

# ENVIRONMENTAL ASSESSMENT

## **Chevron**

### **Oil Shale Research, Development & Demonstration**

**CO-110-2006-120-EA**



**U.S. Department of Interior  
Bureau of Land Management  
White River Field Office  
73544 Hwy 64  
Meeker, CO 81641**



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## ENVIRONMENTAL ASSESSMENT

**NUMBER** CO-110-2006-120 -EA

**CASEFILE/PROJECT NUMBER** Oil Shale Research, Development and  
Demonstration Pilot Lease COC-69165

**PROJECT NAME** Chevron U.S.A., Inc.  
Oil Shale Research, Development and Demonstration Pilot Project.

**LEGAL DESCRIPTION** 6<sup>th</sup> Principal Meridian, Rio Blanco County, Colorado  
T. 3 S., R. 97 W.,  
section 5, NE¼, lots 5, 6, 11, 12.

**APPLICANT** Chevron U.S.A. Inc.  
11111 S. Wilcrest  
Houston, TX 77099

### **BACKGROUND AND INTRODUCTION**

Chevron U.S.A., Inc. (Chevron), a wholly owned subsidiary of Chevron Corporation, is proposing an oil shale research, development, and demonstration (RD&D) project on Bureau of Land Management (BLM) administered land in northwestern Colorado in accordance with BLM's Oil Shale RD&D Program announced in the Federal Register (FR, June 9, 2005, Vol. 70, No. 110).

Pursuant to Section 21 (30 USC 241) of the Minerals Leasing Act (1920, as amended), the BLM solicited RD&D proposals to demonstrate technologies for unlocking deposits of energy now trapped in oil shale, including the nomination of lands to be leased for the RD&D project. In response to its Federal Register announcement, the BLM received 20 nominations for parcels of public land to be leased in Colorado, Utah, and Wyoming. The initiative was subsequently endorsed by Congress in the Energy Policy Act of 2005, Public Law 109-58 (H.R. 6).

An interdisciplinary team, consisting of representatives from the three states (Colorado, Utah, and Wyoming), the Department of Energy, the Department of Defense, and BLM staff members from the affected states, considered the potential of each nomination based on the following criteria prior to recommending proposals for eligibility in the oil shale recovery RD&D program:

- The nomination's potential to advance oil shale technology
- The nomination's economic viability
- The nomination's potential environmental effects.

Of the 20 nominations received, 6 were accepted and 14 were rejected. Five potential RD&D projects and the corresponding leases are located in Colorado (including Chevron's proposal) and one is located in Utah.

The RD&D site proposed by Chevron encompasses a 160-acre tract and associated preference rights to an additional contiguous area of 4,960 acres as established in the Federal Register notice. The larger area may be converted to a commercial lease at a future time after additional BLM review and approval. Upon the company's successful demonstration of an environmentally sound and economically viable shale oil recovery technology, the BLM would non-competitively convert the preference right acreage into a commercial oil shale lease for fair market value. A separate National Environmental Policy Act (NEPA) analysis of the larger preference right acreage would occur at that time, and conditions of the RD&D lease do not guarantee the issuance of the additional 4,960 acres or the conditions under which such lands would be leased. Leases would be issued with sufficient terms and conditions to allow the BLM to monitor for, and prevent, unnecessary and undue degradation to public lands. This Environmental Assessment (EA) addresses only the 160-acre nominated lease site and the plan of operations for the RD&D project proposed by Chevron, and does not analyze additional impacts or development potential associated with the preference right acreage.

In accordance with NEPA, the Chevron proposal (Proposed Action) will be thoroughly analyzed in this EA. Based upon the results, the BLM will decide whether a 160-acre lease will be issued to Chevron for research, development and demonstration of oil shale recovery technology, and whether to authorize activities. If the BLM exercises its discretion to issue an oil shale RD&D lease, the lease will be conditioned with sufficient terms to allow BLM to monitor for, and prevent unnecessary and undue degradation to public lands.

The Energy Policy Act of 2005, Public Law 109-58 (H.R. 6), enacted August 8, 2005, also directs the Secretary of the Interior (the Secretary) to complete a programmatic environmental impact statement (PEIS) for a commercial leasing program for oil shale and tar sands resources on public lands with an emphasis on the most geologically prospective lands within each of the states of Colorado, Utah, and Wyoming. This program is being pursued by the BLM in addition to the RD&D program. The scope of the PEIS will include an assessment of environmental, social, and economic impacts of leasing oil shale and tar sands resources, including foreseeable commercial development activities on BLM-administered lands located in Colorado, Utah, and Wyoming; discussion of relevant mitigation measures to address these impacts; and identification of appropriate programmatic policies and best management practices to be included in BLM land use plans. The PEIS will address land use plan amendments in the affected resource areas to consider designating lands as available for oil shale and tar sands leasing and subsequent development activities.

## **PURPOSE AND NEED FOR THE ACTION**

The Piceance Basin of northwestern Colorado contains substantial oil shale resources on Public Lands. The Department of Interior has identified the need to research and demonstrate on a pilot scale, within the next ten years, the technical, economic, and environmental feasibility of an in-situ (in-place) technology as a means of extracting liquid energy fuels from oil shale on Public Lands. The purpose of the Proposed Action is to lease 160 acres of public land for a research, development, and demonstration project that would advance our knowledge of commercially viable production, development, and recovery technologies that are consistent with sound environmental management.

Chevron has proposed a research project to evaluate the potential for the commercial development of oil shale resources in-situ. The intent of this proposal is to achieve a “proof of concept.” That is, while laboratory experiments and theoretical calculations indicate that various in-situ methodologies are viable commercial options, none have been thoroughly field tested to evaluate the practical application. The Proposed Action provides the opportunity to practically apply those specific technologies under field conditions. The project results would advance knowledge of these methodologies regardless of whether or not they prove commercially viable.

Chevron’s proposed research will gather additional data on oil shale recovery using conventional drilling methods and controlled horizontal fracturing technologies to isolate the target interval, and to prepare the production zone for the application of heat to convert the kerogen to oil and gas. The intent of the Chevron proposal is to prove an in-situ development and production method that would apply modified fracturing technologies as a means to control and contain the production process within the target interval. The BLM has concluded that analyzing Chevron’s proposed recovery process is warranted and may advance knowledge regarding the commercial viability of in-situ technologies for hydrocarbon recovery from oil shale.

## **DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES**

The BLM proposes leasing a 160-acre tract located approximately 45 miles southwest of Meeker, Colorado, and requiring the applicant to submit, as a standard lease term, a Plan of Development for an oil shale research, development, and demonstration project. The RD&D program is the first phase of the BLM’s oil shale program, and is designed to test a variety of extractive technologies on a relatively small scale in a field environment in order to learn more about the technologies, the economic feasibility, and the environmental management challenges associated with shale oil extraction. Applicants were directed to submit proposals with the potential to prove commercial feasibility within ten years so as to inform the BLM’s decisions concerning the authorization of commercial scale oil shale operations on public lands.

Chevron’s proposal is consistent with the Federal Register Notice published June 9, 2005. The lease would be issued with sufficient measures to allow the BLM to monitor for, and prevent, unnecessary and undue degradation to public lands. To achieve the goal of the RD&D program to advance our knowledge of effective technology, economic viability, and sound environmental management, the FR contained specific requirements for a complete application including:

- A description of the lands, not to exceed 160 acres together with any rights-of-way required to support the development of the oil shale research, development and demonstration lease;
- A narrative description of the proposed methodology for recovering oil from oil shale, including a description of all equipment and facilities needed to support the proposed technology;
- A narrative description of the results of laboratory and/or field tests of the proposed technology;
- A schedule of operations for the life of the project and proposed plan for processing, marketing and the delivery of the shale oil to the market;
- A map of existing land use authorizations on the nominated acreage;
- An estimated oil and/or oil shale resources within the nominated acreage boundary;
- The method of oil storage and/or spent oil shale disposal;
- A description of any interim environmental mitigation and reclamation;
- The method of final reclamation and abandonment and associated projected costs; and
- Proof of investment capacity, and a statement from a surety qualified to furnish bonds to the U.S. government for the amount the applicant qualifies for under the surety's underwriting criteria.

Since there are no final regulations for commercial oil shale development, the concepts of the federal oil shale RD&D program would be reflected in the terms of the lease. The lease would be the governing document for the oil shale RD&D project until the project: (1) demonstrates success and becomes eligible for conversion to a commercial lease; (2) fails to meet the goals of the program; or (3) until the lease term expires. The BLM would incorporate lease terms addressing incentives for development, conditions for environmental protection, appropriate bonding, and a provision to convert a successful RD&D project into a commercial lease. The RD&D lease will be issued for 10 years with the option to extend for another 5 years if diligence is demonstrated. Rental fees will be waived for 5 years and royalties will be waived as long as the project is in a RD&D status.

The proposed site location was chosen by the applicant to maximize the potential to demonstrate proof of the concept, and to produce oil in an economically viable and environmentally sound manner. Based on these factors, Chevron has identified a site with the physical and environmental attributes favoring in-situ extraction, including but not limited to:

**Geologic Characteristics:** The Green River Formation contains the oil-shale rich Mahogany zone where existing data (e.g. data extrapolated from Fischer Assay data obtained from existing core holes) support the estimates of oil potential to provide the opportunity to successfully demonstrate the technology.

Topographic Characteristics: Level surfaces that reduce environmental impacts and facilitate accessibility, construction of roads, well pads, facilities, etc.

Hydrologic characteristics: The confining nature of the Mahogany zone minimizes the potential for groundwater impacts.

In accordance with the National Environmental Policy Act (NEPA), the Proposed Action will be thoroughly analyzed against alternative actions. Based upon the results, the BLM will decide whether a 160-acre lease will be issued to Chevron for research, development, and demonstration of their oil shale recovery technology, and whether to authorize activities at the proposed location.

## **PROPOSED ACTION**

Chevron has submitted a Plan of Operations for the proposed oil shale RD&D project to the White River Field Office (WRFO) BLM. The Plan of Operations includes a project description, along with the project design features and mitigation measures developed to address the potential environmental impacts associated with the Proposed Action. Other mitigation measures, provided as a subalternative by the BLM, are addressed specifically in subsequent sections of this EA. Chevron's Plan of Operations is available under separate cover at the WRFO, and is summarized below.

***Project Location:*** The 160-acre lease parcel nominated for Chevron's proposed research and development activities is described as the northern-most 160 acres of Lots 5, 6, 11 and 12, all of which are located within the NE/4 of Section 5, T3S, R97W, 6<sup>th</sup> Principal Meridian, of the Piceance Basin in Rio Blanco County, Colorado. Access to the proposed project area would be via Colorado State Highways 13 and/or 64, and County Roads 5 (Piceance Creek), 26, 29, and 69. The proposed lease parcel is situated adjacent to County Road 69 on Hunter Ridge at an elevation of 6560 to 6660. The location of the proposed Chevron parcel is shown in **Figure 1**.

***Process Overview:*** Chevron proposes to explore the economic viability of shale oil extraction, and to conduct research on alternative means of extracting the liquid fuels from oil shale using conventional drilling technologies and modified fracturing techniques designed to control and contain subsurface processes within the oil-rich Mahogany zone. The use of conventional drilling methods for extraction would require a smaller footprint, and may therefore be less injurious to the environment, than past shale oil extraction technologies. The use of conventional drilling may also be more cost efficient and consume far fewer resources since water and power requirements would be approximately equal to that of any modern oil and gas drilling operation.

Chevron's proposed methodology for shale oil recovery would be implemented over time in a series of seven distinct phases (discussed individually below), and would apply to an oil shale deposit that is approximately 200 feet thick. This methodology would entail drilling wells into the oil shale formation and applying a series of controlled horizontal fractures within the target interval to prepare the production zone for heating and in-situ combustion.

Chevron's oil shale technology was designed to benefit from, and expand on, the insights and experience gained from earlier in-situ efforts. In 1953, Sinclair Oil and Gas Company used both natural and induced fractures to establish communication between wells, and developed an in-situ combustion process to decompose the kerogen. Subsequent field tests conducted by Geokinectics, Inc. / Sandia National Lab, and Laramie Energy Technology Center of the U.S. Department of Energy independently employed explosive and hydraulic fracturing technologies that resulted in relatively high oil recovery rates. In addition, Equity Oil Company's field tests and mathematical models concluded that the injection of hot natural gas was a feasible and economic technology for the heating and decomposition of kerogen. Continental Oil Company and the University of Akron were later issued separate patents that identified the benefit of carbon dioxide as a carrier gas to facilitate a higher yield of shale oil. Based on these previous tests and patents, there is evidence that a technology that provides relative uniformity in the fractured material can be expected to yield economic quantities of shale oil when heated to the kerogen decomposition temperature. Chevron proposes to achieve this relative uniformity by drilling wells into the oil shale formation and applying a series of complex horizontal fractures induced by injecting CO<sub>2</sub> gas into discrete areas of the target interval to effectively rubblize the production zone in a horizontal plane. If necessary, propellants and/or explosives may be directed into the specific horizontally and vertically limited area to facilitate further rubblization of the production zone. CO<sub>2</sub> fracturing is used throughout the oil and gas industry, and has been proven successful in inducing the desired fracture network.

Chevron believes that these fractured zones would have a very high horizontal to vertical component which would allow for the maintenance of a barrier within the target interval. This barrier between the production zone and the upper (A groove) and lower (B groove) water bearing units (see **Figure 4** for the Lithologies Near the Propose Lease Area) would be achieved by creating fractured areas, or "pockets", approximately 1 to 5 acres wide and 50 feet high within the center of the 200-foot oil shale deposit. In this way, a large volume (about 75 feet) of the confining layer would separate the proposed process from the water bearing units above and below. Absent the intersection of natural fractures that communicate with the water bearing intervals, this method of process containment would keep the aquifers out of the production zone. Chevron would consider integrating a dedicated system for measuring hydraulic head as a potential method for assessing the performance of the confining layers. The detection and avoidance of the natural vertical fractures within the formation is a key component of the proposed technology. See **Figure 5** for an illustration of Chevron's concept for Pilot Oil Shale RD&D.

The heating and in-situ combustion phases of the proposed process would include the generation of hot CO<sub>2</sub> gas that would be circulated through the fractured formation from well to well and then routed back to a gas generator to be reheated. This process would create the heat needed to decompose the kerogen into producible hydrocarbons. The in-situ combustion of the remaining organic matter in previously heated and depleted zones would generate the heated gases required to process successive intervals. These gases would then be pressured from the depleted zone into the newly fractured portion of the formation and the process would be repeated.

Chevron proposes to drill up to four adjacent five spot layouts using conventional well construction (an illustration of the proposed layout is shown in **Figure 2**). Each layout would be situated on a 400-foot by 400-foot compacted gravel pad, and would consist of four injection wells surrounding a production well at the center. The distance between the injection wells would depend on the results of planned modeling of the oil shale fracture characteristics, but is thought to be between 100 and 300 feet apart. Two additional wells would be drilled to accommodate the placement of geophones for monitoring the development of fractures in the shale, and 20 to 25 tiltmeters, each capable of measuring movement of less than 1/1000<sup>th</sup> of an inch, would be installed throughout the proposed lease tract to provide further data on the pattern of the fracture network and to monitor fracture movement. As many as 20 groundwater-monitoring wells would be drilled into both the upper and lower water bearing units as part of a comprehensive groundwater monitoring program incorporated into the design of the proposed process. Additional observation wells may be installed as necessary to further monitor the process.

***RD&D Phase Descriptions:*** Chevron's proposed development sequence consists of seven distinct phases. Each phase will be carried out over time and may, upon approval of the BLM, be necessarily modified as testing progresses. A discussion of Chevron's proposed development sequence is provided below:

*Phase 1 Core Extraction:* Initial site preparation would include the installation of a 25-foot wide by 500-foot long access road onto the proposed lease tract from County Road 69. A typical well pad would be constructed to facilitate the extraction of one or more core samples from the complete Parachute Creek interval to a depth of approximately 2,800 feet. The core(s) would be used to develop a more comprehensive site-specific understanding of the geology, mineralogy, hydrogeology, and geophysical properties of the formation. Seismic data and other well log information would also be gathered from this well to better understand the geophysical and hydrological correlation between the formations, and to determine the number, placement, and depths of the groundwater-monitoring wells to be installed onsite prior to initiating the fracturing phases of the proposed project.

The core sample(s) would be transported offsite for laboratory analysis and modeling of the formation characteristics. The data collected from this analysis would provide a better understanding of the formation properties so as to specifically design the fracture treatments based on the local rock mechanics, and to optimize the technology in the laboratory before the proposed project is installed. Upon completion of core extraction and well data collection, the well(s) would be plugged back to the Mahogany zone and converted into a groundwater-monitoring well(s). This phase of the development sequence would be executed over a period of 6 to 8 months beginning upon approval of the RD&D lease and continuing through the summer of 2007.

*Phase 2 Initiate Fractures:* Phase two would be directed at identifying and avoiding the existing natural fracture network. Chevron would then implement an initial small-scale test of the proposed fracture technology (as described above) using information gathered from seismic data and the laboratory analysis of the core sample(s) collected in phase one. This fracture process testing would verify that the extent and direction of the induced fractures were consistent with planned modeling. Phase two testing would be conducted to verify that the process would produce the desired fracture network before proceeding with the rubblelization and heating phases of the proposed project.

A 400-foot by 400-foot compacted gravel well pad would be constructed within the proposed lease site to accommodate a drilling rig and associated facilities, including a reserve pit for the collection of drilling fluids. Prior to any fracturing activities, groundwater-monitoring wells would be installed around a single process test well, and groundwater characterization and baseline data would be collected and analyzed. Wells for the installation of geophysical monitoring devices (tiltmeters and geophones) would also be installed before initiating the fracturing process. A single drilling rig, and a contract fracturing crew, consisting of 5 to 8 specialized trucks and operators, would be brought onsite for several weeks to drill and fracture the formation. Chevron's technical representatives and contract specialists would remain onsite for two or more months to monitor the process. Facilities for proper storage and use of explosives and propellants, along with facilities for collection, analysis, and removal of well cuttings would be installed at this time. This well would be converted into an injection well after completion of the fracture phase. Phase two would be implemented somewhat concurrently with phase three and would continue as described through the fall of 2008.

*Phase 3 Locate Fractures:* Phase three would entail the drilling of one or more additional test wells to confirm and verify the extent of the fracture network, and would begin several months after the initial fracturing performed in phase two, after which it would proceed along approximately the same time line.

*Phase 4 Add Fracturing/Rubblization:* Phase four would facilitate additional fracture of the shale by subjecting the formation to thermal cycles. Hot CO<sub>2</sub> gas would be injected into the fractured formation and would flow between connected fracture test wells to further rubblize the process interval. As many as 20 to 50 CO<sub>2</sub> tanker trucks would be required at the site at various times to complete this phase of development. A gas generator would be installed, and a natural gas pipeline would be routed to the test location to provide fuel for the generation of gases. This natural gas supply line would be installed from a tap on Kinder Morgan's Rocky Mountain Gas Line located at SE/4 of Sec. 33, T2S, R97W. The line would follow a proposed ROW west, across the southern section line of section 33 and 32, where it would turn south and enter the NE/4 of Section 5, T3S, R97W (Chevron's proposed 160-acre pilot site).

Process equipment pads would be constructed on either side of the test well location for the installation of a gas injection compressor and a recycled gas compressor. This phase of the proposed development would be initiated in early 2009 and continue throughout most of the year.

*Phase 5 Heat Formation:* The fifth phase would initiate the formation heating process. Once the fracturing process was completed and deemed sufficient; heated gas would be pressured through the formation and would circulate through the fractured interval. The gas would then be routed to the gas generator to be reheated and recycled to slowly heat the formation to the decomposition temperature of kerogen. No additional equipment would be required to initiate this phase of operation. Chevron would have a team of 3 to 5 operational and technical personnel operating the facilities during this phase. Phase five would begin in early 2010, and continue into year 2011.

*Phase 6 Decompose the Kerogen and Produce Shale Oil:* Prior to the formation reaching the kerogen decomposition temperature, equipment would be installed to collect and process the produced water, gas, and shale oil. Storage tanks and facilities, as described below, would be installed to separate the produced gases from the shale oil and water. Gases would be scrubbed in a caustic treater drum and used as fuel for the heating process or flared. The liquid streams would then be trucked off-site to separate processing or disposal facilities. Local contract personnel would be used to transport and assemble the equipment for storage and separation of liquid streams. This phase would tentatively continue through year 2012.

*Phase 7 Heat Integration:* After extracting the recoverable kerogen from the aforementioned test phases, the last phase of the proposed RD&D program would include drilling a new well pattern adjacent to the first and repeating the fracture process as previously described. Air would then be pressured into the depleted portion of the formation to create the in-situ combustion of the residual organic material remaining in the oil shale after the initial heating and recovery process. The resulting hot gases from the combustion process would be used to heat the newly fractured zone immediately adjacent to the depleted portion of the formation. The resulting gases and liquids would be routed to the equipment installed in the previous phase of operations. An air compressor would be installed to inject air into the depleted zone to generate the in-situ combustion process. A drilling rig crew and 3 to 5 contract personnel would be required for completion of this phase, which would continue through the year 2013.

*Estimated Resource Recovery:* The production rate from Chevron's RD&D test site would be a function of the degree of fracturization of the oil shale formation; the smaller the fragment size, the more readily the kerogen would decompose. Preliminary estimates suggest production rates of five or more barrels per day after one year of initiating the heating process. Chevron's final process calls for in-situ combustion of the residual organic material left in the formation after the initial kerogen heating and recovery process. This combination of processes is believed to result in 90+% recovery of the total energy available within the target zone.

Chevron's goal would be to make full use of all potential resources within the oil shale formation without permanently modifying the land surface. Chevron would also consider processes to recover waste heat in the liquids produced from the formation to generate energy for other processes. Additional research would be conducted to determine if the byproducts from the oil shale could be economically recovered. Both minerals (multi-minerals) and chemical byproducts would be considered.

The small-scale of the project and the use of controlled fracturing technologies would contain the subsurface disturbance within the pilot test plot. The phased approach of the proposed oil shale RD&D project is designed to maximize the exit points at which Chevron could halt the process, re-evaluate, and remediate or re-design, if necessary, before resuming operations. These exit points would be built into the process, both during and after each phase, and would minimize the potential for impacts to the subsurface environment over the life of the project.

*Surface and Groundwater Management:* The Proposed Action would be situated on a broad ridge between Hunter Creek to the east and Dry Gulch to the west. Hunter Creek is an intermittent tributary to Piceance Creek, and Dry Gulch is an ephemeral tributary to Black Sulfur Creek, which is also tributary to Piceance Creek. Both Hunter Creek and Black Sulfur Creek are part of a larger drainage network exhibiting trellis to dendritic drainage morphology. Based on information gathered from topographic maps and area surveys, these creeks are incised and contained within narrow steep walled canyons composed of the Green River Formation.

The banks of these streams are sparsely vegetated with sagebrush, mature pinyon-juniper, and similar vegetation found in semi-arid regions. There is little water quality data available for the proposed test site. The nearest monitoring stations are located from 3 to 5 miles away at Ryan Gulch, Willow Creek, Black Sulphur Creek, and Piceance Creek. Other monitoring locations are within the Piceance Basin, but most are outside the Piceance Creek watershed and may not be indicative of water quality in the vicinity of the Proposed Action.

Baseline surface water quality and flow parameters along Hunter Creek would be collected and analyzed prior to initiating construction activities. Stream parameters would be monitored throughout the construction, operation, and reclamation phases of the proposed RD&D project. Erosion and sediment transport would be controlled through the use of Best Management Practices (BMPs) as described in Chevron's Stormwater Management Plan (SWMP), which is on file with the WRFO BLM as an attachment to Chevron's Oil Shale Research, Development, and Demonstration Plan of Operations. These BMPs may include, but are not limited to, the use of sediment retention ponds, diversion ditches, hay bales or check dams, and geotextiles. Stormwater runoff would be managed using these BMPs in accordance with state and local stormwater permit requirements, and the standards and guidelines for road and pipeline construction outlined in the BLM/FS Oil and Gas Handbook (Gold Book).

Site-specific groundwater characteristics are not well known, and Chevron is currently investigating groundwater quality and usage in the area around the proposed lease site to develop an extensive and comprehensive groundwater-monitoring network. A regional hydrogeologic conceptual model would be developed during the initial phases of the proposed project from existing information, and updated throughout the RD&D program. The information gathered from the laboratory analysis of the initial core sample(s) would allow Chevron to determine the depth, quality, and flow patterns of the groundwater within the formation, and this information would be used to develop the most effective groundwater monitoring plan for the RD&D project. This plan would be submitted to the BLM for approval prior to initiating any further subsurface activities. The approved groundwater monitoring program would be implemented to provide characterization data and to monitor the integrity of containment barriers during operations and after in-situ retorting. This monitoring program would have sufficient vertical and horizontal resolution to ensure environmental compliance over the lifetime of the pilot test and post-operational monitoring period.

An initial array of twelve close-in groundwater-monitoring wells, along with as many as eight additional monitoring wells, with similar completion intervals as the first twelve, placed at the lease boundaries are proposed for determining local baseline conditions and for initial groundwater characterization, geophysical correlation, and process monitoring. These wells would be drilled into both the upper and lower aquifers that lie above and below the Mahogany zone (see **Figure 3**: Stratigraphic Column of the Piceance Basin at the proposed site). The exact depth and placement of these wells have not yet been determined. The data from these wells would be made available to the BLM on a quarterly basis for assessment and monitoring of groundwater quality and flow rates.

Water depletion is not anticipated for the proposed RD&D project, but should depletion become necessary due to unforeseen circumstances, Chevron would augment any depletion, as required by Colorado law, to prevent injury or adverse impacts to vested upstream and downstream water rights. This is required as the proposed pilot project is in an area where it has not been demonstrated that the groundwater is non-tributary. A Biological Assessment of the proposed location has been prepared, and consultation with the U.S. Fish and Wildlife Service would be initiated should water depletion become necessary. Likewise, the de-watering of the production interval is not anticipated for the project as the proposed process would detect, and avoid, areas where the natural vertical fracture and jointing patterns allow for communication between the aquifers. In the event that excess groundwater were to infiltrate the process interval, that water would be extracted using pumping wells and would then be re-injected downgradient into the equivalent aquifer system in order to maintain the regional water table and avoid disturbing baseflow to nearby streams.

The Mahogany zone is anticipated to act like a confining layer either through natural or anthropogenic means, and the proposed project is designed to take advantage of the impermeable and confining nature of the Mahogany zone to inhibit the process from coming into contact with the aquifer systems above and below the target interval. The upper aquifer would be contained using well casing designed specifically to prevent the groundwater from coming in contact with production fluids. As discussed above, the induced horizontal fractures are not expected to extend into the lower aquifer system, but would be contained within the process interval by maintaining a sufficient buffer within the confining layer to exclude the lower water bearing units from production processes.

The natural vertical fracture and jointing patterns within the formation allow for some communication between the upper and lower aquifer systems, and if the proposed process were to contact an existing fault that was in communication with two aquifer systems, natural mixing of those aquifers would have already occurred. However, Chevron would still need to achieve isolation between the rubblized zone and the aquifers before further action could be initiated, and attempts at remediation might include the use of specialized cements and polymers, commonly used in the oil and gas industry, to plug the breach and restore containment. In the event that containment was lost at any phase of the proposed process, operations would be halted and re-evaluated to determine the cause of the problem, and to develop a means to minimize the reoccurrence. The process testing might necessarily be moved to an adjacent area within the lease parcel in order to prevent the re-opening of the communication channel.

The detection and avoidance of natural vertical fractures within the formation is a key component of the proposed technology. Should the integrity of the confining layer become compromised, the process testing would be discontinued, re-evaluated, and mitigated or re-designed in accordance with the containment mitigations and corrective actions provided in Chevron's Response Plan prior to resuming activity. (Chevron's Response Plan is on file with the WRFO BLM).

A fundamental aspect of Chevron's proposed research would involve an analysis of various methods for preventing the loss of groundwater containment at each phase of the operation. The loss of containment could occur in a number of ways, and Chevron is currently investigating ways to remediate potential problems associated with fracturing into a natural fracture or fault that is in communication with the water bearing intervals; unexpected fracture growth into the water bearing intervals; and unexpected growth of the heated zone vertically during the retort phase of the Proposed Action.

Detection devices, such as tiltmeters and geophones, designed to monitor the fracture network would allow Chevron to pinpoint problem areas and drill remediation wells into the target zone to restore containment. In addition, characterization data from laboratory studies would be used in conjunction with field monitoring data and hydrologic modeling studies to implement a containment transport model. This model would assess the potential for adverse effects on water quality associated with various extraction and post-extraction conditions, with and without various engineering controls to limit groundwater flow through the treatment zone (e.g., grouting of spent shale and/or over underlying tuff layers). Chevron would utilize the information gathered from this research and modeling to develop the most effective methods for maintaining, and/or restoring groundwater containment at all phases of the proposed process, and would implement the use of such methods if a loss of containment, risk of contamination, or mixing of aquifer systems seems likely to occur and further containment becomes necessary. Chevron would consider methods such as grouting, drawdown pumping, or other BLM-approved containment methods. A more detailed discussion of surface and groundwater management is presented in the Water Quality section.

**Surface Disturbance:** Clearing and grading would be performed only to the extent necessary to allow for safe and efficient construction and operation. Every effort would be made to salvage root systems, and the ground surface would not be grubbed or cleared of vegetation less than four inches in height where possible. All new surface disturbances would be located on federal lands administered by the BLM. The total available area for process testing within the proposed 160-acre lease site is approximately 60 acres, with additional area consisting of approximately 40 acres for process equipment, staging of materials, employee parking, office and lab facilities, and site security.

A 500-foot buffer zone would be maintained around the proposed lease site, as specified by the BLM, to prevent process activities from exceeding the 160-acre lease parcel. The maximum total area of disturbance within the proposed 160-acre lease parcel over the 10-year term of the lease would be approximately 100 acres. This area includes any necessary relocation of process facilities, as well as any potential future expansion for technological research and development.

A 25-foot wide by 500-foot long compacted gravel access road would be constructed to provide entrance to the proposed project site from County Road 69 which cuts through the west side of the 160-acre lease site. The access road would be entirely within the lease parcel and would not be subject to additional BLM right-of-way permitting. However, consultation with the Rio Blanco County Road and Bridge Department, and a Rio Blanco County Special Use License for access onto County Road 69 would be required. The access road would be constructed in accordance with BLM/FS Gold Book standards for local roads. The location for access from County Road 69 is planned to be on fairly flat and level ground, and would not cross any stream channels or natural drainages and would therefore not require the installation of culverts or any other runoff diversion devices.

Initial clearing and grading of the proposed site would consist of the removal of vegetation and topsoil along the access road, in the staging, parking, office and security areas, and in the first of the four proposed production and injection well layouts (see **Figure 2** for proposed facility layout). Subsequent well pads would be cleared and graded as the drilling and fracturing of additional process intervals becomes necessary. An additional 20-feet around the test facilities would be cleared and graded to serve as access and to provide a firebreak around the area. A 6-foot wire security fence would be installed around the project area for public safety and site security.

Additional surface disturbance outside the 160-acre lease parcel would include a 65-foot wide by approximately 5,280-foot long (7.88 acres) combined right-of-way (ROW) for power, data and telephone communications, and a 4-inch natural gas pipeline to provide fuel for the generation of gases to heat the formation. This ROW would be constructed during the later phases (phase four) of the proposed project, and would originate from a tap on Kinder Morgan's Rocky Mountain Gas Line located at SE/4 of Sec. 33, T2S, R97W. The ROW would be constructed across the southern section line of section 33 and 32, where it would turn south and enter the NE/4 of Section 5, T3S, R97W (Chevron's proposed 160-acre pilot site). The ROW would follow existing corridors and right-of-way authorizations where possible. Power and communication lines would be installed on elevated poles, and the gas pipeline would be constructed underground from the source line to the point where it would enter the 160-acre lease tract, after which it would be constructed on short pipeline sections to avoid contact with the ground and avoid possible corrosion concerns.

The estimated 7.88 acres of surface disturbance associated with the proposed ROW is not included in the 100-acre estimate for disturbance within the lease parcel and would require an additional BLM right-of-way permit prior to construction. The proposed ROW would cross Hunter Creek, located approximately one half mile east of the 160-acre parcel, and would be constructed in compliance with all Right-of-way permit requirements, BLM Gold Book standards for pipelines and flowlines, state and local stormwater management regulations, and all U.S. Army Corps of Engineers Nationwide Permit 12 regulations. Additional BMPs, as outlined in Chevron's SWMP, would be implemented to ensure that the potential for erosion and sediment transport resulting from construction at the banks of the steam channel are minimized.

**Power and Water Usage:** Portable diesel generators would be used to provide the needed power during the preliminary phases of Chevron's proposed RD&D project. The aforementioned combined ROW for power, communications, and natural gas would be constructed only if the fracturing phase is considered successful. The power line would be installed on elevated poles along with communication lines. The natural gas pipeline would be installed underground and would enter the proposed lease site using the same 65-foot wide combined ROW.

Water consumption for the proposed process would be limited to the use of water to mix additives and drilling mud, dust suppression, and personnel uses. In-situ shale oil recovery does not require substantial amounts of water as no spent shale would be brought to the surface. Water usage would vary with the different phases of the Proposed Action and are estimated to average between 12 and 13 acre feet per year (see **Table 10**, Water Quality, Surface and Ground Section, for estimated water needs per year). The water required for construction and operation of the Proposed Action would be purchased from local permitted sources and trucked to the site.

The water and power required for operation of the proposed facilities would be approximately equal to that of a conventional oil and gas drilling operation.

**Transportation and Access:** The Proposed Action would not create additional access onto BLM lands; it would, however, increase traffic on existing roadways and contribute to fugitive dust along the unpaved county roads necessary for access to the site.

**Storage and Disposal of Products:** The products used onsite would be typical of the products used in the oil and gas industry (lubricants, diesel fuel, gasoline, lubricating oils, solvents, and hydraulic fluid), and would be used, stored, and disposed of in accordance with all industry standards and practices, as well as in compliance with all federal, state, and local regulations.

Smaller quantities of other materials such as herbicides, paints, and other chemicals would be used during facility operation and maintenance. Any produced water and/or flush water would be routed to 500-barrel storage tanks for transport offsite to an appropriate disposal facility. Spent caustic would be stored in 50-barrel tanks and transported offsite for disposal. No process wastewater is anticipated in the preliminary phases of the proposed project, but would be expected in the later phases of the program. Drilling fluid returns would be processed by a modularized solids control system to minimize spent drilling fluid generation. This system would produce relatively dry cuttings with minimal associated drilling fluid. The drilled cuttings and fluids would be collected in plastic lined earthen pits approximately 100 feet by 100 feet with six feet of usable depth (eight feet deep). One pit for each of the four proposed well patterns (one producer, four injectors, and 12 groundwater wells) would be anticipated. These pits would be kept clean and free of oil and other harmful constituents, and would be constructed in accordance with industry regulations, and BLM/FS Gold Book standards and guidelines, and would be designed to BLM specifications to deter and/or prevent migratory birds and other wildlife from accessing the contents.

Used oil would be handled in accordance with 40 CFR 279. A used oil recycler would be contracted to handle all used oil.

The management, maintenance, and disposal of sanitary wastewaters would be contracted through local providers. Solid waste products would be stored in closed, animal-proof containers so as not to attract wildlife and to prevent trash from being blown offsite. All solid waste would be managed, collected, and disposed of in accordance with existing laws and regulations by a local contract provider. Other waste products would be collected and disposed of in accordance with existing laws, stipulations, and regulations.

The proposed in-situ process would not include any aboveground retort activities; therefore no spent shale would be brought to the surface as a waste product.

Gas produced as a result of the proposed process would be burned as fuel or flared. Produced shale oil would be stored in 100-barrel tanks and transported offsite for processing and subsequent delivery to consumer markets.

***Personnel Requirements:*** The construction, drilling and fracturing phases of the proposed project would require from 10 to 100 contractors and employees. This estimate includes survey crews, equipment operators, rig crews, consultants, materials delivery, pipeline crews, specialized fracturing contractors, and Chevron technical and supervisory personnel. Personnel requirements would vary with each phase of the Proposed Action.

Initial site preparation would require a survey crew to establish road, pad, and well locations within the proposed RD&D lease parcel. Up to 10 contract employees for a period of 2 to 3 weeks would be employed to complete construction of the proposed project facilities. Drilling rig crews would be brought onsite to extract one or more core samples, and to install groundwater-monitoring wells and all subsequent injection and production well layouts.

A contract fracturing crew, consisting of 5 to 8 specialized trucks and operators would be brought in at various times during the proposed process to facilitate the fracturing phases of the project. Later phases of development would require a pipeline crew, and approximately 10 contractors would be required to transport and assemble the equipment for storage and separation of liquid streams. An estimated 20 to 50 CO<sub>2</sub> tanker trucks would be onsite at various times for the fracturing and heating process, and Chevron would have a team of 3 to 5 operational and technical employees operating the facilities for the duration of the proposed project. No more than 100 employees and contractors would be expected over the life of the RD&D project. Employees and contractors would likely come from surrounding communities, and few would be brought in from outside the area. Temporary employee housing would not be anticipated for the proposed RD&D program, but essential personnel required for extended non-routine testing and/or process monitoring may be housed in temporary trailers as necessary.

**Project Schedule:** Chevron’s proposed development sequence (as described above) would be carried out over time and may, upon approval of the BLM, be necessarily modified as testing progresses. Provided that the RD&D lease is granted, the phased development of the proposed pilot program would be expected to begin in the fall of 2006 and last at least through the year 2013. Tentative scheduling and process activities for each phase of the proposed project is outlined in **Table 1** below.

**Table 1: Chevron Oil Shale Technology Development Schedule**

Phase Description	2006	2007	2008	2009	2010	2011	2012	2013
<b>Phase 1:</b> Site Preparation & Coring Prepare site; Drill core; Gather seismic and well log data		→						
<b>Phase 2:</b> Initiate Fractures Install tiltmeters & Geophones Install groundwater wells & Develop baseline Initiate fracturing & rubblization		→						
<b>Phase 3:</b> Locate Fractures Drill additional wells			→					
<b>Phase 4:</b> Add Fracturing Install gas injection facilities Install gas pipeline; Install electrical feeder Generate thermal cycling				→				
<b>Phase 5:</b> Heat Formation Inject hot gas through formation					→			
<b>Phase 6:</b> Produce Shale Oil Decompose Kerogen & Produce Oil						→		
<b>Phase 7:</b> Heat Integration Drill new pattern & heat to produce oil								→

**Surface Facilities:** Up to four, 400-foot by 400-foot, compacted gravel pads would be constructed over the proposed lease term to accommodate drilling rigs, storage tanks, generators and other process facilities. A single drilling rig would be utilized for the initial core extraction, and for the subsequent drilling of production and injection wells. The drilling rig would be temporary and would constitute the tallest, and most visible, structure on the proposed project site.

Diesel generators would remain onsite during the first three phases of the operation, after which these would be replaced by an external power source. The coring, seismic, and fracturing phases of Chevron's technology would require storage tanks for fuel, water, and drilling fluids as needed. Propellant, explosive, and/or proppant materials may be used in the fracturing process. These materials would be brought onto the site in sealed containers and stored in appropriately designed facilities in accordance with all federal, state, and local laws and regulations. The typical project facilities include, but are not limited to the following:

**Storage Tanks:**

- A 3-foot diameter by 15-foot high gas/liquid separator column.
- A 4-foot diameter by 8-foot long oil/water separator.
- A 100-barrel shale oil storage tank.
- A 500-barrel produced water storage tank.
- A 3-foot diameter by 8-foot long caustic treating drum
- A 50-barrel fresh caustic and 50-barrel spent caustic storage tank.
- A 100-barrel fresh water storage tank.

**Additional Equipment:**

- A gas generator capable of converting natural gas into inert gas.
- An electrically powered compressor capable of pressuring gas from the pipeline into the gas generator.
- An air compressor capable of delivering air into the formation for the in-situ combustion process.
- A heat exchanger for transferring heat from the produced gas.
- A recycle gas compressor capable of recycling the circulating gas from the formation back to the gas generator.
- A fin fan cooler for condensing the liquids in the hot gases coming out of the heated formation.
- A 50-foot flare with an ignition system and flame detection instrumentation capable of burning the noncondensable gases created during unplanned equipment outages.
- Small pumps for transferring the condensed liquid to the oil/water separator and for transferring the separated oil and water to the respective storage tanks.
- A gas turbine for power generation may be installed depending on gas production and gas quality rates.

Modular buildings for office space, basic lab facilities, and site security would be installed as the proposed process proceeds. Portable sanitary facilities would be installed during the initial phase of the proposed project and would remain onsite for the duration of the proposed project.

***Additional Project Design Features:*** Chevron would obtain construction emissions permits, and permits for regulated air pollution sources through the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (APCD). For any emissions source with the potential to emit any "criteria" pollutant in excess of 2 tons per year or any "non-criteria" pollutant in excess of the corresponding limit for that non-criteria pollutant, an Air Pollution Emissions Notice (APEN) must be submitted to the CDPHE-APCD. Emissions sources required to file an APEN may also be subject to Construction Permitting requirements as listed in Colorado Regulation Number 3, Part B; 3). APENs must be updated annually if operating conditions change, or otherwise expire every five years.

Chevron would comply with all federal and state air quality standards, and would comply with all county and state permit conditions and stipulations.

Each monitoring, injection, production, and core well would be subject to, and would comply with, the regulations attached to an Application for Permit to Drill (APD), and the appropriate Sundry Notice would accompany any associated change.

Chevron would obtain and comply with all permits that may be required for construction and operation of the RD&D project. See **Appendix B** for a list of the typical permitting requirements.

Chevron would develop and submit to the BLM for approval the following plans to encompass the entire Proposed Action:

- Response Plan to address the remediation response to the potential for hydraulic fractures in non-aquifer kerogen-rich zones coming into contact with aquifer systems during implementation of in-situ shale oil recovery processes.
- Fugitive Dust Control Plan outlining provisions for dust control mitigation (such as watering roads and enforcing speed limits) during construction and operation of the proposed facilities. In addition, existing lease roads utilized for the proposed project would be maintained and/or upgraded as necessary to conditions equal to, or better, than those that existed prior to project-related use.
- Spill Prevention, Control, and Countermeasure (SPCC) Plan designed to help the Project Manager and all employees to recognize potential spill hazards, prevent spills from occurring, and to manage spill events should they occur. Devices intended to contain, control, or divert spills would be maintained and inspected on a regular basis, and training on the SPCC plan would be required of all employees and contractors.
- Fire Management Plan as an integral part of the overall safety plan that would include evacuation procedures and designated escape routes. This plan would be consistent with the WRFO BLM fire management plan in relation to suppression tactics and accepted practices.

Chevron's primary concern in all of its operations is to protect people and the environment, and the company would provide an emergency preparedness and community right-to-know document to inform the public of the potential hazards associated with the Proposed Action, and to provide access to information on chemicals stored onsite, their uses, and their effects on the environment. Chevron would provide Material Safety Data Sheets (MSDS) for all chemicals stored onsite, and would establish a working emergency action plan in cooperation with local emergency planning committees. Warning and alarm systems would be coordinated in advance with local residents to ensure immediate notification in the event of a dangerous situation.

**Post Operation Measures:** Following in-situ oil extraction, spent shale in the retort zone would be expected to contain various potential contaminants, including soluble salts, trace metals, and residual organics. Adverse effects of these on water quality would be mitigated by reducing the contaminant mass, decreasing the solubilization rate of contaminants, and/or reducing the rate of water movement through the spent shale. A number of mitigation measures would be investigated including, but not limited to:

- Flushing of spent shale in-situ with pH and/or Eh adjusted solutions to reduce the mass of contaminants and to minimize the solubility of key contaminants.
- Injection of pH-buffered grout into the spent shale to control the solubility of specific contaminants and to reduce the permeability and decrease contaminant fluxes into overlying and underlying aquifers.

Upon termination of the proposed RD&D lease agreement, Chevron would remove all facilities from the site, and wells would be abandoned according to sundry notice approval and procedures outlined in Chevron's Oil Shale Research, Development, and Demonstration Plan of Operations. The various types of wells; water monitoring wells, production and injection wells, and tiltmeter and geophone wells, would be cemented to the surface and/or plugged in compliance with all federal, state, or local laws and regulations and industry standards. The site would be reclaimed and returned as near as possible to its natural contours and vegetative state. Surface and groundwater monitoring would continue until such time as the flow and quality are deemed satisfactory for abandonment and stabilization.

## **SUBALTERNATIVES TO THE PROPOSED ACTION**

In addition to the proposed action, BLM has analyzed the environmental impacts of the proposed action with appropriate mitigation measures applied to the project design. The subalternative mitigation actions are described and analyzed in context of the proposed action in the 'Affected Environment and Environmental Consequences' section. The analysis assesses the environmental consequences of the proposed action, enumerates alternative mitigation actions, and evaluates the consequences of the mitigation. The alternatives mitigation measures, in addition to the project design features described above are intended to reduce impacts to health and the human environment and to minimize surface use conflicts. Where no alternatives are necessary to reduce or minimize impacts (i.e. no impacts are anticipated) to a critical element, none are analyzed.

A summary of the mitigation measures included in the project design and additional mitigations in the subalternatives is provided in **Appendix A**.

## **NO ACTION ALTERNATIVE**

Under the No Action Alternative, the application for lease of BLM-administered lands and approval of the proposed oil shale RD&D project would be denied. All other valid uses of public lands would continue under existing authorization or would be considered for approval under the existing White River Resource Management Plan (RMP).

Implementation of the No Action Alternative would prevent or postpone the surface and subsurface environmental impacts associated with the construction and operation of oil shale RD&D facilities on the 160-acre test site. Chevron would not move forward with its research and development proposal at this time on the proposed location, and construction would not occur on BLM-administered lands. None of the impacts associated with the proposed action would immediately occur under the No Action Alternative. Research into improving technology to develop this strategic domestic energy resource would be delayed.

The Energy Policy Act of 2005, Public Law 109-58 (H.R. 6), enacted August 8, 2005, directs the Secretary of the Interior (the Secretary) to complete a programmatic environmental impact statement (PEIS) for a commercial leasing program for oil shale and tar sands resources on public lands with an emphasis on the most geologically prospective lands within each of the states of Colorado, Utah, and Wyoming. Development of the PEIS is occurring simultaneously to this EA and is a common action across all alternatives. The scope of the PEIS will include an assessment of environmental, social, and economic impacts of commercially leasing oil shale and tar sands resources, including foreseeable commercial development activities on BLM-administered lands located in Colorado, Utah, and Wyoming; discussion of relevant mitigation measures to address these impacts; and identification of appropriate programmatic policies and best management practices to be included in BLM land use plans. The PEIS will address land use plan amendments in the affected resource areas to consider designating lands as available for commercial oil shale and tar sands leasing and subsequent development activities. The technology described in the Proposed Action of this EA would not be field tested and refined for commercial application unless and until the PEIS is complete and Chevron is successful in securing a commercial lease.

## **ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL**

The BLM considered, but did not analyze in detail, the following alternatives with regard to the location and technology described in the Proposed Action:

### **A. Relocating the 160-acre RD&D Lease to another site within the Preference Lease Area;**

The preference lease area consists of the contiguous 4,960 acres adjacent to the proposed 160-acre tract. This alternative was not carried forward for detailed analysis. The basis of the Proposed Action is to provide the opportunity to prove the concept that a specific new and untested extraction technology will demonstrate an economic, technically feasible and environmentally acceptable means of recovering potential oil shale energy fuel resources. Oil shale resources in the Piceance Basin are non-uniform in nature. The applicant proposed the best site to demonstrate the proof of concept for their project based on many factors, including: resource potential, technological and environmental factors. Alternatives that would result in modifications to site location may diminish the BLM's ability to advance knowledge of viable recovery technologies, and are unnecessary since no undue environmental degradation will occur. Site relocation within the preference area would have substantially similar effects to the analyzed alternatives and incorporated mitigation, and has been eliminated as a viable proof of concept because the analysis would be redundant.

## B. Modified technologies or methodologies

Alternatives using modified technologies were considered but not carried forward for detailed analysis. The basis for the RD&D project is to provide individual companies the opportunity to prove the concept through a pilot scale demonstration that their specific lab-tested extraction technology will advance our knowledge of economically recovering potential oil shale energy fuel resources. It is the applicant's responsibility to propose the best methodology to demonstrate the proof of concept for their specific technology for advancing knowledge for recovering potential oil shale energy fuel resources.

Alternatives that would result in modifications to the technology or methodology could introduce unknown factors that may affect the RD&D outcome and diminish BLM's capacity to meet the purpose of testing this technology. Moreover, given the low level of impacts identified, there is no reason to believe that a substitute technology or methodology would reduce the impacts of the action. Accordingly, BLM can analyze a reasonable range of alternatives without analyzing in detail other methodologies or technologies.

## **PLAN CONFORMANCE REVIEW**

The Proposed Action and Alternatives are subject to and have been reviewed for conformance with the following plan (43 CFR 1610.5, BLM 1617.3):

Name of Plan: White River Record of Decision and Approved Resource Management Plan (ROD/RMP).

Date Approved: July 1, 1997

Decision Number/Page: Pages 2-6

Decision Language: "...At the discretion of the Secretary of the Interior, research scale lease tracts will be considered within lands available for oil shale leasing. Approval of research tracts will be based on the merits of the technology proposed."

## **AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES**

### **STANDARDS FOR PUBLIC LAND HEALTH**

In February 1997, the Colorado Standards for Public Land Health became effective for all public lands in Colorado. These standards apply to five categories of resource values: 1) Upland Soils; 2) Riparian Systems; 3) Plant and Animal Communities; 4) Threatened and Endangered Species, including BLM Sensitive Species; and 5) Water Quality. Standards describe conditions needed to sustain public land health and relate to all uses of public lands. These findings are located in specific elements listed below.

## CRITICAL ELEMENTS

### AIR QUALITY

#### Affected Environment

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys by creating upslope and downslope circulation that entrain airborne pollutants, and by blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general synoptic weather regime and are most important when the large-scale wind flow is weak.

**Topography:** Chevron's proposed oil shale RD&D project is located in the northern portion of the Piceance Basin, in Rio Blanco County, of northwestern Colorado. The Piceance Basin is bounded by the Cathedral Bluffs to the west, the Grand Hogback to the east, and the Roan Cliffs/Colorado River to the south. Approximately 50 miles to the east of the proposed project area is the large elevated and flattened dome plateau (ranging from nearly 9,000 to over 12,000 ft MSL) established as the mandatory federal Prevention of Significant Deterioration (PSD) Class I Flat Tops Wilderness Area. Dinosaur National Monument is located approximately 50 miles to the northwest of the proposed project area and is considered a State Category 1 Area.

The topography of the Piceance Basin varies from moderately steep mountains, canyons, and mesas in the north-central and south-central portions, to rolling hills and gently sloping river valleys in the eastern and western regions. Elevations range from about 6,000 to nearly 9,000 feet.

**Climate and Meteorology:** The climate of Northwestern Colorado is characterized by low precipitation, dry air, abundant sunshine, and large diurnal temperature ranges. The proposed project area is primarily sagebrush steppe and pinion-juniper woodland at elevations from 6,000 to 7,200 feet with average annual precipitation between 13 to 17 inches, and pinion-juniper/mountain browse at elevations from 6,100 to nearly 9,000 feet with average annual precipitation 14 to 20 inches.

Temperature and precipitation data obtained from the Western Regional Climate Center (WRCC 2006) for Meeker, Rangely and Glenwood Springs, Colorado, are considered to be representative of climatic conditions within the proposed project area. However, because elevation, slope, and aspect affect precipitation and temperatures, the complex terrain results in considerable climatic variability. Precipitation is typically well distributed throughout the year at nearly one inch per month, with mid-winter receiving the lowest average amounts (nearly 1 inch) and fall the highest levels (just under 2 inches). Average temperature and annual precipitation measurements are presented in **Table 2** below.

**Table 2: Climate Data**

Location	Average Temperature Range (°F) January	Average Temperature Range (°F) July	Annual Average Precipitation (in)
Meeker, CO	7 to 37	47 to 86	16
Rangely, CO	4 to 32	56 to 92	10
Glenwood Springs, CO	12 to 37	51 to 89	17

Representative wind measurements are limited within the Analysis Area. Meteorological data collected during 2004, adequate to represent local air pollutant dispersion and transport, were obtained from the Shell Frontier Oil and Gas Bar D monitoring site. These data (combined with upper air measurements from the Grand Junction Airport) were used to predict potential air quality impacts using the EPA preferred AERMOD atmospheric dispersion model.

**Existing Air Quality:** National Ambient Air Quality Standards (NAAQS) have been promulgated for the purpose of protecting human health and welfare with an adequate margin of safety. The State of Colorado has adopted the NAAQS, but has established a more stringent Colorado Ambient Air Quality Standard (CAAQS) for sulfur dioxide (Values listed in **Table 3**). The proposed project is located within an area designated as attainment for all criteria pollutants, indicating that the ambient concentrations of these pollutants are less than the respective NAAQS/CAAQS (Colorado Air Quality Control Commission, 2005) and that existing air quality in the region is acceptable for the protection of human health.

Although specific air quality monitoring is not conducted throughout most of the analysis area, air quality conditions are likely very good, as characterized by few air pollution emission sources (limited industrial facilities and few residential emissions, primarily from smaller communities and isolated ranches), good atmospheric dispersion conditions, as well as limited air pollutant transport into the Project Area, resulting in relatively low local air pollutant concentrations.

Known contributors to existing air pollutant concentrations include the following:

- Exhaust emissions (primarily carbon monoxide [CO] and oxides of nitrogen [NO<sub>x</sub>]) from existing natural gas fired compressors, plus gasoline and diesel vehicle tailpipe air pollutants (CO, NO<sub>x</sub>, particulate matter less than 2.5 microns in effective diameter [PM<sub>2.5</sub>], particulate matter less than 10 microns in effective diameter [PM<sub>10</sub>], sulfur dioxide [SO<sub>2</sub>], and volatile organic compounds [VOC]).
- Dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from disturbed lands, and very limited road sanding during the winter months.
- Limited transport of air pollutants from emission sources located outside the Project Area.

The most complete air quality monitoring data available were assembled by URS Corporation, and are considered to be the best available representation of background air pollutant concentrations throughout the analysis area. These data (reported in micrograms per cubic meter,

or  $\mu\text{g}/\text{m}^3$ ) were used to define background conditions (presented in **Table 3**), and include impacts from existing sources both inside and outside the proposed project area.

The maximum pollutant concentrations are well below applicable NAAQS/CAAQS for most pollutants, although maximum concentrations of ozone approaching the federal standard have been observed. Given the episodic nature of observed high ozone levels, their cause is uncertain, although regional transport or subsidence of stratospheric ozone is possible.

**Table 3: Assumed Background Concentrations of Regulated Air Pollutants**

Pollutant	Averaging Time <sup>(1)</sup>	Background Concentration ( $\mu\text{g}/\text{m}^3$ )	NAAQS <sup>(2)</sup> ( $\mu\text{g}/\text{m}^3$ )	CAAQS <sup>(3)</sup> ( $\mu\text{g}/\text{m}^3$ )	PSD Class I Increments ( $\mu\text{g}/\text{m}^3$ )	PSD Class II Increments ( $\mu\text{g}/\text{m}^3$ )
CO <sup>(4)</sup>	1-hour	1,145	40,000	40,000	NA	NA
	8-hour	1,145	10,000	10,000	NA	NA
NO <sub>2</sub> <sup>(5)</sup>	Annual	9	100	100	2.5	25
Ozone	1-hour <sup>(6)</sup>	173	235	235	NA	NA
	8-hour <sup>(7)</sup>	145	157	157	NA	NA
PM <sub>2.5</sub> <sup>(8)</sup>	24-hour	18	65	65	NA	NA
	Annual	8	15	15	NA	NA
PM <sub>10</sub> <sup>(4)</sup>	24-hour	41	150	150	8	30
	Annual	11	50	50	4	17
SO <sub>2</sub> <sup>(9)</sup>	3-hour	24	1,300	700	25	512
	24-hour	13	365	365	5	91
	Annual	5	80	80	2	20

Notes:

Source: CDPHE-APCD 2006

<sup>(1)</sup> Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

<sup>(2)</sup> National Ambient Air Quality Standards

<sup>(3)</sup> Colorado Ambient Air Quality Standards

<sup>(4)</sup> Data collected by American Soda, Piceance Basin, 2003-2004

<sup>(5)</sup> Based on data collected by Southern Ute Indian Tribe at Ignacio, CO

<sup>(6)</sup> Data collected by the USDI-National Park Service at Mesa Verde, 2003

<sup>(7)</sup> Based on data collected by the CASTNET Network at Gothic and Mesa Verde, CO, and Canyonlands, UT

<sup>(8)</sup> Data collected in Grand Junction, CO (515 Patterson)

<sup>(9)</sup> Data collected by Unocal, Piceance Basin, 1983-1984

NA – not applicable

**Regulatory Framework:** The EPA establishes and revises the NAAQS as necessary to protect public health and welfare, setting the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. Although the EPA recently revised both the ozone and PM<sub>2.5</sub> NAAQS, these revised limits will not be implemented by the Colorado Department of Public Health and Environment-Air Pollution Control Division (CDPHE-APCD) until the Colorado State Implementation Plan is formally approved by EPA. Until then, the EPA is responsible for implementing these revised standards. However, the State of Colorado does implement and enforce the federal air quality standards for PM<sub>2.5</sub> and 8-hour ozone through permitting and air quality plans.

Potential development impacts must demonstrate compliance with all applicable local, state, tribal, and federal air quality regulations, standards, and implementation plans established under the Clean Air Act (CAA) and administered by the CDPHE-APCD (with EPA oversight). Air quality regulations require proposed new, or modified existing, air pollutant emission sources (including the Proposed Action) undergo a permitting review before their construction can begin.

Therefore, the CDPHE-APCD has the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation.

In addition, the U.S. Congress (through the CAA Section 116) authorized local, state and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements (such as Colorado's 3-hour SO<sub>2</sub> ambient air quality standard). Additional site-specific air quality analysis would be performed, and additional emission control measures (including emissions control technology analysis and determination) may be required by the applicable air quality regulatory agencies to ensure protection of air quality resources.

In addition, under the federal CAA and the Federal Land Policy Management Act (FLPMA), the BLM can not authorize any activity which does not conform to all applicable local, state, tribal and federal air quality laws, statutes, regulations, standards, and implementation plans.

The existing air quality of the proposed project area is in attainment with all ambient air quality standards, as demonstrated by the relatively low concentration levels presented above. Given the project area's current attainment status, future development projects which have the potential to emit more than 250 tons per year (or certain listed sources that have the potential to emit more than 100 tons per year) of any criteria pollutant would be required to submit a pre-construction PSD Permit Application, including a regulatory PSD Increment Consumption Analysis under the federal New Source Review and permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of "Best Available Control Technology (BACT) and show that the combined impacts of all applicable sources will not exceed the PSD increments for nitrogen dioxide (NO<sub>2</sub>), PM<sub>10</sub>, or SO<sub>2</sub>. The permit applicant must also demonstrate that cumulative impacts from all existing and proposed sources would comply with the applicable ambient air quality standards throughout the operational lifetime of the permit applicant's project.

A regulatory PSD Increment Consumption Analysis may be conducted at any time by the CDPHE-APCD or the EPA, in order to demonstrate that the applicable PSD increment has not been exceeded by all applicable major or minor increment consuming emission sources. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agency (with EPA oversight).

Mandatory federal Class I areas were designated by the U.S. Congress on August 7, 1977, including those existing wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. All other locations in the country where ambient air quality is within the NAAQS (including attainment and unclassified areas) were designated as PSD Class II areas with less stringent requirements. Also, the CDPHE-APCD has designated Dinosaur National Monument as a State Category 1 Area, with the same SO<sub>2</sub> increments as a federal PSD Class I area. In addition, sources subject to the PSD permit review procedures are required to demonstrate that impacts to Air Quality Related Values (AQRV) will be below Federal Land Managers' Air Quality Related Values Work Group (FLAG) "Limits of Acceptable Change" (FLAG 2000).

The AQRVs to be evaluated include degradation of visibility, deposition of acidic compounds in mountain lakes, and effects on sensitive flora and fauna within the PSD Class I areas. For example, the USDA-Forest Service (FS) White River National Forest Supervisor and Rocky

Mountain Regional Forester are the Federal Land Managers directly responsible for the lands within the PSD Class I Flat Tops Wilderness area. Under the Clean Air Act, they are charged with "... an affirmative responsibility to protect the air quality related values (including visibility) of any such lands within a Class I area..."

Therefore, most of the Analysis Area is currently designated as PSD Class II, Dinosaur National Monument is a State Category 1 Area, and the Flat Tops Wilderness Area is protected by more stringent NO<sub>2</sub>, PM<sub>10</sub>, and SO<sub>2</sub> PSD Class I increment thresholds, as shown above.

The CDPHE-APCD also requires various different pre-construction and operation permits, including: 1) any emission source with the potential to emit any "criteria" pollutant in excess of 2 tons per year must submit an Air Pollution Emission Notice to CDPHE-APCD; 2) all emission sources with the potential to emit NO<sub>x</sub> or CO in excess of 10 tons per year, or 5 tons per year of PM<sub>10</sub>, are required to obtain a permit before construction can begin; 3) sources with potential emissions in excess of 100 tons per year of CO, 40 tons per year of NO<sub>x</sub>, or 15 tons per year of PM<sub>10</sub>, must also include a new source modeling analysis in their permit application. CDPHE-APCD modeling guidelines specify the requirements for conducting modeling, including cumulative analyses; 4) all sources with the potential to emit any "criteria" air pollutant in excess of 50 tons per year must also provide the opportunity for the public to comment on the permit application; and 5) a Title V (or part 70) operating permit is required for all sources with the potential to emit any "criteria" air pollutant in excess of 100 tons per year. Since these pre-construction and operating permit programs are part of the Colorado State Implementation Plan, they have been approved (and are therefore enforceable) by the EPA.

This National Environmental Policy Act (NEPA) analysis compares potential air quality impacts from the proposed project to applicable ambient air quality standards, PSD increments, and AQRV impact threshold levels, but it does not represent a regulatory air quality permit analysis. Comparisons to the PSD Class I and II increments are intended to evaluate a "threshold of concern" for potentially significant adverse impacts, but do not represent a regulatory PSD Increment Consumption Analysis.

### **Environmental Consequences of the Proposed Action**

Potential impacts to air quality were analyzed as described below. No days were predicted to cause a "just noticeable change" in visibility conditions at the mandatory federal Flat Tops PSD Class I Area from direct air pollutant emissions alone.

***Impact Types and Criteria:*** Potential air quality impacts from the proposed RD&D project development were analyzed and reported solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and federal decision makers before a formal Finding of No Significant Impact (FONSI) is issued. Due to the preliminary nature of this NEPA analysis, it should be considered a reasonable, but conservative upper estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting by CDPHE-APCD) are likely to be less. Atmospheric dispersion modeling files used to prepare this analysis are available for review at the WRFO BLM upon request.

The air quality impact assessment was based on the best available engineering data and assumptions, meteorological data, and EPA dispersion modeling procedures, as well as professional engineering and scientific judgment. However, where specific data or procedures

were not available, reasonable, but conservative assumptions were incorporated. For example, the air quality impact assessment assumed that the proposed RD&D activities would operate at full production levels continuously (no “down time”). Therefore, this NEPA analysis assumes a development scenario which is not likely to actually occur.

The air pollutant dispersion modeling was based on one-year of on-site meteorological data collected within the Piceance Basin (Bar D station), as well as regional upper atmosphere data collected at Grand Junction, Colorado. The EPA preferred AERMOD atmospheric dispersion model was used to predict maximum potential near-field ambient air pollutant concentrations (in the vicinity of Proposed Action) for comparison with applicable air quality standards and PSD Class II increments. In addition, similar model analyses for other Oil Shale Research Demonstration and Development projects, as well as the current ExxonMobil Piceance Development Project activities, were combined to determine maximum far-field ambient air pollutant concentrations, atmospheric deposition (acid rain) and visibility impacts at the Flat Tops Wilderness Area.

The criteria for determining the significance of potential air quality impacts include state, tribal and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements include the NAAQS and CAAQS which set maximum limits for several air pollutant concentrations, and PSD increments which limit the incremental increase of specific air pollutants (including NO<sub>2</sub>, PM<sub>10</sub>, and SO<sub>2</sub>) above legally defined baseline concentration levels. Where legal limits have not been established, significance thresholds have been identified for potential atmospheric deposition impacts to sensitive lake water chemistry and terrestrial ecosystems, and a “just noticeable change” in potential visibility impacts.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including CDPHE-APCD and EPA) would review specific air pollutant emissions pre-construction permit applications which examine potential project-wide air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses based on actual facility engineering data would be performed to ensure protection of air quality.

Impacts from both construction and operational activities were considered for Chevron’s proposed Oil Shale RD&D project. These impacts were compared to applicable ambient air standards for Class I and II areas showing that significant air quality impacts would not occur due to the Proposed Action. No violations of applicable state, tribal, or federal air quality regulations or standards are expected to occur as a result of direct or indirect air pollutant emissions (including construction and operation).

***Potential Construction Impacts:*** Air quality impacts would occur during construction (due to surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, drilling activities, facility construction and vehicle engine exhaust) and production (including power generation, product and CO<sub>2</sub> processing, and engine exhausts). The maximum predicted “near-field” air pollutant concentrations occur close to the Project Area; so close that cumulative impacts from other facilities within the Piceance Basin would not significantly increase the maximum predicted “near-field” concentration.

Air pollutant dispersion modeling was performed to quantify potential reasonable, but conservative PM<sub>10</sub> and SO<sub>2</sub> impacts during construction based on the individual pollutant's period of maximum potential emissions. Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during construction were used to predict the maximum 24-hour and annual average PM<sub>10</sub> concentrations. Maximum air pollutant emissions would be temporary (i.e., occurring only during the construction period). The amount of air pollutant emissions during construction would be controlled by watering or applying chemical surfactants to disturbed soils, and by air pollutant emission limits imposed by applicable air quality regulatory agencies. The control efficiency of dust suppressants was computed at 50 percent during construction (equivalent to 1 to 2 percent surface material moisture content per EPA guidance). Actual air quality impacts depend on the amount, duration, location, and characteristics of potential emissions sources, as well as meteorological conditions (wind speed and direction, precipitation, relative humidity, etc.)

The maximum potential short-term (24-hour) PM<sub>2.5</sub> and PM<sub>10</sub> concentrations from construction activities (including a representative background value of 18 and 41 µg/m<sup>3</sup>, respectively), would be 18.5 and 57.8 µg/m<sup>3</sup>, well below the applicable NAAQS of 65 µg/m<sup>3</sup> and 150 µg/m<sup>3</sup>, respectively. In addition, predicted particulate matter concentrations would decrease rapidly away from the emission source. Since these PM<sub>10</sub> construction emissions are temporary, PSD increments are not applicable.

The maximum short-term (3-hour and 24-hour averages) SO<sub>2</sub> emissions would be generated by diesel engines used during construction (sulfur is a trace element in diesel fuel). The maximum modeled concentrations, including representative background values of 24 µg/m<sup>3</sup> (3-hour) and 13 µg/m<sup>3</sup> (24-hour), would be 29.4 µg/m<sup>3</sup> (3-hour) and 14.8 µg/m<sup>3</sup> (24-hour), well below both the restrictive Colorado SO<sub>2</sub> Ambient Air Quality Standard of 700 µg/m<sup>3</sup> (3-hour), the 3-hour SO<sub>2</sub> NAAQS (1,300 µg/m<sup>3</sup>), and the 24-hour standards (365 µg/m<sup>3</sup>). Since these SO<sub>2</sub> construction emissions are temporary, PSD increments are not applicable.

The maximum predicted long-term (annual) NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and SO<sub>2</sub> impacts (including representative background concentrations) were all predicted during construction to be less than the applicable ambient air quality standards. The maximum predicted annual NO<sub>2</sub> concentration of 12.6 µg/m<sup>3</sup> (including a representative background value of 9 µg/m<sup>3</sup>) would be less than the CAAQS/NAAQS of 100 µg/m<sup>3</sup>. The maximum predicted annual PM<sub>2.5</sub> and PM<sub>10</sub> concentration of 8.0 and 14.7 µg/m<sup>3</sup> (including representative background values of 8 µg/m<sup>3</sup> and 11 µg/m<sup>3</sup>, respectively) would be less than the CAAQS/NAAQS of 15 µg/m<sup>3</sup> and 50 µg/m<sup>3</sup>, respectively. The maximum predicted annual SO<sub>2</sub> concentration of 5.5 µg/m<sup>3</sup> (including a representative background value of 5 µg/m<sup>3</sup>) would be less than the CAAQS/NAAQS of 80 µg/m<sup>3</sup>. Chevron plans to use dust mitigation during construction, and at facility operations and access roads to minimize fugitive dust emissions.

**Potential Operational Impacts:** Air pollutant dispersion modeling was also performed to quantify potential reasonable, but conservative NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and SO<sub>2</sub> impacts during operation, based on the period of maximum potential emissions. Operation emissions would occur due to power generation, product and CO<sub>2</sub> processing, and engine exhausts. Chevron plans to install Non-Selective Catalytic Reduction (NSCR) control on gas fired combustion units, and to use Tier II or better standards for diesel combustion engines/generators to minimize impacts resulting from emissions.

As demonstrated in **Table 4**, all other air pollutants and averaging times associated with operational activities are also predicted to be well below applicable ambient air quality standards and PSD Class II increments. As stated previously, all NEPA analysis comparisons to the PSD Class II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment Consumption Analysis.

**Table 4: Predicted Maximum Direct and Total Air Quality Impacts During Operations**

Pollutant	Averaging Time	Direct Concentration	Class II Significance Levels	Background Concentration	Total Concentration	NAAQS/CAAQS
		(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )	(µg/m <sup>3</sup> )
NO <sub>2</sub>	Annual	13.56	25	9	22.6	100
PM <sub>2.5</sub>	24-hour	1.29	NA	18	19.3	65 <sup>(1)</sup>
	Annual	0.33	NA	8	8.3	15 <sup>(1)</sup>
PM <sub>10</sub>	24-hour	25.86	30	41	66.9	150
	Annual	6.11	17	11	17.1	50
SO <sub>2</sub>	3-hour	25.11	512	24	49.1	700 <sup>(2)</sup>
	24-hour	12.05	91	13	25.1	365
	Annual	2.31	20	5	7.3	80

Notes:  
<sup>(1)</sup> Standards for PM<sub>2.5</sub> have not yet been fully implemented  
<sup>(2)</sup> CAAQS standard for SO<sub>2</sub> 3-hour averaging period

**Conformance to Existing Plans and Policies:** Both the CAA and FLPMA require all federal activities (whether conducted directly, or approved through use authorizations) to comply with all applicable local, state, tribal and federal air quality law, statutes, regulations, standards and implementation plans. Potential development would conform to these requirements, consistent with existing land use plans.

**Unavoidable Adverse Effects:** Some decrease in air quality would occur through implementation of the proposed project; however, based on the reasonable, but conservative modeling assumptions, these direct impacts are predicted to be below applicable thresholds.

**Irreversible and Irretrievable Effects:** Once disturbed lands are re-vegetated, potential air quality impacts from the proposed Project would cease after the life of the project. Therefore, there would be no irreversible or irretrievable effects on air quality. Some decrease in air quality would occur through implementation of the Proposed Action. However, based on the reasonable, but conservative modeling assumptions, these direct impacts are predicted to be below applicable

significance thresholds. Once disturbed lands are re-vegetated, potential air quality impacts from the proposed RD&D project would cease. Therefore, there would be no irreversible or irretrievable effects on air quality.

### **Subalternative - Proposed Action with Mitigation**

Under this alternative, and in addition to the measures provided in the Proposed Action, the BLM would require that roads and well locations constructed on soils susceptible to wind erosion be appropriately surfaced to reduce the amount of fugitive dust generated by traffic and construction activities. Dust inhibitors (surfacing materials, non-saline dust suppressants, water, etc.) would be used as necessary on unpaved collector, local and resource roads to prevent fugitive dust problems. To further reduce fugitive dust, the Operator would establish and enforce speed limits (15 to 30 mph) on all project-required roads in and adjacent to the project area.

**Monitoring:** The BLM would require the operator to continue to cooperate with existing atmospheric deposition and visibility impact monitoring programs. The need for, and the design of, additional monitoring could include the involvement of the EPA Region 8 Federal Leadership Forum (EPA 2001) and applicable air quality regulatory agencies. Based upon future recommendations, operators could be required to cooperate in the implementation of a coordinated air quality monitoring program.

### **Environmental Consequences of the Subalternative**

No violations of applicable state, tribal, or federal air quality regulations or standards are expected to occur as a result of direct or indirect air pollutant emissions (including construction and operation). Fugitive dust impacts to air quality during construction and operation would be minimized by implementing mitigation measures to manage the sources of fugitive dust. Based on reasonable, but conservative modeling assumptions, the direct impacts of the Proposed Action are predicted to be below applicable air quality thresholds, therefore the inclusion of additional mitigation measures would ensure that the RD&D program was in compliance with all federal air quality regulations and standards over the life of the project. Some impact to air quality resulting from fugitive dust would be expected under the Proposed Action and Subalternative, but these impacts would not exceed any air pollutant emission limits imposed by applicable air quality regulatory agencies.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur. No violations of applicable state, tribal, or federal air quality regulations or standards are expected to occur as a result of direct or indirect air pollutant emissions (including construction and operation).

## **AREAS OF CRITICAL ENVIRONMENTAL CONCERN**

### **Affected Environment**

The proposed project area is located approximately 4.0 miles southwest of the nearest Area of Critical Environmental Concern (ACEC). The Dudley Bluffs ACEC, located adjacent to County Road 5, protects remnant vegetation associations (RVAs): the Dudley Bluffs Bladderpod, and the Piceance Twinpod. This ACEC would not be sensitive to the vibration, heat, or fugitive dust generated by traffic and normal construction and operation activities associated with the Proposed Action.

### **Environmental Consequences of the Proposed Action**

Construction and operation of the proposed RD&D project would not affect Dudley Bluffs or any other ACEC. Although County Road 5 would be a principle access route to and from the proposed RD&D site, the road is paved and the fugitive dust generated by project related traffic would be minimal.

### **Subalternative - Proposed Action with Mitigation**

No mitigation measures are proposed or necessary to reduce impacts to ACECs from the Proposed Action.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

## **CULTURAL RESOURCES**

### **Affected Environment**

The proposed 160-acre RD&D site was inventoried at the Class III (100% pedestrian) level on March 31 and April 1, 2006. The combined power, communications, and natural gas pipeline ROW was inventoried on April 24, 2006. The purpose of these studies was to identify and record all cultural remains over 50 years old within the area of potential impact, and to assess their significance and eligibility to the National Register of Historic Places (NRHP). (Conner 2006, Compliance Dated 4/10/2006).

Cultural resource inventories must be completed to meet the requirements of the National Environmental Policy Act of 1969, Executive Order 11593, the National Historical Preservation Act of 1966 as amended, the Federal Land Policy and Management Act of 1976, the Antiquities Act of 1906, the Historic sites Act of 1935, the Archaeological and Historic Data Preservation Act of 1974, the American Indian Religious Freedom Act of 1978, and the Native American Graves Protection and Repatriation Act of 1990. These laws are concerned with the identification, evaluation, and protection of fragile, non-renewable evidences of human activity, occupation, and endeavor reflected in districts, sites, structures, artifacts, objects, ruins, and

works of art, architecture, and natural features that were of importance in human events. These resources tend to be localized and highly sensitive to disturbance.

The proposed project area is located approximately 45 miles southwest of Meeker, Colorado at T3S, R97W, Sec. 5NE, 6<sup>th</sup> principal Meridian. The general topographical setting of the proposed project area is the north-descending ridge slope between Hunter Creek and Dry Gulch. The current land use in the area consists of open rangeland, energy development, and seasonal recreation. The proposed project site is sagebrush grassland with shaley, rocky soils underlain by the Uintah Formation. The ground visibility is roughly 40 percent due to heavy sagebrush and grasses and roughly 70 percent in the pinyon-juniper forest area along a portion of the combined ROW. There was zero percent snow cover at the time of the survey.

A Class I inventory (literature search) was conducted for the cultural resources present within the proposed RD&D project area, including the combined power, communications, and natural gas pipeline ROW. File searches were completed through the White River Field Office BLM. The records search identified several previous cultural investigations within the project area, including archaeological investigations for the TransCo Natural Gas Pipeline north of the proposed project, and linear surveys performed in 1981 and 2005 bisecting the northwest quadrant of the proposed project area and the southwest corner of the 160-acre tract respectively. Additionally, the West Hunter Reservoir #1 survey was conducted in 1980 northeast of the project area. The records search identified no known Cultural Resources, and no significant resources were expected because of the low density of finds by other surveys in the area, and the open, heavily vegetated, north sloping terrain.

A 100-percent pedestrian cultural resources survey of the proposed project area and associated ROW was conducted by three archaeologists walking north-south and east-west transects spaced at 15 meter intervals to cover the areas included in Proposed Action. This Class III inventory identified no Cultural Resources in the area. The lack of cultural remains in the proposed project area is attributed to the northeast aspect of the sloping area, and that the area is heavily vegetated with sagebrush. There is no subsurface potential.

### **Environmental Consequences of the Proposed Action**

Construction, operation, and maintenance of the proposed RD&D facilities would not affect any known cultural resources.

### **Subalternative - Proposed Action with Mitigation**

Should important cultural resources not visible on the surface be encountered during the construction of the proposed project facilities, the following measures would be implemented to modify the Proposed Action to mitigate potential impacts to such resources:

- All persons associated with the project will be informed that they would be subject to prosecution for knowingly disturbing historic or archaeological sites, or for collecting artifacts. If historic or archaeological materials are uncovered during any project or construction activities, activities will stop in the immediate area of the find, and the BLM Authorized Officer will be immediately contacted. Within five working days, the BLM Authorized Officer would inform Chevron as to:

- Whether the materials appear eligible for the NRHP;
  - Mitigation measures that Chevron would likely have to undertake before the site can be used (assuming in situ preservation is not practicable); and
  - The timeframe for the BLM Authorized Officer to complete an expedited review under 36 CFR 800.11 to confirm, through the State Historic Preservation Office (SHPO), that the findings of the BLM Authorized Officer are correct and that mitigation was appropriate.
- If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with this process, the Authorized Officer will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation cost. The Authorized Officer will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the Authorized Officer that the required mitigation has been completed, the operator will then be allowed to resume construction.
  - The BLM Authorized Officer will be notified by telephone and with written confirmation, immediately upon discovery of human remains, funerary items, sacred objects, or objects of cultural patrimony. Activities will stop in the immediate area of the find, and the discovery will be protected for 30 days or until notified to proceed in writing by the BLM Authorized Officer.

### **Environmental Consequences of the Subalternative**

No known cultural resources would be impacted by either the Proposed Action or the Subalternative. However, it is possible that important cultural resources not visible on the surface could be encountered during the construction of the project facilities. As a result of the subalternative mitigation action, safeguards would be put into place to protect important cultural resources from damage or destruction resulting from construction and excavation, and any potential unforeseen impacts to cultural resources would be reduced and minimized.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

## **FLOODPLAINS**

### **Affected Environment**

Floodplains are defined as the relatively flat area or lowlands adjoining a body of standing or flowing water that has been, or might be, covered with water. The proposed 160-acre lease tract is situated on a topographic high on Hunter Ridge and would not affect any floodplain.

However, the proposed combined ROW for power, communication, and natural gas pipeline would cross Hunter Creek approximately one half mile east of the proposed 160-acre lease site. The ROW would be constructed across the southern section line of section 33 and 32, and would cross Hunter Creek at the NE/4 of Section 4, T3S, R97W.

Hunter Creek is an intermittent stream that is tributary to Piceance Creek, and is part of a larger drainage network exhibiting trellis to dendritic drainage morphology. Water flow in Hunter Creek is not constant and is dependent on spring runoff and individual storm events. The creek is dry for much of the summer months. Based on information gathered from topographic maps and area surveys, this creek is incised and is contained within a narrow floodplain bordered by steep banks and outcrops composed of the Green River Formation.

The upland areas along Hunter Creek have a good diversity of species and age class, and consist of pinyon-juniper vegetation associations with interspersed populations of serviceberry, mountain mahogany, sagebrush, and some mixed grasses. The banks of Hunter Creek are sparsely vegetated with sagebrush, mature pinyon-juniper, and similar vegetation found in semi-arid regions. A change in vegetative dominance occurs at the transition from upland area (trees and shrubs) to the stream channel (grasses).

The proposed natural gas pipeline would be constructed underground and would cross the narrow floodplain and stream channel of Hunter Creek.

### **Environmental Consequences of the Proposed Action**

No floodplains would be impacted by construction or operation of RD&D facilities on the 160-acre lease tract, and no floodplains would be permanently modified or altered from the construction of the proposed pipeline ROW. The proposed pipeline ROW would remove vegetation along the upland areas and banks of Hunter Creek, and could increase the potential for erosion, sediment transport, and bank de-stabilization during construction.

Chevron would obtain and comply with the Army Corps of Engineers Nationwide Permit 12 conditions and all Colorado Department of Public Health and Environment-Water Quality Control Commission (CDPHE-WQCC) permit requirements. In addition, Chevron's Stormwater Management Plan (SWMP) was written to comply with the CDPHE General Permit No. COR 03000 and related Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) storm water regulations, and includes best management practices for bank stabilization and erosion control. Chevron would adhere to BLM Gold Book guidelines for pipelines and flowlines.

### **Subalternative- Proposed Action with Mitigation**

In addition to the implementation of the permitting requirements and stormwater management BMPs described in the Proposed Action, the BLM would require measures to offset any potential impacts to floodplains. These measures include:

- Limiting construction equipment working in Hunter Creek to that essential for clearing, installation, and restoration.

- Performing routine daily inspections on equipment and vehicles to identify leaks and initiate corrective actions.
- Managing all soil materials such that erosion and sediment transport are minimized.
- Installing structural and/or non-structural erosion controls, as discussed in the Soils section, for bank stabilization and to minimize the potential for sediment runoff into surface waters.
- Monitoring surface water quality and flow as discussed in the Water Quality, Surface and Ground section.
- Revegetating disturbed areas with BLM-approved seed mixes as soon as practical following disturbance.
- Completing all construction activities at the stream crossing during no-flow period.
- Completing stream crossing within 24 hours if possible.
- Limiting grading, topsoil segregation, and excavation along the stream banks to only that area required for installation to avoid excessive disruption of soils and the native seed and rootstock within the soils.

### **Environmental Consequences of the Subalternative**

Temporary impacts to floodplains along Hunter Creek could result from approximately 0.5 acres of surface disturbance associated with the proposed ROW crossing. Subalternative mitigation, along with measures described in the Proposed Action and all permit requirements contained therein, would limit the duration of construction activity, and would ensure that equipment working at or near the banks of Hunter Creek was limited to only that necessary to complete the stream crossing. Revegetation of the affected floodplain would restore the natural function and utility of the floodplain, and the impacts of construction would be temporary.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **INVASIVE, NON-NATIVE SPECIES**

### **Affected Environment**

Noxious weeds and other invasive plants are considered non-native, undesirable native, or introduced species that are able to exclude and out-compete desired native species, thereby decreasing overall species diversity. A noxious weed is commonly defined as a plant that grows out of place and is competitive and persistent. Invasive plants and noxious weeds often invade and persist in areas where native vegetation has been disturbed.

Noxious weeds are a concern to the BLM, the State of Colorado, and Rio Blanco County. The BLM maintains an active noxious weed management program in cooperation with Rio Blanco County, private landowners, and BLM land users. A list of noxious weeds compiled from the BLM White River Field Office, the State of Colorado, and Rio Blanco County weed lists is presented in **Table 5**.

State of Colorado List A species are designated by the Commissioner for eradication, List B species are species that have (or will have) a state noxious weed management plan developed to stop their spread, and management of List C species is the choice of local jurisdictions (Colorado Department of Agriculture 2005). The noxious weed species in this list are acknowledged to be of the most widespread and causing the greatest economic impact in the State of Colorado at this time.

For Rio Blanco County, nine noxious weed species are identified on List B and are prioritized for eradication. Rio Blanco County List A noxious weeds are considered by the Rio Blanco County Weed Advisory Board to be undesirable and are all included on the State of Colorado’s noxious weed list B. Rio Blanco County has not determined List C species.

The BLM has designated major portions of the White River Resource Area as “weed free zones,” and the White River Resource Area RMP states that “a key management element” will include the preventative measures of designating weed-free zones (BLM 1997).

**Table 5: Noxious Weed Species in the White River Resource Area**

Common Name	Scientific Name	State of Colorado	Rio Blanco County	BLM WRFO
Black henbane	<i>Hyoscyamus niger</i>	B	A	X
Black knapweed	<i>Centaurea nigra</i>	B	A	--
Bluebur stickseed	<i>Lappula redowski</i>	--	--	X
Bull thistle	<i>Cirsium vulgare</i>	--	--	X
Canada thistle	<i>Cirsium arvense</i>	A	B	X
Common burdock	<i>Arctium minus</i>	C	--	X
Common mullein	<i>Verbascum thapsus</i>	C	--	X
Dalmatian toadflax	<i>Linaria dalmatica</i>	B	A	--
Diffuse knapweed	<i>Centaurea diffusa</i>	A	B	X
Field bindweed	<i>Convolvulus arvensis</i>	C	--	X
Halogeton	<i>Halogeton glomeratus</i>	C	--	X
Hoary cress/whitetop	<i>Cardaria draba</i>	A	B	X
Houndstongue	<i>Cynoglossum officinale</i>	B	A	X
Leafy spurge	<i>Euphorbia esula</i>	A	B	X
Musk thistle	<i>Carduus nutans</i>	A	B	X
Perennial pepperweed	<i>Lepidium latifolium</i>	B	A	X
Plumeless thistle	<i>Carduus acanthoides</i>	B	A	--
Russian knapweed	<i>Centaurea repens</i>	A	B	X
Russian olive	<i>Eleagnus angustifolia</i>	--	--	X
Scotch thistle	<i>Onopordum acanthium</i> and <i>O. tauricum</i>	B	A	--

Common Name	Scientific Name	State of Colorado	Rio Blanco County	BLM WRFO
Spotted knapweed	<i>Centaurea maculosa</i>	A	B	X
Tamarisk/salt cedar	<i>Tamarix parviflora</i> and <i>T. ramosissima</i>	--	--	X
Yellow starthistle	<i>Centaurea solstitialis</i>	--	--	X
Yellow toadflax	<i>Linaria vulgaris</i>	A	B	X

Source: CO Department of Agriculture 2005, Rio Blanco County, BLM 1997.

The proposed 160-acre RD&D lease parcel was inventoried for the presence of any noxious or invasive weeds on February 27 and 28, 2006 by a WestWater Engineering biologist with extensive knowledge of the area and the plants that are likely to occur in the region. Only a few small patches of snow remained on the ground at the time of the survey. The lease tract was found to be largely free of noxious weeds.

The only species encountered was the common mullein (*Verbascum thapsus*). The largest patch was approximately 100 feet by 20 feet and was found just outside the 160-acre parcel in the bottom of a wash just north of the existing stock reservoir. Another patch of mullein plants was located in small drainage west of the reservoir, and scattered mullein plants were located along the bottom of a gully in the eastern half of the lease parcel. No other noxious weed species were found, and the area surrounding the Proposed Action is relatively free of invasive, non-native plant species.

### **Environmental Consequences of the Proposed Action**

The sparse number of noxious weeds and cheatgrass within the proposed RD&D site is notable. The highly productive and diverse native herbaceous understory suggests that the few weed observations made are an accurate characterization of the site.

The disturbance associated with the Proposed Action could create a noxious weed problem by importing weed seed on vehicles and equipment or by having suitable conditions present (non-vegetated disturbed areas) for the introduction of noxious weeds by other vectors. In addition to noxious weeds, invasive/non-native species such as cheatgrass could also establish on these areas.

Establishment of noxious or invasive weeds would create problems through seed production in proportion to the number of plants and the duration of reproduction. Noxious or invasive species seed production could encourage the spread of these unwanted plants into the adjacent native plant communities. Increased seed production of noxious or invasive plants could aggressively compete with, or exclude, desired vegetation during reclamation. The exclusion of native species could have various environmental effects including a change in fire regimes by increasing the frequency and severity of fires; a change in the nutrient regime in soils; and increased soil erosion. Additionally, noxious weeds can also negatively impact plant community structure by creating, changing the density, or eliminating vegetation layers or canopy cover.

The invasion of noxious weeds and invasive species has the potential to impact native flora and fauna through the loss of biodiversity and the loss of habitat and forage quality for wildlife. These consequences can, in turn, could affect recreational opportunities on BLM lands.

### **Subalternative - Proposed Action with Mitigation**

In addition to the design features identified in the Proposed Action, adverse impacts caused by invasive, non-native species would be further mitigated by implementing measures to treat existing infestations, to prevent the introduction and/or expansion of infestations during construction, and to monitor infestations after construction is complete. Chevron would:

- Revegetate disturbed areas as discussed in the Vegetation section.
- Keep all disturbed areas as free of noxious weeds and undesirable species as practicable during construction, operation, and reclamation operations.
- Conduct pre-construction field surveys each spring prior to construction to identify existing noxious weed infestations within the project area.
- Consult with the BLM and local weed agencies to develop treatment strategies for noxious weed infestations identified during spring surveys.
- Require vehicles and equipment to arrive at the work site clean and free of soil and vegetative debris capable of transporting weed seeds or other propagules.
- Install wash stations at designated infestation areas if any are identified. Equipment would be power-washed to remove soil and propagules prior to leaving the infested areas. Wash station locations will be determined in conjunction with the BLM and local weed agencies after spring surveys have been completed. Wash water will be contained and grease traps will be added as required.
- Use certified weed-free erosion control and reclamation materials (e.g., straw bales and seed mixes).
- Monitor the distribution and density of noxious weeds on the tract, and control and/or eradicate any new or expanded populations for the life of the RD&D project and throughout final reclamation.

### **Environmental Consequences of the Subalternative**

Construction activities associated with the proposed RD&D project would result in the cutting, clearing, and/or removal of existing vegetation within the construction areas. It is anticipated that up to 100 acres of the proposed lease tract, and approximately 7.88 additional acres for the combined powerline, communication line, and natural gas pipeline ROW, would be disturbed over the life of the project. The removal of vegetation and the disturbance of soils during construction would create optimal conditions for the establishment of invasive, non-native species that may continue for many years after the initial disturbance.

Impacts to the native vegetation, visual character, wildlife habitat, soils, and available forage would be minimized by implementing preventative and remedial noxious weed management and revegetation measures. Implementing measures to treat existing infestations and to prevent the introduction of new infestations would inhibit the establishment and expansion of invasive, non-native species during construction and operation of the Proposed Action. Additional post-operation monitoring and treatment provisions would further reduce the potential for invasive, non-native species to establish at the proposed location.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **MIGRATORY BIRDS**

### **Affected Environment**

The Migratory Bird Treaty Act (MBTA), established in 1918, makes it unlawful to pursue, hunt, kill, capture, take, possess, sell, purchase, or barter any migratory bird, including the feathers or other body parts, nests or eggs.

In addition to the MBTA, Executive Order 13186 sets forth the responsibilities of federal agencies to implement further the provisions of the MBTA by integrating bird conservation principles and practices into agency activities and by ensuring that federal actions evaluate the effects of actions and agency plans on migratory birds. Birds protected under the act include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves and pigeons, swifts, martins, swallows and others. A complete list of protected species is found at 50 CFR 10.13.

Similarly, Partners in Flight (PIF) is a cooperative organization that began in 1990 to emphasize the conservation of birds, and addresses bird species not protected by other existing programs. PIF is a partnership of federal, state and local government agencies as well as philanthropic foundations, professional organizations, conservation groups, industry, academic community and private individuals to which the BLM is a contributing member. PIF strives to improve research and management of bird species as well as other aspects of conservation.

The area within and surrounding the proposed 160-acre lease parcel is a progression of habitats beginning with sagebrush flats (proposed 160-acre lease parcel), mature pinyon-juniper along the banks of Hunter Creek to the east and Dry Gulch to the west, and mountain shrub dominated by serviceberry on the southern end of Hunter Ridge. These habitat associations present a possibility that species of migratory birds may forage, roost, breed, nest and/or travel through the project area. The sagebrush, pinyon-juniper, and mountain shrub communities found in and

around the proposed project area are known to support a large array of migratory birds that nest during the months of May through August. However, there are no specialized or narrowly endemic species known to occupy the proposed project area.

Habitat and nesting records for Birds of Conservation Concern (BCC), as described in the Colorado Breeding Bird Atlas (Kingery 1998, and references therein) and Colorado Birds (Andrews and Righter 1992), in the vicinity of the Proposed Action are summarized in **Tables 6 and 7** below. Bird identification and taxonomic nomenclature are in accordance with that applied by the Colorado Breeding Bird Atlas Project.

**Table 6: Raptor Species that May be Present in the Project Area**

Common Name	Scientific Name	Habitat & Breeding Records
Cooper's Hawk	<i>Accipiter cooperii</i>	<ul style="list-style-type: none"> <li>• Cottonwood riparian to spruce/fir forests, including pinyon-juniper woodlands. Nests most frequently in pines and aspen.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Sharp-shinned Hawk	<i>Accipiter striatus</i>	<ul style="list-style-type: none"> <li>• High density young, or even-aged, stands of coniferous forest and deciduous forests of aspen or scrub oak with small stands of conifers.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Red-tailed Hawk	<i>Buteo jamaicensis</i>	<ul style="list-style-type: none"> <li>• Diverse habitats including grasslands, pinyon-juniper woodlands and deciduous, coniferous and riparian forests. Nests in trees (especially cottonwood, aspen, and pines) and on cliffs and utility poles.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Great horned owl	<i>Bubo virginianus</i>	<ul style="list-style-type: none"> <li>• Occupies diverse habitats including riparian, deciduous and coniferous forests with adjacent open terrain for hunting.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>

**Table 7: BCC and PIF Species that May be Present in the Project Area**

Common Name	Scientific Name	Habitat and Breeding Records
Greater sage-grouse	<i>Centrocercus urophasianus</i>	<ul style="list-style-type: none"> <li>• Large continuous areas of sagebrush on flat or gently rolling terrain with open areas in vicinity for leks. Nests in herbaceous areas within sagebrush.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Gray flycatcher	<i>Empidonax weightii</i>	<ul style="list-style-type: none"> <li>• Mixed pinyon-juniper and coniferous woodlands. Nests in the crotch of junipers, pines, and sagebrush.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Gray vireo	<i>Vireo vicinior</i>	<ul style="list-style-type: none"> <li>• Open and drier pinyon-juniper woodlands on rocky slopes at the lower elevation range of pinyon-juniper. Nests in junipers, especially those with protruding snags.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>

Common Name	Scientific Name	Habitat and Breeding Records
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>	<ul style="list-style-type: none"> <li>• Pinyon-juniper woodlands. Nests in pinyon or juniper.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Violet-green swallow	<i>Tachycineta thalassina</i>	<ul style="list-style-type: none"> <li>• Deciduous and riparian forests and pinyon-juniper woodlands. Nests in holes in trees.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Juniper titmouse	<i>Baeolophus griseus</i>	<ul style="list-style-type: none"> <li>• Pinyon-juniper woodlands. Nest in knotholes and other natural cavities in junipers.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Black-throated gray warbler	<i>Dendroica nigrescens</i>	<ul style="list-style-type: none"> <li>• Mature pinyon-juniper woodlands. Nests on horizontal branches in pinyon or juniper.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Green-tailed towhee	<i>Pipilo chlorurus</i>	<ul style="list-style-type: none"> <li>• Sagebrush and mountain shrublands. Nest on the ground or in very low branches.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Brewer's sparrow	<i>Spizella breweri</i>	<ul style="list-style-type: none"> <li>• Sagebrush, desert shrub and mountain shrublands.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Sage sparrow	<i>Amphispiza belli</i>	<ul style="list-style-type: none"> <li>• Large contiguous areas of low-elevation big sagebrush or sagebrush/greasewood shrublands. Nests in sagebrush.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Black-Chinned Hummingbird	<i>Archilochus alexandri</i>	<ul style="list-style-type: none"> <li>• Pinyon-juniper woodlands.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Virginia Warbler	<i>Vermivora virginiae</i>	<ul style="list-style-type: none"> <li>• Sagebrush, desert shrub and mountain shrublands.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	<ul style="list-style-type: none"> <li>• Pinyon-juniper woodlands.</li> <li>• Confirmed breeder in Rio Blanco County.</li> </ul>

**Raptors:** Suitable habitat for raptor nests is primarily restricted to exposed rocky cliffs (Red-tailed hawks) and woodlands with mature stands of pinyon and juniper trees (Sharp-shinned, Cooper's hawk and Great horned owls). No suitable habitat exists within the proposed 160-acre lease tract. However, there are cliff faces along Hunter Creek within 0.5 miles of the tract and mature pinyon-juniper woodland is the dominant habitat to the north, east, and west of the tract. No suitable cliffs were observed within Dry Gulch to the east, or within 0.5 miles west of the tract.

A pedestrian survey of the proposed 160-acre lease parcel and the surrounding areas within a 1/2 mile radius, including Dry Gulch and Hunter Creek, was conducted on February 27 and 28, 2006 by WestWater Engineering wildlife biologists. The area was surveyed again on March 18 using the Kennedy-Stahlecker-Rinker method. This method requires that an attempt be made to call in raptors using a loud digital call of a Great Horned Owl. At the time of the survey the call was played at 21 stations on 4 transects according to BLM WRFO protocol.

Three nests were observed during the February surveys: one Red-tailed hawk nest and two Great Horned Owl nests.

**Red-tailed Hawk:** One stick nest was observed on an east facing cliff overlooking Hunter Creek to the east of the proposed 160-acre lease tract. This nest had been observed first in 2005 and was in current use at that time.

**Great Horned Owl:** Two nests were observed in the large pinyons to the northeast of the proposed lease site. The nests are located within an approximately 15-acre stand of mature pinyon-juniper. The nests are just a few hundred feet from each other and thus most likely represent alternate nest sites for one pair and not multiple nesting pairs. Nest identification was made based on small mammal bones and regurgitated pellets located beneath both nests.

In addition to the nests found during the February survey, a pair of Red-tailed hawks appeared to respond to the calls in the Hunter Creek area, and an additional nest, thought to be that of a Red-tailed hawk, was discovered. This nest was discovered on the east side of Hunter Creek, approximately 3/4 miles from the nearest boundary line of the proposed lease tract.

No other raptors, including Great horned owls, responded to the calls. Careful re-examination of the nest sites found during the February survey indicated that no owls were present at the time of the March survey.

***Other Birds of Conservation Concern:*** No evidence of Greater sage-grouse was discovered within proposed lease tract. The sagebrush habitat in and around the lease tract is in better range condition than most low elevation sagebrush habitat. Sagebrush canopies are not closed and there is a highly productive herbaceous understory. This block of sagebrush habitat is approximately four miles north of the current designated overall range for Greater sage-grouse and five miles north of the closest recently documented Greater sage-grouse use on Big Jimmy Ridge. This vacant habitat on the proposed lease tract is separated from the currently occupied habitat to the south by considerable unsuitable habitats including pinyon-juniper woodlands, canyons and numerous smaller draws.

No migratory birds of conservation concern were observed during the surveys. However, a February survey was not conducive to finding migratory birds that usually do not commence nesting until May or later. Both the sagebrush and pinyon-juniper habitats appeared suitable for all of the birds listed in the table above. Birds observed in the area included western blue bird, robin, scrub jay, nuthatch, chickadee, and raven.

### **Environmental Consequences of the Proposed Action**

Construction and operation of the Proposed Action would result in the disturbance of a total of approximately 100 acres of sagebrush and less than 4 acres of pinyon-juniper habitat. Although the Proposed Action would represent an incremental and longer term reduction in the extent of the habitat associations described, implementation of the Proposed Action would have no measurable influence on the abundance or distribution of breeding migratory birds at the scale proposed since sagebrush and pinyon-juniper are generally abundant in this area, and the loss due to this project would represent a small portion of the habitat suitable for these birds.

Operation of the facility would introduce noise and human activity that may disperse migratory birds from the area, and could deter these birds from nesting in the immediate vicinity. However, the current use of County Road 69 for access to the oil and gas operations to the south of the proposed project has likely already deterred many migratory birds from nesting along this corridor.

Nesting of raptors and migratory birds may be disrupted should construction activities occur within 1/4 mile of active nests during the February 1 to August 15 nesting and brooding period (WRRRA RMP/ROD 1997).

The construction of reserve pits for use in drilling operations would introduce a water source that may attract migratory birds. These pits could pose a threat to migratory birds if not adequately designed, or if oil and other contaminants were allowed to accumulate on the surface.

### **Subalternative - Proposed Action with Mitigation**

Under this alternative, in addition to the proposed action, BLM would require the following mitigation to ensure impacts to migratory birds would be minimized by implementation:

- Conduct follow-up surveys if construction activities do not begin prior to February 1, 2007;
- Minimize, where possible, vegetation clearing while migratory birds are nesting (February 1 through August 15);
- If reserve pits are deemed necessary on site, ensure that pits are lined, fenced on all four sides with net-wire, and covered with plastic barrier to exclude both large and small animals and netted to prevent birds from accessing these pits. Plastic flagging has proven to be ineffective at deterring migratory waterfowl from using reserve pits for foraging, resting or as a source of free water. The Operator will notify the BLM via Sundry Notice of the method that will be used to prevent impacts to migratory birds two weeks prior to the date when completion activities are expected to begin. The BLM-approved method will be applied within 24 hours after completion activities have begun.
- All lethal and non-lethal events that adversely affect migratory birds will be reported to a WRFO Petroleum Engineer Technician and Wildlife Biologist immediately.

No special status species are presently known to occur in the project area. If surveys reveal special status species to be present, Chevron must comply with the following measures detailed in Appendix A of the White River Resource Area RMP (1997):

- No development activities are allowed within 1/2 mile of identified nest sites of listed, candidate, or BLM sensitive raptor species (except Bald Eagle and Ferruginous Hawk) from February 1 through August 15, or until fledging and dispersal of young. Development activities are allowed from August 16 through January 31;
- No development activities allowed within 1/4 mile of identified nests of other special status raptor species from February 1 through August 15, or until fledging and dispersal of young. Development activities are allowed from August 16 through January 31;
- No development is allowed within one (1) mile of identified nests of Ferruginous Hawks from February 1 through August 15, or until fledging and dispersal of young. Development activities allowed from August 16 through January 31;
- No surface occupancy within 1/4 mile of an identified nest of an ESA listed, proposed, or candidate raptor species;
- No surface occupancy within 1/8 mile of an identified nest of other special status raptor species;

These mitigation measures can be exempted, modified, or waived by BLM if conditions warrant and the decision is documented through an environmental analysis. An exception would suspend the stipulation on a one time basis. Modifications would temporarily or permanently change the

language or provision of a stipulation. Waivers are utilized to permanently remove the stipulation due to changed circumstances. Conditions for granting an exception, modification, or waiver are described in the Appendix A of the White River Resource Area RMP (1997).

### **Environmental Consequences of the Subalternative**

Vegetation and soil management practices, as discussed in the 'Subalternative' portion of the Vegetation and Soils sections, would guide reclamation efforts to ensure that habitat associations are restored as near as possible to pre-construction conditions. The mitigation measures described above would reduce the potential impacts to nesting migratory birds, but may not limit impacts to unknown nest locations. If previously unknown nests are identified, the subalternative action would provide for additional mitigation measures to assure that threatened, endangered, or BLM sensitive species and their nesting sites are avoided.

Mitigation measures employed to preclude migratory birds from accidental interaction with reserve pits would reduce and/or prevent waterfowl injury and/or mortality resulting from contact with oil-based drilling fluids stored in open pits. Conservative management measures designed to prevent bird contact with produced water and drilling and completion fluids that may expose the birds to acute or chronic toxicity and/or compromise their natural insulation would greatly reduce the extent of any adverse impacts to migratory birds.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **NATIVE AMERICAN CONCERNS**

### **Affected Environment**

The American Indian Religious Freedom Act, established in 1978, and the Native American Graves Protection and Repatriation Act, established in 1990, protect and allow access by Native Americans to sites that are sacred or have traditional cultural use. Consultation with Native American groups is required concerning all activities that may affect archaeological resources of importance to Native Americans. Since many of these sites are subject to desecration by vandalism and theft, Native American groups do not normally disclose the locations of traditional use areas and sacred sites.

The WRFO BLM extended an invitation to the Ute Indian Tribe to participate in the environmental assessment of the proposed oil shale RD&D project on March 16, 2006. The Tribe declined the invitation on May 12, 2006 as the parcel is neither within, or contiguous to, the Uintah and Ouray Reservation.

### **Environmental Consequences of the Proposed Action**

No archaeological resources, sacred sites, or traditional cultural use areas are known to occur within the proposed project area, and no such sites have been identified.

### **Subalternative - Proposed Action with Mitigation**

If traditional use areas or sacred sites are identified, mitigation measures would be determined in consultation with the appropriate tribe(s) to ensure protection of any sacred sites.

**Environmental Consequences of the Subalternative**

There would be no impact unless previously unknown sites are identified by the Native American groups. In this case, implementation of appropriate mitigation measures to ensure the protection and/or avoidance of traditional use areas or sacred sites would be negotiated with the affected Tribe(s).

**Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

**THREATENED, ENDANGERED, AND SENSITIVE ANIMAL SPECIES**  
(includes a finding on Standard 4)

**Affected Environment**

Special Status Species are those for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species that are protected under the Endangered Species Act (ESA), Colorado State listed species, species that are considered candidates by the FWS, and BLM sensitive species. The special status wildlife species known to occur in Rio Blanco County, their associated habitats and protection status are summarized in **Table 8**.

**Table 8: Special Status Wildlife Species Known to Occur in Rio Blanco County**

Common Name	Scientific Name	Protection Status <sup>1</sup>	May be Affected by Project	Habitat Preference
<b>Mammals</b>				
Black-footed Ferret	<i>Mustela nigripes</i>	FE, SE	No	Semi-arid grasslands and mountain basins; primarily in associations with active prairie dog colonies that contain suitable burrow densities and colonies of sufficient size
Canada Lynx	<i>Lynx canadensis</i>	FT, SE	No	Douglas fir, spruce fir, and subalpine forests above 7,800 feet elevation
Fringed Myotis	<i>Myotis thysanodes</i>	BS	Habitat exists. Occupancy within the project area is unknown	Primarily at middle elevations of 3900 - 7000' in desert, grassland, and woodland habitats. Roosts in rock crevices and cliff walls; forages in coniferous forests and shrublands occurring near open water

Common Name	Scientific Name	Protection Status <sup>1</sup>	May be Affected by Project	Habitat Preference
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	SC, BS	Habitat exists. Occupancy within the project area is unknown	Occupies semi-desert shrublands, pinyon-juniper woodlands, and open montane forests
White-tailed Prairie Dog	<i>Cynomys leucurus</i>	BS	No	Xeric sites with mixed stands of shrubs and grasses in plains, plateaus, desert shrub habitat
Yuma Myotis	<i>Myotis yumanensis</i>	BS	Habitat exists. Occupancy within the project area is unknown	Roosts in rock crevices, buildings, caves, mines, and in swallows' nests; forages in riparian areas; associated with semi-arid canyonlands and mesas at lower elevations
<b>Birds</b>				
American peregrine falcon	<i>Falco peregrinus anatum</i>	SC	No	Nests on cliffs, often near water, forages over adjacent habitats
Bald Eagle	<i>Haliaeetus leucocephalus</i>	FT, ST	No	Nest sites typically occur in proximity to open water and are typically found in mature heterogeneous stands of multi-storied trees; winter habitat includes areas of open water, adequate food sources, and sufficient diurnal perches and night roosts
Barrow's Goldeneye	<i>Bucephala islandica</i>	BS	No	In Colorado, winters on lakes, rivers, estuaries, and bays
Black Tern	<i>Chlidonias niger</i>	BS	No	Breeds in marshes, along sloughs, rivers, lakeshores, and impoundments, or in wet meadows, typically in sites with mixture of emergent vegetation and open water
Burrowing Owl	<i>Athene cunicularia</i>	BS	No	Grasslands and mountain parks, usually in or near prairie dog towns. Also uses well-drained, steppes, deserts, prairies and agricultural lands
Ferruginous Hawk	<i>Buteo regalis</i>	SC, BS	No	Open country, primarily prairies, plains and badlands; sagebrush, saltbush-greasewood shrubland, periphery of pinyon-juniper and other woodland and desert habitats
Greater Sage Grouse	<i>Centrocercus urophasianus</i>	SC, BS	Yes	Sagebrush obligate species; inhabits upland sagebrush habitat in rolling hills and benches; nesting and brooding occur in meadows in proximity to water; winter habitat is sagebrush at submontane elevations
Long-billed Curlew	<i>Numenius americanus</i>	SC, BS	No	Breeds in prairies and grassy meadows, generally near water. Nests in dry prairies and moist meadows. Nests on ground usually in flat area with short grass

Common Name	Scientific Name	Protection Status <sup>1</sup>	May be Affected by Project	Habitat Preference
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	FT	No	Nests on platforms and large cavities in trees, on ledges, and in caves; found primarily in canyons with mixed-conifer forests, pine-oak woodlands, and riparian areas
Mountain Plover	<i>Charadrius montanus</i>	SC, BS	No	Prairie grasslands, arid plains and fields. Nesting plovers choose short grass prairies grazed by prairie dogs, bison and cattle, and overgrazed tall grass and fallow fields
Northern Goshawk	<i>Accipiter gentilis</i>	BS	Yes	Typically nests in mature, old-growth aspen, conifer, and aspen/conifer mixes. Also nests in mature pinyon-juniper in the Piceance Basin; foraging habitats include mountain shrub, pinyon-juniper woodlands, and open habitats
Sharp-tailed Grouse	<i>Tympanuchus phasianellus Columbianus</i>	BS	No	Rolling hills with scrub oak thickets and grassy glades. As an equivalent to sagebrush, they use scrub oaks, serviceberries and willows. In Colorado, the present population consists of only a few hundred birds in Douglas County (CDOW, 2005)
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	FC, SC	No	Riparian obligate species; occurs in large tracts of cottonwood/willow habitat
White-faced Ibis	<i>Plegadis chihi</i>	BS	No	Marshes, swamps, ponds and rivers, mostly in freshwater habitats.
<b>Fish</b>				
Bluehead sucker	<i>Catostomus discobolus</i>	BS	No	In Colorado, the species is limited to western slope and occurs in the Colorado River basin.
Bonytail Chub	<i>Gila elegans</i>	FE, SE	No	Endemic to Colorado River system; main channels of large rivers with swift currents
Colorado River cutthroat trout	<i>Oncorhynchus clarki pleuriticus</i>	SC, BS	No	Found in the Colorado River drainage; the current distribution is limited to a few, small headwater streams and lakes in northwest Colorado.
Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	FE, ST	No	Known from the Colorado River system within large, swift rivers
Flannelmouth sucker	<i>Catostomas latipinnis</i>	BS	No	In Colorado, the species is limited to western slope and occurs in the Colorado River basin.
Humpback Chub	<i>Gila cypha</i>	FE, ST	No	Endemic to Colorado River system; deep, swift running rivers with canyon shaded environment
Mountain sucker	<i>Catostomas platyrhynchus</i>	SC, BS	No	In Colorado, the flannelmouth is found only in large rivers in the Colorado River drainage on the western slope
Plains topminnow	<i>Fundulus sciadicus</i>	BS	No	Present in the White River in small isolated populations
Razorback Sucker	<i>Xyrauchen texanus</i>	FE, SE	No	Endemic to large rivers of the Colorado River system
Roundtail chub	<i>Gila robusta</i>	SC, BS	No	Occurs in the Colorado River mainstem and larger tributaries (e.g., White, Yampa, Dolores, San Juan, and Gunnison rivers)
<b>Reptiles and Amphibians, and Others</b>				

Common Name	Scientific Name	Protection Status <sup>1</sup>	May be Affected by Project	Habitat Preference
Boreal toad	<i>Bufo boreas boreas</i>	FC, SE	No	Marshes, wet meadows, streams, and lakes interspersed in subalpine forest
Great Basin Spadefoot	<i>Spea intermontana</i>	BS	Habitat exists. Occupancy within the project area is unknown	Mainly sagebrush flats, semi-desert shrublands, pinyon-juniper woodland
Midget Faded Rattlesnake	<i>Crotalus viridis concolor</i>	SC, BS	Habitat exists. Occupancy within the project area is unknown	Rock outcrops, talus slopes, and rocky streambeds, may occur in desert shrub, mountain shrub, and coniferous habitats; entire range lies within the Green River Formation of Wyoming, Utah, and Colorado.
Northern Leopard Frog	<i>Rana pipiens</i>	SC, BS	No	Permanent water and associated moist upland vegetation

Source: BLM 2000, USFWS 2006, CDOW 2006.

<sup>1</sup>FT = Federally Threatened; FE = Federally Endangered; FC = Candidate for federal listing; ST = State Threatened; SE = State Endangered; SC = State Special Concern (not a statutory category); BS = BLM Sensitive

Field surveys were conducted in March of 2006 by WestWater Engineering wildlife biologists and found that the proposed 160-acre lease parcel includes no known federally listed animal species and no preferred habitat for such species. The only federally listed or federal candidate species known to occur near the proposed project area are Bald Eagles. Based on the absence of suitable habitat, no other federally listed or federal candidate wildlife species are expected to occur in the project area. The special status species of concern that may occur in the proposed project area are the Greater Sage-grouse and the Northern Goshawk. Several species of BLM Sensitive bats may inhabit the canyons of Hunter Creek and Dry Gulch adjacent to the Proposed Action, and suitable habitat for the Great Basin Spadefoot and Midget Faded Rattlesnake is present in the project area, but it is not known whether or not these species inhabit the area.

Because the Proposed Action involves surface disturbing activities that have potential to increase sediment loads in tributaries to Piceance Creek, Endangered Colorado River Fish are of concern even though the project location has no habitat suitable for fish and no affect on critical habitats is anticipated.

The species of concern that have potential to occur within the proposed project area, either as inhabitants, occasional migrants, or as a rare occurrence are discussed below.

**American Peregrine Falcons** are rare inhabitants and migrants in the Piceance Basin. Peregrine falcons forage over large areas in many habitats, and generally inhabit open spaces usually associated with high cliffs and bluffs overlooking rivers. Some populations are migratory and travel great distances.

**Bald eagles** occur in the Piceance Basin from October to March as winter residents and migrants. Foraging eagles are regularly encountered during winter months, but foraging activities appear to be widely dispersed and wholly opportunistic. Bald eagles tend to use traditional communal roosts located in mature trees near open water or perennial streams. In winter, they may also occur locally in semi-deserts and grasslands, especially near prairie dog towns.

**Ferruginous Hawks** inhabit grasslands and semi-desert shrublands, and are rare in pinyon-juniper woodlands. Breeding birds nest in isolated trees, on rock outcrops, on structures and

power poles, or on the ground. Winter residents concentrate around prairie dog towns. Winter numbers and distribution fluctuate greatly according to the availability of prairie dogs; when a local prairie dog population dies off due to plague, hawk numbers decrease drastically. Migrants and winter residents may also occur in shrublands and agricultural areas.

*Northern goshawks* generally occur in mature old growth aspen, conifer, or mixed aspen/conifer forests, and are known to occur in mature pinyon-juniper habitats. This species has been documented nesting and foraging in suitable habitats in Rio Blanco County, Colorado.

*Greater sage grouse* are closely associated with large, woody sagebrushes and depend on these for food and cover during all periods of the year. Large, woody species of sagebrush including basin big sagebrush, Wyoming big sagebrush, and mountain big sagebrush are used by sage grouse throughout the year in all seasonal habitats. Sage grouse exhibit consistent breeding behavior each year on ancestral strutting grounds, referred to as leks. Leks are situated in relatively open areas with less herbaceous and shrub cover than the surrounding areas, and are typically surrounded by potential nesting habitat (areas adjacent to relatively dense sagebrush stands).

Nesting habitats are characterized by sagebrush communities with well-developed horizontal and vertical diversity. Active nesting sites tend to occur in higher sagebrush density, taller live and residual grasses, more live and residual grass cover, and less bare ground (Connelly et al. 2004). Grouse are susceptible to sagebrush community disturbance and destruction, as well as to the construction of fences, above-ground power lines, and other above-ground structures that may provide perching or roosting opportunities for raptors. Human activities occurring during breeding season may disrupt normal use of leks and subsequently affect local breeding success.

*Endangered Colorado River Fish* (Colorado pikeminnow, humpback chub, razorback sucker, and bonytail chub) occur downstream of the proposed project area, but the area itself does not contain any potential habitat. Designated critical habitat for the Colorado pikeminnow and razorback sucker occurs in the Colorado River from Rifle downstream, including the confluence with Roan Creek. Designated critical habitat for the humpback chub and bonytail chub occurs further downstream in the Black Rocks area near the Colorado-Utah border (BLM 2004). Colorado pikeminnow occur in the White River. The White River downstream from Rio Blanco Lake, including the confluence with Piceance Creek, is designated critical habitat for all Colorado River endangered fish species (BLM 1999).

*Fringed Myotis* occupy a variety of habitats including mid-elevation desert, grass and woodland habitats, and are found at higher elevations in spruce-fir habitat and in mixed timber of ponderosa pine, white spruce, and aspen. While this species most often roosts in rock crevices, caves, and cliff walls, the only studies of maternal roost sites have been associated with buildings. Although studies are limited, foraging habitats seem to be associated with open water, including ponds, creeks, and streams (Schmidt 2003). This species is known to occur in coniferous woodlands and shrublands below 7,500 feet. This species is known to occur in Rio Blanco County, but its status is listed as rare (NDIS 2004).

*Townsend's big-eared bats* occur in many types of habitat, but are often found near forested areas including semi-desert shrublands, pinyon-juniper woodland, and riparian woodland in

semi-desert valleys. This species roosts in caves, crevices or abandoned buildings and other structures, and forages over water, along streams, over springs, and among riparian and shoreline vegetation. This is a species of dry shrub country, but it appears to be tied closely to water (NDIS 2005). This species is known to occur in Rio Blanco County.

*Yuma Myotis* occur in a variety of upland and lowland habitats, including riparian, desert shrub, and moist woodlands and forests, but are usually found near open water. Nursery colonies are usually in buildings, caves and mines, and under bridges.

*Midget faded rattlesnakes* occur in a variety of habitats, from desert shrub to coniferous forests. These snakes are often associated with rock outcrops, talus slopes, and rocky streambeds. Midget faded rattlesnakes are known to occupy rocky outcrops of the Green River formation. They are also found in desert shrub, mountain shrub and coniferous habitats. Little is known about this species. They hunt nocturnally and reproduce between March and September. The snake is endemic to western Colorado, Wyoming and eastern Utah (NatureServe, 2005). Suitable prey includes small mammals, birds, reptiles, and amphibians. No specific information exists on the presence or absence of this species within the proposed project area.

*Great basin spadefoot* is a burrowing toad that utilizes sagebrush flats and semi-desert shrubland as an adult. This species breeds in temporary or permanent lentic habitats and is mostly nocturnal. No specific information exists on the presence or absence of this species within the proposed project area.

### **Environmental Consequences of the Proposed Action**

The Proposed Action occurs mainly in sagebrush habitat, and has potential for Greater sage-grouse use, but is outside the designated overall range for sage grouse. The potential habitat associated with the Proposed Action is approximately four miles north of the current designated overall range for Greater sage-grouse and five miles north of the closest recently documented Greater sage-grouse use. The proposed lease tract is separated from the currently occupied habitat to the south by considerable unsuitable habitats including pinyon-juniper woodlands, canyons and numerous smaller draws. There are no known leks on Hunter Ridge or within two miles of the ridge. The proposed project site was surveyed for signs of sage grouse use on February 27 and 28, 2006, and no indication of use was found.

American Peregrine Falcons are rare inhabitants and migrants in the Piceance Basin and are unlikely to occur in the area of the Proposed Action. However, because peregrine falcons forage over large areas and in many habitats, individuals may occasionally hunt or fly over the proposed site. The Proposed Action is not likely to affect any American Peregrine Falcons.

The Proposed Action does not include suitable winter roost habitat or nesting habitat for Bald Eagles. The project site could be within winter forage range for these birds, but the nearest documented foraging activities are 3 to 5 miles north of the project area. Bald eagles may occasionally forage over the proposed project site, but are unlikely to occur on a regular basis

because no prairie dogs or open water, nesting, or roosting habitats are present. The Proposed Action is not likely to adversely affect foraging Bald Eagles.

The areas surrounding the Proposed Action include suitable nesting habitat for Ferruginous hawks, but these birds tend to concentrate in areas that have abundant prairie dog populations and are unlikely to occur due to the lack of any prairie dog colonies in the project area. The Proposed Action is not likely to adversely affect Ferruginous Hawks.

The areas surrounding the proposed RD&D site include suitable nesting habitat for other raptors and provide mature pinyon-juniper woodlands that could be considered potential nesting habitat for the Northern goshawk. Construction of the proposed RD&D facilities/well pads has the potential to disrupt raptor nesting activities in the surrounding area, but will not remove any suitable nesting trees (with the exception of the proposed natural gas pipeline and utility ROW that may remove a minimal amount of suitable pinyon-juniper trees in the area of Hunter Creek). The current use of County Road 69 and the lack of pinyon-juniper trees of sufficient size within the 160-acre lease site severely limits the possibility of raptor nesting within this corridor. As a result, the construction of the proposed RD&D facilities would not be expected to impact raptor nesting habitat.

Construction of the proposed project facilities would remove up to 100 acres of potential foraging habitat for the Northern Goshawk. Other possible effects to these birds may include displacement due to disturbance, changes in winter foraging distribution, as well as indirect impacts from activities associated with construction and operation of the RD&D facilities and associated access roads. Impacts would be temporary until revegetation efforts were successful and native vegetation was restored. The areas surrounding the proposed project provide adequate foraging ground which would limit the temporary impacts to this species.

The surface waters adjacent to the proposed project area are tributary to Piceance Creek, and increased sedimentation resulting from surface disturbance associated with the Proposed Action could affect Colorado endangered fish if not properly mitigated. Chevron's Stormwater Management Plan outlines the BMPs to be used to prevent stormwater runoff and sediment transport into the waters of the state. In addition, Chevron would comply with all Corps of Engineers (COE) Nationwide Permit 12 conditions for the pipeline and utility crossing at Hunter Creek. No adverse impact to Colorado endangered fish would be expected.

The proposed 160-acre lease site does not provide suitable habitat for any of the special status species bats, but areas along Hunter Creek to the east and Dry Gulch to the west may provide adequate rock crevice and cliff wall roosts, along with adequate mature pinyon-juniper and water resource requirements for these bats. The occurrence of these bats within the proposed project area is unknown. Construction and operation of the proposed RD&D facilities would occur primarily during the daylight hours and would not be expected to have any impact on these bats.

The Proposed Action provides suitable habitat for the Midget faded rattlesnake and Great basin spadefoot, but it is not known if these species currently occupy the area. Direct impacts could occur to these, and other, small terrestrial animals from overall habitat loss and direct mortality by crushing or burial by construction equipment. The Midget faded rattlesnake is fairly mobile, and secretive, and unless a den site was directly impacted by construction equipment, it would

not likely be affected by the proposed project activities. Likewise, the nocturnal Great basin spadefoot would not likely be encountered by daytime construction activities.

### **Subalternative - Proposed Action with Mitigation**

In addition to the proposed action, impacts to special status species would be further minimized by implementing the following mitigation measures:

- The Operator or Operator's proponent will conduct follow-up raptor surveys if construction activities do not begin prior to February 1, 2007;
- Conduct special status species surveys prior to construction activities to determine which species clearances may be needed if construction is planned to begin after April 1, 2007;
- If reserve pits are deemed necessary on site, ensure that pits are lined, fenced on all four sides with net-wire, and covered with plastic barrier to exclude both large and small animals and netted to prevent birds from accessing these pits;
- Reclaim reserve pits as soon as possible after use;
- Adhere to the requirements of USFWS Biological Opinion and the Colorado River Fish Species recovery program.

No special status species are presently known to occur in the project area. If surveys reveal special status species to be present, Chevron must comply with the following measures detailed in Appendix A of the White River Resource Area RMP (1997):

- No development activities are allowed within 1/2 mile of identified nest sites of listed, candidate, or BLM sensitive raptor species (except Bald Eagle and Ferruginous Hawk) from February 1 through August 15, or until fledging and dispersal of young. Development activities are allowed from August 16 through January 31;
- No development activities allowed within 1/4 mile of identified nests of other special status raptor species from February 1 through August 15, or until fledging and dispersal of young. Development activities are allowed from August 16 through January 31;
- No development is allowed within one (1) mile of identified nests of Ferruginous Hawks from February 1 through August 15, or until fledging and dispersal of young. Development activities allowed from August 16 through January 31;
- No surface occupancy within 1/4 mile of an identified nest of an ESA listed, proposed, or candidate raptor species;

- No surface occupancy within 1/8 mile of an identified nest of other special status raptor species;

These mitigation measures can be exempted, modified, or waived by BLM if conditions warrant and the decision is documented through an environmental analysis. An exception would suspend the stipulation on a one time basis. Modifications would temporarily or permanently change the language or provision of a stipulation. Waivers are utilized to permanently remove the stipulation due to changed circumstances. Conditions for granting an exception, modification, or waiver are described in the White River Resource Area RMP.

### **Environmental Consequences of the Subalternative**

The construction and operation activities associated with the Proposed Action would potentially disturb a total of approximately 108 acres of foraging and nesting habitats at the proposed location, and could dislocate individual animals and re-distribute other animal populations in the area. Although the Proposed Action would represent an incremental and temporary reduction in the extent of the habitat associations described, it is not likely to adversely affect any federally endangered or threatened species, or any BLM sensitive species at the scale proposed since sagebrush and pinyon-juniper are generally abundant in this area, and the loss due to this project would represent a small portion of the suitable habitat. Disturbance to individual animals from construction and operation of the Proposed Action could be avoided by conducting surveys prior to initiating construction activities, and by observing surface occupancy and timing restrictions if individuals are located within the area of the Proposed Action. The mitigation measures identified in this subalternative are designed to reduce the amount and duration of disturbance to wildlife, and if implemented and adhered to, would appreciably reduce the potential for adverse impacts to sensitive wildlife species.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

### **Endangered Species Act Section 7 Consultation**

A Biological Assessment (BA) has been prepared in compliance with Section 7(c) of the Endangered Species Act (ESA) and submitted to the U.S. Fish and Wildlife Service (USFWS). The USFWS will review the BA to assess the potential impacts of the Proposed Action with Mitigation on federally-listed endangered, threatened, proposed for listing, and candidate species. The analysis, results, and conclusions presented in the BA are based on surveys and research conducted by biologists contracted by the preparer and the BLM.

Based on the analysis of the impacts of the subalternative (the Proposed Action with Mitigation), the BLM has concluded that there would be “no effect” on all but five federally-listed endangered, threatened, proposed for listing, and candidate species. For the bald eagle, the BA indicated that implementation of the Proposed Action with mitigation may have the potential to disrupt winter foraging resulting in a conclusion of “may affect, not likely to adversely affect”.

Although no water depletion is anticipated for the Proposed Action, water used for drilling operations, dust suppression, and for personnel needs would be purchased from local contract water suppliers and trucked to the site. Average water usage for the proposed RD&D project is estimated at 12 to 13 acre-feet per year. The BLM has concluded that this would constitute a “may affect, not likely to adversely affect” determination for four endangered Colorado River fish species.

New projects involving a depletion of greater than 100 acre-feet per year are required to pay a one-time fee to cover the annual depletion. Projects involving less than 100 acre-feet per year of depletion have no cost to the water user. The estimated depletion for the proposed action is significantly less than 100 acre-feet per year. The project would result in estimated maximum average water use of 13 acre-feet per year.

The USFWS reviewed the Biological Assessment (BA) to assess the potential impacts of the Proposed Action with Mitigation on federally listed endangered, threatened, proposed for listing, and candidate species. In a letter, dated September 12, 2006, the USFWS responded to the BA for the five oil shale RD&D projects. In its biological opinion (ES/GJ-6-CO-94-F017), the USFWS concurred with the conclusions of the oil shale RD&D BAs for all federally listed endangered, threatened, proposed for listing, and candidate species. The USFWS additionally determined that the five RD&D projects fit under the umbrella of the programmatic biological opinion for small water depletions caused by BLM authorized activities. The three companies have been notified of their responsibility to make annual payments to the National Fish and Wildlife Foundation as specified in the USFWS biological opinion.

### **Finding on the Public Land Health Standard for Threatened and Endangered Species**

The proposed action would have no adverse effect on any federally listed species and would not jeopardize the viability of any animal population. The project would not adversely affect habitat condition, utility, or function, nor would it have any discernible effect on species abundance or distribution at any landscape scale. The public land health standard would continue to be met.

### **THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES**

(includes a finding on Standard 4)

#### **Affected Environment**

On March 27 and 28 of 2006, a pedestrian survey and assessment of the vegetation and Special Status Species (SSS) plants of the WRRRA area was conducted for the proposed 160-acre lease parcel and the surrounding area by WestWater Engineering biologists. These biologists have extensive knowledge of the area and the plants that are likely to occur in the region. Only a few small patches of snow remained on the ground at the time of the survey. An additional site assessment specific to SSS plants was also conducted in March, and consisted of a review of geologic maps, documented occurrences of SSS plants, and aerial photography of the proposed area to determine the presence or absence of any potential SSS habitat.

The Proposed Action occurs within the Piceance Basin at an elevation of 6560 to 6650 feet. The Piceance Basin at this elevation is dominated by intermingled Wyoming sagebrush parks, with pinyon-juniper woodlands along the ridge tops and basin big sagebrush dominating the drainage

bottoms. Surface layers (soils and soil parent materials) in the study area are derived primarily from the Uinta Formation, with exposures of the Green River Formation along valley slopes.

The proposed 160-acre lease parcel is located on a broad ridge between Dry Gulch on the west and Hunter Creek on the east. This parcel is located in a Wyoming big sagebrush park bisected by a couple of small drainages. Vegetation cover is fairly uniform across the entire parcel, consisting of Wyoming sagebrush with a perennial grass understory.

A brief description of plant characteristics, habitat, and known occurrence of SSS plants that are either documented within, or which could potentially occur, in the WRRRA is provided below. Descriptions are provided for each of the four categories of SSS plants: Federally listed, Proposed Threatened for Listing, Candidate for Listing, and BLM Sensitive. All of these species are considered rare by the Colorado Natural Heritage Program. The majority of species presented here are associated with the Green River Formation. Others are known from the area but may not have such specific habitat requirements. Of the species listed below, only two are likely to occur near the area of the proposed RD&D lease tract. The two species are the Dudley Bluffs Bladderpod (*Lesquerella congesta*) and the Dudley Bluffs Twinpod (*Physaria obcordata*). Both are Endangered Species Act (ESA) listed as threatened species, and both have a very specific affinity to relatively barren shale outcrops of the Green River Formation.

#### **Federally-listed Threatened Plant Species:**

- **Dudley Bluffs Bladderpod** (*Lesquerella congesta*). An extremely small perennial plant that flowers in late April and peaks in May. Fruit are mature in late May and June. It is endemic to the Piceance Basin exhibiting a small cushion growth form. The only known occurrences of this plant are on barren, white shale outcrops of the Thirteen Mile Tongue of the Green River Formation at elevations from 6000 to 6700 feet. Known occurrences of this plant are located within WRFO Areas of Critical Environmental Concern (ACECs), and many satellite populations occur outside the ACECs throughout the Piceance Basin.
- **Dudley Bluffs Twinpod** (*Physaria obcordata*). This species is endemic to the Piceance basin. A perennial plant flowering in May and June, with fruit set in July. This species occurs on barren white shale outcrops and steep colluvial slopes derived from the Thirteen Mile Tongue and the Parachute Creek member of the Green River Formation at an elevation range of 5900 to 7500 feet. Known occurrences of this plant are located within WRFO ACECs, and many satellite populations occur outside the ACECs throughout the Piceance Basin.
- **Ute lady's tresses** (*Spiranthes diluvialis*). This orchid species inhabits wet meadows and other riparian habitats that are subject to fluvial erosion and deposition. It may also be found near springs, seeps, and lakeshores between 4265 and 6800 feet elevation where there is sufficient ground water. The plant blooms in July. This species has not been documented within the Piceance Basin.

#### **Plants Proposed Threatened for Listing**

- **Graham's beardtongue** (*Penstemon grahamii*). This penstemon blooms in May. It is limited to eastern Utah and one Colorado location west of Rangely within the Raven Ridge ACEC, where it occurs on talus slopes and knolls of the Green River Formation at an elevation range of 5800 to 6000 feet. No occurrences of this plant have been documented within Piceance Basin.

### Plants Candidate for ESA Listing

- **Parachute penstemon** (*Penstemon debilis*) is only known to occur in Garfield County with five known occurrences. The plant grows on sparsely vegetated, south facing, steep, white shale talus in the Mahogany Zone of the Parachute Creek Member of the Green River Formation between 7800 and 9000 feet elevation. No occurrences of this plant are known to occur within the WRRRA.
- **White River penstemon** (*Penstemon scariosus* var. *Albifluvis*). This species occurs on barren shale outcrops of the Green River Formation along the White River in eastern Utah. Like *Penstemon grahamii*, this species is known from one Colorado location within the Raven Ridge ACEC, west of Rangely. The preferred elevation range is 5000 to 7200 feet. No occurrences of this plant have been documented within Piceance Basin.

### BLM Sensitive Plant Species:

- **Park rockcress** (*Boechera fernaldiana* var. *feraldiana*) is known to occur on Weber sandstone as well as limestone outcrops in Uintah County, Utah and in extreme western Moffat County, Colorado. This species is also known to occur in and around Dinosaur National Monument. This species generally occurs at elevations between 5800 and 6000 feet. No occurrences of this plant have been documented within Piceance Basin.
- **Debris milkvetch** (*Astragalus detritalis*) occurs from near Meeker, into northeastern Utah. The plant flowers in May. There does not appear to be a geological substrate with which it is closely associated as it occurs on rocky or sandy soils on alluvial terraces with cobbles. Elevation ranges between 5400 and 7200 feet. No occurrences of this plant have been documented within Piceance Basin.
- **Ephedra buckwheat** (*Eriogonum ephedroides*). This is a small species of buckwheat which occurs on the Green River Formation within the Raven Ridge ACEC west of Rangely at an elevation range of 5800 to 6000 feet. Flowering occurs in May. No occurrences of this plant have been documented within Piceance Basin.
- **Utah gentian** (*Gentianella tortuosa*). In Colorado, this species has been found along the crest of the Cathedral Bluffs where it occurs on barren shale outcrops of the Green River Formation. Several other populations are known from Utah and Nevada. This species blooms in July or August, and occurs at elevations of 8500 to 10800 feet. The known occurrences of this plant are within the South Cathedral Bluffs ACEC.

- **Narrow-stem gilia** (*Gilia stenothyrsa*) is known from a few locations in Mesa and Rio Blanco counties, Colorado, and in the Uinta Basin of Utah. This species grows on silty or gravelly loam soils derived from the Green River or Uinta Formations at elevations of 5000 to 6000 feet. Flowering occurs in late May and into June. The only known occurrence of this species in the Piceance Basin is within the Lower Greasewood ACEC.
- **Piceance Bladderpod** (*Lesquerella parviflora*). This species is known only from Colorado, in Rio Blanco, Garfield, and Mesa counties. Habitat is on shale outcrops of the Parachute Creek Member of the Green River Formation on ledges and slopes of canyons in open areas at elevations from 6200 to 8600 feet. Flowering occurs May through July. Known occurrences of this plant are within the South Cathedral Bluffs ACEC.
- **Narrow-leaf evening primrose** (*Oenothera acutissima*). The only known occurrences of this evening primrose have been documented in Daggett and Uintah counties, Utah, and Moffat County, Colorado. This species flowers in May and June at an elevation range of 5300 to 8500 feet. No populations are known as far south as the Piceance Basin.
- **Rollins cryptanth** (*Oreocarya rollinsii*). In Colorado, this species occurs on white shale barren slopes of the Green River Formation in western Rio Blanco County within the Raven Ridge ACEC. Flowering occurs in May at 5300 to 5800 feet in elevation. No occurrences of this plant have been documented in Piceance Basin.

SSS plants expected within the Piceance Basin most commonly occur on relatively barren exposures of the Green River Formation. These shale barrens appear from a distance to be devoid of vegetation; however, they support a very specific array of plants that are adapted to this habitat. As noted above, several of the SSS plants occur on the Parachute Creek Member of the Green River Formation. The areas of the Parachute Creek Member known to provide species habitat lie at elevations considerably higher than that of the proposed RD&D lease tract.

Within the area that encompasses the proposed lease tract, the Green River Formation is inter-tongued with several units of the Uinta Formation. The Green River Formation is easily distinguished from the Uinta by its light gray (almost white) color, finer texture shale fragments, and finer textured soil particles. The Uinta is a light brown to buff color with coarse textured rock fragments and soil particles. No occurrences of any SSS plants within the Piceance Basin have been documented on soils derived from the Uinta Formation.

Since sufficient information is known about the habitat specificity of the Dudley Bluffs Bladderpod and the Dudley Bluffs Twinpod (highly specific to barren outcrops of the Green River Formation), it is possible to determine the presence or absence of any potential habitat for these species from review of existing data sources.

Review of geologic maps, documented occurrences of SSS plants, and aerial photography of the subject area, along with the biologist's extensive knowledge and experience with the SSS plants in the WRRRA, provides sufficient data and experience to determine the presence or absence of any potential habitat. USGS 1:24000 scale Miscellaneous Field Studies Geological Maps

covering the study area depict in detail the various outcrops of the Green River Formation. Review of known locations of SSS plants shows a strong correlation with the Green River Formation depicted on the maps, especially the Thirteen Mile Creek Tongue.

Because the habitat requirements for SSS plants expected to occur within the study area are shale barrens, it is possible to identify potential habitats based upon the color changes in soils and the vegetative cover shown, and is easily detected on aerial photographs. A comparison of aerial photographs and geologic maps illustrates the strong correlation of know habitats for SSS plants.

### **Environmental Consequences of the Proposed Action**

The Proposed Action is situated entirely on soils derived from the Uinta Formation and is not considered potential habitat for most SSS plants. The parcel is also located at an elevation well above that of the nearest known SSS plant populations. Based upon the uniform vegetative cover, the lack of any potential habitat detected, and the lack of any documented occurrences of SSS plants closer than 3 miles of the parcel, there is virtually no potential habitat for these species present, and no potential for these plants to occur on this tract. There would be no environmental consequences to SSS plants.

### **Subalternative - Proposed Action with Mitigation**

Although there is little or no potential for special status plant species to occur within the project area, pre-construction surveys would be conducted for special status plants during the flowering period to ensure that potential individual plants are identified prior to construction activities. If threatened, endangered, or BLM sensitive plant species or habitat are identified during future field surveys, Chevron would coordinate with the BLM to determine conservation measures and the need for USFWS consultation for threatened and endangered and BLM sensitive plant species. Chevron would also implement the following BLM mitigation measures in the event sensitive plant species are identified:

- Avoiding plants that occur outside the project area and install exclusion fencing to prevent disturbance from construction activities;
- Conducting source population surveys in areas where plants could not be avoided to determine the magnitude of impact on the entire population; and
- Evaluating the potential for site design modifications in areas where plants occur. The potential for site design modifications would depend on feasibility and site-specific terrain conditions.

### **Environmental Consequences of the Subalternative**

Although there is little or no potential for SSS species to be present on the Chevron tract, the proposed mitigation alternatives would ensure that impacts to special status plant species are avoided by identifying any individual plants prior to construction activities and avoiding them. Site design modification would then be considered to ensure that impacts to individual plants are minimized by removing the potential threat to SSS plant species.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

### **Finding on the Public Land Health Standard for Threatened and Endangered Species**

The proposed and alternative actions would not jeopardize the viability of any threatened, endangered, or BLM sensitive plant population. With the implementation of mitigation measures, the project would have no discernible consequence on habitat condition, utility, or function, nor would it have any adverse effect on species abundance or distribution at any landscape scale. The public land health standard would continue to be met.

## **WASTES, HAZARDOUS OR SOLID**

### **Affected Environment**

Hazardous materials are defined by the BLM as any substance, pollutant, or contaminant that is listed as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 USC 9601 et seq., and its regulations. The definition of hazardous substances under CERCLA includes any “hazardous waste” as defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended 42 USC 9601 et seq., and its regulations. The term does not include petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under CERCLA Section 101(14), 42 USC 9601 (14), nor does the term include natural gas.

The affected environment for hazardous materials includes air, water, soil, and biological resources that may potentially be affected by an accidental release of hazardous materials during transportation to and from the project area, storage, and use in construction and operations. Sensitive areas for hazardous materials release include areas adjacent to water bodies, above aquifers, and areas where humans or wildlife would be directly impacted.

There are no known hazardous or other solid wastes on the subject land. No hazardous materials are known to have been used, stored, or disposed of on the site included in the Proposed Action.

As discussed in the Proposed Action, a variety of materials, including lubricants, treatment chemicals, gasoline, oil, and diesel fuels would be used to construct and operate the proposed RD&D facilities. Potentially harmful substances used in the construction and operation would be kept on site in limited quantities, and trucked to and from the site as required.

Most waste generated would be exempt from hazardous waste regulations under the exploration and production exemption of the RCRA. Examples of exempt wastes include process water and hydrocarbon impacted soils. No hazardous substance, as defined by 40 CFR 355, in amounts above the threshold quantities, would be used, produced, stored, transported, or disposed of.

The proposed in-situ process would not include any above-ground retort activities; therefore no spent shale would be brought to the surface as a waste product.

Solid waste includes, but is not limited to, human waste, trash, garbage, ashes, welding rods, etc. Solid waste would be generated during construction activities and during operation of the proposed RD&D facility.

### **Environmental Consequences of the Proposed Action**

Accidental spills or leaks associated with equipment failures, refueling and maintenance of equipment, and storage of fuels, oil, or other fluids could cause soil and surface and/or ground water contamination during construction and operation of the proposed project. The severity of potential impacts from accidental material spills would depend upon the chemical released, the quantity released, and the proximity of the release to a waterbody or aquifer.

The Proposed Action would increase contributions to solid waste landfills. There is potential for trash to attract wildlife, and to be blown off-site into adjacent lands. Solid waste impacts would occur for the life of the project.

### **Subalternative - Proposed Action with Mitigation**

In addition to the design features included in the Proposed Action, the BLM would require the following mitigation measures to ensure that impacts from hazardous or solid wastes would be minimized:

- Watching for signs of hazardous or solid wastes during excavation, and if found, taking appropriate reporting and mitigation measures to protect the public and workers;
- Maintaining the project area in a sanitary condition at all times;
- Providing an adequate number of trash containers on-site;
- Disposing trash and nonflammable wastes at an appropriate waste disposal site;
- Providing portable sanitation facilities onsite, and removing and disposing of contents in accordance with applicable laws and regulations;
- Using, storing, transporting, and/or disposing of hazardous materials in accordance with applicable federal and state laws; and
- Implementing spill prevention measures, inspection and training requirements, and spill response and notification procedures to minimize the potential for accidental spills or leak.
- Preparing and implementing a BLM-approved SPCC plan aimed at reducing the potential for adverse impacts associated with spills and leaks.

### **Environmental Consequences of the Subalternative**

Mitigation measures will reduce the potential environmental impacts of hazardous or solid wastes by implementing additional best management practices (BMPs) to ensure that all wastes are properly handled and that safeguards are in place to prevent and/or manage accidental

releases consistent with Federal and State standards. The proposed project would contribute to solid waste landfills for the life of the project.

Accidental spills or leaks associated with equipment failures, refueling, or maintenance of equipment, and storage of products, fuel, oil, or other fluids during construction and operation of the RD&D facilities may occur, but with adherence to a regular maintenance schedule and good housekeeping practices, these occurrences would be less frequent and less severe.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **WATER QUALITY, SURFACE AND GROUND (includes a finding on Standard 5)**

### **Affected Environment**

**Surface Water:** The proposed RD&D lease site lies upon Hunter Ridge, which forms the divide between Hunter Creek to the east and Dry Gulch to the west. Hunter Creek is an intermittent stream that is tributary to Piceance Creek. Dry Gulch is an ephemeral tributary to Black Sulfur Creek, which is a perennial tributary to Piceance Creek. Piceance Creek is a tributary of the White River, which ultimately flows into the Colorado River via the Green River. Water quality standards and guidance for drainages within the Lower Colorado River Basin are included in Colorado Department of Public Health and Environment-Water Quality Control Commission (CDPHE-WQCC) Regulation No. 37 (2004a).

Both Hunter Creek and Dry Gulch are part of a larger drainage network exhibiting trellis to dendritic drainage morphology. Water flow in these creeks is not constant, but is dependent on spring runoff and individual storm events. Both Hunter Creek and Dry Gulch are dry for much of the summer months. Based on information gathered from topographic maps and area surveys, these creeks are incised and are contained within narrow floodplains bordered by steep banks and outcrops composed of the Green River Formation.

The upland areas along Hunter Creek and Dry Gulch have a good diversity of species and age class, and consist of pinyon-juniper vegetation associations with interspersed populations of serviceberry, mountain mahogany, sagebrush, and some mixed grasses, and their banks are sparsely vegetated with sagebrush, mature pinyon-juniper, and similar vegetation found in semi-arid regions. A change in vegetative dominance occurs at the transition from upland area (trees and shrubs) to the stream channel (grasses).

The “Status of Water Quality in Colorado, 2004” and the 2006 update (CDPHE, 2006b) were reviewed for information related to the project area drainages. The proposed oil shale RD&D parcel is located within stream segment 20 of the White River Basin, which is defined as the mainstems of Black Sulphur and Hunter Creeks from their sources to their confluences with Piceance Creek. Segment 20 has not been designated use-protected. Waters not satisfying either an outstanding water or use-protected criteria will remain undesignated, and will be subject to the antidegradation review provisions set forth in Section 31.8(3) of Standard 31, *Basic Standards and Methodology of Surface Water*. For these waters, no degradation is allowed

unless deemed appropriate following an antidegradation review. These provisions are applicable only if a discharge is made to these waters..

The state has classified segment 20 as being beneficial for the following uses: Cold aquatic life 1, Recreation 2, and Agriculture. The CDPHE defines *Aquatic Life Cold Class 1* waters as being capable or potentially capable of sustaining a wide variety of cold-water biota. *Recreation Class 2* waters are suitable or intended to become suitable for recreational uses on or about the water, including fishing and other streamside recreation. *Agriculture* waters are suitable or intended to become suitable for irrigation of crops and that are not hazardous as drinking water for livestock. The CDPHE has determined that stream segment 20 of the White River Basin is fully supporting of its designated uses except Recreation Class 2, which has not been assessed (CDPHE, 2006b). In addition, Black Sulphur Creek has minimum in-stream flow that may support a more diverse aquatic community, and Hunter Creek does not have year around flow, but may support aquatic life on a seasonal basis.

Newly promulgated Colorado Regulations Nos. 93 and 94 (CDPHE, 2006c and 2006d, respectively) were reviewed for information related to the proposed project area drainages. Regulation No. 93 is the State's list of water-quality-limited segments requiring Total Maximum Daily Loads (TMDLs). The 2006 list of segments needing development of TMDLs includes two segments within the White River: segment 9b, White River tributaries North & South Forks to Piceance Creek, specifically the Flag Creek portion (for impairment from selenium with a low priority for TMDL development) and segment 22, tributaries to the White River, Douglas Creek to the Colorado/Utah boarder, specifically West Evacuation Wash, and Douglas Creek (sediment impairments). Regulation 94 is the State's list of water bodies identified for monitoring and evaluation to assess water quality and determine if a need for TMDLs exists. The list includes two White River segments that are potentially impaired: 9 and 22. Segment 20 was not listed.

Neither Hunter Creek nor Black Sulphur Creek is included in the 2006 Section 303(d) list of impaired waters (CDPHE, 2006c) nor the 2006 monitoring and evaluation list of water bodies with suspected water quality problems (CDPHE, 2006d).

The Colorado River Basin Salinity Control Forum (CRBSCF) is concerned with energy development and the movement of salts downstream in the Colorado River Basin. The CRBSCF was formed to develop interstate cooperation, and to provide the Basin States (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) with the information necessary to comply with Section 303(a) and (b) of the Clean Water Act. The U.S. Environmental Protection Agency (EPA) enacted a regulation in December of 1974 that set forth a basin-wide salinity control policy for the Colorado River Basin, and in 1975, the CRBSCF proposed, the Basin States adopted, and the EPA approved water quality standards to control salinity increases in the Colorado River.

The nearest downstream water quality standard is below Hoover Dam and is 723 mg/L. Congress enacted the Colorado River Basin Salinity Control Act, Public Law 93-320 1974 Title II-Water Quality Program for Salinity Control, and amended in 1984. This Act directed the BLM to implement a comprehensive program to minimize salt loading in the Colorado River Basin, and coordinate salinity control activities with the CRBSCF, the Basin States, the U.S.

Bureau of Reclamation (USBR), and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Other federal agencies that participate in the CRBSCF Work Group meetings include the EPA, U.S. Fish and Wildlife Service (USFWS), and the U.S. Geological Survey (USGS). In addition, the CDPHE-WQCC Regulation No. 39, Colorado River Salinity Standards, establishes water quality standards for salinity or total dissolved solids for the Colorado River and its tributaries in Colorado, and Regulation 61 discusses the implementation of the provision of Regulation 39 in discharge permits.

Because the Proposed Action would disturb soils, and could increase the potential for erosion and sediment transport, the aforementioned laws and regulations would be in effect at the proposed project location to minimize and/or prevent the movement of salts downstream. In addition, a process water discharge would also have the potential to contribute to salinity levels and would also be subject to applicable laws and regulations.

The soil units affected in association with the Proposed Action are described as Piceance fine sandy loam, Redcreek-Rentsac Complex, and Rentsac channery loam (as discussed in the Soils section). These soil units have a listed salinity value of less than 2 mmhos per centimeter, and are typically well drained with moderate to high permeability and water erosion potential. Although the salt content in these soil units is low, there is potential for salt delivery downstream as a result of the surface disturbance proposed.

Stream flow and water quality data have been recorded by the U.S. Geological Survey (USGS) at several gauging stations along Piceance Creek and its tributaries in the area of the Proposed Action. These data for Ryan Gulch, Piceance Creek, Black Sulfur Creek, and Willow Creek are presented in **Table 9** (USGS 2005).

**Table 9: Average Recorded Stream flow & Water Quality Data**

Stream Data	USGS Gauging Station			
	Piceance Ck BL Ryan Gulch Rio Blanco, CO 09306200	Piceance Ck AB Hunter Ck, near Rio Blanco, CO 09306061	Black Sulfur Ck near Rio Blanco, CO 09306175	Willow Ck near Rio Blanco, CO 0930658
<b>Elevation (feet. NGVD29)</b>	6070	6214	6130	6273
<b>Drainage Area (square miles)</b>	506	309	103	48.4
<b>Mean Monthly Discharge (cfs)</b>	29	30	8.1	3.1
<b>Low Flow</b>	20 cfs, Sept. & Oct.	18 cfs, Jan. & Oct.	5.5cfs, Apr. & Dec.	2.7 cfs, Jan.
<b>Peak Flow</b>	61cfs, May	76 cfs, May	18 cfs, May	3.8 cfs, May
<b>Period of Record</b>	1964-2005	1982-1987	1974-1983	1974-1985
<b>TDS (Residue) (mg/L)</b>	32.81*	440.8	1140	128.26
<b>pH</b>	8.3	8.2	8.2	8.3
<b>Calcium (mg/L)</b>	80.2	76.1	96.5	90.2
<b>Magnesium (mg/L)</b>	80.8	63.8	92.5	72.2

Stream Data	USGS Gauging Station			
	Piceance Ck BL Ryan Gulch Rio Blanco, CO 09306200	Piceance Ck AB Hunter Ck, near Rio Blanco, CO 09306061	Black Sulfur Ck near Rio Blanco, CO 09306175	Willow Ck near Rio Blanco, CO 0930658
Sodium (mg/L)	178.7	146.1	146.1	119.1
Sulfate (mg/L)	387.2	288.1	455.5	340.6
Chloride (mg/L)	16.3	13.8	10.5	12.1

<sup>1</sup> All data is based on an average of available data for the years provided.

(Source: USGS, 2006)

\* One data point in excess of 3000 was excluded from the computation of this average.

Water quality is generally lowest at Black Sulfur Creek. Surface water at this location has the highest total dissolved solids (TDS) and sulfate concentrations. This location is downstream of Chevron’s proposed oil shale pilot site. The TDS measured at the stream gauging station exceeds the EPA secondary drinking water standard of 500 mg/L.

Water requirements would vary over the life the proposed project. Early phases of the project are concerned with the coring of one or more wells and the drilling of groundwater evaluation and monitoring wells. Later phases would involve the installation of facilities, and the drilling of production and injection wells. Water uses in Chevron’s proposed process include drilling, dust control, construction, process water and potable water. Most of the water would be used for drilling activities.

Water would initially be purchased from permitted sources and brought in by truck, and other nearby sources may be considered if necessary. Estimated water requirements per year for the proposed process are listed in **Table 10**.

**Table 10: Estimated Water Needs Per Year**

Estimated Water Needs Per Year		
2006	36,320 bbls	4.68 acre feet
2007	134,725 bbls	17.36 acre feet
2008	29,445 bbls	3.79 acre feet
2009	254,410 bbls	32.79 acre feet
2010	9,135 bbls	1.18 acre feet
2011	2,135 bbls	.28 acre feet
2012	233,755 bbls	30.13 acre feet
2013	3,890 bbls	.5 acre feet
<b>Total</b>	<b>703,815 bbls</b>	<b>90.71 acre feet</b>

**Groundwater:** The Uinta-Animas aquifer is the shallowest of the Colorado Plateaus aquifers and is present in the Uinta Basin of northeastern Utah, the Piceance Basin of northwestern Colorado, and the San Juan Basin of northwestern New Mexico. The Proposed Action would be located within the Piceance Creek structural basin, and would conduct in-situ operations in a 200-foot thick layer (Mahogany zone) that lies between what are generally known as the “upper” and “lower” aquifers within the Uinta-Animas aquifer system. In general, the Piceance Basin is relatively well watered. Ground water occurs in both bedrock and alluvial aquifers beneath the Piceance Basin. Unconsolidated alluvial aquifers are the most productive aquifers. These

alluvial deposits are narrow and thin deposits of sand and gravel formed primarily along stream courses. The most important bedrock aquifers are the upper and lower Piceance Basin aquifer systems. These consolidated rock aquifers are lower Tertiary Eocene in age and occur above and below the large oil shale reserves.

The upper aquifer system is about 700 feet thick and consists of several permeable zones in the Eocene Uinta Formation and the upper part of the Parachute Creek Member of the Green River Formation. The lower aquifer system is about 900 feet thick and consists of a fractured dolomitic marlstone of part of the lower Parachute Creek Member of the Green River Formation (EPA 2004). Based upon studies completed largely in the eastern portion of the basin, bedrock aquifer systems of the Green River and Uinta were described in terms of two hydrologic bedrock units, the “Upper” (A groove) and the “Lower” (B groove) as proposed by Coffin and others (1971), who defined the confining unit between them as the Mahogany zone, or R7 (see **Figure 4** for the Lithologies near the proposed lease area).

The upper and lower aquifers are separated by the confining Mahogany Zone of the Parachute Creek Member of the Green River Formation. This Zone is made up of keregenous dolomitic marlstone and shale and would be the target for shale oil extraction under the Proposed Action. Natural fractures in the Mahogany zone permit water to move between aquifers in some areas, but it is generally characterized as having very low permeability. A substantial part of Chevron’s proposed research activities would include developing a better understanding of the groundwater aquifers at the proposed project site.

**Water Level Conditions:** The Uinta-Animas aquifer in the Piceance Basin receives about 24,000 acre-feet per year of recharge, primarily in the upland areas near the margins of the aquifer. Discharge is approximately equal to recharge, and primarily occurs in the valleys of Piceance Creek and other tributaries to the White River or in the valley of the Colorado River and its tributaries. Groundwater is primarily recharged from high elevation snowmelt from where it travels down through the upper aquifer system, the confining layers, and into the lower aquifer system. The groundwater then moves laterally and/or upward discharging from both the upper and lower aquifer systems into alluvial valley fill, streams, and springs.

The potentiometric surface of the Uinta-Animas aquifer generally ranges from about 100 feet above land surface to about 500 feet below land surface; the surface generally is near or above land surface in valleys in areas of groundwater discharge. Large depths to water are more common in highland areas that are remote from streams or other sources of recharge. In the Piceance Basin, the potentiometric surface ranges in altitude from about 6,000 to 8,500 feet, and groundwater primarily flows north-northwest toward the discharge areas along Piceance and Yellow Creeks.

**Groundwater Quality:** Groundwater quality within the Piceance Basin is generally considered to be relatively poor owing to the nahcolite (sodium bicarbonate) deposits and salt beds within the basin. Only very shallow waters such as those from the alluvial and surficial Green River Formation are used for drinking water. Water well data from the Colorado Division of Water Resources (CDWR) indicate that water wells are not common in central Rio Blanco County and are widely scattered throughout the northern Piceance Basin (Topper et al. 2003).

Water in the Tertiary aquifers gain dissolved solids and show changes in major ion chemistry as it moves along the basin flow paths from upland recharge areas to the discharge areas (Topper et al 2003). Dissolved solids concentrations in water from the upper part of the aquifer in the

Piceance Basin generally range from about 500 to more than 1,000 mg/L. Concentrations in the lower part of the aquifer exceed 10,000 mg/L where extensive fracturing of the saline zone that underlies the aquifer has enabled the upward movement of brine (Czyzewski, 2000).

Near the proposed RD&D tract, the water chemistry of the upper bedrock aquifers is dominated by dissolved sodium, magnesium, bicarbonate and sulfate. Sodium and bicarbonate are the dominant dissolved constituents in the water from the upper Parachute Creek Member of the Green River Formation near the base of the upper aquifers. Characteristic trace elements include strontium in concentrations of several milligrams per liter in the Uinta Formation, and fluoride in concentrations of greater than one milligram per liter in water samples from the lower part of the upper aquifers (Tobin, R. 1987).

The principal dissolved constituents in water from the lower aquifer system are sodium and bicarbonate. In the lower aquifer system, the dissolved solids concentration increases from about 1,000 to 20,000 mg/L near the north-central part of the basin. These high concentrations are likely a result from groundwater coming in contact with the ancient evaporate deposits of nahcolite, dawsonite, and halite associated with the Green River Formation. The trace element fluoride has also been detected in unusually high concentrations, ranging from 10 to 30 milligrams per liter in the lower aquifers. The trace elements barium, boron, and lithium are abundant in the lower aquifers where chloride concentrations are also greater than several hundred milligrams per liter (Tobin, R. 1987). Waters with dissolved solids concentrations in excess of 3,000 mg/L are generally unsuitable for potable supply. There is potential for salt and trace element delivery downstream both on surface and groundwater flow through fractures.

There is a significant lack of information on the lower water bearing units of the Green River Formation, and subsurface movement of ground water resources within the oil shale producing formation is not well known at the proposed RD&D site. The most practical method for securing accurate data is through additional water well drilling and aquifer testing.

### **Environmental Consequences of the Proposed Action**

Water quality could be impacted by increased sedimentation resulting from the removal of vegetative cover over portions of the proposed RD&D lease parcel, which would then increase the potential for soil erosion near newly disturbed areas. Runoff-producing storm events would increase sediment loads in intermittent and ephemeral channels if not properly mitigated. Depending on the extent of soil erosion and sediment transport, salt content in the sediment may also degrade water quality. The magnitude of these impacts is dependent on the amount of

surface disturbance at any particular time and the climatic conditions during the time that the soils are exposed to the elements. Impacts would continue to some degree over the 10-year lease term of the proposed RD&D project until such time as mitigation could be implemented and proven successful. The proper use and maintenance of the BMPs outlined in Chevron's Stormwater Management Plan would reduce the magnitude of sediment and salt transport offsite.

The CDPHE-WQCC Regulation No. 39, Colorado River Salinity Standards, establishes water quality standards for salinity or total dissolved solids for the Colorado River and its tributaries in Colorado. Prior to initiating construction activities, Chevron would collect sufficient baseline water quality data from samples collected at the proposed site and would analyze the samples for TDS, for anions including chlorides, carbonate and bicarbonate, nitrates and nitrites, and sulfate; and for the cations calcium, magnesium, iron, and sodium. Existing USGS stream flow and water quality records would be reviewed and evaluated to further develop the background water quality conditions for the proposed RD&D project. These data would be used to develop an extensive water monitoring program to detect potential salinity increases, and to design a response and remediation plan to mitigate any excessive salt movement if necessary.

Some impacts to groundwater resources resulting from hydraulic fracturing and heating of the Mahogany Zone are likely, but the extent of the impact is unknown. Chevron is working to develop technologies and methods to significantly reduce the temperatures required to decompose the kerogen, therefore the processes and products may have properties that are not consistent with a traditional retort. This, and post operation measures that would employ methods for restoring the function of the confining layer by grouting the fracture network to prevent the mixing of aquifers would minimize any impacts to groundwater resources. The natural vertical fracture and jointing patterns in some areas within the formation allow for communication between the upper and lower aquifer systems, and if the proposed process were to contact an existing fault that was in communication with two aquifer systems, natural mixing of those aquifers would have already occurred. In this case, Chevron would likely grout the natural fractures, or relocate the process facilities to avoid any further occurrences.

No chemicals other than CO<sub>2</sub> would be injected into the formation during the fracturing process, and the fracturing treatment would be immediately halted and re-evaluated if containment within the production interval were lost. If CO<sub>2</sub> intrusion into an aquifer were to occur, Chevron would either plug the entry into the aquifer or would not proceed with the heating phase depending on the results of monitoring data. Different methods, consistent with the response plan, could be used to plug the connection to the aquifer depending on the aquifer's location to the wellbore and the nature of the connection (fault, direct fracture growth, high permeability streak, etc.). Polymer gels and cements are typically used to plug water connections in fractured reservoirs. The amount of CO<sub>2</sub> that could potentially be lost would be limited by the size of fracture treatment, and would dissipate during movement of the aquifer. Observation wells would be installed to monitor aquifer containment.

Following in-situ oil extraction, spent shale in the retort zone would be expected to contain various potential contaminants, including soluble salts, trace metals, and residual organics. Methods for reducing the contaminant mass, decreasing the solubilization rate of the contaminants, and/or reducing the rate of water movement through the spent shale zone would be employed to mitigate any adverse impacts to groundwater quality. Due of the extent of the proposed hydraulic fracturing and heating of the target interval, Chevron has developed a comprehensive network of groundwater-monitoring wells to better understand, and to identify actual groundwater impacts early in the proposed process. Response plan actions would be adapted according to information gathered through monitoring efforts. An extensive fracture

surveillance system is also proposed to monitor, control, and contain the fracture network within the production zone to minimize the potential for breakthrough/leaks.

Chevron does not anticipate any de-watering of the target interval during pilot testing. Instead, the proposed process would create small-scale production zones within the tighter rich zones and attempt to stay contained in the individual confining layers. Chevron would determine the hydraulic head in each of the water zones around the test interval during the initial phases of the pilot project to verify that the pressure within the processed zone is higher than that of the water zones below.

While there is some variability in hydraulic head between differing geologic strata throughout the Piceance Basin, Chevron does not anticipate that the difference in hydraulic pressures across the confining units (e.g. Mahogany Zone) where the hydraulic head of the upper water producing units (A-groove) is lower than that of lower water producing units (B-groove), to impact water quality at the proposed test site. Pressures within the processed zone will be higher than the water zones below and therefore the lower aquifer water will be kept out of production intervals during the hydrofracturing process.

The rate at which the poorer quality water travels downgradient is primarily a function of the existing gradient and the hydraulic conductivity of the water bearing zones. Chevron does not expect to change the parameters in the intervals that provide the regional transmissivity. This would be modeled to determine whether a reduction in the hydraulic conductivity in a transmissive interval above or below the production interval for containment purposes would be necessary. Modeling would also be used to determine the most effective post-operation measures for restoring any impacts to the regional transmissivity (i.e. grouting of the production zone). If the proposed retorting or hydrofracturing were to connect, or enhance, the potential for more rapid mixing between two aquifers of differing water quality, the hydraulic conductivity of the production zone would be adjusted as necessary to generally restore pre-existing water mixing patterns. The proposed process, as planned, would not create circumstances for the mixing of groundwater of greatly differing quality, and Chevron would develop and evaluate methods for accomplishing this during the pilot testing process.

The energy recovery, or in-situ combustion phase, of the Proposed Action would be implemented for its potential to increase the overall efficiency of the process. It would not be an integral part of the proposed conversion process, but would be considered after producing the kerogen to create heat for the next zone. If a satisfactory means of preventing contamination of groundwater from the proposed energy recovery (combustion of produced zone) phase of the operation cannot be accomplished, Chevron would not proceed with in-situ combustion. In addition, the proposed test site would be contained and isolated from areas with significant water movement.

The Proposed Action would not materially change the natural groundwater flow patterns. If there were a significant difference in water quality above and below the production interval (the Mahogany Zone), Chevron would develop and implement processes, with BLM approval, that would leave the effective vertical hydraulic conductivity of the target interval approximately equivalent to pre-production condition. The storage capacity of the production zone cannot be determined at this time. For the purpose of estimation only, the heated zone in the pilot project area would occupy 600,000 cu. ft. (~100,000 bbls) if 100 percent of the zone were removed. A successful retort might recover about 40 percent of the material. It is not clear how much, if any,

of this volume would remain as void space because of expansion of the kerogen during the conversion process.

Groundwater migration is expected to flow toward the proposed project site because the area is located in the Hunter Creek syncline. A syncline is a U-shaped fold in the rock layers with the limbs upturned, and the deformed strata dip toward the axis of the syncline. Therefore, the Hunter Creek Syncline could direct groundwater flow toward the proposed test site, essentially as a trough, and would limit groundwater movement away from the site with the limbs containing confining layers acting to inhibit flow away from the site depending on its location with respect to the axis and the direction of plunge on the syncline. Groundwater flow would be expected to be dominated by fracture flow, and the fractures are likely relative to the fold geometry. Geophysical methods would be used to map the axis of the Hunter Creek syncline and to identify fracture patterns.

These fracture patterns would need to be evaluated for the presence of groundwater, groundwater quality if present, and the extent to which these fractures would act as routes for groundwater or contamination migration to potential receptors. While the syncline geometry could limit groundwater migration off-site, it would not eliminate the potential for down dip migration and subsequent recharge of surface waters down stream. The regional structure dips gently to the northwest and the structure of the syncline allows some drainage of the syncline in that direction. It is anticipated that migration of groundwater to the northwest could occur.

***Compliance and Monitoring:*** The Proposed Action would be considered a light industrial activity by the Colorado Department of Public Health and Environment (CDPHE). As an industrial discharger, the applicant would be required to obtain a permit authorizing the discharge of stormwater from the site. The permit requires development of a Stormwater Management Plan outlining how Best Management Practices (BMPs) would be used to control runoff and sediment transport. Chevron's Stormwater Management Plan is on file with the White River Field Office BLM as an attachment to the Oil Shale Research, Development, and Demonstration Plan of Operations (Chevron, 2006).

Chevron would complete a Spill Prevention, Control, and Countermeasure (SPCC) Plan as discussed in the Wastes, Solid or Hazardous section. Chevron would obtain all necessary federal and state permits, and would comply with the Army Corps of Engineers (COE) Nationwide Permit 12 conditions, CDPHE Water Quality Control Division (WQCD) permit no. COR-030000 CDPS General Permit for Stormwater Discharges Associated with Construction Activity, and a COR-010000 CDPS General Permit for Operation Activities, and all other applicable water quality permitting requirements. Any groundwater produced from the Mahogany zone would be characterized to determine its quality, and disposed of in accordance with Onshore Order #7, and BLM approval.

Groundwater characterization and monitoring would consist of well installations and aquifer testing to establish a baseline for groundwater quality. Well logs would be evaluated and correlated with the geophysical information gathered from core samples. Evaluations of the geology, formation characteristics, and local and regional fracturing and jointing patterns would be mapped and tested to establish an understanding of the vertical and horizontal communication within the section. This evaluation would be used in the formulation of technologies to isolate the pilot test area from groundwater to prevent contamination. The information would also be used to select and operate a remediation technology consistent with the response plan in the event that contaminants do come into contact with groundwater.

The proposed groundwater protection strategy is to contain, monitor, and mitigate as necessary while evaluating, learning, and developing more effective procedures for groundwater protection. Chevron would include concepts on potential groundwater protection strategies and methodologies derived from discussions with groundwater professionals from various national laboratories in their groundwater protection plan.

The information currently available on the local ground and surface water flow systems is insufficient to specify at this time the exact number and locations of groundwater-monitoring wells. Chevron proposes a phased approach to groundwater characterization and monitoring in which one or more core holes would be drilled, and geophysical well logs would be run to characterize the geophysical signatures of the major geologic units. In addition to characterizing the subsurface lithology, rock cores would be available for performing laboratory tests on the physical, geochemical, and hydraulic properties of the formations. An initial array of 12 close-in groundwater-monitoring wells is proposed to determine local baseline conditions and for initial process monitoring. The general location of these wells is shown in **Figure 2**. Six monitoring wells would be completed above the process interval, and six would be completed below the process interval. The precise completion intervals and locations would be subject to change based on information gathered from core samples and flow testing. Chevron's proposed groundwater-monitoring program would be implemented with sufficient vertical and horizontal resolution to ensure environmental compliance over the life of the pilot test and post-operational monitoring period.

A fundamental element of Chevron's proposed pilot testing would involve developing more effective methods for detecting any connections between the upper and lower aquifers where the intermingling of aquifers could occur and avoiding them. This would include coring, downhole geophysical and other methods to develop an understanding of pre-existing joints/fractures and the vertical hydraulic conductivity between the upper and lower aquifers, and avoiding areas where testing indicates significant vertical fracture connections across the production zone. Chevron's geophysical monitoring system would be designed to detect connections at the earliest possible stage of operations, and would significantly minimize the potential for any large-scale aquifer breach. Multi-level sampling over time would include multiple redundant up- and down-gradient observations in relevant aquifer units above and below the extraction zone.

Groundwater monitoring coupled with potential non-reactive tracer tests would be crucial for site characterization, process monitoring, recovery optimization, quality and process control, site and aquifer testing, flow path control, and post-retort groundwater monitoring.

Shallow aquifers would be protected from hydrofracturing and production of shale oil by the installation and cementing of surface and intermediate casing specifically designed for this purpose. Any groundwater produced from the Mahogany Zone would be re-injected downgradient or trucked off site and properly disposed of to prevent adverse impacts to surface water.

Chevron has integrated the groundwater-monitoring program into the proposed process operations to minimize the environmental impacts to water resources.

### **Subalternative - Proposed Action with Mitigation**

The Proposed Action identifies potential impacts to surface and groundwater resources. To further mitigate potential impacts to water resources, the BLM would require Chevron to implement the following measures:

- Complete and submit a Spill Prevention, Control, and Countermeasure (SPCC) Plan to the BLM for approval. This Plan would be aimed at reducing the potential for adverse impacts associated with spills and leaks.
- Design all surface disturbing activities such that strict adherence to “Gold Book” fourth edition surface operating standards for oil and gas exploration and development are observed. Copies of the “Gold Book” fourth edition can be obtained at the WRFO BLM.
- Develop the groundwater-monitoring program in coordination with the BLM, and provide the water quality data to the agency on a quarterly basis for assessment.
- Submit design, monitoring, and response plans for groundwater, surface water, and stormwater retention to the AO for approval prior to implementing the Proposed Action.
- Cease all construction activity when soils or road surfaces become saturated to a depth of three inches unless otherwise approved by the AO.
- Avoid the establishment of vegetation where it inhibits drainage from the road surface or where it restricts safety or maintenance.

When preparing the site, all suitable topsoil would be removed and stockpiled on BLM lands within the proposed lease area boundary for use in later reclamation. In all areas disturbed by construction, soil materials would be managed so that erosion and sediment transport are minimized.

Proposed erosion control features include but are not limited to:

- Construction of a runoff retention basin
- Installation of perimeter ditches and/or berm/silt fences/straw bails/geotextiles
- Installation of check dams
- Seeding of unused disturbed areas

All sediment control structures or disposal pits would be designed to contain a 100-year, 6-hour storm event. Storage volumes within these structures would have a design life of 25 years.

All water resource monitoring data would be provided to the BLM on a quarterly basis for review and analysis. The BLM would use this data to monitor potential salinity increases resulting from the Proposed Action, and implement mitigation measures as necessary.

### **Environmental Consequences of the Subalternative**

Potential impacts to surface and groundwater quality in the proposed project area could result from surface disturbance, accidental spills and leaks, and from changes to the flow regime and water quality in the aquifer systems. The subalternative mitigation, along with measures described in the Proposed Action, would reduce these impacts to surface and groundwater resources by putting additional safeguards in place to lessen the frequency and severity of impacts to water resources. Due to the nature of the technology to be employed, system processes and the environment shall be closely and carefully monitored. A comprehensive monitoring program, adaptive response plan, and early coordination with the BLM will ensure potential groundwater impacts are identified as they may occur.

Mitigation and response will be consistent with BLM Gold Book measures and depend on information gained from the monitoring program. Impacts will be mitigated to conditions consistent with pre-construction groundwater characteristics. Operations will be suspended, modified, relocated or terminated to prevent reoccurrence of the impact.

The proposed RD&D project could impact groundwater parameters of the Mahogany zone and adjacent aquifers. Implementing Chevron's comprehensive groundwater monitoring program, in coordination with the BLM, would provide critical information on the water quality and hydrologic characteristics of the area, and would inform the BLM's decisions on future development criteria. The proposed groundwater-monitoring plan would also identify potential water resource impacts in sufficient time to respond with the appropriate mitigation, and therefore limit the potential for adverse effects on water quality.

Likewise, surface water characterization and monitoring in nearby streams would provide early identification of any surface water impacts that could potentially be associated with the Proposed Action, and allow for immediate response.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

### **Finding on the Public Land Health Standard for water quality:**

Available data indicate that the surface water quality of adjacent streams and the groundwater quality of underlying aquifers are within the criteria set by the State of Colorado, and therefore meet the land health standard. By applying sufficient controls, mitigation measures, and restoration methods as described in the Proposed Action and Alternative Mitigation to minimize

impacts to surface and groundwater quality, the public land health status is less likely to change in the proposed project area.

## **WETLANDS AND RIPARIAN ZONES (includes a finding on Standard 2)**

### **Affected Environment**

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances, do support, a prevalence of wetland vegetation typically adapted for life in saturated soil conditions. Wetlands in the proposed project area are typically located along perennial streams. Riparian areas occur as narrow zones between stream and wetland areas and adjacent uplands. Wetlands and riparian areas are a source of substantial biodiversity and serve a variety of functions, including wildlife habitat, naturally improving water quality, and flood control.

The proposed project area is located in the Hunter Creek watershed at the headwaters of the White River Watershed, a tributary of the lower Colorado River. Hunter Creek, located approximately one half mile east of the proposed project area, is a small, incised intermittent stream with a narrow channel that is bordered by steep canyon walls composed of the Green River Formation. The water flow in Hunter Creek is not constant, but is dependent on spring runoff and individual storm events. The riparian area is limited, and supports only sparse vegetation composed mainly of grasses and other vegetation types associated with a semi-arid region.

Immediately above the riparian zone, the dominant vegetation species along the stream banks are mature pinyon-juniper interspersed with serviceberry, mountain mahogany, and sagebrush. Hunter Creek drains into Piceance Creek, a perennial stream approximately three miles to the northeast of the proposed project area.

No wetlands or riparian areas are present within the proposed 160-acre site boundaries. However, the proposed powerline, communication line, and natural gas pipeline ROW would cross approximately 0.1 mile of wetland and riparian vegetation along Hunter Creek. No construction activity would take place in the vicinity of Dry Gulch.

### **Environmental Consequences of the Proposed Action**

Construction of the proposed oil shale RD&D facilities would not disturb any wetland or riparian vegetation. However, construction of the combined powerline, communication line, and natural gas pipeline ROW would result in the short-term alteration of less than one third of an acre of wetland and riparian vegetation. This wetland would not be permanently filled or drained as a result of the combined ROW construction. Accidental leaks of hazardous fluids and/or petroleum products could contaminate surface waters and degrade water quality in the area if not properly mitigated.

The effect of construction would be greatest during, and immediately after construction, but would be brief because the vegetation quickly regenerates, with herbaceous vegetation recovering within 1 to 3 years. The removal of a minor amount of pinyon-juniper vegetation (0.5 acres) along the stream bank would represent a longer-term vegetation loss.

Failure to segregate topsoil over the trenchline in wetland and riparian areas could result in the mixing of topsoil with subsoil, which could lower the biological recruitment of native vegetation after restoration. Inadvertent compaction and furrowing of soils during construction could result from temporary stockpiling of soil and from the movement of heavy equipment, which could alter the natural hydrologic patterns of the wetland and riparian area, inhibit seed germination, or increase the potential for siltation. Impacts to the wetland and riparian areas at Hunter Creek would be temporary.

Impacts to wetland and riparian areas would be minimized by obtaining and complying with the Corps of Engineers Nationwide Permit 12 conditions and all Colorado Department of Public Health and Environment-Water Quality Control Commission (CDPHE-WQCC) permit requirements. In addition, Chevron's Stormwater Management Plan (SWMP) was written to comply with the CDPHE General Permit No. COR 03000, and related Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) storm water regulations.

### **Subalternative - Proposed Action with Mitigation**

In addition to compliance with all permitting requirements and implementing the BMPs outlined in Chevron's Stormwater Management Plan, the BLM would require additional measures to offset any impacts to wetlands and riparian zones. These measures include:

- Minimizing soil compaction and furrowing by using mats or wide tire/low ground pressure equipment for construction activities within riparian zones (if necessary).
- Completing all construction activities in riparian area during no-flow period.
- Completing stream crossing within 24 hours if possible.
- Limiting grading, topsoil segregation, and excavation to the area immediately over the trenchline to avoid excessive disruption of soils and the native seed and rootstock within the soils.
- Prohibiting storage of hazardous materials, chemicals, fuels, lubricating oils, and refueling activities within 200 feet of any wetland or riparian area.
- Limiting construction equipment working in wetlands to that essential for clearing, trenching, installation, backfilling, and restoration.
- Performing routine daily inspections on equipment and vehicles to identify leaks and initiate corrective actions.
- Managing all soil materials such that erosion and sediment transport are minimized.
- Installing structural and/or non-structural erosion controls, as discussed in the Soils section, for bank stabilization and to minimize the potential for sediment runoff into surface waters.

- Monitoring surface water quality and flow as discussed in the Water Quality, Surface and Ground section.
- Revegetating disturbed areas with BLM-approved seed mixes as soon as practical following disturbance.

### **Environmental Consequences of the Subalternative**

Temporary impacts to the wetlands and riparian areas along Hunter Creek would result from the surface disturbance associated with the proposed ROW construction. Alternative mitigation, along with measures described in the Proposed Action and all permit requirements contained therein, would reduce the impacts to wetland and riparian zones by limiting the amount and duration of disturbance to 24 hours if possible, and limiting the amount of disturbance to less than one third of an acre, as well as ensuring that revegetation would be completed in a timely manner and with approved seed mixes to restore the utility and function of the wetland and riparian zones of Hunter Creek.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

### **Finding on the Public Land Health Standard for riparian systems**

The proposed project would have no long-term adverse effect on the land health standard with implementation of mitigation measures and successful revegetation. The public land health standard for wetlands and riparian zones would continue to be met.

### **CRITICAL ELEMENTS NOT PRESENT OR NOT AFFECTED**

No prime and unique farmlands, wild and scenic rivers, wild horses, or wilderness exist within the proposed project area. The site was inventoried for threatened, endangered or sensitive plant species on February 27 and 28, 2006, and no such species were found in the area. No threatened, endangered or sensitive wildlife species are known to be present on the proposed lease site, and neither the Proposed Action, the Subalternative Mitigation to the Proposed Action, nor the No-Action alternative would have any influence on these. There are also no known Native American religious or environmental justice concerns associated with the Proposed Action.

### **NON-CRITICAL ELEMENTS**

The following elements **must** be addressed due to the involvement of Standards for Public Land Health:

**SOILS** (includes a finding on Standard 1)

**Affected Environment**

The soil types in the proposed 160-acre project area occur from 6000 to 7600 feet in elevation. The average annual precipitation in the area is 13 to 17 inches, the average annual temperature is 42 to 45 degrees Fahrenheit, and the average frost-free period is approximately 80 to 105 days. The proposed RD&D site development would occur within soil unit 64 inventoried by the Natural Resources Conservation Service (NRCS). The proposed combined ROW for a natural gas pipeline and power and communication lines would occur within soil units 64, 70, and 73 inventoried by the NRCS. Soil unit, names, and characteristics are listed in **Table 11** (SCS, 2004).

**Table 11: Summary of Project Area Soil Units**

Soil Map Unit	Soil Unit Name	Slope (%)	Ecological Site	Effective Rooting Depth (in)	Runoff	Erosion Potential	Bedrock Depth (in)
64	Piceance fine sandy loam	5 – 15	Rolling Loam	20 – 40	Slow to medium	Moderate to high	20-40
70	Redcreek-Rentsac Complex	5 – 30	Pinion-Juniper Woodland	10 – 20	Medium	Moderate to high	10-20
73	Rentsac Channery Loam	5-50	Pinion-Juniper Woodland	10-20	Rapid	Moderate to very high	10-20

***Piceance fine sandy loam, 5 to 15 slopes:*** Moderately deep, well-drained soil on uplands and broad ridgetops; formed in aeolian material and colluvium derived dominantly from sandstone; surface texture is fine sandy loam and subsurface textures are loam and channery loam; depth to sandstone ranges from 20 to 40 inches. Permeability of the Piceance soil is moderate, and available water capacity is moderately low. Runoff is slow to medium, and the hazard of water erosion is moderate to high. Effective rooting depth is 20 to 40 inches. Typically, the surface layer is brown fine sandy loam 4 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 13 inches is light yellowish brown loam. The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, big sagebrush, serviceberry, prairie junegrass, and sand lupine. This unit is used for livestock grazing and wildlife habitat.

***Redcreek-Rentsac Complex, 5 to 30 percent slopes:*** The Redcreek soil is shallow and well drained. It formed in residual and aeolian material derived dominantly from sandstone. Typically, the surface layer is brown sandy loam about 4 inches thick. The underlying material

is very pale brown, calcareous channery loam 5 inches thick. Hard sandstone is at a depth of 16 inches. Permeability is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to high. The potential plant community on this unit is mainly pinyon and juniper with an understory of beardless wheatgrass, Indian ricegrass, serviceberry, mountain mahogany, sedges, and big sagebrush. This unit is used mainly for livestock grazing and wildlife habitat. It is also used as woodland.

***Rentsac channery loam, 5 to 50 percent slopes:*** This shallow, well drained soil is on ridges, foothills, and side slopes. It formed in residuum derived dominantly from calcareous sandstone. Typically, the surface layer is grayish brown channery loam about 5 inches thick. The next layer is very channery loam about 4 inches thick. The underlying material is extremely flaggy light loam 7 inches thick. Hard sandstone is at a depth of 16 inches. Permeability of this Rentsac soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high. The potential plant community on this unit is mainly pinyon and Utah juniper with and understory of Indian ricegrass, beardless wheatgrass, mountain mahogany, and prairie junegrass. Smaller amounts of big sagebrush, bitterbrush, and serviceberry are also present. This unit is used mainly for livestock grazing and wildlife habitat. It is also used as woodland.

These soil units have a listed salinity value of less than 2 mmhos per centimeter.

**Environmental Consequences of the Proposed Action**

The type of construction activities proposed removes surface cover and disturbs soils. Clearing, grading, and movement of construction equipment and vehicles would remove vegetative cover and expose the soils to the effects of wind, rain, and runoff. The effects would accelerate the erosion process and could result in the discharge of sediment into waterbodies that could adversely affect water quality. Grading, trenching, and backfilling activities could cause mixing of the soil horizons and could result in reduced soil fertility reducing revegetation potential. Movement and operation of construction equipment could compact the soil and result in an increased erosion hazard and reduced revegetation potential. Clearing of existing vegetation could provide an opportunity for noxious weeds to invade disturbed areas, and movement of equipment could transport weed seed and plant parts from one location to another.

Accidental spills or leaks of petroleum products and coolants from construction equipment and diesel generators could cause soil contamination and reduce productivity. The total area disturbed over the soil units of the proposed project is estimated at a total of 108 acres (including power, communication, and gas line ROW). The disturbance would occur in phases over the proposed lease period, and portions of the site could remain non-vegetated for up to 10 years depending upon the success and life expectancy of the proposed project. **Table 12** below shows the calculated disturbance by soil mapping unit for each of the elements of the Proposed Action.

**Table 12: Calculated Disturbance by Soil Mapping Unit**

	Soil Mapping Unit	Total Area
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	64	70	73	<b>(acres)</b>
<b>Research Facilities</b>				
<b>Acres</b>	100.0			100.0
<b>Combined ROW –Pipeline, Power, Communication</b>				
<b>Feet</b>	3080	700	1500	
<b>Acres</b>	4.6	1.0	2.2	7.8
<b>Total Area</b>				
<b>Acres</b>	104.6	1.0	2.2	107.8

### **Subalternative - Proposed Action with Mitigation**

Potential impacts of the proposed RD&D project on soil resources would be minimized by implementing the proper procedures for handling topsoil and subsoil, erosion control, compaction, and reclamation. Impacts to soils would be minimized by implementing the following measures:

- Limit clearing and vegetation removal to the extent practical to provide for safe and efficient construction.
- Stockpile topsoil separately from subsoil to prevent mixing of soil layers.
- Decompact subsoil to a depth of 6 to 10 inches prior to topsoil replacement.
- Restore pre-construction contours and natural drainage patterns.
- Return topsoil to pre-construction depths and locations.
- Install temporary and permanent erosion control measures.
- Use vegetative mulch to reduce erosion potential by providing additional surface relief.
- Seed disturbed areas as discussed in the Vegetation section.
- Control noxious weeds as discussed in the Invasive, Non-Native Species section.
- Minimize the potential for accidental spills or leaks as discussed in the Wastes, Solid or Hazardous section.

Segregation of topsoil material and replacement of topsoil in its respective original position (last out, first in) would assist in the re-establishment of soil health and productivity. Stockpiled topsoil would be covered or seeded with an approved seed mix to prevent erosion and preserve

the soil for use in later reclamation. Previously disturbed areas no longer required for operation, and not intended for future use, would be restored to natural contours and reseeded as soon as possible.

Slopes within the disturbed area would be stabilized by non-vegetative practices designed to hold the soil in place and minimize erosion. Vegetation cover would be re-established as soon as practicable to increase infiltration and provide additional protection from erosion.

At locations where erosion is anticipated, sediment barriers would be constructed to slow runoff, allow deposition of sediment, and to prevent it from leaving the site. In addition, straining or filtration mechanisms may also contribute to sediment removal from runoff. Disturbed surfaces on slopes greater than 5 percent would require the use of silt fence to prevent sediment from leaving the site. Geotextile fabrics would also be utilized on steep slopes to further mitigate erosion. Erosion control and Best Management Practices contained in Chevron's Stormwater Management Plan would be implemented, maintained, and updated as required. Re-seeding of the disturbed areas not in use would be done in accordance with BLM stipulations.

### **Environmental Consequences of the Subalternative**

The potential for erosion would increase as a result of construction activities, and could result in loss of valuable topsoil. Excessive erosion could also adversely affect water quality by contributing to increased sediment loads in nearby streams. The proposed action is estimated to remove vegetation and disturb soils on a total of approximately 108 acres. Implementing measures to offset the impacts to soils, included in both the Proposed Action and in the subalternative mitigation action, would increase the potential for successful reclamation and revegetation, and would subsequently decrease the likelihood of irreparable harm to soil materials and the water bodies that might be affected by erosion and sediment transport.

Spills of petroleum products, fuels, lubricants, and other chemicals used in facility construction, operation, and maintenance could reduce the productivity of soils and inhibit the germination and growth of plants. A BLM-approved SPCC plan would outline measures to reduce the amount and severity of accidental releases, ensure compliance with Federal and State standards, and would therefore lessen potential impacts to soils.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

### **Finding on the Public Land Health Standard for Upland Soils**

Soils within the proposed lease site and those along the proposed combined ROW meet the criteria established in the standard for upland soils. The Proposed Action may adversely impact the public land health standard to protect upland soils at the proposed location, but area-wide would not have a large effect. Implementing the subalternative mitigation measures, along with those contained within the project design of the Proposed Action, would provide adequate assurance that successful topsoil handling procedures, erosion control methods, and restoration measures are adhered to during construction, operation, and reclamation; therefore the proposed project would continue to meet the standard.

## **VEGETATION (includes a finding on Standard 3)**

### **Affected Environment**

Hunter Ridge is one of a number of parallel ridges separated by creeks that drain into Black Sulphur and Piceance Creek to the north of the Proposed Action. The proposed 160-acre lease tract is located near the northern extent of the ridge between the elevations of approximately 6560 to 6660 feet. In this area, Hunter Ridge is approximately 1 1/2 miles wide with Hunter Creek on the east and Dry Gulch on the west. No aquatic or riparian habitat is located on the ridge. The proposed RD&D site has a gentle northeast aspect. The elevation difference between the southwest corner and the northeast corner is approximately 100 feet. Several small erosional drainages and gulleys bisect the site and converge on a small stock reservoir on the northern boundary.

The entire 160 acres is primarily dominated by Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*). Other common woody species include scattered rabbitbrush (*Chrysothamnus nauseosus*), pinyon (*Pinus edulis*), and juniper (*Juniperus* spp.). Understory herbaceous vegetation includes blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), Indian ricegrass (*Oryzopsis hymenoides*), bluebunch wheatgrass (*Pseudoroegneria spicata*), hairy false goldenaster (*Heterotheca villosa*), and an unidentifiable milkvetch (*Astragalus* spp.). Surface layers (soils and soil parent materials) in the general area are derived primarily from the Uinta Formation, with exposures of the Green River Formation along valley slopes.

In the Piceance Basin, the elevation at which the proposed lease tract is located is typically dominated by intermingled Wyoming sagebrush parks and pinyon-juniper woodlands along the ridge tops and basin big sagebrush dominates the drainage bottoms. These two vegetation communities have been identified within the proposed project area and are described below.

***Sagebrush steppe*** communities follow canyon bottomlands, extend onto mesas and plateaus, and occur in some mountain regions along major rivers. This community is dominated by basin big sagebrush, Wyoming big sagebrush, and mountain big sagebrush. The sagebrush type is a mixed low to high growing shrub community. The overstory varies from open to completely closed stands with understory species density and diversity inversely related to overstory closure. Other species commonly associated with this community include rabbitbrush, bitterbrush, broom snakeweed, several grass species, and mixed cacti. Other shrub dominant communities are often associated with this community, including greasewood, four-wing saltbrush, and shadscale.

This vegetation association is influenced by many interacting and independent ecological factors, including climate, soils, topography, fire history, and grazing history. Available moisture, as

influenced by elevation, affects both overstory and understory species composition. Stands below 7000 feet are generally dominated by big sagebrush. This vegetation association covers approximately 98 percent of the proposed 160-acre lease tract.

**Pinyon-Juniper** woodlands typically occur on warm, dry sites on mountain slopes, mesas and plateaus, and include the pinyon pine and at least one juniper species. Habitats in western Colorado most often include the Utah juniper and Rocky Mountain juniper, depending on elevation. This vegetation association exists on a wide range of soils, elevations and exposures and is limited primarily by semiarid or cool-mesic climatic conditions and saline-alkaline soils. Within the proposed project area, the elevation range for this plant community is typically between 5000 and 7000 feet. Only pinyon is present at the upper elevation range, but at the lower elevation range, pinyons are less common and juniper is dominant. The primary juniper species found in the resource area is Utah juniper (*Juniperus utahensis*). The type characteristically occurs on xeric ridgetops with shallow soils.

The majority of the pinyon-juniper woodlands in the areas adjacent to the Proposed Action are mature and occur as closed-canopy stands. These pinyon and juniper stands are primarily restricted to the western-most 50 yards of the tract. A thin patch of widely spaced (>20 yards apart), short (< 6 feet tall) trees is beginning to establish near the center of the tract. There are no mature woodlands within the tract itself; however, the areas to the south, east, and west are dominated by mature pinyon-juniper woodland. The pinyon-juniper vegetation communities cover about 2 percent of the 160-acre lease tract, and approximately 50-percent of the combined powerline, communication, and pipeline ROW.

The proposed project area crosses two ecological sites as described in **Table 13** below. An ecological site is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time; a characteristic hydrology, particularly runoff and infiltration; and a characteristic plant community. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production (NRCS 2003).

**Table13: Descriptions of Ecological Sites Crossed by the Project**

Ecological Site Name	Predominant Plant Species
Pinyon-Juniper	Pinyon pine, Utah juniper, Indian ricegrass, bitterbrush, Utah serviceberry, Wyoming big sagebrush, beardless wheatgrass, western wheatgrass, mountain mahogany, prairie junegrass, Indian ricegrass, mutton grass
Rolling Loam	Wyoming big sagebrush, winterfat, low rabbitbrush, spineless horsebrush, bitterbrush, western wheatgrass, Indian ricegrass, prairie junegrass, Nevada bluegrass, mutton grass, and needle-and-thread grass

**Environmental Consequences of the Proposed Action**

Construction of the proposed project would result in cutting, clearing, and/or removal of existing vegetation to the extent necessary to allow for safe and efficient construction and operation within the 160-acre lease tract and along the proposed combination ROW.

Construction of the proposed test wells and research facilities would remove all vegetation on disturbed areas. An estimated total of up to 100 acres at the 160-acre lease site could remain non-vegetated for up to 10 years depending upon the success and life expectancy of the proposed project. All of these facilities are planned to be sited within the sagebrush association near the center of the tract. The proposed power, communications, and natural gas pipeline would remove only that vegetation necessary for ROW construction and pipeline installation equating to an estimated 4 acres of pinyon-juniper vegetation and 3.88 acres of sagebrush. The proposed ROW would be revegetated as soon as possible after construction.

The longer the disturbance remains non-vegetated, the greater the chance for invasion of weedy plants onto the site. Some of those weedy species can create problems in future reclamation efforts and some may be non-desirable. The proposed disturbance to vegetation could also increase soil erosion and reduce wildlife habitat.

Impacts to vegetation would vary by vegetative community, ecological site type, and revegetation success. Herbaceous vegetation would likely re-establish within 1 to 2 years and would have short-term impacts. The greatest long-term impact on vegetation, aside from extended use of the road and research facilities, would be the loss of native shrub components of the plant communities impacted. The native sagebrush would take approximately 20 years to return to any reclaimed areas, and the small amount of pinyon found at the site is not likely to return to the disturbance for at least 50 years. Attempts in the past to re-establish the shrub species have had only marginal success. The success, or failure, of revegetation efforts would affect other resources including soils, surface water quality, wildlife, visual resources, and livestock grazing. It is reasonable to assume that impacts to vegetation from construction and operation of the Proposed Action would primarily be long-term.

### **Subalternative - Proposed Action with Mitigation**

Potential impacts from disturbance to vegetation associations could include soil erosion, increased potential for the infestation of invasive, non-native species, and indirect impacts to wildlife resulting from reduction of forage and habitat. Measures included in the design features of the Proposed Action, and those listed below would minimize the impacts to vegetation.

- Limiting vegetation removal to the extent necessary to allow for safe and efficient construction activities.
- Salvaging root systems where possible.
- Cutting trees with a chain saw and/or mechanical shears and cut brush with a hydraxe or similar equipment as close to the ground as possible.
- Leaving stumps and root balls in place except in areas requiring topsoiling, or as necessary to create a safe and level workspace.

- Shredding or chipping brush and salvage with topsoil (unless specified otherwise).
- Salvaging and replacing topsoil, as discussed in the Soils section, to preserve and replace existing seed banks and return organic matter needed for seed establishment to the soil.
- Restoring pre-construction contours, drainage patterns, and topsoil.
- Preparing a seedbed (scarifying, tilling, harrowing, or roughening) prior to seeding where needed to improve revegetation potential.
- Installing and maintaining erosion control measures until vegetation becomes established, as discussed in the Soils section.
- Controlling noxious weeds as discussed in the Invasive, Non-Native Species section.
- Promptly seeding disturbed areas not necessary for production and/or operation of the Proposed Action with the goals of replacing suitable wildlife habitat and browse, and providing vegetative cover to stabilize soils and control erosion. Typical seed mixes would reflect environmental conditions and ecological range sites within the proposed lease tract and emphasize the use of native species as provided in following tables. Certified weed-free seed purchased from and blended by qualified producers and dealers would be used for reclamation.

**Table 14: White River Field Office Standard Seed Mix-Rolling Loam**

<b>Standard WRFO Seed Mix (Native Seed Mix #2) Ecological Site/Range Site = Rolling Loam</b>	<b>Rates1 (lbs PLS/acre)</b>
Western wheatgrass (Rosanna)	2.0
Indian ricegrass (Rimrock)	1.0
Bluebunch wheatgrass (Whitmar)	2.0
Thickspike wheatgrass (Critana)	2.0
Globemallow	0.5
Fourwing saltbush (Wytana)	1.0
Total	8.5

**Table 15: White River Field Office Standard Seed Mix-Pinyon-Juniper**

<b>Standard WRFO Seed Mix (Native Seed Mix #3) Ecological Site/Range Site = Pinyon-juniper</b>	<b>Rates1 (lbs PLS/acre)</b>
Western wheatgrass (Rosanna)	2.0
Indian ricegrass (Rimrock)	1.0
Bluebunch wheatgrass (Whitmar)	2.0
Thickspike wheatgrass (Critana)	2.0
Fourwing saltbush (Wytana)	1.0
Utah sweetvetch	1.0
Total	9.0

All seeding rates are in pounds (lbs) of Pure Live Seed (PLS) per acre.

- Employing drill or broadcast seed methods to ensure proper seed placement. Drill seeding is preferred and would be used wherever soil characteristics and slope allow effective operation of a rangeland seed drill. Drill seeding would be performed perpendicular to the slope. Seed would be placed in direct contact with the soil at an average depth of 0.5-inches, covered with soil, and firmed to eliminate air pockets around the seeds. Broadcast seeding would be employed only in areas where drill seeding is unsafe or physically impossible. Seed would be applied uniformly over disturbed areas with manually operated cyclone-bucket spreaders, mechanical spreaders, or blowers. Broadcast application rates would be twice that of drill rates. The seed would be uniformly raked, chained, dragged, or cultipacked to incorporate seed to a sufficient seeding depth. Revegetation operations would commence immediately after recontouring and would not be delayed until the following growing season.
- Completing drill and/or broadcast seeding prior to redistribution of woody material.
- Redistributing large, woody material salvaged during clearing operations over the disturbance in order to meet fire management objectives, provide wildlife habitat and seedling protection, and as a deterrent to vehicular traffic.

### **Environmental Consequences of the Subalternative**

The mitigation measures identified under the subalternative action would serve to minimize areas where soil is disturbed, and enhance soil stabilization with replacement of topsoil and revegetation. The BLM anticipates disturbance to approximately 4 acres of pinyon-juniper woodland vegetation, and a total of approximately 104 acres of herbaceous and sagebrush communities. The potential for successful reclamation of these vegetation types would increase by implementing mitigation measures that would retain soils and provide appropriate seed mixes for the restoration of native vegetation. These measures would also help to ensure that the proposed site would be returned as near as possible to pre-construction contours and vegetative condition. Adhering to the measures listed above would result in the re-establishment of herbaceous vegetation within 1 to 2 years; big sagebrush-dominated communities would likely return to their pre-construction form within 20 to 75 years, and pinyon-juniper woodlands would take from 100 to 300 years to return to pre-construction conditions.

Long-term impacts to wildlife forage and habitat would proportionally decrease as reclamation success increases.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

### **Finding on the Public Land Health Standard for Plant and Animal Communities** (partial, see also Wildlife, Aquatic and Wildlife, Terrestrial)

The plant communities within the area of the Proposed Action have an appropriate age structure and diversity of species which meet the criteria established in the standard for vegetation. With successful reclamation, the Proposed Action with Mitigation would not change this.

## **WILDLIFE, AQUATIC (includes a finding on Standard 3)**

### **Affected Environment**

The proposed 160-acre lease tract is located on top of Hunter ridge and does not contain any streams or creeks that provide habitat for aquatic wildlife. The nearest surface waters to the Proposed Action include Hunter Creek, an intermittent stream located approximately 1/2 miles to the east; and Dry Gulch, an ephemeral stream located approximately 1/2 miles to the west. Neither Hunter Creek nor Dry Gulch provide year-around flows to support aquatic wildlife, although Dry Gulch is tributary to Black Sulfur Creek which does support some fish species. Hunter Creek is tributary to Piceance Creek, which supports a variety of aquatic life.

These streams are all tributary to Piceance Creek located approximately 4 miles north of the proposed RD&D site. Native fish in Piceance Creek include the speckled dace, flannelmouth sucker, and mountain sucker. Trout may appear in Piceance Creek, but their numbers are low. Irrigation drawdown is a major factor in limiting fish populations in Piceance Creek. Refer to the Threatened, Endangered, and Sensitive Animal Species section for discussion on Colorado River endangered fish.

### **Environmental Consequences of the Proposed Action**

Construction of the combined powerline, communications, and natural gas pipeline ROW could affect water quality in down-stream water bodies as it crosses Hunter Creek. Clearing, grading, and movement of construction equipment across the Creek would increase sedimentation and turbidity, stream bank erosion, and introduce the potential for contamination from accidental hazardous material spills or leaks. These effects would be temporary and localized, and would not have any measurable effects on aquatic wildlife.

Construction of the proposed RD&D facilities within the 160-acre lease site would remove vegetative cover and expose soils to the effects of wind, rain, and runoff. These effects could accelerate the erosion process, and could result in discharges of sediment into Hunter Creek that could adversely affect water quality at the proposed location. These effects would be local and are not likely to affect the aquatic life habitats of Piceance Creek.

Impacts to aquatic wildlife would be minimized by obtaining and complying with the Corps of Engineers (COE) Nationwide Permit 12 conditions and by implementing measures outlined in Chevron's Stormwater Management Plan to control erosion and sediment transport.

### **Subalternative - Proposed Action with Mitigation**

Mitigation measures provided in the water quality, soils, vegetation, and wetland and riparian sections would all be implemented to minimize the impacts to aquatic wildlife. These include, but are not limited to:

- Placing any topsoil removed as far as practical from the water's edge.

- Installing erosion and sediment control measures, as discussed in the Soils section, to prevent the flow of spoil into any waterbodies.
- Maintaining erosion and sediment control measures until final stabilization.
- Limiting construction equipment working in stream crossings to that essential for clearing, trench excavation, pipe installation, backfilling, and restoration.
- Crossing streams during periods of low flow and completing the crossing within 24 hours if possible.
- Prohibiting the storage of hazardous materials, chemicals, fuels, lubricating oils, and refueling activities within 200 feet of any waterbody.
- Minimizing erosion from upland areas by restoring and seeding unused portions of the project area as soon as practical as discussed in the Vegetation and Soils section.

### **Environmental Consequences of the Subalternative**

Surface waters in the proposed project area include Hunter Creek and Dry Gulch, approximately 1/2 mile east, and 1/2 mile west respectively of the proposed lease site; Black Sulphur Creek, approximately 3 miles south; and Piceance Creek approximately 4 miles north. Clearing, grading would remove approximately 108 total acres of vegetative cover, exposing moderate to highly erodible soils to the effects of wind, rain, and runoff. Potential impacts to aquatic wildlife in streams near the propose project area could result from surface disturbance, accidental chemical releases, and from potential changes to the flow regime and water quality in the upper aquifer. Implementing measures described in the subalternative mitigation action would improve soil stability, minimize erosion potential, reduce the frequency and severity of accidental spills, and would ensure that preventative measures were in place to protect surface and groundwater resources.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

**Finding on the Public Land Health Standard for plant and animal communities** (partial, see also Vegetation and Wildlife, Terrestrial):

The Proposed Action would not jeopardize the viability of any aquatic population, and would have no consequence on aquatic habitat condition, utility, or function, nor have any discernible effect on animal abundance or distribution at any landscape scale. The public land health standard would continue to be met.

## **WILDLIFE, TERRESTRIAL** (includes a finding on Standard 3)

### **Affected Environment**

As described in the Vegetation section, the proposed project is located within two vegetation communities that support a diversity of wildlife and wildlife habitats. Each of these communities provides nesting, cover, and foraging habitat for a variety of mammal, bird, and reptile species common to northwest Colorado. Wildlife inhabiting the area for which management emphasis is placed included big game (elk and mule deer) and non-game species (raptors).

Refer to the Threatened, Endangered, and Sensitive Animal Species section for discussion on Greater sage grouse, Fringed myotis, Spotted bat, Yuma myotis, Townsend's big-eared bat, Midget faded rattlesnake, Northern goshawk, and Bald eagle.

The Colorado Division of Wildlife (CDOW) manages two big game species in the vicinity of the Proposed Action: elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*). These species are managed in game management units (GMUs) that represent geographic ranges which are typically several hundred thousand to several million acres in area and contain several hundred to tens of thousands of individual animals. The proposed project would be within the area 22 GMU for elk and deer.

**Elk** are adaptable animals and occupy a wide variety of habitats, ranging from semi-desert areas to coniferous forests. Although elk may use coniferous forests or mature stands of pinyon-juniper for cover, they are commonly found in open areas, meadows, and along the edges of wooded areas. The summer range typically provides a mixture of open brushy and grassy areas, water sources, and areas of dense forest cover. Winter ranges are generally at lower elevations where cover and forage are more available during the winter months.

**Mule deer** occur throughout the project area. Suitable habitats, including mountain shrub, aspen, and sagebrush habitats, provide mule deer with forage and cover for all seasons. During the summer months, deer populations can be found in the mountain shrub community, aspen woodlands, and Douglas fir forests (BLM 1999). During the winter months, after the fall migration from summer range, deer concentrate in pinyon-juniper and sagebrush ranges below 7,400 feet where snow depth and temperatures are more moderate. The Piceance Basin has historically supported one of the largest mule deer herds in North America, with base populations reported to be 28,000 to 30,000 animals.

**Raptors** inhabit the proposed project area year-round. The Proposed Action is within and near habitats which may be suitable for raptor nesting. Generally, raptors return to areas in which they have nested in the past, often using the same nest sites. Nesting activities are initiated in mid-February to late April and eggs are laid during March and April. Brooding continues until eggs hatch. Nest occupation continues until chicks are fledged, which usually occurs from early June to mid-August. Refer to the Migratory Birds and Threatened, Endangered, and Sensitive Animal Species sections for discussion on raptors.

The proposed RD&D project lies upon Hunter Ridge, a north to south running ridge which extends for approximately 13 miles from Piceance Creek on the north to the Roan Divide on the south. The ridge lies between Dry Gulch on the west and Hunter Creek on the east and varies in width from two miles at its northern end to a mile or less at its southern end. The top of Hunter Ridge provides a seasonal migration corridor for deer and elk, as it provides both food and cover, while the adjacent drainage bottoms are more open. Deer and elk sign are evident all along Hunter Ridge in all habitat types. Generally, there is a very good mix of browse species for deer and elk in the mountain shrub and pinyon-juniper habitats. All but the upper one mile of Hunter Ridge is normal mule deer winter range. The Proposed Action is just south of, and adjacent to, the mule deer severe winter range at the north end of the ridge. All of Hunter Ridge is elk winter range and all but the southern tip and northern three miles are considered an elk winter concentration area. The Proposed Action also lies within the overall range for black bear and mountain lion. Timing restrictions for construction and critical range data established by the BLM and CDOW are provided in the **Table 16** below.

**Table 16: Big Game Critical Range Data**

<b>Habitat / Range Type</b>	<b>Timing Stipulations (construction restrictions apply)</b>	<b>Area Disturbed (Acres)</b>
Elk year-round range	None	100
Elk summer range	May 15 – August 15*	100
Elk winter range	December 1 – April 30	100
Mule deer overall range	None	100
Mule deer summer range	May 15 – August 15*	100
Mule deer winter range	December 1 – April 30	100

\*development is allowed until 10% of individual GMU summer habitat has been affected and then it is restricted to the given dates. (BLM, 1987; BLM, 1996; CDOW, 2004)

### **Environmental Consequences of the Proposed Action**

Evidence of deer and elk are present on the proposed lease tract. There is abundant evidence of deer in the pinyon-juniper woodland habitat adjacent to the tract and on the slopes of Dry Gulch and Hunter Creek, and to a lesser degree throughout the sagebrush habitat of the 160-acre lease site. Elk sign in the pinyon-juniper woodland habitat is significantly less than the deer sign, but elk sign is present in the area at this time. In the more mature woodland habitat surrounding the proposed lease site, bitterbrush is the most dominant browse species with lesser amounts of Wyoming sagebrush and mountain mahogany. Generally, there is little evidence of deer and elk browsing on sagebrush or bitterbrush in either the sagebrush or woodland habitats.

Construction of the proposed RD&D facilities, access road, and combined utility and pipeline ROW would result in a total loss of up to 108 acres of habitat for big game and other wildlife species. Much of this habitat could be lost long term; 10 or more years, depending on the success of the RD&D program. The proposed project would result in the loss of potential forage and browse when shrubs and other vegetation are removed. However, the sagebrush vegetation type associated with the Proposed Action is generally abundant in the area, and the loss due to

the project would represent a small portion of the available habitat. No bitterbrush or mountain mahogany has been observed within the proposed lease tract, and thus none would be removed.

Disturbance to wildlife would increase during the construction phase of the proposed project where additional traffic, noise, and human activity could have an adverse effect on wildlife within a ¼ mile-wide corridor. The Proposed Action would be in close proximity to mule deer severe winter range and therefore has potential to affect the distribution of this population.

Disturbance to wildlife along the County Road 69 corridor would temporarily increase during construction, but the impact would be lessened during the operation phases of the proposed project as activity at the site would be reduced to a single drilling and fracturing operation. Since the road is already in place, the impact would not be disturbance of new areas, but more frequent disturbance of areas already subject to vehicles and human activity. The Proposed Action would add to the traffic volume on Highways 13 and 64, and County Roads 5, 26, and 69 and could impact wildlife in this corridor as the potential for vehicle/animal collision would be increased.

Big game impacts associated with road density and use is addressed in the White River Resource Area ROD/RMP. The objective of the BLM is to control the proliferation of unauthorized roads and trails on big game ranges within context of the ROD/RMP and to stabilize existing road density. Construction and operation of the Proposed Action would result in no net increase in road density within the Piceance Basin's big game winter range area.

Much of Hunter Ridge supports habitat with very good shrub components for wintering deer and elk. Revegetation of areas not in use, and reclamation of the combined utility and pipeline ROW corridor would include browse species, including bitterbrush, 4-wing salt brush, serviceberry and forb species.

### **Subalternative - Proposed Action with Mitigation**

The proposed action identifies potential impacts to terrestrial wildlife. In order to mitigate potential impacts, BLM would require alternative mitigation measures. Chevron would implement the following mitigation measures to minimize impacts:

- Redistribute large, woody material salvaged during clearing operations so as not to exceed 3 to 5 tons/acre, and mulch excess woody materials;
- Limit fencing on the tract to facilities that otherwise would present a hazard to humans and/or wildlife;
- Seed disturbed areas according to BLM recommendations;
- Support carpooling and establish a policy of reduced vehicular speed, especially at night and;
- If reserve pits are deemed necessary on site, ensure that pits are lined, fenced on all four sides with net-wire, and covered with plastic barrier to exclude both large and small animals and netted to prevent birds from accessing these pits

### **Environmental Consequences of the Subalternative**

Construction activities associated with the Proposed Action could affect wildlife through disturbance, displacement, and mortality. Implementing seasonal restrictions would minimize these impacts by avoiding times that the largest populations are likely to be present in the area. Reclamation measures would ensure that cover, nesting, and forage habitat would be restored as soon as possible to pre-construction conditions across the 160-acre lease area.

The sagebrush vegetation type associated with the Proposed Action is generally abundant in the area, and the loss due to the project would represent a small portion of the available habitat. Restricting any fencing to only those areas necessary to protect wildlife and provide site security would assist in limiting the displacement of animal populations from areas in and adjacent to the proposed lease tract. Implementing measures to preclude migratory birds and other wildlife from accessing reserve pits would limit and/or prevent injury and mortality. Efforts to encourage carpooling and enforce speed limits could result in fewer animal/vehicle collisions.

**Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

**Finding on the Public Land Health Standard for Plant and Animal Communities** (partial, see also Vegetation and Wildlife, Terrestrial):

The proposed action would not jeopardize the viability of any animal population. Because of the small scale of the operations within the larger game management unit, only minor impacts on terrestrial habitat condition, utility, or function would be foreseen, with no discernible effect on animal abundance or distribution at any landscape scale. Neither the Proposed Action nor the mitigation alternative would affect the achievement of the public land health standard.

**OTHER NON-CRITICAL ELEMENTS** For the following elements, only those brought forward for analysis will be addressed further.

Non-Critical Element	NA or Not Present	Applicable or Present, No Impact	Applicable & Present and Brought Forward for Analysis
Access and Transportation			X
Cadastral Survey	X		
Fire Management			X
Forest Management			X
Geology and Minerals			X
Hydrology/Water Rights			X
Law Enforcement		X	
Noise			X
Paleontology			X
Rangeland Management			X
Realty Authorizations			X
Recreation			X
Socio-Economics			X
Visual Resources			X
Wild Horses	X		

## ACCESS AND TRANSPORTATION

### Affected Environment

The principal access routes into the proposed project area are Interstate 70, Colorado State Highways 13 and 64, and Rio Blanco County Roads 5, 26, 29 and 69. Interstate 70 and Colorado State Highway 64 are the major east-west arterials, and Colorado State Highway 13 is the major north-south arterial within general area of the Proposed Action. The majority of these roads are used by recreationists, local ranchers, and oil and gas operators.

Average daily traffic numbers compiled from the Colorado Department of Transportation (CDOT) and the Garfield and Rio Blanco County Road and Bridge Departments for major roads that would access the proposed project area are presented in **Table 17**.

**Table 17: Baseline Traffic Data for Project Area**

Road	Baseline Average Daily Traffic
Colorado Highway 13 between Rifle and junction with south end of RBC 5 (Piceance Creek Road)	2,300 <sup>1</sup>
Colorado Highway 13 between south end of RBC 5 and Colorado Highway 64 near Meeker	2,300 <sup>1</sup>
Colorado Highway 64 between Meeker and north end of RBC 5	830 <sup>1</sup>
Colorado Highway 64 between north end of RBC 5 and Colorado Highway 139	1,700 <sup>1</sup>
I-70 from Rifle to Grand Junction	14,200-23,100 <sup>1</sup>
Rio Blanco County Road 5 (Piceance Creek Road)	562-1076 <sup>2</sup>

<sup>1</sup>Colorado Department of Transportation 2005.

<sup>2</sup>Rio Blanco County Road and Bridge Department, 2005. Lower traffic range measured in May, high traffic range measured in late October/early November, coinciding with big game hunting season.

Rio Blanco County has recently completed a study of traffic impacts as part of a County Capital Improvement Plan and Land Use Plan amendment. These data have not yet been published, but will include updated traffic counts for County Road 5 and County Road 69, which cuts through the western portion of the proposed project site. The Proposed Action would contribute an average of 5 to 10 vehicles per day to the traffic counts on these county roads.

These county roads are also major access routes to natural gas development activities in EnCana's Figure Four Unit, the Eureka Unit, and the Double Willow Unit to the south of the proposed RD&D project area. With the growth of oil and gas development in these Units, traffic in the Hunter Ridge area has also increased markedly. Well drilling equipment, pipeline construction equipment, and gas production traffic travels along these roads throughout the day. These roads were originally designed for rural and agricultural uses and were not intended for the repeated heavy loads associated with oil and gas production and construction.

The entire Proposed Action is within an area where motorized vehicle traffic is limited to existing roads. Unless otherwise designated, off-highway vehicle (OHV) use is limited to existing travel routes in the BLM White River Field Office area between October 1 and April 30 each year (WRRRA RMP/ROD 1997).

A 25-foot wide by 500-foot long access road is proposed to gain entry to the 160-acre lease site from County Road 69. This access road would be entirely within the 160-acre parcel and would not require an additional Right-of-way permit. Existing Right-of-ways on the northern boundary of the proposed lease site would be used (if possible) to construct and access the combined powerline, communications line, and natural gas pipeline ROW.

### **Environmental Consequences of the Proposed Action**

The Proposed Action would not create additional access onto BLM lands, but it would increase traffic on existing roadways, and would contribute to fugitive dust along these county roads for the life of the project. Construction of the access road to the site would cause a disruption to the flow of traffic along County Road 69 for a short period of time (one or two days).

Workers and contractors would commute to and from the job site as no employee housing or man-camp accommodations on-site would be anticipated. Additional traffic resulting from construction and operation of the Proposed Action would include 5 to 10 light passenger vehicles per day and would include heavy vehicles such as drill rigs, water trucks, tanker trucks, equipment haulers, and frac trucks at various times during construction and operation. The traffic volume associated with these larger vehicles would vary with the phases of the proposed RD&D operation. The fracturing phases would require 5 to 8 specialized frac vehicles, and as many as 20 to 50 CO<sub>2</sub> tanker trucks could be required at the site at various times for the gas injection and heating phase of the project.

Construction of the proposed RD&D site may have some impact on the future use of the unsurfaced two-track road to the north of the 160-acre lease site. Portions of this road would be used for access to, and maintenance of, the proposed combined powerline, communications, and natural gas pipeline ROW. Construction of the combined ROW would be short-term. Long-term impacts to traditional use of this road could occur if recreationists, namely big game hunters, are dispersed from the area due to the construction and operation of the proposed RD&D facilities.

The access to the stock watering pond along this road would remain unchanged and therefore would have no impact with regard to rangeland management at that location.

Chevron would develop a Fugitive Dust Plan outlining provisions for dust control mitigation (such as watering roads and construction areas) during construction and operation of the proposed facilities. In addition, existing roads utilized for the proposed project would be maintained and/or upgraded as necessary to conditions equal to, or better, than those that existed prior to project-related use. Chevron would also initiate project discussions with the Rio Blanco County Road and Bridge Department and develop measures, as necessary, to mitigate impacts on Rio Blanco County Roads 5, 26 and 69.

### **Subalternative - Proposed Action with Mitigation**

Impacts to transportation and roads would be minimized by implementing all Special Use License requirements and measures contained within Chevron's Oil Shale Research, Development & Demonstration Project Plan of Operations. In addition, the BLM would require additional alternative mitigation measures including:

- The use of a construction yard as the primary parking for personal vehicles. Encourage employees and contractors to carpool to and from the site.
- Requiring contractors and employees to comply with all posted speed limits for the safety of all personnel and to prevent accidents as well as to minimize fugitive dust.
- Complying with county and state weight restrictions and limitations.
- Controlling dust along unsurfaced access roads and minimizing the tracking of mud onto County Road 69.
- Restoring unsurfaced roads to equal or better condition than pre-construction levels after construction is completed.
- Developing measures to control unauthorized OHV use in cooperation with the BLM and interested landowners.

### **Environmental Consequences of the Subalternative**

Most of the impacts to access and transportation as a result of Proposed Action would be due to an increase in traffic along existing roadways. Encouraging employees and contractors to carpool would decrease the number of vehicles on these roadways, and would subsequently lower fugitive dust emissions on unpaved county roads. There would be potential to contribute to the damage to both surfaced and unsurfaced roads from the movement of heavy equipment and truck traffic. Damage to roads utilized for access to the proposed RD&D site would be minimized by limiting vehicles to state and county standard weight, size, and axle arrangements.

Implementing the Proposed Action with alternative mitigation would not likely result in impacts to roads beyond those associated with oil and gas drilling operations analyzed in the existing WRRR RMP.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **FIRE MANAGEMENT**

### **Affected Environment**

The actions proposed all occur within the D5 Cathedral Bluffs/Roan Plateau fire management unit; an area that has minimal constraints on the use of lightning ignited wildland fire to achieve public land health objectives and perform its natural function within an ecosystem. Nearly all the plant communities in the general vicinity of the project area are mature with moderate to considerable fuel loads. Most of these communities are rejuvenated by fire to maintain healthy, diverse plant communities.

The mature plant communities and relatively dry climate of the Piceance Basin make this area prone to fire especially in the heat of summer when rains are infrequent and dry thunderstorms are common. Human activities, such as construction and welding, can pose an extreme fire hazard during this time as well. Fires in this area are likely to move swiftly as they gain momentum from the considerable fuel loads associated with pinyon-juniper communities on either side of Hunter Ridge and cross the prominent ridge top primarily vegetated with mature sagebrush.

The Proposed Action would initially clear approximately 40 acres of sagebrush vegetation on the 160-acre lease site, and up to 100 acres over the life of the project. Approximately 4 acres of pinyon-juniper vegetation along the proposed ROW for power, communications, and natural gas pipeline installation would be cleared for construction and access.

The WRFO BLM has the primary fire response and suppression responsibility for the northern portion of the Piceance Basin. In the vicinity of the Proposed Action the Meeker Volunteer Fire Department provides mutual aid as requested.

### **Environmental Consequences of the Proposed Action**

Development of an oil shale RD&D facility in the northern portion of Hunter Ridge, along with the prevalent oil and gas operations located on the southern end could restrict the BLM's ability to use wildland fire to achieve public land health objectives for the plant communities along most of Hunter Ridge. This would likely be a long-term impact to fire management objectives as the RD&D lease term is proposed for up to 10 years, and oil and gas activities on the ridge may continue for a considerable time. Any naturally occurring fires in this area would likely be put out while they are small. Large areas of mature vegetation would continue a downward decline in diversity of plant species, especially herbaceous species. Higher costs per acre for fire management would be incurred by BLM for full suppression versus wildland fire use.

Also considerably higher costs can be expected for vegetation management by mechanical or prescribed fire means. These practices must be continued since BLM is mandated to manage for public land health and declining vegetation communities commonly result in declines in overall land health standards.

At the same time, fires started accidentally during construction could adversely affect land or resource management objectives for the vegetation communities in and around the project area. The proposed RD&D project would introduce potential ignition sources (i.e., vehicles, equipment, hot-works, flare, etc.), and if not properly maintained and/or monitored, these sources would increase the fire hazard potential in the area.

Vegetation removal and soil disturbance could provide an opportunity for noxious weeds and cheatgrass to invade the site and related rights-of-way, which could result in a shift from the natural fire regime to an unnatural, more frequent, fire regime which could result in the loss of key ecosystem components. The cleared vegetation would be windrowed if reclamation were to occur immediately after construction, or chipped and scattered for long-term disturbances. This would represent a light dead fuel load as the quantities would be relatively small.

The proposed RD&D facilities would be designed with sufficient defensible space to allow for limited wildland fire use, and to provide protection to workers in the event of a wildfire until such time as evacuation procedures could be implemented. Chevron would establish standards and practices that would minimize the risk of fire danger and, in case of fire, provide for immediate suppression if possible. Chevron employees and contractors would be required to strictly adhere to the company's hot-work procedures, and fire watches would be posted at hot-work areas where there is reasonable possibility of fire occurrence. Chevron would inspect and clean the flare on a regular basis to ensure that the buildup of solids does not occur so as to prevent hot particles from being spread during a high wind. Prior to beginning construction activities, Chevron would be responsible for developing a fire management plan as an integral part of the overall safety plan that would include evacuation procedures and designate escape routes. This plan would be consistent with the WRFO BLM fire management plan in relation to suppression tactics and accepted practices.

### **Subalternative - Proposed Action with Mitigation**

In addition to the standards and practices included in the design of the Proposed Action, the BLM would require alternate measures to minimize the risk of fire danger, and in case of fire, would provide for immediate suppression if possible. Chevron would implement the following fire mitigation measures:

- Coordinate with the BLM and Rio Blanco County Emergency Response teams in developing fire suppression priorities, identifying management restrictions, and determining appropriate fire suppression strategies.
- Notify the BLM, and affected landowners, of any fires during construction, maintenance, or operation of the proposed pilot project.
- Inform site personnel of fire prevention practices concerning smoking materials, welding, etc., and make hand tools available, including shovels and fire extinguishers, for fire control.
- Furnish all motor vehicles and equipment with fire-extinguishing equipment.
- Stage fire fighting equipment and water tanks on site in readily accessible areas.
- Construct defensible space as necessary. Determine design criteria in coordination with BLM fire staff.

- Perform all welding activities in areas where vegetation and other flammable materials have been removed.
- Treat above ground utility poles with fire retardant.
- Control noxious weeds and cheatgrass as discussed in the Invasive, Non-Native Species section.
- Seed disturbed areas as discussed in the Vegetation and Soils sections.
- Create defensible space around facilities and any above ground appurtenances.
- Construct the combined power, communications, and pipeline ROW with defensible space. Defensible space would be achieved in an ecologically and aesthetically pleasing manner with thinning and mulching of trees and brush instead of removing all vegetation.
- Redistribute large, woody material salvaged during clearing operations on BLM WRFO-administered lands. Disperse materials over the portion of the right-of-way from which the trees and brush were originally removed to meet fire management objectives (not to exceed 5 tons/acre of evenly distributed material) and to provide wildlife habitat, seedling protection, and deter vehicular traffic.
- Refer to the BLM Fire Management Activity Plan (FMAP) for additional mitigation requirements.
- Provide a developed evacuation plan to all employees and to county and BLM officials.

### **Environmental Consequences of the Subalternative**

Development of an oil shale RD&D facility would restrict BLM's ability to use wildland fire to achieve public land health objectives and could be a long-term impact to fire management objectives. Large areas of mature vegetation would continue a downward decline in diversity of plant species, especially herbaceous species at the project location. Higher costs per acre for fire management would be incurred by BLM for full suppression versus wildland fire use. Implementing the proposed alternative mitigation measures would provide a cooperative framework for fire management that would protect workers and facilities, and would reduce fire response times and overall costs of suppression by providing for fire suppression equipment at the site. Mitigation measures identified in the subalternative portions of the Soils, Vegetation and Invasive/Non-native species sections would promote restore vegetation and pre-construction contours to the extent possible, and would manage invasive species in such a manner as to avoid any change to the fire regime.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **FOREST MANAGEMENT**

### **Affected Environment**

Within the White River Resource Area (WRRRA), the forest management program has been divided into two sections, Timberland Management and Woodland Management. Timberlands consist of those lands that support stands of trees predominated by Douglas-fir, spruce-fir, lodgepole pine, and aspen. Woodlands consist of those lands that support stands of trees predominated by pinyon-juniper and Gambel oak. There are approximately 24,125 acres of timberlands and approximately 622,590 acres of woodlands in the WRRRA (BLM 1997). The objective of the BLM for forestry is to manage the timberlands and woodlands to maintain productivity, extent, forest structure, and enhancement of other resources.

The Proposed Action would not impact management objectives for timberland, but would occur adjacent to woodland management areas. Approximately 27,600 acres of suitable woodland is available for commercial harvest of juniper posts and poles within the Piceance Geographic Reference Area (GRA).

The dominant species associated with the pinyon-juniper woodlands are pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Common juniper (*Juniperus communis*) and one-seed juniper (*Juniperus monosperma*) may also be present. The stand composition, site characteristics, and productivity are highly variable and are based on moisture relationships.

The proposed 160-acre lease parcel is primarily comprised of sagebrush and herbaceous vegetation and does not occur within any woodlands, but is adjacent to mature stands of pinyon-juniper located to the west, south, and east. The proposed 65 foot wide power line, communications, and pipeline ROW would cross Hunter Creek where stands of pinyon-juniper woodlands occur. For the most part these stands contain old growth characteristics. These woodlands are valuable locally as a source of firewood and posts for fence construction.

### **Environmental Consequences of the Proposed Action**

The proposed combined ROW would remove approximately 4 acres of pinyon-juniper woodland. Chevron would be required to purchase this woodland material and dispose of it as described in mitigation. Impacts resulting from the removal of pinyon-juniper woodlands would be long-term. Following reclamation, these woodlands would be colonized by pinyon and

junipers within 30 years and would develop old growth characteristics between 150 and 300 years.

### **Subalternative - Proposed Action with Mitigation**

In order to mitigate potential indirect impacts that could affect woodland management, vegetation, and forage and nesting habitat, the BLM would require alternative mitigation measures to ensure that the forestry management objectives of the WRRRA are met:

- All trees removed in the process of construction would be purchased from the BLM. The trees would be cut at a maximum stump height of six inches and disposed of by one of the following methods: (BLM 1997).
  - Trees would be cut into four-foot lengths, down to four inches in diameter and placed along the edge of the disturbance before being dozed off the area of disturbance. Limbs would be scattered, but not dozed off.
  - Purchased trees could be removed from federal land for resale or private use.
  - Chipped and scattered.

### **Environmental Consequences of the Subalternative**

Alternative mitigation would not decrease the potential loss of four acres of pinyon-juniper woodland, but would provide for compensation in accordance with the BLM's forestry management objectives.

### **Environmental Consequences of the No Action Alternative**

If the RD&D leases are not approved, no impacts associated with the Proposed Action would occur.

## **GEOLOGY AND MINERALS**

### **Affected Environment**

The proposed lease tract is located within the Piceance Creek Basin which contains thick sequences of Eocene-age sedimentary bedrock. These deposits dip gently in a northeasterly, easterly, and southeasterly direction. The Piceance Creek Basin is located within the Colorado Plateau's physiographic province which is characterized by dissected plateaus with strong relief (Fenneman, 1931).

***General Physiography and Geology:*** The surficial geology in the proposed project area is the shallow dipping Tertiary Uinta Formation within the Green River Formation (Tweto, 1979). A thin veneer of unconsolidated surficial deposits (including residual, aeolian, and alluvial deposits) overlie Uintah Formation bedrock at the proposed lease tract. The Uintah Formation is formed mainly from clastic fluvial-deltaic sediments prograding southward, inter-tonguing with the lacustrine Green River Formation which includes the oil shale beds targeted by the Proposed Action. The thickness of this Formation varies across the region.

**Geologic Hazards:** The proposed RD&D project area lies within Seismic Risk Zone 1 (on a scale of 0 to 3, with Zone 3 having the highest risk) (Algermissen, 1969). Within Zone 1, minor damage to structures from distant earthquakes may be expected. A search of The National Earthquake Information Center data base (2006) for the area within approximately 100 miles of the Proposed Action revealed that since 1950 the largest seismic event was a magnitude 5.7 (Modified Mercalli Intensity VII) centered at approximately 39° 47'N, 108° 22'W.

There are no known active faults within the proposed project area, and no landslide deposits or other evidence of mass wasting is present on the 160-acre lease tract.

**Mineral Resources:** The Green River Formation is comprised of organic-rich shaley limestone, shale, marlstone, and sandstone, and is rich in fish, insect and plant fossils. The Parachute Creek member of the Green River Formation contains very substantial amounts of “oil shale” which is actually a kerogen-rich marlstone (Foutz, 1994). This area is identified in the White River Resource Area ROD/RMP as available for oil shale leasing and development.

Chevron’s targeted zone is the Mahogany in the Parachute Creek Member in the upper unit of the Green River Formation. Other mineral resources in the proposed project area include natural gas, coal, nahcolite, halite, and dawsonite. During drilling, potential water, oil shale, and the minerals nahcolite, halite and dawsonite would be encountered from the surface to the targeted zone. No coal mines are located in the immediate area (Kirschbaum and Biewick, 2003). Coal deposits beneath the nominated tract are at depths greater than 3000 feet and are not considered recoverable using current technologies.

The Piceance Creek Basin is characterized by rich gas accumulations from the Wasatch to the Williams Fork Formation of the Mesaverde. The tract is encumbered by federal oil and gas lease COC-013197 and the nearest producing well is located approximately 0.1 miles west of the western boundary of the tract. The Ryan Gulch and Eureka oil and gas exploratory units are 0.5 miles west and south of the tract respectively, and the northeast corner of the tract is contiguous with the Freedom oil and gas unit. Other oil and gas units in the general area include the Figure-Four and Double Willow.

The nahcolite deposit of the Piceance Creek Basin is the only substantial source of natural sodium bicarbonate known in the world. Nahcolite is present in the Green River Formation as interbeds, nodules, and disseminated crystals within the oil shale. According to studies of the Piceance Basin performed in the 1970’s, there are about 50 million tons of nahcolite per square mile in the vicinity of the Proposed Action. Therefore, the 160-acre tract should have 1/4 of this volume or about 12.5 million tons of nahcolite in place. It is unknown whether this volume is recoverable, and Chevron’s proposed initial coring would be designed to evaluate this resource.

Dawsonite is a dihydroxy sodium aluminum carbonate and a potential source of alumina. It has been estimated that about 60 million tons per square mile occur in the area of the proposed lease tract. Dawsonite is thoroughly disseminated in the oil shale and can only be recovered once the oil shale has been retorted. Once retorted, the dawsonite can be leached from the shale using simple hot-water leaching techniques. This process has not been evaluated using in-situ retorting, and it is unknown whether this resource could be economically recoverable.

Chevron's proposed initial coring and research program would help determine the presence, concentration, and recoverability of this resource.

### **Environmental Consequences of the Proposed Action**

Isolation of the formations, if properly done, would prevent the migration of gas, water, and oil between zones. There would be potential for the destruction of other mineral resources if it were determined that the extraction of nahcolite and dawsonite was not economically feasible.

The leasing of the RD&D parcel would preclude oil and gas exploration and recovery on the proposed 160-acre lease tract for the duration of the proposed lease term. Directional drilling to recover the natural gas resources beneath the tract would be required to prevent interference with the RD&D development. The heating of the subsurface geology could have an impact on the distance within which a gas well could be drilled in proximity to the Proposed Action. Early research activities would determine the extent to which other mineral resources exist and the potential for recovery.

The effects of in-situ heat integration and the possibility of ground heave and/or subsidence are not fully understood. Although fracturing within the production zone would be extensive, no volume of rock would be removed from the process interval. Chevron does not anticipate significant heave or subsidence as a result of the fracturing, heating, or production processes because the subsurface test area would be small (1-5 acres), and the formation is over 750 feet below the surface. Additionally, the pore spaces containing liquids (water, oil, gas, etc.) within the oil shale are very tiny and are not supporting the rock structure. The induced fractures would also be limited in both the horizontal and vertical dimensions and there would be unfractured areas interspersed with the fractured areas which would serve as support columns within the production zone. Therefore the possibility of subsidence is remote. However some ground movement would be expected during the fracturing/rubblization phases of the proposed project and would be monitored by a comprehensive network of tiltmeters, each capable of measuring movement of less than 1/1000<sup>th</sup> of an inch.

There are no known geological hazards in the vicinity of the proposed lease parcel that would have any impact on the Proposed Action, and the RD&D project is not expected to create any geologic hazards.

### **Subalternative - Proposed Action with Mitigation**

The BLM would require Chevron to make every effort to coordinate construction and operation activities with natural gas well and pipeline operators near the site and along access roads, and to work to develop mutually-agreeable methods for resource recovery. Chevron would also contact the lease holder of federal oil and gas lease COC-013197 and inform them of their proposed activities.

### **Environmental Consequences of the Subalternative**

The alternative mitigation would not eliminate all direct impacts on the mineral resources within the proposed lease parcel, but would facilitate the resolution of localized conflicts over recoverable mineral resources.

### **Environmental Consequences of the No Action Alternative**

Under the No Action Alternative, oil shale resources which would have been extracted under the Proposed Action would remain undeveloped. Site-specific knowledge of the oil shale resources, and information regarding the feasibility of the proposed technology, would not be obtained at this time. If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **HYDROLOGY AND WATER RIGHTS**

### **Affected Environment**

The proposed project area is located on the divide between Hunter Creek and Dry Gulch in the White River Basin which is a sub-basin to the Colorado River Basin. Hunter Creek is an intermittent stream and is tributary to Piceance Creek. Dry Gulch is an ephemeral stream that is tributary to Black Sulfur Creek which is a perennial tributary to Piceance Creek. Piceance Creek is tributary to the White River which is tributary to the Green River and ultimately flows into the Colorado River.

The average precipitation in the area is approximately 13 to 17 inches per year with the majority being in the form of winter snowfall and spring thundershowers. An estimated 98 percent of snowmelt and precipitation is lost to evapotranspiration. The remaining water runs off rapidly and replenishes stream flow and/or infiltrates downward into the upper aquifer system, through the confining layers, and into the lower aquifer system. Discharge from the bedrock aquifer systems recharges alluvial valley fill, springs, and streams (Taylor 1987). Approximately 80 percent of annual stream flows in Piceance Creek originates as discharge from alluvial and bedrock aquifers (Tobin 1987). Recharge to Hunter Creek and Dry Gulch is seasonal in nature occurring mostly from snow melt and precipitation events.

Several small erosional drainages, or gullies, bisect the proposed 160-acre lease tract and serve to collect and convey winter and storm runoff waters from the area. Near the northeast corner of the proposed lease tract, a stock watering reservoir has been constructed to impound these surface runoff waters for the use of livestock. These drainages are ephemeral and do not provide a constant supply of water, but rather a consistent volume from individual precipitation events to allow for a useable stock water supply. Below this impoundment, the drainage is again, ephemeral with no documented use of any flows below the stock reservoir.

There are no recorded water rights within the proposed 160-acre lease tract. ExxonMobil has the water rights to the Hunter Creek Wells located approximately 1.5 miles to the northeast of the site.

The proposed project area is located within the Piceance Creek structural basin where groundwater occurs in both bedrock and alluvial aquifers beneath the basin. Unconsolidated alluvial aquifers are the most productive aquifers in the Piceance Basin and are formed primarily

along stream courses. The most important bedrock aquifers are known as the upper and lower Piceance Basin aquifer systems. These consolidated rock aquifers are lower Tertiary Eocene in age and occur within and above the large oil shale reserves.

The upper aquifer system is characterized as semi-confined due to the discontinuous nature of the sandstones. The Uinta formation is saturated below the stream levels. The underlying Parachute Creek Member has the greatest effect on the local hydrology. Hydraulic conductivity is highly variable due to the variation in lithology and local fracturing (Robson and Saulnier, 1980). Reported transmissivities in the upper aquifer range from 8 to 1,000 feet<sup>2</sup>/day (Czyzewski, 2000), but generally are in the range of 610 to 770 feet<sup>2</sup>/day (Topper et al, 2003).

The Mahogany Zone is characterized by low hydraulic conductivity, and acts as a confining unit except where cut by fractures that allow vertical flow between the two aquifers (Czyzewski, 2000). Natural fractures in the Mahogany zone permit water to move between aquifers in some areas within the region, but it is generally characterized as having very low permeability. Fractures and dissolution conductivity are generally lacking in the areas of rich kerogen deposits within the Piceance Basin. The vertical conductivity has been estimated to be as large as 0.37 feet/day.

Groundwater is recharged from snowmelt on high ground from which it travels down through the upper aquifer system (A groove) to the Mahogany Zone. The lower aquifer system (B groove and below) is most likely recharged from infiltration on the upturned margins of the basin where the lower members outcrop, and from vertical fracture conductivity in these same areas. The upland recharge zone and lack of vertical fracturing within the rich Mahogany Zone may account for a slightly higher hydraulic pressure in the lower B groove aquifer system. The groundwater then moves laterally and/or upward discharging from both the upper and lower aquifer systems into springs and streams. The minerals nahcolite (NaHCO<sub>3</sub>), dawsonite (NaAl(OH)<sub>2</sub>CO<sub>3</sub>), and halite (NaCl) are present in the groundwater, and the circulation of the groundwater with these minerals in solution has caused enlargement of the natural fractures and a diminished water quality (Taylor, 1987).

Comprehensive aquifer maps do not exist for the Piceance Basin, but water quality is generally considered to be relatively poor owing to the nahcolite (sodium bicarbonate) deposits and salt beds within the basin. Only very shallow waters such as those from the surficial Green River Formation or within the unconfined valley aquifer system of Piceance Creek are used for drinking water. In general, the potable water wells in the Piceance Basin extend no further than 300 feet in depth according to well records maintained by the CDWR. At least two wells in the Piceance Basin are approximately 1,000 feet in depth, but these are used for stock watering.

Primary hydrogeologic units within the Piceance Basin are listed in **Table 18** below.

**Table 18: Summary of Hydrogeologic Units**

Hydrogeologic Unit	Thickness (ft)	Approx Avg Depth (ft)	Conductivity (ft/day)	Yield (gpm)	Transmissivity (ft <sup>2</sup> /day)
Upper Piceance Basin aquifer	0 – 1,400	700	<0.2 to >1.6	1 to 900	610 to 770
Lower Piceance Basin aquifer	0 – 1,870	2,800	<0.1 to >1.2	1 to 1,000	260 to 380

<b>Mesaverde aquifer</b>	Averages 3,000	7,700	NL	NL	NL
Abbreviations: ft – feet, approx – approximate, avg – average, gpm – gallons per minute, and NL – not listed.					

Table information from Topper et al. (2003).

There is significant lack of information on the lower water bearing units of the Green River Formation, and subsurface movement of ground water resources within the oil shale producing formation is not well known at the proposed test site. The only practical methodology for securing additional data is through additional water well drilling and aquifer testing.

Refer to the Water Quality, Surface and Ground section for a discussion on water quality in the proposed project area.

### **Environmental Consequences of the Proposed Action**

The Proposed Action would not impact water rights within the 160-acre lease tract. Chevron's proposed process could alter groundwater and surface water flows if induced fracture networks were to change the natural interactions between aquifer systems. Chevron would assess the area for the presence of natural fractures prior to initiating any subsurface activities. The hydraulic conductivity of the Green River Formation in general is very low, and natural fractures do allow for migration of water to the extent that these fractures are interconnected and can commute water. The proposed in-situ recovery process would target the kerogen-rich impermeable zones that lie between the aquifer systems, and the fractured area created within this zone would be horizontally and vertically limited and would not be in communication with the aquifers. Therefore, the process would not be part of the pre-existing water mixing pattern. Chevron's proposed technology is expected to maintain the structural integrity and confining properties of the Mahogany zone using controlled horizontal fracture networks to prevent communication between aquifers. The process would involve careful determination of the vertical and horizontal fractures developed during the rubblization process. Chevron would continually monitor the confinement of the process to the targeted oil shale zone, and site-specific restoration methods would be devised as an integral part of the research plan. Evaluation, mapping, and testing of the geology, the formation characteristics, and local and regional fracturing and jointing patterns would be required to establish a better understanding of the existing vertical and horizontal communication within the section.

Contamination of groundwater resulting from the in-situ retorting process has been documented by the EPA, and with no known exceptions, has occurred in all in-situ fossil fuel recovery operations to date. In-situ fossil fuel recovery wells are used to facilitate the recovery of hydrocarbon resources through the conversion of the kerogen to a gas or a liquid form. This process involves the injection of materials into the formation to free the kerogen and allow it to flow via recovery wells to the surface. Most of the injected materials are gasses such as oxygen, carbon dioxide or air, which in previous operations, have not introduced contaminants into the subsurface. The contamination generally results from the incomplete combustion of the hydrocarbons and the resultant combustion byproducts such as phenols and benzene, which then enter the groundwater by means of direct contact or migration through fractures, away from the reaction zone. The primary cause of the incomplete combustion is due to the small scale of the previous testing and the inability to achieve sufficient high temperatures which would be expected in a full scale type operation (EPA, 1999). Following in-situ oil extraction, spent shale

in the retort zone would be expected to contain various potential contaminants, including soluble salts, trace metals, and residual organics. Methods for reducing the contaminant mass, decreasing the solubilization rate of the contaminants, and/or reducing the rate of water movement through the spent shale zone would be investigated, and employed to mitigate any adverse impacts to groundwater quality in accordance with the required State groundwater quality standard needed to achieve site closure (5 CCR 1002-41, The Basic Standards for Groundwater, Section 41.5(C)(6)).

While the USGS groundwater atlas indicates that the general groundwater flow for the basin is to the north-northeast, groundwater migration off-site is not expected. The proposed project site is located along the west axis of the Hunter Creek Syncline which could limit groundwater migration off-site and possibly result in groundwater migrating toward the site. The migration of groundwater off-site would be further reduced by the tendency for the flow to be preferential toward the rubblized zone. Any newly created void space resulting from the rubblization of the formation and the removal of the kerogen would result in a groundwater depression zone and the migration of water toward the proposed test area.

The size and impact of the impressed groundwater depression would depend on the extent of the horizontal fracturing network developed. While the movement of groundwater toward the site has the potential to make maintaining a de-watered zone for in-situ retorting more difficult, it would be beneficial for controlling and reducing the potential migration of contaminants off-site.

The proposed process would also involve higher pressures in the retort zone and could result in an exclusion of lower pressure groundwater from the zone. In the event that groundwater from the upper or lower aquifer systems were to come into contact with production processes within the target zone, Chevron would facilitate alternative containment measures, such as drawdown pumping or perimeter grouting, to isolate the groundwater from potential contamination. The information gathered from core samples, well logs, and aquifer testing would be used to develop the most effective procedures and technologies to isolate the proposed pilot test site from the groundwater in order to prevent contamination. The information would also be used to select and operate a remediation technology in the event that contaminants were to come in contact with the groundwater.

Shallow aquifers would be protected from hydrofracturing and production of shale oil by the installation and cementing of surface and intermediate casing. The objective of surface and intermediate casing is specifically to isolate shallow aquifers. Any groundwater produced from the Mahogany Zone would be re-injected downgradient or trucked off site and properly disposed of to prevent adverse impacts to surface and groundwater.

Groundwater-monitoring wells would be located within and around the proposed test areas to determine baseline conditions and to monitor the groundwater during the drilling and operational phases of the proposed project. Chevron would implement additional groundwater containment measures, with BLM approval, if core samples and/or fracture monitoring indicate that further

containment would be necessary to protect groundwater resources. The construction of groundwater-monitoring wells, process wells and process monitoring equipment holes would be conducted such that no vertical migration of groundwater or process fluids or gas would occur. All wells would be properly abandoned upon termination of the RD&D lease agreement.

### **Subalternative - Proposed Action with Mitigation**

In addition to the comprehensive water quality and geophysical monitoring provided for in the Proposed Action, the BLM would require alternative mitigation measures to ensure that water quality and hydrogeologic characteristics are not compromised: Chevron would:

- Submit design, monitoring, and response plans for groundwater, surface water, and stormwater retention to the AO for approval prior to implementing the Proposed Action.
- Provide the BLM with all water resource monitoring data on a quarterly basis for review and analysis. The BLM would use this data to monitor potential salinity increases resulting from the Proposed Action, and implement mitigation measures as necessary.
- Characterize, and dispose of, any groundwater produced from the Mahogany zone in accordance with BLM approved regulations and guidelines.

### **Environmental Consequences of the Subalternative**

The monitoring data provided to the BLM under this action would provide critical information on the potential impacts to water quality and to the hydrogeologic connectivity within the area. This information would be used in conjunction with an adaptive response plan to ensure that any changes to the local hydrology and water quality were identified early so that potential effects could be localized and contained within the immediate process area.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **NOISE**

### **Affected Environment**

County Road 69 is the primary source of man-made noise within the proposed project area. Traffic up and down the road to oil and gas facilities to the south of the Proposed Action produces varying degrees of noise throughout the day, with very little noise during the night. There are no residences within the proposed project area. Those people subject to noise generated in the project area are, for the most part, employees of the oil and gas companies that operate in the area. Ranchers, seasonal hunters, and other recreationists are also subject to noise generated along this road.

## **Environmental Consequences of the Proposed Action**

The noise generated by the Proposed Action would fluctuate with the alternate construction and operation phases of the project. The construction, well drilling, and fracturing phases would generate noise for two to four months or longer depending on the success of initial operations. The active retorting phases of the proposed project would generate less noise, but that noise would occur 24 hours a day over the life of the project. The noise generating equipment for this process would be diesel and gas generators.

The Colorado Oil and Gas Conservation Commission (COGCC) has established a noise limit of 55 decibels (dBA) as the limit for oil and gas facilities in residential, agricultural, and rural areas. (This can be compared to average highway noise of 60 dBA at 100 feet.) The 55 dBA limit would be reached at 1500 feet from a facility construction site and at 800 feet from an operating drill rig (USDI BLM, 2004). Local wind velocity and terrain effects could cause that distance to vary at different times.

It is anticipated that the Proposed Action would be classified as a light industrial facility in a remote location, where there is no reasonably proximate occupied structure or designated outside activity area. The light industrial standard may be applicable. The day time noise levels permitted under this standard is 70 dBA, and night time limits are reduced to 65 dBA. However, Rio Blanco County has a noise level standard of 65 dBA that would apply to daytime noise levels.

Noise generating equipment would have the latest sound suppression devices (quiet design mufflers or equivalent) installed to ensure a minimum amount of noise emanating from the proposed site. Noise limits set forth in COGCC rule 802 for Noise Abatement applicable to the project's zoning and land use designation would apply to all facilities and equipment.

## **Subalternative - Proposed Action with Mitigation**

In order to minimize potential impacts from noise and ensure the site attains COGCC standards consistent with Colorado law, the BLM would require the following alternative mitigation measures:

- Installation and maintenance of sound suppression devices on the applicable equipment and facility machinery.
- Housing, or covering, of noise producing sources with the appropriate insulated facilities.

## **Environmental Consequences of the Subalternative**

Noise impacts related to construction and operation of the proposed RD&D facilities would be minimized by implementing measures to reduce noise levels to those at, or below, the COGCC allowable noise level conditions.

## **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **PALEONTOLOGY**

### **Affected Environment**

The proposed RD&D project is located in an area mapped as the Uinta Formation (Tweto 1979). The BLM has classified the Uinta as a Category I formation, meaning that it is a known producer of scientifically significant fossils.

The proposed RD&D tract has no outcroppings from which to gather information as to the existence and/or abundance of scientifically significant fossils that may be present in the formation at that location.

### **Environmental Consequences of the Proposed Action**

Since the action proposed in the project area would occur within the Uinta formation, there is potential for impacting fossil resources if it becomes necessary to excavate into the underlying bedrock formation to construct the research facilities, including reserve pits, access road, and combined power, communications, and natural gas pipeline ROW.

### **Subalternative - Proposed Action with Mitigation**

In order to mitigate any potential impacts to Class I geologic formations and associated paleontological resources, the BLM would require that a monitor be present at any time that it may become necessary to excavate into the underlying rock formation in order to bury pipelines, level well pads, excavate reserve pits, or to construct any project features.

The operator would be responsible for informing all persons who are associated with the project that they would be subject to prosecution for knowingly disturbing paleontological sites or for collecting fossils. If fossil materials are uncovered during any project or construction activities, the operator would immediately stop activities in the area of the find that might further disturb such materials and immediately contact the BLM Authorized Officer (AO). Within five working days the AO would inform the operator as to:

- Whether the materials appear to be of noteworthy scientific interest.
- The mitigation measures the operator would likely have to undertake before the site can be used (assuming in-situ preservation is not feasible).

If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with this process, the AO would assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator would be responsible for mitigation cost. The AO would provide technical and procedural

guidelines for the conduct of mitigation. Upon verification from the AO that the required mitigation has been completed, the operator would then be allowed to resume activities.

**Environmental Consequences of the Subalternative**

Requiring the presence of a paleontologist to monitor all excavation activities would allow for the identification of scientifically significant fossils and paleontological resources, and would consequently minimize the potential for damage and/or irretrievable losses of these resources. Informing employees and contractors of the penalties associated with disturbing paleontological sites and collecting fossils would deter these types of actions. Some permanent loss of paleontological resources may inadvertently occur during ground-disturbing activities, but the protective measures implemented by this alternative would limit the potential for harm.

**Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

**RANGELAND MANAGEMENT**

**Affected Environment**

The proposed lease tract and associated ROW occurs on two contiguous fenced grazing allotments. Of these, 126 acres lie within the Piceance Mountain grazing allotment (#06023), and 50 acres lie within the Fawn Creek allotment (#06024). Permitted grazing use for the allotments are as follows:

**Table 19: Permitted Grazing Allotments Occurring within the Proposed Action**

Allotment Number	Allotment Name	Permit Number	Livestock #	Livestock Kind	Period of Use	%FR	Authorized AUMs
06023	Piceance Mountain Pat Johnson	051408	1026	C	05/15-11/15	61	3807
06024	Fawn Creek Bill Brennan	051422	906	C	05/01-06/15	70	959
			906	C	06/16-10/09	5	173
			15	H	05/01-10/31	70	64
			650	C	10/10-11/15	70	553

The proposed lease tract area is used primarily in the spring by both livestock operations.

That part of the tract on the Piceance Mountain Allotment is rolling loam, mid-seral ecological site, with a carrying capacity of 7acres/Animal Unit Month (AUM). That part of the tract on the Fawn Creek Allotment consists of 40 acres of rolling loam, mid-seral ecological site with a

carrying capacity of 7 acres/AUM, and 10 acres of pinyon-juniper woodland with a carrying capacity of 15 acres/AUM (0 AUMs).

### **Environmental Consequences of the Proposed Action**

The actions proposed could result in a forage loss to livestock of about 24 AUMs. An AUM equates to the forage needs of a mature cow with calf for one month. Most of the loss of AUMs would occur on the Piceance Mountain allotment (18 AUMs) with a total loss of 6 AUMs occurring on the Fawn Creek Allotment.

The loss of AUMs along the proposed power, communications, and pipeline ROW would be short-term until successful reclamation of disturbed areas was achieved. Reclamation of the ROW would restore 2 to 3 AUMs of available forage within 3 to 5 years. Long-term loss of forage to livestock of about 21 AUMs could occur over the life of the project.

The expected forage losses would have a negative impact on the livestock operation affected. The forage loss of 24 AUMs on the Piceance Mountain and Fawn Creek allotments would likely require the permittees to reduce the number of cattle grazed in the area or to find replacement forage over the long term.

The Proposed Action could interfere with the proper functioning of the range improvements near the proposal. The existing fences and watering facilities are necessary for control of cattle to achieve grazing objectives on the allotment. Changes made to fences and/or watering facilities could interfere with the control of cattle, and ultimately the proper utilization of the rangeland resource. The range fence located on the proposed 160-acre lease site would likely be removed and/or relocated or modified and would thus have potential to alter the effectiveness for cattle control. This fence would be relocated outside the proposed project area to a position that provides cattle access to the watering facility on the north boundary of the site. All fence work would be done to BLM specifications. The integrity of the allotment boundary fence between allotments would be maintained at all times.

The stock watering reservoir on the north boundary of the proposed lease site would not be removed, but may be modified for use in Stormwater Management. The stock watering reservoir could be modified for use as a retention basin for the management of stormwater on the proposed lease parcel. Stormwater diversion ditches around the proposed RD&D facilities would direct stormwater toward the stock reservoir. Either hay bale or rock check dams would be placed in areas of concentrated flow to collect sediment before it enters the reservoir to protect this water from contamination. If the proposed development were to include the existing stock reservoir, the loss of this water source would be mitigated by constructing a reservoir of comparable size on both the Piceance Mountain and Fawn Creek allotments in the same general vicinity.

### **Subalternative - Proposed Action with Mitigation**

In order to minimize potential indirect impacts on rangelands, the BLM would require alternative mitigation measures:

- Consider limiting any fencing of the RD&D facility to only those areas necessary to protect workers, animals, and to provide site security.

- Re-seed disturbed areas as soon as possible as discussed in the Vegetation section to restore grazing habitat.
- Control noxious weeds as discussed in the Invasive, Non-Native Species section.

### **Environmental Consequences of the Subalternative**

Implementing alternative mitigation measures under this action would reduce the potential impacts to vegetation by providing guidelines for proper re-seeding and control of invasive and noxious weeds in order to maintain the health of the rangeland resources in the area of the Proposed Action. Re-vegetation efforts would also restore a portion of the lost AUMs to the affected allotments. Providing provisions for replacement of those rangeland management facilities that might be impacted and/or removed from the proposed site would ensure that the affected allotments were appropriately compensated for changes to cattle control devices.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **REALTY AUTHORIZATIONS**

### **Affected Environment**

The main access route for activities within the proposed 160-acre lease parcel is County Road 69, which runs through the west side of the site. The access from County Road 69 into the proposed project site would require a 25-foot wide by 500-foot long roadway. A 7.2Kv power line owned by White River Electric Association and an 8-inch natural gas pipeline granted to Rocky Mountain Natural Gas are located to the west of the proposed Chevron tract in T.2S. R.97W. section 33.

A pedestrian survey of the area surrounding the proposed 160-acre lease parcel has located an ExxonMobil remote automated weather station located north of the proposed RD&D project site in the SE 1/4 of section 32 T2S R97W. The location of this station would not be impacted by the Proposed Action. This is a temporary site used to gather data for ExxonMobil's proposed plant and pond site. It is permitted as Temporary Use Permit COC68967 until December 31, 2007.

A land and mineral title search of the area surrounding the Proposed Action indicates that a natural gas pipeline owned and operated by Riata Energy, Inc. runs through sections 7 and 8 T3S, R97W and turns north into section 5 and services Riata's producing gas well 397-5-1 located in the SENW of section 5. This is the only well located in section 5.

There are several pending and approved titles in the general area of the Proposed Action:

- White River Electric Association has a pending 138Kv powerline to supply the proposed ExxonMobil Central Treatment Plant that will be located north of the 160-acre lease site.

This powerline ROW will use the unsurfaced two-track road just north of the proposed project site boundary in T2S R97W Section 33 for construction access and for necessary maintenance in the future.

- EnCana Oil & Gas (USA), Inc. has been approved for a water line that will begin in T2S R97W Section 8 and head south.
- Riata Energy, Inc. has a pending APD for a well 397-8-12 that has been located in the SWNW of section 8.

### **Environmental Consequences of the Proposed Action**

Since the main access road is a county road, no right-of-way would be required. The entrance to the facility from Rio Blanco County Road 69 would involve consultation with the Rio Blanco County Road and Bridge Department, and would require a Rio Blanco County Special Use License. Application for a right-of-way grant would be required for the combined powerline, natural gas pipeline, and telephone and data communications access. This right-of-way would be 65-feet wide by approximately 5280-foot long (7.88 acres). The right-of-way required for the proposed project would have a 10-year term ending at the expiration and/or abandonment of the lease agreement, with a right to request an extension/renewal if development continues. The lease holder or service providers would apply for these authorizations. Roads and utility lines located within the lease boundaries would be authorized under the Plan of Operations and would not require separate rights-of-way.

ExxonMobil's remote automated weather station is located outside the proposed 160-acre lease parcel and would not be impacted by the construction, maintenance, and operations of the RD&D project or related ROW.

Riata Energy, Inc. has discussed replacing the small natural gas line along County Road 69 at some time in the near future, but there would be minimal and manageable cross-impact with Chevron's proposed RD&D operation. No impact to well 397-5-1 is anticipated.

Chevron's proposed combined ROW for power, natural gas, and communications would utilize the same two-track road on the north boundary of the proposed lease area for access as the White River Electric powerline. Cross-impact from the pending powerline should be minimal depending on the timing of construction.

There would be minimal cross-impact with EnCana's approved water line ROW as it would pass outside the proposed RD&D location. Any disruption in traffic flow that may result from the water line construction would be short-term and manageable.

The Proposed Action would not affect Riata's pending APD for well 397-8-12.

### **Subalternative - Proposed Action with Mitigation**

Damage to existing utilities will be minimized under this action by implementing the following measures:

- Using the “One-Call” system to locate and stake the centerline and limits of all underground facilities in the area of the proposed excavation.
- Providing 48-hour notification to the owner/operator of any foreign pipeline prior to performing any work within 10 feet of buried or aboveground-pressurized gas piping.
- Prohibiting machine excavation within 5 feet from any existing pipeline encountered in the ROW unless authorized by the pipeline owner/operator.

The Conditions of Approval for the proposed RD&D site would be made a part of any ROW grant stipulations, along with compliance with all applicable regulations contained in Title 43 Code of Federal Regulations part 2800.

The lease holder or service providers would apply for off-lease utility rights-of-way at an appropriate interval before needed to allow sufficient time for site-specific analysis.

### **Environmental Consequences of the Subalternative**

Potential conflicts with existing pipelines, proposed pipelines, and rights-of-way would be minimized by implementing the proposed alternative mitigation measures, and would ensure that commitments from the applicant to resolve potential conflicts were established prior to construction. Damage to existing realty authorizations would be minimized or avoided entirely by locating and identifying utilities and flowlines prior to construction activities.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, potential realty conflicts would not occur, and no new right-of-way would be granted. No impacts associated with the Proposed Action would occur.

## **RECREATION**

### **Affected Environment**

The proposed project area is located within the White River Extensive Recreation Management Area (ERMA) on BLM lands administered by the WRFO. The WRFO manages the ERMA to provide for unstructured recreation activities, and a diversity of outdoor recreation opportunities, including hunting, dispersed camping, hiking, horseback riding, wildlife viewing, and off-highway vehicle (OHV) use. There are no Special Recreation Management Areas identified within lands administered by the WRFO.

On BLM-administered lands, the Recreation Opportunity Spectrum (ROS) is a classification system and a prescriptive tool for recreation planning and management. ROS classes include Primitive (P), Semi-Primitive Non-Motorized (SPNM), semi-primitive motorized (SPM), Roaded Natural (RN), Rural (R), and Modified Urban (MU). ROS classes within the WRFO ERMA are not specified within the proposed project area. However, the proposed project area most closely resembles a ROS class of SPM.

The SPM physical and social recreation setting is typically characterized by a natural appearing environment with few administrative controls and low interaction between users (but evidence of other users may be present). SPM recreational experience is characterized by a high probability of isolation from the sights and sounds of humans within a setting that offers challenge and risk. The proposed project area would not be located within or near any developed recreation areas.

### **Environmental Consequences of the Proposed Action**

The public would lose up to 160 acres of dispersed recreation potential during the life of the proposed project. The public would be less likely to recreate in the vicinity of the proposed RD&D facilities and would be dispersed elsewhere. Because of the public access provided by County Road 69, the Hunter Ridge area is the site of more intensive hunting activity than other areas nearby where public access is limited. There are a number of hunting camps located along the county road and just east of the proposed project boundary along Hunter Creek. Deer and Elk hunting activities are most likely highest in the later seasons.

At times when construction and operation of the proposed project coincided with hunting seasons (September through November), it may divert big game animals from the area and would likely disrupt the experience sought by these recreationists.

Traffic along County Road 69 is increasing as development activities in the oil and gas Units to the south of the Proposed Action increases. Development of the proposed RD&D facilities would add to the traffic level. The relatively high levels of traffic increase the likelihood of human interactions and encountering the sights and sounds associated with the human environment. Eventually, the increased oil and gas activity together with the greater volume of traffic on the county road would diminish the sense of isolation and change the nature of the recreation experience.

### **Subalternative - Proposed Action with Mitigation**

No mitigation measures are proposed, or necessary, to reduce impacts to recreation.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **SOCIO-ECONOMICS**

### **Affected Environment**

The assessment area for the potential effects of oil shale research and development on social and economic conditions is Rio Blanco County, including the towns of Meeker and Rangely, as well as the City of Rifle, located in Garfield County. Based on the standard elements of socio-economic assessment, conditions inventoried in this section include the following:

- Local Economy
  - Employment
  - Income and earnings
  - Oil and gas activity
  - Other important economic activities near the proposed project area (e.g., grazing, hunting and possible oil shale development)
- Population
- Housing, including temporary and long-term housing resources
- Community facilities and services
- Environmental justice

Socio-economic statistics are often subject to reporting delays of a year or two after the fact. Consequently, socio-economic effects of the recent increase in energy development that has occurred in Rio Blanco County and northwestern Colorado are not yet fully reflected in most published statistics. To augment the published data, this section includes information about recent socio-economic conditions obtained from interviews with local officials and service administrators.

*(Unless referenced otherwise, statistical information contained within this section has been derived, in part or in whole, from the ExxonMobil Piceance Development Project Socioeconomic Technical Report and all references therein. The complete report is on file with the White River Field Office BLM.)*

**Local Economic Conditions:** Employment, earnings, and income are common indicators of economic conditions. Employment data reported by the Colorado Department of Labor and Employment (CDLE) indicate a dramatic increase in employment associated with oil and gas exploration and development activity in the region. More than 500 energy production jobs were added between 2003 and 2004, with more than 1,500 added between 2004 and the third quarter of 2005 (see **Table 20** below). Gains have been registered across the region, with the largest occurring in Garfield and Mesa counties; the latter reflecting a sharp increase in oil and gas field services.

**Table 20: County Employment Data for the years listed**

County	2000	2001	2002	2003	2004	2005 (Est.) **	Pct. Change
Garfield	224	301	364	402	432	1,498	569%
Mesa	345	364	389	453	809	1,152	234%
Moffat	521	509	543	518	499	546	5%
Rio Blanco	454	504	525	504	608	724	59%
Routt	478	504	520	538	573	575	20%
Totals	2,022	2,182	2,341	2,415	2,921	4,494	122%

Source: CDLE, 2006

\*\* Annual averages for 2005 are not yet available. The estimated employment is the average of the first three quarters.

***Unemployment and Labor Force:*** Rio Blanco County's annual unemployment rate from 2000 through September 2005 indicates that recent local unemployment rates tend to parallel statewide unemployment rates, but with Rio Blanco County unemployment generally one to two percent lower than the State of Colorado as a whole.

Labor market information is compiled and reported by the Colorado Department of Labor and Employment. These data are collected and reported monthly on a place of residence basis. An area's labor force is the number of individuals living in a county who are currently employed or unemployed but actively seeking work. Of an average 2004 Rio Blanco County resident labor force of 3,770, a total of 3,611 persons were employed and an average of only 159 persons (4.2 percent) who were unemployed and actively looking for work.

***Labor Earnings and Personal Income:*** Between 2000 and 2002 total and energy industry wages increased from \$70 million to \$84 million; a 20 percent increase. Modest gains in total earnings were registered in 2003, with substantial growth in 2004 and 2005. Total estimated wages of \$109 million paid in 2005 reflects a gain of \$24 million or 28 percent over the 2003 total. After discounting the growth for the effects of inflation (13.4 percent), the net change from 2000 to 2005, represents a 38 percent gain in real wages paid in the Rio Blanco County.

Growth in wages paid in the oil and gas industry has accounted for much of the change. Mining (including oil and gas) sector wages increased between 2000 and 2002, from about \$21 million to \$30 million; an increase of 43 percent. Subsequent increases through 2005 (est.) raised the total mining sector earnings to \$48 million in 2005. Inflation adjusted mining sector earnings rose by 99 percent between 2000 and 2005. As a result of the strong expansion in wages paid in the mining industry, its share of total countywide wages increased from 30 percent in 2000 to 44 percent in 2005.

Per capita personal income in Rio Blanco County increased from \$26,605 in 2000 to \$27,048 in 2003, about 2 percent over the four year period. However, when adjusted for inflation, Rio Blanco County real per capita personal income fell by about 5 percent during this period. Per capita personal income trends in the county generally parallel those of the state as a whole, with Rio Blanco County per capita personal income trailing the statewide averages by 20 to 26 percent.

***Other Economic Activities near the Proposed Project Area:*** Other economic activities occurring within the areas adjacent to the Proposed Action include ranching, grazing, dispersed tourism and recreation (primarily big-game hunting) nahcolite mining, and potential oil shale research and development.

Other than natural gas exploration and production, cattle grazing is the predominant year-round land use in the vicinity of the proposed 160-acre lease site, which contains portions of two BLM grazing allotments. The current permitted AUMs for the two combined allotments allow for a stocking ratio of about 7 acres per AUM.

As discussed in the Recreation section, hunting is traditional for many local residents and tourist alike. The hunting and fishing industry is also a vital part of the economy in northwestern Colorado. According to a recent study prepared by the CDOW, direct sales in Rio Blanco

County associated with wildlife-related recreation activities was approximately \$16.3 million in 2002. Total economic impact to Rio Blanco County, including secondary spending by people who own or work for businesses related to fish and wildlife activities, was about \$28.4 million. Fish and wildlife-related activities were responsible for 360 jobs, mostly in retail trade and services, in Rio Blanco County. Direct sales associated with wildlife-related activities in Garfield County were \$30 million in 2002. Secondary spending was estimated near \$53.1 million and employment related to wildlife activities was 690 jobs. (BBC Research and Consulting, 2004).

The Colorado Department of Wildlife (CDOW) collects hunting statistics for the Game Management Units that include the Proposed Action, but there are no estimates of hunting or other recreation use for the 160-acre site specifically. No licensed hunting and outfitting services are provided in the project area.

There are also extensive deposits of nahcolite and oil shale in the area of the proposed project site. Nahcolite has recently been mined commercially, and the BLM recently approved five applications for oil shale research, development and demonstration leases for further consideration.

**Population:** Like much of northwestern Colorado, Rio Blanco County experienced rapid population growth during the 1970s. The county grew from 4,842 in 1970 to 6,255 in 1980, or thirty percent during the decade. By 1990 total county population had fallen to 6,051 and has remained around 6,000 through 2004.

Population conditions in Rio Blanco County's two population centers, the towns of Meeker and Rangely, have roughly paralleled that of the county. Meeker population grew from 1,597 in 1970 to 2,396 in 1980, a 50 percent increase, then decreased to 2,098 in 1990 and remained between 2,100 and 2,300 through 2004. Rangely population grew from 1,591 in 1970 to 2,278 in 1990, an increase of 41 percent, then peaked in 1996 at 2,361 and has since declined to 2,099 in 2004. In contrast population for the State of Colorado grew by 110 percent between 1970 and 2004. In 2004, 37.5 percent of total Rio Blanco County population was within the Town of Meeker and 34 percent was within the Town of Rangely; about 28.5 percent lived in unincorporated areas of the county.

Unlike communities in Rio Blanco County, population for the City of Rifle in Garfield County has generally continued to trend upward since 1970, rising from 2,150 in 1970 to 6,784 in 2000, a 216 percent increase over the three decades. By 2004, Rifle's population had increased by an additional estimated 976 persons to 7,760, a 14 percent increase in four years.

The Colorado State Demography Office prepares population projections for counties within the state. Rio Blanco County population is projected to grow from 6,048 in 2005 to 8,384 in 2030, about 39 percent during the 25 year period. For the same period, the State of Colorado is projected to grow by 55 percent. These projections do not fully reflect the short-term influences that the county is currently experiencing from energy development. Although the State

Demography Office does not publish population estimates for municipalities, Rifle city officials anticipate average population growth of four percent over the next 20 years (Blankenship, 2006).

**Housing:** The Colorado State Demography Office estimates that 20 percent of total Rio Blanco housing units were vacant during 2004, with 13 and 17 percent vacant in Meeker and Rangely respectively. Vacancy rates in Rifle were reported at 3.87 percent in 2004. A portion of the vacant units were second and seasonally occupied homes and the largest number of second homes in Rio Blanco County were located within the unincorporated portions of the county, which is consistent with many vacancies being attributable to second homes. In contrast to the 2004 State statistics, local officials reported almost no vacancies in rental housing during the fall of 2005.

Rental housing in and around Meeker and the 81 pads in the town's 5 mobile home parks were completely occupied during the fall of 2005. Many mobile home spaces were occupied by construction crews, drilling crews, and the long-established seasonal demand from hunters. Two temporary RV parks have been developed near Meeker to house pipeline workers, one with 90 RV pads and one with 25 pads. These construction worker RV park facilities are operating under county temporary use permits and not intended for long-term use.

The Town of Meeker has also approved the renting of rooms in private residences, as long as the activity does not impact residential (R1) zones. There has recently been some residential subdivision activity within the town, however, few houses have recently been offered for sale in Meeker and when houses come on the market they are quickly purchased for the full asking price and sometimes more.

There were virtually no vacant rental units in Rangely during the fall of 2005 and many rental properties had waiting lists. There are 200 mobile home/RV spaces within the town and recent occupancy has averaged 30 to 40 percent. Rangely has three motels with a total of about 90 rooms. Recent motel occupancy has averaged an estimated 80 percent.

Rifle had an estimated vacancy rate of about two percent across all types of units in the fall of 2005. With the opening of two new motels in 2006, Rifle will have 6 motels with 387 rooms and 2 RV parks with 57 pads; existing motels were typically full during fall of 2005.

**Local Government Facilities and Services:** Chevron's proposed RD&D project would be located entirely within unincorporated Rio Blanco County. Although the Proposed Action would affect most county government services to some degree, those likely to be most affected would be law enforcement (Sheriff's Department), emergency management and response (fire suppression and ambulance) and county road maintenance. Some Garfield County services would also be affected, primarily law enforcement and emergency response services along US Highway 13 north from Rifle to the Rio Blanco County line. Municipal services in Meeker, Rangely and Rifle could also be affected.

Most Rio Blanco County Services are headquartered in Meeker. Some services also maintain satellite offices in Rangely.

**Law Enforcement:** The Rio Blanco County Sheriff's Office provides law enforcement services to the unincorporated portion of Rio Blanco County. Current demand for law enforcement and emergency response services in the county is high, particularly in the areas adjacent to access from Rio Blanco County Road 5. According to the 2005 Rio Blanco County Sheriff's Office

Annual Report, traffic on the 42-mile stretch of County Road 5 increased more than 1200 percent and consequently, so did calls for service. The Piceance Creek area of the County incorporates a large land mass intersected by twenty-four County Roads. The incidents and calls for services in this area has risen 220 percent since 2004 and 402 percent since 2003. Incidents in the east end of Rio Blanco County, which includes the Piceance Creek area, have gone up 59 percent, where incidents in the west end of the county only rose by about 2 percent (Woodruff, 2005).

About 68 percent of all calls in 2005 were traffic or motor vehicle related. For the period from March 1 to March 31, 2006, nearly 70 percent of all calls were related to traffic incidents (Woodruff, 2006). The Sheriff’s Office has responded to an increasing number of accidents on the highways that provide access to the Piceance Creek area. Between 2003 and 2005, accident responses increased 142 percent on CO Highway 64, and 101 percent on CO Highway 13. These figures include property damage accidents resulting from collisions with Deer and other animals. Colorado State Patrol Troopers have recently been reduced from four troopers to one in northwestern Colorado, which has placed additional demands on the Rio Blanco County Sheriff’s Office for accident response.

The patrol sergeant and deputies based in Meeker and Rangely provide law enforcement coverage to the areas adjacent RBCR 5. Response times to the Piceance Creek area can run 45 minutes to an hour or more because of the distance from these population centers. Annual mileage driven by the Rio Blanco County Sheriff’s Office in response to service calls, investigations, detentions, and administration increased by 79 percent from 2004 to 2005. This represents a significant operational cost increase over the previous year.

The Garfield County Sheriff’s Department provides law enforcement on the portion of CO highway 13 from I-70 to the Rio Blanco County line. In the past several years, energy traffic has increased dramatically on the highway, resulting in a corresponding increase in complaints and calls for service. Although the Colorado State Highway Patrol provides patrol services on the rural portion of the highway from Rifle north to the Rio Blanco County line, the Garfield County Sheriff’s Department does respond to complaints, incidents and accidents in that area. Statistical information for all incidents that occurred on the twenty-four (24) Rio Blanco County Roads within the Piceance Creek area is provided in **Table 21** below.

**Table 21: Rio Blanco County Sheriff’s Office Piceance Creek Area Statistics**

Classification	January 1 <sup>st</sup> to December 31 <sup>st</sup>			01-01 to 03-31
	2003	2004	2005	2006
Abandoned Vehicles	1	3	3	1
Accidents	4	20	31	-
Property Damage Accidents	-	-	-	10
Injury Accidents	-	-	-	2
Animal Calls	13	9	38	4
Arson	1	0	0	0
Assault	0	0	1	0
Assist All Other Agencies	17	22	41	7
Assist Meeker Ambulance	-	-	-	5
Assist State Patrol	-	-	-	11

Auto Theft	0	0	1	0
Burglaries	0	0	1	0
Citizen Assist	3	3	7	1
Civil Situations	4	8	4	3
Criminal Mischief	6	2	3	3
Disturbance - Fight	1	0	1	0
Domestic Violence	0	1	1	0
D.U.I	0	0	3	2
Fires	4	6	10	1
Fraud/Forgery	7	0	0	0
Harassment	1	4	1	0
Homicide	0	0	1	0
Juvenile Problem	0	1	2	0
Motorist Assist	0	1	12	5
Narcotics Cases	1	0	3	0
911 Hang up calls	5	13	18	9
Property (Lost/Found)	3	1	5	0
Search and Rescue	2	2	2	0
Sexual Assault	0	0	1	0
Suspicious Incident	11	8	22	3
Thefts	2	5	10	0
Traffic Arrests	0	6	9	4
Traffic Complaints	0	10	17	4
Traffic Hazards	0	2	4	4
Traffic Contacts	39	70	410	69
Trespass	3	4	7	1
Truancy	0	0	1	0
Unattended Death	0	1	0	0
VIN Inspections	6	5	7	6
Warrant Arrests	1	1	1	3
Weapons Violation	0	1	0	0
<b>Totals</b>	135	209	678	158

Source: Woodruff, 2006.

The Rio Blanco County Detention Center was constructed in 1937 and designed to hold 18 prisoners. During the year of 2005, the average daily inmate population for the year was over 18 for the first time in the Center's history. An all-time high record of 31 inmates in detention was reached during the month of July, 2005. The average daily inmate population for the month of March, 2006 was 21 (Woodruff, 2006). In the not too distant past, the jail routinely had excess capacity and the county generated revenue by hosting prisoners from other counties. Over the last several years the situation has reversed, and Rio Blanco County must now often transport inmates and pay other counties to house inmates when the jail is full, resulting in increased costs for the county.

***Emergency Management and Response:*** Emergency response agencies in Rio Blanco County face a variety of issues in providing services, including:

- the large size of the county,
- numerous backcountry roads,
- the large number of recreation visitors,
- the proliferation of energy exploration and development sites,
- extensive communications dead spots, and
- the constraints of mostly volunteer services.

Rio Blanco County does not have a dedicated hazardous materials response team and must rely on agencies in Glenwood Springs, Craig, or Grand Junction for assistance in dealing with accidents involving hazardous materials. Response times for hazardous materials incidents are typically two and one half hours.

Fire suppression services in the area of the Proposed Action are provided by the Meeker Fire and Rescue District, and it takes an hour or more to assemble volunteers, mobilize equipment and respond to emergencies and incidents in the Piceance Creek area. Responding to the Piceance Creek area with equipment and volunteers reduces coverage for Meeker and the surrounding population areas for the duration of the response. Range and wildland fire response is provided by the BLM White River Field Office in Meeker.

Ambulance services for the eastern part of the county are also provided out of Meeker, with two four-wheel drive ambulances and about 15 volunteer emergency medical technicians. Air ambulance services are also available when weather conditions allow. Patients are transported to Pioneers Medical Center in Meeker or hospitals in Rifle, Grand Junction or Denver, depending on the type and severity of the injury and the location of the accident. Emergency management and response services (including fire suppression and ambulance) for the area that includes CO Highway 13 in Garfield County are provided by the Rifle Fire Department from their main fire station in Rifle.

***Hospital and Medical Services:*** Hospital and medical services for Meeker and the eastern portion of Rio Blanco County are provided by Pioneers Medical Center, which operates a 15 bed hospital and provides 24 hour emergency medical, pulmonary, laboratory, radiological, surgical, acute care and rehabilitative services. There are four resident physicians in Meeker who provide services through the Meeker Family Health Center and staff the hospital and emergency room. The physicians also provide medical direction to EMTs who staff the ambulance service and provide training to law enforcement and emergency response personnel in the county.

***Environmental Justice:*** Executive Order (EO) 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the *Federal Register* (59 FR 7629) on February 11, 1994. EO 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level).

The percentage of minorities in Rio Blanco County overall is lower than the state average by 18.1 percentage points. According to the 2000 Census, persons in poverty are 10.7 percent of the Meeker CCD, the eastern half of the county, which includes the Proposed Action. This is 1.4 percentage points higher than the overall rates for Rio Blanco County and the State of Colorado. However, the area which excludes the Town of Meeker is closer to the county-wide average.

Very few people live within the areas surrounding the proposed RD&D project. The rural, agricultural nature of the Piceance Creek area and the relatively limited amount of privately owned land within and immediately adjacent to the proposed lease site means that a limited number of residents, regardless of their minority or income status, would be directly affected by health and safety aspects of the project.

### **Environmental Consequences of the Proposed Action**

Chevron's in-situ shale oil extraction technology is not labor intensive. Less than 100 employees and/or contractors would be involved at any time for the construction and operation of the proposed project.

These workers would include construction crews, drill rig crews, specialty contractors such as fracturing crews, contract truck drivers (including tanker trucks, water trucks, equipment haulers, rig movers, and sanitation contractors), suppliers, security personnel, technical representatives, consultants, and Chevron supervisors and employees. The majority of the contract workforce would be onsite temporarily (one day to several months), and depending on the phase of the Proposed Action, as few as 3 to 5 employees could be required for operation. Most of the employment required for construction and operation of the facilities would most likely not be new employment, but workers and contractors already available and operating in the region.

Construction and operation service contractors would likely come from Meeker and Rangely in Rio Blanco County, and from the Rifle and Parachute areas of Garfield County, Colorado. With the increased activity in oil and gas development in the proposed project area and the subsequent need for labor, some service contractors may be required from Grand Junction, Colorado and Vernal, Utah. It is anticipated that any Chevron employees who may need to relocate to the area would likely take up residence in the Rangely, Meeker or Rifle areas.

The local Motels, restaurants, grocery stores, gas stations, vehicle and equipment repair shops, to name a few, may all experience additional activity that could lead to the creation of new jobs within the service and retail sectors.

The Proposed Action would contribute to the increasing demands upon local law enforcement and emergency response in Rio Blanco County. Construction and operation of Chevron's proposed RD&D facilities would be a factor in the increased area traffic along County Roads 5, 26, and 69. Depending on the development phase, an average of approximately 5 to 10 vehicles per day would be added to the traffic counts on these roads. Chevron would encourage employees and contractors to carpool to and from the site to cut down on traffic on state highways and county roads. Chevron would also implement a health and safety program that would include training on-site supervisory personnel in First Aid and cardiopulmonary resuscitation (CPR), and would provide site security for the protection of the public, site personnel, and property. A fire prevention and control program as discussed in the Fire Management Section would be developed in cooperation with the BLM and Rio Blanco County emergency response agencies.

If possible, new employees would be hired from within the communities of the region, and local contractors would be used for the majority of construction, drilling activities, and service.

Grazing permittees in the proposed project area would be negatively affected if the reduction in forage caused by the surface disturbance of the Proposed Action required a consequent reduction in livestock numbers. The purchase of replacement forage and/or the relocation or addition of

fences and stock watering ponds may be required to maintain present rangeland management objectives.

Recreation, especially seasonal hunting, in the immediate vicinity of the Proposed Action could be disrupted by the construction and operation activities that may direct game animals away from the areas adjacent to the proposed RD&D site, but compliance with all timing limitations to protect sensitive wildlife species would maintain sufficient big game species numbers within the project area, and would therefore reduce the impact to big game hunters.

Likewise, observing all noise, visual resource management, and revegetation stipulations to minimize the sights and sounds of human activities and to maintain the natural character of the landscape would help to retain existing recreational opportunities.

The pilot scale and exploratory nature of the proposed Research, Development, and Demonstration project, along with the staged approach of its implementation, would preclude this action from having the adverse impacts to the socio-economics of the region as was experienced in the past. No commercial scale oil shale development would take place at this time. It is unlikely that there would be any notable increase in regional activity at this scale for the 10-year term of the proposed oil shale leasing program.

The ongoing Colorado Local Government Energy Impact Program would be a source of future mitigation for socio-economic costs that may be related to the Proposed Action should the process be deemed successful and eligible for commercial leasing, but federal royalties would be waived for the duration of the RD&D program, and rents would be waived for the first 5 years of the 10-year lease term, so the RD&D program would not make any substantial contribution to the distribution of funds associated with energy impacts at this time. The Colorado Local Government Energy Impact Program, administered by the Colorado Department of Local Affairs (DOLA), provides direct distributions and grant funds to local governments in areas impacted by energy development, specifically including Mineral Lease activities.

Chevron has committed to good stewardship of the land, and to the health and vitality of the communities in the region. The proposed development would be implemented at a measured pace so as to reduce the risk of making poor decisions with regard to the economic viability of the proposed technology. In the event that the Proposed Action were deemed unsuccessful at any time during the RD&D program, abandonment of the project would include removal of all facilities, after which the site would be returned as nearly as possible to pre-construction conditions, and any measures required to alleviate the impacts that such abandonment would have on the local population of the region would be implemented by working closely with local municipalities.

### **Subalternative - Proposed Action with Mitigation**

No additional measures would be required to offset demands on local law enforcement, emergency response services, employment and housing, and ranching and recreation other than those already provided for in the Proposed Action.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **VISUAL RESOURCES**

### **Affected Environment**

The entire proposed project area is on public lands administered by the WRFO BLM that have received a VRM Class III designation. The management goal for this class is to partially retain the existing character of the landscape. The change brought about by activities on lands with VRM III designation may be evident, but should not dominate the natural landscape character. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

County Road 69 provides public access to Hunter Ridge, and the entire proposed project area, thus the opportunity for recreation use and view of the landscape is consequently high. However, the visual sensitivity of the area remains low because the road is not a through road and recreation use increases only seasonally, during the later hunting seasons.

Distance and intervening terrain shield the area from the most highly traveled route in the area; the Piceance Creek Road (CR 5). Local ranchers and a growing number of oil and gas company employees and contractors make up most of the potential viewing public.

### **Environmental Consequences of the Proposed Action**

The proposed test wells and related research facilities, with associated access road and utility and pipeline right-of-way, would alter the landscape character and would create visual impacts for the life of the project. The Proposed Action would introduce man-made industrial facilities that would draw attention due to their size, color and shape.

Removal of vegetation and recontouring of the natural surface during construction would introduce linear features into the landscape and offer contrasting soil and vegetation colors and patterns that had not previously been there.

The proposed project site and related facilities would be situated in a prominent location on top of Hunter Ridge adjacent to County Road 69. This road is used mostly by workers involved in oil and gas extraction, local ranchers, and seasonal hunters. Travelers on this road would not likely have the same sensitivity to development of the site, and the accompanying impact to the scenic resource, as would other recreationists and those people involved in activities where visual quality is an important component of their outdoor enjoyment. Viewers along the road would be drawn to the proposed research site, and the drilling rigs and associated facilities within the site would dominate the viewshed in the immediate area, but the sensitivity of the road is considered low due to the nature of the user. Impacts would be long-term and could last throughout the term of the lease program.

The proposed pilot project would be relatively small in scale, with the tallest structure on the site being a drilling rig. Tanks, process facilities, and fencing, as described in the Proposed Action Section, would remain on the site for the life of the project and would alter the landscape character. The Proposed Action's prominent location and proximity to County Road 69 would likely prevent this action from meeting the standards of the VRM III classification.

### **Subalternative - Proposed Action with Mitigation**

In order to minimize the potential for visual impacts, the BLM would require alternative mitigation measures to reduce the visual contrast impacts associated with the Proposed Action:

- Minimizing fugitive dust by watering roads and construction areas, as needed.
- Seeding disturbed areas, and restoring the natural contours of the land, as discussed in the Vegetation section.
- Restoring the natural drainage and runoff patterns to as near as possible to pre-construction condition.
- Painting all aboveground facilities to blend into the natural surroundings in accordance with BLM-recommended color schemes.
- Siting prominent structures off of ridge lines as feasible
- Using low-profile structures as feasible.
- Siting slash/debris piles in low visibility areas if possible.
- Thinning and feathering edges of cleared areas where applicable and feasible.
- Co-locating of utilities and pipelines in combination with existing corridors if possible.
- Encourage employees and contractors to carpool to and from the site to reduce the amount of traffic on local roads, and to minimize fugitive dust.

### **Environmental Consequences of the Subalternative**

The proposed Chevron RD&D project is located adjacent to a relatively busy county road, which is utilized extensively by the oil and gas industry in the area. Taking into consideration the form, line, color, and texture of the proposed facilities during construction and installation would help to reduce some of the visual impacts associated with the Proposed Action, but would not remove the unavoidable evidence of industry.

### **Environmental Consequences of the No Action Alternative**

If the RD&D lease is not approved, no impacts associated with the Proposed Action would occur.

## **CUMULATIVE IMPACTS SUMMARY**

Compliance with NEPA requires an analysis of the cumulative impacts of past, present, or reasonably foreseeable future projects on various natural and human resources. Cumulative impacts may result when the environmental impacts associated with a proposed project are added to temporary or permanent impacts associated with past, present, or reasonably foreseeable

future projects. Cumulative impacts can result from individually minor but collectively significant actions taking place over time. For the purpose of this analysis, cumulative impacts of the Proposed Action with Subalternative Mitigation will be added to other proposed oil shale RD&D projects, as well as ongoing and future oil and gas operations within the WRRRA.

The geographic context of cumulative impacts varies by natural resource. For example, air quality and socio-economic cumulative impacts may affect an entire region downwind, or a multi-county area, where other impacts may just occur within a specific wildlife habitat, game management unit, or watershed. Unless specifically stated otherwise in the resource-specific sections to follow, the cumulative impact assessment area for resource analysis within this EA includes the White River Resource Area, which is managed by the WRRRA Resource Management Plan and Record of Decision (RMP/ROD). The White River Resource Area is the analysis area because 100 percent of the Proposed Action, along with the four other RD&D oil shale proposals, occur within its borders and the cumulative effects of nearby projects can be specifically evaluated in relation to all five of the proposed RD&D oil shale leasing projects. Effects of distant projects (i.e. those located outside the White River Resource Area) are not assessed because their impact would generally be localized, or would not contribute significantly to the cumulative impacts within the proposed project area, and these distant projects have been analyzed under resource area-specific resource management plans.

Existing environmental conditions in the project area reflect changes based on past projects and activities. The project area is rural and relatively undeveloped. The Proposed Action would be located within an area that is adjacent to existing unitized oil and gas operations, pipeline and utility corridors, gas plants, and historic nahcolite and oil shale mining operations. The Kinder Morgan TransColorado pipeline, American Soda, and EnCana's Figure-Four, Double-Willow, and Eureka Units, are 5 to 12 years old, and are considered existing conditions. Construction and operation of the five proposed oil shale RD&D projects would be considered foreseeable future projects, and would result in an increase in energy production activity in the Piceance Basin.

The primary human influences on the project area are oil and gas development, historic oil shale and nahcolite mining, and livestock grazing. Estimates of the total past, present, and foreseeable future surface disturbance from oil and gas development and oil shale and nahcolite mining are presented in **Table 22** below. Future developments are based on proposed EnCana, ExxonMobil, and Riata Energy Gas oil and gas projects and future oil and gas development. Existing and future oil and gas development is based on estimates from the BLM White River Field Office (BLM 2006). Disturbance includes BLM and fee-lands. The timeframe analyzed is 10 to 15 years.

The White River Resource Area (WRRRA) includes 2.6 million acres of land. Of this, 1,455,900 million acres of surface estate and 365,000 acres of split mineral estate are managed by the WRFO BLM (BLM ROD/RMP 1997). To assist in quantifying cumulative impacts, the 800 acres associated with the five proposed oil shale RD& D projects equate to 2.5 percent of all past, present, and future proposed actions, and 0.06 percent of the WRRRA managed by BLM.

The total amount of disturbed acreage associated with all past, present, and future actions as listed in the following table equate to 2.2 percent of the WRRRA.

**Table 22: Surface Disturbance Estimate for Past, Present, and Reasonably Foreseeable Future Projects in the White River Resource Area**

Activity	Assumptions	Disturbance (acres)
<b><i>Future Oil Shale Research, Development, and Demonstration Tracts</i></b>		
Shell Oil Company	Three 160-acre tracts (Shell estimates nearly all the tracts will be disturbed.)	480
Chevron USA, Inc.	One 160-acre tract (Chevron estimates that approximately 100 acres of the 160 acre tract will be disturbed. For purposes of this tabulation, the entire 160 acres is included.)	160
EGL Resources Inc.	One 160-acre tract (CHEVRON estimates that only 36 acres of the 160 acre tract will be disturbed. For purposes of this tabulation, the entire 160 acres is included)	160
<b><i>Existing Pipelines – all in reclamation process</i></b>		
CIG Uintah Basin	84 miles (220 miles total) of 20-inch diameter natural gas pipeline from Uintah County, Utah to Greasewood Hub, Colorado to Sweetwater County, Wyoming.	475
EnCana Eureka and Double Willow Units	Variable length and diameter gathering pipelines in Piceance Basin, Colorado.	175
NGL Pipeline	16.9 miles of 4-inch diameter NGL pipeline from Dragon Trail Plant, Colorado to Dragon, Utah	85
Kinder Morgan TransColorado	32 miles (300 miles total) of 22-inch diameter natural gas pipeline from Greasewood Hub, Colorado to Farmington, New Mexico.	300
Questar	45 miles (45 miles total) of 14-inch diameter natural gas pipeline from Plateau Creek, Colorado to Greasewood Hub, Colorado to Utah.	260
El Paso	38 miles (143 miles total) of 24-inch diameter natural gas pipeline from Greasewood Hub, Colorado to Wamsutter, Wyoming.	350
Entrega	46 miles (327 miles total) of 36-inch and 42-inch diameter natural gas pipelines from Meeker Hub, Colorado to Cheyenne, Wyoming.	560
<b><i>Future Pipelines</i></b>		
EnCana Meeker Project	175 miles (205 miles total) of up to 10-inch, 12-inch, 16-inch, 24-inch, 30-inch, and 36-inch natural gas, NGL and water pipelines from Logan Wash, Colorado to Dragon, Utah.	1,222
Eureka and Double Willow Units	Variable length and diameter gathering pipelines in Piceance Basin, Colorado.	875
Riata Sagebrush	19 miles of up to 10-inch natural gas gathering line from Black Sulphur to ROC.	100
Northwest/Williams (FERC)	37 miles of 36-inch natural gas pipeline from Parachute to Greasewood Hub.	525
<b><i>Proposed Gas Plants</i></b>		
EnCana/Enterprise (Meeker Gas Plant)	Natural Gas Plant in T.1S., R.97W., Sections 18 and 19	50
EnCana	Natural Gas Plant near Meeker Hub, Colorado.	80
Riata Energy	Natural Gas Plant near Stake Springs Draw.	10

Activity	Assumptions	Disturbance (acres)
<b><i>Existing Oil and Gas Development</i></b>		
Other Oil and Gas Wells	3,052 wells and ancillary facilities	8,761
<b><i>Future Oil and Gas Development</i></b>		
EnCana Figure Four Unit	327 wells and ancillary facilities	900
ExxonMobil Piceance Development Project	Central Treatment Facility, ponds and pipeline	1600
Other Oil and Gas Wells	15,000 wells and ancillary facilities in 15-20 years Complete Cumulative Analysis to be completed in WRRR RMPA/EIS to be completed in CY08.	17,000
<b><i>Existing Nahcolite Mining</i></b>		
American Soda	Parachute Pipeline, Mining Production Well Field and Piceance Processing Site	80
Natural Soda Inc.	Mining Production Well Field	72
<b><i>Existing Oil Shale Mining</i></b>		
Shell Mahogany Project	Experimental Oil Shale Recovery Activities	150
<b><i>Future Utilities</i></b>		
White River Electric Assn.	138kV connection lines to substations in Piceance Basin.	184
<b><i>Future Rio Blanco County Services</i></b>		
Waste Water Disposal Pond	Sewer, Septic and waste disposal Wray Gulch, Hwy 64 and County Road 5	2
Paving and Overlay	County Road 5 Piceance Creek	0
Meeker Airport Expansion	Runway expansion and/or extension	TBD
Rangely Airport Upgrade	Update runway, aprons, facilities	0
Meeker Jail/Justice Center	Pending study results and budget approval	TBD
<b>Total</b>		<b>34,616</b>

Sources: BLM 2006; Rio Blanco County Planning Department 2006.

Direct, indirect and cumulative effects of reasonably foreseeable oil and gas development were analyzed in the White River Resource Area Draft Resource Management Plan (DRMP) and associated environmental impact statement (EIS). The DRMP/EIS, completed in 1997, addressed all reasonably foreseeable oil and gas development (including roads and pipelines) over a 20-year period. The proposed oil shale RD&D pilot program is designated in the White River Resource Area RMP. As such, impacts, direct, indirect, and cumulative, were addressed in the related EIS. Additionally, Oil shale development is currently the focus of an Oil Shale and Tar Sands Resources Leasing Programmatic Environmental Impact Statement (PEIS) initiated by the BLM to further address the issues of resource use, resource development, resource protection, resource impacts, and multiminerall recovery.

At the same time, oil and gas development in the Piceance Basin is the subject of an Oil and Gas Environmental Impact Statement (EIS) that will address the long-term impacts of oil and gas production in the WRRR.

Impacts from reasonably foreseeable oil and gas development activities outside the White River Resource Area have been analyzed in other resource area-specific resource management plans including, but not limited to, the Book Cliffs RMP, the Grand Junction RMP and ROD, and the

Colorado Oil and Gas Leasing and Development Final EIS (covering the BLM Glenwood Springs, Kremmling, Little Snake, Northeast, and San Juan/San Miguel Field Offices) (BLM 1991).

The potential cumulative impacts associated with each critical and non-critical element that must be addressed to meet the Public Land Health Standard are discussed below. Cumulative impacts are focused upon all five of the Oil Shale Research, Development, and Demonstration projects as proposed by Chevron USA, Inc., EGL Resources, Inc, and Shell Oil Company, and were prepared as part of a cooperative effort between the WRFO BLM and the primary third party contractors to the BLM for each of the individual Environmental Assessments. The development proposed in this Environmental Assessment is tiered to the White River Resource Area RMP/EIS, and is within the scope and analysis of that RMP/EIS.

## AIR QUALITY

Construction and operation of the five proposed oil shale RD&D projects would result in temporary impacts to air quality during construction, and longer-term impacts during operation of the RD&D facilities. Construction of the reasonably foreseeable future projects would involve the use of heavy equipment that produces exhaust emissions and fugitive dust. The majority of impacts would be mitigated by the large geographical area in which the projects would occur. Wind dispersion and dilution would reduce the magnitude of emissions and fugitive dust.

Air pollutant dispersion modeling was performed to quantify potential NO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and SO<sub>2</sub> impacts during operation based on the period of maximum potential emissions and other emission sources located within the Piceance Basin. This includes all five Oil Shale Research Development and Demonstration projects, as well as the current ExxonMobil Piceance Development Project activities. Operation emissions would occur as a result of power generation, product and CO<sub>2</sub> processing, and engine exhausts.

Potential maximum cumulative air quality concentrations throughout the Piceance Basin, SO<sub>2</sub> impacts within Dinosaur National Monument (a CDPHE-APCD Category I area), as well as NO<sub>2</sub>, PM<sub>10</sub>, and SO<sub>2</sub>, atmospheric deposition (acid rain) and visibility impacts to the Flat Tops Wilderness PSD Class I areas are presented in **Table 23**.

**Table 23: Maximum Potential Cumulative Air Quality Impacts by Impact Region**

Location	Parameter	Units	Cumulative Impact	Impact Threshold
Piceance Basin	Nitrogen dioxide	Annual ( $\mu\text{g}/\text{m}^3$ )	4.3	25
		24-hour ( $\mu\text{g}/\text{m}^3$ )	1.4	65
	PM <sub>2.5</sub>	Annual ( $\mu\text{g}/\text{m}^3$ )	0.3	15
		24-hour ( $\mu\text{g}/\text{m}^3$ )	5.0	30
	PM <sub>10</sub>	Annual ( $\mu\text{g}/\text{m}^3$ )	0.6	17
		3-hour ( $\mu\text{g}/\text{m}^3$ )	124	512
	Sulfur dioxide	24-hour ( $\mu\text{g}/\text{m}^3$ )	17.1	91
		Annual ( $\mu\text{g}/\text{m}^3$ )	2.8	20
3-hour ( $\mu\text{g}/\text{m}^3$ )		10.7	25	
Dinosaur National Monument	Sulfur dioxide	24-hour ( $\mu\text{g}/\text{m}^3$ )	1.6	5
		Annual ( $\mu\text{g}/\text{m}^3$ )	0.08	2
		3-hour ( $\mu\text{g}/\text{m}^3$ )	10.7	25
Flat Tops Wilderness Area	Nitrogen dioxide	Annual ( $\mu\text{g}/\text{m}^3$ )	<0.01	2.5
	PM <sub>2.5</sub>	24-hour ( $\mu\text{g}/\text{m}^3$ )	<0.01	65

Location	Parameter	Units	Cumulative Impact	Impact Threshold
	PM <sub>10</sub>	Annual ( $\mu\text{g}/\text{m}^3$ )	<0.01	15
		24-hour ( $\mu\text{g}/\text{m}^3$ )	0.01	8
		Annual ( $\mu\text{g}/\text{m}^3$ )	<0.01	4
	Sulfur dioxide	3-hour ( $\mu\text{g}/\text{m}^3$ )	1.8	25
		24-hour ( $\mu\text{g}/\text{m}^3$ )	0.4	5
		Annual ( $\mu\text{g}/\text{m}^3$ )	<0.01	2
	Atmospheric Deposition	Maximum Total Nitrogen Deposition (kg/ha-yr)	0.265	3
		Maximum Total Sulfur Deposition (kg/ha-yr)	0.033	3
	Ned Wilson Lake Chemistry <sup>(1)</sup>	ANC Change ( $\mu\text{eq}/\text{l}$ )	0.75	1
	Trappers Lake Chemistry	ANC Change (percent)	2.7	10
	Upper Ned Wilson Lake Chemistry <sup>(1)</sup>	ANC Change ( $\mu\text{eq}/\text{l}$ )	0.80	1
Visibility	Equal to 1.0 deciview (days/year)*	13 to 20	More than 1 day/year	

<sup>(1)</sup> Because these lakes' lowest (10<sup>th</sup> percentile) background ANC values are less than 25  $\mu\text{eq}/\text{l}$ , the applicable impact threshold is no more than a 1  $\mu\text{eq}/\text{l}$  change. kg/ha-yr = kilograms per hectare per year; NA = Not applicable; PM<sub>10</sub> = particulate matter less than 10 microns in effective diameter; PM<sub>2.5</sub> = particulate matter less than 2.5 microns in effective diameter

\*The USFS uses modeling results that identify days at or greater than 0.5dv as a concern threshold.

Potential direct atmospheric deposition (acid rain) impacts within the Flat Tops Wilderness Area were calculated, and the maximum direct total (wet and dry) nitrogen and sulfur deposition during operation were predicted to be nearly 0.265 and 0.033 kg/ha-yr, respectively; well below the 3 kg/ha-year threshold (Fox et. al. 1989). In addition, potential changes in Acid Neutralizing Capacity at three lakes within the Flat Tops Wilderness Area were all predicted to less than their significance thresholds (USFS 2000): a potential 2.7 percent change at Trappers Lake (compared to the 10 percent threshold), and nearly a 0.8 microequivalent per liter ( $\mu\text{eq}/\text{l}$ ) change at the more sensitive Ned Wilson and Upper Ned Wilson lakes (also below a one  $\mu\text{eq}/\text{l}$  threshold for sensitive lakes).

The U.S. Forest Service (USFS) considers potential visibility impacts within their mandatory federal PSD Class I areas greater than a 1.0 deciview “just noticeable change” from cumulative air pollutant emission sources to be an adverse impact. Potential cumulative visibility impacts were calculated based on observed hourly relative humidity and speciated aerosol concentrations measured between 2001 and 2004, as specified in the FLAG Guidance (FLAG 2000).

If the predicted air quality impacts had occurred during the observed visibility measurement period, a 1.0 deciview “just noticeable change” would have been exceeded between 13 and 20 days per year at the Flat Tops Wilderness Area. However, 10 to 14 days per year were predicted to occur in the months of November through January, when visitor use in the Flat Tops Wilderness Area is minimal. For the 3 to 6 days per year predicted to have more than a “just noticeable change” in visibility during February through October, 1 to 3 days per year also experienced precipitation events.

Given the reasonable, but conservative assumptions incorporated into the cumulative visibility impact analysis (maximum emission rates, duration and timing of the predicted impacts, etc.), and considering the magnitude, frequency, duration, and timing of the predicted impacts, it is unlikely that perceptible visibility impacts would actually occur from the Proposed Action when combined with other activities in the Piceance Basin. The BLM will cooperate with the CDPHE-APCD to achieve the national visibility goal of “no man-made impairment of visibility within mandatory federal PSD Class I areas” by EPA’s specified date of 2064 AD. The BLM is also

preparing a less conservative cumulative modeling analysis (using the CALPUFF modeling system) in order to better quantify potential cumulative visibility impacts within the Flat Tops Wilderness Area. Finally, the BLM requires the operators to comply with all applicable air quality regulations. As noted in the direct and indirect impacts section, the BLM will impose mitigation measures to reduce emissions of particulate matter and other pollutants which could impact visibility. Therefore, no significant adverse air quality impacts are likely to actually occur.

The BLM recognizes that if Oil Shale Research, Development and Demonstration Projects can successfully establish that their technologies are adequate to proceed for commercial development, another more detailed and less conservative air quality impact assessment would be prepared using updated air pollutant emissions inventories, meteorological conditions, and dispersion modeling techniques.

The BLM will continue to cooperate with existing atmospheric deposition and visibility impact monitoring programs. The need for, and the design of, additional monitoring could include the involvement of the EPA Region 8 Federal Leadership Forum (EPA, 2001) and applicable air quality regulatory agencies. Based upon future recommendations, operators could be required to cooperate in the implementation of a coordinated air quality monitoring program.

## **AREAS OF CRITICAL ENVIRONMENTAL CONCERN**

Construction and operation of the Proposed Actions would not occur on, or have any impact to, any ACEC in the WRRRA. Construction of other reasonably foreseeable future projects would be limited to existing disturbance footprints within any ACEC as managed by the WRRRA RMP.

## **CULTURAL RESOURCES AND NATIVE AMERICAN CONCERNS**

Past disturbances to cultural resources within the WRRRA have been related to collection, disturbance by OHV users, intentional destruction or vandalism, and construction associated with roads, facilities, and utilities. The five proposed oil shale RD&D projects have been surveyed for evidence of cultural resources and it has been determined that construction of the projects would not affect any known eligible cultural sites.

Each of the five Proposed Actions and all proposed reasonably foreseeable future projects would include mitigation measures designed to avoid additional direct impacts on cultural resources. Data recovery, and other mitigation measures, would be implemented where direct disturbance could not be avoided. Pressure on cultural sites within the Piceance Basin would likely continue, and would be exacerbated by an increase in human presence.

Additional Right-of-way access into previously inaccessible sites could increase the potential for trespass and vandalism, and vibrations from drilling and heavy equipment could damage fragile cultural resources.

None of the proposed RD&D project sites are within, or contiguous to, any Indian Reservation. The Ute Indian Tribe was invited to participate in the environmental assessments for the RD&D projects, and have declined as there are no Native American Religious Concerns in the area. Reasonably foreseeable future proposals would necessarily contact the appropriate Tribe(s) to

determine if such sites exist, and to establish mitigation for the protection of archaeological resources of importance to Native Americans.

## **SOILS AND FARMLANDS, PRIME AND UNIQUE**

It is estimated that the five proposed RD&D projects would disturb 595 acres of the 800 acres available. Disturbance would result in short- to long-term impacts to soils depending on the success of reclamation efforts. Soil disturbance would result in approximately 1.8 percent of all soils impacted from past, present, and reasonably foreseeable soil disturbance in the project area, and in 0.04 percent of the entire WRRRA. Impacts would be highly localized and limited to the periods of construction and reclamation. Cumulative impacts would be minimized by implementing alternative mitigation measures to ensure the proper handling of topsoil and spoil, erosion control, and reclamation procedures for each of the reasonably foreseeable future projects. There are no prime farmland soils impacted by any of the Proposed Actions.

## **FLOODPLAINS**

None of the RD&D sites proposed would be constructed within a floodplain, and therefore would have no impacts on floodplains. No floodplains would be permanently modified or altered from the construction of Chevron's proposed pipeline ROW. Cumulative impacts would be minimized by implementing stream bank stabilization, restoration measures, and engineering practices for foreseeable development projects within or impacting floodplains.

## **WATER RESOURCES, SURFACE AND GROUND**

Construction of the proposed RD&D projects could have short-term impacts on surface water resources if not properly mitigated. Cumulative impacts on surface water bodies affected by the Proposed Actions would be limited primarily to water bodies that are affected by other projects within the same watershed. Direct in-stream impacts associated with construction runoff and increased sediment loads during initial storm events following construction would have the greatest impacts on surface water resources, but these impacts would only occur if best management practices are not properly designed and implemented. Runoff from construction activities at reasonably foreseeable projects near water bodies would also contribute to cumulative impacts.

Cumulative impacts would be minimized with implementation of erosion control measures, development of Spill Prevention Control and Countermeasures Plans, and best management practices during project operation and reclamation for all reasonably foreseeable projects.

Three of the five test sites are located within the Yellow Creek watershed where the volume of groundwater flow moving through a 10-mile long cross-section, or vertical slice, in the upper Parachute Creek Unit is over 7,000 gpm. The volume of groundwater flow moving through these sites is approximately 50 gpm, or less than 1 percent of the total groundwater flow in the basin. The potential long-term effects from the two sites in the Piceance Creek watershed are even smaller, due to the much larger size of this watershed and its groundwater flow zone. In this context, the large geographic area would, to some degree, provide mitigation for water quality impacts. The Proposed Actions would all perform suitable reclamation activities to meet Colorado Ground Water Quality Standards at compliance well locations, resulting in no

cumulative downgradient impacts. Groundwater monitoring programs would be established to allow verification of water quality standards. Other reasonably foreseeable projects within the WRRRA would also be required to meet or exceed these standards. Reestablishment of pre-construction contours and vegetation would restore surface water infiltration into groundwater recharge areas, and thus cumulative impacts on groundwater resources are not expected.

## **VEGETATION AND INVASIVE, NON-NATIVE SPECIES**

Construction of the five proposed RD&D projects would have short-term impacts to herbaceous species that would regenerate within 1 to 3 years, and long-term impacts to sagebrush and pinyon-juniper vegetation that could take 50 to 100 years to reestablish following successful reclamation. Removal of vegetation and the disturbance of up to 595 acres would create conditions conducive to the invasion and establishment of invasive, non-native, and noxious weed species that could continue for many years after the initial disturbance. These impacts would be greatest where other projects were constructed within the same period and area as the RD&D sites.

The Proposed Actions would contribute to the cumulative impact on vegetation and invasive species. However, the amount of vegetation that would be disturbed is relatively small compared to the projected oil and gas vegetative disturbance in the WRRRA DRMP and EIS.

Vegetative loss from the Proposed Actions would result in approximately 1.8 percent of all vegetation impacted from past, present, and reasonably foreseeable soil disturbance in the project area, and would result in a temporary vegetation loss of 0.04 percent of the entire WRRRA. Cumulative impacts would be minimized by implementing measures for the proper handling of topsoil and spoil, erosion control, preventative and remedial noxious weed management, and revegetation stipulations for each of the reasonably foreseeable future projects.

## **MIGRATORY BIRDS**

The construction activities associated with the Proposed Actions, along with oil and gas development and other activities in the WRRRA, would contribute to cumulative habitat loss and displacement of migratory birds. Impacts would occur during the construction, operation, and reclamation phase of the RD&D projects, but would have little influence on the abundance or distribution of migratory birds at the scale proposed. Due to abundant suitable habitat throughout the project areas, habitat fragmentation would be unlikely. Habitat loss from all five Proposed Actions would be approximately 1.8 percent of the habitat loss from past, present, and reasonably foreseeable soil disturbance in the project area, and would result in a temporary habitat loss of approximately 0.04 percent of the entire WRRRA.

Cumulative impacts would be minimized by complying with timing limitations and surface occupancy stipulations, and providing buffer zones around active nests or sensitive areas to preserve habitat for nesting birds. Impacts would be minimized by implementing measures for reclamation, co-locating reasonably foreseeable future projects in areas of existing development or disturbance, and by limiting construction of new roads and right-of-ways.

### **THREATENED, ENDANGERED, AND SENSITIVE ANIMAL SPECIES**

Construction of the proposed RD&D facilities would not likely jeopardize the viability of any threatened, endangered, or sensitive animal species, but would contribute to a relatively minor amount of available habitat loss. Disturbances associated with construction would result in a loss of up to 595 acres of potential habitat for threatened and endangered and BLM sensitive species and could result in nest abandonment, direct mortality, reproductive failure from stress, and loss of foraging and breeding habitat. The five Proposed Actions would make a minor contribution to the cumulative impacts on northern goshawk habitat with a temporary loss of approximately 161 acres of pinyon-juniper habitat.

Approximately 364 acres of upland and bottomland sagebrush habitat preferred by the Greater sage grouse would be lost, as would approximately 70 acres of grassland habitat. Localized Greater sage grouse habitat fragmentation could occur along sagebrush-dominated ridgelines. Cumulative impacts would be greatest where other projects are constructed within the same time frame and area. Future oil and gas development within the White River Resource Area may contribute to the cumulative impacts on BLM Sensitive species through habitat loss and fragmentation.

Cumulative impacts would be minimized by implementing measures that prohibit construction during sensitive nesting seasons for each of the reasonable foreseeable future projects, and by co-locating reasonably foreseeable future projects in existing utility corridors to the extent feasible. Reclamation activities would reestablish vegetation and reasonably foreseeable future projects would commit to off-site mitigation (vegetative community treatment/conversion, seeding, etc.), as necessary, to compensate for unavoidable disturbances.

### **THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES**

There is no habitat for threatened, endangered, and sensitive plant species on any of the five proposed RD&D lease tracts. Construction of the proposed RD&D facilities would not jeopardize the viability of any threatened, endangered, or sensitive plant species. Reasonably foreseeable future projects would be subject to pre-construction surveys, avoidance requirements, and mitigation measures if special status species plants cannot be avoided. Cumulative impacts are not anticipated.

## **WASTES, SOLID OR HAZARDOUS**

Accidental spills or leaks associated with equipment failures, refueling and maintenance of equipment, and storage of fuel, oil, or other fluids could cause soil, surface water, and/or groundwater contamination during construction of each of the Proposed Actions. The severity of potential impacts from an accidental hazardous material spill would depend upon the chemical released, the quantity released, and the proximity of the release to a waterbody or aquifer.

The proposed projects would increase contributions to solid waste landfills during construction, operation and reclamation, and would contribute to cumulative impacts on solid waste for the duration of the project. Reasonably foreseeable projects would be required to comply with all applicable federal, state, and local regulations.

## **WETLANDS AND RIPARIAN ZONES**

No wetlands or riparian zones are within any of the five proposed RD&D project sites. One site would construct a utility and pipeline ROW across Hunter Creek, but no wetlands would be permanently filled or drained as a result of this construction. Cumulative impacts could occur where the other reasonably foreseeable future projects are constructed within, or adjacent to, this corridor, but the impacts would be temporary until wetland vegetation returned to pre-construction levels. Cumulative impacts would be minimized by implementing measures to lessen the duration of disturbance, reduce the soil disturbance, and enhance restoration. Sediment transport from runoff during construction could result in impacts to wetlands or riparian zones, but would be mitigated through stormwater runoff control and best management practices.

Reasonably foreseeable future projects would be subject to requirements for protection of wetlands and riparian areas under the Clean Water Act and BLM guidelines, including avoidance and mitigation of impacts and compensatory mitigation of unavoidable wetland impacts.

## **WILDERNESS**

No wilderness areas would be impacted by the Proposed Actions. Potential indirect impacts to wilderness areas caused by dust and air emissions from project construction and operation, and from reasonably foreseeable development, are described in the air emissions cumulative impact discussion.

## **WILDLIFE, AQUATIC AND WILDLIFE, TERRESTRIAL**

Construction of the proposed RD&D projects would have some temporary and possibly long-term impacts on wildlife resources. If not properly mitigated, additional sedimentation resulting from construction activities associated with the Proposed Actions could affect aquatic wildlife in the nearby rivers and streams, and excessive water withdrawals from reasonably foreseeable projects could have cumulative impacts to water bodies and the wildlife within and around them.

Many woodland accipiters and owls nest in the pinyon-juniper woodlands in the areas surrounding the Proposed Actions. These raptors can be sensitive to development and disturbance from industrial activity. The cumulative loss of approximately 161 acres of pinyon-juniper woodland wildlife habitat would displace wildlife species to other areas of suitable habitat, and would decrease the carrying capacity of the land. While suitable habitat may be available in adjacent areas, a cumulative loss of habitat would increase intra-and inter-specific competition. Wildlife populations could decrease as a result of the increased resource competition, and stress could cause a reduction in reproductive success as well as direct mortality.

Vegetation removal would result in a loss of cover, nesting, and forage habitat. The degree of impact would depend on the type of habitat affected and the rate that vegetation would regenerate after reclamation. Loss of habitat for wildlife, including raptors and big game, would occur on approximately 595 acres. Vegetative loss from the Proposed Actions would result in approximately 1.8 percent of all vegetation impacted from past, present, and reasonably foreseeable soil disturbance in the project area, and would result in a temporary vegetation loss of 0.04 percent of the entire WRRRA.

Within the WRRRA, the potential for habitat fragmentation from oil and gas development and the Proposed Actions could influence the distribution of big game. The Proposed Actions are within important mule deer winter ranges. Local and long-distance migratory patterns may be adversely modified by the cumulative effects of reasonably foreseeable projects, including the proposed RD&D projects. The additional traffic and human activity in the region would likely contribute to an increase in poaching and vehicle collisions with wildlife, but would not likely cause a noticeable reduction in populations.

Impacts would occur over the life of the projects, and would be greatest where other projects are constructed within the same period and area as the Proposed Actions. Due to abundant suitable habitat throughout the proposed project areas, it is unlikely that the Proposed Actions would have any measurable influence on the abundance or distribution of wildlife at the scale proposed. Cumulative impacts would be minimized by co-locating reasonably foreseeable future projects in existing utility corridors to the extent feasible, and by implementing measures that prohibit construction activities during sensitive wildlife periods.

Implementing measures for the proper handling of topsoil and spoil, erosion control, preventative and remedial noxious weed management, and revegetation for each of the reasonably foreseeable future projects would mitigate the loss of wildlife habitat.

## **ACCESS AND TRANSPORTATION**

For transportation, the cumulative impact analysis area includes Rio Blanco CR 5 (Piceance Creek) and the associated local road network in the Piceance Creek area. These county roads were originally designed for rural and agricultural uses and were not intended for the repeated heavy loads associated with the current expansion in oil and gas production. The increasing traffic volume, frequency, and vehicle size on these rural roads has contributed to an increase in

the costs associated with repair and maintenance of these county roads, and has contributed to increased traffic accidents that require emergency response. Sustained high levels of traffic could have secondary impacts on wildlife, and on the quality of recreation in the region.

Collectively, construction and operation of the five proposed oil shale RD&D projects would contribute to these traffic effects. Additionally, past, present, and reasonably foreseeable future developments have, and will continue to, create additional access onto BLM lands by constructing new roads into areas that were previously inaccessible by vehicle. The remote and relatively undisturbed nature of these areas are valued by local hunters and recreationists that seek a natural appearing environment with few administrative controls and a low interaction between users. The probability of isolation from the sights and sounds of human activity would be diminished over time. Development of the five RD&D operations would not create additional access onto BLM-administered lands, but would contribute to an increase in human activity in the region and would thereby become a factor in the diminished sense of isolation in these remote areas.

Cumulative impacts would be minimized by encouraging carpooling to reduce traffic volume, obeying posted speed limits to reduce impacts to wildlife, and complying with county weight restrictions for roads and bridges along access routes. Limiting new road construction to existing corridors and adhering to visual resource management stipulations would mitigate the cumulative impacts of access and transportation in remote areas.

## **FIRE MANAGEMENT**

One of the five Proposed Actions is located within a prescribed natural fire area defined in the WRRRA RMP. The other four sites are located in areas where fires can be suppressed as wildfires. The five Proposed Actions are estimated to result in the removal of approximately 595 acres of pinyon-juniper woodland, sagebrush, and grasslands. A portion of this acreage at each proposed location would include defensible space to allow for wildfires to achieve public land health objectives, and to protect workers and facilities in the event of a wildfire.

Of the 595 acres of disturbance, approximately 161 acres is estimated to be of pinyon-juniper woodland and approximately 364 acres is sagebrush which could create moderate to considerable dead fuel loads if left unmanaged upon removal.

Accidental fires from human activity would likely increase in the vicinity of the five RD&D tracts, and along transportation routes to and from the areas with the introduction of potential ignition sources where fire fuels are located. Increased activity resulting from the Proposed Actions and other reasonably foreseeable future actions could have a cumulative affect on the BLM's ability to use wildfire to achieve public land health objectives in those areas, and additional accidental fires would increase demands on the WRFO fire response services.

Cumulative impacts on fire management could be minimized by implementing mitigations outlined in the BLM Fire Activity Management Plan, and by developing fire suppression priorities, identifying management restrictions, and determining appropriate fire suppression strategies in coordination with the BLM and Rio Blanco County emergency response teams.

## **FORESTRY MANAGEMENT**

Construction of the five proposed RD&D facilities would result in the clearing of 161 acres of pinyon-juniper woodlands within the WRRRA that is classified as non-commercial. The woodlands are not within the allowable harvest and are not managed for commercial firewood production. The current WRRRA RMP/EIS anticipated that oil shale and sodium development would occur on 620 of the 632,800 acres of pinyon-juniper woodland within the WRRRA (BLM 1997). The Proposed Actions are within the range of previously-analyzed impacts and account for less than 0.03 percent of the available woodland resource. Cumulative impacts would be minimized by seeding disturbed areas, controlling noxious weeds, and reclaiming the sites at the termination or abandonment of the RD&D lease agreements. Past, present and future development projects have resulted in temporary reductions in woodlands. Restoration methods would be applied as appropriate to meet forestry management objectives and minimize cumulative impacts to woodlands.

## **GEOLOGY AND MINERALS**

The five Proposed Actions would each employ in-situ shale oil extraction techniques to recover the shale oil resources beneath each 160-acre tract. Each Proposed Action would, by virtue of the limited areal extent and thickness of the production zones, produce to the surface a small portion of the shale oil resource underlying the tract. The total amount of shale oil that would be produced during the proposed RD&D program would be extremely small relative to the 1,200 billion barrels of shale oil thought to be contained in the Green River formation in the Piceance Basin.

A thick zone of sodium minerals, primarily nahcolite and dawsonite, is intermingled with oil shale in the depositional center of the Piceance Basin. Development of oil shale resources containing substantial deposits of nahcolite and/or dawsonite could preclude future development of the sodium minerals at these locations. The Proposed Actions would avoid such interference either by developing oil shale zones that lack in substantial deposits of sodium minerals, by developing methods and technologies to recover the minerals, or by isolating the formations so as to avoid destruction of the nahcolite and dawsonite.

The Proposed Actions would not adversely affect the future recovery of oil shale or other minerals outside the proposed lease tracts.

If successful, the RD&D projects could lead to commercial development of oil shale resources that could contribute to the nation's domestic energy supply and help to reduce the United States' dependency on foreign oil imports. The Proposed Actions would contribute to the collective knowledge of the geology, mineralogy, hydrogeology, and geophysical properties of the Piceance Basin for the benefit of industry, science, education, and government. The proposed RD&D projects could recover valuable mineral resources for consumer use, and could develop technologies for reducing the environmental impacts of mineral extraction that could be applied industry wide.

## **HYDROLOGY AND WATER RIGHTS**

Groundwater extraction for on-site use as makeup and process water (1 to 20 gpm) at the Shell sites would result in minor impacts to groundwater flow in the upper Parachute Creek member at those sites. However, these impacts would last only through the completion of the oil recovery phase. The largest volume of groundwater would be required during reclamation to resaturate the area where kerogen was heated and the oil was recovered. Resaturation or refilling of the pyrolyzed, or retorted, materials would require from 1 to 3 years using water derived from either natural inflow or extraction and injection wells completed in the upper Parachute Creek member. There would be potential for minor depletions from Yellow Creek during the reclamation phase at each site, caused by a reduction in groundwater discharge. Given the small size of each site and the relatively slow movement of groundwater in the subsurface, potential depletions would be limited to Shell's estimated 0.04 cfs flow reduction at Yellow Creek. Following the reclamation phase, groundwater flow directions and velocities would likely resemble pre-development patterns. Water rights for any depletion would be secured prior to use. Water depletions are not anticipated for the Chevron and EGL projects. Long-term, basin-wide, cumulative impacts are not anticipated given the scale of the RD&D proposals.

## **NOISE**

The five Proposed RD&D tracts are located several miles from each other in a rural setting. There are no noise receptors (homes, schools, businesses) within 0.5 mile of any of the tracts. Noise from each of the operations would not be cumulative due to distance and the rural setting of the dispersed facilities. Cumulatively, noise increases are associated with foreseeable development. Noise mitigation will be applied as appropriate on a site-specific basis to mitigate impacts to receptors.

## **PALEONTOLOGY**

All of the Proposed Actions are underlain by the Uinta Formation. The Uinta Formation is a BLM Class I paleontologic formation and is known to contain scientifically significant vertebrate fossils or noteworthy occurrences of invertebrates or plant fossils. Disturbance of bedrock could damage fossil resources and could contribute to the cumulative basin-wide degradation of paleontologic resources.

The Proposed lease tracts have either not been surveyed for fossils or have been surveyed with negative results, although significant plant fossils have been found in the vicinity of Shell Site 3. Cumulative impacts would be mitigated by monitoring bedrock-disturbing activities and by informing construction and operation personnel as to the penalties associated with the collection of fossils.

## **RANGELAND MANAGEMENT**

Grazing allotments exist on all of the five proposed RD&D tracts. Fences erected at the sites to provide for safe and efficient work space would preclude grazing on approximately 550 acres. Impacts to a total of 126,490 AUMs would be less than 1 percent of the entire WRRRA.

Changes made to rangeland improvements on one of the proposed lease tracts would include relocation of an existing fence and modification of a stock watering reservoir for use in stormwater management. These rangeland modifications, as planned, are not likely to interfere with the control of cattle at that location. Cumulative grazing allotment losses may cause a reduction in livestock numbers, and replacement forage may need to be identified. Reasonably foreseeable projects may result in the cumulative reduction of available livestock forage, and impacts to rangeland improvements could interfere with the control of cattle and the proper utilization of the rangeland resource.

## **REALTY AUTHORIZATIONS**

The Proposed Actions all have other existing and proposed projects within, adjacent to, or crossing them. These include natural gas wells, water and gas pipelines, utilities, roads, and a vegetation research plot. Some of the existing facilities would need to be relocated to another area to allow for safe and efficient construction and operation of the proposed Oil Shale RD&D facilities and would require acquisition of additional Rights-of-way. This would amount to an increase in surface disturbance within that area. Cumulative impacts could result as multiple project requests within existing parcels of land become more frequent as energy development expands within the WRRRA. Additional realty authorizations would be required to accommodate this increase, and the demand for authorization management would rise.

## **RECREATION**

The Proposed Actions all occur within the White River Extensive Recreation Management Area (ERMA) of which the BLM has custodial management to provide for unstructured recreation activities and a diversity of outdoor recreation opportunities. The primary recreational uses in the area of the Proposed Actions include hunting, dispersed camping, hiking, bike riding, horseback riding, wildlife viewing, and off-highway vehicle (OHV) use. The Proposed Actions would result in a potential long-term loss of up to 800 acres of recreational lands. The public would be less likely to recreate in the vicinity of the proposed RD&D facilities and would be dispersed elsewhere. Cumulatively, increased development in the WRRRA would reduce lands available for recreation, and would impact the recreational experience sought by those desiring a natural appearing environment with low interaction between users.

Increased use of existing roads by oil and gas operators and other reasonably foreseeable project proponents would increase the probability of encountering the sights and sounds of human activity, and would likely disperse recreationists to other locations. This would also contribute to the dispersal of big game and would impact hunting activities along these corridors. This could affect the service, retail, and public interests of local communities in the region that depend on the hunting season and recreational tourism for a substantial portion of their yearly revenues.

## **SOCIO-ECONOMICS**

The cumulative impact assessment area for socio-economics includes Rio Blanco, Garfield, and Mesa Counties since these counties would provide the workforce for the Proposed Actions, and would receive the tax and royalty income generated by reasonably foreseeable oil and gas projects within the White River Resource Area. The five proposed oil shale RD&D projects would contribute to the development of mineral resources in the Piceance Basin, and would be a factor in the ongoing socio-economic change throughout the region.

The Proposed Actions along with present and future oil and gas production activities in the Piceance Basin would contribute to additional employment opportunities throughout the region and would expand the local tax base as workers move into the area and purchase homes, land, goods and services. Although federal royalties have been waived for the duration of the proposed RD&D program and rents have been waived for 5 years, reasonably foreseeable future oil shale development would ultimately contribute to Colorado Local Government Energy Impact Programs, and increased oil and gas production in the WRRRA will continue to contribute federal royalties, bonuses, rents, and severance tax revenues to the local governments impacted by energy development. These impacts would be considered beneficial to local communities in the region.

The social infrastructure of the cities and counties affected have not been able to keep pace with the rapid growth in the oil and gas industry and demands upon law enforcement, emergency response, community services, and road and bridge maintenance have increased substantially. Aging facilities are at, or near, capacity, transportation networks and community services are in need of upgrading and/or repair, and current staffing is not adequate for managing the increased activity. This creates a financial and logistical burden on local governments attempting to maintain the level of service expected within their communities, while at the same time are under increasing pressure to provide the needed services in more remote locations such as the Piceance Basin. The proposed oil shale RD&D projects would contribute to these demands on local services.

The surface disturbance resulting from construction of the proposed oil shale facilities, along with present, and future oil and gas activities could have an effect on the economic viability of the ranching and recreation industries in Rio Blanco County. The cumulative loss of forage for livestock and big game could result in a reduction in livestock numbers and the dispersment of deer and elk away from traditional hunting grounds in the area.

Other recreational activities could be dispersed to more isolated locations as the Piceance Basin becomes more developed. The changes in the natural landscape of the White River Resource Area brought about by development could contribute to a decline in the economic benefits generated by these industries. Implementing reclamation activities as required to re-establish vegetation in disturbed areas, limiting new road and facility construction to existing corridors, and adhering to visual resource management stipulations to diminish the sights and sounds of human activities would minimize the cumulative impacts to these industries.

The White River Resource Area RMP/ROD (BLM 1997) included oil shale research as reasonably foreseeable in its cumulative impact analysis. Current development in the WRRRA,

including the actions proposed, has not exceeded the foreseeable development analyzed in the RMP/ROD. However, oil shale development beyond the proposed RD&D program together with the expansion of oil and gas development in the Piceance Basin could result in broad impacts to the communities of northwestern Colorado. Although the BLM has not made the decision to allow oil shale development on a commercial scale, the leasing of oil shale lands for this purpose is a reasonably foreseeable future prospect. Should the proposed RD&D projects prove to be successful in developing efficient methods for shale oil extraction, the processes would likely generate interest from other oil and gas producers and new development could expand quickly on both public and private lands in Colorado, as well as in Utah and Wyoming. Rapid development of oil shale, and concurrent oil and gas operations, in northwestern Colorado could change the rural/agricultural character of remote energy producing regions into a more industrial environment.

Construction of new roads, pipelines, utility corridors, and production facilities would introduce additional human activity to relatively undisturbed areas, and an increase in local populations would likely result from the promise of high-paying jobs in the energy industry. Traffic on local roads could be expected to grow and facility maintenance and service needs would insure that relatively high levels of traffic are sustained.

The smaller communities in the region would experience the greatest impact resulting from sudden population growth. Meeker, Rangely, Parachute, DeBeque, and Rifle do not presently have sufficient housing, emergency response capabilities, community services, or correctional facilities to accommodate a substantial population increase, and city and county governments in the area are reluctant to increase spending on community services and housing requirements for energy production growth as a result of previous experience with the historic boom and bust cycles associated with the oil and gas industry. Other communities in the region, such as Grand Junction, are capable of meeting the social demands of a large workforce, but would be impacted to some degree by the problems associated with population growth, such as crime and drug use. On the other hand, managed growth is necessary to sustain local economies. Local governments benefit from the increase in tax revenues to support schools, hospitals, and community services. Sustained growth brings with it the addition of new business in the retail, service, and public sectors which provide jobs, lowers unemployment rates, increases productivity, and maintains the health and vitality of a community.

The decision to allow commercial-scale oil shale development is contingent upon the assurance that today's extractive technologies are able to operate economically, and at an environmentally acceptable level, before conversion to commercial operations is considered. The pilot RD&D program would be designed as a small-scale, carefully staged, research and development project that would enhance the collective knowledge of the oil shale resource and evaluate its potential as a future domestic energy supply. A Programmatic Environmental Impact Statement is currently being prepared by the BLM to address the foreseeable commercial-scale oil shale leasing, and in response to the increase in oil and gas drilling activity, the BLM will prepare a Resource Management Plan Amendment/EIS beginning later this year. The cumulative impacts of the industry on the social infrastructure in the WRRRA, including the Piceance Basin, will be further analyzed in that RMPA/EIS.

## **VISUAL RESOURCES**



AO	Authorized Officer
APCD	Air Pollution Control Division
APD	Application for Permit to Drill
AQRV	Air Quality Related Values
AUM	Animal Unit Months
BACT	Best Available Control Technology
BLM	Bureau of Land Management
BMP	Best Management Practice
CAAQS	Colorado Ambient Air Quality Standard
CDOLA	Colorado Department of Local Affairs
CDOLE	Colorado Department of Labor and Employment
CDPHE	Colorado Department of Public Health and Environment
CDWR	Colorado Division of Water Resources
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COE	Corps of Engineers
COGCC	Colorado Oil & Gas Conservation Commission
CRBSCF	Colorado River Basin Salinity Control Forum
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
FLPMA	Federal Land Policy Management Act
FMAP	Fire Management Activity Plan
GRA	Geographic Reference Area
HMA	Herd Management Area
MBTA	Migratory Bird Treaty Act
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OHV	Off-Highway Vehicle
PEIS	Programmatic Environmental Impact Statement
PIF	Partners in Flight
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RD&D	Research, Development & Demonstration
RMP	Resource Management Plan
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	Right-of-Way
RVA	Remnant Vegetation Associations
SCS	Soil Conservation Service
SPM	Semi-Primitive Motorized
SSS	Special Status Species
SWMP	Stormwater Management Plan
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
VOC	Volatile Organic Compound
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VRM	Visual Resource Management
WQCC	Water Quality Control Commission
WQCD	Water Quality Control Division
WRCC	Western Regional Climate Center
WRFO	White River Field Office
WRRR	White River Resource Area

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The following agencies were consulted, formally and/or informally through personal discussion, during preparation of this document.

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Colorado Division of Wildlife  
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