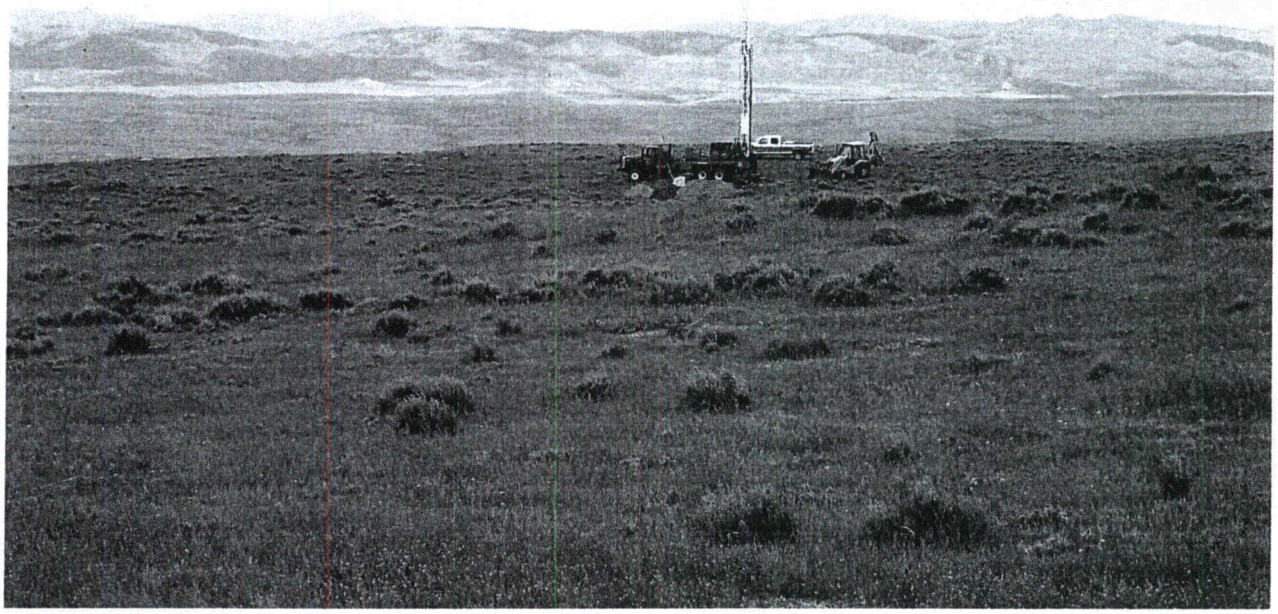
SUA-1341 License Amendment
Ludeman Project
Converse County, Wyoming

Environmental Report
Volume I Section 1 through 3.3 December 2011



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1 INTRODUCTION OF THE ENVIRONEMENTAL REPORT

Uranium One USA Inc. (Uranium One) is submitting this Environmental Report (ER) to the United States Nuclear Regulatory Commission (NRC) as part of a combined source and 11e.(2) byproduct material license application to construct and operate an in situ leach uranium recovery (ISR) facility at the proposed Ludeman Project site in Converse County in the State of Wyoming. An NRC combined source and 11e.(2) byproduct material license is required to recover uranium by ISR extraction techniques, under the provisions of the Atomic Energy Act of 1954 (AEA), as amended by the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) as well as Title 10 U.S. Code of Federal Regulations (CFR), Part 40, "Domestic Licensing of Source Materials." This section summarizes the proposed activities including the nature of the facilities, equipment, and procedures to be used in the proposed project.

1.1 LICENSING ACTION REQUESTED

This ER has been prepared in support of an application to the United States Nuclear Regulatory Commission (NRC) for an amendment to Materials License SUA-1341 to develop and operate the proposed Ludeman Project in Converse County, Wyoming. Uranium One is using suggested guidelines and standard formats from both state and federal agencies, found in NRC's NUREG-1748, to ensure that all information is provided for NRC Staff to complete the environmental review portion. The proposed project will consist of three Satellite facilities with associated injection/production wellfields, lixiviant make-up circuit, ion exchange circuit, six deep injection disposal wells and six surge ponds. Uranium from ion exchange resins at the proposed Ludeman Satellite facilities will be transported and subsequently processed at the Willow Creek Central Processing Plant located in Johnson County, Wyoming.

This application and ER have been prepared using guidelines and standard formats from both Wyoming state and federal agencies. The TR is presented primarily in the NRC format found in Regulatory Guide 3.46, *"Standard Format and Content of License Applications, Including Environmental Reports, For In Situ Uranium Solution Mining"* (June 1982) and NUREG-1569, *Standard Review Plan for In Situ Leach Uranium Extraction License Applications* (June 2003). The guidance in NUREG-1569 was used to ensure that all necessary information is provided to allow NRC staff to complete their review and approval of this license application in a timely manner.

The need for this project arises from the fact that, according to the U.S. Energy Information Administration (EIA), the total domestic recovery of U_3O_8 yellowcake in the first quarter of 2011 was only 1.06 million pounds, down 7 percent from the previous quarter. In 2010, total domestic recovery was only 4.23 million pounds in contrast with

domestic demand for approximately 47 million pounds U_3O_8 (EIA 2011). The proposed project represents an important new source of domestic uranium production that is essential to provide a continuing source of U fuel to power electricity generation facilities. This additional domestic recovery will help alleviate U.S. dependency for yellowcake from foreign suppliers located in Canada, Russia, Kazakhstan and Australia among others

1.2 PROPOSED ACTION

As described in Section 3 of the TR, the proposed action involves Uranium One utilizing ISR processes and methodologies to recover uranium from known ore bodies. This process includes an ISR extraction process and an ISR recovery process. The ISR process is accomplished by installing a series of injection and production wells. Utilizing the injection wells, a carbonate leaching solution, or barren lixiviant, is injected into the ore body. To promote flow across the mineralized areas, corresponding production wells are used to pump water from the ore body, and allow for the collection of the uranium bearing carbonate leach, or pregnant lixiviant, solution. Once the pregnant lixiviant reaches the Satellite facility, the uranium is removed from the lixiviant through the use of pressurized downflow ion exchange columns. Once the resin in an individual exchange column can no longer hold additional uranium molecules, the resin from that vessel is moved to another vessel where the uranium molecules are eluted from the resin. After the elution process is complete, the resin is moved back into the ion exchange column and re-introduced to the ion exchange process. After the lixiviant has passed through the ion exchange system, the solution is re-fortified with a concentrated carbonate solution, making barren lixiviant, and can then be recycled to the injection wells for further recovery.

The next phase of the process is the further refinement of the uranium rich solution to create a marketable product. Uranium from ion exchange resins at the proposed Ludeman Satellite facilities will be transported and subsequently processed at the Willow Creek Central Processing Facility, located in Johnson County. This is accomplished by precipitating the dissolved uranium out of the eluant solution, dewatering the uranium solids, and drying the uranium slurry. The dried uranium product, yellowcake, is then packaged to allow safe transportation.

Initial wellfield(s) for the Proposed Action are developed concurrently with construction of the proposed Satellite facilities and ancillary ISR facilities. Groundwater restoration will take place in the initial wellfield(s) when the uranium resource has been adequately depleted and, simultaneously, additional sequential wellfield developed will occur. The goal of groundwater restoration will be to return the concentration of an identified constituent in the Production Zone to an NRC-approved background concentration or to a relevant MCL, whichever is higher, or to an alternate concentration limit (ACL)

approved by NRC pursuant to 10 CFR Part 40, Appendix A, Criterion 5(B)(5) using Best Practicable Technology (BPT). Successful groundwater restoration was demonstrated within the proposed project area by the Leuenberger pilot production facility. A detailed description of the proposed action is presented in Section 3 of the TR.

Following groundwater restoration activities, all injection and recovery wells will be reclaimed using mandated plugging and abandonment procedures. In addition, a sequential land reclamation and re-vegetation program will be implemented on the site. This surface reclamation (i.e., decommissioning and decontamination (D&D) will be performed on all disturbed areas, including the Satellite facilities, wellfields, ponds and roads such that upon license termination, the site will be released for unrestricted use. Uranium One will maintain financial responsibility for groundwater restoration, facility decommissioning and surface reclamation until NRC approves license termination and site release. Financial assurance is discussed in Section 6 of this ER

1.3 PROJECT HISTORY

The proposed project area was initially identified as a significant uranium prospect in the late 1970s. Multiple parties investigated and evaluated prospects in the vicinity of the proposed project. Teton Exploration Drilling Company, Inc. (TETON) and Nuclear Exploration and Development Company (NEDCO) conducted extensive exploratory drilling and prepared a Mine License Application that was dated September 1, 1981 for start of ISR operations at the Leuenberger Project. The Leuenberger Project was located in the northwest portion of the proposed project site. An extensive exploration and aquifer testing program was conducted by TETON and NEDCO. A pilot production plant was built at the Leuenberger site and production began in January of 1980. The plant operated for approximately one year and was technically successful. However, the economic conditions of the uranium market forced commercial mining plans to be postponed. The pilot plant was decommissioned and groundwater was restored under NRC and Wyoming Department of Environmental Quality (DEQ) guidance.

Uranium Resources, Inc. (URI) completed exploratory drilling and conducted an extensive pumping test of the Production Zone aquifer systems in the northeast portion of the proposed Ludeman Project site during November 1980. URI subsequently prepared a Mine License Application for the proposed site. The URI project was permitted but was never operated as a result of the declining economics for uranium production.

Additionally, Envirosphere was retained by Nuclear Assurance Corporation (NAC) to conduct hydrologic testing and analyses of an ore zone at the Peterson property area located in the southeast portion of the proposed Ludeman Project site. Hydrologic testing at this area occurred September 19 through December 5, 1979. No uranium extraction or processing was completed at the Peterson property.

1.4 CORPORATE ENTITIES INVOLVED

This License Application which includes the TR and ER have been prepared and submitted by Uranium One Americas, Inc., a Nevada corporation. The immediate parent company of Uranium One Americas, Inc. is Uranium One Investments Inc., a Canadian corporation. The ultimate parent company of Uranium One Americas, Inc. is Uranium One Inc., located in Toronto, Ontario, Canada, with a primary listing on the Toronto Stock Exchange (TSX) and a secondary listing on the Johannesburg Stock Exchange (JSE Limited).

1.5 DESCRIPTION AND SITE LOCATION

The proposed Ludeman Project is located in the southern portion of the Powder River Uranium District of Wyoming, within Converse County, Wyoming (Figure 1-1). The proposed project covers approximately 31 Sections (19,888 acres) and its location is described as follows:

- T34N R74W – All of Sections 12, 13, 14, 23, 24 and the east half of Section 22;
- T34N R73W – All of sections 3, 4, 5, 7, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 34, 35, the west half of the west half of Section 2, the south half of Section 6, the west half of the west half of Section 11, the south half of Section 24, the west half of Section 25, the west half of the east half of Section 25, the northeast quarter of the northeast quarter of Section 25, the east half of Section 28, the west half of Section 36, and the west half of the east half of Section 36;
- T34N R72W – The southwest quarter of Section 19 and the north half of the northwest quarter of Section 30; and
- T33N R73W – The northwest quarter of the northeast quarter of Section 1, the north half of the northwest quarter of Section 1, the north half of the north half of Section 2, and the north half of the north half of Section 3.

The proposed project is located approximately 10 miles northeast of Glenrock, Wyoming. State Highway 95 provides access to the proposed project area from the towns of Glenrock and Rolling Hills to the west, and State Highway 93 provides access from Douglas, Wyoming to the southeast. Interstate 25 provides access to both of these state highways from the south of the proposed project site. The proposed project will consist of three Satellite facilities, several in-situ uranium extraction wellfields, and related infrastructures. Figure 1-2 shows the proposed site layout.Detailed information related to the site location is presented in Section 2.1. of the TR.

Figure 1-1: Proposed Project General Location

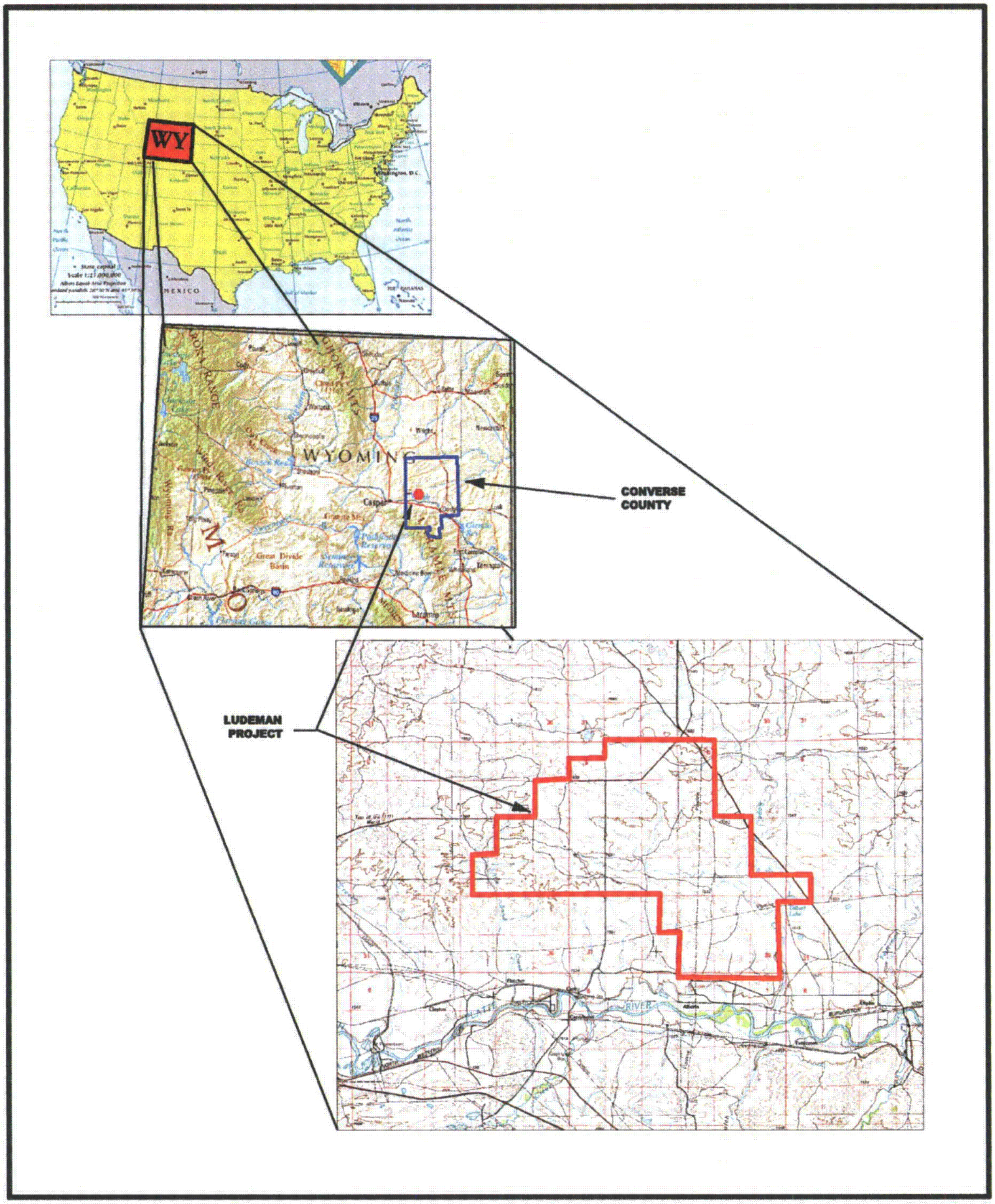
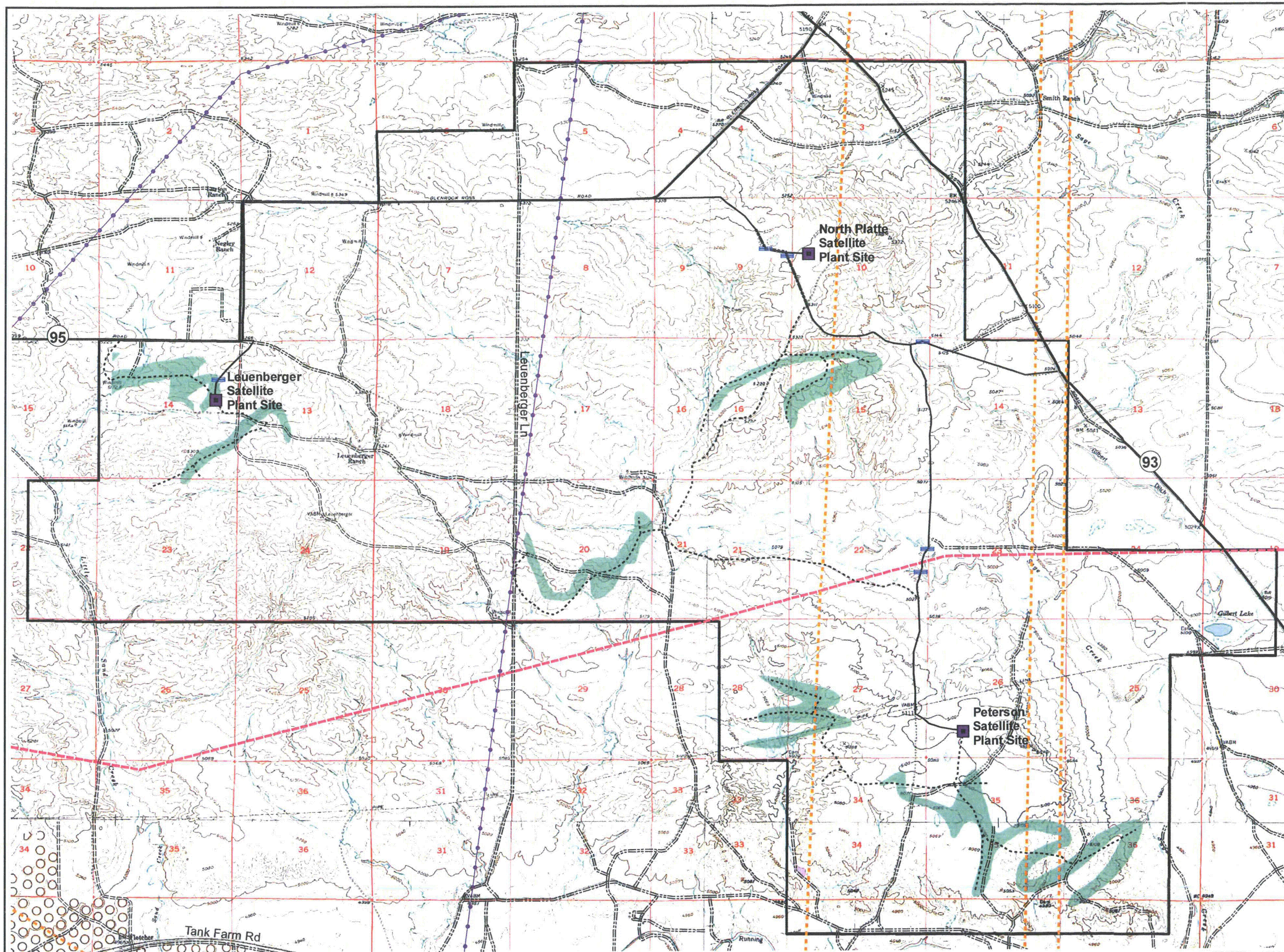


FIGURE 1-2
PROPOSED INFRASTRUCTURE
LUDEMAN PROJECT
CONVERSE COUNTY, WY

DRAFT



LEGEND

- Proposed Plant Site Location
- Proposed Culvert Location
- Main Access Road
- Field Access Road
- Transmission Line
- Crude Oil Pipeline
- Natural Gas Pipeline
- Ore Body
- Ludeman Project Area

0 1,800 3,600 5,400 7,200 Feet

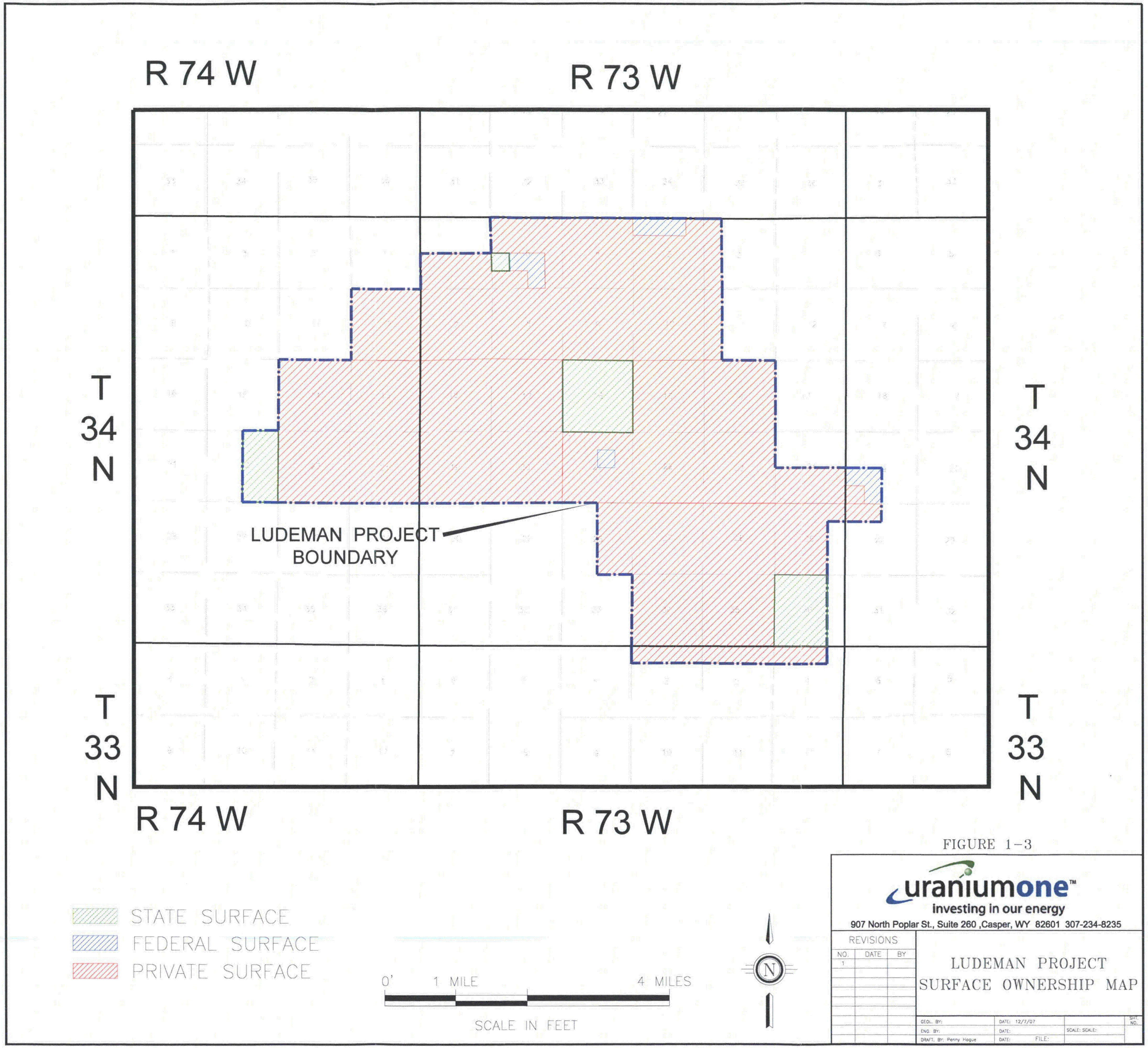
PREPARED FOR:
URANIUM ONE
CASPER, WY

TREC, Inc.
Engineering & Environmental Management
951 Werner Court
Suite 395
Casper, WY 82601
Phone (307) 265-0696
Fax (307) 265-2498
www.treccorp.com

E:/Wyoming/Project_8204_Ludeman/MapDocuments/
Fig 2 Proposed Infrastructure 120909.mxd

1.6 SURFACE AND MINERAL OWNERSHIP

Surface ownership within the proposed project area includes private land, with some areas located in federal and state owned lands. Figure 1-3 illustrates surface land ownership and Figure 1-4 delineates mineral ownership for the proposed project site. Uranium One has executed surface use agreements with all land owners who hold surface ownership in the proposed project area.


R 74 W
R 73 W
T 34 N
T 33 N
LUDEMAN PROJECT BOUNDARY
STATE SURFACE
FEDERAL SURFACE
PRIVATE SURFACE
0' 1 MILE 4 MILES
SCALE IN FEET
N
FIGURE 1-3
uraniumone
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REVISIONS
NO. DATE BY
LUDEMAN PROJECT SURFACE OWNERSHIP MAP

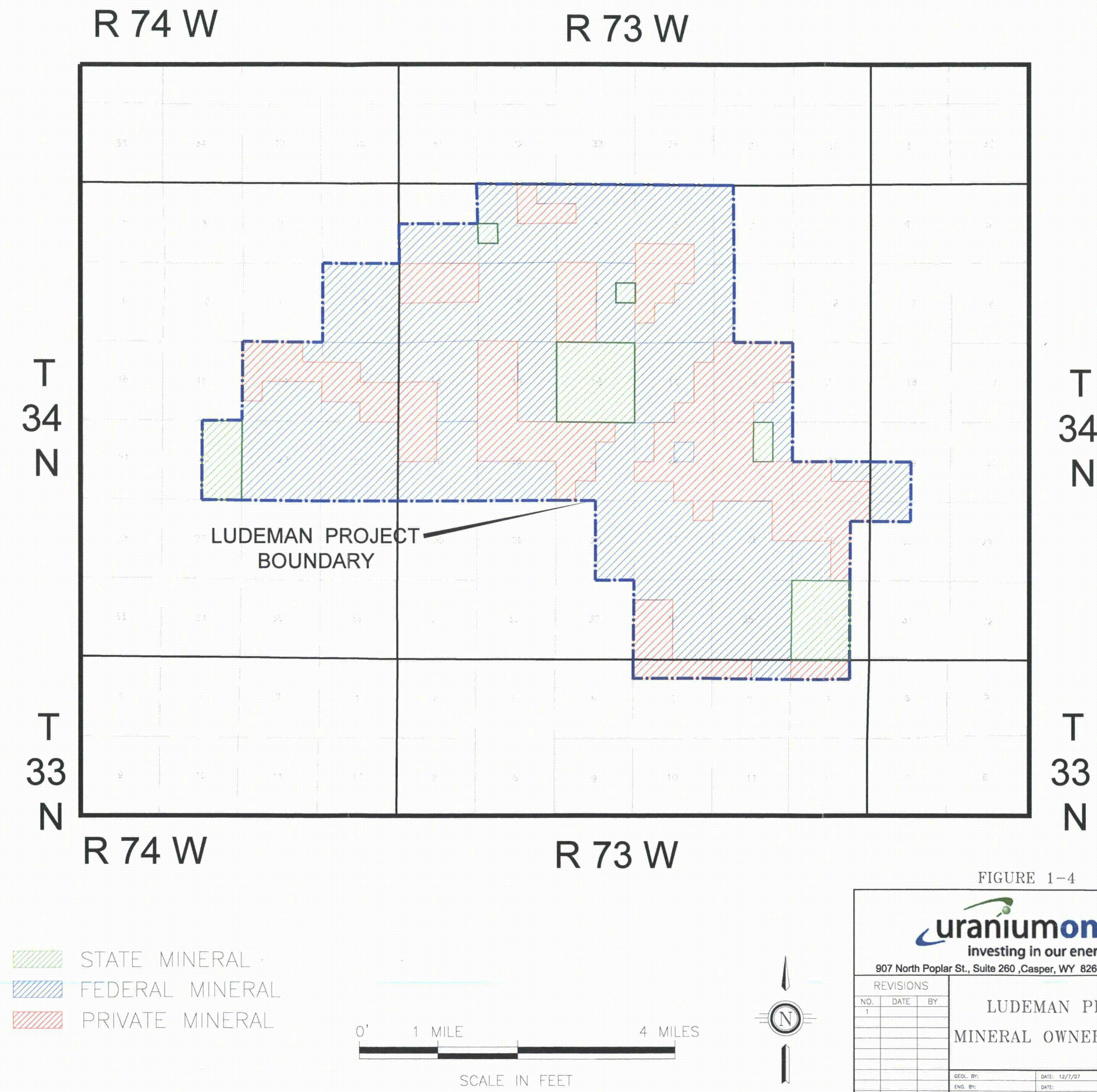

FIGURE 1-4

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LUDEMAN PROJECT
MINERAL OWNERSHIP MAP

REVISIONS		
NO.	DATE	BY
1		

GEOL. BY:	DATE: 12/7/07		SHT. NO.
ENG. BY:	DATE:	SCALE: SCALE:	
DRAFT. BY: Penny Hogue	DATE: FILE:		

1.7 PROPOSED PROJECT ORE BODY

Uranium ore within the proposed project area occurs in typical roll-front deposits. Uranium One exploration nomenclature designates the sands in the project area by decreasing numbers with increasing depth. The Production Zone aquifers in the proposed project area are the 70, 80 and 90 Sands of the Lebo member of the Paleocene Fort Union formation. The sand thickness is variable and ranges in thickness from 13 to 164 feet in the 70 Sand, zero to 161 feet in the 80 Sand and 19 to 299 feet in the 90 Sand. The 70 Sand is continuous across the planned wellfields as is the 90 Sand. The 80 Sand is not continuous across the area as it pinches out in the south-east and east-central portions of the proposed project area.

Confinement exists between the 70, 80 and 90 Sand Production Zones and the overlying and underlying sands throughout the proposed project area.

The mineralization in the 90 Sand in the western portion of the project area varies from 189 to 292 feet deep from surface level and averages 219 feet in depth. The mineralization in the 80 Sand varies from 303 to 441 feet deep from surface level and averages 352 feet in depth. Mineralization in this area is primarily contained within the 60, 80, 90 and 100 Sands; only the 80 and 90 Sands are planned to be mined. The thickness of the mineralization in the 90 Sand averages 8.3 feet with an average grade of 0.090 percent U_3O_8. The thickness of the mineralization in the 80 Sand averages 9.5 feet with an average grade of 0.130 percent U_3O_8.

The mineralization in the central part of the proposed project area varies from 465 to 690 feet deep averaging 557 feet in depth from surface. Mineralization is primarily contained within the 50, 60 and 70 Sands; only the 70 Sand is planned to be mined. Mineralization thickness in this portion of the project area averages 10.6 feet with an average grade of 0.074 percent U_3O_8.

The south-eastern portion of the proposed project area has depths to mineralization ranging from 19 to 366 feet, averaging 191 feet. The 70, 80 and 90 sands contain the primary mineralization in the area, averaging 4.6 feet in thickness with an average grade of 0.093 percent U_3O_8.

Typical stratigraphic intervals to be mined are shown in the geologic cross sections and generalized stratigraphic column in Section 2.6 of this application. For ISR wellfields, the Production Zone is the geological sandstone unit where the recovery solutions are injected and produced. However, the ore thickness and corresponding Production Zone at any location is a fraction of the total thickness of the host sand and rarely exceeds 20 feet.

1.8 ISR WELLFIELD

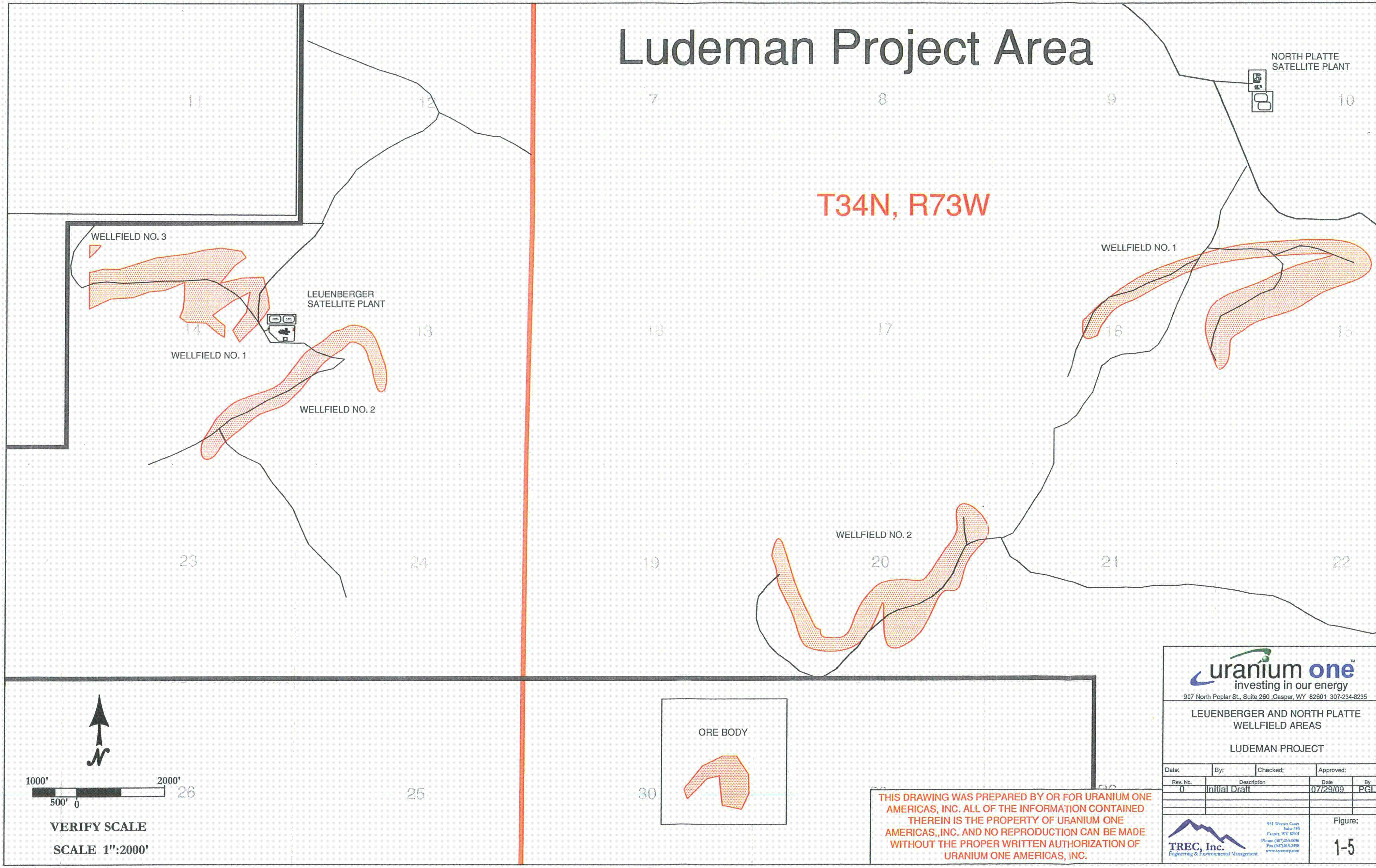
1.8.1 Well Construction and Integrity Testing

Well construction materials, methods, development, and integrity testing are described below. All work will be performed under the direction and supervision of qualified Uranium One personnel.

1.8.1.1 Well Construction Materials

During the life of the proposed project, Uranium One will install production and monitor wells. The production wells will consist of injection and recovery wells. The injection wells will be used to convey the barren lixiviant to the Production Zone, while the recovery wells will be used to recover the pregnant lixiviant after contact with the uranium ore. These wells will be installed using the same completion method so that the wells can be used for either injection or recovery. The ability to change the well function allows for improved uranium recovery and more efficient groundwater restoration as well as an improved ability to respond to potential excursions of lixiviant. Typical well completion schematics for recovery wells, injection wells, and monitor wells are shown on Figure 3-2 of the TR. Wellfield locations for the proposed project Satellite facilities can be found in Figures 1-5 and 1-6.

All production wells are planned to be constructed of Standard Diameter Ratio (SDR) 17 polyvinyl chloride (PVC) with a sufficient pressure rating to withstand the maximum anticipated injection pressure and the maximum resistance to hydraulic collapse pressure anticipated during cementing of the well. Additionally, the wells will be constructed in accordance with Section 6, Chapter 11, "Non Coal In Situ Mining", of the WDEQ Land Quality Division (LQD) Rules and Regulations. The specifications embodied in Chapter 11 have been previously proposed by Uranium One for Moore Ranch, Uranerz for Nichols Ranch and Hank, and Ur-Energy for Lost Creek, and have had such specifications accepted by NRC in their license approvals. The wells are planned to be installed using 4.5, 5.0 or 6.0 inch SDR17 well casing. PVC casing is typically supplied in 20 ft. lengths, and the lengths will be mechanically joined with either threaded connections and/or a water tight O-ring seal, secured in place by a high strength nylon spline.



Ludeman Project Area
T34N, R73W
NORTH PLATTE
SATELLITE PLANT
LEUENBERGER
SATELLITE PLANT
WELLFIELD NO. 3
WELLFIELD NO. 1
WELLFIELD NO. 2
WELLFIELD NO. 1
WELLFIELD NO. 2
11
12
7
8
9
10
14
13
18
17
16
15
23
24
19
20
21
22
26
25
30
ORE BODY
N
1000'
2000'
500'
0
VERIFY SCALE
SCALE 1":2000'
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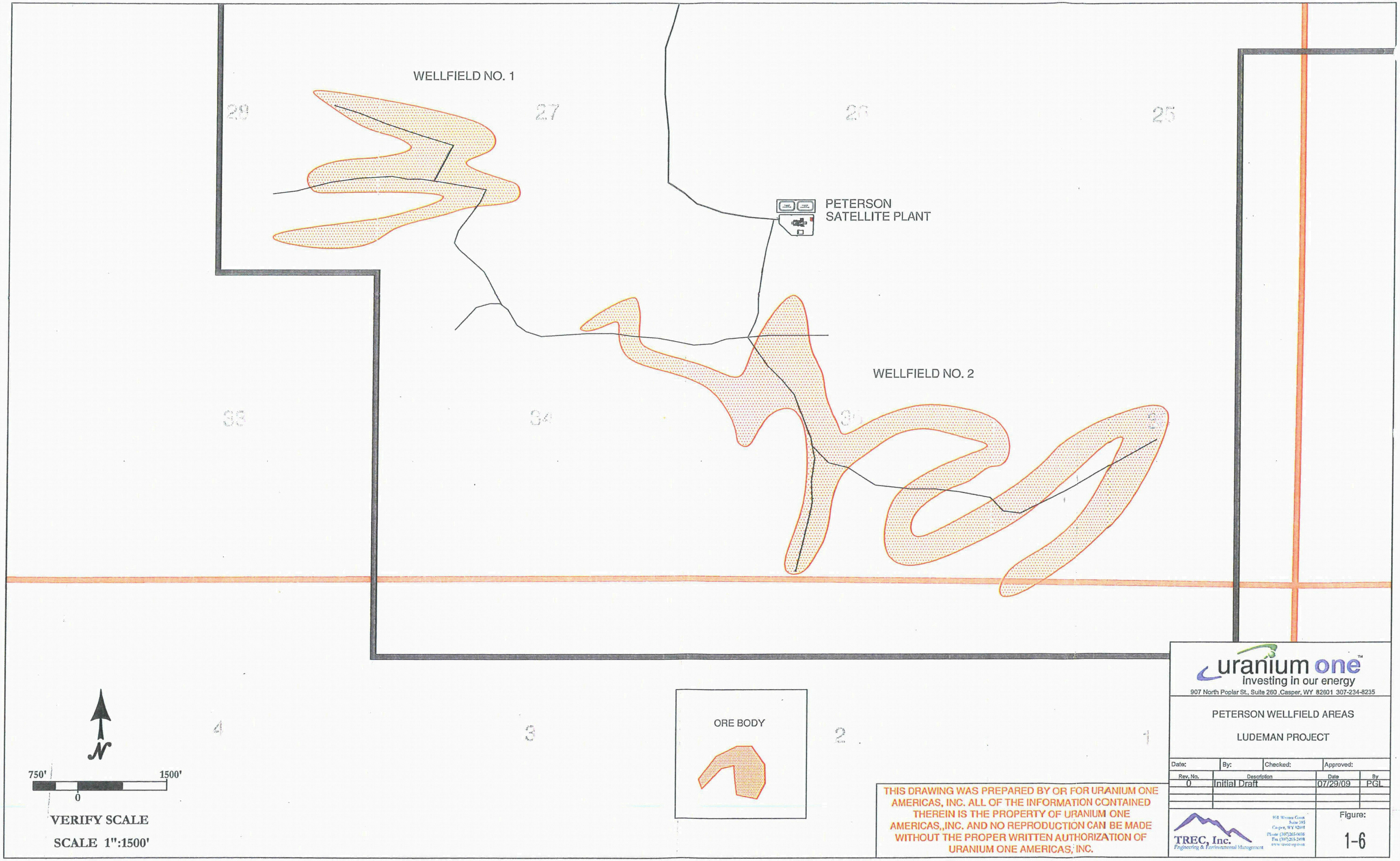
LEUENBERGER AND NORTH PLATTE
WELLFIELD AREAS
LUDEMAN PROJECT
Date:
By:
Checked:
Approved:
Rev. No.
Description
Date
By
0
Initial Draft
07/29/09
PGL
TREC, Inc.
Engineering & Environmental Management
951 Werner Court
Suite 395
Casper, WY 82601
Phone (307)265-0696
Fax (307)265-2498
www.treccorp.com
Figure:
1-5


WELLFIELD NO. 1
29
27
26
25
PETERSON
SATELLITE PLANT
WELLFIELD NO. 2
33
34
35
4
3
2
1
ORE BODY
N
750'
0
1500'
VERIFY SCALE
SCALE 1":1500'
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PETERSON WELLFIELD AREAS
LUDEMAN PROJECT
Date: By: Checked: Approved:
Rev. No. Description Date By
0 Initial Draft 07/29/09 PGL
TREC, Inc.
Engineering & Environmental Management
Figure:
1-6

In accordance with Section 6 of Chapter 11, Uranium One plans to use an annular seal consisting of a cement slurry or a cement bentonite mixture approved by the LQD Administrator. A cement bentonite mixture was approved by the LQD Administrator for the installation of Uranium One's regional baseline monitor wells. The purpose of sealing the annular space is to assure structural integrity of the casing, stabilize the upper formations, protect against contamination of the well from the surface, and to prevent migration of ground water from one aquifer or water-bearing stratum to another.

The interior monitor wells will be screened in the Overlying and Underlying Aquifers, while the perimeter monitor wells will be screened in the Production Zone. The completion intervals for these wells will be predetermined and will use the same materials of construction as the production wells.

1.8.1.2 Well Construction Methods

The recovery and injection wells will be installed with identical completion methods to allow the ability to change the well function for improved uranium recovery, more efficient restoration, and improved ability to respond to potential excursions. Monitor wells will also utilize the same completion methods of the recovery and injection wells and is described below:

- <u>Construction Method (see Figure 1-4)</u>

  1. A 5 to 6.5 inch diameter pilot hole will be drilled through the projected mineralized zone within the Production Zone aquifer. The pilot hole may penetrate the upper portion of the Underlying Aquitard to obtain an accurate geophysical log, however the pilot hole will not fully penetrate the Underlying Aquitard that separates the Production Zone from the Underlying Aquifer. The pilot hole will be logged using a geophysical tool which will provide a suite of logs consisting of gamma, single point resistance, spontaneous potential, neutron and deviation. The grade and depth of each mineralized intercept will be provided by the log;

  2. To complete the well, the pilot hole will be reamed to a diameter of 7 $^{7/8}$ to 9 $^{7/8}$ inches (a minimum of 3 inches greater than the nominal OD of the casing) to a maximum depth of 15 feet below the bottom of the mineralized zone. The pilot hole below the bottom of the reamed hole will be filled with drill cuttings during the reaming process. In some cases, the ream hole may be drilled and logged without a pilot hole being drilled first. PVC casing with a nominal OD of 5 to 6.6 inches will be placed in the reamed hole to a depth approximately 10 feet below the mineralization. Centralizers will be placed on the casing string at a maximum

spacing of one per 40 feet. Also, a wooden dowel or bolt will be placed through the casing approximately 3 feet from the bottom to act as a stop;

3. A specified volume of cement slurry calculated to fill the annular volume and mixed to approved specifications will be pumped inside the casing through a cementing head. Once the cement is in place, a cement wiper plug will be placed in the top of the casing. A volume of displacement water will then be pumped into the casing forcing the cement slurry out of the bottom of the casing and up the annulus between the casing and the reamed hole. Once the wiper plug reaches the wooden dowel or bolt in the bottom of the casing displacement of the cement will end and the valve on the cementing head will be closed which will hold the cement in place while the cement cures. The use of a wiper plug cleans the cement slurry from the inside of the casing and assures that the cement will not be over displaced by providing a surface indication (increased pressure reading) of when the cement job is complete. The well annulus will be topped off with cement to the surface prior to reentry by the drill rig;

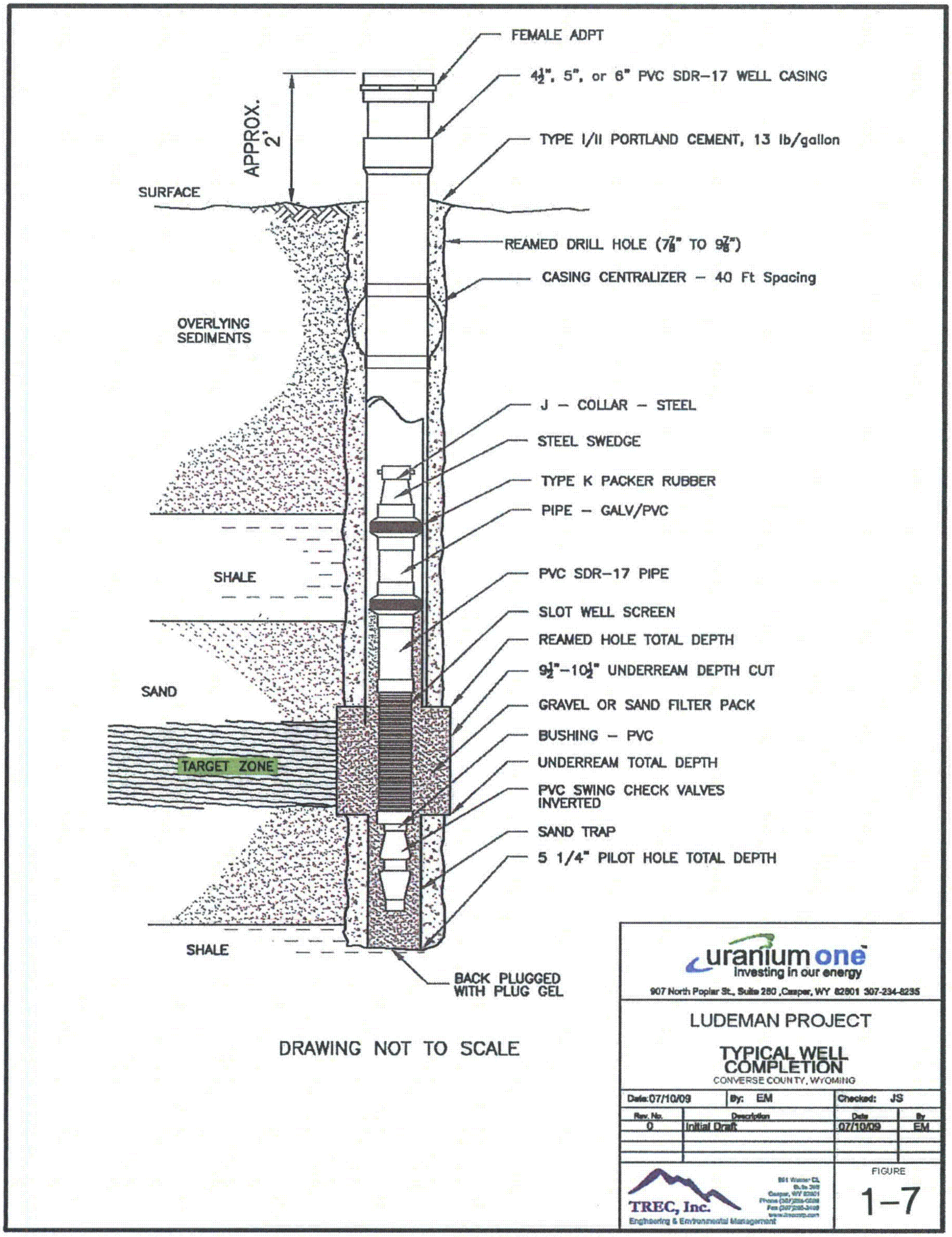
4. After the cement is allowed to cure for a minimum of 72 hours, the well will be under-reamed through the mineralized zones to a diameter of 9 $^{1/2}$ to 10 $^{1/2}$ inches, depending on the OD of the casing. The under-reaming will be completed by a specialized tool utilizing retractable blades. The blades are closed for the trip down the well and are opened by pressure from the rig mud pump. After under-reaming the designated zone through the casing and cement, the blades are again retracted for the trip out of the well. The well may be caliper logged as necessary to verify the correct interval has been opened. If deemed necessary, to support sand zones that are not competent, a well screen will be telescoped into the casing covering the under-reamed zone. The uppermost screen openings will be placed below the top of the under-reamed interval and below the bottom of the annular seal. A PVC riser pipe will be attached to the top of the screen and will be held in place by one or more k-packer(s). Gravel pack sand may be placed between the screen and the under-reamed hole;

5. The well will be developed to remove contaminants and fines from the drilling and completion process and maximize the flow rate. A well completion form will be completed documenting all of the details on drilling, completion materials, casing depth, completion interval, and the cement mix;

6. After drying, the drill cuttings contained in the pits will be covered with subsoil and the stockpiled topsoil. The ground surface will then re-contoured and reseeded; and

7. The well will then be integrity tested as discussed in sections below.

Figure 1-7: Proposed Project Typical Well Completion



1.8.1.3 Well Development

Following well installation, but before baseline water quality samples are taken for groundwater restoration and water quality monitoring, the wells will be developed to restore the natural hydraulic conductivity and geochemical equilibrium of the screened aquifer. All wells will be developed initially immediately after construction using air lifting, swabbing or other accepted development techniques. Well development removes water and drilling fluids from the casing, by flushing it with water from the screened interval. The purpose of well development is to allow representative formation water to enter the well screen and casing. This process is necessary to allow representative samples of groundwater to be collected for monitor wells, and to ensure efficient injection and recovery operations from the production wells.

Final development of monitor wells will be performed by pumping the well, or swabbing for the amount of time necessary, to ensure that stable formation water is present. pH and conductivity measurements will be taken on the development water during this process to ensure that development activities have been effective. The field parameters must be stable at representative formation values before baseline sampling will begin.

1.8.1.4 Well Mechanical Integrity Testing

Prior to being placed into operation and after well completion, the integrity of the wells will be verified by a pressure based Mechanical Integrity Test (MIT) as required by State and Federal UIC Programs.

The MIT is conducted by placing inflatable packers near the top of the casing and directly above the riser pipe connected to the screen interval. The packers are inflated and the interval between the packers is filled with water and pressurized to the test pressure (maximum allowable injection pressure plus a safety factor of 20 percent). This pressure must be maintained within 10 percent for 10 minutes to pass the MIT. An alternative to using a top inflatable packer may be utilized. Instead of an inflatable packer, the top of the casing may be sealed by a specially designed flange top. A well integrity record will be completed for each tested well. If a well shows an unacceptable pressure drop during the integrity test, the packers may be reset and the equipment checked for leaks. If in successive tests the well passes the integrity requirements, the well will be deemed acceptable for use as injection, recovery, or monitor well.

If there are obvious leaks, or the pressure drops by more than ten percent during the ten-minute period, the seals and fittings on the packer system will be reset and/or checked and another test is conducted. If the pressure drops less than ten percent the well casing is considered to have acceptable mechanical integrity.

The maximum allowable injection pressure will be based on the formation fracture pressure. At these depths, Uranium calculates that the maximum allowable injection pressures will range from 90 to 145 psi across the extent of the property.

If a well casing does not meet the MIT criteria, the well will be taken out of service and the casing may be repaired and the well re-tested. If this is not done the well is plugged and abandoned. The WDEQ-LQD will be notified of any well that fails the MIT. If a repaired well passes the MIT, it will be employed in its intended service following approval from the LQD Administrator that the well has demonstrated mechanical integrity. If the well defect resulting in a failed MIT occurs at depth, the well may be plugged back and re-completed for use in a shallower zone, provided it passes the subsequent MIT. If an acceptable test cannot be obtained after repairs, the well will be plugged and abandoned.

In addition to the initial testing after well construction, a MIT will be conducted on any well after any repair where a downhole drill bit or underreaming tool is used. Any production well with evidence of suspected subsurface damage will require a new MIT prior to the well being returned to service. In accordance with WDEQ requirements, MITs will be repeated once every five years for all production and injection wells.

The MIT of a well will be documented to include the well designation, date of the test, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MITs are maintained on site and are available for inspection. In accordance with WDEQ requirements, the results of MITs are reported to the WDEQ on a quarterly basis.

1.9 ION EXCHANGE SYSTEM

In accordance with data presented in the NRC NUREG-1910 (NRC, 2009), Section 2.7.1, Uranium One will utilize pressurized down-flow ion exchange (IX) columns. The uranium-bearing solution, or pregnant lixiviant, recovered from the wellfield will be piped to the pressurized down-flow ion exchange systems in the Satellite facility for extraction of the uranium using specialized ion exchange resin. With this ion exchange system the radon present in the lixiviant is forced back underground in the re-fortified groundwater which thereby provides for significantly reduced potential for occupational and/or public exposure to radon and its progeny. More specific emission details are discussed in Sections 4 and 7 of the TR.

NUREG-1910 notes the pressurized downflow ion exchange systems contain most of the ^{222}Rn present in the lixiviant. Thus, the use of this type of ion exchange system allows for more effective control of ^{222}Rn. ^{222}Rn is only released during resin transfer and routine maintenance. Use of a pressurized, downflow ion exchange system enables Uranium One

to control where the ^{222}Rn can go during maintenance and resin transfer, in turn allowing for a reduction in ^{222}Rn emissions relative to other available ion exchange technologies. The use of this type of system also represents a specific emission control method which reduces emissions to levels that are as low as reasonably achievable (ALARA) and complies with the requirements of 10 CFR Part 40, Appendix A, Criterion 8. The use of engineering controls, such as pressurized, downflow ion exchange columns, along with independent tank and area ventilation systems will ensure that exposures to ^{222}Rn and its progeny are maintained ALARA. Vents on the individual ion exchange vessels are connected to a manifold which is exhausted outside the Satellite facility in the event ^{222}Rn is released.

These columns will be operated in series as pairs to allow one column to be in the lead position and one in the tail position. This will allow the column in the tail position to be placed in the lead position once the original lead column is taken off-line for resin transfer. Resin will be transferred to an elution tank, where the resin will be stripped, and then transferred back to a pressurized down-flow ion exchange column. A process flow diagram can be seen in Figure 3-9 of the TR.

An additional set of ion exchange columns will be used for restoration purposes only. As the pregnant lixiviant passes through the ion exchange system, the uranyldicarbonate and uranyltricarbonate ions will be removed preferentially from the lixiviant. The barren lixiviant leaving the ion exchange systems will normally contain less than 2 mg/l of uranium. After the barren lixiviant leaves the ion exchange system, CO_2 and/or carbonate/bicarbonate will be added as necessary to refortify the barren lixiviant with the carbonate/bicarbonate concentration desired for recovery operations. The barren lixiviant will then be pumped back to the wellfields, with an oxidant (O_2 gas) added before the solution is re-injected into the Production Zone.

1.9.1 Ion Exchange Circuit Equipment

Materials of construction and general specifications for the ion exchange circuit equipment are listed below. Detailed specifications and dimensions will be addressed during detailed engineering.

- Ion Exchange Columns: The ion exchange columns are pressurized downward-flow vessels constructed of mild steel with an epoxy internal coating. Internal distribution headers are constructed of 316SS steel; and
- Booster Pumps: Booster pumps are standard pumps of steel construction.

1.9.2 Restoration Circuit

Uranium One will use RO treatment during groundwater restoration to maximize permeate and minimize brine production. The interference from groundwater restoration with ongoing uranium recovery operations will be kept to a minimum by maximizing the quantity of permeate re-injected into wellfields undergoing RO treatment and will hasten the clean-up of the affected groundwater. Restoration equipment will be housed in the Satellite facility.

1.9.2.1 Restoration Circuit Equipment

Materials of construction and general specifications for the restoration circuit equipment are listed below. Detailed specifications and dimensions will be addressed during detailed engineering.

- RO Systems: The RO unit and related pumps will be will be constructed of chemically compatible material; and
- Restoration IX Columns: The restoration IX columns will be constructed of mild steel with an epoxy internal coating. Internal distribution headers are constructed of 316SS steel.

1.9.3 Bleed Treatment Circuit

To control the movement of lixiviant within the Production Zone, a small percentage of barren lixiviant will continuously be diverted away from the volume being pumped back to the injection wells, resulting in more lixiviant being pumped from the Production Zone than injected. This bleed will create a negative pressure gradient within the Production Zone, causing groundwater from the surrounding area to be drawn toward the wellfield. The negative-pressure gradient will contain the lixiviant within the ore-bearing region of the Production Zone, preventing the lixiviant from migrating away from the wellfield, and minimize the dilution of lixiviant by uncontrolled fluid movement.

It is anticipated that the bleed rates will range from approximately 0.5 percent to 1.5 percent of the recovery flow rate, and average approximately 1.0 percent. As discussed in Section 3.1.6.1, Water Balance, the wellfield bleed will be removed by processing a portion of the lixiviant through the production RO unit. The resulting brine from this RO unit will be piped either to the surge ponds or to the deep disposal wells.

1.9.4 Resin Transfer and Elution

Once the ion exchange resin in an ion exchange column is loaded to capacity with uranium complexes, the column will be taken out of service. The resin loaded with uranium will be transferred from one of the proposed Satellite facilities to the Willow Creek CPP via tanker truck. Once the resin has been stripped of the uranium by the process of elution, the resin will be returned to the Ludeman Satellite for reuse in the ion exchange circuit. In the elution circuit the loaded resin will be stripped of uranium by a process based on the following chemical reaction:

$$R_2UO_2(CO_3)_2 + 2Cl^- + CO_3^{-2} \longrightarrow 2\ RCl + UO_2(CO_3)_3^{-2}$$

After the uranium has been stripped from the resin, the resin may be rinsed with a sodium bicarbonate solution. This rinse removes the high chloride eluant physically entrained in the resin and partially converts the resin to bicarbonate form. In this way, chloride ion buildup in the lixiviant can be controlled.

1.10 CHEMICAL STORAGE FACILITIES

Chemical storage facilities at the proposed Satellite facilities will be designed to store and contain each specific material used. Materials storage areas will be constructed and maintained according to best practices. Figure 3-8 in the TR depicts the facility layout. Proper signage will be installed in the storage areas. Appropriate handling procedures will be instituted and observed, and a hazard communication program in accordance with OSHA standards will be in place to deal with potential hazards associated with all materials stored at the site.

1.10.1 Process Related Chemicals

Process-related chemicals will be stored in bulk at the proposed Satellite facilities will potentially include carbon dioxide, sodium carbonate/bicarbonate, oxygen, and sodium sulfide, and hydrogen peroxide. Risk assessments completed by the NRC in NUREG-6733 for ISR facilities identified anhydrous ammonia and bulk acid (sulfuric and hydrochloric) storage as the most hazardous chemicals with the greatest potential for impacts to chemical and radiological safety.

1.10.2 Oxygen Storage and Delivery System

Oxygen will be added to the injection stream either upstream of the injection manifolds within the header house buildings or to individual injection well meter runs. Oxygen storage will be placarded and located near the Satellite facilities or at centralized

position(s) in the wellfield. Each vessel will be equipped with safety relief devices and will be located at least 25 feet from buildings or as required by applicable NFPA and OSHA standards. The storage facility will be designed to meet industry standards in NFPA-502F and OSHA standards for the installation of bulk oxygen systems on industrial premises (29 CFR 1910.104).

Oxygen service pipelines and components must be clean of oil and grease since gaseous oxygen will cause these substances to burn much more rapidly if ignited, as it will any other combustible material. All components intended for use with the oxygen distribution system will be properly cleaned using recommended methods in CGA G-4.1. The design and installation of oxygen distribution systems will be based on CGA-4.4.

1.10.3 Carbon Dioxide Storage and Delivery System

The carbon dioxide storage and delivery system will be stored adjacent to the Satellite facility where it may be added to the lixiviant prior to leaving the facility, and for the make-up of sodium bicarbonate for addition to the lixiviant stream. It will be used to dissolve carbon dioxide into the pregnant lixiviant to improve recovery of uranium.

1.10.4 Chemical Reductants

Hazardous materials typically used during groundwater restoration activities include the addition of a chemical reductant (i.e., sodium sulfide or hydrogen sulfide gas). To minimize the potential for accidents involving process chemicals to impact areas where licensed material is handled, these materials are stored outside of process areas. Sodium sulfide may be used as a chemical reductant during groundwater restoration. The material consists of a dry flaked product and is typically purchased on pallets of 55-pound bags or super sacks of 1,000 pounds. The bulk inventory will be stored outside of process areas in a cool, dry, clean environment to prevent contact with any acid, oxidizer, or other material that may react with the product. There are no current plans to use hydrogen sulfide gas at the proposed project. However, in the event that Uranium One determines that use of hydrogen sulfide as a chemical reductant is necessary, proper chemical safety precautions will be taken.

1.10.5 Non-Process Related Chemicals

Non-process related chemicals that may be stored at the proposed project site include petroleum products (gasoline, diesel) and propane. Due to the flammable and/or combustible properties of these materials, all bulk quantities will be stored outside of process areas at the Satellite facility. All gasoline and diesel storage tanks will be located above ground and within secondary containment structures designed to accommodate at

least 110 percent of the volume of the largest tank in the containment structure. If the aboveground hydrocarbon storage capacity exceeds 1,320 gallons, Uranium One will prepare a Spill Prevention, Control, and Countermeasure (SPCC) plan in accordance with EPA requirements in 40 CFR Part 112.

1.10.6 Facility Areas Where Fumes or Gases May Be Generated

The potential exists for buildup of carbon dioxide or oxygen gases may also occur in confined spaces such as header houses if carbon dioxide and oxygen lines are present. Procedures will require monitoring for these gases in confined spaces or basements where these gases may be present prior to employees conducting work in these areas.

1.11 WASTE MANAGEMENT

This section describes the proposed waste management system. Liquid and solid wastes are divided into two general categories: 11e.(2) waste and non-11e.(2) waste. The proposed waste management system is summarized below for each category of waste. Additional details about Waste Management are found in Section 4 of this document.

1.11.1 11e.(2) Liquid Waste

1.11.1.1 Brine

Brine will be generated from RO treatment of the production bleed and from RO treatment of the groundwater restoration water. Brine will be routed from the production and restoration RO units in the Satellite facilities to a wastewater collection system.

1.11.1.2 Excess Permeate

Permeate will also be generated from the treatment of both the process bleed and groundwater from groundwater restoration. Excess permeate which is not recycled back to operation or restoration activities will be used as plant makeup water. Permeate will be high quality water and will generally be put to beneficial use.

1.11.1.3 Other 11e.(2) Liquid Waste

Other 11e.(2) liquid wastes include spent eluate, resin transfer wash water, plant wash-down water, and fluids generated from wellfield release. Liquid wastes generated in the Satellite facility will be discharged to the wastewater disposal system or to the feed of the

s RO Unit while water collected from wellfields will be collected in dedicated portable tanks or tanker trucks and transported to the wastewater disposal system. Any water captured from leaking pipelines or equipment will also be transported to the wastewater disposal system in dedicated portable tanks or tanker trucks.

These liquid wastes will be combined with brine and disposed of through the deep disposal well.

1.11.2 Non 11e.(2) Liquid Waste

1.11.2.1 Stormwater Runoff

Stormwater management is controlled under National Pollutant Discharge Elimination System (NPDES) permits issued by the WDEQ-WQD. As part of the permit, a storm water pollution plan (SWPPP) will be prepared describing best management practices (BMPs) used to keep pollutants out of surface waters and storm drains. Facility drainage will be designed to route storm runoff water away from or around the plant, ancillary buildings and parking areas, and chemical storage. The design and controls of the proposed project facility will be implemented such that runoff is not considered to be a potential source of pollution.

1.11.2.2 Domestic Liquid Waste

Domestic liquid wastes from the restrooms and lunchrooms will be disposed of in a septic system that meets the requirements of the WYDEQ-WQD and will likely include one or more septic tanks for primary treatment. Septic tank effluent will be disposed of in a gravity or pressure-dosed drain field. The septic system will be separate from other liquid waste lines to prevent 11e.(2) byproduct material discharge into the septic fluid. These systems are in common use throughout the United States and the effect of the system on the environment is known to be minimal.

1.11.2.3 Waste Petroleum Products and Chemicals

At the proposed project, small quantities of used oil will be generated from equipment and vehicles used on-site. The waste petroleum products will be temporarily stored on-site before being transported to a nearby recycling or disposal facility. These wastes will not have been affiliated with the processing or generation of 11e.(2) byproduct material.

Waste petroleum product fluids will be stored in an aboveground storage tank located in the maintenance shop. The storage tank will be cylindrical and constructed of steel with a

locking cap and venting system. Secondary containment will be designed to contain 110 percent of the tank volume. Spills of waste petroleum will be contained, mitigated, cleaned up, and reported in accordance with WDEQ requirements.

The proposed project is anticipated to be classified as a conditionally exempt small quantity generator (CESQG) by WDEQ/SHWD. As such, the project will be required to generate less than 220 pounds (100 kg) of hazardous waste in any calendar month, generate less than 2.2 pounds (1 kg) of acutely hazardous waste, and store less than 2,200 pounds (1,000 kg) of hazardous waste at any one time.

1.11.3 Solid 11e.(2) Byproduct Material

All contaminated items that cannot be decontaminated to meet release criteria will be properly packaged, transported, and disposed of off-site at a licensed to 11e.(2) byproduct material disposal facility. Solid wastes generated by the proposed project that may become contaminated with radioactive isotopes consist of items such as rags, trash, packing material, worn or replaced parts from equipment, piping, filters, protective clothing, and solids removed from process pumps and vessels. Radioactive solid waste which has a contamination level precluding decontamination will be isolated in drums or equivalent DOT approved containers. These materials will be stored on site inside the security controlled area until such time that a full shipment can be shipped to a waste disposal site or mill tailings facility licensed to accept 11e.(2) byproduct materials.

This 11e.(2) byproduct material will be collected and stored within the proposed project Satellite facilities in appropriate containers (e.g., 55 gallon drums with drum liners) approved by DOT, and will be appropriately labeled and placarded for the class of material being shipped. When these containers are full, they will be closed, sealed and stored within the byproduct storage area and stored in a strong, tight container as defined by DOT regulations. The strong, tight containers will be capable of preventing the spread of contamination and contact with precipitation. The proposed project plans to use covered roll-off containers with an approximate capacity of 15-30 cubic yards. Once full, these containers will be shipped off-site for disposal to a byproduct licensed disposal facility. During storage, the containers will be located within a designated security controlled area. Access to the byproduct storage facility will be controlled through the use of security fencing, locked gates, and proper posting as a security controlled area.

Larger items such as contaminated equipment that cannot be stored in a roll-off container will be stored in the proposed project Satellite facilities or covered/sealed in manner that will prevent the spread of contamination in the byproduct storage area.

1.11.4 Non-11e.(2) Solid Waste

1.11.4.1 Uncontaminated Solid Waste

Uncontaminated solid waste will be collected on the site on a regular basis and disposed of in the nearest approved sanitary landfill, compliant with the rules and regulations of WDEQ-SHWD.

1.11.4.2 Septic System Solid Waste

Domestic liquid wastes from the restrooms and lunchrooms will be disposed of in an approved septic system that meets the requirements of the WDEQ for Class V UIC wells. Occasionally, it will be necessary to dispose of sludge material collected in septic systems holding tanks. The disposal of these sludge materials must be performed in accordance with WDEQ-SHWD rules and regulations.

1.11.4.3 Hazardous Waste

Hazardous wastes are defined by WDEQ-SHWD's Hazardous Waste Management Chapter 2 or by USEPA in 40CFR Part 261. Generated materials defined by these regulations as hazardous waste will be consolidated in appropriate containers upon generation and shipped off-site for disposal at a facility licensed for the acceptance of hazardous wastes. Wastes that may be generated at the proposed project that may be classified as hazardous wastes include solvent rags, expired laboratory reagents, solvents, cleaners, or degreasers. It is also expected that the proposed project facility will generate Universal Wastes such as batteries, fluorescent light bulbs and used oil.

It is anticipated that the proposed project facilities will be classified by WDEQ-SHWD as a Conditionally Exempt Small Quantity Generator (CESQG). As such, the project will be required to generate less than 220 pounds (100 kg) of hazardous waste in any calendar month, generate less than 2.2 pounds (1 kg) of acutely hazardous waste, and store less than 2,200 pounds (1,000 kg) of hazardous waste at any one time. This classification as a CESQG does not relieve Uranium One from complying with CESQG regulations and those requirements to dispose of classified hazardous wastes at a properly licensed hazardous waste facility. Uranium One will comply with the EPA and WDEQ-SHWD CESQG requirements and monitor the generation of hazardous waste to ensure compliance with the weight generation rules of those regulations.

1.12 INSTRUMENTATION AND CONTROL

1.12.1 Wellfield Operations/Ion Exchange Circuit

The wellfield and ion exchange circuits operate at steady state conditions, and deviations from the normal operating flow rates and pressure profiles (e.g., 10 percent or greater) are indicative of operating upsets. An automatic emergency shutdown system consisting of pressure and flow rate switches will be provided for these circuits when normal operating parameters are exceeded. Instrumentation and control related to these circuits to accommodate emergency shutdown systems and alarms are listed below:

- Instrumentation will be provided to measure total production and injection flow and pressure on the main trunk lines at the Satellite facilities. Flows and pressures will be monitored continuously and will be displayed locally on the metering instrumentation and displayed at the facility control room. Automatic shutdown and alarms will be provided for deviations outside of established operating parameters; and
- The individual well flows will be adjusted and controlled within the header houses. Manifold pressures inside the header houses will be maintained below the maximum operating pressure. Instrumentation will be provided to measure individual well recovery and injection flow rates, as well as the manifold pressures coming into and going out of the individual header houses. Flows and pressures will be monitored continuously and will be displayed locally in the header house. These values will also be displayed in the facility control room. Total recovery and injection flows will be derived from the sum of the individual flows. Flows will also be continuously monitored to trigger and log an alarm in the event set parameters are exceeded. Wellfield header houses will also be equipped with sensors to detect the presence of liquids in the basement and initiate alarms. Automatic shutoff valves and alarms will be provided for deviations outside of established operating parameters for the systems controlled within the header house.

In the event of an automatic shutdown, an alarm will notify the operator. Once the upset (broken piping, leaking vessels, etc.) is identified and corrective action taken, only then can the circuit be manually restarted. This type of control system provides the best protection against fluid spills to the environment by limiting the amount of fluid released and by providing immediate notification to facility operators and enhancing response to any upset conditions. Backup for the automatic emergency shutdown systems are provided by local displays and controls for the metering instrumentation or header house displays if systems controls or displays in the Satellite facility should become temporarily unavailable.

1.12.2 Process Areas

In the process areas, tank levels are measured in chemical storage tanks as well as process tanks. Instrumentation will be installed to provide continuous monitoring of chemical and process tank levels. Other instrumentation may also be provided in process areas to provide continuous monitoring for rates and pressures of process fluids and chemicals and other in-line instrumentation used for process measurements. Readout from process area instrumentation will be displayed on the facility control room monitors and will be displayed locally on the metering instrumentation providing backup monitoring.

Alarms and automatic shutdown of systems (where needed) will be provided for deviations outside of established operating parameters. The alarms and automatic shutdown systems will provide the best protection against upset conditions of process fluids or chemicals by limiting the amount of fluids or chemicals released and immediate notification to facility operators, enhancing response to any upset conditions. The continuous monitoring will also be used operate the facility process at maximum efficiency.

1.12.3 Process Waste Water Disposal

Process waste water will be disposed of through deep disposal wells as described in Section 4. These wells will be equipped with a high-level shutoff switch on the injection tubing to prevent operation of the pumps at pressures greater than the limiting surface injection pressure. In addition, the wells will be equipped with a low-pressure shutoff switch on the surface injection line that will deactivate the injection pump in the event of a surface leak. Finally, the wells will include a high/low pressure shutoff switch with a pressure sensor on the tubing/casing annulus. This switch will stop the injection pump in the event of either (1) a tubing leak or (2) a casing, packer, or wellhead leak.

This type of instrumentation and control system provides the best protection against process waste water spills to the environment by limiting the amount of fluid released and providing immediate notification to facility operators enhancing response to any upset conditions. Pressure monitoring in the tubing/casing annulus also provides immediate indicators of potential well integrity issues. Backup for the automatic emergency shutdown systems are provided by local displays and controls for the metering instrumentation in the Satellite facilities and at the wellhead if systems controls or displays in the Satellite facility control room should become temporarily unavailable. In addition, inspections of the disposal wells will be conducted once per shift.

If a deep disposal well is to become temporarily unavailable, due to routine maintenance etc., there are surge ponds at each Satellite location to temporarily store the accumulated waste water until the deep disposal well has returned to operation.

1.12.4 Radiological Monitoring Instrumentation

Handheld radiation detection instruments and portable samplers will be used to monitor radiological conditions at the Satellite facilities. Specifications for this equipment are discussed in further detail in Section 5 of the TR. The location of monitoring points and monitoring frequency for in-facility radiation safety is also discussed in Section 5.

1.12.5 Byproduct Material Disposal

Byproduct material will be collected and stored within the Satellite facilities in appropriate containers (e.g., 55-gallon drums with drum liners). When these containers are full, they will be closed and stored within the Satellite facilities or will be moved to a byproduct storage area and stored in a strong tight container as defined by DOT regulations. The strong tight containers will be capable of preventing the spread of contamination and contact with precipitation. Uranium One plans to use covered roll-off containers with an approximate capacity of 20 cubic yards. Once full, these containers will be shipped for disposal to a licensed disposal facility. During storage, the containers will be located within a restricted area. Access to the byproduct storage facility will be controlled through the use of security fencing, locked gates, and proper posting as a restricted area.

Larger items such as contaminated equipment that cannot be stored in a roll-off container will be stored in the Satellite facilities or covered/sealed in manner that will prevent the spread of contamination in the byproduct storage area.

1.13 APPLICABLE REGULATORY REQUIREMENTS AND PERMITS

Prior to Uranium One commencing ISR operations, a permit to mine must be obtained from WDEQ and a Source and 11e.(2) byproduct materials license must be obtained from NRC. Table 1-1 lists the necessary environmental approvals from Federal and State Agencies required for the proposed project. All approvals are in-progress. All necessary approvals must be secured prior to commencement of commercial recovery at the site.

Table 1-1: Environmental Approvals for the Proposed ISR Uranium Project

Issuing Agency	Description	Status
Wyoming Department of Environmental Quality 122 West 25th St Herschler Building Cheyenne, Wyoming 82001	Underground Injection Control Class III Permit (WDEQ Title 35-11)	Permit to Mine Application – submitted February 10, 2010, Application was deemed complete on August 12, 2011, currently under technical review by WDEQ-LQD.
	Groundwater Reclassification (EPA-Aquifer Exemption) (WDEQ Title 35-11)	Groundwater reclassification will be completed (information in application) by WDEQ prior to issuance of final Permit, and confer with EPA's on their Aquifer Exemption process.
	Underground Injection Control Permit (Deep Disposal Well) (WDEQ Title 35-11)	Class I UIC Permit application under preparation; expected submittal to WDEQ in Q3 - 2012.
	Industrial Stormwater NPDES Permit (WDEQ Title 35-11)	An Industrial State Stormwater WPDES Permit will be required for the satellite facilities. Expected application submittal 30 days prior to start of operations.
	Construction Stormwater NPDES Permit (WDEQ Title 35-11)	Construction Stormwater NPDES authorizations are applied for and issued annually under a general permit based on projected construction activities. The Notice of Intent will be filed at least 30 days before construction activities begin in accordance with WDEQ requirements. (Q2 -2013)
	Mineral Exploration Permit (WDEQ Title 35-11)	Approved Mineral Exploration Permit 339DN is currently in place for the Ludeman area.
	Underground Injection Control Class V, Septic System (WDEQ Title 35-11)	The Class V UIC permit will be applied for following installation of an approved site septic system during facility construction.
	Air Quality Permit	Application will be submitted six months prior to start of construction (Q1 2013)
U.S. Nuclear Regulatory Commission Washington, DC 20555	Amendment of Materials License SUA-1341 (10 CFR 40)	Application submitted herein
U.S. Environmental Protection Agency 1200 Pennsylvania Ave, NW, Washington, DC 20460	Aquifer Exemption (40 CFR 144, 146)	See Groundwater reclassification process above

Issuing Agency	Description	Status
U.S. Department of Interior, Bureau of Land Management 2987 Prospector Drive Casper, WY 826040	Notice of Intent to Explore (43 CFR 3809)	Notice of Intent to Explore will be submitted as needed for exploration drilling activities on BLM surface
U.S. Army Corps of Engineers 2232 Dell Range BLVD., Suite 210 Cheyenne, WY 82009-4942	Nationwide Permit Authorization, Wetlands	All necessary information has been provided to the USACE, USACE has determined (May 11, 2011) the methods used to identify wetlands within the permit are consistent with the Corps of Engineers Wetland Delineation Manual. Activities can be covered under nationwide permits.

1.14 SURETY ARRANGEMENTS

Pursuant to 10 CFR Part 40 and Appendix A, Criterion 9, Uranium One will provide adequate financial assurance for the proposed project. Uranium One will provide NRC Staff with financial assurance cost estimates for all aspects of the proposed project, including groundwater restoration, surface reclamation, and D&D of proposed facilities.

Pursuant to Criterion 9, licensees are required to submit annual financial assurance updates reflecting potential changes in costs for specific licensed activities resulting from inflation, changes in equipment or personnel costs, or new activities proposed to be started or completed prior to the proceeding annual update. In order to be granted a license, an applicant must propose and receive NRC approval of financial assurance cost estimates for the phase of the project that will exist prior to the next annual update; but the applicant is not required to provide the actual financial assurance mechanism supporting that NRC-approved cost estimate until licensed operations commence. Pursuant to these requirements, Uranium One will comply with Criterion 9 requirements for these annual financial assurance updates and will have in place an NRC-approved financial assurance mechanism after receiving the NRC license and prior to beginning active ISR operations.

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2 ALTERNATIVES

2.1 DESCRIPTION OF ALTERNATIVES

NRC regulations 10 CFR Part 51 and guidance at NUREG-1569 require this chapter to provide realistic alternatives to the Proposed Action of the proposed Ludeman Project (proposed project). These alternatives include but are not limited to (1) the No-Action Alternative; (2) the Proposed Action; (3) reasonable alternatives although deemed not suitable.

Currently, the process of evaluating potential alternatives within the confines of the 10 CFR Part 51 involves the consideration of two (2) types of alternatives: (1) primary and (2) secondary.

For purposes of this ER, the alternatives assessed, and the data and analyses included herein are identical to those discussed in Section 8 of the TR.

2.1.1 No-Action Alternative

Under the provisions of the National Environmental Policy Act (NEPA), Uranium One is required to assess the No-Action Alternative. Under the No-Action alternative, the NRC would not approve the proposed project combined Source and 11e.(2) Byproduct Materials License Application to construct, operate, and decommission the proposed project. Uranium ISR would not occur at the proposed project and, accordingly, none of the associated potential impacts identified and analyzed as part of the Proposed Action.

The No-Action Alternative would result in significant financial impacts to Uranium One, Converse County, Wyoming and the surrounding communities. Uranium One has invested significant resources to develop the proposed project that would be irretrievably lost under the No-Action Alternative. In addition, the No-Action Alternative would adversely affect the economic growth of Campbell, Natrona and Converse Counties. As discussed in further detail in Section 9, the proposed project is expected to provide significant positive economic impacts to the local and State economies, including stakeholders with which Uranium One has surface leases and which own the mineral rights in the proposed project area.

A decision to not issue an NRC combined Source and 11e.(2) Byproduct Materials License to Uranium One would leave a large resource unavailable for domestic energy production. Uranium One is continuing to develop estimates of the reserves at the

proposed Ludeman Project and currently estimates the resource is 6.3 million pounds U_3O_8.

According to the U.S. Energy Information Administration (EIA), the total domestic production of U_3O_8 in the first quarter of 2011 was only 1.06 million pounds, down 7 percent from the previous quarter. In 2010, total domestic production was only 4.23 million pounds in contrast with domestic demand for approximately 47 million pounds U_3O_8 (EIA 2011). The proposed project represents an important new source of domestic uranium supplies that are essential to provide a continuing source of fuel to power generation facilities. This additional domestic uranium production will help alleviate U.S. dependency on foreign suppliers located in Canada, Russia, Kazakhstan and Australia among others.

Under the No-Action Alternative, baseline conditions will be influenced by natural processes and by other industrial, commercial, and residential development in the area. Groundwater in the ore-bearing zone will remain unsuitable for drinking due to the high levels of naturally occurring radionuclides and other constituents described in Section 2.7 of the TR.

2.1.2 Proposed Action

As described in Section 3 of the TR, the Proposed Action involves Uranium One utilizing ISR processes and methodologies to recover uranium from known ore bodies. The ISR process is accomplished by installing a series of injection and production wells. Utilizing the injection wells, a carbonate leaching solution, or barren lixiviant, is injected into the ore body. To promote flow across the mineralized areas, corresponding production wells are used to pump water from the ore body, and allow for the collection of the uranium bearing carbonate leach, or pregnant lixiviant, solution. Once the pregnant lixiviant reaches the Satellite facility, the uranium is removed from the lixiviant through the use of pressurized downflow ion exchange columns. Once the resin in an individual exchange column can no longer hold additional uranium molecules, the resin from that vessel is moved to another vessel where the uranium molecules are eluted from the resin. After the elution process is complete, the resin is moved back into the ion exchange column and re-introduced to the ion exchange process. After the lixiviant has passed through the ion exchange system, the solution is re-fortified with a concentrated carbonate solution, making barren lixiviant, and can then be recycled to the injection wells for further mining.

The next phase of the process is the further concentration of the uranium rich solution to create a marketable product. Uranium from ion exchange resins at the proposed Ludeman Satellite facilities will be transported and subsequently processed at the Willow Creek Central Processing Facility, located in Johnson County. This is accomplished by

precipitating the dissolved uranium out of the eluant solution, dewatering the uranium solids, and drying the uranium slurry. The dried uranium product, yellowcake, is then packaged to allow safe transportation.

Initial wellfield(s) for the Proposed Action are developed concurrently with construction of the proposed Satellite facilities and ancillary ISR facilities. Groundwater restoration will take place in the initial wellfield(s) when the uranium resource has been adequately depleted and, simultaneously, additional sequential wellfield developed will occur. The goal of groundwater restoration will be to return the concentration of an identified constituent in the production zone to an NRC-approved background concentration or to a relevant Maximum Concentration Limit (MCL), whichever is higher, or to an Alternate Concentration Limit (ACL) approved by NRC pursuant to 10 CFR Part 40, Appendix A, Criterion 5(B)(5) using Best Practicable Technology (BPT). Successful groundwater restoration was demonstrated within the proposed project area by the Leuenberger pilot ISR facility. A detailed description of the Proposed Action is presented in Section 3 of the TR.

Following groundwater restoration activities, all injection and recovery wells will be reclaimed using mandated plugging and abandonment procedures. In addition, a sequential land reclamation and re-vegetation program will be implemented on the site. This surface reclamation (i.e., decommissioning and decontamination (D&D) will be performed on all disturbed areas, including the Satellite facilities, wellfields, ponds and roads such that upon license termination, the site will be released for unrestricted use. Uranium One will maintain financial responsibility for groundwater restoration, facility decommissioning and surface reclamation until NRC approves license termination and site release. Financial assurance is discussed in Section 6 of the TR.

2.1.3 Reasonable Alternatives Considered But Rejected

2.1.3.1 Conventional Uranium Milling and Underground Milling

As a part of the alternatives analysis conducted by Uranium One, three uranium recovery alternatives were considered. Underground and open pit mining with associated milling facilities and heap leach facilities represent the three currently available alternatives to ISR operations for the uranium deposits in the proposed project area. These alternatives were eliminated based on economics, health, safety, and environmental impacts in relation to the proposed project ore body.

Conventional uranium recovery methods are not suitable for the recovery of lower grade ores due to the significant capital costs associated with the construction and operation of a conventional mine and associated mill. Further discussion of conventional mining methods is provided below.

2.1.3.2 Open Pit Mining

Open pit mining requires the removal of all material covering the orebody. This overburden must be removed and stockpiled to allow removal of the uranium-bearing ore. Once removed, the ore must be transported to a conventional uranium mill for further processing and uranium extraction.

Open pit mining of the relatively low grade proposed project ore would require a capital investment that is not supported by the current uranium market. The nearest conventional mill with an operating license that could receive uranium ore for toll milling is the Denison Mines White Mesa Mill located in Blanding, Utah, nearly 600 miles away. The combination of capital costs to develop an open pit mine at the proposed project, the operating and maintenance costs to mine the ore, and the transportation costs to Blanding, Utah far exceed the current value of the ore as a feedstock for White Mesa. The nearest conventional uranium mill, Kennecott Uranium Corporation's Sweetwater Mill, located in the Great Divide Basin in Wyoming, is currently licensed for operations but is on standby status. However, if the Sweetwater Uranium Mill was currently licensed for operation, similar economic factors would preclude mining the proposed project deposit under current and future reasonably projected uranium market conditions.

Environmental factors must also be considered in addition to the economic factors for open pit mining. Open pit mining would produce large piles of waste rock that would permanently alter the topography of the proposed project site. In addition, substantial dewatering of the pit on the order of several thousand gpm would be required to depress the potentiometric surface to allow mining. Large quantities of groundwater with naturally elevated radium-226 and uranium would be discharged requiring treatment and necessary subsequent disposal of a radioactive solid waste. Moreover, the necessary dewatering process would consume large volumes creating the need for groundwater.

2.1.3.3 Underground Mining

Underground mining of the proposed project deposit would involve sinking mine shafts to the vicinity of the orebodies, horizontally driving crosscuts and drifts to the ore bodies at different levels, physically removing the ore and transporting the mined ore to a conventional uranium mill for further processing. The economic factors involved with this alternative are similar to those for ores mined from an open pit; although depending on depth to the deposit can be significantly more costly and dangerous for workers.

Additionally, from an environmental perspective, underground mining in conjunction with the associated milling process involves significantly higher risks to employees, the public, and the environment. Radiological exposure to the personnel in these processes is increased, not only from the mining process but also from milling and the resultant mill

tailings. The milling process generates a significant amount of waste relative to the amount of ore processed. Extensive mill tailings impoundments are needed for the disposal of these wastes. The potential non-radiological health and safety risks to workers as well as the environmental impacts associated with underground mining are recognized as being considerably greater than those associated in ISR operations.

8.1.3.4 Heap Leaching

As an alternative to conventional milling, uranium is extracted from low-grade ore by heap leaching. This may be done if the uranium content is too low for the ore to be transported to and economically processed at a uranium mill. The low-grade ore is crushed ore then mounded above grade on a leaching pad with a liner. The heap leaching pads must be constructed with the same standards as conventional mill tailings impoundments including a double liner per 10 CFR Part 40, Appendix A. A sulfuric or alkaline leaching agent is introduced on the top of the pile via a sprinkler or drip system which percolates down until it reaches the liner below, where it is captured and pumped to a processing facility. After completion of the leaching process (within months to years), the leached ore is either left in place, or removed to a disposal site, and new ore is placed on the leach pad (so-called on/off scheme, or dynamic heap leaching). Though impacts from heap leaching may be less than those from conventional mining, the impacts from an associated underground or open pit mine remain substantial. For these reasons, this alternative was deemed not suitable for the proposed project.

2.1.4 Satellite Facilities versus Central Processing Facility

Shipping uranium-laden resin is a standard industry practice for Satellite facilities in conjunction with central processing facilities. However, the option of processing and drying on site versus shipping resin for processing and drying to a CPP was eliminated for the following reasons:

- Environmental Health and Safety: A CPP will potentially create more 11e.(2) and non-11e.(2) wastes than a Satellite facility. This would require more waste to be transported and disposed at a licensed facility; and
- Operating Cost: The costs associated with the construction and operations of a CPP outweigh the costs associated with that of a Satellite facility. Uranium One's Willow Creek CPP has the capacity for toll processing of resin which will make the construction of a CPP for the proposed Ludeman Project gratuitous.

2.1.5 Lixiviant Chemistry

Uranium One proposes to use a sodium bicarbonate lixiviant which is an alkaline solution. Where the groundwater contains carbonate, an alkaline lixiviant mobilizes fewer potentially deleterious constituents from the ore body and requires chemical addition than an acidic lixiviant. Also, test results at other, similar uranium ISR projects indicate only limited success with acidic lixiviants, while the sodium bicarbonate has proven highly successful at commercial ISR recovery operations in Wyoming to date. Another alternate leach solution is an ammonium carbonate solution which has been used in ISR programs at other locations; however, operators have experienced difficulty in restoring and stabilizing the aquifer. Therefore, these solutions were excluded from Uranium One consideration for the proposed project.

2.1.5.1 Acidic Leach Solutions

Acid-based lixiviants, such as sulfuric acid, have been used in the United States and are widely used internationally. Acid leach has historically produced a majority of the world's ISR production. Acid-based lixiviants generally achieve a higher degree of recovery (70-90%), better leaching kinetics, and a shorter leaching period. However, acid-based lixiviants dissolve heavy metals and other solids associated with uranium in the host rock and other chemical constituents that may require additional remediation (International Atomic Energy Agency, 2001).

In the United States, acid-based lixiviants have been used only for small-scale research and development operations. At the Nine Mile test site in Wyoming, test patterns were developed using acid-based and carbonate-based lixiviants. The acid-based pattern developed two significant problems. During uranium recovery operations, gypsum precipitated on well screens and within the aquifer, plugging wells and reducing the efficiency of wellfield circulation. Restoration efforts had limited success, apparently due to gradual dissolution of the precipitated gypsum following restoration, resulting in increased salinity and sulfate levels in the affected groundwater (Mudd, 2000).

The commercial use of alkaline lixiviants in the United States has been related to the need to restore affected groundwater and alkaline mine sites are recognized to be technically easier to restore. For this reason, a commercial ISR facility using an acid-based lixiviant has not been developed in the United States and Uranium One determined an acid-based lixiviant was not a suitable alternative for the proposed project.

2.1.5.2 Ammonia-based Lixiviants

Ammonia-based lixiviants have been used in the United States, in Texas and Wyoming. However, operational experience has shown ammonia tends to adsorb onto clay minerals in the subsurface and then desorbs slowly from the clay during restoration, therefore requiring that a much larger volume of groundwater be removed and processed during aquifer restoration (Mudd, 2000). In addition, concerns arose in the early 1980s over the potential post mining oxidation of ammonia in the groundwater to form nitrate and nitrite species. When combined with the slow desorption from clay this potential difficulty resulted in a movement away from ammonia-based lixiviants including an outright ban on their use in Texas. Due to the additional consumptive use of groundwater to meet groundwater restoration requirements, Uranium One determined that an ammonia-based lixiviant is not a suitable alternative for the proposed project.

2.1.5.3 Other Potential Lixiviants

Other lixiviants which have been evaluated in laboratory scale and limited field tests include potassium based lixiviants, a range of oxidants including air, iodine, potassium permanganate, and a variety of trace additives such as clay stabilizing agents to increase the selective oxidation and mobilization of uranium minerals. To date, these alternatives have consistently proven to be far less economical than the planned oxygen-sodium bicarbonate system.

2.1.6 Groundwater Restoration

The groundwater restoration techniques proposed by Uranium One have been successful at other ISR operations in Wyoming. Groundwater sweep, permeate/reductant injection and groundwater treatment have successfully restored the groundwater to pre-mining quality or designated regulatory limit. No practicable alternative(s) to the groundwater restoration method noted herein currently is available. The NRC and the WDEQ consider the method currently employed as the Best Practicable Technology available.

2.1.7 Alternate Waste Management Options

Liquid wastes generated from production and restoration activities generally are managed at ISR facilities by solar evaporation ponds, deep well injection, land application or some combination thereof. The use of deep waste disposal well(s) is considered by Uranium One to be the best alternative to dispose of these types of wastes. The proposed project deep injection well(s) will isolate liquid wastes generated by the project from any underground source of drinking water (USDW). These wells must be authorized by the State of Wyoming under an appropriate Underground Injection Control (UIC) Permit.

Uranium One has considered a wide range of liquid treatment/disposal methods for use at the proposed project. The alternatives analysis considered three primary waste streams from ISR operation:

- Facility eluant;
- Wellfield purge water; and
- RO reject produced during wellfield restoration.

A "design basis influent" was developed for the three typical ISR wastewater streams to be managed as well as the projected water quality characterization for blending the waste streams. The alternatives analysis was completed stepwise with the development of a common evaluation basis, screening of potentially applicable treatment technologies, development of candidate treatment trains, and technical and cost evaluation of the treatment trains. The initial screening of treatment technologies included evaluation of each technology for potential implementation, flexibility, maintainability, and relative capital and operating costs. The retained technologies were developed into treatment options and then the comparative evaluation of each option was conducted in parallel for each waste stream. Both capital and annual operating costs were developed for each option in order to calculate a net present value. The costs developed were comparative order-of-magnitude estimates intended for comparison purposes and were based on an ISR model case that could then be scaled to a particular operation. Costs that were common to all options such as regulatory reporting, project management, and administrative costs were not included.

Land application is feasible and historically has been used at some ISR facilities as a wastewater treatment/disposal method, generally in conjunction with deep well disposal and/or spray/solar evaporation. Discharges through land application may have to be treated to meet surface water quality standards and soil concentration limits to assure that there is no potential for future environmental liability due to accumulation of contaminants in the soil or groundwater below the land application surface area. For this reason land application was not chosen in the screening process for further consideration.

The following discussion provides a description of each treatment/disposal method considered and the relevant characteristics that led to the selection of deep well injection as the preferred alternative.

2.1.7.1.1 Deep Well Disposal

On any site where geologic and hydrogeologic conditions will allow, deep well injection is the preferred method for wastewater disposal. Deep well injection is permitted primarily on the condition that potential Underground Sources of Drinking Water (USDW) cannot be adversely impacted by disposal operations, rather than by the quality

and characteristics of the wastewater injected. NRC, however, requires characterization of the waste stream with respect to worker health and safety and analyses of potential consequences of leaks or spills. Accordingly, deep well "discharge standards" as incorporated into a permit are based on the mine operator's characterization of the waste stream. This method was considered potentially suitable for all ISR waste streams.

2.1.7.1.2 Mechanical Evaporation

Mechanical evaporation utilizing equipment that requires either gas or electric power was considered. Evaporation is energy-intensive, but produces the smallest possible volume of waste for disposal. Disposal costs per unit volume can be evaluated against the evaporator operations cost to determine the economic viability of evaporation as a post-treatment step. For this evaluation it is assumed that a volume reduction of approximately 95% is achieved. This method was considered potentially suitable for all ISR waste streams.

2.1.7.1.3 Chemical Precipitation and Reverse Osmosis

Chemical precipitation and reverse osmosis which can utilize the chemical precipitation step to either pre-treat the wastewater for more efficient operation of the reverse osmosis system or use the chemical precipitation step to treat the brine was considered. Both brine residual and sludge are formed. This method was considered potentially suitable for all ISR waste streams.

2.1.7.1.4 Spray/Solar Evaporation

Spray/solar evaporation utilizing natural evaporation and enhancing the rate by spraying water to increase the surface area, which was assumed to provide a 95% volume reduction for this evaluation, was considered. While solar evaporation is technically feasible, the evaporation rate and length of the evaporation season must be considered in parallel with the flow rate of water to be treated. Evaporation pond size may become unreasonably large if the evaporation rate is low. If sprayers are used for evaporation enhancement, overspray due to high winds must be controlled. Additional issues with evaporation ponds include windblown accumulations of dust and dirt, and the eventual need to remove salts and accumulated solids. This method was considered unsuitable for ISR waste streams.

Table 2-1 provides a summary of the technical and cost evaluation of candidate water treatment and management options for a combination of the process wastewaters. For each of the alternatives considered, the table lists the advantages and disadvantages, the chemicals required, residues storage capacity, required offsite shipments, power

requirements, labor requirements, environmental and safety considerations, capital cost, and 20-year Net Present Value (NPV). For capital cost and 20-year NPV, the deep disposal well alternative is considered the base case and the capital cost and 20-year NPV for the other alternatives are scaled from it.

As shown by Table 2-1, the NPV for the Deep Well Alternative and the Spray/Solar Evaporation Alternative were the most favorable (lowest estimated life cycle cost), with the Deep Well Option as the lowest overall cost. The Deep Well option presents additional environmental, safety and health benefits including the following:

- Minimize worker exposure to concentrated brine streams that may contain uranium and byproduct material;
- Minimize the required footprint and therefore land disturbed by the system;
- Minimize the residual, either solid or liquid, stored onsite and also shipped offsite. There is no offsite transportation of residual required with a deep well; and
- Minimize the requirement for chemicals and other commodities.

Based on this comparative evaluation the deep well water management alternative for ISR wastewater provides clear economic and environmental advantages. All solid wastes will be properly managed.

2.1.8 Uranium Processing Alternatives

2.1.8.1 Higgins Loop

In coordination with the NRC GEIS, Uranium One's Proposed Action includes the use of pressurized down-flow ion exchange system. With this ion exchange system the radon present in the barren recovery solution is forced back underground in the re-fortified groundwater which, thereby, provides for significantly reduced potential for occupational and/or public exposure to radon and its progeny of pressurized down-flow ion exchange columns.

An alternative considered by Uranium One was to utilize a Higgins Loop ion exchange system. The Higgins Loops is a closed-loop system in which uranium-laden resin advances through the system in the different stages of adsorption, backwash, regeneration, and rinse in preparation for another adsorption cycle. The ion exchange system is a vertical cylindrical loop, containing a packed bed of resin that is separated into four operating zones by butterfly, or "loop" valves. These operating zones, adsorption, regeneration, backwashing and pulsing, function like four separate vessels thus increasing the resin loading efficiency.

The Higgins loop resin exchange process is disadvantageous as it results in significant attrition of the resin. The flow system used to load and strip the resin of uranium generates a significant back pressure. The back pressure results in excessive compressive forces on the resin itself and results in damage to the resin particles. The damage resin particles will often increase the back pressure in the system, resulting in accelerated damage to the resin. Additionally, the cycling of the resin between the loading chamber and the stripping chamber results in damage to the resin as the resin particles experience significant physical impact with other resin particles, the chamber walls and plumbing, valves, etc. The damage to and loss of the resin results in significant additional costs for replacement resin. If it is determined that advances in resin and valve technologies negate the damage to the resin this process alternative may be re-evaluated and potentially implemented.

2.1.8.2 Central Processing Facility

At a Central Processing Facility ion exchange resin loaded with uranium is pumped into the elution (stripping) column. The resin is then treated with eluant (stripping solution) composed of water, salt (to add chloride) and soda ash (to maintain high pH and carbonate levels). The uranium on the resin is exchanged for the chloride ions in the stripping solution and is complexed by the carbonate. It is then precipitated from the stripping solution with hydrochloric acid and ammonia. The resulting uranium bearing slurry is washed, dewatered and dried

Uranium One will utilize the Willow Creek Central Processing Facility (SUA-1341) for further processing of uranium loaded resin produced from the proposed Lüdeman Satellite facilities. The use of these Central Processing facilities led to the selection of Satellite facilities as the preferred alternative for the proposed Ludeman Project.

Table 2-1: Treatment Alternatives Comparative Evaluation Matrix – 150 gpm ISR Wastewater

Evaluation Factor	Deep Well	Mechanical Evaporation	Chemical Precipitation/RO	Spray/Solar Evaporation
Advantages	Economical, no residuals so no onsite storage or offsite transport required, no concentrated chemicals required, minimal operating requirements, minimal space requirements, flexible with regard to water quality and disposal rate.	Produces very low volume brine for disposal or further processing by solidification or to dry salt for zero liquid discharge, produces treated water with essentially zero contaminants (distilled water), can be operated campaign style.	Broadly applicable to metals and common anion contaminants, chemical precipitation pretreatment allows operation of RO system to produce less brine, produces high quality treated water stream for reuse or discharge.	Primary treatment is simple system consisting of ponds, pumps, piping and nozzles. No complicated equipment, low capital cost. Commonly used for management of brine in arid climates. Can allow complete evaporation to dryness or remove low volume brine for solidification and offsite disposal.
Disadvantages	Site geology will dictate feasible disposal flow rate. Site hydrogeology (presence of potential drinking water aquifers) will dictate disposal well depth. Permitting process may be lengthy. Attention to water chemistry and need for antiscalent is required to minimize wellscreen scaling and fouling issues. Changes in water chemistry may require re-permitting. No recovery of treated water.	Long equipment lead, distillate is corrosive and would need conditioning for reuse or discharge, high capital and power cost, concentrates radionuclides into the evaporator brine by 20 times or more.	Produces both liquid and solids residues with higher volume liquid residues that other options. Highest labor. Requires bulk concentrated chemicals. Highest truck traffic of options evaluated for chemical deliveries and residuals transport.	Treatment rate dependent upon weather. "Overdesign" required to account for weather shutdowns. Potential for birds and other wildlife to drink and contact water. Treatment time affected by wind with high potential for overspray. Reduced efficiency and operating difficulty due to freezing in winter so large storage capacity required. Windborne dust and dirt reduce efficiency and increase maintenance (cleanouts). Large quantities of chemicals required for solidification and large quantities of solidified brine produced for offsite disposal.
Chemicals Required	None to minimal. Antiscalent may be required depending on water characteristics.	Minimal for evaporator and limited to antiscalent compounds and some cleaning products. Lime, soda ash, and polymer required for solidification.	Lime, Concentrated acid, Polymer, antiscalent and RO cleaning chemicals. Lime, soda ash and polymer for solidification.	Lime, soda ash, and polymer for solidification.

Evaluation Factor	Deep Well	Mechanical Evaporation	Chemical Precipitation/RO	Spray/Solar Evaporation
Residues Storage Capacity	Small feed tank – 10,000 gal storing regular strength wastewater	60,000 gal brine storage – approximately 5 days of storage for feed to solidification system. 100 yd^3 solidified brine (3-4 days)	200,000 gal brine storage – (4 days) 80 yd^3 sludge (20% solids by weight) from chemical precipitation storage 500 yd^3 solidified brine (3-4 days)	40,000,000 gal storage for low evaporation months 60,000 gal brine storage for low evaporation months 100 yd^e solidified brine (3-4 days)
Offsite Shipments	None	Approximately 10 trucks per week with solidified brine.	Approximately 43 trucks per week with solidified brine and dewaterered sludge.	Approximately 10 trucks per week with solidified brine.
Other Considerations	None	Brine is concentrated waste (20X feed), potentially characterized as hazardous or mixed waste	Brine is concentrated waste (6X feed) potentially characterized as hazardous or mixed waste	Brine is concentrated waste (20X feed) potentially characterized as hazardous or mixed waste
Power	710,000 kwh/yr	11,008,000 kwh/yr	2,912,000 kwh/yr	8,822,000 kwh/yr
Labor	Minimal	3 – 4 FTE	6 FTE	3 – 4 FTE
Environmental /Safety	Safest and lowest environmental impact of options. Smallest carbon footprint with low operating power requirement and no truck traffic. No residuals stored onsite, no potential for wildlife exposure to holding ponds. No requirement for chemicals. No potential exposure to concentrated residues.	Large carbon footprint with over 10 times the power requirement of a deep well and 20 times the power requirement of the RO/precipitation option. Requires high operating temperatures and pressures. Low to moderate footprint primarily for brine storage tanks. Requires storage of brine as feed to solidification system and offsite transportation of solidified brine stream. High chemical requirements for solidification chemicals. High operating temperature and pressure.	Moderate carbon footprint with the lowest operating power requirement but the most truck traffic of any option evaluated. Handling of highest quantity of residues required including onsite storage and offsite disposal. Higher labor requirements with more potential for exposure to chemicals and residuals during sludge dewatering operations and residuals management.	Moderate carbon footprint with greater the power required of a deep well and some truck traffic for offsite brine disposal. Greatest risk to wildlife due to large volume ponds. Greatest potential for release of salts from overspray. Potential for exposure to labor from the sprays.
Capital Cost Estimate	Base Case	3.56 times base case	1.79 times base case	4.21 times base case
20 Year NPV	Base Case	17.6 times base case	68.9 times base case	17.9 times base case

2.2 COMPARISON OF THE PREDICTED ENVIRONMENTAL IMPACTS

As discussed above, Uranium One has identified and developed the Proposed Action as the best approach to recovering uranium resources from the proposed project. Table 2-2 provides a summary of the potential environmental impacts for the No-Action Alternative (Section 2.1.1), the Proposed Action (Section 2.1.2), and the reasonable alternatives considered but rejected (Section 2.1.3). The predicted impacts for the Uranium One recovery alternatives discussed in this section are not included for comparison because these alternatives were eliminated due to potential significant environmental and economic impacts. Section 4 of this ER provides a more detailed discussion of potential environmental impacts of the Proposed Action and No-Action Alternatives.

Table 2-2: Comparison of Predicted Environmental Impacts

Potential Impact	Alternative	Potential Impacts
Potential Land Surface Impacts	Proposed Action	Surface disturbance will range from short term for construction of well pads and utility corridors that will be reclaimed after construction to long term for roads, buildings, parking areas, and surge ponds that will remain until final D&D. All disturbance will be reclaimed to be suitable for pre-construction uses.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Open-pit mining would result in significant surface disturbance due to the pit overburden stockpiling and would create permanent topographic changes, increase fugitive dust, and the potential for subsidence. Both heap leaching and open-pit mining methods require crushing the ore and disposing of the tailings, creating long term or permanent 11e. (2) byproduct material.
	CPP versus Satellite Facility	Satellite facility would result in a smaller surface disturbance due the smaller facility size than the proposed central processing facility.
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Disposal in evaporation ponds would result in slightly more surface disturbance than the proposed surge ponds due to the increased surface area to aid in the evaporation process.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Land Use Impacts	Proposed Action	Small impacts on agricultural production (livestock grazing) and hunting on up to eight acres for duration of the proposed project.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Area used for pit, ramps, haul roads, overburden stockpiles, and topsoil stockpiles would be restricted from any other uses for the duration of the proposed project.
	CPP versus Satellite Facility	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Same as Proposed Action plus additional land use impact from installation of evaporation ponds and/or land application areas.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Transportation Impacts	Proposed Action	Approximately eight acres will be disturbed to construct infrastructure access roads. A small risk of spills of process chemicals and small quantities of 11e. (2) byproduct material during the project life.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Conventional mining methods would require more employees which will increase traffic on local roads.
	CPP versus Satellite Facility	A Satellite facility would increase the traffic volume due to the shipment of loaded resin to a central processing facility
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Geology and Soil Impacts	Proposed Action	No significant impacts on geology. Approximately eight acres will be stripped of topsoil for construction of facilities. Topsoil will be stockpiled and seeded with a temporary seed mix to protect from erosion until it is replaced during reclamation. Once replaced the soil will be revegetated and support pre-construction land use.
	No Action	None
	Conventional Mining/Milling Including Heap Leach	Open pit mining would have significant impacts on geology and soil since all overburden from the surface to the ore zones would be removed. The overburden would be stockpiled and seeded with a temporary seed mix to protect form erosion until replaced during reclamation.
	CPP versus Satellite Facility	Same as the Proposed Action
	Use of Alternate Lixiviants	Same as the Proposed Action
	Alternate Waste Management	Evaporation ponds were require a larger surface area disturbance than the Proposed Action resulting in more topsoil removal and stockpiling.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Surface Water Impacts	Proposed Action	Surface disturbance may pose a small risk of increased sediment load to ephemeral drainages. Minimal risk of fuel or chemical spills.
	No Action	None
	Alternate Milling Method	Open pit mining would alter the surface drainage network requiring the restoration of all drainages during reclamation. The surface disturbance is significantly increased from the Proposed Action and would pose a larger risk of sediment load to surface waters. In addition, the potential for large amounts of groundwater to be discharged from the open pit would impact ephemeral drainages that only see flow during runoff or storm events.
	CPP versus Satellite Facility	Same as the Proposed Action
	Use of Alternate Lixiviants	The potential spill of an acid or ammonia based lixiviant would have more of an adverse effect on surface water than a sodium-bicarbonate based lixiviant.
	Alternate Waste Management	Evaporation ponds would disturb more surface area resulting in the increased risk of sediment load to drainages.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Groundwater Impacts	Proposed Action	Excursion of lixiviant may have a small potential to contaminate adjacent aquifers. Minimal risk of fuel or chemical spills leaching to shallow aquifer. Small net withdrawal of water from the ore zone aquifer to contain fluids. Water consumed will naturally recharge with time.
	No Action	None
	Alternate Milling Method	Open-pit and underground mining would drastically alter the hydrogeology of the area. All aquifers from the bottom of the ore zone to the surface would be exposed. Groundwater exposed in pit would need to be discharged altering surface water flow.
	CPP versus Satellite Facility	Same as the Proposed Action
	Use of Alternate Lixiviants	The potential migration of an acid or ammonia based lixiviant would have more of an adverse effect on groundwater than a sodium-bicarbonate based lixiviant.
	Alternate Waste Management	Same as the Proposed Action
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Ecological Impacts	Proposed Action	BMPs will minimize wildlife access to lined retention ponds and storage facilities. No threatened or endangered species will be impacted. Loss of habitat will be minimal and temporary.
	No Action	None
	Alternate Milling Method	Open pit mining would disturb much more habitat by increased surface disturbance.
	CPP versus Satellite Facility	Same as the Proposed Action
	Use of Alternate Lixiviants	Same as the Proposed Action
	Alternate Waste Management	More habitat loss could result due to increased impoundment size.
	Uranium Processing Alternatives	Same as the Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Air Quality Impacts	Proposed Action	Slight increases in fugitive dust will occur, primarily during construction. An increase in fugitive dusts over baseline levels will occur during the life of the project. Combustion and greenhouse gases will be minimal and offset by the recovered uranium.
	No Action	None
	Alternate Milling Method	Open-pit mining would increase fugitive dust emissions by exposing much more disturbed soil surface. Large equipment would increase gaseous greenhouse emissions. Tailings would increase risk of airborne contaminants, including radioactive materials.
	CPP versus Satellite Facility	The potential for impact to air quality increases with a CPP due to the potential exposure to dried yellowcake particulates from an accident.
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Waste Management	Increased emissions may occur if larger lined retention ponds are constructed.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Noise Impacts	Proposed Action	Noise will increase over background levels. Nearest residence could experience noise levels above the annoyance (55-dBA) threshold during construction.
	No Action	None
	Alternate Milling Method	Increased noise levels would result from open-pit mining due to heavy equipment operation.
	CPP versus Satellite Facility	A CPP would potentially produce less noise with the absence of resin shipping trucks.
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Waste Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Historical and Cultural Impacts	Proposed Action	Potential impacts will be minimal, since NRHP eligible sites do not exist on the proposed project site. A stop-work provision will be used if any previously undiscovered cultural resources are found.
	No Action	None
	Alternate Milling Method	Open-pit mining disturbs more area than that of ISR facilities increasing the chance of disturbing unknown cultural resources.
	CPP versus Satellite Facility	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Similar to Proposed Action, although potential impacts could increase with increased retention pond size.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Visual/Scenic Impacts	Proposed Action	Minimal visual impacts will result from new structures and equipment but will remain consistent with the BLM visual resource classification of the area.
	No Action	None
	Alternate Milling Method	Open-pit mining would create a significant visual impact with large stockpiles and a large tailings impoundment.
	CPP versus Satellite Facility	Similar to the Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Waste Management	More and larger impoundments than required under the Proposed Action would have localized visual impacts.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Socioeconomic Impacts	Proposed Action	Most of the workforce is expected to come from the local area minimizing impacts on housing and local services. Project would have slight, positive benefit to the State on severance tax, royalty, and sales and use tax collections and moderate benefits to Campbell County on property and production taxes. Remoteness of the site might slightly increase the need for increased emergency services (fire and ambulance service).
	No Action	None
	Alternate Milling Method	Conventional mining and milling methods require more employees than ISR facilities. Revenues to the State, which are based on production, would be similar to Proposed Action, but Campbell County revenues from property taxes would be more due to additional equipment required for conventional mining.
	CPP versus Satellite Facility	A CPP would require more employees than a Satellite facility which would have a direct positive impact on the local economy
	Use of Alternate Lixiviants	Same as Proposed Action, possibly for an extended amount of time if alternate lixiviant requires more time for restoration.
	Alternate Waste Management	Same as Proposed Action possibly extending the construction period due to the need to construct more impoundments.
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Non-Radiological Impacts	Proposed Action	Minimal risk of public exposure through chemical leaks and spills will be mitigated by employing BMPs.
	No Action	None
	Alternate Milling Method	Conventional mining and milling methods have an increased risk and more severe accidents compared to that of the Proposed Action. Safety hazards are compounded due to the depths of the mineral ore to be recovered.
	CPP versus Satellite Facility	A CPP has additional equipment and chemicals that could present safety hazards not found in a Satellite facility
	Use of Alternate Lixiviants	Similar to Proposed Action; acid or ammonia-based lixiviant would introduce additional non-radiological health risks.
	Alternate Waste Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Radiological Impacts	Proposed Action	The estimated radiological impacts resulting from routine site activities will be compared to applicable public dose limits as well as naturally occurring background levels.
	No Action	None
	Alternate Milling Method	Radiological exposure to the personnel in these processes is increased, not only from the mining process but also from milling and the resultant mill tailings. The milling process generates a significant amount of waste relative to the amount of ore processed. Extensive mill tailings impoundments are needed for the disposal of these wastes.
	CPP versus Satellite Facility	Same as Proposed Action
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Same as Proposed Action
	Uranium Processing Alternatives	Same as Proposed Action

Table 2-2: Comparison of Predicted Environmental Impacts (Continued)

Potential Impact	Alternative	Potential Impacts
Potential Waste Management Impacts	Proposed Action	The proposed project deep injection well(s) will isolate liquid wastes generated by the project from any underground source of drinking water. A slight risk of exposure to the public during transportation exists though will be minimized by employing BMPs.
	No Action	None
	Alternate Milling Method	Conventional mining and milling creates considerably more waste than ISR, including tailings, which would be 11e.(2) byproduct material, and residue left from the treatment of water.
	CPP versus Satellite Facility	A CPP will potentially create more 11e.(2) and non-11e.(2) wastes than a Satellite facility requiring more waste to be transported and disposed at a licensed facility.
	Use of Alternate Lixiviants	Same as Proposed Action
	Alternate Waste Management	Evaporation ponds accumulate salts and windblown material such as dust that will need eventual removal increasing the risk for potential impacts during transport to an off-site facility.
	Uranium Processing Alternatives	Same as Proposed Action

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The proposed Ludeman Project (proposed project) is located in the southern portion of the Powder River Basin (PRB), in the Sothern Powder River Uranium District in Campbell County, Wyoming in the Wyoming East Milling Region as defined by NUREG-1910 (GEIS Sec. 3.3). Figure 1-1 of this TR shows the general site location of the proposed project site and surrounding area in the PRB area in relation to surrounding population centers, interstates and highways.

The proposed project covers approximately 31 Sections (19,888 acres) and its location is described as follows:

- T34N R74W – All of Sections 12, 13, 14, 23, 24 and the east half of Section 22.
- T34N R73W – All of sections 3, 4, 5, 7, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 34, 35, the west half of the west half of Section 2, the south half of Section 6, the west half of the west half of Section 11, the south half of Section 24, the west half of Section 25, the west half of the east half of Section 25, the northeast quarter of the northeast quarter of Section 25, the east half of Section 28, the west half of Section 36, and the west half of the east half of Section 36.
- T34N R72W – The southwest quarter of Section 19 and the north half of the northwest quarter of Section 30.
- T33N R73W – The northwest quarter of the northeast quarter of Section 1, the north half of the northwest quarter of Section 1, the north half of the north half of Section 2, and the north half of the north half of Section 3.

The information in this section provides relevant data concerning the physical, ecological, and social characteristics of the proposed project area, and the surrounding environs for uranium in-situ production. This section examines the nature and extent of present and projected land, and water use and trends in population or industrial patterns. Preliminary data were obtained from several sources followed by field studies to collect on-site data to check land uses.

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3.1 LAND USE

NRC guidance in NUREG-1569 requires discussion of land use in, and within a two-mile radius surrounding the proposed Ludeman Project (proposed project). This section describes the nature and extent of present and projected land use. Preliminary data were obtained from several sources followed by field studies to collect on-site data to check land uses. The proposed project area is located in the Wyoming East Milling Region as defined by NUREG-1910 (GEIS, p. 1-2).

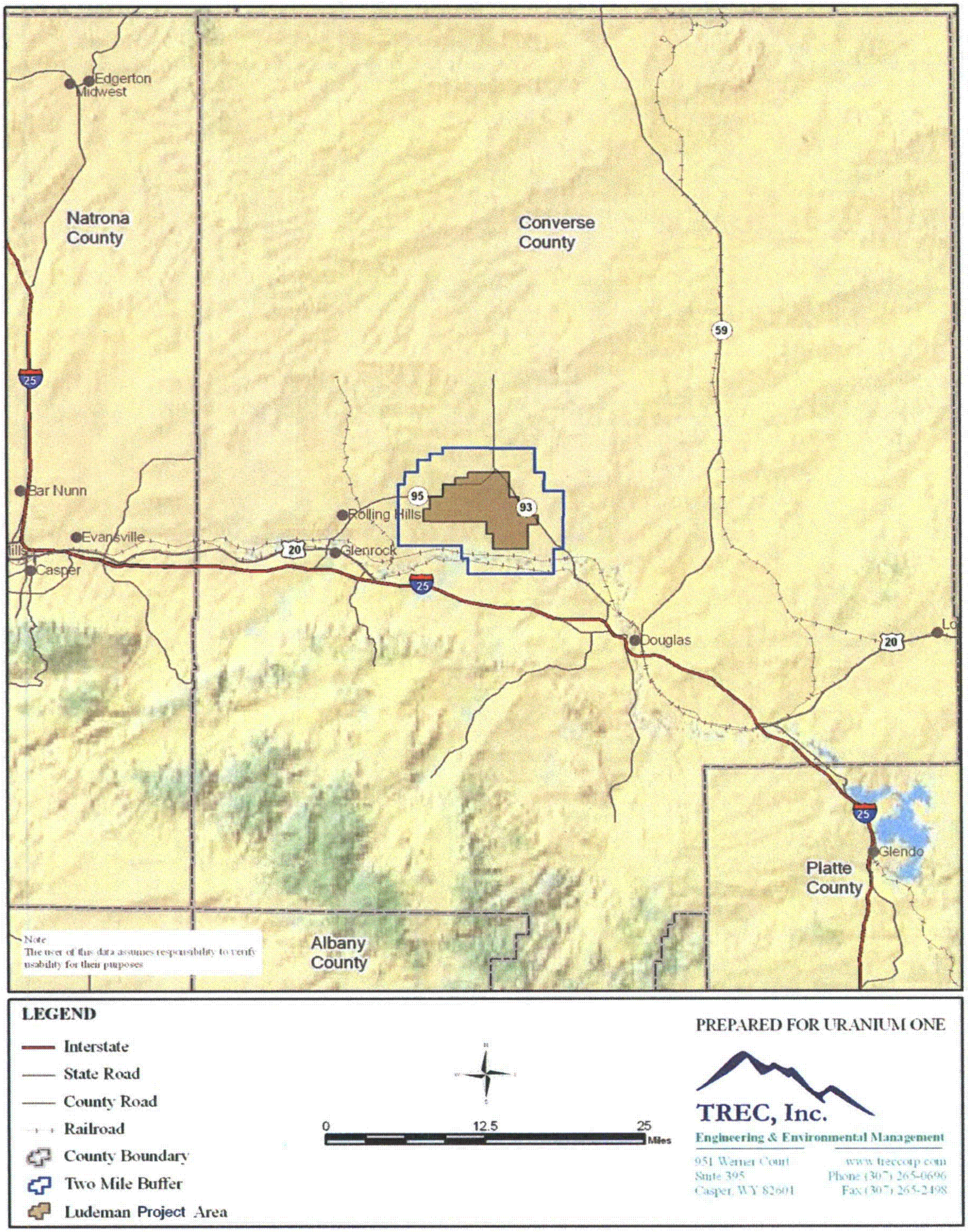
3.1.1 General Setting

The proposed project is located in central Wyoming in Converse County. State Highway 95 provides access to the proposed project from the towns of Glenrock and Rolling Hills to the west and State Highway 93 provides access from Douglas to the southeast. Interstate 25 provides access to both of these state highways from the south of the proposed project. (Figure 3.1-1)

Surface ownership within the proposed project area includes private land, with some areas located in federal state owned lands. Figure 1-2 of this ER illustrates surface land ownership and Figure 1-3 of this ER delineates mineral ownership for the proposed project site. Uranium One has executed surface use agreements with all land owners who hold surface ownership in the proposed project area

The proposed project is located within the Pathfinder to Guernsey sub-basin of the greater Platte River Basin. The greater Platte River Basin is located within the Rocky Mountain, Wyoming Basin, and Great Plains Physiographic Provinces. The topography of the basin includes valleys, high plains, hills and mountains. Elevations in the Platte River Basin range from 4,025 to 12,013 feet above mean sea level. As described in Section 2.5 of the TR, average annual precipitation for the region of the proposed project ranges from nine to 12 inches per year.

Figure 3.1-1: Proposed Ludeman Project Location with Major Roads and Rail



3.1.2 Land Use Classification

Land use and land cover within the proposed project and a two-mile buffer area around the proposed project is illustrated on Figure 3.1-2. Table 3.1-1 defines the land use and land cover types depicted on Figure 3.1-2.

Table 3.1-2 presents current land uses and land cover in 22-1/2 degree sectors centered on each of the 16 compass points. These sectors radiate from the geographic center of the proposed project. The total areas of the sectors vary because of the irregular site boundary. Rangeland is the primary land use within the proposed project area and within the surrounding two-mile buffer area. Also within the two-mile buffer area, but outside the proposed project boundary, areas of irrigated cropland exist (primarily along the North Platte River). Non-irrigated cropland is scattered within the two-mile buffer area. Within the proposed project, there is one residence. There are 31 residential sites in the two-mile buffer area outside the proposed project. Oil and gas pipelines cross the proposed project and lands within the two-mile buffer area. The Bozeman Trail crosses the proposed project and other lands within the two-mile buffer area. The Child's Cutoff Trail generally parallels the North Platte River south of the Project. Portions of the Trail are within the two-mile buffer area.

Table 3.1-1: Land Use and Land Cover Definitions

Land Use/Land Cover	Definition
Ir	Irrigated Cropland
NI	Non-Irrigated Cropland
R-Other	Rangeland and other Non-Agricultural Land
W	Water

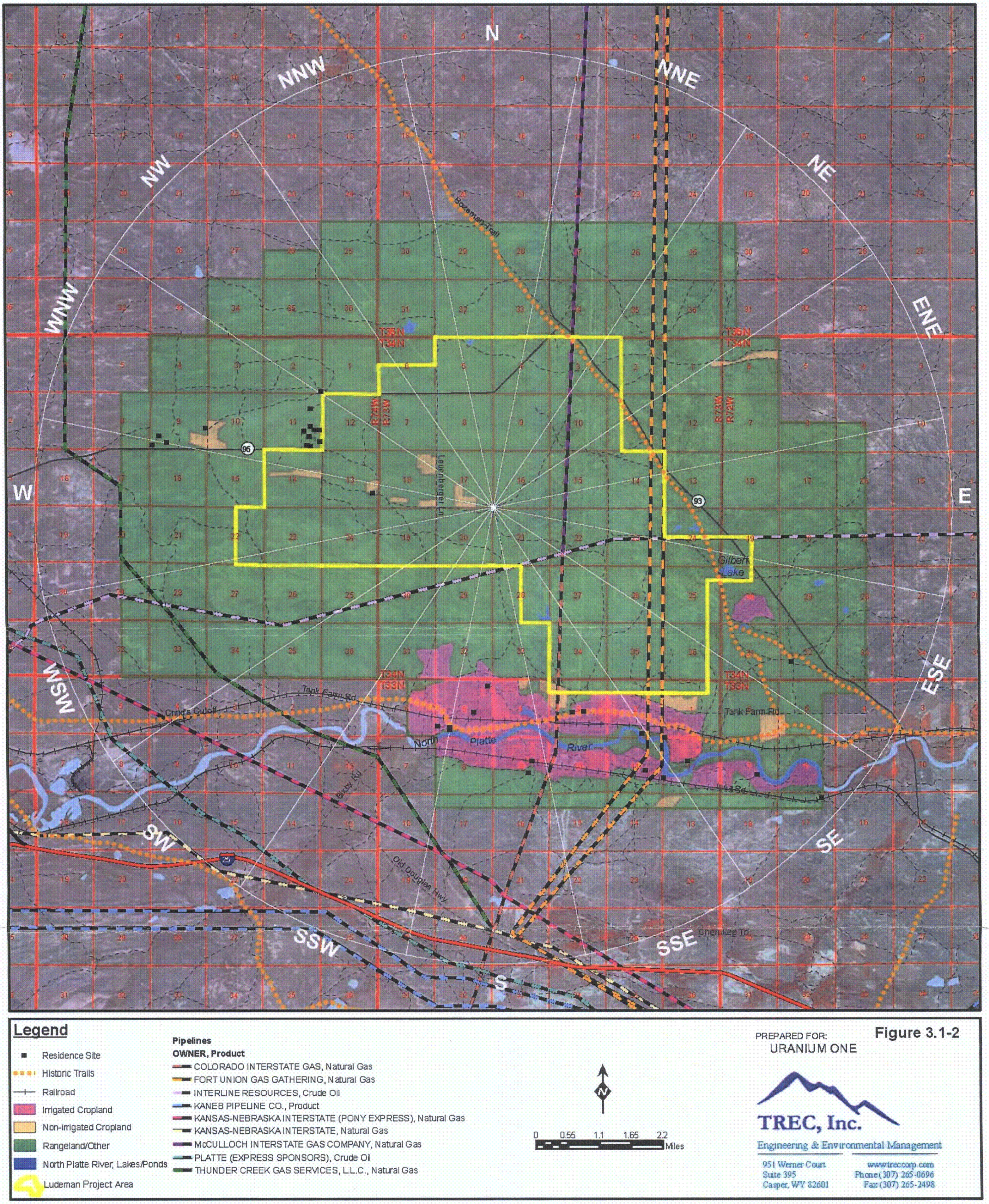

N
NNW
NNE
NW
NE
WNW
ENE
W
E
WSW
ESE
SW
SE
SSW
SSE
S
T35N
T34N
T34N
T33N
R73W
R72W
Bozeman Trail
Leuenberger Ln
Gilbert Lake
Tank Farm Rd
Childs Cutoff
North Platte River
Old Douglas Hwy
Cherokee Trl
95
93
Legend
Residence Site
Historic Trails
Railroad
Irrigated Cropland
Non-irrigated Cropland
Rangeland/Other
North Platte River, Lakes/Ponds
Ludeman Project Area
Pipelines
OWNER, Product
COLORADO INTERSTATE GAS, Natural Gas
FORT UNION GAS GATHERING, Natural Gas
INTERLINE RESOURCES, Crude Oil
KANEB PIPELINE CO., Product
KANSAS-NEBRASKA INTERSTATE (PONY EXPRESS), Natural Gas
KANSAS-NEBRASKA INTERSTATE, Natural Gas
McCULLOCH INTERSTATE GAS COMPANY, Natural Gas
PLATTE (EXPRESS SPONSORS), Crude Oil
THUNDER CREEK GAS SERVICES, L.L.C., Natural Gas
0 0.55 1.1 1.65 2.2 Miles
PREPARED FOR:
URANIUM ONE
TREC, Inc.
Engineering & Environmental Management
951 Werner Court
Suite 395
Casper, WY 82601
www.treccorp.com
Phone (307) 265-0696
Fax (307) 265-2498

Figure 3.1-2

Table 3.1-2: Land Use and Land Cover of the Proposed Ludeman Project and within Two Miles (3.3-km) of the Project Boundary

Compass Sector[1]	Land Use and Land Cover within Project (in acres)				Land Use and Land Cover within Two-Mile Buffer Surrounding Project (in acres)				Total
	Ir	NI	R-Other	Water	Ir	NI	R-Other	Water	
North	0.0	0.0	1,130.6	7.4	0.0	0.0	2,040.6	0.0	3,178.5
North-Northeast	0.0	0.0	1,344.3	0.0	0.0	0.0	2,392.2	0.0	3,736.5
Northeast	0.0	0.0	1,307.3	0.0	0.0	0.9	3,084.4	0.0	4,392.6
East-Northeast	0.0	0.0	978.6	0.0	0.0	80.1	2,946.3	0.0	4,004.9
East	0.0	0.0	1,346.2	0.0	0.0	0.0	4,005.8	12.0	5,363.9
East-Southeast	0.0	0.0	2,272.3	28.2	155.1	0.0	3,442.1	21.5	5,919.2
Southeast	1.9	0.3	2,533.3	0.0	960.6	217.8	2,478.8	162.3	6,354.9
South-Southeast	5.2	26.7	1,095.8	12.4	1,219.1	135.9	1,569.6	102.1	4,166.9
South	0.0	0.0	131.3	0.0	1,388.6	23.6	1,911.5	71.4	3,526.4
South-Southwest	0.0	0.0	155.1	0.0	664.0	0.0	1,140.0	8.6	1,967.8
Southwest	0.0	0.0	274.2	0.0	0.0	0.0	2,098.1	0.0	2,372.3
West-Southwest	0.0	0.0	1,124.4	0.0	0.0	0.0	4,324.7	0.0	5,449.1
West	0.0	142.2	2,150.7	0.0	0.0	0.2	3,061.7	0.0	5,354.7
West-Northwest	0.0	98.2	1,428.3	0.0	0.0	123.6	3,556.2	0.0	5,206.4
Northwest	0.0	37.8	1,172.3	0.0	0.0	0.0	3,177.1	0.0	4,387.2
North-Northwest	0.0	0.0	1,083.4	0.0	0.0	0.0	2,592.6	21.2	3,697.3
Total	**7.1**	**305.2**	**19,528.2**	**48.1**	**4,387.4**	**582.0**	**43,821.5**	**399.1**	**69,078.6**

[1]22 ½ degree sectors centered on each of 16 compass points
Ir = Irrigated Cropland, NI = Non-Irrigated Cropland, R = Rangeland and Other Non-Agricultural Land

Predominant current land use within the two-mile buffer area is rangeland. In 2006, Converse County ranked first in Wyoming for sheep production and tenth for cattle production. According to the 2002 agricultural census, Converse County had 339 farms and ranches with a total of 2,517,920 acres. The average size of a farm or ranch was 7,427 acres. A total of 71,452 acres was cropland, and of this 30,584 were irrigated for forage crops. In 2006, cash receipts for livestock sales totaled $37.7 million in Converse County. Table 3.1-3 shows the 2006 livestock inventory for Converse County (NASS, 2008).

Table 3.1-3: 2007 Livestock Inventory for Converse County

Type of Livestock	Number
Beef Cows	39,950
Cows	35,000
Breeding Sheep & Lambs	65,000
Total animals	139,950

Recreational lands are present in Albany, Campbell, Converse, Johnson, Natrona, Niobrara, and Platte Counties within 50 miles of the proposed project (Table 3.1-4). Recreational opportunities provided by federal and state lands in the county have become an increasingly important component of the local economy. The regional setting (Converse, Natrona, Platte, Campbell, Niobrara and Albany counties) of the proposed project provides broad, panoramic prairie landscapes, which provide a setting for a variety of outdoor recreational activities. Major attractions include Medicine Bow National Forest, Thunder Basin National Grassland, Hogadon Ski Area, North Platte River, Glendo Reservoir, several state historic sites, and the historic Bozeman Trail and Overland Emigrant Route.

Table 3.1-4: Recreational Areas within 50-miles of the Proposed Ludeman Project

Name of Recreational Facility	Managing Agency	Distance From Ludeman Project (miles)
Thunder Basin National Grasslands	USFS	18
Bessemer Bend	BLM	42
Fort Fetterman	Wyoming State Parks	4.4
Edness K. Wilkins State Park	Wyoming State Parks	23
Glendo State Park	Wyoming State Parks	36
Wyoming Pioneer Museum	Wyoming State Parks	12
Ayres Park and Natural Bridge	Wyoming State Parks	9
North Platte River Access:		
PP&L	Wyoming Game and Fish	6.5
Bixby	Wyoming Game and Fish	2.5
South Douglas	Wyoming Game and Fish	13
Orin Junction Bridge	Wyoming Game and Fish	25
Glendo	Wyoming Game and Fish	42
Mills Bridge	Wyoming Game and Fish	31
Paradise Valley/Robertson Road	Wyoming Game and Fish	35
Speck/Bessemer/Hartnett	Wyoming Game and Fish	42
Schmitt	Wyoming Game and Fish	43
Sechrist	Wyoming Game and Fish	44
Casper Mountain	Natrona County	32
Hogadon Ski Area	Casper City	33
Bozeman Trail	Various Agencies	in Project and beyond (Monument is 32 miles)
Child's Cutoff Trail	Various Agencies	in two-mile Survey Area and beyond

As shown on Figures 2.2-2 and 1-2 in Section 1, there are public lands scattered within the proposed project area and surrounding two-mile buffer area. Some of the public land parcels outside of the proposed project are accessible via public roads and provide potential dispersed recreational opportunities, such as hunting. Within the proposed project, there are four parcels of state land and four parcels of BLM-managed federal

land. Of these, only three parcels (all of which are BLM-managed lands) are adjacent to public roadways.

In addition to the recreational sites on public lands shown in Table 3.1-4, larger communities in the 50-mile area provide a variety of recreational opportunities. These include municipal and private campgrounds, golf courses, rodeo grounds, parks, ball parks, recreation centers, and swimming pools.

There is one residence within the proposed project. Table 3.1-5 shows the distance to the nearest residence from the center of the proposed project for each 22-1/2 degree sector centered on each of 16 compass points. It also shows distance to the nearest site boundary for residences outside the Project. Outside of the proposed project, the nearest residence sites are less than 500 feet from the proposed project boundary as displayed in Table 3.1-5 and shown on Figure 3.1-2.

Table 3.1-5: Distance to Nearest Residence and Site Boundary from Center of Proposed Project for Each Compass Sector

Compass Sector[1]	Nearest Residence (miles)	Nearest Site Boundary (feet/mile)
North	11.0	42,240/8.0
North-Northeast	23.7	107,302/20.3
Northeast	3.8	2,485/0.5
East-Northeast	20.6	93,936/17.6
East	18.8	75,946/14.4
East-Southeast	5.8	7,944/1.5
Southeast	5.0	3,992/0.8
South-Southeast	3.9	1,697/0.3
South	3.2	11,207/2.1
South-Southwest	3.9	5,734/1.1
Southwest	4.5	18,322/3.5
West-Southwest	10.4	31,649/6.0
West	Within Ludeman Project	Within Ludeman Project
West-Northwest	3.2	251/.05
Northwest	3.6	261/.05
North-Northwest	7.7	24,211/4.6

1 22½ degree sectors centered on each of the 16 compass points

3.1.2.1 Oil and Gas Development

The proposed project is located within the Powder River Basin Uranium District, which extends across portions of southern Montana and Sheridan, Campbell, Johnson, and Converse counties in Wyoming. In addition to uranium, the Powder River Basin contains major deposits of coal, coal bed methane (CBM) and other petroleum resources. These resources are more prevalent in the northern portion of the Powder River Basin. In the southern Powder River Basin (the portion that includes the proposed project), coal and CBM resources are less prevalent (Office of Federal and State Materials, 2008). There have not been any coal mines or CBM wells in the two-mile buffer area. The Dave Johnson Power Plant, located six miles east of Glenrock (but outside of the two-mile buffer area), produces electricity with coal produced in the Powder River Basin.

Wells in the two-mile buffer area have since been plugged and abandoned or permits have expired. Wyoming Oil and Gas Conservation Commission data accessed in December 2008 (WOGCC, 2008) indicated only one active oil and gas well site within the two-mile radius buffer area. The other nearest active location is a permit to drill approximately three miles north of the proposed project area.

The administering agency for split estate minerals (private surface and federal subsurface minerals) is the Casper Field Office of the Bureau of Land Management.

3.1.2.2 Aesthetics

The proposed project is located on flat to rolling grasslands that are typical landscapes in the Powder River Basin. The proposed project landscape is rural in character, with some rural residential development along the northwest portion of the proposed project.

The BLM has assigned Visual Resource Management (VRM) classifications to all lands within each BLM Region, including private lands and lands managed by other agencies. There are no Class I areas within 50 miles of the proposed project. Class I is the most visually sensitive classification. VRM Class II areas within 50 miles of the proposed project are generally south of Interstate 25 along the Laramie Mountains and along the North Platte River. Areas of extensive urban modification and several areas of oil, natural gas, and coal production (such as Natrona and Converse Counties near Casper and Douglas) have been classified as VRM Class IV or V/Rehabilitation. The majority of the proposed project area falls within a VRM Class IV area with portions classified as Class III areas (Office of Federal and State Materials, 2008). Detailed discussion of VRM classifications and evaluations is presented in Section 2.4.2 of the TR.

3.1.2.3 Transportation and Utilities

The primary transportation routes from the nearest communities are on State Highway 95 from Glenrock and State Highway 93 to Douglas. Both Glenrock and Douglas are connected to the nearest largest city (Casper) by Interstate 25. Average Annual Daily Traffic counts on Highway 95 near Rolling Hills were 1,810 vehicles in 2006. On Highway 93 near Orpha, Average Annual Daily Traffic count was 340 vehicles in 2006. (Office of Federal and State Materials, 2008). One county road, Leuenberger Lane, crosses the project area. Several other county and private roads cross lands within the two-mile buffer area.

Railroad lines parallel both sides of the North Platte River south of the project area within the two-mile buffer area.

There are several oil and gas pipelines and overhead utilities across both the proposed project and the two-mile buffer area.

3.1.2.4 Fuel Cycle Facilities

The NRC website (US NRC, 2007) provides maps and information on nuclear fuel cycle facilities in the United States. The nearest uranium fuel fabrication facility is located in Richland, Washington. The only conversion facility in the U.S. is in Illinois, and the only gaseous diffusion enrichment facility is in Kentucky.

Several uranium projects occur or are proposed within a 50-mile radius of the proposed project as shown on Figure 3.1-3. These sites are listed in Table 3.1-6. The nearest operational *in situ* uranium recovery facility is the Smith Ranch ISR facility. Smith Ranch and Willow Creek are the only currently producing uranium facilities in Wyoming.

Table 3.1-6: Uranium Recovery Facilities Located or Proposed within 50-Mile Radius of the Proposed Project

Facility	Owner	Status	Description
Smith Ranch	Power Resources, Inc., dba Cameco Resources	Operating	The Smith Ranch-Highland Uranium Project is the primary processing facility for Cameco operations. Intend to expand.
Highland Ranch	Power Resources, Inc dba Cameco Resources	Operating	ISR Satellite facility to Smith Ranch – Highland Uranium Project
Moore Ranch	Uranium One	Licensed	ISR project
Reynolds Ranch	Power Resources, Inc dba Cameco Resources	Proposed	ISR Project
Allemand-Ross	Uranium One	Proposed	ISR Project

Notes: ISR = *In situ* Recovery

Figure 3.1-3: Uranium Recovery Facilities Located or Proposed within 50-Mile Radius of the Proposed Ludeman Project