

2.0 Chapter 2: Proposed Action and Alternatives

PRI proposes to develop in-situ recovery of uranium within the Reynolds Ranch mining area located adjacent to and north of the existing Smith Ranch-Highland Uranium Project in the southern portion of the Powder River Basin in western Converse County, Wyoming (figure 1-1). The Reynolds Ranch area would be an expansion of the Smith Ranch-Highland Uranium Project area with portions of the project area covered under a separate permit issued by BLM. Adding REY to the SR-HUP project allows PRI to maintain current production levels over time as the SR-HUP area uranium resource is depleted. The Reynolds Ranch project has been licensed by the NRC under source material license SUA-1548 and encompasses approximately 8,280 acres.

Approving the project would result in development of the federal mineral estate and the disturbance of public lands administered by the BLM. Under 43 CFR 3809, mining operations that perform more than “casual use” activities on five or more acres of public lands must submit a plan of operations to BLM for review and approval. That plan of operations (June 2009) is available upon request from the CFO; a synopsis of the POO, NRC permit, and the WDEQ/LQD permit to mine is presented in section 2.1.3. The Proposed Action is described in section 2.1.

In addition to the Proposed Action, this EA analyzes the No Action Alternative. Under that alternative, development of the wellfields on BLM-administered public land would not be allowed. Section 2.2 contains a description of the No Action Alternative.

Under the rules and regulations, mines are required to collect extensive baseline information and to implement extensive monitoring programs and mitigation measures. The currently approved permits to conduct mining operations for the Smith Ranch-Highland Uranium Project include these requirements. Monitoring programs and mitigation measures that are required by regulation are considered part of the Proposed Action and the alternatives considered in this EA. These data collection requirements, mitigation plans, and monitoring commitments would be extended to include mining operations on the Reynolds Ranch addition if it is permitted for mining.

Other alternatives considered but eliminated from detailed analysis and rationale for eliminating them in accordance with 40 CFR 1502.14 are discussed in section 2.4.

2.1 ALTERNATIVE I - Proposed Action

2.1.1 Summary of Proposed Action

The Proposed Action is that portion of the Reynolds Ranch project that would take place on BLM-administered surface, if approved by the BLM. The project would be constructed in multiple sections within townships 36 and 37 north, ranges 73 and 74 west, 6th Principal Meridian in Converse County, Wyoming (table 2-1 and figure 2-1) within the administrative boundary of the BLM’s Casper Field Office. The project is located along Ross Road approximately 30 miles northwest of Douglas, Wyoming and northeast of Glenrock (figure 1-1). The POO provides a complete description of the Reynolds Ranch project as a whole, including the Proposed Action.

**Table 2-1
Reynolds Ranch Proposed Action - Surface Ownership Within the Reynolds
Ranch Project Area (derived from figure 2-1) Monitoring Well Rings**

Aliquot Area	Ownership (acres)				Acres Inside Monitoring Well Rings			
	BLM	State of WY	Fee	Split Estate	BLM	State of WY	Fee	Split Estate
T. 36 N., R. 73 W.								
SEC. 5	-0-	-0-	-0-	240	-0-	-0-	-0-	-0-
SEC. 6	40	-0-	-0-	600	-0-	-0-	-0-	-0-
SEC. 7	-0-	-0-	320	-0-	-0-	-0-	-0-	-0-
SEC. 17	-0-	-0-	360	120	-0-	-0-	-0-	-0-
SEC. 18	-0-	-0-	320	320	-0-	-0-	-0-	-0-
T. 36 N., R. 74 W.								
SEC. 1	-0-	-0-	80	560	-0-	-0-	-0-	148.403
SEC. 2	-0-	-0-	160	320	-0-	-0-	-0-	160.200
SEC. 11	-0-	-0-	320	160	-0-	-0-	-0-	21.900
SEC. 12	-0-	-0-	40	600	-0-	-0-	29.344	6.702
SEC. 13	-0-	-0-	-0-	320	-0-	-0-	-0-	-0-
SEC. 14	-0-	-0-	40	200	-0-	-0-	-0-	-0-
T. 37 N., R. 73 W.								
SEC. 30	-0-	-0-	240	240	-0-	-0-	108.548	104.539
SEC. 31	40	-0-	120	400	-0-	-0-	52.002	127.462
SEC. 32	-0-	-0-	-0-	160	-0-	-0-	-0-	-0-
T. 37 N., R. 74 W.								
SEC. 25	-0-	-0-	120	80	-0-	-0-	11.941	-0-
SEC. 26	400	-0-	80	-0-	91.149	-0-	58.383	-0-
SEC. 35	240	-0-	400	-0-	161.019	-0-	148.913	-0-
SEC. 36	-0-	640	-0-	-0-	-0-	191.633	-0-	-0-
TOTAL (8,280)	720	640	2,600	4,320	252.169	191.633	409.131	569.206
* Stock Grazing Homestead Act split estate lands w/ surface owner agreements in place.								

PRI anticipates developing eight wellfields in the project area; three of which would affect BLM-managed surface. For purposes of this analysis, the affects of the Proposed Action are defined as those actions taking place on BLM surface. Surface-disturbing activities on BLM lands would include injection, recovery, and monitoring well installation, construction of primary and

secondary access roadways, wellfield header houses, pipeline/utility trenches, and power lines. Figure 2-1 illustrates the project area and the proposed location of new facilities and infrastructure relative to BLM-administered surface. The area within the wellfield monitoring well rings on BLM surface would comprise approximately 252 acres; of this, approximately 34.57 acres would be short-term disturbance. Life-of-project disturbance (power lines, roads, header houses, and well pads) would affect approximately 11 acres of the BLM surface. The total surface disturbance resulting from the implementation of the Proposed Action would be approximately 45.6 acres of BLM-administered lands (table 2-2).

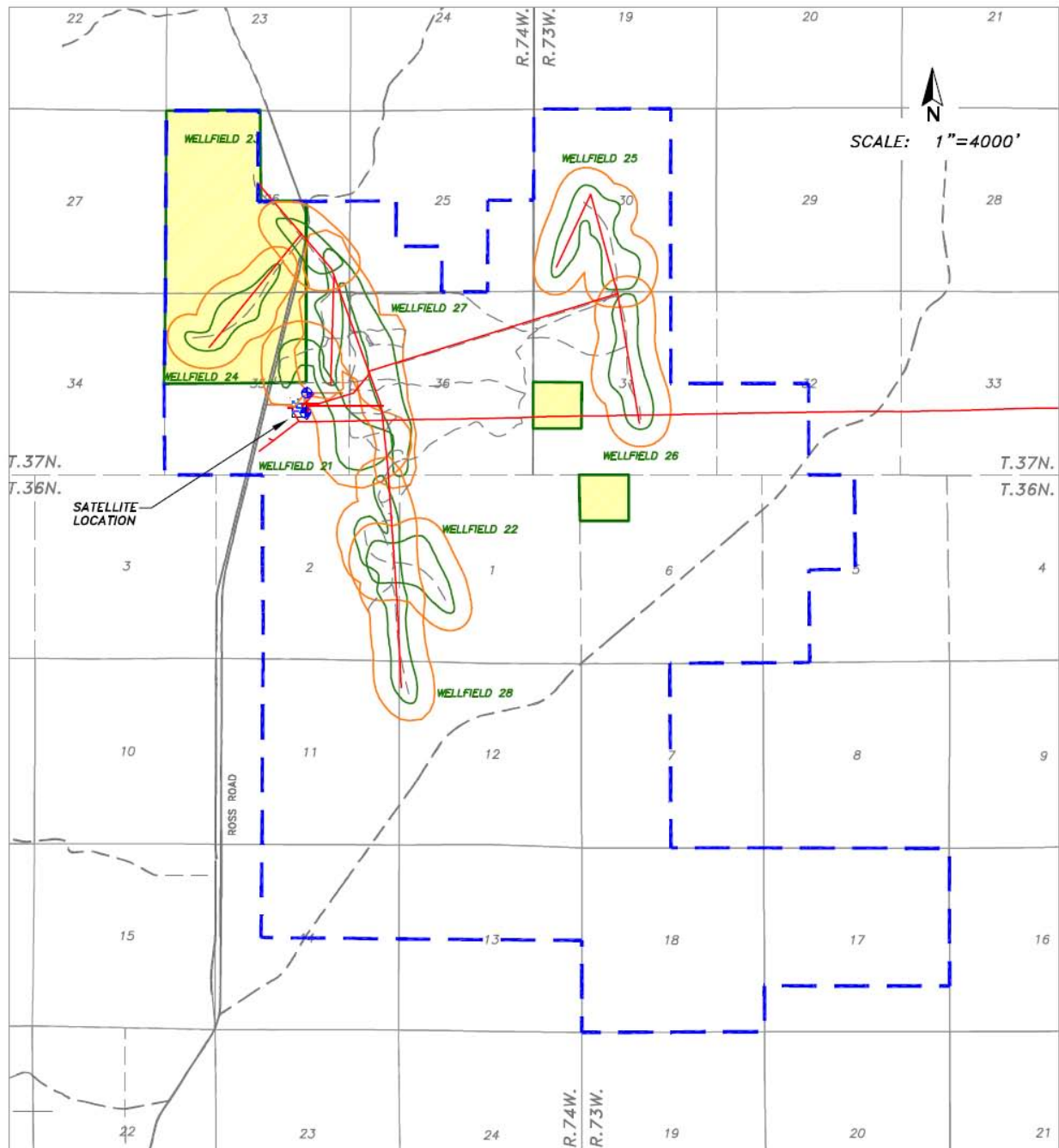
The project area encompasses approximately 8,280 acres, of which approximately 4,320 acres are split estate (private surface overlaying federal minerals), 726 acres are BLM surface and minerals, 2,600 acres are fee lands and minerals, and 640 acres are state lands (figure 2-2). Approximately 8.8% of the surface estate in the project area is managed by the BLM, 83.5% privately owned, and 7.7% state, while the mineral estate is 61.2% federal, 31% private, and 7.7% state. The numbers provided above vary slightly from those provided in the plan of operations (POO) and scoping notice (BLM 2008e) due to errors in ownership designations in the previous mapping and the difference realized when calculating areas using AutoCAD versus aliquot description.

For the projected 15-year operational life of the project, approximately 11 acres of BLM-administered surface would be completely removed from wildlife habitat use until final reclamation. This represents less than 1% of the total project acreage (table 2-2). Wellfields would be fenced to prohibit livestock entry. At the end of the project, the entire project area would be returned to the pre-ISR mining use of wildlife habitat and livestock grazing.

**Table 2-2
Anticipated Surface Disturbance by Surface Ownership**

Disturbance Area	Total Acres Impacted	BLM Surface (Proposed Action)	Split Estate (Stock Raising Homestead Act Lands)*	State	Private Surface and Subsurface
Wellfields	275.16	34.57	121.48	40.71	78.40
Facilities/Roads	113.59	11.07	26.95	38.79	36.78
Total	388.75	45.65	148.43	79.50	115.18
* All split estate lands covered with landowner consent agreements.					

Figure 2-1: Reynolds Ranch Project Area Well Field Development and Infrastructure Plans



LEGEND

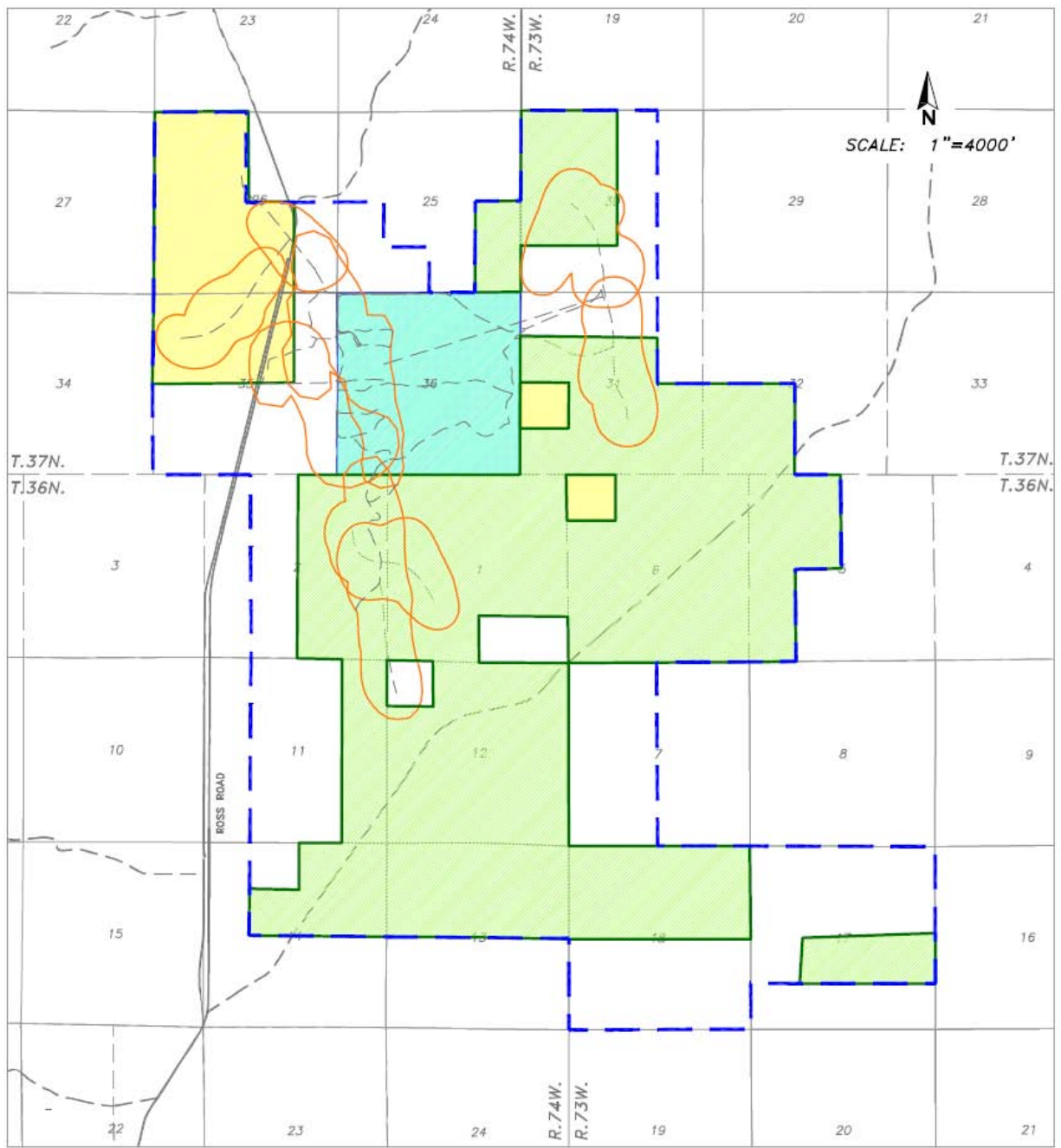
- | | |
|-------------------|-----------------------------|
| UTILITY CORRIDORS | PERMIT BOUNDARY |
| PAVED ROADS | ORE BODY OUTLINES |
| GRAVEL ROADS | MONITOR WELL RINGS |
| WATER WELLS | BLM SURFACE/PROPOSED ACTION |

NOTE:
PIPELINES AND POWER LINES ARE LOCATED WITHIN THE UTILITY CORRIDORS.

POWER RESOURCES, INC. dba
CAMECO RESOURCES
REYNOLDS RANCH MINE OPERATION PLAN
PROPOSED MINE PLAN LAYOUT

T.36,37N., R.73,74W.
CONVERSE COUNTY, WYOMING

Figure 2-2: Reynolds Ranch Project Area Land Ownership and Wellfield Development Areas



LEGEND

- | | | | |
|--|-----------------------------|--|---|
| | PAVED ROADS | | PRIVATE SURFACE/PRIVATE MINERAL |
| | GRAVEL ROADS | | PROPOSED DEVELOPMENT AREAS (MONITOR WELL RINGS) |
| | STATE LAND | | PERMIT BOUNDARY |
| | BLM SURFACE/BLM MINERAL | | |
| | PRIVATE SURFACE/BLM MINERAL | | |

POWER RESOURCES, INC. dba
 CAMECO RESOURCES
 REYNOLDS RANCH MINE OPERATION PLAN
 OWNERSHIP MAP
 T.36,37N., R.73,74W.
 CONVERSE COUNTY, WYOMING

2.1.2 Pre-Construction Activities - Permitting

NRC and WDEQ/LQD Pre-Construction Permitting

Regardless of surface or mineral ownership, prior to commencing operation of an in-situ recovery project in Wyoming, the operator must obtain a permit to mine from the WDEQ/LQD. Additionally, because Wyoming is not a NRC agreement state, a source material license or an amendment to an existing license must also be obtained from the NRC. Other state of Wyoming permits, such as an air quality permit, a storm water discharge permit, well permits, etc., are also required and must be obtained prior to project start-up.

Development, production, restoration, and reclamation activities are described in detail in the WDEQ/LQD permit to mine and the NRC applications. WDEQ/LQD is currently reviewing an amendment to the existing permit to mine and project approval. The LQD permit to mine is incorporated by reference and is essentially the same as the NRC source material license application.

The WDEQ/LQD and NRC authorizations affect the Reynolds Ranch project regardless of surface or mineral ownership but do not authorize activity on federal lands. Therefore, these authorizations would control the activities undertaken at Reynolds Ranch should BLM select the No Action Alternative. By selecting this alternative BLM would not allow development on federal lands but have no influence over the rest of the Reynolds Ranch project.

BLM Approval Process

As the Proposed Action would affect public lands administered by the BLM, that agency has an obligation under 43 CFR 3809 and the NEPA to review the POO and assure that no unnecessary and undue degradation would occur. A MOU between the WDEQ/LQD and BLM provides for the WDEQ/LQD to have lead review responsibility for analyzing information regarding landowner interests other than the BLM, and analysis of impacts related to climatology, hydrology, overburden, soils, vegetation, wildlife, and wetlands. A copy of the BLM/LQD MOU is included as attachment A of the June 2009 POO. BLM requires the project proponent to comply with all applicable state and federal regulations. While the WDEQ/LQD analyzes and permits the entire project, the BLM also analyzes the Proposed Action as it affects federal lands.

The BLM is responsible for analyzing affects to archaeological and paleontological resources, noxious weed issues, NEPA concurrence, and special status species under the Endangered Species Act by actions that occur on public lands. BLM CFO provided a list of resource issues to PRI that must be addressed through the NEPA process for the proposed project that were not addressed, or not addressed fully, in the NRC Reynolds Ranch EA. The in-situ uranium development issues addressed by the two federal agencies differ because of their different missions and authorities. BLM's NEPA review of the Proposed Action is not meant to duplicate the NRC NEPA review and EA performed as part of its licensing process. The NRC EA evaluated potential impacts associated with construction, operation, aquifer restoration, and decommissioning of the project. It also addresses resource issues identified by BLM and the

public, relative to BLM's resource responsibilities. The NRC's EA is incorporated by reference to this EA.

PRI submitted a POO for BLM review and public comment in 2008. The BLM initiated public scoping on the project in July 2008. The BLM determined that the 2008 POO was deficient, thus, a revised POO was provided to BLM in June 2009, and an addendum to the 2009 POO was provided March 2010. Mitigation measures such as concurrent reclamation, reseeding, and erosion control are contained in the Proposed Action. Additional mitigation measures to be applied to address resource issues not adequately addressed in the POO are identified in this EA. If determined to be appropriate, the BLM approval of planned operations would be authorized in accordance with 43 CFR 3809.415 and .420.

2.1.3 Synopsis of Plan of Operations

Commercial uranium ISR production has been practiced since the mid 1960s in the United States and is currently the leading extraction technology for uranium production in this country. Chapters 3 and 4 of the WDEQ/LQD permit to mine provide a detailed description of the ISR process. The primary advantages of ISR over conventional mining include: (1) limited surface disturbance when compared to open pit mining; (2) reduced long-term environmental impacts; (3) lower capital costs; and, (4) the ability to mine low-grade ores that would be unrecoverable using open pit or underground mining techniques.

PRI proposes to extract uranium oxide (U_3O_8 or yellowcake) using the proven in-situ recovery process over an anticipated project life of 15 years from eight wellfields in the Reynolds Ranch project area. Three of these wellfields would be partially or fully on BLM-administered surface. The proposed uranium recovery areas, called wellfields or mine units, are indicated on figure 2-1. The surface disturbance would be limited to the construction of injection, recovery, and monitoring wells, access roads, various pipelines, and power lines, header house buildings, and associated wellfield equipment lay-down or staging/storage pads. These lay-down or staging areas are used to maintain supplies of equipment at centrally located.

ISR involves the use of conventional water wells and a leaching solution, called a lixiviant, to extract the uranium without physically removing the ore bearing strata. The lixiviant consists of native groundwater to which an oxidant, such as oxygen, has been added to make the uranium soluble in the groundwater and a complexing ion, such as carbon dioxide, with which the uranium combines allowing it to be carried in the groundwater to the surface. The resulting uranium-rich solution would be drawn to production wells where it is pumped to the surface and then transferred to the satellite ion exchange facility. At the satellite facility, the ore-bearing fluid is put through the ion exchange columns where the uranium is extracted from the solution on to resin beads. The leaching solution is then recharged with the oxidant and reinjected to recover additional uranium from the wellfield.

The uranium-loaded resin would be transported to the Smith Ranch Central Processing Plant (CPP) and/or the Highland Central Processing Facility where it is stripped and processed into yellowcake. The stripped resin would be returned to the satellite facility for reuse.

After economic recovery of a mine unit has been reached, lixiviant injection is discontinued and groundwater restoration is started. Groundwater restoration is accomplished using a combination of techniques that may include groundwater sweep, treatment of groundwater by reverse osmosis with reinjection, bioremediation, or chemical reductant addition to precipitate heavy metals back into the formation. Groundwater restoration is discussed in detail in chapter 6 of the WDEQ/LQD reclamation plan of the permit to mine.

2.1.3.1 Delineation Drilling and Wellfield Construction

In addition to the overall WDEQ/LQD project permitting and NRC licensing process, PRI must geologically and hydrologically assess, and LQD must approve, each individual mine unit or wellfield prior to lixiviant injection. Conceptually, mine unit 27 would be the first of the eight wellfields to undergo this evaluation and approval process. This process generally takes place after permit approval and is independent of the permit to mine. The wellfield assessment and permitting process is detailed in chapters 3, 4, and 5 of the LQD mine permit application. The following is a general discussion of proposed construction techniques to be used by PRI when implementing the Proposed Action. These construction techniques would be applicable to all activities, including drill sites, pipelines, and access roads within the project area but may vary in detail between the individual wellfields and well sites.

Delineation Drilling

The irregular shape, distribution, and grade of the uranium deposits require that a considerable amount of delineation (exploratory) drilling be performed to determine ore reserves and provide the information needed to design and engineer a wellfield for development. The surface disturbance footprint for each delineation borehole would be approximately 800 square feet. Each borehole would be geophysically logged, plugged, and abandoned in accordance with state and federal requirements before the next hole is drilled. Drilling mud pits would be protected from human and animal intrusion until the contained fluid has been removed or has evaporated, after which the pits would be backfilled and reclaimed according to regulations.

Wellfield Construction

Surface disturbance within the project area would not occur all at once but in sequence over several years depending on the uranium production rate. Mine units are approved individually. Between permitting, aquifer testing, pump testing, monitor well installation, wellfield installation, wellfield development, and interim surface reclamation each unit would take up to a year and a half to complete.

PRI plans to keep soil disturbances caused by the mining operation to a minimum. In accordance with WDEQ/LQD requirements, topsoil would be salvaged from building sites (for example, the satellite building), permanent storage areas, main access roads, and staging sites. The salvaged topsoil would be stockpiled, seeded to minimize erosion, and later reapplied as needed during reclamation. PRI estimates that a maximum of 22.5 acres of topsoil would be so treated throughout the lifetime of the Smith Ranch-Highland Uranium Project and Reynolds Ranch operations (NRC application and WDEQ/LQD permit, chapter 6).

Generally, access roads are only constructed to the header houses while existing two-track or cross-county travel is used to access injection, production, and monitoring wells. These efforts are intended to avoid establishing permanent roads in the area and to reduce overall surface disturbance. With the exception of the header houses and access roads, all disturbed areas within each wellfield would be reclaimed and seeded following wellfield development. These areas would be available for wildlife use during uranium production activities. Although the exact location of all surface-disturbing activities that are projected to occur within the eight identified wellfields is unknown, the nature and extent of such disturbances would be similar to what has been implemented in the other wellfields of the SR-HUP uranium project.

Current estimates of surface disturbance resulting from the development of mine units 21 through 28 are found in the POO. This disturbance estimate would be the outcome of wellfield injection and production well installation, the construction of header houses, access roads, installation of utilities (power lines, pipelines, fiber optic cable, etc.), and wellfield storage pads. These estimates were derived by determining the area of the orebody and assuming 49.8% of the wellfield area would be disturbed by well development operations. Additional disturbance features, which would occur outside the wellfields, include linear disturbances such as pipelines, power lines, fiber optics lines and access roads as well as infrastructure features including the satellite facility, deep injection well, equipment storage pad, and monitoring wells.

Life of project (LOP) disturbance for those areas not undergoing interim reclamation and remaining un-vegetated until decommissioning (i.e. roads) and final reclamation takes place following groundwater restoration, is approximately 11 acres.

The actual number of pilot holes and wells may change as wellfield development progresses; roughly, 50 to 55 wells are connected to each header house. The number of header houses needed to develop the uranium in a wellfield is determined by the size, shape, and complexity of the orebody.

Well Drilling and Completion

Several types of wells would be installed at the project site--injection wells, production wells, and monitor wells. Injection and recovery wells in a wellfield are completed in the mineralized intervals of only one production zone at any one time. Injection and recovery wells are completed in a manner that isolates the open hole or screened ore-bearing interval from all other aquifers; this is described more fully in the POO.

Monitor wells would be installed to detect migration of mining fluids, both vertically and horizontally. Monitor wells would be located in the production zone in a ring around the wellfield units to monitor the ore-bearing zone to detect horizontal movement of mining fluids. These monitoring wells would be installed at a well spacing of 500 feet between monitor well and production patterns. Monitor wells installed in the overlying and underlying aquifers at a density of one for each three acres of wellfield area would detect vertical movement of mining fluid. The distance between overlying or underlying monitor wells in the same zone would not exceed 1,000 feet and would be installed within the confines of the wellfield unit area.

Pilot holes for production and injection wells would be drilled through the target completion interval with a small rotary drilling unit using native mud and a small amount of commercial drilling fluid additive for viscosity control. The hole would be logged, reamed, casing set, and cemented to isolate the completion interval from all other aquifers. The cement would be placed by pumping it down the casing and forcing it out the bottom of the casing and back up the casing-drill hole annulus to the surface. The pilot holes would be large enough in diameter to provide at least three inches of annulus space per regulation. The POO contains a typical well completion schematic. After the well is cemented to the surface and the cement has set, the well would be drilled out and completed either as an open hole or fitted with a screen assembly (slotted liner), which may have a sand filter pack installed between the screen and the under-reamed formation.

Production, injection and monitoring wells would undergo mechanical integrity testing (MIT) following well completion; class 3 wells (injection wells) would undergo MIT every five years thereafter to evaluate the continuing integrity of the well casing. If a well does not meet the mechanical integrity criteria, the casing would be repaired and the well re-tested. If the well passes the subsequent MIT, it would be placed back in service; if a well cannot be repaired, it would be plugged. The NRC, WDEQ/LQD, and BLM maintain records documenting all MITs for review. An inventory of wells tested and results are provided to the WDEQ/LQD in quarterly reports (LQD permit, chapter 3).

Pipeline, Utility, and Access Road Construction Corridors

During the wellfield development phase, power line installation, pipeline construction, and road construction could result in full use of a 72-foot corridor in various portions of the project. However, use of the full corridor would be rare and limited to the construction phase. Main or primary access roads have a driving surface limited to 20 feet while secondary access roads have a driving surface of 12 feet. Reclamation would be necessary on the pipeline corridors, under the power lines, and on 30 to 38 feet of the access road. For the surface disturbance analysis, a 72-foot wide area of short-term disturbance was assumed for the roads and adjacent utilities with a 22-foot reclamation width resulting in a 20-foot wide LOP disturbance. Surface disturbance calculations for the two-track roads were estimated at 20 feet short-term disturbance. Electrical utilities and fiber optics to each individual injection and recovery well and the header house would be buried with the wellfield piping, but overhead power lines would be installed between wellfields and tied into each header house. These power lines would be located along roads as much as possible. Piping from the header house to the satellite ion exchange facility would also be located along roads as much as possible, but it could also be located along a more direct path between these structures. The corridor for these pipelines is estimated at a width of 20 feet total disturbance.

Pipelines/Utilities

The wellfields would consist of groups of injection and production well patterns typically arranged with four corner injection wells and a central production well per pattern (five spot injection/production layout). Small groups of injection and production wells would be piped to central distribution centers, called header houses, where oxidant would be added to the injection

fluid. Fluids would be conveyed between the satellite facility and wellfield header houses through buried pipelines. Pipelines, power lines, and fiber optics lines would be constructed in the same corridor and adjacent to wellfield access roads to the extent possible.

Access Roads

Access to and from the project area would be via existing roads and two-tracks with primary access being by the Ross Road (Converse County Road 31), which is paved and designed for two-way traffic, including large trucks. The uranium loaded resin beads from the ion exchange column at the satellite facility would be trucked 6 miles to the south down Ross Road to the SR-HUP central processing facility. Stripped resin beads would be returned via truck to the satellite facility for re-use.

The access road from Ross Road to the satellite facility would not be paved. Secondary roads, which provide access to the header houses, are designed for light use. Both primary and secondary access roads would use culvert crossings at all significant drainages. Figure 2-1 indicates the approximate location of access roads that would be constructed for the REY addition. As each mine unit is delineated, designed, and developed, additional secondary access roads would be required to provide access to and from the header houses. These access roads would be, to the extent feasible, located over or immediately adjacent to the utility corridors (power lines and pipelines). Two-track roads would be used to access individual wells to avoid establishing additional roads in the project area. To the extent possible, existing roads would be used when traveling within the Reynolds Ranch area; however, PRI has stated that it would need to construct access roads through the area (NRC application and EA).

PRI would control the activities of drilling and project development contractors to specified disturbance corridors in an effort to minimize surface disturbance. PRI would also prohibit travel during periods when severe rutting (creation of ruts in excess of 4" deep) or resource damage might occur.

The locations of the proposed roads have been placed to maximize transportation efficiency and reduce redundancy. Roads would be closed and reclaimed by PRI when they are no longer required for operations, unless otherwise directed by the regulatory agency or at the request of the landowner. Project-related traffic during wellfield production operations would be significantly less than that required during the construction and wellfield development phase. A more detailed discussion of access road construction and use is contained in the POO.

2.1.3.2 Public Safety

The NRC license requires PRI to post notices to the public stating that permission must be obtained to enter the mining areas and giving information on how to obtain that permission. This permission includes personal protective equipment and an escort. Some areas of the SR-HUP are off limits to persons without specific training. PRI and the landowners would allow access during hunting season, and additional signage would be posted. Field personnel would also make frequent field visits as an added safety precaution. The CPP and satellite facilities are

operated 24 hours a day, are secured, and controlled using locks. Some newer header house buildings are monitored using surveillance cameras.

Chapter 3 of the NRC permit application and the NRC source material license state that the public would be protected from exposure to radiologic material by applying equipment control and work practices. PRI maintains a detailed environmental and radiological program to monitor any releases from the SR-HUP and Reynolds Ranch operations to the environment. The program scope encompasses monitoring of air, groundwater, surface water, and direct radiation. The program is designed to meet the requirements of NRC's 10 CFR 40.65.

2.1.3.3 Water Management Plans

Water management is critical to the project, as water is needed for all aspects of the recovery and restoration processes. All water used at the project would be obtained from groundwater sources appropriated in accordance with state requirements. The primary water uses at the project would be drilling water, mine unit production bleed (0.5 – 1.5% of the production volume), groundwater restoration bleed (20-25% of the production volume), and reverse osmosis make-up water. Mine unit groundwater restoration would consume the greatest volume of water. Process water recycling and wastewater minimization programs would be employed at the project in an effort to minimize the volume of water to be disposed. Wastewater disposal would occur through deep well injection. Details concerning the water management plans, including water balance calculations, treatment and disposal facilities, and surface water management plans are provided in chapters 4, 5, and appendix D-6 of the LQD permit.

The project-wide environmental groundwater-monitoring program includes quarterly monitoring of operating domestic and stock wells located within 1 km of operating wellfields. Water samples would be obtained from these wells and analyzed for uranium and radium-226. Groundwater monitoring sites near proposed wellfields would be added to the monitoring program once operations commence.

2.1.3.4 Ancillary Facilities

Each wellfield would contain a number of header houses, injection, monitoring, and production wells, and an equipment-staging pad. Bulk carbon dioxide and oxygen, or sodium bi-carbonate, may be stored in compressed form in the wellfield. Bulk cement would be stored in the field in portable silos. Figure 2-1 indicates the approximate location of the satellite and deep injection well facility, access roads, pipelines, and power/utility corridors for the project. The specific locations of the individual wells, header houses, and staging areas have not yet been determined. The satellite and deep injection well facility are located on private land within the project area.

2.1.3.5 Workforce and Traffic

During wellfield development, the workforce and traffic associated with the project would be diverse and would include the greatest number of persons. Construction operations would occur only during daylight hours. Trades that would be represented include dirt contractors, electricians, wellfield maintenance and construction crews (installing pipelines, header house

structures etc.), well drillers (using truck-mounted rotary drilling rigs) and wellfield operation crews (pump installation, well swabbing, MIT, etc.), water truck drivers, surveyors, reclamation crews, and operations supervisors.

Water for drilling operations would be hauled from water wells in the project area that have been permitted through the Wyoming State Engineer's Office (WSEO) for industrial use. The equipment and supplies needed for completion of these activities would be stockpiled at various times and places until wellfield development was completed. Staging areas would be used to maintain supplies of equipment at centrally located sites in an effort to minimize the traffic throughout the project area and on Ross Road.

Operations and wellfield maintenance activities would begin once field development activities were completed, and the wellfield put into production. Ancillary equipment that would be used in the wellfield production operations would include truck mounted pump pulling units, trailer mounted hose reels, electrical generators, trenchers, backhoes, light duty 4-wheel drive vehicles, and 4-wheel all terrain vehicles. Downhole well maintenance operations would include the use of truck mounted pulling units and contract well drillers, as needed. Cement is used continually during wellfield development and in operations; cement silos would be staged as needed in the areas being developed. The volume of cement needed and the number of loads of cement delivered monthly would vary depending on drilling and abandonment activity levels. The uranium-loaded resin beads from the ion exchange column at the satellite facility would be trucked to the SR-HUP central processing facility. Stripped resin beads would be trucked back to the satellite for re-use.

Carbon dioxide and liquid oxygen would be delivered to various sites in the project area on a regular basis once wellfield development is completed. CO₂ would be delivered twice a week, while O₂ would be delivered four to six times a month; sodium bi-carbonate may also be used.

2.1.3.6 Restoration, Reclamation, and Decommissioning

Groundwater Restoration

Following uranium recovery in each mining unit, PRI would ensure that groundwater was restored to premining conditions. The goal of groundwater restoration is to return the aquifer to the baseline conditions that existed prior to the start of uranium recovery; or, if approved, to a secondary standard of premining "class of use." This secondary restoration standard is to return the groundwater to a quality of use that it was suitable for prior to mining. Restoration would involve groundwater sweep, clean water injection, and geochemical stabilization of the aquifer with a reductant. A full description of groundwater restoration is contained in the NRC and WDEQ/LQD permits.

Surface Reclamation and Decommissioning

Surface reclamation within the wellfields would occur in three phases:

1. Interim reclamation of areas disturbed by delineation drilling activities would take place if the time between this level of exploration and development drilling were delayed for some reason;
2. Following completion of wellfield construction, the disturbed acreage would be recontoured, scarified, and seeded with a seed mix approved by regulatory agencies. The LQD permit requires that disturbed areas are reclaimed within one year of construction; and,
3. Activities associated with final decommissioning would involve plugging and abandoning the wells and reclaiming the surface areas disturbed by operations. Final facility decommissioning plans (per NRC license condition 9.11 of SUA-1548) would be submitted for NRC review and approval at least 12 months before the planned commencement of decommissioning of a wellfield. Following regulatory approval of groundwater restoration, buried wellfield lines and pipelines would be removed and the affected surface areas reclaimed.

As mentioned previously, PRI plans to keep soil disturbances to a minimum. In accordance with WDEQ requirements, topsoil would be salvaged from building sites, permanent storage areas, main access roads, and chemical storage sites. The salvaged topsoil would be stockpiled, seeded to minimize erosion, and later reapplied as needed. PRI estimates that a maximum of 22.5 acres of topsoil would be so treated throughout the lifetime of the Reynolds Ranch operations on BLM- managed lands.

For areas where only limited disturbance occurred, such as at well sites and along pipeline routes, topsoil would be separated from the subsoil using a backhoe and reapplied once the well work was completed or the pipeline ditch backfilled. These areas would be seeded with an approved mixture to minimize wind and water erosion.

Detailed descriptions concerning regrading and reshaping, building and facilities decommissioning, mine unit reclamation and revegetation, and topsoil handling are provided in chapter 6.2.3 of the LQD permit to mine reclamation plan. The seed mix and seeding methods would be reviewed on an annual basis as part of the LQD annual report. The seed mix used on federal lands would be approved by BLM.

Any mulch applied to areas with high soil erosion potential or where use is otherwise indicated would be free from mold and noxious weed seeds. Site preparation may include tilling or chiseling to break up compacted soils, increase water penetration, promote root growth, and control erosion.

Post Mining Land Use

Following the completion of groundwater restoration and subsequent regulatory approval, PRI would plug and abandon all production, injection, and monitoring wells in accordance with state and federal rules and regulations. Such practices could include (1) removal of all pumps and tubing; (2) plugging the well with an appropriately formulated abandonment gel or slurry; (3) cutting the well casing below the ground surface; (4) placing a cement plug to seal the well; and,

(5) backfilling, smoothing, and leveling the area to blend in with the surrounding terrain. In addition, buried wellfield lines and pipelines would be removed and the affected surface areas appropriately reclaimed. Affected areas on federal lands would be leveled and re-seeded with a BLM-approved seed mixture.

PRI has stated that its goal is to return all lands disturbed by the mining project to their premining land use of livestock grazing and wildlife habitat unless an alternate use is approved by the state and the landowner (*e.g.*, a rancher who wishes to retain access roads and/or buildings). In addition, PRI's objective is to return the disturbed lands to a production capacity equal to or better than which existed before mining.

The criteria for determining the success of the reclamation effort includes (1) post-mining vegetation cover and production equal to that on an appropriate comparison area; (2) species composition and diversity capable of supporting the planned post mining use; and, (3) a reclaimed vegetation community able to sustain grazing pressure at a rate equal to that of the surrounding native areas. All of the above will be achieved for a period of two consecutive years prior to full bond release.

Once bond release has occurred, the area would be available for other land uses as deemed appropriate by the landowner.

2.1.3.7 Hazardous Materials and Operational Wastes

Hazardous Materials

Wellfield development requires using hazardous materials (cement and commercial drilling mud products for well completions, corrosion inhibitors, glycol, anti-freeze, new and used lube oils, paints, gasoline, and diesel fuel) for equipment operation and infrastructure construction. Limited volumes of these materials would be in various locations within the field during different stages of construction and development. The volume of any single material on hand at any one time would not be expected to exceed the threshold planning quantity (TPQ) of 10,000 pounds for hazardous materials, as required by Title III of the Superfund Amendments and Reauthorization Act (SARA). This is due to the shallow nature of the geologic target, the small size of the drilling locations, the rigs used, and the short duration of each drilling operation (3 days). Extremely hazardous substances (EHSs), as defined in SARA, are not expected to be used in the operations. Large volumes of some hazardous materials would be stored in various locations in the field to facilitate operations. These materials could include bulk cement in portable silos, carbon dioxide, liquid oxygen, sodium bi-carbonate, gasoline, diesel fuel, and propane. No use of materials or chemicals considered extremely hazardous wastes as defined in 40 CFR 355 is proposed.

Waste Disposal

Human wastes generated during field construction and development operations would be collected in standard portable chemical toilets and transported off-site to a state-approved wastewater treatment site.

Solid wastes generated at the site would include both contaminated and non-contaminated wastes. Contaminated wastes could include rags, trash, packing material, worn or replaced parts from equipment, piping, and sediments removed from process pumps and vessels. Radioactive solid wastes with contamination levels requiring disposal at a licensed facility would be isolated in solid waste disposal containers prior to offsite disposal. Under NRC license condition 10.1.7 of SUA-1548, PRI is required to maintain an area within the restricted area boundary to store contaminated materials prior to their disposal. PRI disposes of 11e.(2) by-product waste at NRC permitted disposal facilities. Similar operations in SR-HUP generate less than one container, or 10 cubic yards, of 11e.(2) byproduct waste annually. Therefore, operations at the project would generate a similar volume of contaminated material.

The non-contaminated wastes, such as packing material, would be disposed of in the SR-HUP solid waste disposal facility as authorized by the WDEQ.

Typical conventional mining wastes, such as overburden and tailings, would not be generated because of the proposed Reynolds Ranch in-situ operations. Liquid wastes, such as purge water, would be disposed of at permitted disposal facilities.

2.1.3.8 Regulatory Compliance, Mitigation, and Monitoring

The regulations at 43 CFR 3809.420 –“What performance standards apply to my notice or plan of operations?” state, at (3), –that operations and post-mining land use must comply with the applicable BLM land-use plans and activity plans, . . . as appropriate,” and, at (4), –you must take mitigation measures specified by BLM to protect public lands.” In order to comply with these general operating standards, PRI has committed to undertake the stipulated mitigations.

The Department of Interior General Mining Laws and Wyoming State Law requires mines to collect extensive baseline information and implement extensive monitoring programs and mitigation measures. The currently approved permits to conduct mining operations for the Smith Ranch-Highland Uranium Project include these requirements. Monitoring programs and mitigation measures that are required by regulation are considered part of the Proposed Action and No Action alternatives considered in this EA. These data collection requirements, mitigation plans, and monitoring plans are in place for the No Action Alternative as part of the current approved permit to conduct mining operations for the existing SR-HUP.

All operations would be conducted in accordance with industry standards for safe and efficient operation. PRI would periodically inspect project roads, wells, and reclamation areas to ensure they are in conformance with the LQD and BLM permit requirements. It is the responsibility of PRI to minimize resource damages or loss and to ensure safe operating conditions on all maintenance and monitoring activities. The WDEQ/LDQ permit, which is being amended to include REY, contains numerous pre-operational, operational, and post operational monitoring and reporting provisions; these are discussed in detail in the POO and in chapter 5, Multi-Media Monitoring Program, of the LQD permit.

2.2 ALTERNATIVE II - No Action Alternative

Regulations found in 40 CFR 1502.14(d) require the analysis of a No Action Alternative. Under this alternative, no wellfields would be developed to exploit federal mining claims underlying split estate lands for which landowner consent *has been* obtained. Private lands overlying private minerals and state lands overlying state minerals could not be placed so as to affect the federal surface overlying federal mineral estate or private split estate lands for which written landowner consent *has not* been obtained. As PRI has obtained landowner agreements for all split estate lands in the Reynolds Ranch project area, the decision to be made by BLM regarding Reynolds Ranch would affect mining operations on approximately 45.6 acres of the project. Specifically, selection of the No Action Alternative would affect three wellfields; it would preclude development of the northwest half of wellfield 23, all of wellfield 24, and the northwest lobe of wellfield 21 (figure 2-1). Therefore, the No Action Alternative is defined as the development of the Reynolds Ranch project resulting in approximately 343 acres of disturbance within the 8,280-acre project area, as proposed and permitted by NRC and currently being considered by WDEQ/LQD. These activities would affect private- and state-owned surface, of which approximately 240.6 acres would be short-term disturbance and 102.52 acres would be life-of-project disturbance.

2.3 ALTERNATIVES ANALYZED - Summary of Environmental Impacts

Table 2-3 contains a summary of impacts and mitigation measures for the Proposed Action and No Action analyzed in this EA. A detailed analysis of project impacts and mitigation measures is presented in chapter 4.

2.4 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The regulations at 40 CFR 1502.14(a), require the BLM to explore and evaluate all reasonable alternatives. The following alternatives were considered by the BLM, found to be unreasonable for reasons provided, and were eliminated from detailed analysis.

2.4.1 Reynolds Ranch as a Stand-alone Mining and Processing Operation

Reynolds Ranch could be developed as a stand-alone mining operation for which all associated ancillary and support facilities would be constructed. This would include, but would not be limited to, a central uranium processing plant, process water disposal facility, solid waste disposal unit, equipment maintenance facilities, equipment storage yards, and office. This operation would also require a separate construction, development, operation, technical, and administrative support staff.

2.4.2 Open Pit Mining

Historically, uranium ore was mined from open pits. When employing open pit mining methods, the ore deposits must be located near the surface. Mining methods employed to excavate ore include drilling, blasting, and mechanical removal of overburden, topsoil, and ore. Machinery

**Table 2-3
Summary of Environmental Impacts and Mitigation Measures**

RESOURCE	PROPOSED ACTION	NO ACTION	MITIGATION
Air Quality	Temporary short-term construction-related increases in dust and exhaust emissions.	Same as Proposed Action; impacts to air quality could occur due to other proposed and on-going activities.	Implement dust suppression during construction; properly maintain construction equipment; promptly reclaim area.
Topography And Physiography	No or minimal changes in topography due to cuts and fills.	No impacts on BLM lands, otherwise same as Proposed Action	Avoid steep slopes; properly reclaim area.
Geology and Geologic Hazards	No impacts expected to geology or geologic hazards.	No impacts on BLM lands, otherwise same as Proposed Action	Minimize disturbance or avoid sensitive areas; promptly reclaim area.
Paleontology	No impacts would occur with the application of appropriate mitigation.	No impacts on BLM lands, otherwise same as Proposed Action. Impacts could occur due to other proposed and on-going activities.	Notify BLM of any discoveries. Comply with Instruction Memorandum No. 2009-011
Mineral Resources	Depletion of uranium resources.	Impact to the claimant and the availability of processed uranium if Proposed Action denied.	Promote efficient recovery of uranium resources.
Soils	Disturbance of approximately 46 acres of previously undisturbed soils. No impacts would occur with the application of appropriate mitigation.	No impacts on BLM lands, otherwise same as Proposed Action. Impacts could occur due to other proposed and on-going activities.	Minimize disturbance; implement soil erosion practices until sites are permanently reclaimed; promptly stabilize and reclaim; appropriate road and well location design and maintenance. Monitor construction and use of resource or special purpose roads.

**Table 2-3
(cont.)**

RESOURCE	PROPOSED ACTION	NO ACTION	MITIGATION
Water Resources (surface water)	No direct impacts to springs or seeps, or usable groundwater. No impacts would occur with the application of appropriate mitigation.	No impacts on BLM lands, otherwise same as Proposed Action. Impacts could occur due to other proposed and on-going activities.	Avoid channel crossings; construction in channels during periods of no or low flow; prompt stabilization and reclamation; appropriate road and well location design and maintenance. Monitor construction and use of special purpose roads.
Water Resources (groundwater)	Potential groundwater impacts at an ISR facility can result from: (1) residual constituent concentrations in excess of baseline concentrations after the restoration of the production aquifer; (2) a migration of production liquids from the production aquifer to the surrounding aquifers during operation; (3) a mechanical failure of the subsurface well materials releasing production fluids into the overlying aquifers; and, (4) movement of constituents to groundwater outside the licensed area (NRC 2009).	No impacts on BLM lands, otherwise same as Proposed Action. Impacts to water resources could occur due to other proposed and on-going activities.	BLM, NRC, WDEQ/LQD, and WDEQ/WQD require monitoring and mitigation that would detect excursions of uranium enriched groundwater into aquifers above or below the production aquifer. Restoration of pre-mining groundwater quality is a requirement of these agencies.
Noise	Temporary construction related increases in noise.	Temporary construction related increases in noise. Impacts from noise could occur due to other proposed and on-going activities.	Properly muffle construction equipment.

**Table 2-3
(cont.)**

RESOURCE	PROPOSED ACTION	NO ACTION	MITIGATION
Vegetation and Wetlands	<p>Short-term disturbance of up to 46 acres of previously undisturbed vegetation. No impacts would occur with the application of appropriate mitigation.</p> <p>No wetlands were identified within the Proposed Action area.</p>	<p>Temporary impacts to vegetation and wetlands could occur due to other proposed and on-going activities.</p> <p>No impacts would occur to wetlands with the application of appropriate mitigation.</p>	<p>Minimize disturbance; implement noxious weed controls; allow no disturbance to wetlands; prompt revegetation with native, adapted species; appropriate road and wellfield location design and maintenance. Monitor construction and use of resource or special purpose roads.</p>
Wildlife and Fisheries	<p>Direct effects from collision-related mortality; direct/indirect effects from 46 acres of habitat alteration; temporary displacement particularly during construction. Impacts would be unlikely with the application of appropriate mitigation.</p>	<p>No impacts on BLM lands, otherwise same as Proposed Action; Temporary impacts to wildlife could occur due to other, proposed and ongoing activities.</p>	<p>Comply with all seasonal stipulations and applicant committed measures for wildlife protection unless otherwise authorized by the BLM; minimize disturbance; promptly reclaim.</p>
Threatened, Endangered, Proposed and Candidate, Species, and Sensitive Animal and Plant Species	<p>No adverse effects to these species; Impacts would be unlikely with the application of appropriate mitigation. Individuals of certain state sensitive species may be affected (e.g., collision-and/or construction-related mortality).</p>	<p>No impacts on BLM lands, otherwise same as Proposed Action. Impacts to species could occur due to other, proposed and on-going activities.</p>	<p>Complete surveys and consultation with US Fish and Wildlife Service prior to construction; avoid sensitive species habitats where practical.</p>

**Table 2-3
(cont.)**

RESOURCE	PROPOSED ACTION	NO ACTION	MITIGATION
Cultural Resources	Added knowledge and information about cultural resources of the area. No impacts would occur with the application of appropriate mitigation.	No impacts on BLM lands, otherwise same as Proposed Action. Impacts could occur due to other proposed and on-going activities.	Surveys completed of all areas located within the area of potential effect; avoid or mitigate NRHP eligible sites where practical; notify BLM and/or SHPO of any discoveries.
Socioeconomic / Environmental Justice	Temporary beneficial economic impacts to local and state economics during project construction and development; long term benefits from collection of severance, property and ad valorem taxes; no impacts to environmental justice.	Loss of positive economic benefits from denied activity on BLM lands; otherwise same as Proposed Action.	Hire workers locally as available.
Landownership and Use	No change in landownership; temporary loss of grazing forage and wildlife habitat; temporary decrease in recreation in immediate area.	No impacts on BLM lands, otherwise same as Proposed Action. Use of lands could be temporarily impacted due to other proposed and on-going activities.	Prompt stabilizing after construction and reclamation of disturbed areas.

**Table 2-3
(cont.)**

RESOURCE	PROPOSED ACTION	NO ACTION	MITIGATION
Health and Safety	Temporary increases in fugitive dust from travel on dirt roads. Potential for unauthorized public access. Increased opportunity for vehicle collisions on Ross Road.	No impacts on BLM lands, otherwise same as Proposed Action. Fugitive dust and groundwater impacts could occur due to other proposed and on-going activities, as could vehicle collision.	Apply WDEQ/LQD and NRC requirements for mitigation and monitoring air quality and groundwater conditions and management of contaminated wastes and other project related wastes. Provide signage and access restrictions to protect the public; provide employee training for over road travel safety.
Visual Resources	Temporary visual impacts during construction; no long-term impacts requiring re-categorization of existing visual resource management classification.	No impacts on BLM lands, otherwise same as Proposed Action. Impacts to VRM could occur due to other, proposed and on-going activities.	Minimize disturbance; prompt stabilization and reclamation of disturbed areas; painting above ground features to blend with the surrounding landscape.

used may include a large number of pieces of large earth moving equipment, such as bulldozers, scrapers, track hoes, dump trucks, and loaders.

No open pit uranium mines are currently operating in Wyoming.

2.4.3 Underground Mining

Underground shaft mines have been employed to access deeper ore bodies. Underground mining involves construction of access tunnels and shafts. Drilling, blasting, and mechanical removal of ore is done underground with spoil and ore taken to the surface of the mine. Mechanical equipment used for underground mines includes large bores, road headers, augers, hammer drills, haul trucks, rail cars, and loaders. Underground mines disturb less land surface than open pit mines.

No underground uranium mines are currently operating in Wyoming.

Processing of ore obtained in both of these methods requires a mill to crush and grind the rock as well as solvent extraction and settling tanks to liberate the uranium from the powdered ore. The milling process generates a significant amount of waste relative to the amount of ore processed (roughly 95% of the ore is disposed as waste). Extensive mill tailings ponds are needed for the disposal of these wastes (NRC 2006).

The environmental impacts associated with open pit and underground mining are recognized as being considerably greater than those associated with in-situ recovery mining. Therefore, although both open pit and underground mining of uranium have occurred near the Reynolds Ranch area, these alternatives will not be considered further in this analysis (NRC 2006).

Alternatives Consideration

Development of REY as a “stand-alone” operation was not considered because it would not be economically viable. The proximity of the existing SR-HUP central processing plant and associated infrastructure, the existing trained work force, and the support staff make such a separate facility economically infeasible and unnecessary.

Due to the depth and quality of uranium at the Reynolds Ranch project area, it is not economically feasible to mine using either surface or underground mining methods. Without the technology of ISR, the Reynolds Ranch area uranium could not be recovered.