.25 mile of any occupied or undetermined lek between March 1 and July 15 to protect nesting greater sage-grouse. Based on the implementation of these environmental protection measures, the lack of active leks within the project area, and the small amount of greater sage-grouse breeding habitat potentially affected by the proposed project, impacts to greater sage-grouse are anticipated to be low.

BLM Sensitive Wildlife Species

Bat Species

A number of BLM sensitive bat species also may be impacted by project construction. Three sensitive bat species including fringed myotis, spotted bat, and Townsend's big-eared bat may potentially occur within the project area. No impacts to communal roosts (e.g., hibernacula, nursery colonies, bachelor roosts) would be anticipated from the project construction or operation, based on review of bat literature for Wyoming (WGFD 2010) and the lack of suitable roost trees, underground structures, or mines within the project area. The project construction would result in the disturbance of 238 acres of potentially suitable foraging habitat for these bat species until reclamation has been completed and the plant communities have been reestablished. Therefore, impacts to these three bat species are anticipated to be low.

Pygmy Rabbit

Impacts to the pygmy rabbit may result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts may result from increased habitat fragmentation, human presence, and noise. The extent of likely habitat disturbance as a result of the proposed project would be relatively low and only occur in pygmy rabbit habitat that is moderate in quality (Griscon et al. 2010). Based on the maximum surface disturbance possible under the Proposed Action, approximately 160 acres of pygmy rabbit habitat within the Arch Unit of the project area and an additional 78 acres in the Monell Unit would be impacted by construction activities. Although high probability habitat does exist within the project area, the habitat is located in the separate eastern portion of the Arch Unit where no disturbance would occur under the Proposed Action.

Given the extent of suitable sagebrush habitat in the surrounding region and the existing level of development within the project area, activities associated with the proposed project within suitable pygmy rabbit habitat may impact individuals, but they would not adversely affect the viability of the local population of this species. In addition, the BLM requires that pygmy habitat be identified prior to surface disturbing activities and habitat disturbance minimized or avoided during the APD process. Therefore, impacts to the pygmy rabbit are anticipated to be low.

White-tailed Prairie Dog

Impacts to the white-tailed prairie dog may result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts may result from increased habitat fragmentation, human presence, and noise. Based on the results of the field surveys, a total of 11 white-tailed prairie dog colonies occur within the project area; two of the prairie dog towns are located on the Arch Unit and nine prairie dog towns are located on the Monell Unit. Under the Proposed Action approximately 114 acres of white-tailed prairie dog colonies within the Arch Unit of the project area and approximately an additional 10 acres in the Monell Unit would be impacted by construction activities. Based on the relatively small amount of white-tailed prairie dog colonies potentially impacted by the proposed project, impacts to the white-tailed prairie dog are anticipated to be low. Habitat disturbance in surrounding areas may encourage future colonization in the short-term, based on the availability of disturbed soils that would occur within the project area subsequent to the project-related construction.

Wyoming Pocket Gopher

Impacts to the Wyoming pocket gopher may result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts may result from increased habitat fragmentation and human presence and noise. Habitat disturbance as a result of the proposed project is presented in **Table 4-5**.

It is not anticipated that construction activities would permanently alter Wyoming pocket gopher habitat within the project area, following successful reclamation. In fact, habitat disturbance may encourage

future colonization in the short-term, based on the availability of disturbed soils that would occur within the project area subsequent to the project-related construction. In addition, the BLM requires Wyoming pocket gopher surveys prior to surface disturbing activities. During the APD process, trapping Wyoming pocket gophers would be required in order to determine which species of pocket gopher is present. Habitat surveys and trapping would be in accordance with BLM approved methods and if Wyoming pocket gophers are identified during trapping efforts, suitable habitat would be avoided. Therefore, impacts to the Wyoming pocket gopher are anticipated to be low.

Table 4-5 Wyoming Pocket Gopher Habitat Potentially Impacted by the Project

WYNDD Habitat Category ¹	Arch Unit Estimated Surface Disturbance (acres) ²	Monell Unit Estimated Surface Disturbance (acres) ²
Low	160	<1
Moderate	0	9
High	0	69

¹ Based on the WYNDD habitat probability model for Wyoming (Griscom et al. 2010).

² Based on the maximum surface disturbance possible under the Proposed Action.

Ferruginous Hawk

Impacts to ferruginous hawks generally would be the same as described for raptors in Section 4.1.7. Impacts specific to ferruginous hawks, would result in the incremental loss of 238 acres of potentially suitable habitat. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. Because a number of variables (e.g., nest location, species' sensitivity, breeding, phenology, topographical shielding) would determine the level of impact to a breeding pair, appropriate protection measures, such as seasonal constraints and establishment of buffer areas for avoidance (e.g., 1-mile Controlled Surface Use [CSU] nest buffer during the breeding season [February 1 to July 31] within the RSFO), would be implemented at active nest sites (determined by the BLM wildlife biologist) on a species-specific and site-specific basis, in coordination with the jurisdictional agencies (e.g., BLM, WGFD, or USFWS) in compliance with established regulations and policies. As a result of these protection measures, construction-related impacts to the ferruginous hawk are anticipated to be low and no take is expected as a result of the proposed project.

Burrowing Owl

Impacts to burrowing owls generally would be the same as described for raptors in Section 4.1.7. Impacts specific to burrowing owls, if present, would result in the incremental loss of less than 114 acres of potentially suitable habitat (i.e., prairie dog colonies) within the Arch Unit and an additional 10 acres on the Monell Unit. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. In compliance with established regulations and policies, APC would be required to conduct nesting surveys during the breeding season (April 1 to September 10) during the APD process. If a nest is found, an 820-foot no surface occupancy buffer must be applied in addition to a 0.50-mile CSU buffer during the breeding season. Therefore, impacts to burrowing owls are anticipated to be low.

Mountain Plover

Impacts to mountain plovers, if present within the project area, would occur as a result of the disturbance of potentially suitable nesting habitat (**Table 4-6**). Additional impacts such as displacement and

avoidance also would result from increased noise and human presence associated with construction activities.

Table 4-6 Mountain Plover Habitat Potentially Impacted by the Project

WYNDD Habitat Category¹	Arch Unit Estimated Surface Disturbance (acres)²	Monell Unit Estimated Surface Disturbance (acres)²
Low	2	10
Medium	97	16
High	61	52

¹ Category was based on the WYNDD habitat probability model for Wyoming (Keinath et al. 2010).

² Disturbance estimate was based on the maximum surface disturbance possible under the Proposed Action.

However, it is not anticipated that construction activities would permanently alter mountain plover habitat within the project area, following successful reclamation. Habitat disturbance may encourage future use of the project area, subsequent to project construction, given the decreased vegetation height and density. In compliance with established regulations and policies, APC would be required to conduct mountain plover nesting surveys within suitable habitat between April 10 and July 10. If an active nest is located, a 0.25-mile buffer would be established to protect the nest from disturbance until the young fledge. As a result, impacts to nesting mountain plovers are anticipated to be low.

Long-billed Curlew

Impacts to long-billed curlews, if present, would occur as a result of the disturbance of 1 acre of potentially suitable grassland habitat within the project area. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. In compliance with established regulations and policies; however, due to the extent of suitable habitat adjacent to the disturbed areas and the temporary nature of project construction, impacts to this species are expected to be relatively low. In addition, migratory bird nests would be identified prior to surface disturbing activities during the APD process and avoided.

Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher

Impacts to Brewer's sparrow, loggerhead shrike, sage sparrow, and sage thrasher generally would be the same as described for migratory birds in Section 4.1.7.2. Impacts specific to Brewer's sparrow, loggerhead shrike, sage sparrow, and sage thrasher would occur as a result of disturbance to 238 acres of potentially suitable habitat within the project area. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. However, due to the extent of suitable habitat adjacent to the disturbed areas and the temporary nature of project construction, impacts to these species are expected to be relatively low. In addition, migratory bird nests would be identified prior to surface disturbing activities during the APD process and avoided.

Great Basin Spadefoot

Potential impacts may include direct mortalities of individuals from construction activities, ground compaction, and vehicle traffic within suitable habitat. Impacts also may result from the incremental long-term reduction of 238 acres of potential habitat until reclamation is completed and vegetation has been re-established. The project may impact individuals but would not likely cause a trend towards federal listing or loss of population viability. This species has a broad geographic range in Wyoming and

impacts would be considered relatively low, based on the amount of suitable habitat present in the project vicinity.

Federally Listed Fish Species

As required by the GRRMP and the USFWS agreement, project water use must be evaluated to determine if water depletions would occur and affect the four federally endangered fish species and their critical habitat in the Upper Colorado River Basin. On January 21-22, 1988, the Secretary of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration were co-signers of a cooperative agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) (USFWS 1987). An objective of the Recovery Program was to identify reasonable and prudent alternatives that would ensure the survival and recovery of the four endangered Colorado River fish species, while providing for new water development in the Upper Colorado River Drainage Basin.

As discussed in Water Resources, Section 4.1.4.2, water use for drilling and completion activities and dust control would be obtained from deep aquifer groundwater in two existing water wells. The average water use would be approximately 10.7 acre-feet per year for well drilling and completion and dust control. Water used for drilling in the project area would be obtained from permitted water sources that do not contribute to depletions of the Colorado River system. The WSW 1 and WSW 2 water wells would be considered historic depletions (permitted prior to January 1988). The USFWS address new and historic depletions differently under the Section 7 agreement of March 11, 1993. Historic depletions, regardless of size, do not pay a depletion fee to the Recovery Program. Also, Section 7 consultation for historic depletions was conducted in association with the 1993 Section 7 agreement. Furthermore, the Wyoming State Engineer's Office confirmed that producing water from WSW 1 and WSW 2 water wells would not contribute to depletion of the Colorado River system due to the depth that the wells are fully cemented and the casing program (Wyoming State Engineer's Office 2013). Therefore, no additional consultation under Section 7 of the ESA is needed for water withdrawals related to this drilling project.

In conclusion, water withdrawal from deep Lance and Fox Hills formations would not affect surface water or instream flows in the Green River because there is no connection between the deep aquifers providing the water and shallow aquifers or surface water. There would be no effect on federally endangered fish species in the Colorado River system because there would be no net water depletion in the Green River.

Plants

There are no federal, state, or county-listed or BLM sensitive plant species in the project study area. As a result, there would be no impacts to special status plant species.

4.1.9 Air Quality and Climate Change Direct Impacts

4.1.9.1 Alternative I – No Action Alternative

Under the No Action Alternative, the existing Monell/Arch Unit would continue to operate at the current rate of development. As approved in the Monell EA (BLM 2006a), APC would drill and develop 31 additional wells. Air quality impacts from the approved development will or have undergone all necessary air quality permitting actions (see Section 3.9.1 for a review of potentially applicable regulations) as dictated by the type of operation and specifications for individual emission sources. The air quality permitting processes and associated compliance tracking requirements are designed to ensure compliance with the NAAQS and WAAQS.

4.1.9.2 Alternative II – Proposed Action

Criteria Pollutant Emissions

Emissions of criteria pollutants associated with the Proposed Action would be generated from 1) construction equipment and fugitive dust, 2) drilling and completion activities, and 3) operation of fully producing wells with maintenance vehicle traffic. The details of the emission inventory development are documented in the Emissions Inventory Report (AECOM 2013). The emission inventory was developed on best available information which included reasonable assumptions about the types of equipment and operating schedules anticipated for all activities associated with the Proposed Action.

The annual emissions associated with drilling and construction would vary based on the number and type of wells being drilled in a given year based on the schedule described in Section 2.2.4, Drilling Schedule, Work Force, and Project Traffic. In general, the maximum emissions would occur in the years when the most wells are being drilled. During the 9-year time frame of the project, an average of 14 wells would be drilled annually. The annual emissions associated with production would vary based on how many wells are active at any given time, with total maximum emissions occurring when the greatest number of wells is in production. To provide a conservative estimate of the emissions associated with this project, the emissions for each project year were calculated based on the proposed project schedule and the maximum emissions for each pollutant that was analyzed were selected for reporting. Total source emissions for the Proposed Action along with the projected maximum impact year for each pollutant are listed in **Table 4-7**. The maximum impact year is correlated to the year when the highest number of wells are in production (2021). Emissions of H₂S were not assessed and are assumed to be negligible.

Table 4-7 Source Emissions for Proposed Action

Pollutant	Maximum Emissions (tons)	Maximum Emissions Year
NO _x	253	2021
CO	220	2021
SO ₂	8	2021
PM ₁₀	33	2021
PM _{2.5}	18	2021
VOC	276	2021

VOC = volatile organic compound.

Direct Impacts from Criteria Pollutants

It should be noted that the air quality permitting process (see Section 3.9.1 for a review of potentially applicable regulations) for stationary sources is designed to ensure compliance with the NAAQS and WAAQS. The AAQS only apply to ambient air, which is defined to start at the fence line or ambient boundary of the facility. Mobile sources and temporary sources are typically not included in this permitting process, as the emissions from these sources are controlled by other regulatory programs. Applicable fugitive dust control measures associated with road traffic, construction activities, and disturbed land are covered under the WAQSR and the GRRMP. The NEPA process requires disclosure of all impacts, not just those analyzed under the air quality permitting process for stationary sources.

Direct impacts are those that are associated only with the emissions from the Proposed Action. Cumulative impacts are the combination of effects from the Proposed Action and existing sources and reasonably foreseeable developments. Cumulative impacts can be assessed by combining modeled

impacts for the Proposed Action with representative background concentrations typically determined from ambient data collected in a location that is representative of the Proposed Action. Cumulative impacts to air resources are discussed in Section 4.2.9. The pollutants typically considered in a direct impact analysis are NO₂, SO₂, CO, PM_{2.5}, and PM₁₀ for both the short term and annual AAQS identified in **Table 3-10**. Direct impacts of emissions from the Proposed Action on O₃ (which is formed in the atmosphere) AAQS compliance cannot be assessed. Direct impacts are assessed using near-field rather than regional impact analysis techniques because the impacts from the emissions are lessened due to dispersion and chemical transformation as the pollutants travel long distances from the source.

While the tools used to assess the impacts from stationary sources can be used to quantitatively assess the impacts from all emissions sources, they do not perform well and can be overly conservative for many of the temporary and mobile source types that are utilized in an oil and gas operation. Further, the type of detailed data necessary to conduct the level of analysis conducted under a stationary source permitting process for applicable sources is not currently available for the Proposed Action. The results from this analysis can be considered a conservative assessment of the potential impacts from the Proposed Action.

To assess the potential near-field impacts from the emission of criteria pollutants from the Proposed Action, it is reasonable to use the impacts analysis recently completed for the nearby and much larger Continental Divide-Creston (CD-C) Natural Gas Development Project (BLM 2012d). This analysis included the modeling of a variety of scenarios aimed at demonstrating that the types of activities associated with oil and gas development and production operations anticipated under that project can occur without causing a violation of the AAQS. The modeling was completed using the USEPA-approved model AERMOD and typical settings and approaches.

The modeled compressor station had 24,936 horsepower (hp) of engine power, while the Proposed Action is estimated to have close to 22,000 hp when all 13 engines are installed and operating together. Modeled drilling and production scenarios assessed both concentrated well development and multiple rigs operating within a single 40-acre section and various permutations combining different well densities and rig combinations. Fence line impacts were assessed at 100 meters and 250 meters from the modeled source. Tier 2 drill rig engines were one of the drill rig types evaluated for the CD-C project; these engines also are planned under the Proposed Action.

The near-field modeling study was designed to assess compliance with the following AAQS: 1-hour and annual NO₂, 1-hour and 8-hour CO, 24-hour and annual PM₁₀, 24-hour and annual PM_{2.5} and 1-hour, 3-hour, 24-hour, and annual SO₂. The modeling analysis indicated that direct impacts (exclusive of background concentrations) from all evaluated scenarios for the CD-C project were below the AAQS for all pollutants and averaging periods evaluated.

Given that the modeled scenarios designed to assess impacts from the CD-C project are conservative or comparable to the planned Proposed Action, it is reasonable to conclude that the Proposed Action would not have any significant direct impacts on the AAQS. The applicant-committed environmental protection measures identified in Sections 2.2.5 and 2.3 that impact air quality emissions were accounted for in the input data that served as the basis for the emission inventory development effort summarized in **Table 4-7**.

Hazardous Air Pollutants Emissions

The details of the HAP emission inventory development, including source type, are documented in the Emission Inventory Report (AECOM 2013). Source emissions of benzene, toluene, ethylbenzene, xylene, formaldehyde, and n-hexane for the Proposed Action are listed in **Table 4-8**, as well as their maximum predicted emissions year. Emission estimates indicate that formaldehyde may be emitted in a quantity greater than the major source limit of 10 tpy and the combination of hazardous air pollutant (HAP) emissions would be less than the major source limit of 25 tpy; therefore, the proposed project may

constitute a major HAP source. It is important to clarify that being categorized as a major source does not constitute a significant impact on air quality, it simply triggers a different air quality permitting process.

Table 4-8 Hazardous Air Pollutants from Proposed Action

Pollutant	Maximum Emissions (tons)	Maximum Emissions Year
Benzene	0.48	2021
Toluene	0.40	2021
Ethylbenzene	0.05	2021
Xylenes	0.20	2021
Formaldehyde	11.62	2021
n-Hexane	10.09	2021

AQRVs

AQRVs that are commonly evaluated in air quality impact studies include visibility and deposition to soils and lakes. The Federal Land Managers' Air Quality Related Values Work Group (FLAG 2010) provides a screening analysis to determine if a proposed project is exempt from AQRV impact review based on its annual emissions (Q) and distance (D) from a Class I area.

A Q/D screening analysis was performed to evaluate the impact of the Proposed Action on AQRVs in the closest Class I area or sensitive Class II area, Dinosaur National Park (**Figure 3-10**). In this analysis the Q/D ratio defined as the ratio of applicable project emissions in tpy and distance in kilometers (km) to the selected area is compared to the FLMs AQRVs Workgroup (FLAG) threshold of 10. The pollutants which were considered in this analysis are SO₂, NO_x, and PM₁₀. A complete review also would require analysis of sulfuric acid. Sulfuric acid emissions were not quantified as part of this effort but are expected to be much lower than those of SO₂, NO_x, and PM₁₀.

Based on an approximate distance of 92 km (57 miles) to Dinosaur National Park and the total project emissions listed in **Table 4-7**, the results of this screening analysis (Q/D = 294 tpy/92 km = 3.2 tpy/km) indicate that the Proposed Action is exempt from further AQRV impact review.

Climate Change

Climate change analyses are comprised of many factors, including GHGs, land use management practices, albedo effect, etc. The tools necessary to quantify climatic impacts from this small-scale project are presently unavailable. Therefore, climate change analysis for the purpose of this document is limited to accounting and disclosing factors that contribute to climate change.

The GHG Protocol categorizes direct and indirect emissions into three broad scopes:

- Scope 1: All direct GHG emissions.
- Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam.

Both direct (Scope 1) and indirect (Scope 2) emissions were estimated for the Proposed Action. Source emissions for the Proposed Action are listed in **Table 4-9**.

Direct emissions of GHGs result from a variety of activities associated with the oil and gas industry including the combustion of fossil fuels and fugitive releases of methane.

Table 4-9 Hazardous Air Pollutants from Proposed Action

Emission Scope	CO₂ (tpy)	CH₄ (tpy)	N₂O (tpy)	CO₂e (tpy)
Scope 1	155,433	1,264	0.32	182,086
Scope 2	6,096	0.13	0.10	6,130
Total	161,529	1,265	0.42	188,217

N₂O = nitrous oxide.

In Wyoming, the total GHG emissions from all sources was approximately 56 million metric tons of CO₂e (Center of Climate Strategies [CCS] 2007) in 2005. In comparison, the total direct emissions of GHG from the Proposed Action are approximately 160 thousand tons or less than 0.3 percent of the Wyoming budget.

4.1.10 Land Use and Special Designations

4.1.10.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to lands and realty beyond the currently authorized activities. Currently, approximately 1,450 acres within the Monell Unit are disturbed for fluid mineral facilities and well pads. Within the Arch Unit, 297 total acres are disturbed from fluid mineral facilities and well pads. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells. There would be slight changes to land uses, as lands currently used for grazing and recreational opportunities, are developed for fluid mineral extraction.

4.1.10.2 Alternative II – Proposed Action

The proposed project would affect lands managed by the BLM and other private landowners. Although State of Wyoming lands are within the project area, less than one percent of the proposed project-related disturbance would occur on state lands. As portrayed in **Table 4-10**, within the Monell Unit, approximately 77 acres of land would be disturbed initially (15 acres on federal and 62 acres on private), the majority of which would be from well pads. Only 10 acres of the initial disturbance would be attributed to the compressor station and production facilities. Long-term disturbance would drop to approximately 50 acres over the life of the project (41 acres on federal and 9 acres on private), of which the majority would be associated with well pads. There would be no new roads, pipelines, and power lines within the Monell Unit. All 85 new wells would be located on existing well pads.

Within the Arch Unit, approximately 160 acres would be disturbed initially (62 acres on federal, 85 acres on private, 13 acres on unknown ownership, and 1.5 acres on state), the majority of which would be from well pads, pipelines, new roads, and power lines. Long-term disturbance would drop to approximately 66 acres over the life of the project (26 acres on federal and 40 acres on private), of which the majority would be associated with well pads and new roads. The production facility would account for 12 acres of long-term disturbance. There would be 5.5 miles of new roads, 13 miles of pipelines, and 2 miles of power lines within the Arch Unit. The 40 new wells would be located on 21 new pads. Within each unit, most of the long-term disturbance, approximately 69 percent, would take place on private land. Once oil and gas production operations are completed, reclamation and revegetation would return the land to its pre-disturbance uses.

As a result of the Proposed Action, land ownership would not change and no areas of special designation would be affected. Current land uses would continue with emphasis on oil and gas development in existing leases, further reducing livestock grazing, wildlife habitat, and recreation

opportunities. The project-related land uses would be compatible with the RMPs and other policies, plans, and regulations for the project area. Therefore, land use impacts would be considered relatively low under the Proposed Action.

Table 4-10 Initial and Long-term Surface Disturbance by Landowner and Unit

Landowner/ Manager/ Monell Unit	Facility	Initial	Long-term
BLM	Wells	15	9
	Production Facilities	0	0
BLM Total		15	9
Private	Wells	52	32
	Production Facilities	10	9
Private Total		62	41
Monell Total		77	50
Landowner/ Manager/Arch Unit	Facility	Initial	Long-term
BLM	Wells	29	10
	Roads	19	16
	Pipelines	14	0
	Production Facility	0	0
BLM Total		62	26
Private	Wells	23	10
	Roads	21	18
	Pipelines	26	0
	Production Facility	15	12
Private Total		85	40
Arch Total		147	66
Grand Total Monell and Arch Units		238*	118**

* Total includes approximately 13 acres of initial disturbance within the Arch Unit as a result of power line construction on unknown landownership, and approximately 1.5 acres of well construction disturbance within the Monell Unit on state land.

** Total includes approximately 1 acre of long-term well pad disturbance within the Monell Unit on state land.

4.1.11 Transportation

4.1.11.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to the road network beyond the currently authorized ROWs. New roads (5.5 miles) to facilitate the Proposed Action would not be constructed, nor would an elevated level of vehicle trips occur. There would be slight changes to the 156 miles of existing roads and vehicle traffic as leases are developed for fluid mineral extraction.

4.1.11.2 Alternative II – Proposed Action

New roads would be constructed as needed to provide access to the proposed new wells. In addition to the approximately 156 miles of roads already in place within the project area, up to 5.5 miles of new roads would be necessary to access the new wells under the Proposed Action.

Transportation resources would be slightly affected by the additional vehicle trips required for construction, drilling, and maintenance activities. These would be greatest during the construction, drilling, and completion phases of the project, spread over the period of development. The projected maximum daily increase in trips per day for the Proposed Action Alternative is expected to occur during the first year of development. The daily increase in trips per day would be 14 heavy duty vehicle trips and 3 light duty vehicle trips for all 85 wells being drilled during drilling, completion, and reclamation. This would result in an additional average traffic volume of 17 total round trips a day during well drilling, completion, and reclamation. Vehicle traffic over the 40-year operations period would increase by 25 daily vehicle round trips. Of this daily increase, 18 trips would result from heavy vehicles and 7 trips from light vehicles. Patrick Draw Road (CR-24) and Bitter Creek Road (19S) would experience the largest increase in project traffic. As a result of the low level of existing traffic and the anticipated modest increase in project traffic, road closures or the use of flagmen are not anticipated. No interruption of traffic would occur on I-80. Any slight change to interstate traffic would be the result of construction vehicles merging on and off the interstate.

While the greatest impact to transportation would be increased traffic in and near the project area and the use of new and existing roads during construction, the current traffic to, from, and within the project area is relatively light, so increased traffic levels would be within the capacity of the access roads.

4.1.12 Recreation

4.1.12.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to recreation opportunities into the future. Authorized activities would result in a negligible effect to recreation resources, due to the long-term nature of disturbance and relatively slow rate of development in the project area.

4.1.12.2 Alternative II – Proposed Action

Surface disturbance generated by construction would potentially have relatively low impacts on recreation activities such as hiking and hunting for big game. Construction activities and drilling operations would generate increased noise and traffic primarily during the day, which may temporarily diminish hiking, hunting, and other recreational activities. The presence of new aboveground facilities would potentially slightly diminish the hunting and wildlife viewing experience by displacing habitat as well as increasing noise and human presence. Pleasure drivers utilizing the Ft. LaCledde Loop Back-Country Byway also may experience a reduced recreational experience resulting from changes in the visual landscape due to the new aboveground facilities.

These impacts would likely be minor due to recreational users being accustomed to existing mineral development and operations within the project area. Project disturbance is expected to be within the Recreation Opportunity Spectrum designation of Roaded Natural. Following completion of construction and drilling operations, noise, and traffic would return to near pre-construction levels. Additionally, impacts to recreation uses would be considered relatively low because the project would not affect developed recreational facilities or sites, measures would be implemented to minimize the visual effects of the project, the checkerboard ownership pattern and controlled nature of the property reduces accessibility for public recreation, and the other more appealing areas are located in the general vicinity.

4.1.13 Visual Resources and Noise

4.1.13.1 Alternative I – No Action Alternative

Under the No Action Alternative, oil and gas development activities would continue within the project area at the current rate, resulting in minor changes to visual resources and noise beyond the currently authorized activities. Authorized activities would result in continued short-term visual and noise impacts due to construction, drilling, and completion activities of previously approved wells, and long-term visual impacts resulting from well pads and associated ancillary facilities.

4.1.13.2 Alternative II – Proposed Action

The Proposed Action would modify public lands managed for VRM Class III and Class IV objectives. The majority of the project area, approximately 82 percent, is managed as VRM Class IV. Short-term visual impacts due to construction, drilling, and completion activities would occur from new well pads and facilities on federal, state, and private lands. The existing landscape of these lands would be slightly to moderately modified by additional lines, colors, forms, and textures from proposed new project structures, such as new well pads, facilities, roads, and pipelines. The new project facilities would be visible from public roads including I-80, Bitter Creek Road (CR 195/Ft. LaClede Loop Back-Country Byway), and Patrick Draw Road (CR-24).

The predominant characteristic landscape is that of oil and gas development and transportation. The proposed Monell-Arch facilities and activities would blend with the natural topographic diversity and existing industrial development that occur in the area and would not dominate the view of the casual observer. Therefore, the Proposed Action would not attract the attention of the casual observer and would continue the basic elements of form, line, color, and texture of landform, vegetation, structures, and sky that currently exist in the project area landscape.

Noise would be generated by vehicles and equipment during access road and well pad construction, light and heavy traffic along access roads, well drilling operations, and reclamation activities. The noise level for receptors (i.e., wildlife, people using the roads, or local workers) would depend upon the distance to the receptor, screening effects from terrain and vegetation, wind speed, and other localized climate factors. Temporary moderate noise levels would be produced during construction as a result of traffic and equipment operation such as drill rigs and bull dozers. USEPA guidance states that the threshold for residential noise impacts resulting from construction activities is reached at 55 dBA (USEPA 1974); however, due to the large distance from the nearest residences in the Point of Rocks area (approximately 10 miles from the northwest of project area boundary), adverse impacts to residential areas would not affect residential areas.

4.1.14 Livestock Grazing and Wild Horses

4.1.14.1 Alternative I – No Action Alternative

Under the No Action Alternative, APC would continue to develop their existing mineral leases in the Monell Unit and impacts to livestock grazing would be based on current rates of fluid mineral development, well abandonment, operations, and maintenance activities. The BLM would continue to approve APDs on a case-by-case basis. Approximately 1,450 acres of vegetation are currently displaced by roads, pipelines, well pads, and ancillary facilities within the Monell Unit and 297 acres are similarly displaced in the Arch Unit.

4.1.14.2 Alternative II – Proposed Action Alternative

Livestock Grazing Allotments

Under the Proposed Action Alternative the project area would be expanded to a total of 22,416 acres in both the Monell and Arch units (10,124 and 12,292 acres, respectively), and completely contained within the Rock Springs and Tipton allotments. No new wells, roads, pipelines, power lines, or ancillary facilities

would be constructed within the Tipton allotment. Approximately 238 acres would be temporarily disturbed in the Rock Springs allotment (160 acres in the Arch Unit and 78 acres in the Monell Unit), of which 118 acres would be long-term (66 acres in the Arch Unit and 52 acres in the Monell Unit). The total temporary disturbance would equate to an approximate loss of 17 AUMs and a long-term loss of 9 AUMs. It is unlikely that these reductions to AUMs would result in decreased stocking rates due to the fact that the reduction is very minor compared to the total available AUMs in the Rock Springs Allotment (1,598).

The new compressor station and two production facilities would be located in an undetermined portion of Sections 3, 23, and 35. Within these sections, there are two water wells and 8.7 miles of intermittent streams that could be affected by the location of these facilities. Water wells could be relocated if the facility footprint overlapped their current location. Of the 8.7 miles of intermittent streams, only a small portion would be affected due to the small size of the facilities (3.1 acres in Section 3, 12 acres in Section 23, and 6.2 acres in Section 35) compared to the entire 640 acres in a section. A potential flow line crossing of Bitter Creek could disturb areas adjacent to the stream in the Monell Unit. However, the crossing would be constructed using a bore technique, which would avoid direct disturbance to the stream. In addition, mitigation measure WR-1 (Section 4.1.4, Water Resources) would require a 500-foot buffer near Bitter Creek.

Construction activities and the use of unpaved roads would result in varying degrees of fugitive dust emissions. The dust would settle on nearby vegetation and may reduce palatability and overall vegetative growth due to decreased photosynthetic capability. Broad horizontal leaves would be more susceptible to deposition than narrow vertical leaves or blades. The degree to which dust deposition may reduce forage palatability would depend on several factors such as wind conditions, type and general condition of the affected plants, frequency and effectiveness of dust control measures, and the frequency and timing of precipitation events to wash dust from the affected vegetation. Permittees in the Rock Springs Allotment may decide to relocate livestock away from construction areas and frequently traveled roads to protect them from the potential adverse effects of fugitive dust emissions. Due to the large size of the Rock Springs Allotment there is sufficient area for potential livestock and wild horse relocation. Additionally, as part of the Proposed Action, every pad to be drilled would apply water to disturbed areas for dust suppression during periods of dry and windy weather.

Noxious and invasive weeds have become a growing concern in the western U.S. due to the threat they pose to native ecosystems and biological diversity, based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. Any surface-disturbing activities have the potential to spread noxious or invasive weeds if they are present. See Section 3.5 for the Wyoming State and Sweetwater County list of identified noxious weed species that could potentially occur within the project area. All of the listed species could compete with desirable forms of livestock forage vegetation. The spread of noxious weeds would be minimized through implementation of site-specific reclamation and noxious weed plans as part of the APD process.

Road construction and increased traffic volumes could lead to increased rates of livestock-vehicle collisions. The posting of speed limit signage and compliance with appropriate speed limits within the project area would reduce the likelihood of livestock-vehicle collisions.

Project construction activities could indirectly result in damage to rangeland improvements. This would most likely involve fences and gates. Rangeland improvements in the vicinity of construction activities would be documented and any damage would be repaired to previous condition or current BLM standards. The construction of roads in areas that were previously remote could lead to accidental or intentional trespass and livestock harassment or theft.

Wild Horse Herd Management Areas

Wild Horses in the Salt Wells Creek HMA would experience the same level of temporary and permanent surface disturbing impacts as livestock. Since the disturbance acreages are exclusive to the Rock

Springs Allotment, they are mutually exclusive to the Salt Wells Creek HMA. Impacts to water sources also would be similar as for livestock grazing. It is unlikely that this would result in a reduction to the AML of the Salt Wells Creek HMA.

Dust generated by construction activities and travel on unpaved roads also could affect wild horses. The quality and quantity of forage vegetation around these areas could be compromised if vegetation is exposed to fugitive dust emissions without adequate mitigation or environmental conditions to offset potential impacts.

Similar to livestock, wild horses are adversely affected by invasive and noxious weeds as native forage vegetation is reduced due to competition with less palatable, nourishing, and even toxic forms of vegetation. Surface disturbing activities and unsuccessful reclamation can facilitate the spread of noxious weed species throughout the project area.

Foaling season occurs between April and July. Various project activities, vehicular traffic, and overall human presence could create stress for mares and their foals during this time. If subjected to enough stress, mares have been known to abandon their foals shortly after birth. This is unlikely to be a problem due to the relatively large size of the HMA compared to the project area.

Certain activities, such as traffic and project components could pose a threat to wild horses. Higher than normal traffic volumes could increase the risk of wild horse-vehicle collisions. The posting of speed limit signage and strict enforcement could be successful in preventing injury or death to wild horses due to vehicle collisions. Some project components could present a risk to wild horses. Open pits or trenches and unmarked fencing could pose injury risks to horses. Project components that pose a health risk could be fenced and marked with high visibility flagging to ensure the health of wild horses.

4.1.15 Cultural Resources

4.1.15.1 Alternative I – No Action Alternative

Under the No Action Alternative, the project would not be implemented and there would be no additional surface disturbance other than what is currently authorized. Management of fluid mineral development would continue to be governed by current BLM policy and procedures with APDs approved on a case-by-case basis. Under the Monell EA approved in 2006, APC plans to drill and develop 31 additional wells in the Monell Unit; there would be no new development in the Arch Unit. Adverse effects to historic properties associated with currently authorized development would be avoided or, if avoidance is not feasible, mitigated or minimized as stipulated in previous NEPA analyses and through Section 106 compliance. None of the potential direct impacts to historic properties as identified for the Proposed Action would occur. Illegal collecting of artifacts and vandalism most likely would continue to occur.

4.1.15.2 Alternative II – Proposed Action

Development of the project could adversely affect historic properties if they are present in areas of proposed surface disturbance (e.g., well pads, roads, pipelines, power lines). Potential direct impacts to historic properties include, but are not limited to, physical destruction or damage to all or part of a historic property, alteration of a historic property, and removal of a historic property from its historic location. Indirect effects include, but are not limited to, the introduction of visual or audible elements that are out of character with the significant features of a historic property and illegal collecting of artifacts, vandalism, or inadvertent damage as a result of increased numbers of project personnel during project construction and increased access.

The types and numbers of historic properties that could be adversely affected by the project are unknown at this time. Class III cultural resources field inventories have not been conducted as of this date, but would be completed for areas not previously inventoried to Class III standards. The Class III inventories would be completed during the APD process when the locations of proposed facilities are known. If a historic property is identified in a proposed disturbance area and would be adversely

affected, the property would be avoided through project redesign. However, if avoidance is not feasible, adverse effects to the property would be minimized or mitigated through SHPO and BLM-approved treatment plans, which may include data recovery. Construction monitoring also may be required in some cases. As a result of data recovery, beneficial information would be contributed to existing regional archaeological databases. Data recovery also would prevent loss of information through unauthorized collecting and vandalism.

Visual impacts to the NRHP-eligible Lincoln Highway, Overland Trail, UPRR Mainline, and historic telegraph line are not expected to occur. The Arch Unit expansion would have the potential to create a new visual impact to the contributing segments of the Lincoln Highway. However, the setting of these segments has been visually impacted by modern development, including I-80 corridor, pipelines, power lines, the Black Butte Coal mine pits, and Patrick Draw well field facilities. A segment of the Overland Trail is located 2.5 miles south of the project boundary, but the setting of the trail has been compromised by existing oil and gas development. The segments of the UPRR Mainline and telegraph line located within the project boundary have been determined as non-contributing segments to their overall NRHP eligibility.

Increases in both surface activities and number of workers during construction could increase the potential for indirect impacts at archaeological sites. Studies indicate that human activities and increased access could result in both advertent and inadvertent harmful effects to these fragile resources. Indirect impacts are difficult to quantify and control, but they can include loss of surface artifacts due to illegal collecting and inadvertent destruction.

The potential for the discovery of unanticipated cultural resources during project construction exists within proposed disturbance areas and could result in an adverse effect. Unanticipated discoveries could result in displacement or loss (either complete or partial) of the discovered cultural resource. Displacement of cultural material affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric settlement and subsistence patterns.

Additional mitigation for cultural resources would include the following steps:

CR-1: If previously undiscovered cultural resources are encountered during construction activities, work would be halted within 100 feet of the find, and the find would be reported to the BLM Authorized Officer. Treatment of any discovered cultural material would be conducted based on direction by the BLM.

CR-2: APC-appointed onsite supervisory personnel would be educated about the sensitive nature of cultural resources and the steps to be taken if buried cultural material would be encountered during construction. Workers would be informed that destruction, collection, or excavation of cultural resources from federal land is illegal.

CR-3: If human remains are discovered during construction activities, work would be immediately halted within 100 feet of the discovery, and the discovery would be reported to the BLM Authorized Officer. Treatment of any human remains would be conducted based on direction from the BLM.

4.1.15.3 Native American Consultation

Consultation between the BLM and interested tribes would continue in an effort to identify places of traditional religious and cultural importance, as well as address concerns the tribes may have regarding these places. No surface disturbance would occur within or immediately adjacent to the boundary of a place of traditional religious and cultural importance prior to completion of all consultation required by law, and, as appropriate, implementation of at least the field phase of any data recovery or mitigation plan to address impacts to that resource. Any data recovery or mitigation plan would be reviewed and approved by the BLM and Wyoming SHPO prior to implementation. Interested tribes would be invited to participate in the development of any data recovery or mitigation plan.

4.1.16 Socioeconomics and Environmental Justice

4.1.16.1 Alternative I – No Action Alternative

Under the No Action Alternative, increases in project-fueled sales, lodging, property, and severance tax revenue, as well as local gains in employment and service industries, would continue at the current rate of oil and gas development, which is slower than the rate anticipated under the Proposed Action. Local, state, and federal governments would still receive revenue from existing and projected future oil and gas production within the project area.

4.1.16.2 Alternative II – Proposed Action

To determine whether the existing local infrastructure and services are adequate, impacts to socioeconomic resources were analyzed to determine whether:

- The total population of the county would increase by 10 percent or more;
- The project-related demand would cause the vacancy rate for temporary housing to fall to less than 5 percent; or
- The estimated demand for public services would exceed the existing capacities of available public services.

Population and Communities

Construction of the proposed project would require approximately up to 14 workers per well all hired from the local work force. The total number of workers on site at any given time would be less than this amount. An average of 14 wells to be drilled annually for 9 years, would result in a construction population work force of approximately 195 workers per year. Given that the populations of Sweetwater and Carbon counties are approximately 44,175 and 15,785, respectively, the local communities would be able to supply the estimated number of workers or accommodate new employees moving to the area.

Temporary Housing

The influx of non-local workers would generate increased short-term demand for temporary housing in the Rock Springs and Rawlins area. It is anticipated that non-local workers would primarily use trailers for temporary housing and would seek spaces in recreational vehicle parks or campgrounds in the local area. A small percentage would seek hotel/motel room or rental accommodations. Availability of temporary housing at some locations may be limited because of tourist activity during the summer months, and competition for temporary accommodations could displace some tourists. This displacement is anticipated to be minimal.

Community Services and Facilities

The influx of workers to area communities would incrementally increase demand for local services such as law enforcement, fire protection, medical services, and school services. However, because of the limited amount of population increase, it is anticipated that increased demand could be adequately absorbed and accommodated by existing services and no new local expenditures for labor or capital would be required.

Tax Revenues and Public Finance

Construction of the project would increase sales tax revenues for state and county governments for the duration of the construction period. Sales tax revenues would result from the spending of workers' wages and APC's purchases of goods and services in the local and regional economy. For the purposes of estimating tax revenues from employee wages, approximately 20 percent of the total wages (up to an average of 195 annual construction workers multiplied by the combined Sweetwater and Carbon county average annual wage for construction and extraction occupations [\$42,964] for 9 years) are projected to be spent locally. The average combined sales tax of Sweetwater and Carbon counties of 1.5 percent on

\$15,080,364 would result in sales tax revenues between Sweetwater and Carbon counties of over \$226,205 over the course of 9 years. State sales tax at a rate of 4 percent would equate to approximately \$603,215 in sales tax accrued to the state. It is anticipated that the project would add up to 10 permanent employees for maintenance and operations, further adding to the local and state tax revenue base.

In addition, the project would provide increased Sweetwater County property tax revenues in the form of ad valorem taxes, severance taxes, federal royalties, and other taxes on facilities and production. Industrial properties assessed by the State are taxed at 12 mills on 11.5 percent of their assessed value. Property taxes are a primary source of county and school district revenue, and the contributions from the proposed project would benefit local government operations. Property tax payments would decrease over time as the infrastructure depreciates. For every \$1 million worth of pipeline and facilities would result in approximately \$1,380 in taxes in the first year, depreciating over time. Based on the total value of new wells and facilities and an average of 14 producing wells drilled per year, the tax revenues would be approximately \$43,470 in the first year and gradually depreciating over time for each well. If the total project is approved and EOR is successful, the total well value projected cost for 125 producing wells is \$281 million and the tax revenue would be \$388,125 for the first year, depreciated thereafter.

The ad valorem tax rate for Sweetwater County is approximately 6.2 percent, and is applied to the previous year's production. For every \$1 million in revenue, approximately \$62,000 in revenue would be generated for Sweetwater County. If the average production over 30 years was \$5 million annually, approximately \$9.3 million in revenue would be generated. Severance taxes on natural gas production are 6 percent. For every \$1 million worth of production would generate \$60,000 in severance tax revenue. If the average production over 30 years were \$5 million annually, approximately \$9 million in revenue would be generated.

Abandonment of the wells and facilities would end project contributions to the Sweetwater County tax base. At the time of BLM-approved abandonment, tax receipts would be reduced from the wells and associated facility's in-service date to depreciation. Total decreases in tax receipts cannot be quantified at this time.

In summary, impacts from the proposed project on socioeconomic resources would be considered relatively low for the following reasons: 1) the influx of non-local project-related employees would result in a temporary population increase in surrounding communities of less than 1 percent; and 2) the demand for public services would not exceed existing capacities of affected public services. A beneficial impact of increased tax revenues would result from the operation of the proposed project, compared to the lower development and production quantities under the No Action Alternative. At the time of abandonment, project contributions to the local tax base would end.

Environmental Justice

As required by EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," the proposed project was evaluated for any disproportionately high and adverse human health or environmental effects on minority communities and low-income communities within the context of NEPA. Both Sweetwater and Carbon counties have a Hispanic minority population meaningfully greater (1.5 times as a percentage) than the Hispanic minority population of the state. Ultimately, however, the project would generate income within the affected counties if they supply workers and services, potentially benefiting minority communities. Moreover, because the proposed project is not located in large communities or urban areas (the nearest community is approximately 10 miles from the northwest project area boundary), there is no evidence that the project would have a disproportionately high adverse human health or environmental effect on minority and low-income populations. No low-income communities are located within the project area or would be adversely affected by the project.

4.2 Cumulative Effects

Principal past actions that were considered in the evaluation of the cumulative impacts are those that have affected similar resources and for which the effect is still residual in the environment. Past or ongoing actions in the vicinity of the Monell/Arch project area that were considered in this analysis are shown in **Figure 4-1**. A CESA is defined in the initial part of the discussion for each resource. The extent of the CESA varied depending on the resource. Air resources have the most extensive CESA due to the air dispersion aspect, as discussed in Section 4.2.9. Cumulative impacts were analyzed for the Proposed Action by identifying the effects from the alternative in combination with other past, present, reasonably foreseeable future actions (RFFAs).

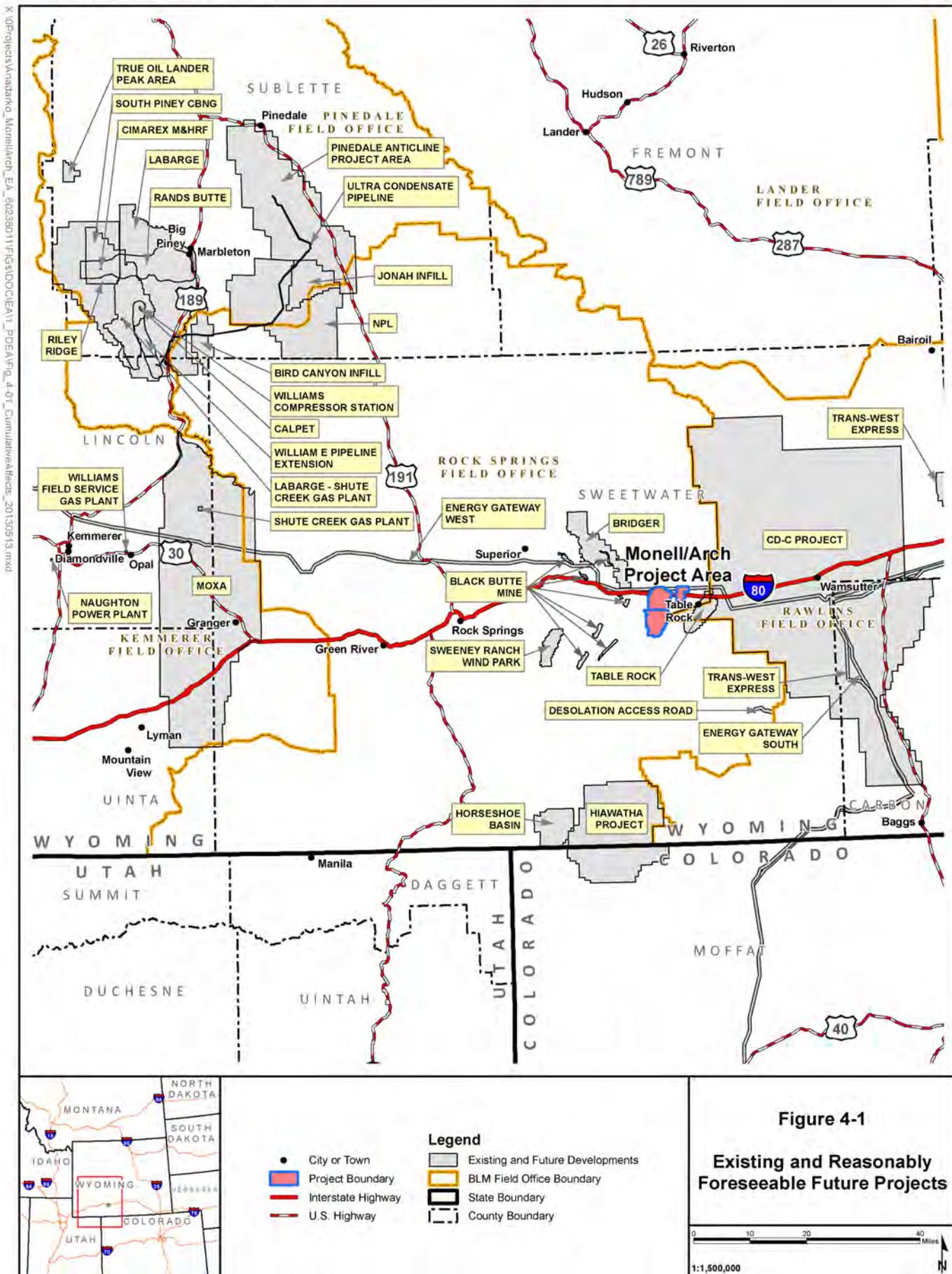
Past and present projects that have occurred in the vicinity of the Monell/Arch project area include oil and gas exploration and extraction, pipeline construction, electric transmission line construction, grazing, road development (including I-80), coal development, and other private land actions. RFFAs in or near the project area are listed in **Table 4-11**. Projects in the CESA for air resources are not listed specifically, since they are included in the CD-C analysis and the relative scaling process used for the Monell/Arch Project (see Section 4.2.9). The past and present actions listed above and the RFFAs included in **Table 4-11** involve actions that are likely to affect the same resources that are analyzed for direct and indirect effects.

4.2.1 Geology, Geologic Hazards, and Minerals

The CESA for geology, geologic hazards, and mineral resources covers an area roughly bounded by T17N to T21N, R95W to R101W. The rationale for the area is that it encompasses adjacent and existing oil and gas development. There would be no cumulative impacts to unique geologic features or from geologic hazards under either alternative. The Proposed Action would add another 125 wells in addition to the hundreds of wells that have been drilled in the CESA. The wells that would be drilled under the Proposed Action represent a very small increase compared to the thousands of wells that would be drilled in the CD-C Natural Gas Development Project and the 88 wells that are expected to be developed at within the Table Rock project area. Therefore, the oil and gas development under the Proposed Action would contribute a small increase in oil and gas development and a minor cumulative effect on the extraction of oil and gas resources in the CESA.

4.2.2 Paleontological Resources

The CESA for paleontological resources would be the same as geology, geological hazards, and mineral resources. Cumulative impacts to paleontological resources would result from surface disturbance related to industrial developments (e.g., oil and gas, electrical transmission lines, coal development, and wind energy), unauthorized collection, and natural erosion processes in the analysis area. With the implementation of the required environmental protection measures in compliance with state and federal regulations and policies, the proposed project, when added to past, present, and future development would not be expected to greatly contribute to cumulative impacts to paleontological resources in the CESA.



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Table 4-11 Reasonably Foreseeable Future Actions in or near Project Area

Project	Brief Description	Approximate Location
1. Table Rock (http://www.blm.gov/wy/st/en/info/NEPA/documents/rsfo/tablerock.html)	<ul style="list-style-type: none"> Approval to drill up to 88 wells over 14 years. ROD signed in January of 2012. 	<ul style="list-style-type: none"> Sweetwater County, Wyoming. 40 miles east of Rock Springs, just east of the Monell/Arch project area.
2. CD-C Natural Gas Development Project (http://www.blm.gov/wy/st/en/info/NEPA/documents/rfo/cd_creston.html)	<ul style="list-style-type: none"> Proposal to drill, develop up to 8,950 natural gas wells, including up to 500 coalbed natural gas wells. Approximately 1.1 million acre project area. 15-year construction period; 30- to 40-year project life. 	<ul style="list-style-type: none"> Sweetwater and Carbon counties, Wyoming. The project CD-C project area is east of the Monell/Arch project area with a slight overlap in T19N R98W.
3. Gateway South Transmission Project (http://www.blm.gov/wy/st/en/info/NEPA/documents/hdd/gateway_south.html)	<ul style="list-style-type: none"> 500-kilovolt (kV) transmission line, approximately 400 miles in length from Medicine Bow, Wyoming to Mona, Utah. 250-foot-wide ROW. 	<ul style="list-style-type: none"> Alternative routes located north-south near U.S. 30 east of project area.
4. Gateway West Transmission Project (http://www.wy.blm.gov/nepa/cfodocs/gateway_west/)	<ul style="list-style-type: none"> 230-kV electric transmission system approximate 990 miles in length from Glenrock, Wyoming, to 20 miles southwest of Boise, Idaho. 125-foot to 250-foot ROW. 	<ul style="list-style-type: none"> Alternative routes located east-west along I-80 through Monell/Arch project area.
5. TransWest Express Transmission Project (http://www.blm.gov/pgdata/content/wy/en/info/NEPA/documents/hdd/transwest.html)	<ul style="list-style-type: none"> Extra-high voltage direct current transmission system with 250-foot-wide, approximately 725-mile-long ROW. Extends between south-central Wyoming and southern Nevada. 	<ul style="list-style-type: none"> Alternative routes in and near the Monell/Arch project area parallel the routes for Gateway South.
6. Sweeney Ranch Wind Park (http://www.blm.gov/wy/st/en/info/NEPA/documents/rsfo/sweeneyranch-wind.html)	<ul style="list-style-type: none"> Proposed wind development project. 9,700-acre project area. Up to 119 wind turbine generators and associated infrastructure. 	<ul style="list-style-type: none"> Sweetwater County, Wyoming Approximately 15 miles southeast of Rock Springs, Wyoming, west of the Monell/Arch project area.
7. Desolation Access Road (http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/rsfodocs/desolationroad.Par.90885.File.dat/modified_fonsi.pdf)	<ul style="list-style-type: none"> Approval of 2 new well pads and access road. Modified FONSI signed 2010. 	<ul style="list-style-type: none"> Sweetwater County, Wyoming. Approximately 30 miles south of Wamsutter, Wyoming, southwest of the Monell/Arch project area.

Table 4-11 Reasonably Foreseeable Future Actions in or near Project Area

Project	Brief Description	Approximate Location
8. Black Butte/Bridger Mine http://www.blm.gov/style/medi alib/blm/wy/information/NEPA/rsfdocs/pit14/feis.Par.47265.File.dat/00feis.pdf and http://www.blm.gov/wy/st/en/in fo/NEPA/documents/rsfo/bridg ercoal.html	<ul style="list-style-type: none"> • Coal mine that supplies the Jim Bridger Power Plant. • Produces coal from federal, private, and state lands since 1979. 	<ul style="list-style-type: none"> • The current lease modification is approximately 35 miles northeast of Rock Springs, Wyoming.

4.2.3 Soils

The CESA for soils is the boundary for the project. Past, present, and reasonably foreseeable projects that would be expected to produce incremental and cumulative impacts within the CESA are shown in **Figure 4-1**. These projects would contribute incremental changes to the current level of alterations to soil resources in the analysis area from historic and ongoing management activities.

Projects that have contributed to cumulative impacts to soils result from surface disturbance related to grazing, recreation, oil and gas development, construction of pipelines and roads, and other natural and anthropogenic activities within the analysis area. Reasonably foreseeable future actions that would affect soils in the CESA include the Energy Gateway West transmission line and the CD-C Natural Gas Development Project.

Oil and gas exploration and development have contributed to cumulative impacts in the study area. Impacts associated with this type of activity include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, and loss of topsoil productivity. These impacts could increase runoff and lead to increased susceptibility of the soil to erosion and sedimentation to nearby waterbodies unless erosion and sediment controls and storm water management practices are implemented and maintained.

Where public and private lands are grazed, soils experience an increase in compaction and a decrease in vegetative cover, especially in areas where cattle concentrate (e.g., water sources, salt licks). This results in accelerated runoff and erosion and a reduction in soil quality. If grazed, riparian and wetland soils may receive the greatest impact.

With implementation of BLM conditions of approval and compliance with BLM policies for minimizing erosion, the proposed project, when added to past, present, and reasonably foreseeable future actions is not expected to result in significant cumulative impact to soil resources.

4.2.4 Water Resources

The CESA for water resources is the 6th level watersheds that encompass and drain the Monell/Arch project area. Water resources within the CESA have and could continue to be affected by surface disturbance activities as a result of surface coal mining, oil and gas development, livestock grazing, and recreational use. Water resources could be adversely affected by the cumulative ground disturbance from this and other current or proposed projects within the CESA, including the Table Rock Oil and Gas Project, CD-C Project, Energy Gateway West Transmission Project, and Black Butte/Bridger Coal Project, each of which would increase surface disturbance. Further expansion of the existing road network to accommodate additional resource development may have adverse impacts, including temporary increases in storm water runoff and increases in suspended and dissolved solids concentrations in the runoff during construction and reclamation when ground disturbance is occurring. Each new project would be required to obtain a construction storm water discharge permit, and to

prepare and adhere to an approved SWPPP. Once reclamation of disturbed ground is complete, the effects to water resources are expected to be relatively low.

The proposed project would use approximately 96 acre-feet of groundwater from relatively deep aquifers in the Lance and Fox Hills formations for drilling, completion, testing, and production operations. This groundwater withdrawal would combine with other groundwater uses in the CESA. However, none of the project groundwater withdrawals would be derived from sources that are connected to surface flows in Bitter Creek or downstream resources such as the Green River.

4.2.5 Vegetation and Noxious Weeds

The CESA for vegetation resources and noxious weeds encompasses the entirety of the project area. Existing and reasonably foreseeable projects that would be expected to produce incremental and cumulative impacts within the CESA include Energy Gateway West transmission line, and CD-C Natural Gas Development Project. The existing and reasonably foreseeable projects in the vegetation CESA are shown on **Figure 4-1**.

Surface disturbance under the Proposed Action, combined with the RFFAs would contribute small, incremental changes to vegetation cover within the CESA that would be scattered throughout the project area at any particular time. Past and present actions and RFFAs would cumulatively and incrementally reduce vegetation cover types until such time that reclamation is deemed successful and native plants are re-established. Impoundments or other permanent features developed during construction and operation of the reasonably foreseeable project, would represent a permanent loss of vegetation in the CESA. Impacts to vegetation associated with the CD-C Natural Gas Development Project and the Table Rock oil and gas development would be similar as described in Section 4.1.5. Surface disturbance activities from implementation of the project in combination with existing and reasonably foreseeable projects within the vegetation CESA could further spread noxious weed and invasive species into previously undisturbed areas, and may increase the acreage and population numbers of currently established noxious weed and invasive species.

It is assumed that portions of past disturbances have been reclaimed, and ongoing reclamation of construction and operation disturbance in the proposed project and past, existing, reasonably foreseeable projects, would add vegetation cover over time. Overall, vegetation recovery is anticipated to be long-term over the majority of CESA due to reclamation constraints (e.g., soil alkalinity or salinity) and low regional annual precipitation rates; however, vegetation would become reestablished and increase in abundance as a result of interim and final reclamation and natural recolonization. Based on the proposed reclamation and revegetation activities within the CESA implemented in compliance with federal and state regulations and policies, including the development and implementation of site-specific reclamation plans and noxious weed management plans, extensive cumulative effects to vegetation resources are not anticipated.

4.2.6 Wetland and Riparian Resources

The CESA for wetland and riparian resources encompasses the entirety of the project area. Existing and reasonably foreseeable projects that would be expected to produce incremental and cumulative impacts within the CESA include Energy Gateway West transmission line, CD-C Natural Gas Development Project, and the Table Rock oil and gas development. The existing and reasonably foreseeable projects in the wetland and riparian resources CESA are shown in **Figure 4-1**.

Small, incremental changes in surface disturbance that would be scattered throughout the project area would occur under the Proposed Action, and the reasonably foreseeable future projects within the CESA. Within the CESA, most of the wetlands and riparian areas are located along Bitter Creek in the Monell Unit. It is assumed that the RFFAs most likely would be sited to avoid the few wetland and riparian areas within the CESA. With the implementation of proposed mitigation WR-1, the proposed project would not impacts to wetlands and riparian areas in the CESA. In addition, the proposed project, and existing, and reasonably foreseeable future projects would comply with federal and state regulations and permits related to alteration of wetlands and policies requiring minimal changes to riparian areas. It is anticipated that cumulative effects to wetland and riparian resources would be negligible.

4.2.7 Wildlife and Aquatic Resources

Wildlife

The CESA for wildlife resources encompasses WGFD's Bitter Creek Pronghorn Herd Unit and the South Rock Springs and Baggs Mule Deer Herd units. The Bitter Creek Pronghorn Herd Unit covers an area of approximately 1,837,349 acres in southwest Wyoming and the South Rock Springs and Baggs Mule Deer units cover 1,474,655 and 2,147,347 acres, respectively. These units were chosen for the wildlife CESA, based on the geographic coverage of big game habitat and vegetation types present (e.g., sagebrush shrubland and grassland). Other wildlife groups utilize a smaller portion of the CESA.

As with all other resources, the cumulative analysis for wildlife and aquatic resources focuses on past, present, and RFFAs presented in **Figure 4-1** and the proposed project assuming that: 1) human use of the CESA would increase with the implementation of the proposed project, 2) wildlife habitats currently are at their respective carrying capacities in and adjacent to the project area, and 3) the overall region has been previously affected by at least some level of historic and current development activities and will be affected by reasonably foreseeable actions.

Historic, current, and future developments in the CESA have resulted, or would result, in the reduction of carrying capacities as characterized by the amount of available cover, forage, and breeding areas for wildlife species. Surface disturbance in the CESA primarily results from oil and gas development, including pipelines, access roads, and seismic exploration, and from transmission lines and wind energy development. However, other activities such as livestock grazing, development of recreational facilities, and growth of Wyoming communities also contribute to cumulative impacts on wildlife and their habitats.

Big Game. Cumulative impacts to wildlife resources would be directly related to habitat loss, habitat fragmentation, animal displacement, and direct mortalities. Long-term surface disturbance incrementally adds to wildlife habitat losses, overall habitat fragmentation, and animal displacement. Approximately 1,747 acres or 8 percent of the project area has been developed. Effects from the Monell and Arch units would combine with other cumulative actions such as oil and gas development projects including: Continental Divide-Creston, Desolation Access Road, Hiawatha, Horseshoe Basin, and Table Rock. Transmission lines in the area are Gateway South, Gateway West, and TransWest Express. These projects would result in an estimated disturbance of 30,667 acres in the South Rock Springs and 33,975 acres in the Baggs Mule Deer Herd Units. The overall cumulative impacts would be considered minor in terms of the percent of area affected in the herd areas (2 percent and 1 percent, respectively, in the South Rock Springs and Baggs Herd units).

Big game, especially pronghorn and mule deer, also would be impacted to a limited extent by encroaching human activities associated with development activities resulting, or could result in habitat loss and fragmentation and animal displacement. These impacts may be more pronounced in areas designated as crucial habitat (e.g., crucial winter habitat, parturition areas), which may lead to declines in local big game populations. However, as discussed above, no crucial habitat would be disturbed from the Proposed Action.

Raptors and Migratory Birds. The CESA for raptors is the Monell and Arch units including a 1-mile buffer around the project area. BLM records indicate that no raptor nests have been documented within the project area; however, five inactive ferruginous hawk nests were observed in the Arch Unit during the September 2012 surveys. The BLM records also indicate the presence of five nests within 1 mile of the project boundary including one of each for burrowing owl, ferruginous hawk, red-tailed hawk, prairie falcon, and an unknown raptor. In addition, it is anticipated that a number of other shrubland and, to a limited extent, waterfowl and shorebird species breed, forage, and migrate through the Monell and Arch units. The Proposed Action would disturb approximately 118 acres on a long-term basis. No other cumulative actions would directly affect raptor habitat in the project area. Additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, and dust deposition) also may occur within the CESA as a result of vehicle traffic.

Small Game Species. The CESA for small game wildlife species is the Monell and Arch units. Any impacts to small game species would be similar to those discussed in the Raptors and Migratory Birds Section. Many of the local small game populations that occur in the CESA would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development. A portion of the cumulative disturbance surface area has been, or would be, reclaimed or has recovered. The reclaimed areas and areas associated with habitat conversion would be capable of supporting wildlife use; however, plant species composition and densities likely would change as reclamation efforts via reseeding reestablish plant communities over time.

Aquatic Species

The CESA for fish, invertebrates, and amphibians is the 6th level watersheds that drain the Monell/Arch project area. The estimated area of these watersheds is approximately 102,395 acres. The Proposed Action would not result in any direct alteration of habitat in Bitter Creek or reduce flows due to groundwater withdrawals. Project construction and operation would result in an initial temporary surface disturbance of 238 acres and 118 acres after reclamation is completed. The Monell/Arch Project would add a very small incremental effect on aquatic habitat in the CESA in terms of sediment input from soil disturbance. Other cumulative actions within the CESA have and could continue to disturb surface soils within the four 6th level watersheds, as discussed in Section 4.2.4, Water Resources.

4.2.8 Special Status Species

Wildlife

Special status animal species would be cumulatively impacted by past, present, and RFFAs and the resulting direct impacts would generally be the same as discussed in Section 4.2.7, Cumulative Impacts for Wildlife and Aquatic Resources; however, on BLM-managed lands (and private lands in many cases), surveys typically are required in potential or known habitats of threatened, endangered, or otherwise special status animal species. These surveys would help determine the presence of any special status animal species or extent of habitat, and protective measures generally would be taken to avoid or minimize direct disturbance in these important areas.

Aquatic Species

The CESA for the special status species, flannelmouth sucker, is the 6th level watersheds that drain the Monell/Arch project area. As discussed for aquatic biological resources in Section 4.2.7, the Proposed Action would not result in any direct alteration of habitat in Bitter Creek or reduce flows due to groundwater withdrawals. Project construction and operation would result in an initial temporary surface disturbance of 238 acres and 118 acres after reclamation is completed. The Monell/Arch Project would add a very small incremental effect on flannelmouth sucker habitat in the CESA in terms of sediment input from soil disturbance. Other cumulative actions within the CESA have and could continue to disturb surface soils within the four 6th level watersheds, as discussed in Section 4.2.4, Water Resources.

The CESA for the four federally endangered fish species (bonytail, Colorado pikeminnow, humpback chub, and razorback sucker) is the Green River watershed. Water use for the Monell/Arch Proposed Action would not result in depletions to surface flows in the Green River watershed or the Upper Colorado River Basin. Therefore, the Monell/Arch Project would not contribute to depletions from cumulative actions in the Upper Colorado River Basin.

Plants

The CESA for special status plant species is the boundary for the Monell and Arch units. The Monell/Arch Project would not contribute to cumulative impacts to special status species, since no species are present within the project area.

4.2.9 Air Quality and Climate Change

4.2.9.1 Criteria Pollutants

As stated in the discussion on direct impacts under Section 4.1.9, the air quality permitting process for stationary sources is designed to ensure compliance with the NAAQS and WAAQS. The Proposed Action would need to be evaluated under the permitting program as applicable given the type of operation being proposed and specifications for individual emission sources. The near-field modeling study was designed to assess compliance with the following AAQS: 1-hour and annual NO₂; 1-hour and 8-hour CO; 24-hour and annual PM₁₀; 24-hour and annual PM_{2.5}; and 1-hour, 3-hour, 24-hour, and annual SO₂. The modeling analysis indicated that cumulative impacts were below the AAQS for all pollutants and averaging periods at a distance of 250 meters from the source. Cumulative impacts were above the 1-hour NO₂ NAAQS for the most conservative drilling and production scenarios involving Tier 2 engines and above the 24-hour PM₁₀ and PM_{2.5} AAQS for the well pad construction scenario. Both of these scenarios involve source types, namely drill rigs and fugitive dust that can be difficult to properly assess with dispersion modeling techniques with the modeled impacts being in many cases overly conservative. Given that the modeled scenarios designed to assess impacts from the CD-C project are conservative or comparable to the planned Proposed Action it is reasonable to conclude that the Proposed Action would not cause or contribute to any significant cumulative impacts on the AAQS at a distance of 250 meters from the source and is unlikely to have significant cumulative impacts between the pad boundary and 250 meters from the source.

Both the CD-C project area and the area of the Proposed Action are within approximately 50 miles, as shown in **Figure 4-2**, of the Ozone Nonattainment area, which warrants a regional assessment of their impacts on this region. While the well spacing in the CD-C study was lower per 40-acre section and therefore of comparable scale to the Proposed Action when assessing near-field impacts; the difference in overall project magnitude would be the important factor when evaluating the Proposed Action's impacts on O₃ AAQS attainment. The CD-C project accounted for 8,736 proposed active wells and 2,475 existing active wells in their ozone modeling analysis, while the Proposed Action is proposing for only 125 new wells to be drilled. The CAMx model was used to quantify the cumulative impacts to regional air quality including assessing O₃ AAQS attainment issues resulting from the CD-C project, other proposed oil and gas developments in the study area (Reasonably Foreseeable Development, or RFD) and all other regional emissions sources within the study area. The study indicated that the CD-C project would not significantly cause or contribute to any modeled exceedances of the O₃ AAQS. Given the significant differences in scale between the Proposed Action and the CD-C project, it is reasonable to conclude that the Proposed Action would not have any significant cumulative impacts on the O₃ AAQS attainment.

4.2.9.2 HAPs

The Proposed Action is unlikely to be a major source for HAPs and is not expected to greatly increase adverse cumulative impacts from HAPs.

4.2.9.3 AQRVs

The Q/D analysis performed for the Proposed Action above indicates that the project is exempt from a more thorough review of the impacts on AQRVs because it is not anticipated to greatly add to cumulative impacts at the nearest sensitive area.

4.2.9.4 Climate Change

The tools necessary to quantify climatic impacts from this small-scale project are presently unavailable. Therefore, climate change analysis for the purpose of this document is limited to accounting and disclosing factors that contribute to climate change. Both direct and indirect emissions of GHGs were estimated for the Proposed Action above, and the total of these emissions from the Proposed Action represent a small contribution, 0.3 percent, to the Wyoming GHG budget (CCS 2007).

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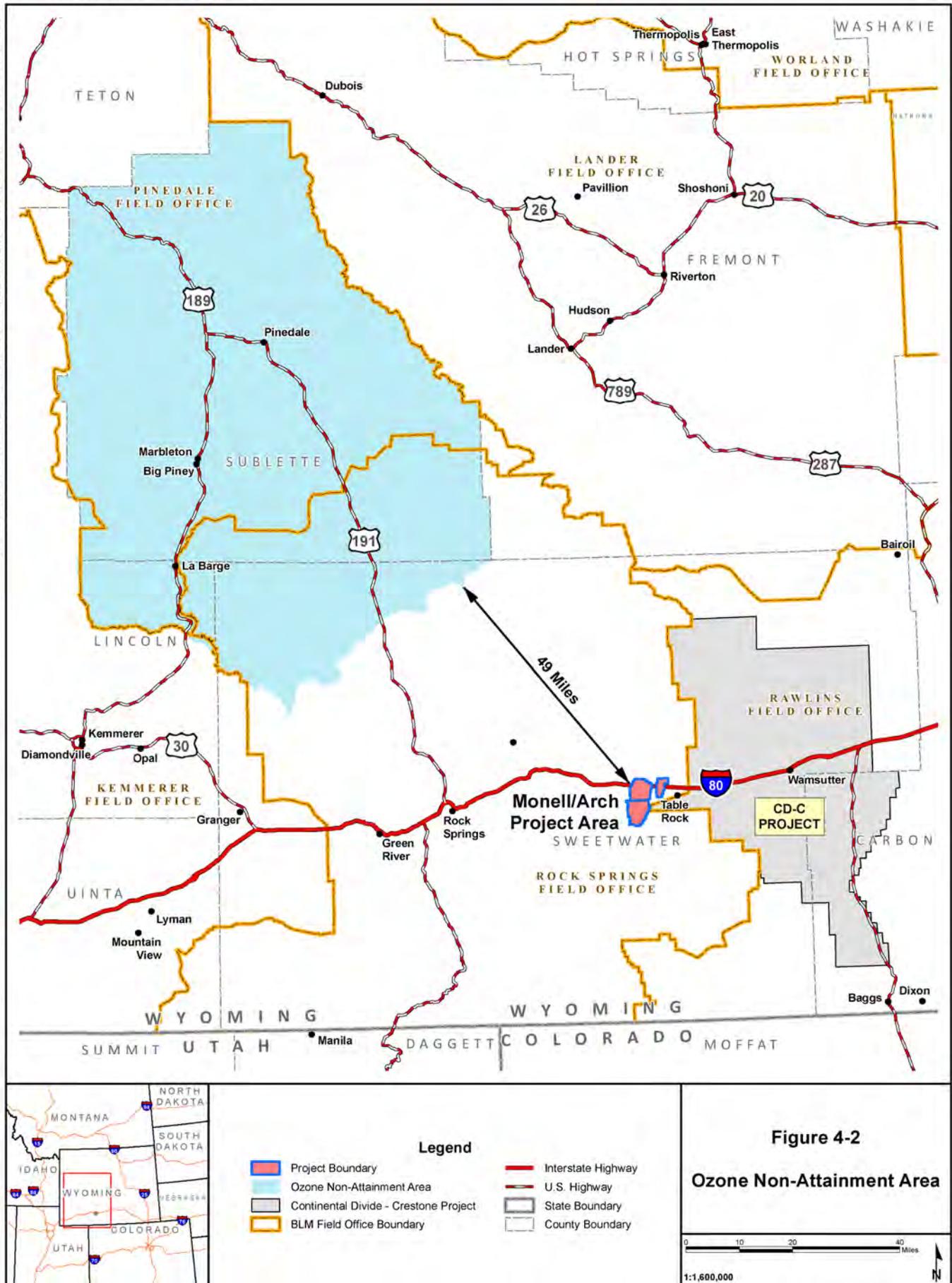


Figure 4-2

Ozone Non-Attainment Area

4.2.10 Lands and Realty

The CESA for lands and realty is the project area and the immediate surrounding area. Resource development has been prominent on the landscape in and around the project area for many years, and projections indicate this trend is likely to continue. Within the CESA, the Proposed Action would add up to 125 wells to the project area over 9 years in addition to ongoing APC oil and gas operations, as well as the proposed Gateway West Transmission project, adding to incremental surface development. As wells are plugged and abandoned, disturbance areas would be reclaimed. Unnecessary service roads also may be reclaimed at that time, resulting in some scattered additional land available for other uses. Development within the CESA would result in new ROWs, which may open up access to the public where none previously existed and may affect existing and future land uses; however, because the predominant use of the CESA is mineral development, cumulative impacts to land use and realty are expected to be relatively low as the current land uses would continue.

4.2.11 Transportation

The CESA for transportation is the project area and primary access roads to the area. Related projects within the CESA include previously approved and existing APC oil and gas activities, and the proposed Gateway West Transmission Project. Expansion of the existing road network to accommodate additional resource development may have adverse and beneficial impacts. Adverse impacts would include an increase in traffic within the CESA and primary access roads, as well as greater maintenance needs on new and existing roads as heavy truck traffic increases. A potential benefit would include a larger maintained road network that may be utilized by recreational and other land uses. The projects in the CESA and the Proposed Action have relatively low numbers of daily trips and are not expected to have much impact on local access routes and overall transportation patterns.

4.2.12 Recreation

The CESA for recreation is the project area with a 2-mile buffer outside the boundary. Within the CESA, the Proposed Action would add up to 125 wells to the project area over 9 years in addition to ongoing APC oil and gas operations. Existing and past oil and gas operations have contributed to a considerable amount to surface disturbance within the CESA. Adverse cumulative impacts to recreational resources within the CESA include access closures (mostly short-term), increased noise and activity associated with resource development, and a reduction in dispersed camping opportunities. Due to previous oil and gas development, the existing road network has reduced the value of primitive recreational values in the area. Additional roads for mineral development would provide increased access to motorized recreational users. This increase in human activities from mineral development and motorized vehicles is likely to continue to have a long-term impact on recreational users such as hunters and hikers who tend to avoid areas that have been heavily developed. While a substantial portion of the CESA would be affected by industrial activities from the proposed project in combination with other proposed and approved activities, there would be relatively low overall impacts to recreational activities within the CESA.

4.2.13 Visual Resources and Noise

The CESA for visual resources is the project area, as well as the viewshed of the proposed project. This is the area within which public users (travelers on roads, hunters, off-highway vehicle users, and hikers) would see potential changes in the landscape. The visual environment within the project area and surrounding region has existing alteration from oil and gas development, roads and railroad corridors. Past, present, and foreseeable future resource development in the CESA would have both direct and indirect cumulative impacts to visual resources from emissions, ancillary facilities, and the general upsurge of human activities. As wells are plugged and abandoned, unnecessary service roads also may be reclaimed at that time, resulting in scattered changes to the visual landscape. The Gateway West alternative corridor in and near the CESA, potentially resulting in increased cumulative visual impacts from power pole structures along the already disturbed I-80 corridor. The Proposed Action would further alter the visual environment, but would correspond to BLM VRM III and IV classifications and related

management objectives in the area. The CESA for noise is the project area with a one-mile buffer. Present and future actions within the CESA would produce noise as a result of vehicle traffic, equipment use, and facility operations. When including adjacent cumulative actions with one mile of the project area boundary, the proposed action would add a level of noise consistent with current activities. The resulting combined noise effects of these cumulative actions would be considered mostly temporary and localized in terms of their effects on wildlife or human use of the area.

4.2.14 Livestock Grazing and Wild Horses

The CESA for livestock grazing is the affected allotments (Rock Springs and Tipton) in their entirety. For wild horses, it is the Salt Wells Creek and Great Divide Basin HMAs in their entirety. Existing well development activities in the Monell and Arch units have disturbed approximately 1,450 and 297 acres of vegetation, respectively, from past development. The proposed expansion would disturb an additional 52 acres of vegetation in the Monell Unit and 66 acres in the Arch Unit. RFFAs that may affect forage production include the CD C Natural Gas Development Project, the Energy Gateway West Transmission Project, the Sweeney Park Wind Farm, the Black Butte/Bridger mine, and oil and gas development in the Table Rock field. These projects would overlap with a portion of the Rock Springs and/or Tipton allotments and the Salt Wells Creek and/or Great Divide Basin HMAs, and contribute to the surface disturbance and reduction in forage availability for livestock grazing and wild horses. The CD-C Natural Gas Development Project would impact the Tipton allotment, while the Energy Gateway West Project overlaps with the Rock Springs and Tipton allotments and the Salt Wells Creek and Great Divide Basin HMAs. The Sweeney Park Wind Farm overlaps with the Rock Springs Allotment and the Salt Wells Creek HMA, the Bridger portion of the Black Butte/Bridger mine overlaps with the Rock Springs Allotment and the Great Divide Basin HMA, and the Black Butte portions of the Black Butte/Bridger mine would overlap with the Rock Springs Allotment and the Salt Wells Creek and Great Divide Basin HMAs. The Table Rock Unit overlaps with the both the Rock Springs and Tipton allotments and the Salt Wells Creek HMA. These projects would contribute incremental changes to the current level of effects to livestock grazing and wild horses in their respective CESAs. In total, these RFFAs would disturb 57,744 acres in the Tipton Allotment, 119,148 acres in the Rock Springs Allotment, 65,233 acres in the Great Divide Basin HMA, and 113,861 acres in the Salt Wells Creek HMA. With implementation of BMPs, the GRRMP management guidance, and applicant committed measures, the proposed Monell/Arch Project, when added to past, present, and reasonably foreseeable future actions, is not expected to result in significant cumulative impacts to livestock grazing or wild horse HMA management.

4.2.15 Cultural Resources

The CESA for cultural resources includes the project boundary encompassing the Monell and Arch units, plus an area that extends 3 miles beyond the boundary. Numerous Class III cultural resource inventories have been conducted in the CESA and various prehistoric and historic sites have been identified. The majority of prehistoric sites are open camps, lithic scatters, and lithic procurement sites. Historic sites include, but are not limited to, debris scatters associated with ranching or stock herding activities, roads, and trails related to historic habitation and utilization of the area. Disturbance that has or would occur on federal lands is subject to laws and regulations that protect cultural resources, especially those eligible for the NRHP.

Past projects permitted by the BLM in the CESA have been inventoried for cultural resources prior to implementation. For RFFAs, Class III inventories would be completed for all federal undertakings, including actions on non-federal lands that operate under federal license, permit, or funding, thereby decreasing potential impacts to cultural resources. By complying with federal and state laws, regulations, and policies, the potential for incremental increases in cumulative impacts would be avoided.

Multiple oil and gas development projects would contribute to the potential changes in the setting of cultural resources in the CESA. Increased public access from new roads may increase vandalism, requiring careful enforcement of state and federal laws. With implementation of BLM requirements, the

project, when added to past, present, and RFFAs is not expected to result in significant adverse cumulative impacts to cultural resources.

4.2.16 Socioeconomics and Environmental Justice

The CESA for socioeconomics and environmental justice is defined by the boundaries of Sweetwater and Carbon counties. The cumulative effects of past and current development in the region are evident in the existing settlement patterns. Such development and related activities, events, and people associated with it, provide the area with its rich heritage and cultural history. Absent the area's energy resources, the region likely would be much less developed and populated than it is today.

The collective cumulative activity has contributed to past growth and development, and underlies important economic and social conditions and trends in the area. Increases in oil and gas activities over a short period of time can cause noticeable increase in housing demand, employment, and income, which can lead to changes in population trends that could potentially have detrimental effects to community services, social structures, and lifestyles. For example, the additional population gained through employment in the oil and gas sector could intensify law enforcement problems, although a proven link has not been established in this area. Boom and bust cycles of oil and gas development can lead to short-term pressures on existing social and physical infrastructure, which can lead to development of infrastructure that may no longer be necessary during bust cycles, and can create a drain on local revenues when the population and incomes decline during a bust cycle. Given the relatively small amount of employment and infrastructure required by this project, the project is not expected to add to the need for new infrastructure, but would generate revenue that could improve local infrastructure.

The project would contribute a relatively small amount to the cumulative impacts of socioeconomics in Sweetwater and Carbon counties, but its effect would be to generate more funds that would be available to improve the local physical and social infrastructure.

4.3 Summary of Mitigation Measures

Mitigation measures are those actions that may be taken to avoid or minimize impacts that would otherwise be significant. The impact analysis assumed implementation of applicant committed measures (Section 2.3), as well as compliance with federal laws like the CWA and CAA, and implementation of applicable BLM policies and guidelines, such as the requirements of the GRRMP, and Wyoming BLM reclamation measures. Monitoring is required to ensure the implementation of these measures.

Examples of applicant committed measures (see Section 2.3) and compliance with BLM policies that would protect environmental resources include the following actions:

Air Resources

Control measures identified in the GRRMP and Wyoming Air Quality Standards and Regulations would be followed for dust control on roads and other surface disturbance areas. These measures would include use of water on dirt roads and covering open-trucks carrying materials that could cause airborne dust.

Paleontological Resources

In accordance with BLM's procedures for surface-disturbing actions in formations with a high potential for paleontological resources, highly sensitive areas would be monitored during construction by a qualified paleontologist with a permit issued by the Wyoming State Office of the BLM. Should fossil materials of known or suspected scientific significance be encountered during excavation on the access roads, drill pads, or associated mud pits, the operator would stop work immediately in the vicinity of the discovery and the BLM Authorized Officer would be contacted. Activities would be redirected until the BLM

Authorized Officer can assess the situation and advise on mitigation measure requirements before surface disturbing operations can continue.

Soils

During construction, APC has committed to reclaim all disturbed areas not needed for production to reduce site impacts. These actions would reduce the intensity of the impacts to soils as well as the time it would take to return the disturbed soils to a stable and productive state. In addition, the BLM Wyoming Reclamation Policy I.M. No WY-2012-032 requires proponents to identify, delineate, and segregate all salvaged topsoil and subsoil based on a site-specific soil evaluation including depth, chemical, and physical characteristics.

Water Resources

Protective measures would be implemented in compliance with state and federal regulations, including preparation of a Spill Prevention, Control, and Countermeasures (SPCC) Plan, to minimize potential leaks and require rapid clean up in the event of a spill before reaching waterbodies or drainageways. Any adverse impacts from leaks or spills would be dependent on the size and location of the spill in relation to nearby waterbodies and the absence or presence of streamflow at that time.

Wyoming Oil and Gas Commission Rules and Regulations (Chapter 4, Rule 402) would require water quality analysis of disposal water and the receiving water.

Noxious Weeds

Implementation of post-construction monitoring in consultation with the BLM would further minimize and mitigate the impacts associated with the introduction and/or spread of noxious weeds and invasive species. In addition, the development and implementation of a site-specific reclamation plan including a site-specific Noxious Weed Management Plan would occur during the APD process.

Wetland and Riparian Vegetation

BLM guidelines require special mitigation measures within 500 feet of riparian areas. Additional protection measures, if needed, would be developed as part of the APD process.

Wildlife and Special Status Species

Wildlife and special status species mitigation would include:

- No surface disturbance or disruptive activities would be allowed within 0.25 mile of any occupied or undetermined greater sage-grouse lek from March 1 through July 15.
- A 1-mile controlled surface use buffer and seasonal restrictions (February 1 – July 31) would be established for active ferruginous hawk nest sites located within project disturbance areas.
- If active mountain plover nests are located in suitable habitat near project disturbance areas, a 0.25-mile buffer would be established. The seasonal restriction would be April 10 through July 10, if nests are observed in disturbance areas.
- No surface disturbance activities would be allowed within crucial winter/yearlong big game range from November 15 through April 30.

The following additional mitigation measures were identified in previous resource sections as a means of providing further reduction or avoidance of impacts from the Proposed Action.

Water Resources

Water resources mitigation would include:

WR-1: Potential water quality and channel alteration impacts to streams would be avoided by implementing a 500-foot buffer distance from the edge of wetland/riparian areas and perennial streams. Surface disturbance could be allowed within this buffer with adequate measures to ensure that no runoff from disturbed areas entered the streams or wetland/riparian areas were not affected. Additional mitigation measures would be determined during the APD onsite process.

WR-2: Fuel or other chemicals would not be stored within 500 feet of Bitter Creek or other riparian areas and 100 feet from the edge of the inner gorge of intermittent or large ephemeral drainages. Exceptions would be considered on a case-by-case basis.

WR-3: Anadarko would coordinate and discuss with the BLM and WDEQ the baseline groundwater sampling required by the WOGCC and determine if any additional sampling is necessary prior to project development. Guidance would be provided by the *Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development* (McMahon et al. 2007). Copies of the findings should be provided to all appropriate agencies including the BLM and WDEQ.

Cultural Resources

Additional mitigation for cultural resources would include the following steps:

CR-1: If previously undiscovered cultural resources are encountered during construction activities, work would be halted within 100 feet of the find, and the find would be reported to the BLM Authorized Officer. Treatment of any discovered cultural material would be conducted based on direction by the BLM.

CR-2: APC-appointed onsite supervisory personnel would be educated about the sensitive nature of cultural resources and the steps to be taken if buried cultural material would be encountered during construction. Workers would be informed that destruction, collection, or excavation of cultural resources from federal land is illegal.

CR-3: If human remains are discovered during construction activities, work would be immediately halted within 100 feet of the discovery, and the discovery would be reported to the BLM Authorized Officer. Treatment of any human remains would be conducted based on direction from the BLM.

4.4 Residual Effects

Residual effects are any adverse direct, indirect, and cumulative effects that remain after all environmental protection and mitigation measures have been applied. For this project, implementation of the ACMs, required federal and state laws, regulations, and policies, and mitigation measures for water, resources, noxious weeds, riparian and wetlands, and cultural resources are projected to be adequate to reduce or avoid adverse impacts. Although the impact magnitude would be considered to be low after the implementation of the resource protection measures, some residual effects would exist for the following resources.

Soils – Long-term loss of soil productivity (118 acres) due to construction of the compressor station, production facilities, and portion of the well pads that are not reclaimed.

Vegetation – Long-term loss of vegetation (118 acres) due to construction of the compressor station, production facilities, and portion of the well pads that are not reclaimed.

Wildlife – Long-term loss of wildlife habitat due to construction of the compressor station, production facilities, and portion of the well pads that are not reclaimed.

Livestock Grazing – Long-term loss of 118 acres and 10 AUMs in the Rock Springs allotment.

Land Use – Long-term loss of 118 acres due to construction of the compressor station, production facilities, and portion of the well pads that are not reclaimed would reduce non oil and gas land uses, such as grazing and recreation.

Recreation – Long-term loss of 118 acres due to construction of the compressor station, production facilities, and portion of the well pads that are not reclaimed would reduce recreational opportunities.

5.0 List of Preparers and Reviewers

The people listed in **Table 5-1** prepared the EA under the guidance of the BLM staff listed in **Table 5-2**. The people listed in **Table 5-2** provided oversight, information, and review of the EA.

Table 5-1 List of Preparers, AECOM

Resource/Responsibility	AECOM Team Member	Education and Experience
Project Manager, Aquatic Biological Resources and Special Status Aquatic Species	Rollin Daggett	BS College of Environmental Science and Forestry at Syracuse University; MS University of Newfoundland 37 years experience
Assistant Project Manager, Wildlife, Special Status Wildlife	Jamelle (Jamie) Schlangen	MS Applied Ecology; MPA Natural Resource Management; BS Wildlife Ecology 17 years experience
Senior Technical Advisor	Ellen Dietrich	BA Anthropology; Graduate Study Soil Science 32 years experience
Geology and Minerals, Paleontology	William Berg	MS Geology 31 years experience
Water Resources	David Fetter	BS Watershed Science 9 years experience
Soils	Terra Mascareñas	BS Soil and Crop Science 15 years experience
Air Quality, Climate Change	Linsey DeBell	MS Geochemical Systems 9 years of experience
Vegetation, Special Status Plants, Wetlands/Riparian Areas	Erin Bergquist	MS Ecology; BS Environmental Studies and Economics 12 years of Experience
Wildlife, Special Status Animals	John Leonhart	MA Biology; BS Zoology 12 years of experience
Rangelands/Livestock Grazing	Chris Dunne	BS Natural Resources Management 6 years experience
Lands and Realty, Transportation, Recreation, Socioeconomics, Environmental Justice, and Visual Resources	Steve Graber	BS Natural Resources Management; BA Economics 6 years experience
Cultural Resources	Kim Munson	MA Anthropology; BA Anthropology 28 years experience
Geographic Information Systems	Brent Read	BS Physical Geography 7 years experience

Table 5-2 BLM Interdisciplinary Team

Resource/Responsibility	BLM Team Member
Rock Springs Field Office	
Project Lead/Senior Natural Resource Specialist	Ted Inman
Natural Resource Specialist	Doug Linn
Asst. Field Manager, Minerals and Lands	Joanna Nara-Kloepper
Petroleum Engineer	James Evans
Planning & Environmental Coordinator	Nancy Favour
Hydrologist	Dennis Doncaster
Archeologist	Jessey Dowdy
Botanist/Riparian Team	Jim Glennon
Fishery Biologist/Riparian Team/Wildlife Supervisor	John Henderson
Range Management Specialist	Cherette Bonomo
Supervisory Wildlife Biologist	Patrick Lionberger
Outdoor Recreation Planner/VRM Specialist	Steve Madden
Wild Horse & Burro Specialist	Jay D'Ewart
Lead Realty Specialist	Patricia Hamilton
Realty Specialist	Stephanie Anderson
GIS Specialist	Douglas Kile
BLM State Office	
Air Quality, Climate Change	Charis Tuers

6.0 References

- AECOM. 2013. The Monell/Arch Units Environmental Assessment Air Quality Emissions Inventory Development. Prepared for Anadarko Petroleum Corporation and Bureau of Land Management, Rock Springs Field Office, Rock Springs, Wyoming.
- AECOM. 2012a. White-tailed Prairie Dog and Raptor Nest Survey Report for the Monell/Arch Units Environmental Assessment, Wyoming. Final Report. Prepared for Anadarko Petroleum Corporation and Bureau of Land Management, Rock Springs Field Office, Rock Springs, Wyoming.
- AECOM. 2012b. Field Survey GIS Data of Raptors and White-tailed Prairie Dog Towns. September 2012.
- Alberta Agriculture and Food. 2007. Using the Animal Unit Month (AUM) Effectively. Retrieved from [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex1201](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex1201). Accessed October 25, 2012.
- Anderson, R. C. and R. T. Ryder. 1978. Seismic Model Study of Patrick Draw Field, Wyoming: A Stratigraphic Trap in the Upper Cretaceous Almond Formation. U.S. Geological Survey Open-File Report 780-496, 20 pp.
- Bartos, T., L. Hallberg, and M. Clark. 2010. Available groundwater determination, Technical Memorandum. WWDC Green River Basin Water Plan II – Groundwater study Level I (2007-2009). Chapter 6, Groundwater quality. August 2010. Cheyenne, Wyoming. http://waterplan.state.wy.us/plan/green/2010/finalrept/gw_toc.html. Accessed April 11, 2011.
- Bartos, T. and L. Hallberg. 2010. Available groundwater determination, Technical Memorandum. WWDC Green River Basin Water Plan II – Groundwater study Level I (2007-2009). Chapter 5, Groundwater and hydrogeologic units. August 2010. Cheyenne, Wyoming. http://waterplan.state.wy.us/plan/green/2010/finalrept/gw_toc.html. Accessed April 11, 2011.
- Baxter, G. T. and M. G. Stone. 1980. Amphibians and Reptiles of Wyoming. Wyoming Game and Fish Department, Cheyenne Wyoming. 137 pp.
- Baxter, G. and J. Simon. 1970. Wyoming Fishes. Bulletin No. 4, Wyoming Game and Fish Department, Cheyenne, Wyoming. 168 pp.
- Belnap, J., S. L. Phillips, D. M. Miller, D. R. Bedford, and A. L. Flint. 2003. Resistance and Resilience of Biological Soil Crusts to Soil Surface Disturbance in the Mojave Desert [presentation]. In: Arid Southwest Lands Habitat Restoration Conference, March 3-7, 2003, Palm Springs (CA).
- Blomberg, E. J., J. S. Sedinger, M. T. Atamian, and D. V. Nonne. 2012. Characteristics of Climate and Landscape Disturbance Influence the Dynamics of Greater Sage-grouse Populations. *Ecosphere* 3(6):55. <http://dx.doi.org/10.1890/ES11-00304.1>.
- Boeker, E. L. and T. D. Ray. 1971. Golden Eagle Population Studies in the Southwest. *The Condor* 73:463-467.

- Braun, C. E. 1986. Changes in Sage Grouse Lek Counts with Advent of Surface Coal Mining. Proceedings: Issues and Technology in the Management of Impacted Western Wildlife. R. D. Comer, T. G. Baumann, P. Davis, J. W. Monarch, J. Todd, S. VanGytenbeck, D. Willis, and J. Woodling, eds. Thorne Ecological Institute. Boulder, Colorado.
- Bureau of Land Management (BLM). 2013a. Best Management Practices for Fluid Minerals. Internet Address: http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices.html. Accessed February 22, 2013.
- Bureau of Land Management (BLM). 2013b. Instruction Memorandum No. 2013-033. Fluid Minerals Operations – Reducing Preventable Causes of Direct Wildlife Mortality. Posted December 13, 2012. Expiration September 30, 2014.
- Bureau of Land Management (BLM). 2012a. Paleontology Laws and Policy. http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/paleontological_regulations.html. Accessed November 1, 2012.
- Bureau of Land Management (BLM). 2012b. GIS Data Provided in Response to Data Request. Provided by C. Sheets, BLM Rock Springs Field Office to M. Jones, AECOM. September 6, 2012.
- Bureau of Land Management (BLM). 2012c. GIS Data of Visual Resource Management Classes. Provided by D. Kile, BLM Rock Springs Field Office to B. Read, AECOM. August 16, 2012.
- Bureau of Land Management (BLM). 2012d. Draft Environmental Impact Statement Continental Divide-Creston Natural Gas Development Project. BLM/WYO/PL-13/002+1310, BLM Wyoming High Desert District – Rawlins Field Office, Rawlins, Wyoming. November 2012.
- Bureau of Land Management (BLM). 2011a. A Report on National Greater Sage-grouse Conservation Measures. Prepared by the Sage-grouse National Technical Team (NTT) for the National Greater Sage-Grouse Planning Strategy Charter. Denver, Colorado.
- Bureau of Land Management (BLM). 2011b. GIS Data Provided in Response to Data Request. Provided by D. Kile, BLM Rock Springs Field Office to E. Dietrich, AECOM. March 30, 2011.
- Bureau of Land Management (BLM). 2010. BLM Sensitive Species List for Wyoming. Updated April 2010.
- Bureau of Land Management (BLM). 2009. GIS Data of Allotment Boundaries. Provided by L. McCarthy, BLM Rawlins Field Office to B. Read, AECOM. 2009.
- Bureau of Land Management (BLM). 2008. Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management Rawlins Field Office, Rawlins, Wyoming. Prepared by United States Department of the Interior Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming, January 2008. http://www.blm.gov/wy/st/en/programs/Planning/rmps/rawlins/feis_prmp.html. Accessed November 1, 2012.
- Bureau of Land Management (BLM). 2008a. GIS Data of Visual Resource Management Classes, Alternative 4. Provided by L. McCarthy, BLM Rawlins Field Office to B. Read, AECOM. 2008.
- Bureau of Land Management (BLM). 2008b. GIS Data of Allotment Boundaries. Provided by D. Kile, BLM Rock Springs Field Office to J. Thoene, AECOM. October 2008.

- Bureau of Land Management (BLM). 2007. Potential Fossil Yield Classification (PFYC) System for Paleontological Resources on Public Land, Instruction Memorandum No. 2008-009, October 15, 2007. <http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/laws-and-policy.html>. Accessed November 1, 2012.
- Bureau of Land Management (BLM). 2006a. Monell Enhance Oil Recovery Project Environmental Assessment. EA N0. WY-040-EA05-161. BLM Rock Springs Field Office, February 2006.
- Bureau of Land Management (BLM). 2006b. Integration of Best Management Practices into Application for Permit to Drill Approvals and Associated Rights-of-Way. Instruction Memorandum No. 2007-021, November 8, 2006.
- Bureau of Land Management (BLM). 2005. Environmental Assessment for the Bitter Creek Shallow Oil and Gas Project, Sweetwater County, Wyoming. Rock Springs Field Office, Rock Springs, Wyoming. June 2005.
- Bureau of Land Management (BLM). 2003. Decision Record, Finding of No Significant Impact and Environmental Assessment for the Copper Ridge Shallow Gas Exploration and Development Project. Rock Springs Field Office. December 2003.
- Bureau of Land Management (BLM). 2001. Federal Land Policy and Management Act of 1976 (90 Stat. 2743; 43 United States Code 1601, et seq).
- Bureau of Land Management (BLM). 1998a. Paleontological Resource Management. BLM Manual 8270. <http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/laws-and-policy.html>. Accessed November 1, 2012.
- Bureau of Land Management (BLM). 1998b. General Procedural Guidance for Paleontological Resource Management. BLM Handbook H-8270-1. <http://www.blm.gov/wo/st/en/prog/more/CRM/paleontology/laws-and-policy.html>. Accessed November 1, 2012.
- Bureau of Land Management (BLM). 1997. Record of Decision and Green River Resource Management Plan. BLM Rock Springs District Office, Green River Resource Area, Rock Springs, Wyoming, October 1997.
- Bureau of Land Management (BLM). 1985. BLM Manual 9113, Roads. Release 9-247, U.S. Department of the Interior.
- Case, J. C., C. S. Arneson, and L. L. Hallberg. 1998. GIS Dataset: Surficial Geology of Wyoming at 1:500,000-scale. Laramie, Wyoming.
- Center for Climate Strategies (CCS). 2007. Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990-2020.
- Cole, E. K., M. D. Pope, and R. G. Anthony. 1997. Effects of Road Management on Movement and Survival of Roosevelt Elk. *Journal of Wildlife Management* 61(4): 1115-1126.
- Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.
- Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to Manage Sage Grouse Populations and Their Habitats. *Wildlife Society Bulletin* 28(4): 967-985.

- Enhanced Oil Recovery Institute (EORI). 2003. About EORI. University of Wyoming. <http://www.uwyo.edu/eori/about/>. Accessed April 30, 2013.
- Federal Land Managers' Air Quality Related Values Workgroup (FLAG). 2010. Phase I Report—Revised (2010), Natural Resource Report NPS/NRPC/NRR—2010/232, October 2010.
- Fitzgerald, J. P., C. A. Meaney, and D. M. Armstrong. 1994. Mammals of Colorado. University Press of Colorado Publishing, Niwot, Colorado.
- Gaines, J. 2008. Monell Unit CO₂, Patrick Draw Field, Sweetwater County, Wyoming. Anadarko Petroleum Corporation, May 28, 2008.
- GeoCommunicator. 2012. Allotment Data. Retrieved from <http://www.geocommunicator.gov/blmMap/Map.jsp?MAP=GA&MAP=ENERGY>.
- Griscom, H., D. A. Keinath, and M. D. Anderson. 2010. Pocket gopher surveys in western Wyoming, final project report. Report prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming. February 2010.
- Harlow, D. L. and P. H. Bloom. 1987. Buteos and the Golden Eagle In: Proceedings of the Western Raptor Management Symposium and Workshop. National Wildlife Federation Science and Technology Series No. 12. Washington D.C.
- Holbrook, H. T. and M. R. Vaughan. 1985. Influence of Roads on Turkey Mortality. *Journal of Wildlife Management* 49(3): 611-614.
- Holloran, M. J. 2005. Greater Sage-grouse (*Centrocercus urophasianus*) Population Response to Natural Gas Field Development in Western Wyoming. PhD Dissertation, University of Wyoming, Laramie, Wyoming.
- Holmes, T. L., R. L. Knight, L. Stegall, and G. R. Craig. 1993. Responses of Wintering Grassland Raptors to Human Disturbance. *Wildlife Society Bulletin*. 21(4):461-468.
- Howard, A. D. and J. W. Williams. 1972. Physiography In: Mallory, W.W., (editor), *Geologic Atlas of the Rocky Mountain Region: Denver, Colorado; Rocky Mountain Association of Geologists*; pp. 29-31.
- Holzworth. 1972. Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States. USEPA AP-101. Office of Air Programs, Research Triangle Park, North Carolina.
- Interagency Monitoring of Protected Visual Environments (IMPROVE). 2012. VIEWS 2.0 Database for Data Collected at Bridger (site BRID1). <http://views.cira.colostate.edu/web/Trends/>. Accessed November 2012.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Synthesis Report – Summary for Policymakers. Cambridge University Press. Cambridge, England, and New York, New York.
- Isaacs, A., B. Mordick, and A. Williams Anthony. 2009. Enhanced Oil Recovery by CO₂ Injection, Powder River and Washakie Basins, Wyoming [abstr]. American Association of Petroleum Geologists Annual Convention and Exhibition, Denver, Colorado, June 7-10, 2009.
- Johnsgard, P. A. 1990. Hawks, Eagles, and Falcons of North America. Smithsonian Institution Press, Washington, D.C. 403 pp.

- Johnsgard, P. A. 1988. North America Owls: Biology and Natural History. Smithsonian Institution Press, Washington, D.C. 295 pp.
- Johnson, D. E. 2012. Historical Assessment of Lincoln Highway Segments in and Adjacent to the Anadarko Petroleum Corporation Monell and Arch Units, Sweetwater County, Wyoming. September 17, 2012.
- Kaeding, L., B. Burdick, P. Schrader, and W. Noonan. 1986. Recent Capture of a Bonytail (*Gila elegans*) and Observations on the Nearly Extinct Cyprinid from the Colorado River. *Copeia* 1986: 1021-1023.
- Keinath, D. A., M. D. Anderson, and G. P. Beauvais. 2010. Range and Modeled Distribution of Wyoming's Species of Greatest Conservation Need. Report Prepared by the Wyoming Natural Diversity Database, Laramie Wyoming for the Wyoming Game and Fish Department, Cheyenne, Wyoming and the U.S. Geological Survey, Fort Collins, Colorado. August 20, 2010.
- Keith, R., C. Gill, and K. Gelwicks. 2003. Progress Report. Green River Watershed Native Non-Game Fish Species Research: Phase I. Submitted to BLM by Wyoming Game and Fish Department, Green River and Laramie Offices. Agreement Number 02-FC-40-6870.
- Kent, H. C. 1972. Review of Phanerozoic History: In: Mallory, W. W., (editor). *Geologic Atlas of the Rocky Mountain Region: Denver, Colorado*; Rocky Mountain Association of Geologists; pp. 56-59.
- LaGory, K. E., Y. S. Chang, K. C. Chun, T. Reeves, R. Liebich, and K. Smith. 2001. A Study of the Effects of Gas Well Compressor Noise on Breeding Bird Populations of the Rattlesnake Canyon Habitat Management Area, San Juan County, New Mexico. Final Report, May 2001. National Energy Technology Laboratory, National Petroleum Technology Office, U.S. Department of Energy, Tulsa, Oklahoma.
- Love, J. D., A. C. Christiansen, and A. J. Ver Ploeg. 1993. Stratigraphic Chart Showing Phanerozoic Nomenclature for the State of Wyoming; Wyoming Geological Survey Map Series No. 41, Laramie; Wyoming.
- Love, J. D. and A. C. Christiansen. 1985. Geologic Map of Wyoming; U.S. Geological Survey, scale 1:500,000.
- Lyon, A. G. and S. H. Anderson. 2003. Potential Gas Development Impacts on Sage Grouse Nest Initiation and Movement. *Wildlife Society Bulletin* 31(2): 486-491.
- Maddux, H., L. Fitzpatrick, and W. Noonan. 1993. Colorado River Endangered Fishes Critical Habitat. Biological Support Document. U.S. Department of the Interior, Fish and Wildlife Service, Utah/Colorado Field Office, Salt Lake City, Utah, 225 pp.
- Malm, W. C. 1999. Introduction to Visibility. Air Resources Division National Park Service Cooperative Institute for Research in the Atmosphere (CIRA) NPS Visibility Program Colorado State University Fort Collins, Colorado 80523 Under Cooperative Agreement CA2350-97-001: T097-04, T098-06. May 1999.
- Medina, K. 2011. Wyoming Department of Environmental Quality, Water Quality Division, Casper Office. Personal communication with AECOM. January 20, 2011.
- McMahon, P., P. von Guerard, B. Ruddy, J. Kinard, J. Dupree, and R. Zuellig. 2007. Regional Framework for Water-resources Monitoring Related to Energy Exploration and Development. U.S. Geological Survey, Colorado Water Science Center. September 30, 2007.

- Miller, W., J. Valentine, D. Archer, H. Tyus, R. Valdez, and L. Kaeding. 1982. Colorado River Fishery Report. U.S. Fish and Wildlife Service, Salt Lake City, Utah.
- Munn, L. C. and C. S. Arneson. 1999. Draft 1:100,000-Scale Digital Soils Map of Sweetwater County. University of Wyoming Agricultural Experiment, Laramie, Wyoming. Internet website: <http://www.sdvc.uwyo.edu/100k/soil100.html>.
- National Academy of Sciences. 2010. Advancing the Science of Climate Change. National Academic Press. Washington, D.C.
- National Atmospheric Deposition Program. 2012. National Trends Network: <http://nadp.sws.uiuc.edu/NTN/>. Accessed October 2012.
- National Park Service (NPS). 2011. AQRV Definition, <http://www.nature.nps.gov/air/permits/aris/aqrv.cfm>. Accessed July 2011.
- Natural Resources Conservation Service (NRCS). 2012a. Partial Soil Survey Geographic (SSURGO) Database for Sweetwater County Area, Wyoming. Internet website: <http://SoilDataMart.nrcs.usda.gov/>. June 27, 2012.
- Natural Resources Conservation Service (NRCS). 2012b. Plants Database. Internet website: <http://plants.usda.gov/java/>. Accessed November 2012.
- Natural Resources Conservation Service (NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.
- Natural Resources Conservation Service (NRCS). 2002. <ftp://ftp.wcc.nrcs.usda.gov/support/climate/wetlands/wy/56037.txt>. Accessed May 3, 2011.
- Natural Resources Conservation Service (NRCS)-Soil Quality Institute. 2001. Rangeland Soil Quality-Wind Erosion. 2 pp. Internet website: <http://soils.usda.gov/sqi>.
- Nicholoff, S. H., compiler. 2003. Wyoming Bird Conservation Plan, Version 2.0. Wyoming Partners in Flight. Wyoming Game and Fish Department, Lander, Wyoming.
- Petersen, M. D., A. D. Frankel, S. C. Harmsen, C. S. Mueller, K. M. Haller, R. L. Wheeler, R. L. Wesson, Y. Zeng, O. S. Boyd, D. M. Perkins, N. Luco, E. H. Field, C. J. Wills, and K. S. Rukstales. 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps. U.S. Geological Survey Open-File Report 2008-1128. 61 pp.
- Postovit, H. R. and B. C. Postovit. 1987. Impacts and Mitigation Techniques. In: Raptor Management Techniques Manual. National Wildlife Federation, Washington D. C.
- Reijnen, R., R. Foppen, C. T. Braak, and J. Thissen. 1995. The Effects of Car Traffic on Breeding Bird Populations in Woodland. III. Reduction of Density in Relation to the Proximity of Main Roads. *Journal of Applied Ecology*.
- Reijnen, R., R. Foppen, and H. Meeuwssen. 1996. The Effects of Traffic on the Density of Breeding Birds in Dutch Agricultural Grasslands. *Biological Conservation*. 31(1): 95-101.
- Reijnen, R., R. Foppen, and G. Veenbaas. 1997. Disturbance by Traffic of Breeding Birds: Evaluation of the Effect and Considerations in Planning and Managing Road Corridors. *Biodiversity and Conservation* 6(4): 567-581.

- Robson, S. G. and E. R. Banta. 1995. Ground Water Atlas of the United States. Arizona, Colorado, New Mexico, Utah. USGS HA 730-C. http://pubs.usgs.gov/ha/ha730/ch_c/index.html. Accessed January 18, 2011.
- Roehler, H. W. 1993. Stratigraphy of the Upper Cretaceous Fox Hills Sandstone and Adjacent Parts of the Lewis Shale and Lance Formation, East Flank of the rock Springs Uplift, Southwest Wyoming. USGS PP 1532. Washington, D.C. http://pubs.er.usgs.gov/djvu/PP/pp_1532.djvu. Accessed April 11, 2011.
- Roehler, H. W. 1992. Correlation, Composition, Areal Distribution, and Thickness of Eocene Stratigraphic Units, Greater Green River Basin Wyoming, Utah, and Colorado. USGS PP 1506-E. http://pubs.er.usgs.gov/djvu/PP/pp_1506_e.djvu. Accessed January 18, 2011.
- Ryder, R. T., L. W. Lee, W. F. Agena, and R. C. Anderson. 1989. Seismic Profile through Patrick Draw – Table Rock Area, East Flank Rock Springs Uplift, Wyoming; In: Eisert, J. L., Ed. 1992, Gas Resources of Wyoming, Wyoming Geological Association 40th Field Conference Guidebook, Casper, Wyoming, pp. 209-230.
- Sawyer, H., R. Nielson, and D. Strickland. 2009. Sublette Mule Deer Study (Phase II): Final Report 2007 Western Ecosystems Technology, Inc. Cheyenne, Wyoming, US.
- Sawyer, H., R. M. Nielson, F. Lindzey, and L. L. McDonald. 2006. Winter Habitat Selection of Mule Deer Before and During Development of a Natural Gas Field. *Journal of Wildlife Management* 70(2): 396-403.
- Schmutz, J. K. 1984. Ferruginous and Swainson's Hawk Abundance and Distribution in Relation to Land Use in Southeastern Alberta. *Journal of Wildlife Management* 48(4): 1180-1184.
- Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage Grouse (*Centrocercus urophasianus*). Pages 1-28 In: A. Poole and F. Gill, editors. *The Birds of North America*, No 425. The Birds of North America, Philadelphia, Pennsylvania, USA.
- Sims, P. K., C. A. Finn, and V. L. Rystrom. 2001. Preliminary Precambrian Basement Map Showing Geologic-geophysical Domains, Wyoming: U.S. Geological Survey Open-file Report 01-199.
- Skeeters, W. W. and L. A. Hale. 1972. Southern Wyoming in Mallory, W.W., (editor), *Geologic Atlas of the Rocky Mountain Region: Denver, Colorado*; Rocky Mountain Association of Geologists; pp. 274-276.
- Stainbrook, J. 2012. Email Correspondence from J. Stainbrook, Western Archaeological Services, to K. Munson, AECOM. December 10, 2012.
- Stalmaster, M. V. and J. R. Newman. 1978. Behavioral Responses of Wintering Bald Eagles to Human Activity. *Journal of Wildlife Management* 42(3): 506-513.
- Stokes, D. W. and L. Q. Stokes. 1996. *Field Guide to Birds: Western Region*. Little, Brown, and Company.
- Thompson, S. P., R. S. Johnstone, and C. D. Littlefield. 1982. Nesting History of Golden Eagles in Malheur- Harney Lakes Basin, Southeastern Oregon. *Journal of Raptor Research* 16(4): 116-122.
- U.S. Army Corps of Engineers (USACE). 1987. *Corps of Engineers Wetland Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

- U.S. Bureau of Economic Analysis (BEA). 2012a. Total Full-time and Part-time Employment by NAIC industry. Table CA25N. <http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1#reqid=70&step=1&isuri=1>. Accessed October 18, 2012.
- U.S. Bureau of Economic Analysis (BEA). 2012b. Personal Income by Major Source and Earnings by NAIC industry. Table CA05N. <http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1#reqid=70&step=1&isuri=1>. Accessed October 18, 2012.
- U.S. Bureau of Economic Analysis (BEA). 2010a. Total Full-time and Part-time Employment by SIC Industry. Table CA25. <http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1#reqid=70&step=1&isuri=1>. Accessed April 5, 2011.
- U.S. Bureau of Economic Analysis (BEA). 2010b. Personal Income by Major Source and Earnings by SIC Industry. Table CA06. <http://www.bea.gov/iTable/iTable.cfm?reqid=70&step=1#reqid=70&step=1&isuri=1>. Accessed April 27, 2011.
- U.S. Bureau of Labor Statistics. 2012. Local Area Unemployment Statistics. <http://data.bls.gov/pdq/SurveyOutputServlet>. Accessed October 2012.
- U.S. Census Bureau. 2012a. State and County Quick Facts. <http://quickfacts.census.gov/qfd/index.html>. Accessed October 2012.
- U.S. Census Bureau. 2012b. American Fact Finder. <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. <http://quickfacts.census.gov/qfd/index.html>. Accessed October 2012.
- U.S. Census Bureau. 2012c. American Fact Finder. Profile of General Population and Housing Characteristics. Table DP-1. <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. Accessed October 19, 2012.
- U.S. Census Bureau. 2003. 2000 Census of Population and Housing. Wyoming 2000, Issued April 2003. <http://www.census.gov/prod/cen2000/phc-2-52.pdf>. Accessed October 19, 2012.
- U.S. Census Bureau. 2000. Census 2000, Demographic Profiles American Fact Finder. <http://censtats.census.gov/pub/Profiles.shtml>. Accessed October 2012.
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), and U.S. Environmental Protection Agency (USEPA). 2010. Watershed Boundary Dataset for Wyoming. Accessed on January 19, 2011, at: <http://datagateway.nrcs.usda.gov>.
- United States Department of Commerce, United States Census Bureau, Geography Division. 2009. TIGER/Line Shapefile, Sweetwater County, Wyoming, All Lines Shapefile. Internet website: <http://www2.census.gov/cgi-bin/shapefiles2009/national-files>. Accessed August 2009.
- U.S. Department of the Interior and United States Department of Agriculture. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado. 84 pp.
- U.S. Environmental Protection Agency (USEPA). 2012a. AirData Monitor Values Report: http://www.epa.gov/airdata/ad_rep_mon.html Accessed October 2012.
- U.S. Environmental Protection Agency (USEPA). 2012b. Clean Air Status and Trends Network (CASTNET): <http://epa.gov/castnet/javaweb/index.html>. Accessed October 2012.

- U.S. Environmental Protection Agency (USEPA). 2011a. National Ambient Air Quality Standards: <http://www.epa.gov/air/criteria.html#3>. Accessed June 2011.
- U.S. Environmental Protection Agency (USEPA). 2011b. Climate Change – Science – State of Knowledge. Internet website: <http://www.epa.gov/climatechange/science/stateofknowledge.html>. Accessed June 2011.
- U.S. Environmental Protection Agency (USEPA). 2008. Draft Supplemental Environmental Impact Statement (DSEIS) Red Dog Mine Extension – Aqqaq Project Volume I. Seattle, Washington.
- U.S. Environmental Protection Agency (USEPA). 1990. New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting (Draft). Office of Air Quality Planning and Standards. October 1990.
- U.S. Environmental Protection Agency (USEPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974. <http://www.nonoise.org/library/levels74/levels74.htm> Accessed June 3, 2010.
- U.S. Fish and Wildlife Service (USFWS). 2013. Letter to Wyoming Game and Fish Department Regarding Reevaluation of the Block Clearance Process for the Black-footed Ferret in Wyoming. March 6, 2013.
- U.S. Fish and Wildlife Service (USFWS). 2012a. National Wetland Inventory (NWI) dataset. Accessed on October, 2012 at <http://www.fws.gov/wetlands/>.
- U.S. Fish and Wildlife Service (USFWS). 2012b. GIS Data of National Wetlands Inventory. April 2012.
- U.S. Fish and Wildlife Service (USFWS). 2012c. Federally Listed, Proposed, and Candidate Species in Wyoming. Internet website: http://www.fws.gov/wyominges/Pages/Species/Species_Endangered.html. Accessed November 30, 2012.
- U.S. Fish and Wildlife Service (USFWS). 2010. Federal Endangered, Threatened, Proposed, and Candidate Species and Designated Critical Habitats that occur in or may be affected by Projects in Sweetwater County, Wyoming. Last updated July 2010.
- U.S. Fish and Wildlife Service (USFWS). 2008. Conclusion of Section 7 Consultation for the Little Canyon Project Natural Gas Development Project Proposed by XTO. FWS/R6 ES/UT 06-F-0309; 6-UT-09-F-003. Memorandum from Utah Field Supervisor, Ecological Services, West Valley City, Utah. December 4, 2008.
- U.S. Fish and Wildlife Service (USFWS). 2002a. Bonytail (*Gila elegans*) Recovery Goals: Amendment and Supplement to the Bonytail Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region 6, Denver, Colorado.
- U.S. Fish and Wildlife Service (USFWS). 2002b. Colorado Pikeminnow (*Ptychocheilus lucius*) Recovery Goals: Amendment and Supplement to the Colorado Squawfish Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region 6, Denver, Colorado.
- U.S. Fish and Wildlife Service (USFWS). 2002c. Humpback Chub (*Gila cypha*) Recovery Goals: Amendment and Supplement to the Humpback Chub Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region 6, Denver, Colorado.

- U.S. Fish and Wildlife Service (USFWS). 2002d. Razorback Sucker (*Xyrauchen texanus*) Recovery Goals: Amendment and Supplement to the Razorback Sucker Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver Colorado.
- U.S. Fish and Wildlife Service (USFWS). 1989. The Black-footed Ferret Survey Guidelines for Compliance with the Endangered Species Act. Denver, Colorado and Albuquerque, New Mexico.
- U.S. Fish and Wildlife Service (USFWS). 1987. Final Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Region 6, Denver, Colorado, September 29, 1987.
- U.S. Forest Service (USFS). 2011. Lake Water Chemistry Provided by the D. Miller of the USDA Forest Service, January 2011.
- U.S. Geological Survey (USGS). 2012. National Hydrography Dataset (High Resolution) – Waterbodies. Internet website: <http://nhd.usgs.gov/data.html>. Accessed February 2012.
- U.S. Geological Survey (USGS). 2011. National Hydrography Dataset. GIS Dataset. Reston, Virginia. <ftp://nhdftp.usgs.gov/DataSets/Staged/SubRegions/PersonalGDB/HighResolution/>. Accessed April 8, 2011.
- U.S. Geological Survey (USGS). 2008. GIS Raster Data of National Gap Analysis Program Land Cover Data. December 2008.
- U.S. Geological Survey (USGS). 2006. Quaternary Fault and Fold Database for the United States. <http://earthquake.usgs.gov/hazards/qfaults/>. Accessed October 30, 2012.
- U.S. Geological Survey (USGS). 2004. National Gap Analysis Program. Southwest Regional GAP Analysis Project Data. RS/GIS Laboratory, College of Natural Resources, Utah State University.
- U.S. Geological Survey (USGS). 2002. Assessment of Undiscovered Oil and Gas Resources of the Southwestern Wyoming Province, 2002. U.S. Geological Survey Fact Sheet FS-145-02; November 2002, 2 pp.
- Utah Department of Natural Resources. 2006. Range-wide Conservation Agreement and Strategy for Roundtail Chub (*Gila robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomas latipinnis*). Prepared for the Colorado River Fish and Wildlife Council. Salt Lake City, Utah.
- Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. Greater Sage-grouse Population Response to Energy Development and Habitat Loss. *Journal of Wildlife Management* 71(8): 2644-2654.
- Ward, A. L. 1976. Elk Behavior in Relation to Timber Harvest Operations and Traffic on the Medicine Bow Range in South-central Wyoming. In: *Proceedings Elk-Logging-Roads Symposium*, ed. S.R. Hieb. Pp.32-43. Moscow, University of Idaho.
- Watson, J.E. (ed.), 1980, *Catalog of Wyoming Stratigraphy*. Tooke Engineering; Casper, Wyoming, not paginated.
- Weimer, R. 1966. Time-Stratigraphic Analysis and Petroleum Accumulations, Patrick Draw Field, Sweetwater County, Wyoming: *American Association of Petroleum Geologists Bulletin* Vol. 50, No. 10 (October), pp. 2150- 2175.

- Western Archaeological Services (WAS). 2012. Email Correspondence from J. Pastor, Western Archaeological Services, to K. Munson, AECOM. October 17, 2012.
- Western Regional Climate Center. 2012. Western U.S. Historical Summaries (individual stations) <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy7845>. Accessed October 2012.
- Wetland Training Institute. 1995. Wetland Training Institute, Inc. (WTI). 1995. Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual. Poolesville, Maryland. WTI 95-3.
- Whitehead. 1996. Ground Water Atlas of the United States. Montana, North Dakota, South Dakota, Wyoming. USGS HA 730-I. http://pubs.usgs.gov/ha/ha730/ch_i/index.html. Accessed January 18, 2011.
- Woffinden, N. D. and J. R. Murphy. 1989. Decline of a Ferruginous Hawk Population: A 20-year Summary. *Journal of Wildlife Management* 53(4).
- Wyoming Department of Administration and Information. 2011. Wyoming Sales, Use, and Lodging Tax Revenue Report. http://eadiv.state.wy.us/s&utax/Report_FY11.pdf. Accessed October 18, 2012.
- Wyoming Department of Agriculture. 2012. Weed and Pest Declared List (By County) Amended February 2012. Available at www.wyoweed.org
- Wyoming Department of Employment. 2012. Occupational Employment and Wages March 2012. <http://doe.state.wy.us/LMI/EDSMarch2012/TOC000.htm>. Accessed October 19, 2012.
- Wyoming Department of Environmental Quality (WDEQ). 2012a. WYPDES Storm Water Program, Active Storm Water Permit Authorizations under the Mineral Mining General Permit. http://deq.state.wy.us/wqd/WYPDES_Permitting/WYPDES_Storm_Water/stormwater.asp. Accessed November 1, 2012.
- Wyoming Department of Environmental Quality (WDEQ). 2012b. Wyoming Water Quality Assessment and Impaired Waters List (2012 Integrated 205(b) and 303(d) Report). Document #12-0203. Cheyenne, Wyoming. <http://deq.state.wy.us/wqd/watershed/>. Accessed September 11, 2012.
- Wyoming Department of Environmental Quality (WDEQ). 2012c. Wyoming Department of Environmental Quality Air Quality Division Standards and Regulations: http://deq.state.wy.us/aqd/std/Chapter2_10-21-09FINAL_CLEAN.pdf. Accessed October 2012.
- Wyoming Department of Environmental Quality (WDEQ). 2012d. Wyoming Air Quality Monitoring Network: <http://www.wyvisnet.com/reports.aspx>. Accessed October 2012.
- Wyoming Department of Environmental Quality (WDEQ). 2010. Revised WDEQ Permitting Guidance: Oil and Gas Production Facilities. WDEQ. March 2010.
- Wyoming Department of Environmental Quality (WDEQ). 2005. Wyoming Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters. April 26, 2005. Cheyenne, Wyoming. http://deq.state.wy.us/wqd/wqdrules/Chapter_08.pdf. Accessed on April 12, 2011.
- Wyoming Department of Environmental Quality (WDEQ). 2004. Source Water Assessment Program Final Report and GIS Delineations. Trihydro Corporation. Laramie, Wyoming. Report accessed on January 25, 2011; GIS data. <http://deq.state.wy.us/wqd/www/SWP%20WHP/index.asp>. Accessed April 27, 2006.

- Wyoming Department of Revenue, 2011. 2010-2011 Annual Report. <http://revenue.wyo.gov/dor-annual-reports>. Accessed October 19, 2012.
- Wyoming Department of Transportation. 2011. Vehicle Miles 2010, Planning Program. <http://www.dot.state.wy.us/files/content/sites/wydot/files/shared/Traffic/traffic%20data/2010/2010%20VMB%20Book.pdf>. Accessed October 19, 2012.
- Wyoming Game and Fish Department (WGFD). 2012. Letter Submitted to the BLM, Rock Springs Office. WGFD, Cheyenne, Wyoming, October 29, 2012.
- Wyoming Game and Fish Department (WGFD). 2011. GIS data of Antelope Seasonal Range Boundaries – 2011 for Wyoming at 1:100,000
- Wyoming Game and Fish Department (WGFD). 2010a. Wyoming State Wildlife Action Plan. Prepared by the Wyoming Game and Fish Department.
- Wyoming Game and Fish Department (WGFD). 2010b. GIS Data for Sage-grouse Core Areas. <http://gf.state.wy.us/web2011/wildlife-1000382.aspx>. Accessed June 2010.
- Wyoming Game and Fish Department (WGFD). 2009. The Wyoming Mule Deer Initiative. Prepared by the Mule Deer Working Group, Wyoming Game and Fish Department. April 24, 2009.
- Wyoming Game and Fish Department (WGFD). 2004. Atlas of Birds, Mammals, Reptiles, and Amphibians in Wyoming. Wyoming Game and Fish Department, Wildlife Division. July 2004.
- Wyoming Geological Association. 1992. Oil and Gas Fields Symposium of the Greater Green River Basin and Overthrust Belt. Wyoming Geological Association, Casper, Wyoming.
- Wyoming Natural Diversity Database (WYNDD). 2012. Data Compiled for J. Schlangen, Completed November 29, 2012. Unpublished report. Wyoming Natural Diversity Database, University of Wyoming, Laramie, Wyoming.
- Wyoming Natural Diversity Database (WYNDD). 2007. 2007 Wyoming Plant Species of Concern List. Wyoming Natural Diversity Database, University of Wyoming. March 20, 2007. http://www.uwyo.edu/wyndd/_files/docs/soc-plants/2007_plant_soc.pdf.
- Wyoming Office of State Lands and Investments. 2011. Wyoming State Lands – About Us. <http://lands.state.wy.us/index.php/component/content/article/97-agency/85-about-us>. Accessed June 9, 2010.
- Wyoming Oil and Gas Conservation Commission (WOGCC). 2012. Online Database, Statistics and Field Summaries.
- Wyoming Oil and Gas Conservation Commission (WOGCC). 2010. WOGCC Rules and Regulations, Chapter 4, Rule 402.
- Wyoming State Engineer's Office. 2013. Personal Communication with J. Manley and M. Ebsen, Anadarko Petroleum Company, Denver, Colorado, February 12, 2013.
- Wyoming State Engineer's Office (WSEO). 2012a. WSEO e-Permit Online Interface. Search Water Rights by Location Parameters. <https://seoweb.wyo.gov/e-Permit/Common/Home.aspx>. Accessed December 4, 2012.

Wyoming State Engineer's Office (WSEO). 2012b. Water Wells for Wyoming at 1:5,000,000. GIS Database: ftp://seoftp.wyo.gov/geolibrary_data/SEOWells.zip. Accessed March, 2012.

Wyoming State Geological Survey. 2012. Landslides in Wyoming. <http://www.wrds.uwyo.edu/wrds/wsgs/hazards/landslides/lshome.html>. Accessed October 30, 2012.

Wyoming Tourism. 2011. Places To Stay. <http://www.wyomingtourism.org/placestostay>.
<http://censtats.census.gov/pub/Profiles.shtml>. Accessed April 27, 2011.

Appendix A

Summary of Public Review Comments

Table A-1 Summary of Public Review Comments

[Note: A summary of each comment is provided below. The exact text of each comment is provided in a separate file that is posted on the BLM website.]

No.	Public Review Comment Summary	BLM Response
AH-1	Careful consideration should be made in regard to the number of wells in combination with other activities such as oil and gas development, power plants, and mining.	Detailed impact analyses are provided in Chapter 4 of the EA including direct and indirect effects of the Proposed Action in Section 4.1 and cumulative effects in Section 4.2.
AH-2	The effects of air emissions and other project activities should be evaluated for wildlife.	Direct and indirect effects of the Proposed Action on wildlife resources are provided in Section 4.1.7 and cumulative effects in Section 4.2.7. Existing protection measures for wildlife involving GRRMP policy and guidance are referenced in these sections. Additional NEPA analysis at the APD level will provide site specific analysis and potential impact identification that will guide implementation of BMPs and conditions of approval (COAs).
AH-3	The analysis should consider the amount of activity in the area.	See the response to comment AH-1 regarding cumulative impact analyses.
BB-1	Please record me as opposed to the proposed Monell/Arch Oil and Gas Development.	Comment noted.
BB-2	The Patrick Draw Field already displaces wildlife, which is an important resource in Wyoming. Please protect wildlife resources.	Impacts to wildlife resources are discussed in Sections 4.1.7 and 4.1.8 of the EA. Potential displacement of wildlife species is discussed as one of the impact topics. The analysis concludes that displacement would be short-term in duration, with animals returning following the completion of project construction and drilling activities. Protection for wildlife resources would be provided by GRRMP policy and guidance involving avoidance of sensitive periods and buffers from disturbance areas.
APC-1	Given the minimal potential environmental impacts and the mitigation measures that are suggested, APC believes a "Finding of No Significant Impacts" is appropriate.	Comment noted.
APC-2	The proposed mitigation measures found in the EA are inconsistent with the impact analysis and should be adjusted to not render overly burdensome and unnecessary mitigation. For example, the protection measure for ferruginous hawk on page 4-18 is worded differently compared to page 4-45.	The reference to protection measures for ferruginous hawk on page 4-18 is a BLM GRRMP management measure for protecting this species. Reference to this management measure and condition of approval on page 4-45 was revised to include the term "controlled use."

Table A-1 Summary of Public Review Comments

[Note: A summary of each comment is provided below. The exact text of each comment is provided in a separate file that is posted on the BLM website.]

No.	Public Review Comment Summary	BLM Response
APC-3	Section 3.9.1.2 implies PSD applicability was evaluated based on the CO ₂ e emissions from the entire project. PSD applicability will be evaluated based on each individually permitted source.	The sentence in question was revised to state: “PSD applicability is determined for each individually permitted source. Given that this level of detail is not available for this study, the project was conservatively assumed to have the potential of being a PSD major source when considering its overall potential to emit CO ₂ e.”
APC-4	Section 4.1.9.2 states that the modeling analysis indicated modeled impacts for all scenarios evaluated for the CD-C project were below the AAQS. It is incorrect to state that there were no direct impacts.	The statement in the EA is correct given the context of the statement. Direct impacts, as defined for the EA, do not include background conditions, only project-related effects; rather it is an analysis of the “Direct Modeled” results presented in Chapter 3 of the CD-C Air Quality Technical Support Document. There was no AAQS violation exceedances modeled when only the project sources were accounted for in the modeling results. A clarification of what is meant by “direct” impacts was added to Section 4.1.2.9. The inclusion of background does result in some exceedances at some distances evaluated in the CD-C study. These exceedances are discussed in Section 4.2.9.1.
APC-5	The NEPA process does not precede existing legal rights. APC has valid existing rights to conduct exploration and development within the project area.	Comment noted.
APC-6	The environmental impacts in Section 4.0 are not described in a consistent manner, suggesting different interpretations throughout the development stage of this project, thereby creating a climate of uncertainty for the proponent to exercise prior existing rights.	The resource impact sections were revised to use the terms “relatively low” impacts. The terms “minimal” and “minor” were deleted where appropriate.
APC-7	Mitigation measures must recognize the balance between minimizing impacts and the legal rights of leaseholders. Overly burdensome mitigation that is inconsistent with the assessed impacts or seeks to eliminate all impacts could result in a violation of leaseholder’ rights.	The resource protection measures identified are consistent with BMPs and the GRRMP.

Table A-1 Summary of Public Review Comments

[Note: A summary of each comment is provided below. The exact text of each comment is provided in a separate file that is posted on the BLM website.]

No.	Public Review Comment Summary	BLM Response
APC-8	The EA misrepresents the traffic numbers. In reference to Table 2-1, the number of round trips for well pad construction should be 375.	Text has been modified per comment. Table 2-1 has been updated as well as corresponding text in Transportation, Section 4.1.11.
None	Request	No response required for request.
CLG-2*	The Coalition requests that the BLM and the proponent closely coordinate the project implementation and reclamation with Coalition members.	The BLM has noted your comment and will share your request with the proponent as appropriate.
CLG-3	The BLM must assure consistency with the County Commissions and Conservation Districts' local plans and policies to the extent practical, consistent with federal law.	The Proposed Action and No Action Alternative are in conformance with the GRRMP, and all applicable federal, state, and local laws, as identified in Table 1-2.
CLG-4	The Coalition members support energy development because it benefits their local economy, is part of the custom and culture, and such development is consistent with the local plans and policies.	Comment noted.
CLG-5	The Green River RMP directs the management of federal lands within the proposed development area for the Monell/Arch Units Oil and Gas Development.	This information is discussed in Section 1.4 of the EA.
CLG-6	For the reasons mentioned in CLG-4 and CLG-5, the Coalition supports the Proposed Action.	Comment noted.
CLG-7	The Coalition requests that its members be kept informed about any proposed changes which will affect the size of the surface disturbance.	This EA addresses the programmatic development of the Monell/Arch Units Oil and Gas Development. All future APDs received would have additional site-specific NEPA analysis. The Coalition can contact the BLM regarding the status of development.
CLG-8	The EA must define when construction is considered complete and intra-reclamation must begin immediately as soon as the production equipment is set. Additional reclamation techniques should be analyzed in the EA.	As defined in Chapter 2.0 of the EA, "Following initial construction, disturbed areas not needed for operational purposes would be reclaimed by grading, seeding, or other approved means of stabilization." During the APD process, a site-specific reclamation plan will be developed. All future APDs received would have additional site-specific NEPA analysis and would evaluate any additional reclamation techniques that may be required.

Table A-1 Summary of Public Review Comments

[Note: A summary of each comment is provided below. The exact text of each comment is provided in a separate file that is posted on the BLM website.]

No.	Public Review Comment Summary	BLM Response
None	Request	No response required for request.
CLG-10	The Coalition requests the development of a general noxious weed plan for the project that would then be further refined in the APD site-specific plans. Close coordination, and annual meetings with interested parties are requested.	This EA addresses the programmatic development of the Monell/Arch Units Oil and Gas Development. All future APDs received would have additional site-specific NEPA analysis based on the development of site-specific plans during that process. Refer to Sections 3.5.2 and 4.1.5.2 of the EA.
CLG-11	The Coalition requests that the applicant be required to use whatever seed mixture is necessary to reestablish native plants as soon as possible. The Coalition is concerned that a native seed mix will not be sufficient to re-establish native plants.	During the APD process, the BLM can determine if additional seed mixes for site-specific conditions are appropriate. Additional site-specific NEPA analysis would be conducted on the site-specific reclamation plan and any additional seed mixes would be identified at that time.
CLG-12	Ranchers in adjacent allotments should be allowed to participate in the development of a noxious weed plan or be a cooperating agency for any reclamation or development of a noxious weed plan.	A revision was made in the paragraph discussing noxious and invasive weeds in Section 4.1.14.2 of the EA. The revision stated that site-specific reclamation and noxious weed plans would be developed as part of the APD process. This is already stated in Section 4.1.5 of the EA.
CLG-13	Damage to rangeland improvements as a result of construction activities must be repaired immediately to previous condition or BLM Standards. Livestock operators and Coalition members should be allowed to comment as specific plans are developed.	See paragraph 6 in Section 4.1.14.2 regarding damage to rangeland improvements. Specific plans for activities outside of those described in this EA would require additional NEPA analysis. Comments for those plans would be submitted to the BLM during that process.
CLG-14	Consultation with livestock operators should occur during development of wells regarding mitigation and mutually beneficial development.	This EA addresses the programmatic development of the Monell/Arch Units Oil and Gas Development. Additional site-specific NEPA analysis would be conducted as part of the APD process. Livestock operators would be informed of well development activities and actions needed to minimize effects to livestock operations.

Table A-1 Summary of Public Review Comments

[Note: A summary of each comment is provided below. The exact text of each comment is provided in a separate file that is posted on the BLM website.]

No.	Public Review Comment Summary	BLM Response
CLG-15	Disturbance of sage grouse and their habitat is a major issue in southwest Wyoming because it is a candidate species. The Proposed Action does not impact any sage grouse core areas and construction would not occur in sage grouse breeding habitat. The Coalition supports the proponent's development plan, which minimizes impacts to sage grouse.	Comment noted.
CLG-16	Sweetwater County should be consulted prior to issuing Title V rights-of-way to the proponent or other entities performing work for this development on R.S. 2477 roads.	Title V is a section under FLMPA. There are no BLM RS2477 designated roads in the project area. The proponent would need to coordinate through Sweetwater County for these ROW permits.
CLG-17	The Coalition requests any road closures or road maintenance issues, including those that impact livestock grazing, be coordinated with its members, especially Sweetwater County.	All road closures (if required) and maintenance activities will be conducted in conformance with BLM policies and standards. Table 1-2 acknowledges that the proponent must coordinate with Sweetwater County regarding movement of heavy equipment and proper use and maintenance of roads.
CLG-18	The EA should list management requirements for dust control on roads constructed or used for this project.	Water will be applied to disturbance areas for fugitive dust control during dry and windy conditions, as described in Sections 2.2.3.1, 3.9.1.9, and 4.1.9.2 of the EA. Reference also is made to these dust control measures in Section 4.3 of the EA. The control measures would follow guidance in the GRRMP and the Wyoming Air Quality Standards and Regulations.
TRCP-1	Our comments focus on the ability for the BLM to properly manage fish and wildlife habitats under the Multiple-Use, Sustained Yield mandates required by law. Our comments also provide assistance on how to best balance the needs of energy development and the conservation of public lands.	Comment noted.

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TRCP-2	The TRCP's energy program developed a set of principles – FACTS for Fish and Wildlife – that call on the federal government and the energy industry to address funding, accountability, coordination, transparency, and science when making decisions on whether or how to allow energy development on lands that contain valuable fish and wildlife resources.	Thank you for your comment. The information on the FACTS sheet has been reviewed and considered.
TRCP-3	We are concerned that this EA and associated management activities administered by the BLM are not adequately or consistently addressing population objectives for sage grouse, mule deer or pronghorn set forth by the state wildlife agency.	Big game and sage-grouse are addressed in Sections 3.7.1, 3.8.1.1, 4.1.7.2, and 4.1.8.2 of the EA.
TRCP-4	Concern that the EA consider fishing, hunting, and wildlife related activities as important contributors to the economy.	Comment noted. Sections 4.1.7, 4.1.8, and 4.1.12 in the EA discuss hunting, fishing, and wildlife related topics.
TRCP-5	The TRCP is concerned that increasing energy development projects will fragment, degrade, and displace big game habitat on their respective seasonal ranges, migratory corridors, and stop-over areas.	Comment noted. Refer to Sections 3.7 and 4.1.7 of the EA.
TRCP-6	Energy development projects that disturb high, wind-swept plateaus (winter range) can adversely affect big game populations, hunting opportunities, and local economies.	Comment noted. Refer to Sections 3.7 and 4.1.7 of the EA.
TRCP-7	The EA needs to consider key scientific findings related to changes in use patterns of mule deer and pronghorn due to development.	Comment noted. Refer to Sections 3.7 and 4.1.7 of the EA.
TRCP-8	Energy development projects need to identify and protect crucial stop-over areas, migratory corridors, and winter ranges, and develop adequate designs and mitigation measures to minimize disturbance to big game.	Section 3.1.7 of the EA describes the location of big game ranges; Section 4.1.7 of the EA describes potential impacts to big game. Timing restrictions in winter/year-long habitat are included in the analysis, based on established regulations and policy to minimize disturbance to big game.

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TRCP-9	The TRCP is concerned with the effects that development projects have on sage-grouse and male lek attendance when located within 11 miles of a lek.	Section 4.1.8 of the EA describes potential impacts to sage-grouse and other special status wildlife. Given required timing restrictions outlined in the GRRMP, impacts to sage-grouse are anticipated to be low.
TRCP-10	The EA should include specific activities that protect and improve sagebrush ecosystems to reduce impacts to sage-grouse and improve land use patterns and population trends.	Protection measures discussed in Sections 4.1.5.2 and 4.1.7.2 in the EA include BMPs and GRRMP policy and guidance to minimize long-term effects to vegetation and wildlife habitats. No additional mitigation is required when considering the expected low level of adverse impacts to sage-grouse.
TRCP-11	Buffers surrounding infrastructure should be between 2 – 4 miles to provide adequate protection for sage-grouse.	The EA describes the distances to leks and intervening features (i.e., I-80) near the project area in Section 4.1.8 of the EA.
TRCP-12	The BLM needs to implement conservation practices in the appropriate locations to prevent sage-grouse from becoming listed as a threatened or endangered species. Increased traffic volumes and human presence as a result of the proposed project is a concern.	The EA describes the potential for impacts to sage-grouse and the distances to leks in Section 4.1.8.2 of the EA.
TRCP-13	Additional development in the Arch Unit may pose threats to sage-grouse and other wildlife.	Section 4.1.8.2 of the EA describes potential impacts to sage-grouse and other special status wildlife species. Given required timing restrictions outlined in the GRRMP, COAs, and BMPs, impacts to sage-grouse are anticipated to be low.
TRCP-14	Threshold data should be collected and on-ground monitoring of wildlife should be conducted prior to development of this project. The WGFD should establish a threshold decline trigger for re-evaluation of the project.	Sections 4.1.7 and 4.1.8 of the EA describes potential impacts to wildlife and special status species. No additional monitoring is proposed given the low potential for adverse impacts. The WGFD stated “. . . no terrestrial wildlife concerns pertaining to this EA” in their comment letter (see comment WGFD-1).
TRCP-15	The TRCP supports responsible energy development that balances land and resource values with fish and wildlife populations, and appreciates the opportunity to provide comments and work with the BLM on this EA.	Comment noted.
SC-1	The Sweetwater Board of Commissioners strongly supports the Monell/Arch Units Oil and Gas Development.	Comment noted.

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No.	Public Review Comment Summary	BLM Response
SC-2	Sweetwater County finds this project is consistent with the Sweetwater County Comprehensive Plan – 2002 goals.	Comment noted.
SC-3	Any crossing or access to Sweetwater County road rights-of-way requires an access permit or license from the County. Contractors are encouraged to call the Public Works Director prior to moving heavy equipment to ensure that public roads, cattle guards, and bridges are maintained and not damaged. Dust control is a concern.	Table 1-2 acknowledges that permits and licenses are required for road access and crossings, and coordination is required for heavy equipment movement. The BLM will share your request with the proponent as appropriate. See the response to comment CLG-18 regarding dust control.
SC-4	Coordination with the Sweetwater County Land Use Department is encouraged to ensure that the proposed project is in conformance with the County planning and zoning requirements.	The BLM has noted your comment and will share your request with the proponent as appropriate. This EA and the public review process is a way of informing the public and interested government agencies regarding the proposed project.
SC-5	Sweetwater County is a member of the Coalition of Local Governments and supports the comments submitted by the Coalition.	Comment noted. See comment responses for the Coalition letter coded as CLG.
WDEQ-1	Explain how the existing surface disturbance was calculated. How much of this acreage, if any, has been successfully reclaimed? What are the plans for reclaiming disturbed areas that are not needed for production, but have not been reclaimed?	The proponent provided GIS and text information that was used to estimate existing disturbance acreages for the Monell and Arch Units. The disturbance estimates are considered conservative. New information was added to Section 1.1 of the EA to provide a summary of reclamation efforts. Per BLM requirements, disturbed areas not needed for production must be reclaimed in compliance with site-specific COAs developed during the APD process.
WDEQ-2	Page 1-5, Table 1-2: Water from hydrostatic pipeline testing may be applied to roads and land surfaces if it will not reach a water of the state, meets certain water quality standards, and a Land or Road Application Permit is obtained from WDEQ.	No water would be required for hydrostatic testing of flowlines, as stated in Section 2.2.5 of the EA.

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WDEQ-3	Chapter 4 of the WDEQ Water Quality Rules and Regulations requires that the WQD be notified of spills or releases of chemicals. The Decision Record (DR) should include this requirement and explain how affected resources would be restored.	The EA assumed that all legal requirements, such as those for the CWA, would be followed. The BLM will comply with onshore order #7 (regarding produced water) and Notice to Lessees 3A (regarding undesirable events) as appropriate. Undesirable events would be reported as required. Operators reporting a spill would report the event to all required agencies, including WDEQ. In the event of a spill or undesirable event, a written order from the BLM would state what measures would be required for rehabilitation of the affected surface area.
WDEQ-4	Page 2-4, Section 2.2.3.1, Road Construction: The BLM should require a minimum disturbance and upgrading of roads to the minimal standard for the production phase.	All road upgrades and/or new roads will be constructed in conformance with BLM policies and standards. Please refer to Section 2.2.3.1 of the EA for information on roads and upgrades identified in the Proposed Action. When the actual locations of necessary new service roads in the Arch Unit are determined, right-of-way applications will need to be submitted (as appropriate) and are subject to additional NEPA analysis.
WDEQ-5	It is suggested that the highest quality topsoil should be separately stripped, stockpiled, and re-applied on the top of the other "topsoil material".	The BLM Wyoming Reclamation Policy I.M. No. WY-2012-032 requires proponents to identify, delineate, and segregate all salvaged topsoil and subsoil based on a site specific soil evaluation, including depth, chemical, and physical characteristics. This requirement is mentioned in Section 4.1.3.2 of the EA and the EA assumed that it would be implemented.
WDEQ-6	Page 2-8, Section 2.2.3.4, Completion and Production Testing: The proponent is currently investigating alternatives for recycling and re-use of flowback and produced water through pilot programs in other assets and basins. Prior to subsurface disposal of these fluids, WDEQ reserves the right to review and comment on all disposal methods not previously authorized by the WOGCC.	Comment noted. Refer to Section 2.2 for a description of the Proposed Action.

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No.	Public Review Comment Summary	BLM Response
WDEQ-7	<p>Page 2-12, Section 2.2.5, Water Requirements: All water used for the waterflood operation must have a water quality analysis performed with the exception of the water originating in the Almond Formation (same source and receiving formation).</p> <p>The two existing producer wells in Section 23 must be authorized as Class II disposal wells prior to use.</p> <p>There is a typo on page 2-13 in the legal descriptions of the disposal wells.</p>	<p>Section 4.1.4.2 of the EA states that “Wyoming’s UIC Program requires a standard laboratory analysis of disposal water and the receiving formation water be conducted (WOGCC 2010), which would provide baseline information.”</p> <p>This section also states that “Injection of produced water, which must be approved through the State of Wyoming’s Underground Injection Control (UIC) Program,...”. Clarification has been added that injection wells must be authorized as Class II disposal wells prior to use.</p> <p>The typo in the legal description on page 2-13 has been corrected.</p>
WDEQ-8	<p>Page 4-5, Section 4.1.4.2: Clarify how much existing disturbance is present in the project area in Section 4.1.4.2.</p>	<p>Clarification has been added to Section 4.1.4.2 of the EA.</p>
WDEQ-9	<p>Page 4-6, Table 4-1 reports 1154 acres of existing disturbance but elsewhere the EA reports 1747 acres. Existing disturbance should be identified as initial and long-term disturbance.</p>	<p>Table 4-1 was revised to provide estimates of subwatershed disturbance, with an overall total disturbance of 1,747 acres. Existing disturbance is all assumed to be long-term disturbance.</p>
WDEQ-10	<p>Page 4-6: With respect to the injection and disposal of produced water, this section appears to address current procedures. However, with reference to the statement “The aquifer targeted for reinjection is the Mesaverde, which also is only used in the area for industrial use of oil and gas production”, prior authorization for a Class II UIC aquifer exemption must be approved by the WOGCC.</p>	<p>See response to WDEQ-7. Clarification has been added that the Mesaverde aquifer includes the Almond Formation.</p>
WDEQ-11	<p>Also in that section (page 4-6) is the statement “Water used by the project for well construction and development operations would come from existing water supply wells in the project area, and may be supplemented by an outside source.” A water quality analysis for these sources of water must be supplied for review.</p>	<p>Comment noted. Refer to Sections 3.4 and 4.1.4 of the EA.</p>

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WDEQ-12	Page 4-6 and 4-45, Water Resources Mitigation Measure WR-3: Add to mitigation measure WR-3 that clarifies the requirement to establish baseline data prior to project development, and request that it follows the “Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development.” Include discussions with WDEQ in development of the monitoring.	Wyoming Oil and Gas Commission Rules and Regulations (Chapter 4, Rule 402) would require water quality analysis of disposal water and the receiving water. Clarifications have been added to mitigation measure WR-3 that indicates proponent coordination and discussion with BLM and WDEQ.
WDEQ-13	WQD has concerns about how much existing disturbance is in the project area, its status of reclamation, and the lack of a monitoring plan for groundwater and surface water. These issues should be addressed in the DR.	Existing disturbance in the project area is described in Chapter 2 of the EA. The Monell/Arch Units Oil and Gas Development EA analyzes the effects of the Proposed Action in combination with other cumulative actions including past oil and gas development in Section 4.2.
WGFD-1	We have no terrestrial wildlife concerns pertaining to the EA.	Comment noted.
WGFD-2	Information was provided regarding the presence of flannelmouth sucker in the Bitter Creek drainage in relation to the project area.	This information is summarized in Section 3.8.2.2 of the EA.
WGFD-3	Information was provided regarding the development of a range wide conservation agreement for roundtail chub, bluehead sucker, and flannelmouth sucker. WGFD is concerned that the proposed project could negatively impact the upper Bitter Creek drainage by increasing sediment input, altering channel geometry, changing the flow regime, or increasing the risk of pollutants entering the watershed.	The conservation agreement is referenced in Section 3.8.2.2 of the EA. Potential impacts from construction and operation activities on aquatic habitat and species in the Bitter Creek drainage are considered to be low magnitude due to compliance with regulatory requirements and APD conditions of approval to meet site-specific needs, as discussed in Section 4.1.7 of the EA.
WOC-1	It is requested that the BLM consider scoping comments that were submitted in November 2012 by the Wyoming Outdoor Council.	The scoping comments submitted by the Wyoming Outdoor Council were considered in the EA although they were not listed in the Draft EA. The text in Section 1.5 of the EA was revised to identify eight comment letters. Several new issues were added to the bulleted list.

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WOC-2	The BLM should fully consider a wide array of mitigation measures including the applicant-committed measures listed in Section 2.3 of the EA.	The applicant-committed measures are considered part of the Proposed Action and assumed they will be implemented to protect environmental resources. In accordance with BLM policies, BMPs, and COAs will be applied as appropriate to protect environmental resources. Also, additional NEPA analysis at the APD level will provide site specific analysis and potential impact identification that will guide implementation of BMPs and COAs.
WOC-3	BLM should evaluate if the enhanced oil recovery will result in carbon sequestration. The BLM should condition the project to achieve as much actual carbon sequestration as possible.	The emission calculations did not assume carbon sequestration. It is conservative to assume that enhanced oil recovery does not result in any carbon sequestration. The Proposed Action that was evaluated did not include carbon sequestration as part of the project plan. Carbon sequestration is not technically feasible at this time.
WOC-4	The BLM should fully consider capture of CO ₂ in flowback fluids.	See response to comment WDEQ-6. The BLM does not have authority to require CO ₂ capture.
WOC-5	The BLM should ensure that the Monell/Arch project fully complies with pending regulations on hydraulic fracturing by making compliance a COA.	These regulations are not approved at this time, so they cannot be included as a COA. If this becomes BLM policy in the future, a COA could be added as part of the permit to drill.
WOC-6	The BLM should ensure that Instruction Manual 2013-033 for wildlife protection is a COA.	The BLM will include this IM as guidance in protecting wildlife resources. The reference was added to the Section 4.0 Introduction as a management guidance protection measure.

AH – Alice Hindman

BB – Brooke Bullinger

APC – Anadarko Petroleum Corporation

CLG – Coalition of Local Governments

TRCP – Theodore Roosevelt Conservation Partnership

SC – Sweetwater County

WDEQ – Wyoming Department of Environmental Quality

WGFD – Wyoming Game and Fish Department

WOC – Wyoming Outdoor Council

* CLG – Numbers in this letter are not sequential due to two comments being requests.