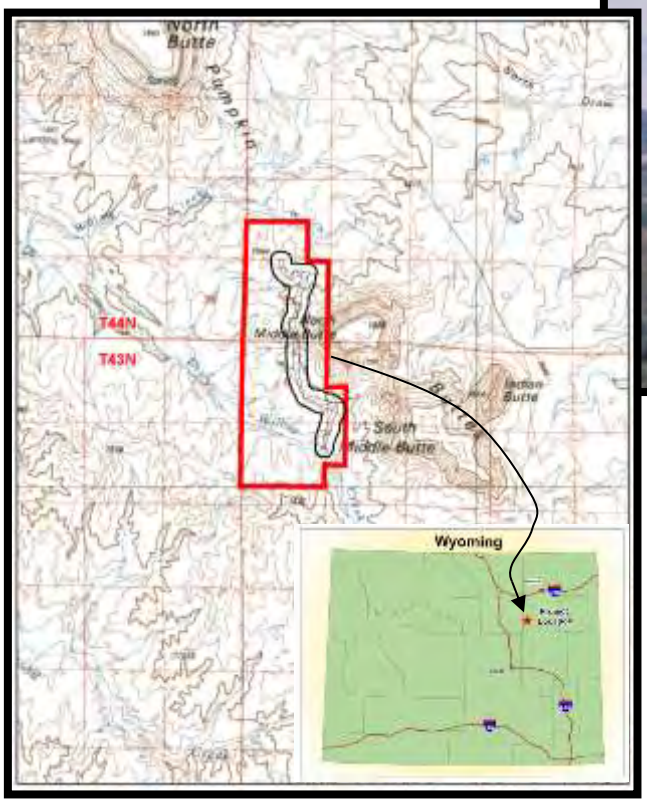
# Environmental Assessment for Uranerz Energy Corporation's Proposed Hank Unit Uranium *In-Situ* Recovery Project, Campbell County, Wyoming

## WYW-169904




**July 2015**

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The BLM manages more land – 256 million acres – than any other Federal agency. This land, known as the National System of Public Lands, is primarily located in 12 Western States, including Alaska. The Bureau, with a budget of about $1 billion, also administers 700 million acres of sub-surface mineral estate throughout the nation. The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

# ENVIRONMENTAL ASSESSMENT
# WY-070-EA13-226

*This Environmental Assessment was prepared by the Bureau of Land Management (BLM) with assistance from TRC Environmental Corporation, an independent environmental consulting firm. The BLM, in accordance with 40 Code of Federal Regulations 1506.5 (a) & (b), is in agreement with the findings of the analysis and approves and takes responsibility for the scope and content of this document.*

# ENVIRONMENTAL ASSESSMENT FOR URANERZ ENERGY CORPORATION'S PROPOSED HANK UNIT URANIUM *IN-SITU* RECOVERY PROJECT, CAMPBELL COUNTY, WYOMING

**Bureau of Land Management**
**Wyoming High Plains District**
**Buffalo Field Office**
**Buffalo, Wyoming**

**July 2015**

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ACL | Alternate Concentration Limit |
| A.D. | Anno Domini |
| AIRFA | *American Indian Religious Freedom Act* |
| AMSL | above mean sea level |
| AO | authorized officer |
| APE | Area of Potential Effect |
| APLIC | Avian Power Line Interaction Committee |
| ARPA | *Archaeological Resources Protection Act of 1979* |
| AQD | Air Quality Division |
| AUM | animal unit month |
| BFO | Buffalo Field Office |
| bgs | below ground surface |
| BGEPA | *Bald and Golden Eagle Protection Act* |
| BLM | Bureau of Land Management |
| BMP | best management practice |
| BO | Biological Opinion |
| B.P. | before present |
| CBNG | coal bed natural gas |
| CCESC | Campbell County Educational Services Center |
| CDWA | *Clean Drinking Water Act* |
| CEQ | Council on Environmental Quality |
| CERCLA | *Comprehensive Environmental Response Compensation and Liability Act of 1980* |
| CESQG | conditionally exempt small quantity generator |
| CFR | *Code of Federal Regulations* |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| CPA | core population area |
| CPP | Central Processing Plant |
| CR | County Road |
| CWA | *Clean Water Act of 1977* |
| DL | delisted |
| DOE | Department of Energy |
| DR | Decision Record |
| EA | Environmental Assessment |
| EHS | extremely hazardous substance |
| EIA | Energy Information Administration |
| EIS | Environmental Impact Statement |
| E.O. | Executive Order |
| EPA | Environmental Protection Agency |
| EPACT | *Energy Policy Act of 2005* |
| ERA | Extended Reference Area |
| ERP | Emergency Response Plan |
| ESA | *Endangered Species Act of 1973* |
| FLPMA | *Federal Land Policy and Management Act of 1976* |
| FONSI | Finding of No Significant Impact |
| ft | foot, or feet |
| $ft^2$ | square feet |
| $ft^3$ | cubic feet |
| FY | fiscal year |
| GEIS | Generic Environmental Impact Statement |
| gpm | gallons per minute |
| GHG | greenhouse gas(es) |
| GSG | Greater Sage-Grouse |
| $H_2O_2$ | hydrogen peroxide |
| HAP | hazardous air pollutant |
| HDPE | high-density polyethylene |
| IM | Instruction Memorandum |
| in. | inch(es) |
| ISL | *in-situ* leaching |
| ISR | *in-situ* recovery, can also be called *in-situ* leaching |
| IX | ion exchange |
| kg | kilogram(s) |
| km | kilometer(s) |

## LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

| | |
|---|---|
| lb | pound(s) |
| LOP | life-of-project |
| LQD | Land Quality Division |
| MBTA | *Migratory Bird Treaty Act* |
| MCL | Maximum Contaminant Level |
| µg | microgram(s) |
| $\mu g/m^3$ | micrograms per cubic meter |
| mi | mile(s) |
| $mi^2$ | square mile(s) |
| mg | milligram(s) |
| mg/L | milligrams per liter |
| MIT | mechanical integrity test |
| µm | micron(s), or micrometer(s) |
| MOA | Memorandum of Agreement |
| MOU | Memorandum of Understanding |
| mph | miles per hour |
| na | not applicable |
| $Na_2CO_3$ | sodium carbonate |
| $NaHCO_3$ | sodium bicarbonate |
| NAAQS | National Ambient Air Quality Standards |
| NAGPRA | *Native American Graves Protection and Repatriation Act* |
| NEPA | *National Environmental Policy Act* |
| NHPA | *National Historic Preservation Act* |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxide or oxides (one or more nitrogen oxides) |
| NOAA | National Oceanographic and Atmospheric Administration |
| NRC | Nuclear Regulatory Commission |
| NRCS | Natural Resource Conservation Service |
| NRHP | National Register of Historic Places |
| $O_2$ | oxygen |
| PA | Programmatic Agreement |
| Pb | lead |
| pCi/g | picoCuries per gram |
| pCi/L | picoCuries per liter |
| pers. comm. | personal communication(s) |
| PLS | pure live seed |
| $PM_{2.5}$ | particulate matter of less than 2.5 microns |
| $PM_{10}$ | particulate matter of less than 10 microns |
| POD | Plan of Development |
| POO | Plan of Operations |
| ppm | parts per million |
| PRB | Powder River Basin |
| PSD | prevention of significant deterioration |
| PVC | polyvinyl chloride |
| Ra | radon |
| RCRA | *Resource Conservation and Recovery Act* |
| RFFA | Reasonable Foreseeable Future Action |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| ROI | region of influence |
| ROW | Right-of-Way |
| RTV | restoration target value |
| SARA | *Superfund Amendments and Reauthorization Act* |
| SDWA | *Safe Drinking Water Act* |
| SEIS | Supplemental Environmental Impact Statement |
| SERP | Safety and Environmental Review Panel |
| SGCN | Species of Greatest Conservation Need |
| SHWD | Solid and Hazardous Waste Division |
| SML | Source Material License |
| SMZ | Sage-grouse Management Zone |

## LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

| | |
|---|---|
| $SO_2$ | sulfur dioxide |
| SOP | Standard Operating Procedure |
| SPF | Satellite Processing Facility |
| SS | sensitive species |
| SWCA | SWCA Environmental Consultants |
| SWPPP | Storm Water Pollution Prevention Plan |
| T&Cs | terms and conditions |
| TCP | Traditional Cultural Property |
| TDS | total dissolved solids |
| TEPC | threatened, endangered, proposed, and candidate |
| Th | thorium |
| TPQ | threshold planning quantity |
| TRC | TRC Environmental Corporation |
| TSD | treatment storage or disposal |
| $U_3O_8$ | triuranium octoxide |
| UCL | Upper Control Limit |
| $UF_6$ | uranium hexafluoride |
| UIC | Underground Injection Control |
| Uranerz | Uranerz Energy Corporation |
| USACE | U.S. Army Corps of Engineers |
| U.S. | United States |
| U.S.C. | *United States Code* |
| USCB | U.S. Census Bureau |
| USDOT | U.S. Department of Transportation |
| USDW | U.S. Drinking Water |
| USFWS | U.S. Fish and Wildlife Service |
| UUD | unnecessary or undue degradation |
| VOC | volatile organic compound |
| VRM | visual resource management |
| WAAQS | Wyoming Ambient Air Quality Standards |
| WBC | Wyoming Business Council |
| WDEQ | Wyoming Department of Environmental Quality |
| WDERP | Wyoming Department of Employment, Research, and Planning |
| WEAD | Wyoming Economic Analysis Division |
| WGFD | Wyoming Game and Fish Department |
| WIA | Wildlife Inventory Area |
| WOGCC | Wyoming Oil and Gas Conservation Commission |
| WQD | Water Quality Division |
| W.S. | Wyoming Statute(s) |
| WSEO | Wyoming State Engineer's Office |
| WSGIT | Wyoming Sage Grouse Implementation Team |
| WSGS | Wyoming State Geological Survey |
| WUS | Waters of the U.S. |
| WY | Wyoming |
| WYDOT | Wyoming Department of Transportation |
| WYNDD | Wyoming Natural Diversity Database |
| WYPDES | Wyoming Pollutant Discharge Elimination System |
| WYSHPO | Wyoming State Historic Preservation Office |
| yd | yard(s) |
| $yd^3$ | cubic yard(s) |
| < | less than |
| > | greater than |
| % | per cent (per hundred) o |
| $^o$ | degree(s) |
| $^oF$ | degrees Fahrenheit |

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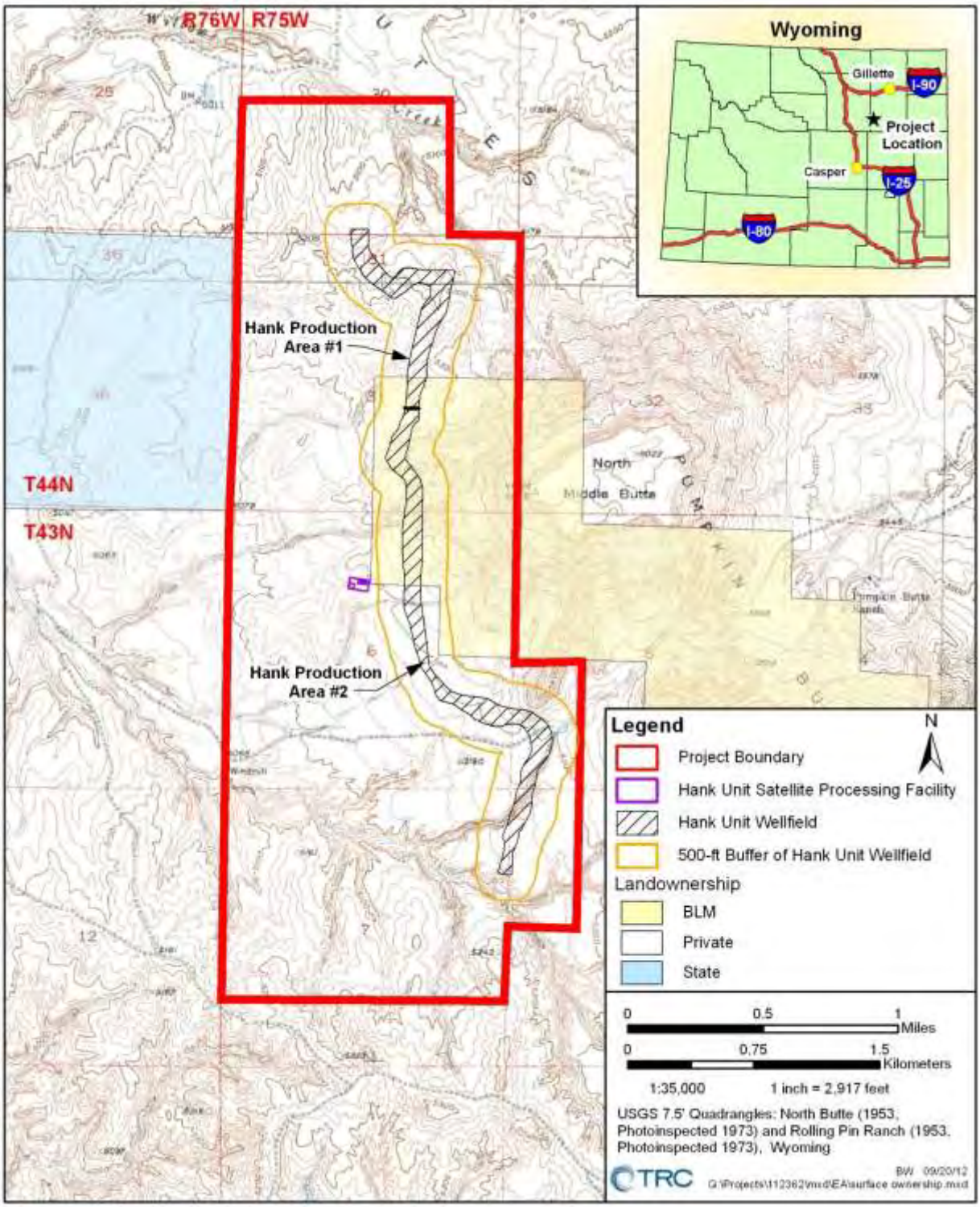
# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Uranerz Energy Corporation (Uranerz) proposed to the Bureau of Land Management (BLM), Buffalo Field Office (BFO) the development and operation of the Hank Unit Uranium *In-Situ* Recovery (ISR) Project (the Proposed Action). ISR is sometimes called *in-situ* leaching (ISL), although ISR is the more accurate and preferred term as both leaching and recovery of the leached constituents occurs. The Hank Unit project area is located west of the Pumpkin Buttes area in southwest Campbell County, Wyoming, and is approximately 46 miles (mi) southwest of Gillette, and approximately 61 mi northeast of Casper (Figure 1.1).

The Hank Unit project area includes a total of 2,250 acres comprising one wellfield in a single contiguous mine unit, to be developed in two phases (Figures 1.1 and 2.1). Most of the Hank Unit lands are "split-estate," meaning the surface and mineral ownerships are different. Approximately 1,970 acres (approximately 88%) of the surface lands are owned by private individuals, and approximately 280 acres (approximately 12%) of the surface lands are owned by the U.S. Government and administered by BLM (Figure 1.1). The federal government categorizes minerals into three classifications: leasable, locatable, and salable. Uranium is a locatable mineral, a mining claim mineral. The entity that owns or controls a given mining claim has the right to explore for and/or develop the locatable minerals on the lands within that mining claim. Uranerz owns or controls the mining claims located on the lands proposed to be mined in this project. Approximately 1,538 acres (approximately 68%) of the mineral estate in the Hank Unit is owned by the federal government, and approximately 712 acres (approximately 32%) is owned by various private entities. All mining claims are recorded with, and this information maintained by, the BLM. Although all mining claims involve federally-owned mineral estate, BLM administers only those federally-owned mineral lands that coincide with BLM-administered federally-owned surface lands; 280 acres in this project (approximately 12%).

Facilities for the Hank Unit Project would include the buildings associated with a Satellite Processing Facility (SPF), wells and related components, power lines, pipelines, communication




Source: Uranerz 2012.

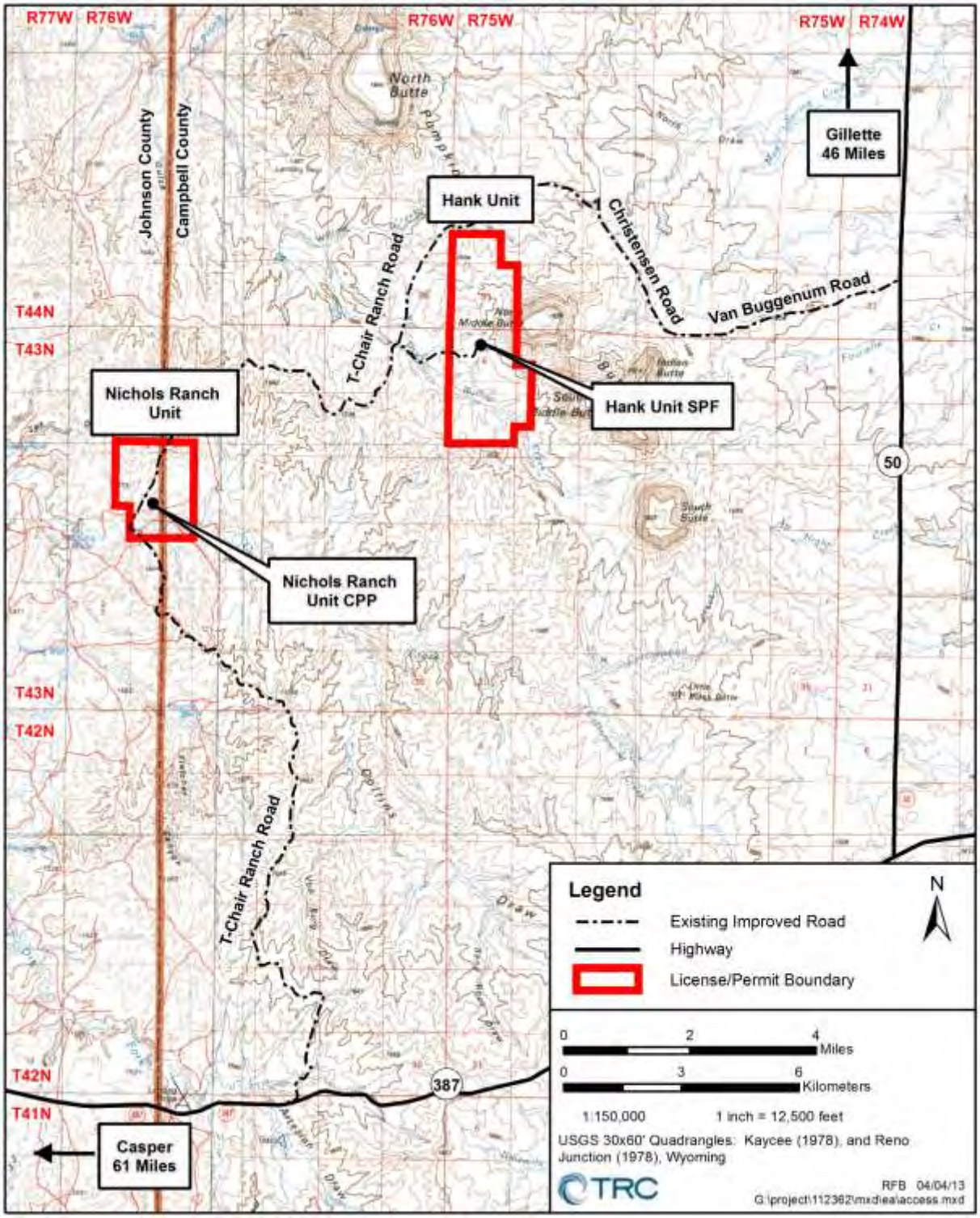
Figure 1.1 Hank Unit Uranium ISR Project Location Map.

lines, and access roads. Over the life of the project (LOP), approximately 33 acres of BLM administered surface and approximately 126.4 acres of privately-owned surface would be disturbed (see Section 2.0 for details).

This environmental assessment (EA) presents BLM's analysis of the likely effects on resources from the development and operation of the Hank Unit uranium ISR project proposed by Uranerz as part of the Nichols Ranch Uranium ISR Project area. The information and analyses presented in this EA provides the basis upon which BLM will decide on the proposed Hank Unit project (see Section 1.2 and 1.3). The Nichols Ranch ISR Project consists of the Nichols Ranch Unit and the Hank Unit (Figure 1.2). Uranerz has obtained numerous permits/approvals needed for the entire Nichols Ranch ISR Project, including: an NRC Source Material License (SML) (#SUA-1597), issued July 2011 (NRC 2011) for the milling (processing) of uranium from this site from the Nuclear Regulatory Commission (NRC), a Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (LQD) Permit to Mine (#PT778), issued December 2010 (WDEQ LQD 2010), and various others (Table 1.1).

The Nichols Ranch Unit is located approximately 4 mi west of the Hank Unit. Although the federal government does own some mineral estate in the Nichols Ranch Unit, it does not own any surface estate there. Therefore, none of the locatable minerals in that unit are BLM-administered. However, the federal government does own leasable minerals (e.g., coal, oil, gas) and salable minerals (e.g., sand, gravel, clinker) in various parcels within the Nichols Ranch Unit. Two years prior to reviewing and issuing the SML for the entire project, the NRC issued a Generic Environmental Impact Statement (GEIS), NUREG-1910 (NRC 2009a), which addressed uranium ISR in four specific regions in the western U.S. One of these areas is the Wyoming East Uranium Milling Region, where the Nichols Ranch Project is located. The NRC also completed a site-specific Supplemental Environmental Impact Statement (SEIS) for the entire Nichols Ranch ISR Project, NUREG-1910 Supplement 2 (NRC 2011).

Because there are no BLM-administered lands within the Nichols Ranch Unit, the Nichols Ranch Unit can be operated independently from the Hank Unit. The potential environmental impacts from the Nichols Ranch Unit project were fully addressed by the NRC SEIS (NRC 2011), and the reader should refer to this document for any additional information for this unit.




Source: Uranerz 2012.

Figure 1.2 Nichols Ranch Uranium ISR Project Location Map.

As described in detail in Section 2.0, Uranerz would conduct milling of the uranium-loaded resin beads either in-house at their Nichols Ranch Central Processing Plant (CPP), or via third-party toll milling at Cameco Resources' Smith Ranch-Highland CPP located approximately 50 mi south of the Hank Unit.

Uranerz has demonstrated written surface owner consent on split estate lands within the Hank Unit. Therefore, BLM has authority only over the approximately 280 acres of BLM-administered surface lands within the Hank Unit. For the remainder of the EA, unless specifically noted, any reference to "BLM-administered lands," "public lands," or similar terminology, will refer only to those lands with both BLM surface and federally-owned locatable minerals. These are the lands containing BLM-administered locatable minerals. The Nichols Ranch Unit is addressed in the cumulative impacts section of this EA (Section 4.0).

## 1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

Exploration and development of federal locatable minerals by private industry is part of BLM's Locatable Minerals Program under the authority of 43 *Code of Federal Regulations* (CFR) 3800, *General Mining Law of 1872*, *Mining and Minerals Policy Act of 1970*, *Federal Land Policy and Management Act of 1976* (FLPMA), and *National Materials and Minerals Policy, Research, and Development Act of 1980*. BLM is mandated to make locatable mineral resources available for exploration and development, unless such activities would cause unnecessary or undue degradation of public lands.

BLM is an agency that manages multiple resources and multiple uses of the lands under its administration. Per the provisions of FLPMA (FLPMA Sections 102(8) and (12)), public lands are to be managed in accordance with the balance of several considerations including, "…in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values…" and, "…in a manner which recognizes the Nation's need for domestic sources of minerals…from the public lands including implementation of the *Mining and Minerals Policy Act of 1970* (84 Statute 1876, 30 United States Code (U.S.C.) 21a) as it pertains to the public lands." The purpose of the Surface Management [of Locatable Minerals] regulations in 43 CFR 3809 *et seq*., and the implementing

regulations for FLPMA with respect to mining, is to "…prevent unnecessary or undue degradation of public lands by operations authorized by the mining laws…" (43 CFR 3809.1(a)). The purpose and need for this EA is to analyze the likely site-specific impacts associated with the Proposed Action and its' alternatives, identify mitigation measures that should reduce or eliminate those impacts, and provide agency decision makers with the detailed information needed upon which to base their decision.

In addition to the federal mining laws and regulations, expanding nuclear power is a key component of the *Energy Policy Act of 2005* (EPACT) signed into law on August 8, 2005. This policy calls for federal agencies to:

> "…develop a national energy policy designed to help the private sector, and, as necessary and appropriate, state and local governments, promote dependable, affordable, and environmentally sound production and distribution of energy for the future."

The EPACT also provides significant incentives for the continuation and expansion of nuclear power in the U.S. For example, the U. S. Department of Energy (USDOE) is offering conditional commitments for a total of $8.33 billion in loan guarantees for the construction and operation of two new nuclear reactors at a plant in Burke, Georgia. The federal government's intent is to reenergize the domestic nuclear industry, help create valuable long-term jobs, and reduce greenhouse gas (GHG) emissions (USDOE 2010).

Uranerz' objective for the Hank Unit Project is to produce an estimated 1.85 million pounds (lb) of uranium over the LOP. Uranerz has contracted to sell this amount of uranium to certain companies (personal communications (pers. comm.) with Mike Thomas and/or Dawn Kolkman of Uranerz, between October 2010 and February 2015). Uranerz is a for-profit company, and their sole product is uranium.

## 1.3 DECISION TO BE MADE

Uranerz initially submitted the Hank Unit ISR Project Plan of Operations (POO) to BLM BFO on February 26, 2008 (Uranerz 2012). In order to be in compliance with federal regulations at 43 CFR 3809.11 and .401, Uranerz submitted the Hank POO as their activities proposed to result

in greater than casual use disturbance of public lands. A POO must contain such information as needed to fully describe the proposed operations and demonstrate that they will not result in unnecessary or undue degradation of public lands (43 CFR 3809.401). The BLM reviews the POO and notifies the project proponent whether its' description is complete (per 43 CFR 3809.401(b)), and if not, what information is still needed (per 43 CFR 3809.411(b)). Once the POO is considered complete by the BLM, the BLM makes the POO available for a mandatory 30-day public review and comment period (per 43 CFR 3809.411(c)). BLM then conducts a NEPA analysis of the described operations, and determines whether they are likely to result in unnecessary or undue degradation (UUD) (per 43 CFR 3809.411(d), .415, and .420). If UUD is a likely result, the POO may be changed to add mitigation needed to avoid UUD resulting from its' implementation, and the POO reanalyzed. Once the POO is approved by the BLM, an adequate bonding instrument of a type acceptable to BLM must be provided (per 43 CFR 3809.500-582), and proponent may begin their proposed operations (per 43 CFR 3809.412).

Uranerz initially submitted the Hank Unit POO to the BLM on February 26, 2008, and the BLM assigned the project BLM serial case file number WYW-169904. The BLM BFO determined the POO was not complete per the requirements of 43 CFR 3809.401(b), and comments were submitted to Uranerz on September 6, 2011, and April 17, 2012. Uranerz submitted responses to BLM's comments, and revised information for the POO, to BFO staff on March 16, 2012, and May 22, 2012. BLM determined the POO to be complete per 43 CFR 3809.401 on June 8, 2012. These documents are available for review at the BLM BFO website (http://www.blm.gov/wy/st/en/info/NEPA/documents/bfo/nichols-ranch.html).

In accordance with NEPA and CEQ regulations (40 CFR 1501.7), an early and open process for determining the scope of issues to be addressed and for identifying the issues related to a proposal is required. Once the POO was determined complete, the BLM initiated the mandatory minimum 30-day public review and comment period (per 43 CFR 3809.411(c)). The BLM also concurrently began its' required *National Environmental Policy Act* (NEPA) review and analysis of the proposed project. In compliance with the environmental review requirements of BLM Handbooks H-3809-1 (Surface Management [of Locatable Minerals]; BLM 2012a) and H-1790-1, National Environmental Policy Act (BLM 2008b), the BLM BFO released a public scoping

notice for the review period on June 13, 2012. The scoping period closed on July 15, 2012. The BLM received only one comment letter, and this did not identify any issues not already identified by BLM. As NRC had completed their NEPA analysis for the Nichols Ranch/Hank Uranium ISR Project (included both the Nichols Ranch and Hank units) (NRC 2011), those resources within NRC's purview had already been analyzed. The BLM's NEPA review analyzed those resources under its' purview. The BLM NEPA Handbook (BLM 2008b) allows BLM to tier to existing EISs, and the NRS GEIS (2009a) and SEIS (2011) are incorporated here by reference. This EA presents the results of BLM's NEPA review and analysis of the proposed project.

Based on the BLM's NEPA analysis of the proposed project, the BLM can issue a decision on the Plan of Operations (POO) received for Uranerz' Hank Unit Project. The BLM will either issue a Finding of No Significant Impact (FONSI), or if significant impacts are anticipated, proceed with the preparation of an Environmental Impact Statement (EIS). Another option is that an EA may be prepared for an action that would result in some significant impacts, if the EA is tiered to a broader EIS which fully analyzed those significant impacts.

In accordance with BLM Handbook H-3809-1, Surface Management [of Locatable Minerals] (BLM 2012a), after the NEPA analysis has been completed, there are three possible courses of action BLM may take when issuing its decision on the POO (per 43 CFR 3809.411(d)):

(1) Approve the POO as received;

(2) Approve the POO subject to changes or conditions that are necessary to meet the performance standards of §3809.420 and to prevent unnecessary or undue degradation. BLM may require Uranerz to incorporate other agency permits, final approved engineering designs and plans, or other conditions of approval based upon the review of the POO filed under §3809.401(b); or

(3) Disapprove, or withhold approval of, the POO because it:

- (i) Does not meet the applicable content requirements of §3809.401;
- (ii) Proposes operations that are in an area segregated or withdrawn from the operation of the mining laws, unless the requirements of §3809.100 are met; or
- (iii) Proposes operations that would result in UUD of public lands.

## 1.4 RELATIONSHIP TO STATUTES, REGULATIONS, PLANS, AND OTHER ENVIRONMENTAL ANALYSES

### 1.4.1 Conformance with Applicable Land Use Plans

The Proposed Action is in conformance with the Record of Decision (ROD) and the approved BFO Resource Management Plan (RMP) (1985) and Amendments (BLM 2001, 2003a). The signed ROD for the BFO RMP provides overall direction for management of all resources on BLM-administered lands in the BFO planning area. The RMP was prepared under the authority of FLPMA and other applicable laws and regulations, and includes broad land use plan decisions that provide overall direction for management of resources and resource uses within the BFO planning area. In the RMP, decisions are expressed as goals and objectives (desired outcomes), allowable uses, and management actions anticipated to achieve desired outcomes. The land use planning decisions for BLM-administered lands within the Hank Unit project area are contained in the BFO RMP, as amended (BLM 1985, 2001, 2003a).

### 1.4.2 Relationship to Other Plans and Environmental Analyses

BLM's NEPA review of the Project is not meant to duplicate the NRC's NEPA review, which included their GEIS for *In-Situ* Leach Uranium Milling Facilities (NRC 2009a), and their SEIS prepared for the Nichols Ranch ISR project (which includes the Hank Unit) (NRC 2011) as part of its SML licensing process for the project. Rather, this EA tiers to the NRC GEIS (NRC 2009a) and SEIS (NRC 2011) which are incorporated by reference into this EA. The POO for the Hank Unit project area is also incorporated by reference into this EA (Uranerz 2012). Incorporation of approved NEPA documents by reference provides the opportunity to reduce paperwork and redundant analysis in the BLM NEPA process, and allows BLM to briefly summarize the relevant portions of those documents rather than repeat them. This EA will focus on those issues and mitigation measures not fully analyzed in sufficient detail in the NRC's GEIS and SEIS, in support of BLM's NEPA requirements and regulatory authorities. These, and other, NEPA analysis documents relevant to this project and incorporated here by reference include:

- NUREG-1910 Supplement 2, SEIS for the Nichols Ranch ISR Project, Final Report (NRC 2011).
- NUREG-1910, GEIS for In-situ Leach Uranium Milling Facilities, Final Report (NRC 2009a).
- EA for Third Party Processing of Ion Exchange Resin to Power Resources, Inc. (also doing business as Cameco Resources, Inc.), Smith Ranch/Highlands Uranium Project (NRC 2009b).
- EA for the Yates Petroleum Corporation All Day Coal Bed Natural Gas (CBNG) Plan of Development (BLM 2011e).
- EA's for Anadarko Petroleum Corporation, Dry Willow Phase I and Dry Willow Phase II CBNG Plans of Development (BLM 2007).
- Final EIS and RMP Amendment for the Powder River Basin (PRB) Oil and Gas Project, WY-070-02-065 (BLM 2003a).

On December 2, 2009, the NRC and BLM announced they had entered into a Memorandum of Understanding (MOU) that outlines how the agencies will coordinate on future environmental analyses related to development of uranium resources on public lands (BLM and NRC 2009). This MOU is meant to eliminate duplicative NEPA analysis and conflicting jurisdiction in the future; however, this MOU would not facilitate the current BLM and NRC NEPA reviews for the Hank Unit Project due to timing issues.

There is also a MOU between the BLM and the State of Wyoming recognizing the authorities and responsibilities of both agencies when permitting mining operations on BLM-administered lands. The intent of this MOU is to avoid unnecessary permitting duplication while providing protection for human health and the environment (BLM and WDEQ 2003).

In accordance with regulations contained in 43 CFR 1610.5, the information provided above demonstrates that the Proposed Action is within the intent, scope, and meaning of the BLM BFO RMP. The BLM BFO RMP (1985) states that:

> "Unless formally withdrawn from mineral location, all lands in the resource area, including federally administered surface/minerals and split estate, are open to exploration, location, and development of locatable minerals on valid [sic – the term that should have been used is "active"] mining claims. In order to explore for and develop locatable minerals (excluding casual use), a notice of intent or a plan of operations is required depending on the amount of disturbance and type of activity. All locatable

minerals actions are reviewed to ensure compliance with the bonding policy for surface-disturbing activities."

### 1.4.3 NEPA Compliance

This EA is a site-specific analysis of the potential impacts that could result from implementation of the Proposed Action or alternatives thereof. The EA, and the analysis it presents, assists BLM in project planning, ensuring the projects' compliance with NEPA, and determining whether any significant impacts could result from the proposed activities. As stated earlier (Section 1.3), this EA will assist the BLM authorized officer (AO) in making a decision regarding this project, which will be one of the following: 1) no significant impacts are anticipated, allowing a FONSI to be issued; 2) significant impacts are anticipated, therefore an EIS is needed; or, 3) significant impacts are anticipated, but a FONSI can be issued as the EA appropriately tiers to an existing EIS that fully analyzed those impacts. If appropriate, the FONSI would briefly present the reasons why implementation of the Proposed Action would not result in significant impacts (effects) to public lands and resources beyond those already addressed in the BFO RMP and/or the EIS(s) to which it is being tiered. A Decision Record (DR) would be prepared and signed for the EA, explaining the reasoning for the decision, and approving the selected alternative. However, if the BLM AO determines this project will have significant impacts beyond those already fully analyzed in an existing EIS, the BLM would begin the process of preparing an EIS.

The proposed project was analyzed in accordance with the requirements of NEPA, the Council on Environmental Quality (CEQ) regulations, BLM regulations codified in 43 CFR 3809, and the BLM NEPA Handbook (BLM 2008b). This EA serves several purposes:

- To provide the public and government agencies with information about the potential environmental consequences of the project and its' alternatives;
- To identify all practicable means to avoid or minimize environmental harm from the project and alternatives; and,
- To provide the responsible official (i.e., the BLM AO) with information with which to make an informed decision regarding the project.

### 1.4.4 Supplemental Authorities - Statues and Regulations

NEPA is only one of many statutes that contain procedural requirements that pertain to treatment of elements of the environment when the BLM is considering a decision, a "federal action." Table 1.1 provides an overview of the federal, state, and county laws applicable to uranium development projects and the key regulatory requirements that would govern project implementation. Additional approvals, permits, and authorizing actions may be necessary.

The development of this project would not affect the achievement of the Wyoming Standards for Healthy Rangelands (BLM 2010c). The Proposed Action is also in conformance with the applicable provisions of the Campbell County Natural Resource and Land Use Plan (2007) and complies with all other relevant federal, state, and local laws.

The following authorities are used to process and evaluate uranium mining applications: NEPA and the *Wyoming Environmental Quality Improvement Act*. Additional guidance and regulations are set forth in 40 CFR 1500 (Protection of Environment), 43 CFR 1601 (Planning, Programming, and Budgeting), and 43 CFR 3809 (Surface Management [of Locatable Minerals], BLM 2012a). Other relevant guidance includes BLM Manual Section 1601, Land Use Planning (2000), and BLM NEPA Handbook (H 1790-1) (2008a).

## 1.5 SCOPING, PUBLIC INVOLVEMENT, AND ISSUES

Approval of the proposed Hank Unit Project would result in disturbance of public lands administered by BLM. Per 43 CFR 3809, entities intending to conduct mining-related activities involving greater than "casual use" disturbance on 5 acres or more of BLM-administered lands must submit a POO to BLM for review and approval prior to disturbing the lands. Uranerz initially submitted the Hank Unit POO to BLM on February 26, 2008. The BLM BFO determined the POO was not complete per the requirements of 43 CFR 3809.401, and comments were submitted to Uranerz on September 6, 2011, and April 17, 2012. BLM BFO began its' NEPA analysis of the proposed project; specifically, those resources outside NRC's purview.

Table 1.1 Major Federal, State, and Local Permits, Approvals, and Authorizing Actions Applicable to Hank Unit Uranium Project Development and Operation in Campbell County, Wyoming.

| Agency and Level | Permit, Approval, or Action | Authority |
|---|---|---|
| FEDERAL: | | |
| BLM | POO | *Mining Claims Under the General Mining Laws of 1872,* as amended (30 *U.S.C.* §29 and 43 CFR 3800 *et seq.*); *FLPMA*, as amended (43 *U.S.C.* §1701 *et seq.* and 43 *CFR* 100-9260 *et seq.*) |
| | EA or EIS | *NEPA*, as amended (42 *U.S.C.* §4321 *et seq.* and 40 *CFR* 1500-1508 *et seq.*) |
| | Antiquities and cultural resources | *Antiquities Act of 1906*, as amended (16 *U.S.C.* §431-433 *et seq.*); *Archaeological Resources Protection Act of 1979* (ARPA), as amended (16 *U.S.C.* §470aa-470ii *et seq.*); *Preservation of American Antiquities,* as amended (43 *CFR* 3 *et seq.*); *National Historic Preservation Act* (NHPA), as amended (16 *U.S.C.* §470 *et seq.*) |
| | Native American Religious Concerns | *American Indian Religious Freedom Act of 1978* (AIRFA) (42 *U.S.C.* §1996 *et seq.*); *Native American Graves Protection and Repatriation Act* (NAGPRA) (25 *U.S.C.* §3001 *et seq.*) |
| NRC | Source Material Licenses for the possession and use of source material and byproduct material | *Atomic Energy Act*, as amended (42 *U.S.C.* § 2011 *et seq.*); *Uranium Mill Tailings Radiation Control Act*; Requirements under Title 10 *CFR* Parts 20 and 40, and the guidance in NUREG-1569, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications," and Title 10, Part 51 |
| | EIS for Source Material License | *NEPA,* as amended (42 *U.S.C.* §4321 *et seq.*) |
| U.S. Army Corps of Engineers (USACE) | Provide protection to wetlands | Executive Order (E.O.) 11990, "Protection of Wetlands" May 24, 1977 (42 FR 26961) |
| U.S. Environmental Protection Agency (EPA) | Regulate hazardous waste treatment, storage, and/or disposal | *Resource Conservation and Recovery Act of 1976* (RCRA), as amended (42 *U.S.C.* §6901 *et seq.*). *Comprehensive Environmental Response Compensation and Liability Act of 1980* (CERCLA), as amended (43 *U.S.C.* §9615 *et seq.*) |
| | Spill Prevention Control and Countermeasures Plans | *Federal Pollution Prevention Act of 1990* (30 *U.S.C.* §133 *et seq.)* (40 *CFR* 112 *et seq.*) |

Table 1.1 (Continued)

| Agency and Level | Permit, Approval, or Action | Authority |
|---|---|---|
| EPA, contd. | Regulate and protect drinking water supplies; provides criteria for exempted aquifers | *Safe Drinking Water Act* (SDWA), as amended (43 *U.S.C.* §300f *et seq.*), 40 CFR 146.4 *et seq.*; *Clean Water Act of 1977* (CWA) (33 *U.S.C.* §1251 *et seq.*) |
| | BLM and NRC assessment of Environmental Justice | E.O. 12898, "Environmental Justice" February 11, 1994 |
| U.S. Fish and Wildlife Service (USFWS) | Coordination, consultation, and impact review of federally listed, threatened, and endangered species required for BLM and NRC | *Fish and Wildlife Coordination Act* (16 *U.S.C.* §661-666c *et seq.*); Section 7 of the *Endangered Species Act of 1973* (ESA), as amended (16 *U.S.C.* §1536 *et seq.*); *Eagle Act of 1958* (43 *U.S.C.* §155 *et seq.*); *Bald and Golden Eagle Protection Act* (BGEPA), as amended (16 *U.S.C.* §668-668dd *et seq.*) |
| | Migratory bird impact coordination required for BLM and NRC | *Migratory Bird Treaty* Act (MBTA) (16 *U.S.C.* §704 *et seq.*); E.O. 131186, "Responsibilities of Federal Agencies to Protect Migratory Birds" January 10, 2001 |
| STATE: | | |
| WDEQ Air Quality Division (AQD) | Permits to construct and permits to operate | *Federal Clean Air Act*, as amended (42 *U.S.C.* §7401 *et seq.*); *Wyoming Environmental Quality Act*, Article 2, Air Quality, as amended (Wyoming Statute (W.S.) 35-11-201 through 35-11-212 *et seq.)* |
| WDEQ Land Quality Division (LQD) | Mine permits, impoundments, and drill hole plugging | *Wyoming Environmental Quality Act*, Article 4, Land Quality, as amended (W.S. 35-11-401 through 35-11-437 *et seq.*) |
| WDEQ Water Quality Division (WQD) | National Pollutant Discharge Elimination System permits for discharging waste water and storm water runoff | *Wyoming Environmental Quality Act,* Article 3, Water Quality, as amended (W.S. 35-11-301 through 35- 11-311); Section 405 of the *Federal Water Pollution Control Act* (*Clean Water Act*) (codified at 33 *U.S.C.* §1345); EPA administered (40 *CFR* 122); State Program Requirements (40 *CFR* 123); EPA Water Program Procedures for Decision-making, as amended (40*CFR* 124); WDEQ WQD Rules and Regulations, Chapter 18 |
| | Administrative approval for discharge of hydrostatic test water | *Wyoming Environmental Quality Act,* Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311 *et seq.*) |

Table 1.1 (Continued)

| Agency and Level | Permit, Approval, or Action | Authority |
|---|---|---|
| WDEQ WQD, contd. | Permits to construct groundwater injection and disposal wells | *Wyoming Environmental Quality Act*, Article 3, Water Quality, as amended (W.S. 35-11-301 through 35-11-311 *et seq.*); Section 1421 of the Federal *SDWA* (codified at 40 *CFR* Parts 144 and 146). |
| Wyoming Department of Transportation (WYDOT) | Permits for oversize, over length, and overweight loads | Chapter 20 of the Wyoming Highway Department Rules and Regulations (W.S. 31-217.2 through W.S. 31-217.7) |
| | Access permits to state highways | Chapter 13 of the Wyoming Highway Department Rules and Regulations (W.S. 24-2-105, and W.S. 24-6-101 to 111) |
| Wyoming State Engineer's Office (WSEO) | Permit to appropriate groundwater | Chapter 1, Part V of State Engineer's Office Regulations (W.S. 41-4-503 *et. seq.*) |
| COUNTY: | | |
| Campbell County | Land Use Plan compliance | *Wyoming Land Use Planning Act* (W.S. 9-8-101 through 9-8-302); Campbell County Natural Resource and Land Use Plan (Campbell County 2007) |
| | Noxious weed control | County Code |

BLM assigned the Nichols Ranch/Hank Project BLM serial case file number WYW-169904. Uranerz submitted responses to BLM's comments, and revised information for the POO, to BFO staff on March 16, 2012, and May 22, 2012. BLM determined the POO (Uranerz 2012) to be complete per 43 CFR 3809.401 on June 8, 2012. These documents are available for review at BLM BFO and BLM website (http://www.blm.gov/wy/st/en/info/NEPA/documents/bfo/nichols-ranch.html).

In accordance with NEPA and CEQ regulations (40 CFR 1501.7), an early and open process for determining the scope of issues to be addressed and for identifying the issues related to a proposal is required. The BLM determined the Uranerz Hank POO to be complete on June 8, 2012, and initiated the mandatory minimum 30-day public review and comment period (per 43

CFR 3809.411(c)). In compliance with environmental review requirements of BLM Handbooks H-3809-1, Surface Management [of Locatable Minerals] (BLM 2012a), and H-1790-1, NEPA (BLM 2008b), the BLM BFO released a public scoping notice for the review period on June 13, 2012. The scoping period closed on July 15, 2012. The BLM received only one comment letter, and this did not identify any issues not previously identified by BLM.

BLM conducted Native American consultation in accordance with the American Indian Religious Freedom Act (AIRFA), Native American Graves and Repatriation Act (NAGPRA), National Historic Preservation Act (NHPA), NEPA, 1996 Executive Order (E.O.) 13007 Indian Sacred Sites (U.S. Presidential E.O. 1996), and all other applicable regulations and guidelines. BLM discussed the Proposed Action with various tribal representatives in face-to-face meetings on November 9, 2010, May 19, 2011, January 12, 2012, January 26, 2012, May 22, 2012, June 12, 2012, and October 17, 2012, and by conference call on November 6, 2012, and July 19, 2013. BLM formally requested assistance from the Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck, Northern Arapaho, Northern Cheyenne, Yankton, Crow Creek Tribe, Lower Brule Tribe, Standing Rock, Rosebud, Sisseton Wahpeton Oyate, and Oglala Tribes to identify sites in and near the project area that have religious and traditional cultural importance.

The internal BLM review process and public scoping led to the identification of the following land and resource management issues/concerns potentially associated with the Proposed Action:

- Impacts to the Pumpkin Buttes' Traditional Cultural Property (TCP);
- Impacts to cultural resources;
- Impacts on wetlands and riparian areas;
- Impacts to ephemeral and intermittent drainages by erosion from disturbed areas;
- Impacts to groundwater;
- Control of invasive, nonnative species ("weeds");
- Protection of special status wildlife and plant species including threatened, endangered, proposed and candidate (TECP), and BLM-sensitive species (SS);
- Potential effects on small and big game species, raptors, and migratory birds;
- Potential effects on public health from the release of radon and other radioactive isotopes into the environment due to the uranium mining/milling process;

- Impacts to air quality;
- Potential conflict with other land uses including mineral resource exploration and extraction activities (leasable minerals such as “conventional” oil/gas, and coal bed natural gas (CBNG)), other uranium exploration/mining projects, exploration/development of salable minerals), grazing, etc.;
- Impacts to visual resources, open space, and vistas;
- Impacts on grazing lessees and private land owners including traditional rural lifestyles;
- Reclamation; and,
- Cumulative effects.

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# 2.0 PROPOSED ACTION AND ALTERNATIVES

## 2.1 INTRODUCTION

Uranerz proposes to develop and operate a uranium ISR project within the Hank Unit Project Area located in southwest Campbell County, Wyoming (see Figure 1.1). This is the Proposed Action, or Alternative 1. Approving the project would result in development of federal mineral estate and disturbance of public surface lands administered by the BLM. Under regulations at 43 CFR 3809, locatable mineral activities that involve greater than "casual use" disturbance on five or more acres of BLM-administered lands must submit a POO to BLM for review and authorization. The POO for the Hank Unit project is available for review at the BLM BFO office and website, and is summarized here (see Section 2.2). This information is essentially identical to the information contained in the NRC Source Material License (SML) (#SUA-1597) and the WDEQ LQD Permit to Mine (#PT778). All these documents, SML, Mine Permit, and POO, have been reviewed by the public. The SML and Mine Permit were approved by NRC (NRC 2011) and WDEQ LQD (WDEQ LQD 2010), respectively.

This EA also analyzes the No Action Alternative, or Alternative 2 (see Section 2.3). Under Alternative 2 (the No Action Alternative), no development of that portion of the uranium ore body situated within the Hank Unit project area on BLM-administered lands would be authorized. Because of the configuration of BLM-administered and privately-owned lands in the Hank Unit, if BLM does not approve the POO, no portion of the Hank Unit project would be developed. Owing to the land ownership configuration, and how ISR wellfields and monitor well rings must be configured, not being able to mine any portion of the ore body situated on BLM-administered lands would result in loss of approximately half the ore body. Two relatively small portions of the ore body located on private lands would remain, with these separated by approximately 1 mile (mi). This configuration would leave too little of the ore body to be developed economically. Adding to this situation would be the higher costs associated with developing relatively small, separated parcels.

Under NRC and WDEQ LQD rules and regulations, uranium ISR projects are required to collect extensive pre-mining baseline information, and development of extensive monitoring programs and mitigation measures prior to initiation of development and mining operations. The currently

approved NRC License (NRC 2011) and WDEQ LQD Mine Permit (WDEQ LQD 2010) for Uranerz to conduct operations at the Hank Unit include these requirements. Monitoring programs and mitigation measures that are required by NRC and WDEQ LQD regulations are considered part of the Proposed Action, and the alternatives considered in this EA.

In accordance with regulations per 40 CFR 1502.14, BLM has developed and considered several additional alternatives; these alternatives were not carried through detailed analysis in this EA, however. Information regarding these alternatives and why they were not carried through detailed analysis is presented in Section 2.4.

## 2.2 ALTERNATIVE 1 - PROPOSED ACTION

### 2.2.1 Summary of the Proposed Action

The Proposed Action analyzed here is the development of that portion of the Hank Unit ore body that occurs on BLM-administered lands. BLM-administered lands are limited to approximately 280 acres within the Hank Unit. The project would be constructed in multiple sections within Townships 43 and 44 North, Range 75 West, 6th Principal Meridian, Campbell County, Wyoming (see Figure 1.1), within the administrative boundary of the BLM BFO.

The Hank Unit Project Area includes a total of approximately 2,250 acres. Surface ownership is divided between private entities (1,970 acres, 88%) and the U.S. Government (280 acres, 12%) (Figure 1.1, and Table 2.1). Much of the mineral estate is owned by the federal government (approximately 1,538 acres, 68%), and the remainder by various private entities (approximately 712 acres, 32%). However, only those lands containing both BLM surface and federally-owned minerals (280 acres, 12%) are administered by BLM. All of the uranium mineral rights to be mined as part of the Proposed Action are unpatented mineral rights held or controlled by Uranerz. See Section 1.1 for more detailed information.

Under the Proposed Action, Uranerz would develop one wellfield, divided into two production areas (Figure 1.2). Production Area #1, the northern portion, would be developed first, followed by Production Area #2, the southern portion. Total disturbance within the entire Hank Unit would be approximately 159.4 acres, with approximately 33 acres on BLM-administered lands (Table 2.2). The life of the project (LOP) is anticipated to be approximately 10 years; the

Table 2.1 Surface Ownership Within the Hank Unit Project Area.

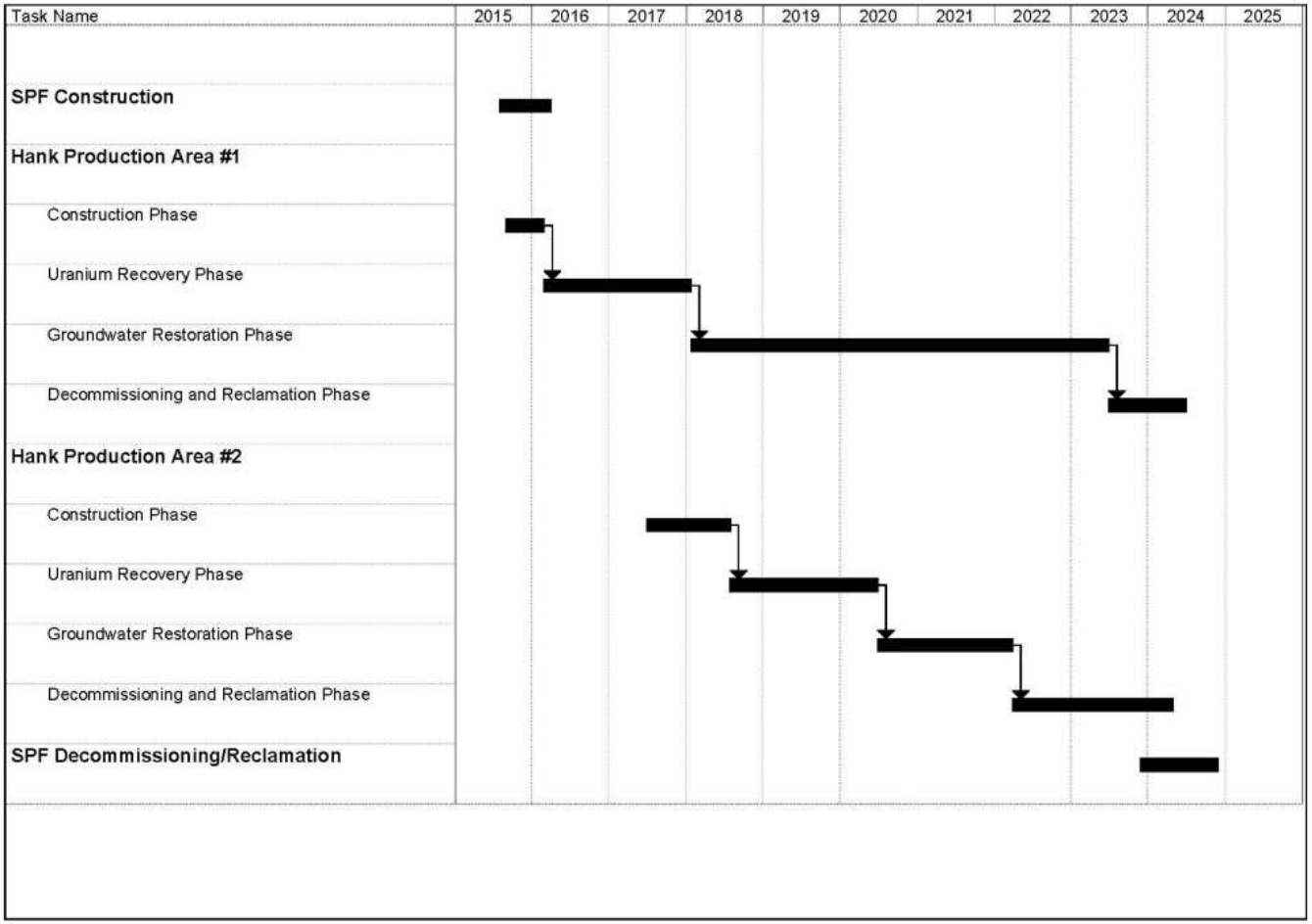
| | Legal Location | | | Surface Ownership | | |
|---|---|---|---|---|---|---|
| Unit | Section | Township | Range | BLM-administered Lands (acres) | Privately-owned Lands (acres) | Total (acres)[1] |
| Hank | 30 | 44N | 75W | 0 | 256 | 256 |
| | 31 | 44N | 75W | 170 | 523 | 693 |
| | 5 | 43N | 75W | 0 | 80 | 80 |
| | 6 | 43N | 75W | 110 | 544 | 654 |
| | 7 | 43N | 75W | 0 | 487 | 487 |
| | 8 | 43N | 75W | 0 | 80 | 80 |
| Total | | | | 280 | 1,970 | 2,250 |

[1] Section totals are accurate; some sections exceed 640 acres per section.

tentative project schedule is presented in Figure 2.1. The Proposed Action would occur in four major phases. The first phase would be infrastructure development, and include all construction-related activities. The second phase would be uranium recovery, and include all uranium recovery and processing activities. The third phase would be groundwater restoration, and include all activities to return groundwater quality to pre-construction conditions. The fourth, and final, major phase would be decommissioning and reclamation, and would include the removal of all facilities and infrastructure, and permanent reclamation activities.

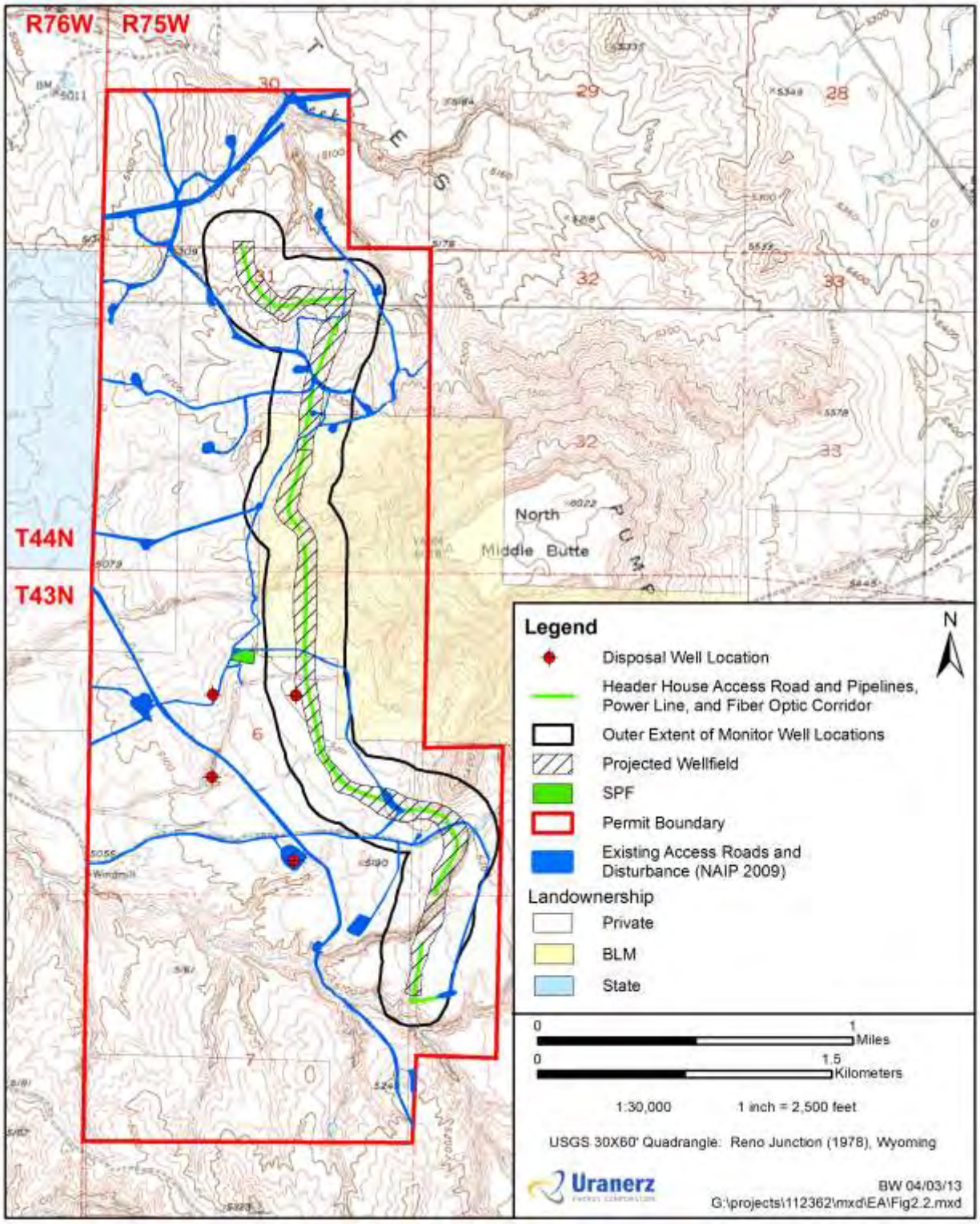
For purposes of this analysis, the effects of the Proposed Action are defined as those likely to occur from actions taking place on all lands within the Hank Unit. Surface-disturbing activities include installation and operation of injection, recovery (also called production), and monitoring wells, access roads, wellfield header houses, pipeline/utility trenches, and power lines. Figure 2.2 shows the project area and proposed locations for new facilities and infrastructure. Table 2.2 summarizes anticipated amounts of initial and LOP disturbance by surface estate ownership type.

Approximately 159.4 acres would be initially disturbed during development of the Proposed Action; 126.4 acres (79%) on privately-owned surface lands and the remaining 33 acres (21%) on BLM-administered surface lands. Total disturbance accounts for only 7% of the entire Hank Unit project area. Following project development, approximately 147.1 of the 159.4 acres




Source: Uranerz 2012.

Figure 2.1 Tentative Hank Unit Project Schedule.




Source: Uranerz 2012.

Figure 2.2 General Locations of SPF, Wellfield, Access Roads, and Pipeline, Utility, and Communication Corridors Within the Hank Unit Project Area.

Table 2.2 Estimated Acres of Surface Disturbance Within the Hank Unit (Proposed Action).

| | Initial Disturbance | | | Life-of-Project (LOP) Disturbance | | |
|---|---|---|---|---|---|---|
| | BLM-administered Lands | Privately-owned Lands | Total | BLM-administered Lands | Privately-owned Lands | Total |
| SPF | 0.0 | 4.0 | 4.0 | 0.0 | 4.0 | 4.0 |
| Other Facilities[1] | 1.0 | 3.4 | 4.4 | 0.1 | 0.4 | 0.5 |
| Wellfield[2] | 32.0 | 119.0 | 151.0 | 2.1 | 5.2 | 7.3 |
| Total | 33.0 | 126.4 | 159.4 | 2.2 | 9.6 | 11.8 |

Source: Uranerz 2012.

[1] Includes any disturbance associated with the wellfield access road and monitor wells that would not be located inside of the wellfield.
For initial disturbance on BLM-administered lands, it is assumed that there would be 15 monitor wells with 0.06 acres of disturbance per well (maximum of 50 ft X 50 ft area) for approximately 1.0 acres of total disturbance. On private lands, it is assumed that there would be 54 monitor wells with 0.06 acres of disturbance per well (3.2 acres of disturbance total), plus 500 ft of additional wellfield access road not located inside of the wellfield (0.2 acres), for a total of 3.4 acres of initial disturbance.
For life-of-project (LOP) disturbance on BLM-administered lands, it is assumed that 15 monitor wells with 0.002 acre per well disturbance (10 ft X 10 ft area each) would result in a total of 0.1 acres of disturbance. For LOP disturbance on privately-owned lands, it is assumed that there would be 54 monitor wells with 0.002 acres disturbance per well (total of 0.2 acres), plus 500 ft of additional wellfield access road (0.2 acres), for a total of 0.4 acres of disturbance.

[2] For initial disturbance on BLM-administered lands, it is assumed to include all areas within the wellfield (32 acres). For initial disturbance on privately-owned lands, it is assumed to include all areas within the wellfield (119 acres).
For LOP disturbance on BLM-administered lands, it is assumed that there would be 4,300 ft wellfield access road with a width of 20 ft (total 2.0 acres), plus 4 header houses on BLM lands (0.02 acres each) for 0.1 acre of disturbance, and a combined total of 2.1 acres. For LOP disturbance on privately-owned lands, it is assumed that there would be 11,000 ft wellfield access road with a width of 20 ft (5 acres), plus 6 header houses on private lands (0.02 acres each) for 0.2 acres, and a combined total of 5.2 acres.

disturbed (92% of disturbed acres) would be temporarily revegetated (interim reclamation). There would be a total of 11.8 acres of LOP disturbance: 9.6 acres on privately-owned lands, and 2.2 acres on BLM-administered lands. Total LOP disturbance accounts for approximately 0.5% of the entire Hank Unit project area. Following completion of uranium recovery and aquifer restoration, the project area would undergo decommissioning that would involve the redisturbance of temporarily revegetated areas, the removal of project facilities, and the permanent reclamation of the project sites (see Section 2.2.3.5).

### 2.2.2 Preconstruction Activities

#### 2.2.2.1 NRC, WDEQ LQD, and Other Non-BLM Permitting

Regardless of surface or mineral ownership, prior to commencing development/construction or operation of a uranium ISR project in Wyoming, the operator must obtain a SML from the NRC and a Permit to Mine from the WDEQ LQD. Other required State of Wyoming permits include an air quality permit, a storm water discharge permit, well permits, etc., that would need to be obtained prior to project start-up (see Table 1.1). As discussed in Section 1.0, Uranerz has secured the NRC SML, WDEQ LQD Permit, deep disposal well permit from WDEQ Water Quality Division (WQD), and all other non-BLM permits/approvals required for the Nichols Ranch ISR project (which includes the Hank Unit).

Development, recovery, restoration, and reclamation activities are described in detail in the POO, NRC SML, and WDEQ LQD Mine Permit. The NRC SML (#SUA-1597) was approved by NRC in July 2011 (NRC 2011), and WDEQ LQD approved Permit to Mine (#778) in December 2010 (WDEQ LQD 2010). These documents are incorporated here by reference.

#### 2.2.2.2 BLM Approval Process

The NRC regulates uranium milling operations and WDEQ LQD regulates uranium mining operations within the Nichols Ranch Unit Project Area (includes Hank Unit) regardless of surface or mineral ownership. However, these agencies do not authorize disturbances on BLM-administered surface lands. As the Proposed Action would include surface estate administered by BLM, BLM is obligated per 43 CFR 3809 and NEPA to review this project. If determined appropriate, BLM would authorize the POO, including addition of any provisions or mitigation measures needed to ensure no unnecessary and undue degradation of public lands would occur.

The MOUs between the State of Wyoming and BLM provides for WDEQ LQD to have lead review responsibility for analyzing information regarding surface owner interests, except for BLM-administered lands within the project area. WDEQ LQD also has lead responsibility for

data and analysis of impacts related to climatology, hydrology, overburden, soils, vegetation, wildlife, and wetlands (BLM and WY 1975; BLM and WDEQ LQD 2003). The WDEQ LQD analyzes and permits the entire project, which includes both Nichols Ranch and Hank Units.

The BLM, however, analyzes the Proposed Action (only Hank Unit) under the appropriate regulations, as it includes BLM-administered lands. Therefore, BLM analyzes all aspects of the Proposed Action as it relates to BLM-administered surface estate. BLM's analysis includes air quality, cultural resources and Native American concerns, geology, energy and other mineral resources, geological hazards, grazing and range management, recreation, vegetation (including special status species), invasive species, wetlands, visual resources, water resources (including surface and ground water, and aquifers, aquitards, and other hydrologic parameters), and wildlife (including special status (SS) species, and threatened and endangered species) (see Chapters 3 and 4 for more details). In addition, Uranerz must comply with all applicable federal, state, and other regulations, laws, statutes, and policies.

The ISR uranium development issues addressed by the two federal agencies differ because of their different missions and authorities. BLM's NEPA review of the Proposed Action is not meant to duplicate the NRC NEPA review and resulting SEIS, performed as part of its SML licensing process. BLM's and NRC's reviews do overlap in certain areas, however, and BLM may utilize NRC's analysis by tiering to that document. The NRC GEIS (NRC 2009a) and SEIS (NRC 2011) evaluated potential impacts associated with construction, operation, aquifer restoration, decommissioning, and reclamation of the entire Nichols Ranch project (including the Hank Unit); this EA tiers to these documents and incorporates them by reference into this EA.

Uranerz initially submitted a POO to BLM BFO for approval to disturb BLM-administered lands on February 26, 2008. The BLM determined that the POO was not complete as submitted; Uranerz submitted the last set of revised materials to the BLM on May 22, 2012. The revised POO was deemed complete by the BLM on June 8, 2012. Numerous mitigation measures required and approved by NRC and WDEQ LQD, as well as BLM, are contained in the revised POO and the Proposed Action it describes (Alternative 1). Additional mitigation measures not adequately addressed in the POO are identified and included in this EA. BLM's authority to

approve disturbance due to uranium exploration and/or development activities is limited to BLM-administered lands; however, BLM will analyze environmental effects originating from the entire Hank Unit. BLM reviews submitted POOs in accordance with 43 CFR 3809.411.

BLM may approve a POO as submitted, if it is determined to not result in unnecessary or undue degradation of public lands. The two other possible outcomes from BLM's review of a POO are to: 1) approve the POO, subject to changes or conditions necessary to meet the performance standards of §3809.420, and to prevent unnecessary or undue degradation. BLM may require Uranerz to incorporate other agency permits, final approved engineering designs and plans, or other conditions of approval from the review of the POO filed under §3809.401; or, 2) disapprove, or withhold approval of, the POO because it a) does not meet applicable content requirements of §3809.401(b); b) proposes operations in an area segregated or withdrawn from the operation of the mining laws, unless the requirements of §3809.100 are met; or, c) proposes operations that would result in unnecessary or undue degradation of public lands. If a POO is disapproved, or withheld from approval, this does not preclude the Operator from submitting another version with new or modified design(s) for overcoming the deficiency(ies). However, depending on the severity of the deficiency(ies), the new or modified resubmission may be treated as an entirely new POO, in which case the entire BLM review process would begin anew.

The BLM initiated public scoping on the proposed Hank Unit Project (per 43 CFR 3809.411(c)) on June 13, 2012, and the public comment period concluded on July 15, 2012. Only one comment was received, and it raised no issues beyond those BLM BFO had already identified.

### 2.2.3 Summary of the Plan of Operations (POO)

#### 2.2.3.1 Overview

Commercial uranium ISR has been conducted in the U.S. since the mid-1960s and is currently the leading extraction technology for uranium recovery in this country. Chapter 2.0 of the NRC SEIS and the Mine Plan section of the POO provide a detailed description of the ISR process and that information will not be repeated here (NRC 2011; Uranerz 2012). The primary advantages

of ISR over conventional mining include: 1) limited surface disturbance over LOP; 2) reduced long-term environmental impacts; 3) lower capital costs; and, 4) the ability to produce uranium from low-grade ores that would be otherwise economically unrecoverable.

Uranerz proposes to produce uranium using the proven ISR process over an anticipated production life of approximately 4.5 years from the wellfield in the Hank Unit. The location of the proposed uranium recovery area, called a wellfield, is illustrated in Figure 2.2. There are two production areas within the Hank Unit wellfield, and these areas would be developed sequentially. A portion of both production areas would be located on BLM-administered lands (see Figure 1.1). The surface disturbance on these lands would be limited to construction of injection, recovery, and monitoring wells, access roads, header house buildings, and various wellfield buried pipelines, power lines, and fiber optic communication lines. Similar facilities, and the Satellite Processing Facility (SPF), would be located on privately-owned lands.

Uranium ISR involves the use of conventional water wells and a leaching solution (lixiviant) to recover the uranium without physically removing the mineralized rock, as occurs in conventional mining operations. The lixiviant proposed for use in the Hank Unit Project would consist of native groundwater to which an oxidant, such as oxygen, would be added. The uranium exists in the rock in a chemically reduced state, and the oxidant solubilizes the uranium into the groundwater. A complexing ion is also added, such as carbon dioxide, with which the dissolved uranium combines, thereby allowing it to be transported in the groundwater to the surface. The resulting uranium-rich solution is drawn to recovery wells (also called production wells) where it is pumped from the subsurface and transferred to the Hank Unit SPF. In the SPF, the uranium-bearing fluid is piped to ion exchange (IX) columns, which recover the uranium from the water; the complexed uranium is attracted to the resin beads inside the IX columns. The now barren leaching solution is recharged with oxidant and reinjected into the wells to recover additional uranium. The uranium-loaded resin beads would be sent to either Uranerz' Nichols Ranch Central Processing Plant (CPP) or Cameco's Smith/Highland Ranch CPP. In the CPP, the uranium would be stripped from the resin beads, then dried and packaged for shipment. See the NRC SEIS (2011) or the POO (Uranerz 2012) for more detailed information; also briefly summarized below in Section 2.2.3.3.

2.2.3.2 Construction Phase

Topsoil Salvage Operations

Prior to the initiation of any construction activities, topsoil would be salvaged from all proposed disturbance areas during construction activities, including the SPF, wellfield access roads, buried utility lines, well sites, and header house sites.

On BLM-administered lands, topsoil would be directly hauled to areas that have been recontoured and ready to be re-topsoiled, instead of stockpiling the topsoil. However, if direct re-placement of topsoil is not possible, the topsoil would be stored in designated topsoil stockpiles in accordance with WDEQ LQD rules and regulations. Maximum height of the topsoil stockpiles would be 3 feet (ft) with a spread-out base to aid in retaining viability of the biological components of the soil. These stockpiles would be located to minimize topsoil losses from wind and water erosion. Topsoil stockpiles would not be located in any drainage channels or other locations that could lead to a loss of material.

After creation of any topsoil stockpiles, berms (or toe ditches) would be constructed around the base of each. All stockpiles would then be seeded at the first seasonally appropriate times with the following interim seed mixture, using pure live seed (PLS):

Interim Seed Mixture (14.0 lbs PLS per acre total, for drill seeding):

6.0 lbs PLS Western wheatgrass,
6.0 lbs PLS Thickspike wheatgrass, and
2.0 lbs PLS Slender Wheatgrass.

For broadcast seeding, the amount of seed would be doubled. Seeding of topsoil stockpiles would reduce soil loss from wind and water erosion. All topsoil stockpiles would be identified with highly visible signs labeled "Topsoil," in accordance with WDEQ LQD requirements. Topsoil salvaged during construction of facilities that will be present during entire LOP, such as wellfield access roads and header house, would not be reapplied until final restoration and reclamation has occurred. However, topsoil salvaged during construction of wells and buried utility lines would be reapplied and seeded once construction is completed.

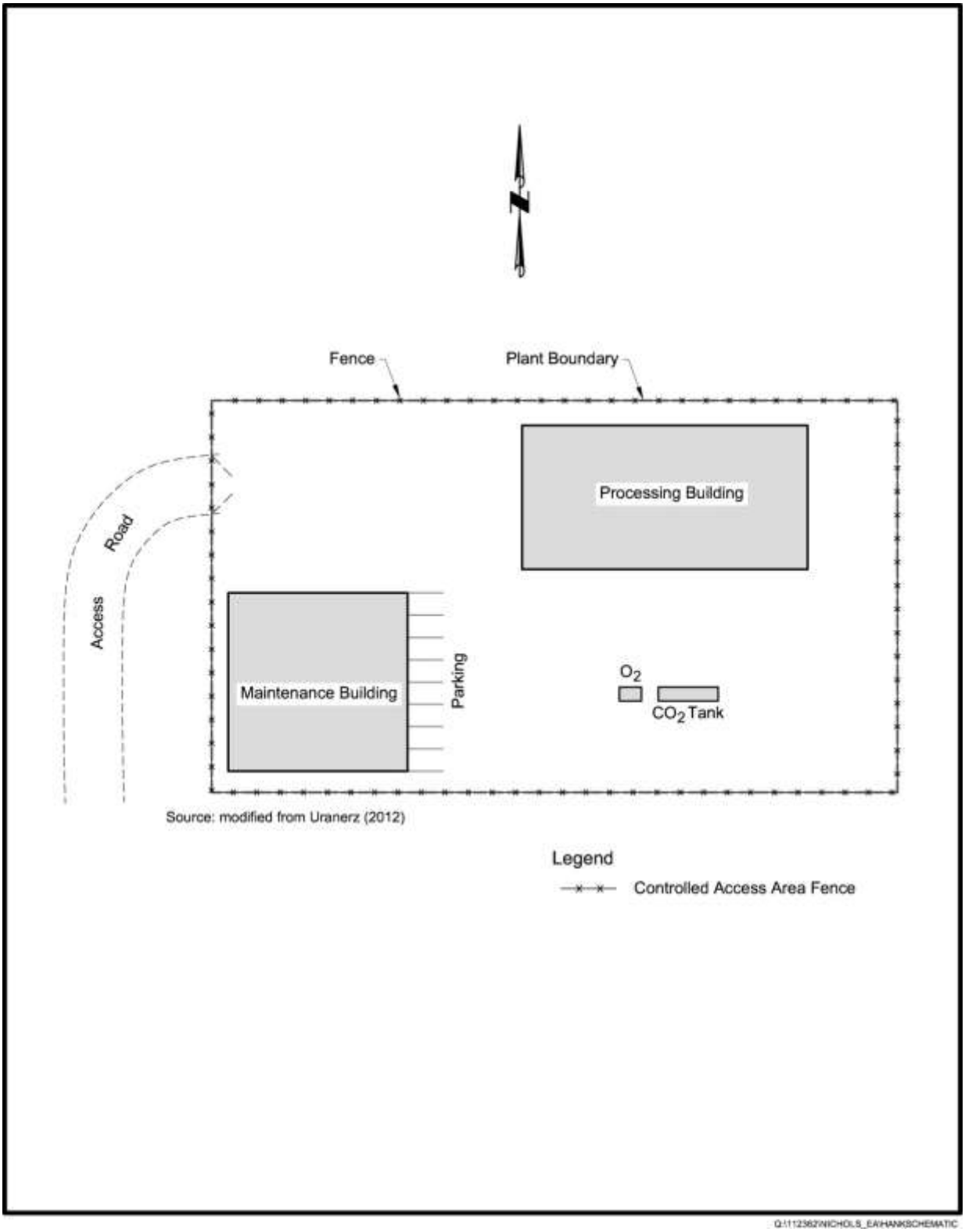
Other Site Preparation Activities

Tractor trailers would deliver materials and equipment needed to construct the wellfields and SPF to the Hank Unit using existing roads. These roads are currently used for oil/gas and coal bed natural gas (CBNG) development and are designed to accommodate such large delivery vehicles (Figure 2.2). As construction of uranium ISR facilities is of relatively small scale as compared to that for other industrial projects, the trucking activities needed for this stage of the Project is also relatively minor. No improvements to existing access roads would be needed under the Proposed Action. Various construction vehicles would be required (e.g., bulldozers, excavators, front-end loaders, scrapers, etc.), with many of these likely transported to the site on flatbed trailers. Larger loads during this phase will be graders, cranes, drill rigs, and potentially oversized loads carrying IX vessels or other nonstandard loads for SPF construction. Uranerz estimates eight passenger vehicles (standard light-duty or 3/4-ton trucks, gasoline or diesel) per day per week, and six tractor trailers (diesel) per week during the construction phase.

Uranerz would install fencing to prevent livestock from entering the active (i.e., developed) portion of each wellfield. To minimize potential impacts to big game, Uranerz would utilize a three-strand fence comparable with WDEQ LQD Type III fence. This type of fencing will prevent livestock from entering the wellfield, but allow wildlife to safely pass through the wellfield (WDEQ LQD 1994). Once restoration and reclamation activities are completed, all fences would be removed from BLM-administered lands.

Satellite Processing Facility (SPF)

The Hank Unit SPF would be located in the approximate center of the Hank Unit on privately-owned surface land, and house the IX system (Figure 2.3). Approximately 4 acres of initial and LOP disturbance will include the SPF, a concrete batch plant, and temporary storage areas. The SPF will consist of a main metal building approximately 80 x 180 ft in area with maximum eave heights of approximately 25 ft. The SPF will also include a 90 x 60 ft maintenance building with maximum eave heights of 18.5 ft, a dedicated area for vehicle, electric, and pump maintenance, and additional office space for field and operations personnel. Major processing equipment would be housed inside the SPF, except 2 to 4 bulk chemical storage tanks of oxygen and carbon




Source: Uranerz 2012.

Figure 2.3 Plan View of Layout of the Proposed Hank Unit SPF.

dioxide to be located outside the processing building (Figure 2.3). In accordance with NRC regulations, the entire Hank Unit SPF would be fenced with a 6-ft high chain-link fence, and gated to control access to the site.

The Hank Unit SPF would be constructed on concrete pads with curbs to prevent liquids from leaving the building and entering the environment. The concrete needed will be mixed and formed using the on-site batch concrete plant. Uranerz' proposed engineering controls and monitoring program are designed to quickly detect spills and leaks, allowing these to be minimized in number and extent. Leaks from vessels and equipment on the pads, including water from equipment wash down, would drain to a sump and either be pumped back into the process circuit or to a Class I deep disposal well to be located near the SPF. This deep disposal well would be similar in design and depth to existing deep disposal wells at other active uranium ISR sites, and is discussed in more detail later in this section. The SPF's concrete floors would be designed to support the full weight of all processing vessels and other equipment to be housed therein, and to meet all applicable building codes and standards. Outside chemical storage locations would be constructed with concrete curbed secondary containment for all tanks.

Primary Access Roads

The primary transportation routes to/from the proposed Hank Unit Project Area would be via existing state, county, and private roads (see Figure 1.2). The Project Area is accessible from two directions: State Highway 50 to Van Buggenum Road (County Road (CR) 102), to Christensen Road (CR 21), to private T-Chair Ranch roads; or, via State Highway 387 to private T-Chair Ranch roads. CRs 21 and 102 are gravel surfaced crowned-and-ditched public roads maintained by Campbell County, ranging 18 to 24 ft wide. These roads are capable of handling two tractor trailers passing one another, and have a speed limit of 30 miles per hour (mph).

Ranch roads occurring on T-Chair Ranch property are privately-owned and maintained crowned-and-ditched roads ranging 15 to 20 ft wide. They were constructed by either the property owner or through road use agreements with various companies represented in the area. These roads have a posted speed limit of 30 mph, which allows for the safe passage of both passenger cars

and tractor trailers. Both the county and private ranch roads are currently being used by numerous oil/gas, CBNG, and other operators active in the general area. This set of roads, including CR 31 in Converse County, will be used for transporting resin beads between the Hank Unit SPF and either Uranerz' Nichols Ranch CPP, or Cameco Resources' Smith Ranch-Highland CPP. Uranerz and Cameco Resources entered into an agreement in which Uranerz could transport uranium-loaded resin beads to Cameco Resources' Smith Ranch-Highland CPP for final processing, if needed. Once delivered to either CPP, the uranium would be processed into yellowcake and transported off-site.

No additional main access roads would be required or constructed. Only public roads or roads located on private surface lands would be crossed as part of the transfer of resin beads between Uranerz' Hank Unit SPF and either of the two CPPs.

Wellfield Access Road

While the Proposed Action would utilize existing main roads to access the SPF, an additional access road from the SPF to the header houses in the wellfield would need to be constructed (Figure 2.2). This wellfield access road would have a driving surface no more than 20 ft wide, and would be constructed pursuant to the surface owner's instructions. In accordance with BLM road guidelines, that portion of the road to be located on BLM-administered lands, and to be used by heavy equipment, would be constructed and surfaced for use during both wet and dry conditions (BLM 2008a). During construction, the roads would be watered as needed to minimize dust emissions. The water would be obtained from existing sources that have been permitted by the Wyoming State Engineer's Office (WSEO). Access roads would cross ephemeral drainage channels at three locations in the Hank Unit and properly-sized culverts would be installed at each channel crossing. The culvert designs would follow the design criteria listed in WDEQ LQD Guideline 8 (WDEQ LQD 2014a) or BLM specifications (BLM 2008a).

Getting to individual wells from the wellfield access road would involve driving either on existing two-track roads or across the wellfield. No new roads would be constructed from the wellfield access road to the injection, recovery, and monitor wells. This approach is typical for uranium ISR projects, and is expected from existing operations having experienced limited

amounts of vehicular traffic during construction, and minimal during operation. This expectation anticipates avoiding establishing additional permanent roads, thereby reducing expected overall surface disturbance.

With the exception of header houses and access road, all disturbed areas within the wellfield would be re-topsoiled and re-vegetated at the first seasonal opportunity following wellfield development. These areas would be reclaimed as described below in Section 2.2.3.5.

Although exact locations for all surface-disturbing activities anticipated to occur within the wellfield are unknown at this time, the nature and extent of such disturbances would be similar to those implemented in other ISR uranium projects in Wyoming, and are described here.

Header Houses

Uranerz would install a maximum of approximately 10 header houses within the Hank Unit: approximately 6 on privately-owned surface lands, and 4 on BLM-administered lands. These buildings would contain the manifolds with valves, piping, electrical closures, flow meters, and instrumentation for serving approximately 30 to 60 injection and recovery wells per header house. Piping contained in header houses would connect feeder lines from injection and recovery wells with trunk lines connected to the Hank Unit SPF. Electrical power would be supplied to each header house via either buried or aboveground power lines, as site-specific conditions dictate. A more detailed discussion is given below.

Each header house would be a metal building up to 40 ft long x 20 ft wide x 14 ft high, sitting atop a concrete or steel foundation set into an excavation approximately 6 ft deep. The concrete foundation would be 6 inches (in.) thick, or steel plate would be 3/16 in. thick. Piping would enter header houses through the walls of their foundations. Removable metal grating would serve as raised floors atop the foundations, allowing access to subfloor areas containing valves and hose runs. Other manifolds and control equipment would be on header houses' main floors. Foundation floors would slope to sumps with automatic level control sump pumps. These would collect any fluids in the foundations, and pump them into the recovery pipelines. The sump pumps would also include check valves to prevent flow of materials back into the header houses.

Each header house would be situated immediately adjacent to the wellfield access road. Once construction of a given header house is complete, the area around it would be re-contoured, re-topsoiled, and re-vegetated. All header houses would be painted with a color that blends into the surrounding topography. This would typically be Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) for header houses on BLM-administered lands. Header houses on privately-owned lands would be painted Covert Green, or Carlsbad Canyon (Munsell Soil Color 2.5Y 6/2), depending on which best blends into the surrounding environment.

Individual well flow readings would be recorded on a per shift basis, and overall wellfield flow rates would be balanced at least once per day. Alternately, flow and volume data from equipment in each header house would be transferred to the main plant and checked. In addition, an Uranerz Environmental Safety & Health staff representative or designate would conduct a daily walkthrough inspection of each header house. These inspections would provide visual surveys of procedural implementation, housekeeping, and contamination control.

Buried Pipelines, Power Lines, and Communication Lines

During the construction phase, buried pipelines, power lines, and fiber optic communication lines would be installed within the wellfield. These facilities would all be placed in the same general corridor area (maximum of 20 ft wide, generally adjacent to the wellfield access road) to minimize disturbance. Disturbance of the full width of the utility corridor would rarely occur, and likely only during the Project's construction phase.

Trunk lines from the header houses to the SPF would be up to 14 inches in diameter and made of high-density polyethylene (HDPE). Feeder lines between well heads and header houses would be 1- to 2-inch diameter HDPE or polyvinyl chloride (PVC) pipe. Pipelines would be buried a minimum of 2 ft below the surface using a conventional open trench method, and backfilled after system testing has been successfully completed. All electrical utilities and fiber optic communication lines to each individual injection and recovery well, header houses, and the Hank Unit SPF would also be buried a minimum of 2 ft below the surface. To minimize surface disturbance, buried electrical and fiber optic communication lines would be installed using a

cable plow method. Interim and/or permanent reclamation procedures would be completed on all pipelines, power lines, and fiber optic communication lines after lines have been buried.

To minimize potential environmental impacts due to the installation of power lines, pipelines, and fiber optic communication lines, Uranerz would utilize the following mitigation measures: 1) Uranerz (or electrical contractor) would not construct any aboveground power lines, permanent high-profile structures such as storage tanks, or other potential perch sites within 0.5 mi of any active Greater Sage-Grouse (GSG) lek near the Project Area, and 2) all pipelines and fiber optic communication lines within 2 mi of the base of the North Middle Butte (in/near the Pumpkin Buttes Traditional Cultural Property (TCP)) would be buried to minimize potential visual impacts to that area. In addition, wherever practical, power lines within 2 mi of the base of Pumpkin Buttes TCP would be buried to minimize potential visual impacts to prehistoric sites eligible for the National Register of Historic Places (NRHP).

Whenever possible, power lines would be buried, and in areas of existing disturbance. All aboveground power lines must be in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (Avian Power Line Interaction Committee (APLIC) 2006). Overhead power lines constructed within 2 mi of the base elevation of North Middle Pumpkin Butte would be designed to reduce potential visual contrast. Uranerz would also install buried fiber optic communication lines between the SPF, header houses, and wells for remote monitoring and controlling of wellfield recovery and restoration activities; these would reduce vehicle traffic and human presence in the wellfields during much of the LOP.

Well Drilling and Wellfield Construction

Several types of wells would be installed in the project area: for injection, recovery (also called production), monitor, and deep disposal. Injection and recovery wells would be completed in the mineralized intervals of one production zone at a time. These wells would be completed to isolate the "ore"-bearing interval from all other aquifers. Monitor wells would be used to monitor and detect migration of mining fluids, both vertically (to aquifers overlying and underlying the "ore" zone aquifer) and horizontally (within the "ore" zone, laterally away from the wellfield). The deep disposal well(s) would be installed to properly dispose of liquid wastes generated during all phases of the ISR process.

Surface disturbance within the project area would occur over several years depending on the uranium recovery rate. NRC will review and approve only the first production area prior to start-up, while WDEQ LQD will review and approve each of the two production areas individually. Regulatory review and approval for the "wellfield package" would likely take up to a year to complete for each production area. This "package" includes detailed information for aquifer testing, pump testing, injection and recovery well installation, monitor well installation, utility installation, wellfield delineation and development, and interim surface reclamation.

Prior to any drilling activities, topsoil from each drill site would be separated from the subsoil with a backhoe and stockpiled. The topsoil would be removed first and placed in a topsoil stockpile. The subsoil for each drill site's mud pit would then be removed and placed next to that mud pit. When use of a given mud pit is complete (usually within 30 days of initial excavation), its' subsoil would be backfilled into it, followed by the re-placement of topsoil and re-vegetated as described later in Section 2.2.3.5.

Delineation Drilling and Wellfield Development

Delineation drilling typically occurs in a greater density than exploration drilling; there are usually more drill holes closer together. The general shape and location of the mineralized zoned ("ore body") was determined prior to POO submission. However, more information is needed, including more exact determinations of the uranium grade, and the depth, location, and thickness where the various grades occur. This more exacting data is needed to more precisely determine the installation locations of production/recovery and injection wells, and this affects the exact placement of the various other facilities (header houses, pipelines, electrical lines, monitor wells, etc.). If a given delineation borehole is determined to be within the "ore body" (mineralization at the needed grade or higher), the borehole would be developed into a recovery well, as described below. However, if a delineation borehole is not within the "ore body" (mineralization below the needed grade), the borehole would be geophysically logged, and plugged and abandoned in accordance with appropriate state and federal requirements.

The surface disturbance or footprint for each delineation borehole would be a maximum of approximately 800 square feet ($ft^2$), or 0.02 acres. Drilling mud pits would be temporarily fenced to prevent human and animal intrusion and injury. This fencing would remain until the

drilling fluids have been removed or evaporated, after which the pits would be backfilled and permanently reclaimed as described below in Section 2.2.3.5.

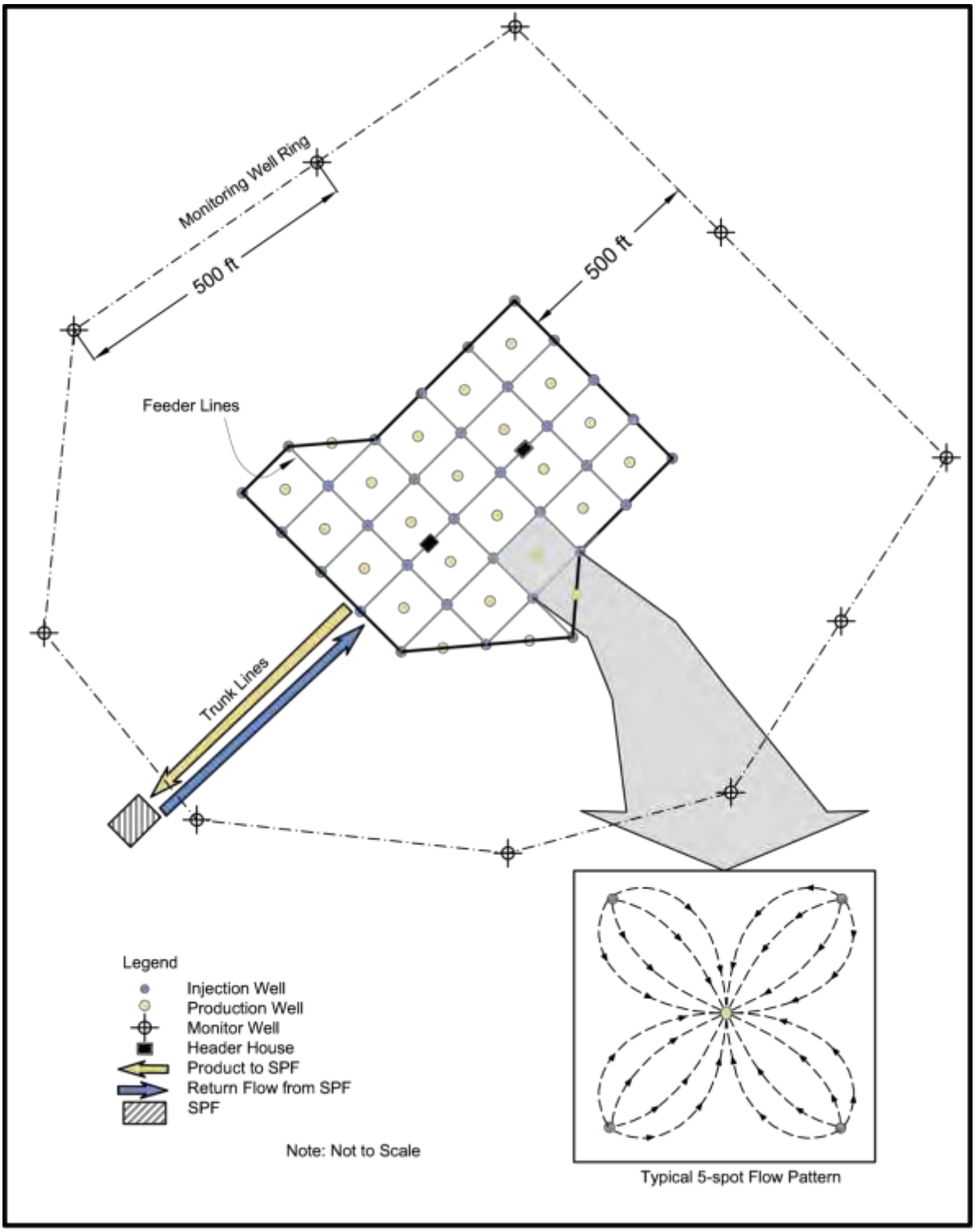
The wellfield would consist of groups of injection and recovery wells. Typically, these would arranged in a square, with four corner injection wells, and a central recovery well, called the "five-spot" injection/recovery layout (Figure 2.4). This pattern is often used as it tends to maximize the reach of fluids within and surrounding those wells. Flow from small groups of injection and recovery wells would be piped to the header houses, then to the SPF from header houses through buried trunk lines.

The initial surface disturbance or footprint for each injection or recovery well would be a maximum of 800 $ft^2$ (0.02 acres). To the extent possible, Uranerz would minimize all surface-disturbing activities. In accordance with WDEQ LQD regulations, topsoil would be salvaged from the production area.

Pilot holes, vertical holes used for both recovery and injection wells, would be drilled through the target completion interval with a small rotary drilling unit using native mud and a small amount of commercial drilling fluid additive for viscosity control. These holes would be logged, reamed, casing set, and cemented to isolate the completion interval from all other aquifers. Cement would be pumped down the casing, and forced out the bottom of the casing and back up the annulus between the casing and drill hole to the surface, ensuring proper cement density. These holes would provide at least 3 in. of annulus space, per regulations. After the wells are cemented to surface, and the cement set, they would be drilled out and completed either as open holes or fitted with a screen assembly (slotted liner). These assemblies may have a sand filter pack installed between the screen and the under-reamed formation. Figure 2.5 shows the cross section of a typical injection/recovery well design.

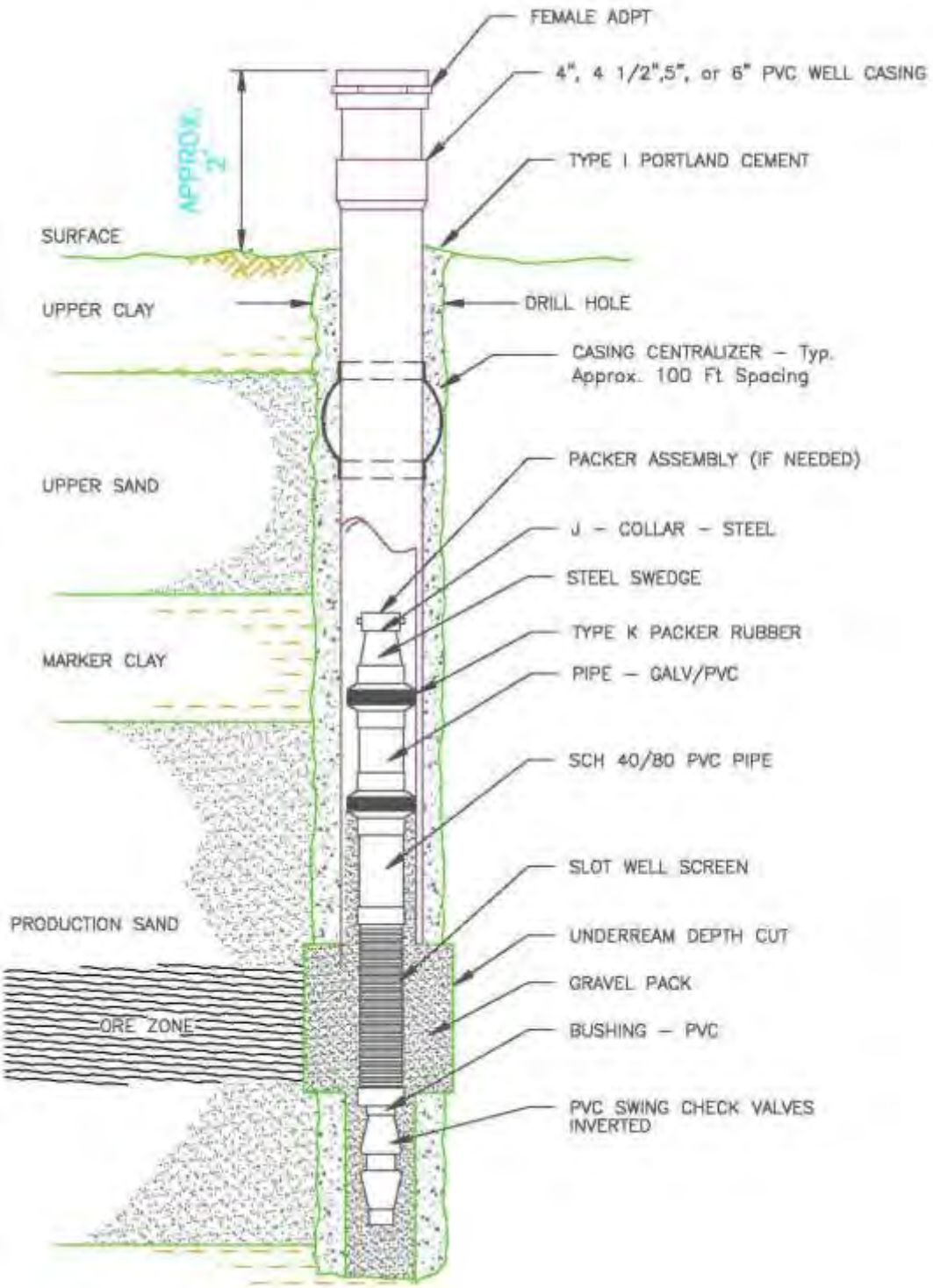
Monitor Wells

Monitor wells would be installed to detect migration of mining fluids away from the wellfield, both vertically and horizontally. Monitor wells would be completed in the production zone in a ring around the wellfield. This outermost monitor well ring would be installed approximately




Source: Uranerz 2012.

Figure 2.4 Plan View of Typical "Five-Spot" Well Units, Wellfield Layout, and Flow Pattern. Each "5-spot" has four production/recovery wells in each corner, and one injection well in center. Also shown is general relationship and flow between wellfield, header houses, and SPF.




Source: Uranerz 2012.

Figure 2.5 Typical Injection and Recovery (Production) Well Design.

500 ft between the ring and wellfield, with a maximum of 500 ft between each monitor well (Figure 2.4). Monitor wells would also be installed in the aquifers overlying and underlying the production ("ore") zone aquifer at a density of one well for every 4 acres of wellfield, no more than 1,000 ft apart. These monitor wells inside the wellfield would detect movement of mining fluids vertically above and below the "ore" zone, and horizontally away from the wellfield. Although exact locations of wells on BLM-administered lands are subject to BLM approval, the approximate locations of all monitor wells has already been reviewed and approved through the NRC SML and WDEQ LQD Permit processes (Figure 2.6). Detailed groundwater monitoring procedures are presented below in Section 2.2.3.7.

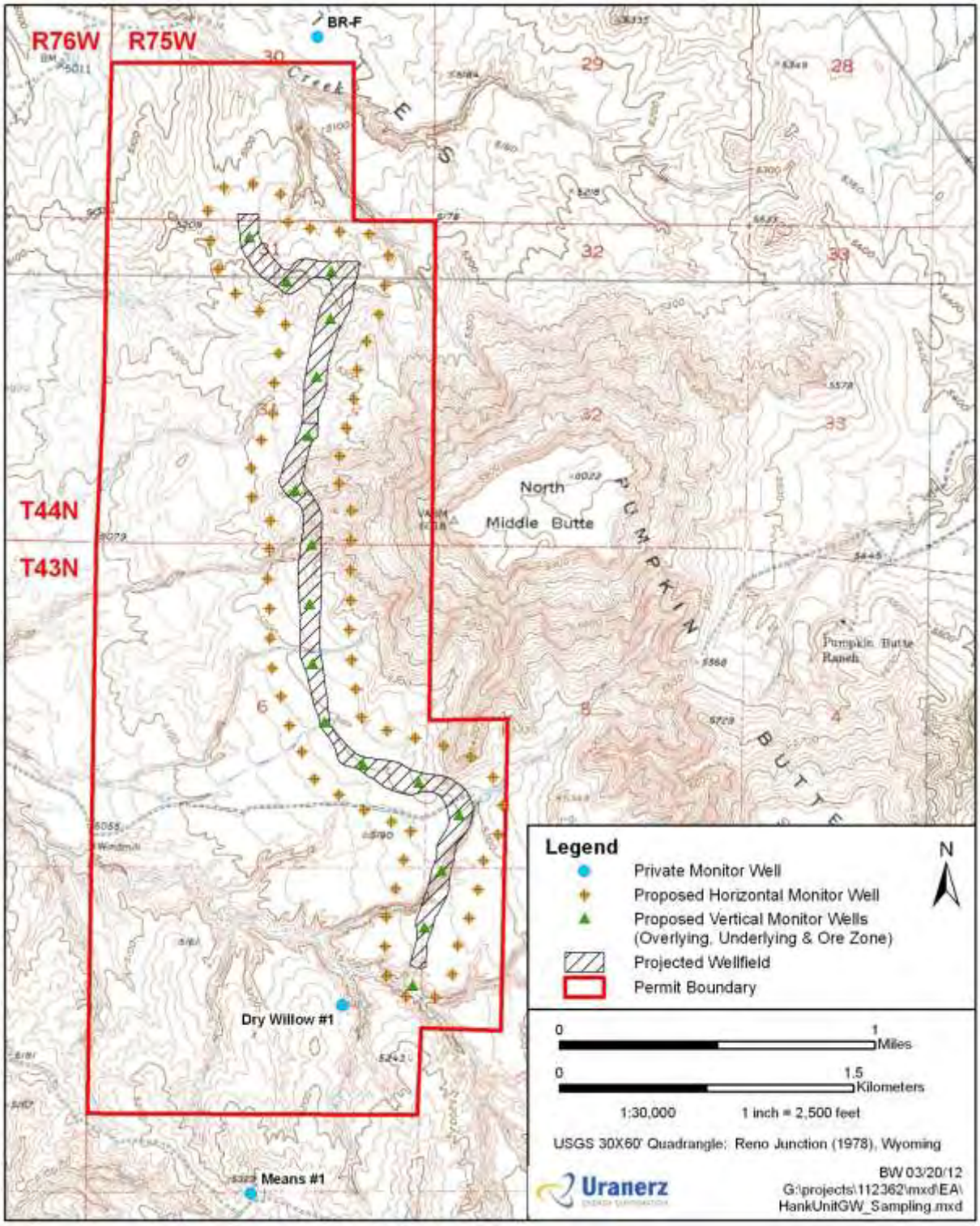
The surface disturbance or footprint for each monitor well during installation would be a maximum of 800 $ft^2$ (0.02 acres), and each monitor well would be geophysically logged. Figure 2.7 shows the cross-section of a typical monitor well design.

Well Mechanical Integrity Testing (MIT)

Following well completion, mechanical integrity tests (MITs) would be performed on all recovery, injection, and monitoring wells. The Class III wells (injection) would undergo an MIT every 5 years thereafter to evaluate the continuing integrity of the well casing. If a well does not meet the integrity criteria, the casing would be repaired (if possible) and the well retested. If the well passes the subsequent MIT, it would be placed back in service. If a well cannot be repaired, it would be plugged and abandoned in accordance with appropriate state and federal regulations. The NRC and WDEQ LQD maintain copies of MIT records for all wells; BLM would receive copies of MITs for each well on BLM-administered lands. An inventory of well tests and results are provided to the NRC and WDEQ LQD in required periodic regulatory reports. A photograph of a typical completed and operating wellfield is presented in Figure 2.8.

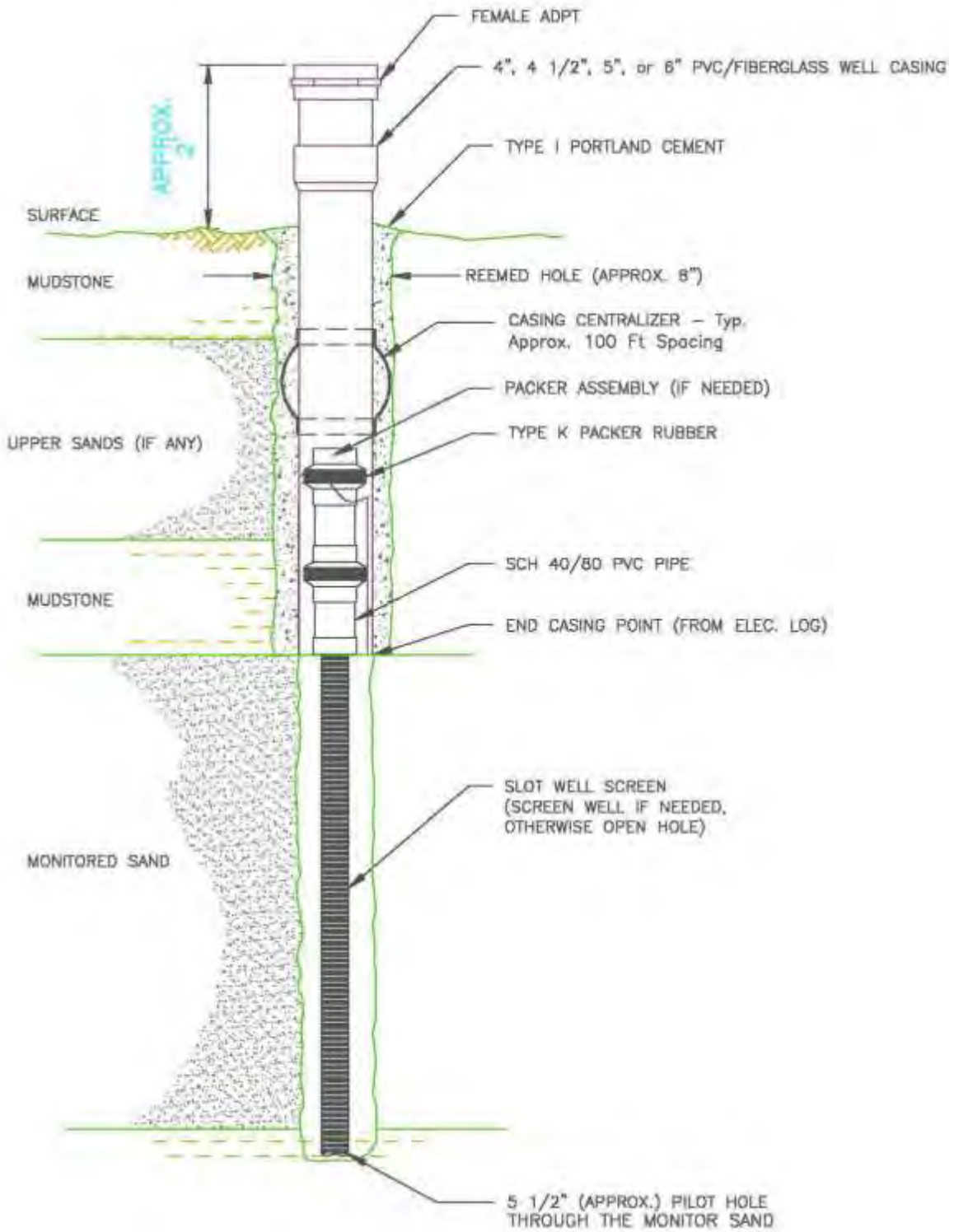
Fresh Water Well

Uranerz would install a fresh water well within the Hank Unit Project Area; likely near the Hank Unit SPF on privately-owned land. This well would provide fresh water for plant wash down, processing, aquifer restoration, eye wash stations, and safety showers.




Source: Uranerz 2012.

Figure 2.6 Hank Unit Groundwater Monitor Well Locations.




Source: Uranerz 2012.

Figure 2.7 Typical Monitoring Well Design.

Figure 2.8 View of Typical Operating Uranium ISR Wellfield. Well heads are enclosed within the white cylinders, for protection from wildlife, livestock, and weather. Photograph of wells in Cameco's Smith Ranch/Highland uranium ISR project, courtesy Dawn Kolkman, Uranerz.

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Deep Disposal Well(s)

As is typical of ISR projects, liquid wastes would be generated during all phases of the ISR process. Uranerz has received permission to install up to four Class I (non-hazardous) deep disposal wells in the Hank Unit Project Area to properly dispose of these materials (Figure 2.7), although all four may not be installed. The deep disposal well(s) would be located on privately-owned lands near the Hank Unit SPF. Liquid wastes that would be disposed include: process bleed, process solutions, wash down water, and aquifer restoration water.

Any wastewater generated during or after the uranium extraction phase (including aquifer restoration) of site operations are classified as "11e.(2) byproduct material" under NRC regulations 10 CFR Part 30, and must be properly disposed of according to specific regulations.

Each deep disposal well would be approximately 8,450 ft deep or greater, depending on the depth selected and approved confining zone. Uranerz has obtained an Underground Injection

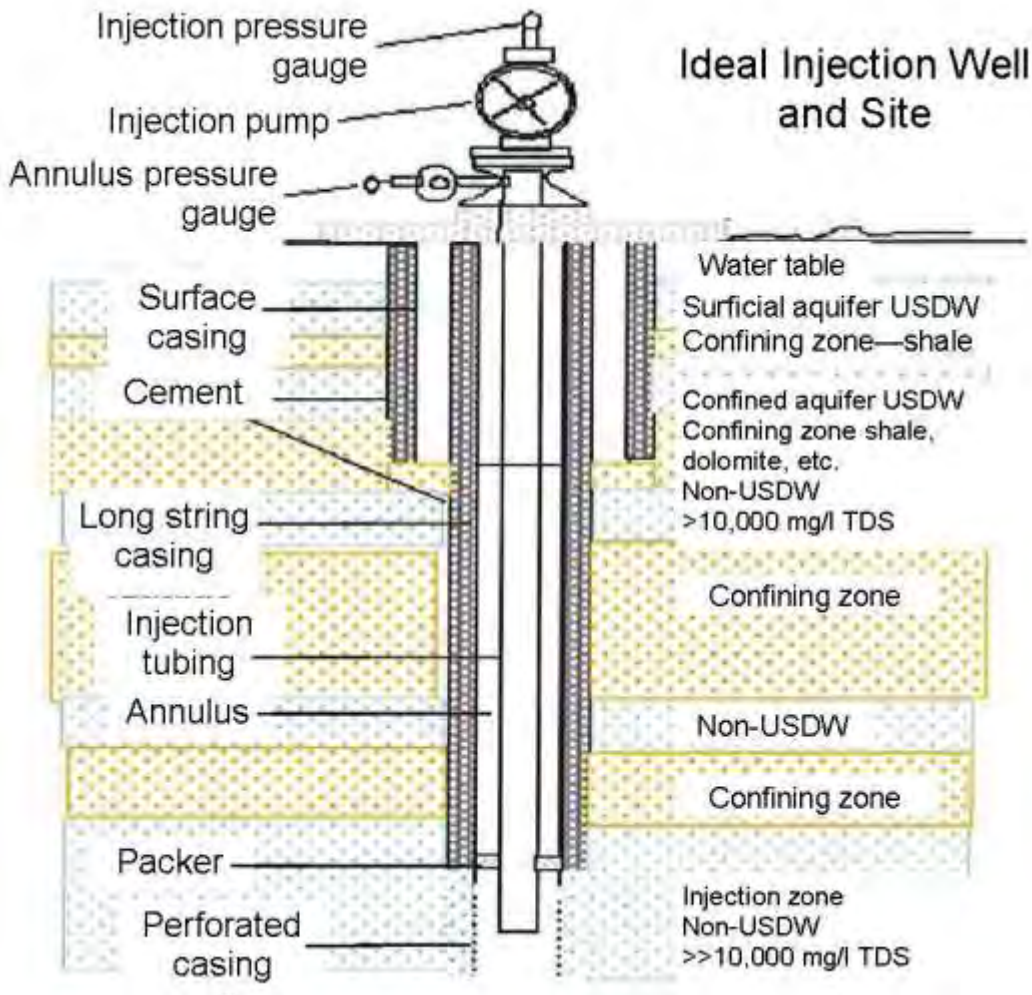
Control (UIC) permit for the installation and use of Class I injection wells from the WDEQ Water Quality Division (WQD), who has primacy for this as delegated by the Environmental Protection Agency (EPA). Each deep disposal well would be constructed as illustrated in Figure 2.9 and would be completed only to the approved formation or zone for that well. For the deep disposal well(s) in the Hank Unit, the well(s) would be completed in one of the following formations: Teckla Member of Lewis Shale, or Teapot or Parkman Formations of Mesaverde Group. Disposal would be strictly limited to the permitted formation/zone. The deep disposal well(s) would be drilled on privately-owned lands, and installed, tested, operated, and monitored in accordance with the approved UIC permit. In accordance with this permit, Uranerz would limit the combined injection rates to a maximum of 150 gallons per minute (gpm) flow of liquid effluent wastes into the well(s) over the life of the Hank Unit Project.

Petroleum Products and Wastes

Uranerz and its' contractors would manage, store, handle, and dispose of all petroleum products and wastes in compliance with all appropriate federal and state regulations. In addition, Uranerz would train its personnel to properly handle, transport, and dispose of all petroleum products and wastes, and hazardous materials and wastes, to avoid and reduce the potential occurrence of spills, leaks or releases of such materials. Uranerz would also develop and implement an Emergency Response Plan (ERP) to address potential spills, leaks, or releases of such materials. Uranerz would also mitigate potential spills, leaks, or releases of petroleum products and wastes by conducting routine maintenance and inspections on all appropriate vehicles and equipment, repair them as needed, and clean up any spills, leaks, or releases. In the event of a spill, leak, or release of petroleum products/wastes, Uranerz would clean up and dispose of materials contaminated by the spill, leak, or release in accordance with state and federal regulations. All spills of petroleum products/wastes or hazardous chemicals/wastes in excess of the maximum allowable quantity as determined by WDEQ WQD would be reported to that agency.

Hazardous Materials and Wastes

Wellfield development requires using hazardous materials such as cement, commercial drilling mud products, corrosion inhibitors, glycol, antifreeze, new and used lube oils, paints, gasoline, and diesel fuel, for equipment operation and infrastructure construction. Limited volumes of




Source: Uranerz 2012.

Figure 2.9 Typical Deep Disposal Well Design.

these materials would be temporarily stored in various locations within the wellfield during different stages of construction and operations. The volume of any single material on hand at any one time would not exceed the threshold planning quantity (TPQ) of 10,000 lbs for hazardous materials, as specified by Title III of the *Superfund Amendments and Reauthorization Act* (SARA). This minimization is necessary as the geologic target zones are shallow. This maximum amount is not likely to be surpassed due to the small size of the drilling rigs used and drilling locations, and the short duration of each drilling operation (usually 3 days). Extremely hazardous substances (EHSs), as defined in SARA, are not expected to be used in the operations.

If such substances are needed, Uranerz would develop and implement management programs to meet the applicable WDEQ Solid and Hazardous Waste Division (SHWD) regulatory requirements. All wastes generated from these materials would be handled and disposed of in accordance with applicable federal and state regulations.

Based on typical uranium ISR operations, and the typical hazardous waste types generated at similar uranium ISR facilities, it is anticipated that the Hank Unit Project would be classified as a conditionally exempt small quantity generator (CESQG) under *Resource Conservation and Recovery Act* (RCRA) and applicable Wyoming regulations. This classification does not require a permit or license from WDEQ. A CESQG:

(i) Must state whether its waste is hazardous;

(ii) Must not generate more than 100 kilograms (kg) (220 lbs) per month of hazardous waste or, with exception to spills, more than 1 kg (2.2 lbs) of acutely hazardous waste;

(iii) May not accumulate more than 1,000 kg (2,205 lb) of hazardous waste on-site at any time; and,

(iv) Must treat or dispose of its hazardous waste in a treatment storage or disposal (TSD) facility that meets the specific requirements of 40 CFR 261.5.

If the Hank Unit facility fails to meet these four criteria, it would lose CESQG status and must be fully regulated as either a small-quantity generator (more than 100 kg (220 lb) but less than 1,000 kg (2,205 lb) of non-acute hazardous waste per calendar month) or a large-quantity generator (at least 2,205 lb of non-acute hazardous waste per calendar month). Any hazardous waste, such as organic solvents, paints, waste oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical waste, and spent batteries would be disposed of in accordance with a management program that the facility would develop to meet applicable local, federal, and state regulatory requirements for the disposal of nonradioactive hazardous waste. The Campbell County Landfill is permitted to accept such hazardous wastes for disposal.

The probability of a failure of a pipeline carrying pregnant lixiviant (lixiviant containing complexed uranium) in the wellfield would be limited. Pipelines would be buried two to five ft

below the surface, and made of corrosion-free HDPE. They would also be inspected and tested prior to burial to ensure they are sound; pipeline pressure test results would be documented.

If a discharge of pregnant lixiviant from wellfield pipelines were to occur, Uranerz would implement numerous engineering and management controls. Installation and use of high and low pressure alarms/shutdowns and flow meters on piping leading to/from the wellfield and SPF would minimize the amount of process fluid lost. If a spill or release occurs, and after it has been controlled, the affect area would be surveyed with a gamma meter, and soil samples collected throughout. A spill record would be created documenting the volume, area affected, and corrective action taken. Per with NRC standards, areas exceeding twice background gamma would undergo additional soil sampling to determine if particular isotopes (radium-226, thorium-230, and lead-210) concentrations increased significantly above background. Soils would also be analyzed for uranium. If soil samples shows an increase from baseline (2.5 to 3 picoCuries per gram (pCi/g), for example), the affected soil would be removed, placed in an approved by-product storage container(s), and shipped to a licensed, NRC-approved disposal site.

Sanitary and Solid Wastes

Sanitary wastes would be generated from restrooms, lunchrooms, and other areas with toilet facilities. Portable self-contained chemical toilets will be provided for human waste disposal during construction. These holding tanks would be pumped out and their contents disposed of at an approved sewage facility in accordance with applicable rules and regulations regarding sewage treatment and disposal. Upon completion of construction operations, sanitary wastes from restrooms would be disposed of in an on-site septic system to be constructed and operated by Uranerz. This septic system would be located on privately-owned surface lands immediately north of the Hank Unit SPF, and designed to accommodate the estimated maximum of 35 permanent employees. Prior to construction of this facility, Uranerz would obtain a permit to construct it from WDEQ WQD; no permit is required from Campbell County.

All phases of the proposed Hank Unit Project would generate solid wastes. These wastes would include spent resin, empty chemical containers and packaging, pipes and fittings, tank sediments,

and domestic trash. Solid wastes would be classified as nonradioactive or radioactive prior to disposal. Nonradioactive solid wastes would be collected on-site in self-contained portable dumpsters or trash cages located near the SPF, and disposed of in a sanitary industrial landfill located near the city of Gillette. It is estimated that approximately 350 to 500 cubic yards ($yd^3$) of nonradioactive solid waste would be generated annually from project activities.

As soon as practicable after completion of construction activities, all debris and other waste materials not placed in the dumpsters or trash cages would be cleaned up, removed from the construction area, and disposed of in an approved landfill. No potentially harmful materials or substances would be left on location, and all solid waste would be disposed of at an appropriate solid waste disposal facility. All facilities that would be used by Uranerz would be properly permitted through the appropriate state/local regulatory authority.

All radioactive solid wastes classified as a "11e.(2) byproduct material" would be disposed of at a licensed waste disposal site or mill tailings facility. Uranerz plans to temporarily store these wastes on-site within the fenced SPF in accordance with NRC regulations, and the wastes periodically transported to an appropriately permitted disposal facility located off-site. Uranerz estimates that approximately 30 to 45 $yd^3$ per year of radioactive solid waste would be generated at the proposed Hank Unit Project. Uranerz has not yet selected an off-site radioactive disposal facility, but options being considered include: UR Energy's Shirley Basin facility near Mills, Wyoming; Energy*Solutions*' Clive facility in Clive, Utah; and, Energy Fuels' White Mesa facility in Blanding, Utah. Regardless of the location, all radioactive wastes would be disposed at a properly permitted and licensed waste disposal facility in accordance with applicable federal and state regulations.

Erosion Control Practices

As with all forms of disturbance, there would be a potential for wind and water erosion, and movement of sediments into drainages during all phases of the Hank Unit Project. Therefore, to reduce potential erosion, Uranerz would develop and implement a Storm Water Pollution Prevention Plan (SWPPP) in accordance with federal and state regulations and appropriate

guidance documents. Uranerz would obtain SWPPP permit coverage from WDEQ WQD for the Hank Unit Project. Appropriate best management practices (BMPs) to control erosion would be utilized, and required inspections of the Project Area would evaluate if the BMPs are producing the desired results. For example, berms and contouring would be used when and where possible, to minimize potential erosion and sediment movement. In addition, seeding with native seed mixtures would also occur as part of interim and permanent reclamation operations. Seeding of an area would take place during the appropriate growing season, either spring or fall, whichever comes first, following the disturbance.

All surface facilities, including wellfields and associated structures, access roads, office and maintenance buildings, pipelines, and SPF, would be designed and located to maintain existing surface water drainage patterns. In the event surface runoff could be impeded by a facility, culverts and diversion ditches would be installed to control runoff and prevent excessive erosion. If surface runoff is concentrated in a certain area, erosion measures such as energy dissipaters would be used to slow the runoff flow so erosion and sediment transport are minimized.
If an ephemeral drainage is crossed by roads or wellfield operations, appropriate measures (e.g., re-vegetation, grading and contouring, placement of hay bales, culvert installation, and sedimentation breaks) would be utilized. This would reduce the impact to the ephemeral drainage, including erosion and sediment movement into the drainage.

As much as possible, construction of new access roads would be avoided by using existing roads within the Project Area. When and where a new road is needed, design and construction would incorporate such parameters as drainages, topography, weather conditions, and land rights for the least amount of impact. If a new road must cross an ephemeral drainage, it would cross the drainage at a right angle (where possible) to minimize erosion, using appropriate culvert(s) size(s). If a drainage must be crossed, but cannot be crossed at a right angle or along elevation contours, appropriate erosion control measures would be designed and implemented.

Wellfield construction activities could result in some short-term or temporary erosion. Drilling, well development, pipeline construction, header house construction, pipeline placement, and access road construction activities would incorporate erosion protection measures based on

conditions where and when construction activities are occurring. BMPs specified in the SWPPP that may be used, include but are not limited to: re-vegetation, grading and contouring, hay bale placement, culvert installation, sedimentation breaks, and water bar placement.

In areas where steep grades are encountered during construction, interim reclamation measures (such as seeding of disturbed areas) would occur in addition to the erosion protection measures mentioned above. Seeding would occur in spring or fall, whichever comes first following disturbance.

Interim Revegetation Practices

Following the completion of facility construction and installation (including roads, header houses, wellfield, pipelines, power lines, and communication lines), all disturbed areas not needed for ongoing operations would be revegetated at the first seasonal opportunity. The goals of interim revegetation are to minimize wind and water erosion from disturbed areas, and maintain soil viability. Disturbed areas would be leveled, recontoured to blend into existing topography, scarified, and seeded to create a stable surface. The seed mixture for interim revegetation on BLM-administered lands would include, per acre, using pure live seed (PLS) (see also Topsoil Salvage Operations earlier in this section):

Interim Seed Mixture (14.0 lbs PLS per acre total, for drill seeding):

- 6.0 lbs PLS Western wheatgrass,
- 6.0 lbs PLS Thickspike wheatgrass, and
- 2.0 lbs PLS Slender Wheatgrass.

For broadcast seeding, the amount of seed would be doubled. These areas would remain re-vegetated through final wellfield decommissioning, when permanent re-vegetation occurs.

2.2.3.3 Uranium Recovery Phase

Introduction

Commercial uranium ISR has been practiced since the mid-1960s in the U.S., and is currently the leading extraction technology for uranium production in the U.S. The Mine and Reclamation Plan sections of the POO provide a detailed description of the ISR process (Uranerz 2012). The

primary advantages of ISR over conventional open pit mining include: 1) relatively minimal surface disturbance; 2) reduced long-term environmental impacts; 3) lower capital costs; and, 4) the ability to mine low-grade ores that would be otherwise unrecoverable.

Uranerz proposes to extract uranium from the Hank Unit Project Area wellfield using the ISR process with an anticipated LOP of 10 years; Figure 2.1 shows the proposed Project schedule. The wellfield is partially situated on BLM-administered lands, and to be mined sequentially as Production Areas #1 and #2 (Figure 1.2). Surface disturbance for the entire Hank Unit Project would include installation of processing facilities (the SPF); various wells for injection, recovery, monitoring, fresh water, and deep disposal; wellfield access road; various pipelines, power lines, and fiber optic communication lines; and header house buildings. Surface disturbance on BLM-administered lands would include all such facilities, except the SPF, deep disposal well(s), and fresh water well; these would be only on private surface lands. Uranerz estimates that, during construction, there would be approximately 33 acres of disturbance on BLM-administered lands and 126.4 acres of disturbance on privately-owned lands.

Uranium Recovery

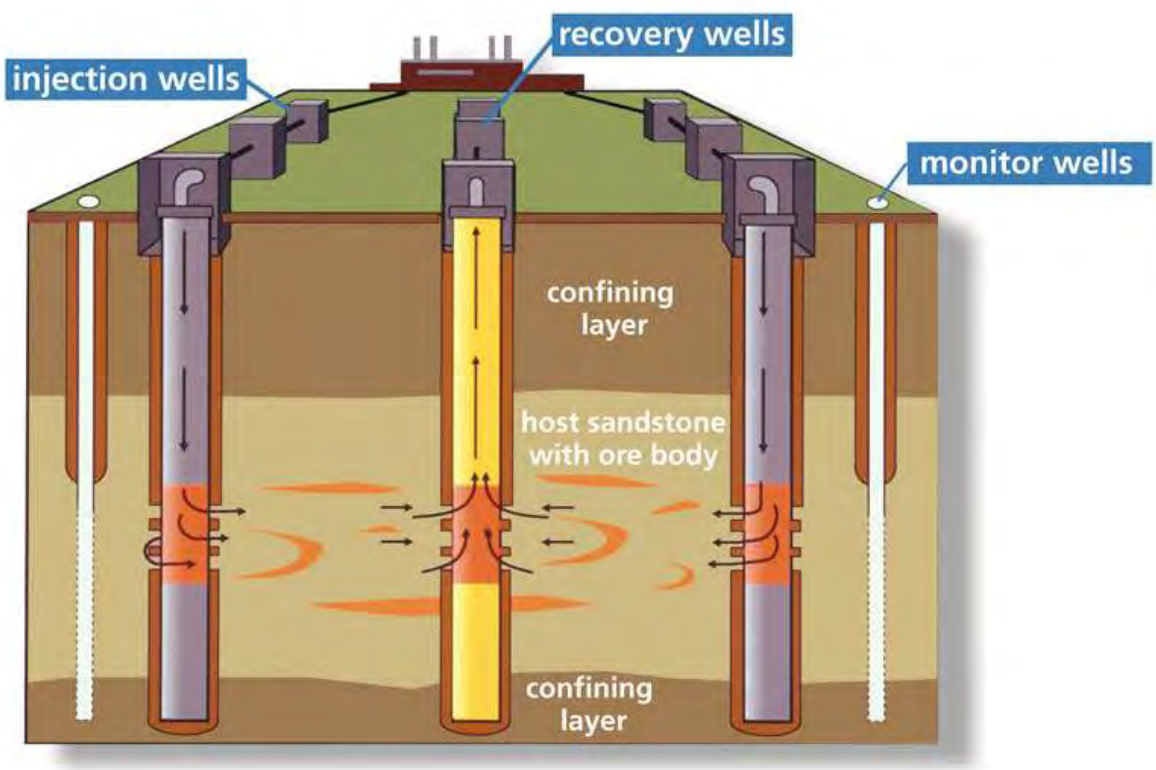
The ISR process is a mining method that uses conventional water well technology, with the addition of an oxidant such as oxygen to form a leaching solution ("lixiviant"), to extract uranium from mineralized zones. The ISR process does not involve physically removing rock from the ground like conventional open-pit and underground mining, thereby eliminating the attendant rock waste and dust problems, and their related health and environmental concerns.

The lixiviant to be used in the Hank Unit Project is sodium bicarbonate ($NaHCO_3$), although sodium carbonate ($Na_2CO_3$) may also be used. These substances are pumped via injection wells into the native groundwater in the zones containing uranium mineralization of the desired grade range ("ore" zones). Oxygen is used to dissolve uranium into the groundwater. The dissolved oxidized uranium would react with bicarbonate and/or carbonate ions in the lixiviant to form soluble uranyl tricarbonate and/or bicarbonate complexes. Carbon dioxide ($CO_2$) would be used in typically minimal amounts to both keep the pH around neutral, and if needed, as another source of carbonate and bicarbonate ions. Small quantities of hydrochloric acid may also be

used to adjust the pH of the lixiviant, and control bacterial growth in the wells. The resulting uranium-rich solution ("pregnant lixiviant") is drawn into recovery (production) wells where it is pumped to the surface, and then transferred to the IX unit in the SPF (see Figures 2.4 and 2.10). More detailed information concerning the lixiviant chemistry is presented in the NRC SEIS (2011) and POO (Uranerz 2012).

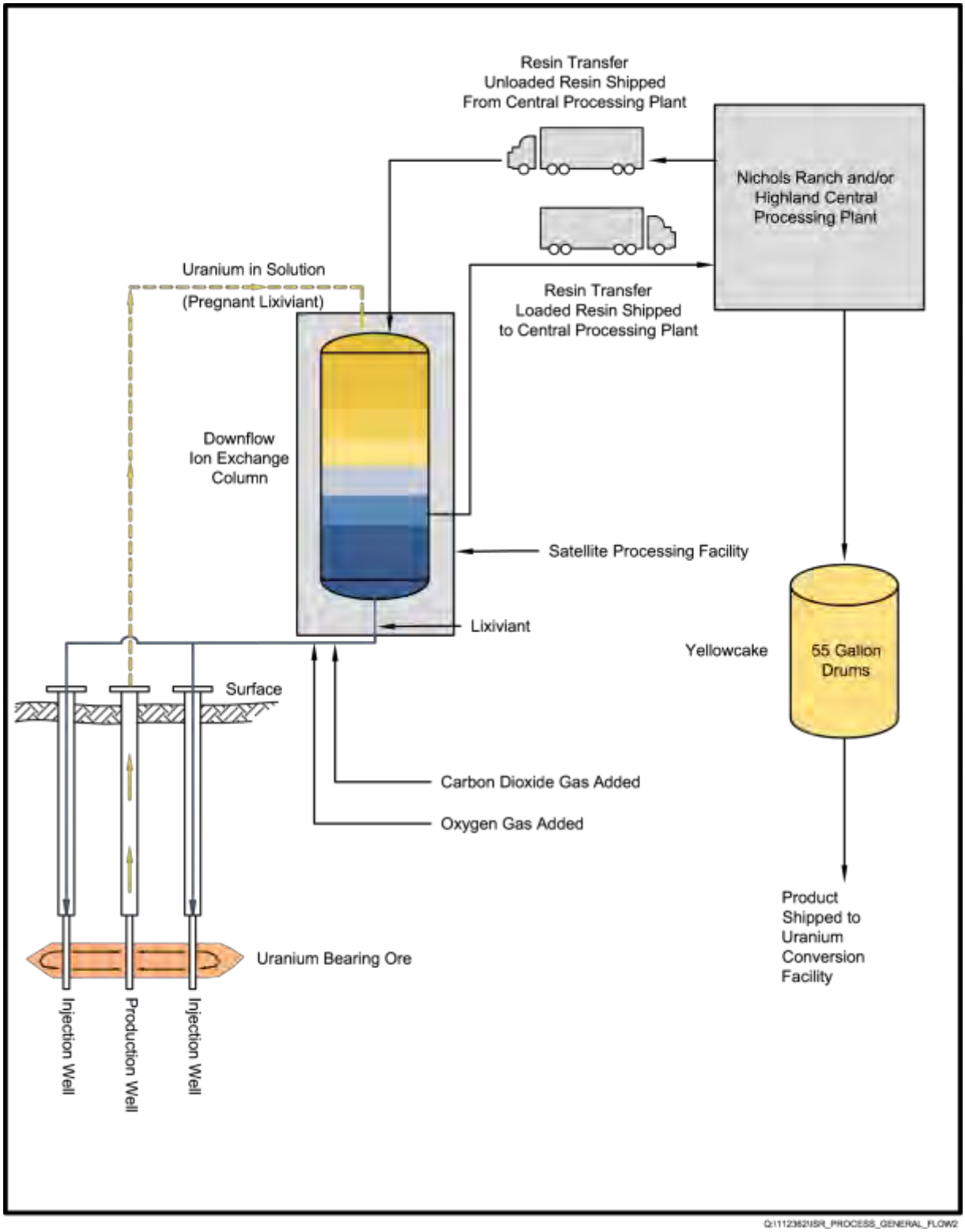
On-Site Uranium Processing

As the uranium-rich solution is received at the Hank Unit SPF, it would be pumped into a series of downflow IX columns (Figure 2.11). Uranerz estimates that approximately four IX columns would be needed in the SPF. Uranium dissolved (complexed with carbonate and/or bicarbonate




Source: Uranerz 2012.

Figure 2.10 Idealized Schematic Cross Section to Illustrate "Ore" Zone Geology and Lixiviant Migration from an Injection Well to a Recovery (Production) Well. Also shown are pipelines to/from injection and recovery wells to a header house.




Source: Uranerz 2012.

Figure 2.11 Flow Diagram of Anticipated Hank Unit Uranium ISR Recovery Process. The process to be used in the Hank Unit Project is typical for such projects.

ions) in the groundwater would be adsorbed onto resin beads in the columns via IX processes. This process also frees the carbonate and bicarbonate ions, and the water containing them (now barren lixiviant) is reinjected into the wellfield. As the resin beads in a given IX column become saturated with uranium, that column would be taken offline. The uranium-loaded resin beads would then be transported off-site from the Hank Unit SPF for further processing (elution and precipitation of the uranium) to either Nichols Ranch and/or Smith Ranch-Highland CPPs.

Transportation of Resin Beads for Off-Site Uranium Processing

The uranium-loaded resin beads would be transported by truck from the Hank Unit SPF to the CPP located in the Nichols Ranch Unit approximately 4 mi west (see Figure 1.1), and/or Cameco Resources' Smith Ranch-Highland CPP approximately 50 mi south. The loaded beads would be placed in an elution circuit, which reverses the dissolution process. Sodium bicarbonate and/or carbonate is added to the circuit, which frees the uranium from the resin beads by complexing with the it. This eluate will then be de-carbonated (removal of the carbonate and/or bicarbonate ions) by lowering the pH. Adding hydrogen peroxide ($H_2O_2$) to the de-carbonated eluate then allows precipitation of the uranium in solid particles ("yellowcake").

Uranerz estimates that during peak production approximately six round trips per week would occur from the Hank Unit SPF to Nichols Ranch and/or Smith Ranch-Highland CPPs. The NRC prepared an EA that addresses the transporting of resin beads from several uranium mining regions in Wyoming (including the PRB where the Hank Unit is located) to the Smith Ranch-Highland CPP. The EA determined no significant impacts would occur to the environment from transporting uranium-loaded resin beads, and the NRC issued a FONSI (NRC 2009b). This issue was also addressed in NRC's GEIS (NRC 2009a).

The trucks used to transport loaded resin are sole-use vehicles, labeled and operated under U.S. Department of Transportation (USDOT) requirements contained in 49 CFR Parts 171 through 189, and NRC regulations contained in 10 CFR Part 71. At either CPP, the uranium is stripped from the resin beads, dried, placed in 55-gallon drums, and weighed. The dried uranium is "yellowcake" (triuranium octoxide, $U_3O_8$), and is Uranerz' final product; this is what will be shipped off-site by the purchaser(s).

The resin beads (stripped of uranium) would then be returned by truck from either CPP to the Hank Unit SPF, where they would be placed back into IX columns to be re-loaded with uranium. This process would be repeated until the productive LOP is reached. Access from the Hank Unit SPF to Nichols Ranch CPP would be from existing unnamed and improved T-Chair Ranch roads (see Figure 1.1), which do not cross any BLM-administered surface lands. Access to Cameco Resources' Smith Ranch-Highland CPP would also be via existing improved roads, nearly all of which do not cross BLM-administered surface lands. Only Ross Road (CR 31) in Converse County crosses some BLM-administered surface lands. No separate approval from BLM is required for use of CR 31: this a public road; and, crossing BLM surface lands is considered (per 43 CFR 3809.415(b)) "reasonably incident to prospecting, mining, or processing operations." Uranerz has a road use agreement with the surface owners for use of nonpublic roads, and no separate approvals are required for the use of public roads.

Uranium Precipitation, Drying, and Transport

The precipitation and drying process would be conducted at either Nichols Ranch and/or Cameco Resources' Smith Ranch-Highland CPPs (Figure 2.11). This process would not be carried out at the Hank Unit SPF, and is therefore not considered part of the Proposed Action. After the uranium is stripped from the resin beads and precipitated, it is dried into "yellowcake," the final product. The yellowcake is packaged into 55-gallon, 18-gauge metal drums which hold an average of 950 pounds, and are classified by USDOT as Type A packaging (49 CFR Parts 171 through 189, and 10 CFR Part 71). More detailed descriptions of these processes are presented in the NRC GEIS (2009a) and POO (Uranerz 2012). The packaged yellowcake is then shipped by truck to a conversion plant in Metropolis, Illinois. There the yellowcake will be converted into uranium hexafluoride ($UF_6$), for use in the enrichment step of nuclear reactor fuel cycles. Additional detailed information concerning this process is presented in the NRC GEIS (2009a).

Public Safety

Uranerz' NRC SML (SUA-1597) requires the company to post public notices stating Uranerz' permission must be obtained prior to entering mining areas, and how to obtain permission.

Permission includes required use of proper personal protective equipment and a company escort. The wellfield and SPF are to be fenced and off limits to all persons without specific safety training. The SPF would operate 24 hours a day, 365 days per year, and secured and controlled using locks. Some header house buildings may be monitored using surveillance cameras.

The NRC SML (SUA-1597), and Section 3.0 of the WDEQ LQD Permit to Mine (PT778), state that the public would be protected from exposure to radiologic material by Uranerz applying appropriate equipment control and work practices. Uranerz would maintain detailed environmental and radiological programs to monitor any releases from the Hank Unit SPF (and Nichols Ranch Unit SPF and CPP) to the environment. The program scope encompasses monitoring of air, groundwater, surface water, soils, vegetation, and direct radiation. The program is designed to meet the NRC requirements codified in 10 CFR 40.65.

Water Management

Water management is critical to the Hank Unit Project because water is needed for all aspects of the uranium recovery and aquifer restoration processes. All water used in the Project would be obtained from groundwater sources in the Project Area, likely near the SPF, and appropriated in accordance with WSEO regulations. More information concerning the fresh water well is presented in Section 2.2.3.2. The primary water uses would be drilling, wellfield uranium recovery, uranium processing, aquifer restoration, and reverse osmosis make-up water. Aquifer groundwater restoration would consume the greatest volume of water. Process water recycling and wastewater minimization programs would be employed to minimize the volume of water to be disposed. Wastewater disposal would occur through one or more deep disposal wells. Uranerz would conduct extensive surface and groundwater monitoring during all phases of the Hank Unit Project. Detailed information is presented below in Section 2.2.3.7.

Workforce and Traffic

Uranerz estimates that a vast majority of the construction workers needed for this project would be available in the local areas including Gillette, Wright, and/or Casper with distances ranging

from 22 to 61 mi away from the project site. Approximately 45 to 55 workers would be needed during the construction phase of the Proposed Action. The largest number of workers and the most diverse number of trades would occur during construction and wellfield development. Construction operations would occur only during daylight hours. Trades likely needed to work on the project include dirt contractors, electricians, wellfield maintenance and construction crews (installing pipelines, header house structures etc.), well drillers (using truck-mounted rotary drilling rigs) and wellfield operation crews (pump installation, well development, MITs, etc.), water truck drivers, surveyors, reclamation crews, and construction and operations supervisors.

During the construction, recovery, and decommissioning phases of the project, Uranerz estimates traffic volumes would consist of approximately eight pickup trucks trips per day, and six tractor-trailers per week. During the uranium recovery phase, Uranerz estimates that there would be approximately six pickup round trips per week, or one round trip per day between the SPF and the Nichols Ranch and/or Smith Ranch-Highland CPPs. During the decommissioning phase, it is estimated that vehicle traffic would be less than half that during the construction phase (i.e., approximately four pickup trucks trips per day per week, and three tractor-trailers per week) (Uranerz 2012).

Equipment and supplies needed for completion of construction and wellfield development activities would be stored at various times and places until development activities are completed. Temporary staging areas would be established immediately adjacent to the SPF, and would be used to maintain supplies of equipment to minimize traffic throughout the Project Area.

Operations and wellfield maintenance activities would begin once field development activities are completed and the wellfield is in production. Uranerz estimates approximately 20 to 35 workers would be needed during the uranium recovery phase of the Proposed Action. Workers would likely come from communities such as Gillette, Wright, Buffalo, Kaycee, and Casper, Wyoming, and possibly other communities, with distances ranging from 22 to 61 mi away from the proposed Project Site.

Ancillary equipment that would be used in wellfield recovery operations would include truck-mounted pump pulling units, trailer-mounted hose reels, electrical generators, trenchers, backhoes, light duty 4-wheel drive vehicles, and 4-wheel all-terrain vehicles. Downhole well maintenance operations would include use of truck-mounted pulling units, and contract well drillers, as needed. Concrete will be needed continually during construction and wellfield development activities, and operations. A temporary small concrete batch plant would be staged near the SPF. The volume of concrete needed, and number of loads of cement delivered monthly, would vary according to the type and levels of activities.

Carbon dioxide and liquid oxygen would be delivered to the Hank Unit SPF on a regular basis once the operational phase of the project is initiated. Carbon dioxide would likely be delivered twice per week via tractor-trailers, while liquid oxygen would likely be delivered four to six times per month. Other products and supplies would be delivered on an as-needed basis.

#### 2.2.3.4 Groundwater Restoration Phase

##### Introduction

For each of the two Production Areas, at least 12 months prior to their planned decommissioning, a final decommissioning plan for that area would be submitted to the WDEQ LQD and NRC for review and approval. This final decommissioning of each area would occur after termination of uranium recovery phase, but prior to starting its' final decommissioning.

After the decommissioning plan for an area is approved by WDEQ LQD and NRC, lixiviant injection would be discontinued and groundwater restoration initiated. Groundwater restoration would be accomplished using a combination of techniques including groundwater sweep, reverse osmosis with reinjection, and geochemical stabilization (Uranerz 2012).

Following completion of uranium recovery in a production area, Uranerz would ensure the groundwater in that area was restored to pre-mining conditions. The goal of groundwater restoration is to return the aquifer to the baseline conditions existing prior to starting uranium

recovery. Or, if approved, to a secondary standard of pre-mining "class of use," the quality of use it was suitable for prior to mining. Restoration would involve groundwater sweep, clean water injection, and geochemical stabilization of the aquifer with a reductant. A detailed discussion concerning the aquifer restoration process is presented below.

Water to be used in this process would come from the wellfields and from the fresh water well to be located near the SPF. All these sources would be properly appropriated through WSEO.

Aquifer Restoration

After the uranium is recovered, the groundwater in the wellfield still contains other constituents (including heavy metals) that had been mobilized by lixiviant during uranium mobilization and recovery. Uranerz would begin aquifer restoration in each wellfield as the uranium recovery operations end. Consistent with current uranium ISR restoration practices, Uranerz may propose that restoration criteria or restoration target values (RTVs) be established on a parameter-by-parameter basis, although the primary goal of restoration is to return all parameters to pre-ISR baseline conditions. Prior to beginning operations, background (baseline) groundwater quality would be determined by collecting and analyzing water from the monitoring wells before any ISR operations occur. Uranerz expects the groundwater can be returned to pre-ISR baseline conditions. However, if water quality parameters cannot be returned to average pre-ISR baseline levels through reasonable restoration efforts, Uranerz would propose an alternate standard to NRC and WDEQ LQD for those constituents not returned to background levels. Prior to NRC and WDEQ LQD approval of alternate standards, Uranerz would be required to demonstrate that these Alternate Concentration Limits (ACLs) would maintain public health and safety.

The aquifer restoration program for the proposed Hank Unit Project would include three stages: groundwater transfer; groundwater sweep; and, groundwater treatment. These three stages would be designed to effectively and efficiently restore the groundwater so loss is minimized and restoration is optimized. Depending on the rate of progress of restoration, Uranerz may not need all of these stages of aquifer restoration to achieve approved RTVs. Monitoring would also be conducted as part of the aquifer restoration program.

Groundwater Transfer Stage

During the groundwater transfer stage, water would be transferred among wellfields: between a wellfield where groundwater restoration is beginning and one where ISR recovery is beginning; or, within the same wellfield if one area is in a more-advanced state of restoration than another. Water containing higher total dissolved solids (TDS), such as from a wellfield being restored, would be recovered and injected into the wellfield beginning ISR operations. This direct transfer of water would lower the TDS in the wellfield being restored and blend the water in the two wellfields so they are similar in conductivity. The water recovered from the wellfield being restored may be passed through an IX column and filtered, if suspended solids poses a blockage problem for injection well screens. Groundwater transfer would reduce the amount of water sent to the deep disposal well(s) during restoration as overall Project Area groundwater volume will be approximately maintained.

Groundwater Sweep Stage

During the groundwater sweep stage, groundwater from a wellfield beginning restoration would be pumped to the IX systems at the SPF through all recovery wells without reinjection. To accomplish this, groundwater is drawn into the wellfield to flush contaminants from the "ore" zone or "sweep" the aquifer. The water produced by the groundwater sweep would be sent to the Hank Unit SPF for treatment, and removal of any remaining uranium. The rate of groundwater sweep depends on the ability of the wellfield to sustain the withdrawal rate, and the capacity of the treatment equipment, as discussed below.

Groundwater Treatment Stage

During the groundwater treatment stage of the aquifer restoration process, groundwater would be returned to the SPF and passed through IX and reverse osmosis treatment equipment. This water would then be sent to the deep disposal well(s) or back into the wellfield. The IX columns would remove most of the soluble uranium from the water, replacing it with chloride or sulfate. Prior to or following IX treatment, the groundwater may pass through a decarbonation unit to

remove residual carbon dioxide. During treatment, an amount of reductant (a substance capable of bringing about the reduction of another substance while the reductant itself is oxidized) sufficient to reduce any remaining oxidized minerals may be metered into the injection stream. This is to decrease the concentration of oxidation-reduction sensitive elements in the water. Sodium hydroxide may be used during this treatment stage to adjust pH levels. This would also assist in immobilizing certain parameters, such as trace amounts of heavy metals. All or some portion of the restoration recovery water may be sent to the reverse osmosis system.

The reverse osmosis system serves to reduce the TDS in groundwater being restored, reduces the quantity of water needed to be removed from the aquifer to achieve the RTVs, concentrates the dissolved contaminants in a smaller volume of water (forming a brine) to facilitate waste disposal, and enhances ion exchange. A high percentage of water passes through the reverse osmosis membranes, leaving approximately 60% to 90% of the dissolved salts in the resulting brine water. The clean water, or permeate, would either be reinjected into the wellfield, stored for use in the ISR process, or sent to the deep disposal well(s). The permeate may also be decarbonated prior to reinjection into the wellfield.

The brine water contains most of the dissolved solids and is sent to the deep disposal well(s). Make-up water from a number of sources may be added prior to the reverse osmosis process, or inclusion in the wellfield injection stream, to control the amount of bleed into the restoration area. These sources would include water from a wellfield in a more advanced state of restoration, water being exchanged with a new wellfield production area, water from a different aquifer, or purge of an operating wellfield. The volume of water treated and re-injected through the production zone during this phase would depend on the efficiency of restoration back to pre-ISR baseline water quality, and the efficiency of the reverse osmosis in removing contaminants.

Groundwater Monitoring and Stabilization

During restoration, lixiviant injection ceases. The possibility of an excursion is greatly reduced, and the frequency of monitoring well sampling would be modified during this phase. During aquifer restoration, Uranerz would sample the overlying and underlying aquifer monitoring wells

once every 60 days, and measure static water levels. These samples would be analyzed for excursion parameters of chloride, total alkalinity, and conductivity. Uranerz would sample the recovery wells on a frequent basis to determine the effectiveness and efficiency of their aquifer restoration technique for the parameters presented in Table 2.3.

Restoration would be deemed complete when Uranerz is able to demonstrate stability of the aquifers through monitoring. NRC regulations require groundwater quality be returned to the standards identified in Criterion 5B(5) of 10 CFR Part 40 Appendix A, or any ACL approved by NRC in accordance with Criterion 5B(6). According to this criterion, ACLs may be proposed when background concentrations are not practically achievable at the site and present no substantial hazard to human health or the environment.

Once NRC and WDEQ LQD deem the production area as restored, a 12-month stability period would begin to ensure the achieved restoration goals are maintained. The monitoring ring wells would be sampled once every two months and analyzed for the upper control limit parameters for chloride, total alkalinity, and conductivity. Monitor wells completed in the production zone would also be sampled and analyzed for the same parameters listed above.

Table 2.3 Sampling Parameters for the Recovery Wells During Aquifer Restoration.[1]

| | | |
|---|---|---|
| Alkalinity | Copper | Nitrate |
| Ammonium | Electrical conductivity | pH @ 25 °C (77 °F) |
| Arsenic | Fluoride | Potassium |
| Barium | Iron | Radium-226 |
| Bicarbonate | Lead | Selenium |
| Boron | Magnesium | Sodium |
| Cadmium | Manganese | Sulfate |
| Calcium | Mercury | TDS |
| Carbonate | Molybdenum | Uranium |
| Chloride | Nickel | Vanadium |
| Chromium | | |

[1] Uranerz would have to provide data in support of any ACLs they propose, including consideration of practicable corrective actions and that the proposed ACLs are as low as reasonably achievable.

2.2.3.5 Decommissioning and Reclamation Phase

Wellfield Decommissioning

Wellfield decommissioning would begin following the successful conclusion of the aquifer restoration stability period, along with preparation and submittal of the wellfield restoration report to, and approval by, NRC and WDEQ LQD. Wellfield decommissioning would include plugging and abandonment of all recovery, injection, and monitor wells along with the removal of pipelines, well heads, and associated equipment. All wells would be plugged and abandoned in accordance with state and federal rules and regulations. This would include: 1) removal of all pumps and tubing; 2) plugging the wells with an appropriately formulated abandonment gel or slurry; 3) cutting off the well casing below the ground surface; 4) placing a cement plug to seal the well (on private surface lands); 5) backfilling, smoothing, and leveling the area to blend with surrounding terrain; and, 6) re-placement of topsoil for final re-vegetation.

If the wellfield equipment is still serviceable, well equipment and pipeline materials would be taken to the new production area for continued use. Wellfield equipment no longer usable would be surveyed for gamma radiation (inside and out) and placed in either the contaminated or non-contaminated "boneyard" areas in the SPF for subsequent removal from the Project Area. Non-salvageable contaminated piping, well heads, and associated equipment would be transported from the Project Area to an NRC-approved disposal facility. Non-salvageable non-contaminated materials would be transported to an appropriate landfill.

Plant Dismantling and Decommissioning

After groundwater restoration is complete, decommissioning the SPF would commence. All SPF process equipment would be dismantled and either sold to or used in another licensed facility, or decontaminated in accordance with NRC regulations and guidelines. Material that cannot be decontaminated to an acceptable level would be disposed of in an NRC-approved/licensed disposal facility. After decontamination, non-salvageable materials and structures (like building foundations) would be removed and disposed of at an appropriate landfill.

Road Reclamation

The wellfield access road constructed for the project would likely be removed and revegetated. If the private surface owner so desires, any roads constructed or improved on their lands would remain when operations are complete. All portions of the wellfield access road on BLM surface lands would be removed and revegetated. Road reclamation involves removal of road surface materials and any fill materials. The roadbed would be disced or ripped to reduce compaction and promote vegetation establishment. Stockpiled topsoil would then be reapplied, and the area would be mulched and seeded with the permanent seed mixture as discussed below.

Permanent Revegetation Practices

All revegetation would be performed in accordance with the WDEQ LQD and BLM regulations and policies, and the methods listed in the approved mine and reclamation plans. Final revegetation of the mine area would consist of seeding with approved final reclamation seed mixtures. Tables 2.4 and 2.5 present the seed mixtures to be used for permanent revegetation on privately-owned and BLM-administered surface lands, respectively. The seed mixture in Table 2.4 was developed through discussions with the private surface owners, and approved by NRC and WDEQ LQD. The seed mixture in Table 2.5 was recommended by BLM in June 2012; BLM may adjust this mixture when final reclamation occurs, if needed. Broadcast seeding rates would be double these amounts where drill seeding is not practical. Uranerz would mulch all permanently reclaimed areas immediately following seeding with 2 tons per acre of certified weed-free grass hay. The mulch would be blown on and then crimped into the ground. Crimping causes the mulch to stand up, securing it to the ground, and allowing it to capture more moisture, thereby improving reclamation success.

Evaluation of Reclamation Success

The successful reclamation and restoration of the Hank Unit would be based on returning the affected land back to its original uses of livestock grazing and wildlife habitat. This would be accomplished by removing all structures and roads, except those desired by the surface owner, and reclaiming and re-vegetating all lands disturbed within the Hank Unit Project Area.

Table 2.4 Reclamation Seed Mixture for Use on Privately-owned Surface Lands.[1]

| Species | Percent of Mix | Pounds PLS/acre |
|---|---|---|
| Western wheatgrass | 28 | 4.2 |
| Revenue slender wheatgrass | 28 | 4.2 |
| Bozoisky Russian wildrye | 19 | 2.85 |
| Greenleaf pubescent | 9 | 1.35 |
| Gulf annual ryegrass | 6 | 0.9 |
| Yellow blossom sweet clover | 5 | 0.75 |
| Ladak 65 alfalfa | 5 | 0.75 |
| Total | 100 | 15.0 |

Source: WDEQ LQD 2010.

[1] Drill seeding rate. Seeding rates would be doubled for broadcast seeding.

Table 2.5 Reclamation Seed Mixture for Use on BLM-administered Surface Lands.[1, 2]

| Species | Percent of Mix | Pounds PLS/acre |
|---|---|---|
| Western wheatgrass | 35 | 5.5 |
| Bluebunch wheatgrass | 19 | 3.0 |
| Green needlegrass | 9 | 1.5 |
| Slender wheatgrass | 19 | 3.0 |
| Needle-and-thread | 9 | 1.5 |
| Purple prairie clover | 3 | 0.5 |
| Prairie coneflower | 3 | 0.5 |
| Rocky Mountain bee plant | 3 | 0.5 |
| Total | 100 | 16.0 |

Source: Uranerz 2012.

[1] Drill seeding rate. Seeding rates would be doubled for broadcast seeding.
[2] This seed mixture was approved by BLM in 2012. BLM may adjust this mixture when final reclamation occurs, if needed.

As outlined in the POO, success of the final revegetation for both privately-owned and BLM-administered lands would be determined by meeting pre-mining land use conditions and reclamation success standards using the "Extended Reference Area" (ERA) method in WDEQ

LQD Guideline No. 2 (WDEQ LQD 2014a). This approach involves statistical comparison of the reclaimed area with an adjacent undisturbed area of the same (or nearly so) vegetation type and density. The ERA would be at least ½ the size of the reclaimed area that is being assessed, or no smaller than 25 acres. Uranerz would consult with WDEQ LQD on an appropriate area, ensuring the ERA adequately represents the reclaimed area being assessed. Uranerz would collect vegetation data as outlined in the Reclamation Plan of the approved POO, and prepare a report documenting re-vegetation monitoring results. The success of the final revegetation would be determined by the WDEQ LQD, and either the private surface owners (for privately-owned lands), or BLM (for BLM-administered lands).

Successful reclamation includes: 1) achieving post-mining vegetation cover similar to, or better than, that on the ERA; 2) achieving species composition and diversity capable of supporting the planned post-mining uses; and, 3) achieving a vegetation community able to sustain grazing pressure at a rate equal to that of the surrounding undisturbed areas. The MOU between BLM and WDEQ states that WDEQ LQD would take the lead on approval of revegetation success on privately-owned surface lands. In accordance with WDEQ LQD regulations, all the criteria listed above would be achieved and maintained for a period of at least two consecutive years prior to full bond release being sought or approved. For BLM-administered surface lands, WDEQ LQD would require BLM's concurrence with reclamation success on BLM-administered surface lands prior to full bond release on those lands (BLM and WDEQ LQD 2003).

While the wellfield is in operation, that area would be fenced off not only for security measures, but also to exclude livestock from entering the wellfield. To protect newly revegetated areas, Uranerz would leave the fencing in place. Livestock grazing within the fenced and re-vegetated wellfields would not be allowed unless WDEQ LQD approves such a practice.

Post-mining Land Uses

Uranerz' goal is to return all lands disturbed by the ISR project to their pre-mining land uses of livestock grazing and wildlife habitat. An alternate standard may be approved by the WDEQ LQD, and either the BLM (for BLM-administered lands), or the private surface owners (on

privately-owned surface lands). In addition, Uranerz' objective is to return the disturbed lands to a vegetation production capacity equal to, or better than, that which existed before mining.

Once full bond release has occurred, the area would be available for other land uses as deemed appropriate by the private surface owners and/or BLM for their lands.

2.2.3.6 Mitigation Measures

Overview

Regulations at 43 CFR 3809.420 state operations and post-mining land uses must comply with the applicable BLM land use plans and activity plans as appropriate, and operators must implement mitigation measures specified by BLM to protect public lands. To comply with these general operating standards, Uranerz would implement stipulated mitigations as required by the BLM, NRC, WDEQ LQD, and any other appropriate federal, state, or local agency.

As part of NRC licensing and WDEQ LQD permitting requirements, uranium ISR projects are required to collect extensive environmental baseline information and implement extensive monitoring programs and mitigation measures. Mitigation measures and monitoring required by regulation and approved NRC SML and WDEQ LQD Permit are considered part of the Proposed Action, included in this EA, and presented below.

All operations would be conducted in accordance with industry standards for a safe and efficient operation. Uranerz would periodically inspect project roads, wells, and reclamation areas to ensure they are in conformance with BLM requirements, NRC SML, WDEQ LQD Permit, and other regulatory agency requirements. It is the responsibility of Uranerz to minimize resource damage or loss and ensure safe operating conditions during all construction, operation, maintenance, and monitoring activities. Numerous pre-operational, operational, and post-operational monitoring and reporting requirements would be undertaken, and the results would be reported to all appropriate regulatory agencies.

Pre-construction Planning and Design Measures

All project facilities would be designed and located to minimize disturbance to areas of high-value wildlife habitat, including wetlands and riparian areas. Other examples include avoidance of raptor nests, compliance with Greater Sage-Grouse (GSG) seasonal stipulations, and avoidance of National Register of Historic Places (NRHP) eligible cultural resource sites. Addition pre-construction planning and design measures are presented below.

Cultural Resources and Native American Concerns

For the NRC Hank Unit SML, the NRC performed Section 106 consultations with the Wyoming State Historic Preservation Office (WYSHPO), the Advisory Council on Historic Preservation (ACHP), BLM, and the Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck Assiniboine/Sioux, Northern Arapaho, Northern Cheyenne, and Oglala Sioux Tribes. The NRC determined the issuance of the SML would result in an adverse effect to the Pumpkin Buttes TCP (Site 48CA268) and four other sites it considered to be TCPs (Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753) (NRC 2010). The NRC, WYSHPO, ACHP, and tribes consulted on a Memorandum of Agreement (MOA) to address adverse impacts from the Proposed Action to the setting of the five TCPs, and outlining mitigation measures intended to reduce such impacts from the Hank Project. This MOA ("NRC MOA"), *Memorandum of Agreement Among United States Nuclear Regulatory Commission, United States Bureau of Land Management Buffalo Field Office, the Advisory Council on Historic Preservation, the Wyoming State Historic Preservation Officer, Cheyenne River Sioux Tribe, Crow Tribe, Eastern Shoshone Tribe, Fort Peck Assiniboine/Sioux Tribe, Northern Arapaho Tribe, Oglala Sioux Tribe, and Uranerz Energy Corporation Regarding Mitigation of Adverse Effects to Historic Properties from the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming,* was signed by NRC, WYSHPO, ACHP, the Eastern Shoshone Tribe, the Northern Arapaho Tribe, and Uranerz in September 2011 (NRC et al. 2011). BLM, the Cheyenne River Sioux, Crow, Fort Peck Assiniboine/Sioux, Northern Cheyenne, and Oglala Sioux Tribes were invited signatories to the NRC MOA, but declined to sign it. The following mitigation measures addressing impacts to the TCPs, many of which are outlined in the NRC MOA, are considered part of the Proposed Action:

1) Uranerz would not conduct any ground-disturbing work within the boundaries of Sites 48CA268, 48CA6148, 48CA6475, 48CA6490, 48CA6748, 48CA6751, 48CA6753, 48CA6754, and 48CA6927.

2) To avoid physical impacts to three sites (Sites 48CA6148, 48CA6754, and 48CA6927) that could be physically impacted by the Proposed Action, Uranerz would maintain a 50-ft minimum disturbance avoidance buffer around the boundaries of these sites. In addition, Uranerz would delineate or mark the area around the physical boundaries of these three sites to help prevent inadvertent disturbance. Uranerz would delineate/mark these sites in consultation with the Tribal Monitor, and a professional meeting with the Secretary of Interior's Standards for Archaeology and History; thereby ensuring that ground-disturbing activities do not adversely affect the historic properties. The delineation/marking of these sites would not interfere with livestock or wildlife movement and it would not be a safety hazard. The delineation/marking would be installed prior to construction of the Hank Unit and would be removed upon completion of construction operations.

3) If Uranerz determines that it must conduct ground-disturbing activities within the boundaries of a historic property listed in Table 4.31, Uranerz would notify NRC, WYSHPO, and WDEQ LQD, and BLM (if on BLM-administered lands). Uranerz would provide the appropriate agencies with information on the ground-disturbing activity, the adverse effect to the historic property, and a proposed mitigation/treatment plan. The NRC would consult with parties who signed the NRC MOA before making a determination of the proposed ground-disturbing activities' adverse effect and submit it to the WYSHPO for concurrence. If an adverse effect is found, the NRC would consult with the signatory parties of the NRC MOA and review the proposed mitigation/treatment plan. Once an appropriate mitigation/treatment plan has been agreed upon, the mitigation/treatment plan would be implemented.

4) Uranerz would not conduct any ground-disturbing activities above the 5,500-ft elevation of the North Middle Butte of the Pumpkin Buttes TCP. This elevation level and above

was determined to hold the most significance during tribal consultations conducted during analyses performed in relation to other mineral-related development activities, specifically CBNG. This Programmatic Agreement (PA) is called the "Pumpkin Buttes PA," *Pumpkin Buttes Programmatic Agreement Between the Bureau of Land Management and the Wyoming State Historic Preservation Officer Regarding Mitigation of Adverse Effects to the Pumpkin Buttes Traditional Cultural Property from Anticipated Federal Minerals Development, Campbell County, Wyoming* (BLM and WYSHPO 2009). Although the Pumpkin Buttes PA has expired, this elevation level remains of supreme importance to the tribes.

5) Uranerz would provide for one qualified Tribal Monitor representing all Tribes to be present during construction activities at the Hank Unit. Construction activities include: ground clearing and excavation activities for the Hank Unit SPF, initial trunk line installation, and header house placement. Notification of the commencement of construction activities at the Hank Unit would be communicated to the Tribes at least one month prior to the start of construction.

6) The Tribes would decide how they would like to select the representative of all Tribes who would serve as the Tribal Monitor. The position can be rotated through each of the Tribes, but would not be shorter than a 2-week period for each Tribal Monitor.

7) The Tribal Monitor would be compensated at the prevailing rate of a comparable job for the State of Wyoming during periods of active construction only. In the event of a suspension of construction activities, Uranerz would be relieved of its obligations to compensate the Tribal Monitor until construction resumes.

8) The qualified Tribal Monitor would be considered a contractor to Uranerz and must comply with the Uranerz Contractor/Guest Environmental, Safety, and Health Guidelines and Site Requirements, Occupational Safety and Health Administration, NRC, and any other state regulations. The Tribal Monitor must also agree to any NRC/state requirements imposed via license or permit. The Tribal Monitor would be expected to

comply with the reasonable requests and instructions of Uranerz' Construction Manager. The Tribal Monitor would be permitted to observe construction, assist in cases of unanticipated discoveries, and to ask questions relating to construction activities and receive responses thereto, but he or she shall not participate in the construction activities and shall not impede or hinder construction activities in any way. In the event of any noncompliance by the Tribal Monitor with these requirements, the Tribal Monitor would be required to leave the construction site and Uranerz would be relieved of any further obligation to permit or compensate the attendance of that particular Tribal Monitor thereafter.

9) All disturbed lands associated with the project, including access roads, pipelines, well locations, power lines, management facilities, etc., would be expediently reclaimed and reseeded in accordance with the project-specific Reclamation Plan of the Uranerz POO.

10) Wherever possible, existing roads would be utilized. In order to minimize visual contrast, roads would be placed outside areas containing dense patches of sagebrush and follow natural contours wherever practicable. The aggregate used on new roads would be of a color that does not create a visual contrast to the surrounding topography.

11) All pipelines would be located in corridors next to or within road areas wherever possible. Pipeline corridors would use existing disturbance areas, and be placed outside areas containing dense patches of sagebrush where practicable.

12) Wherever practicable, areas of existing disturbance would be used during development and operations. To minimize visual contrast, well locations would not be placed in areas of dense sagebrush or other vegetation unless absolutely necessary. Brush hogging or other vegetation removal on drilling locations within areas of dense sagebrush or other vegetation would be feathered to reduce visual contrast and limited to 30 ft in diameter from each well. All aboveground infrastructures related to well production would be painted in a color that best blends in with the surrounding topography. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or

Carlsbad Canyon Tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The aggregate used on surfaces surrounding the well locations, if any, would be a color that does not create a visual contrast to the surrounding topography.

13) Wherever practical, power lines servicing wells would be buried, and buried power lines would be placed inside, or within 5 ft of, the trench utilized for pipelines when possible. Construction of aboveground power lines within 2 mi from the base elevation of Pumpkin Buttes would be designed to reduce visual contrast. Any power line should use areas of existing disturbance whenever possible.

14) All permanent aboveground structures (e.g., production equipment, tanks, etc.) not subject to safety requirements would be painted to blend with the natural color of the landscape. The color would simulate the standard environmental colors established by the BLM for VRM. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The aggregate used to surround all permanent aboveground structures would be a color that does not create a visual contrast to the surrounding topography.

15) Uranerz would not conduct any ground-disturbing work in areas that have not been previously inventoried and cleared for cultural resources.

16) Uranerz would instruct all employees, contractors, subcontractors, and any additional parties involved in the project not to search for, retrieve, deface, or impact archaeological materials (e.g., arrowhead hunting), and that it is a violation of the federal *Archaeological Resources Protection Act of 1979* (ARPA) (16 U.S.C. 470aa-mm) to do so on federal land.

17) If previously unknown cultural resources are discovered at the site, Uranerz would immediately stop the ground-disturbing activities in the area of the discovery and would immediately notify the NRC, and WYSHPO, and BLM if located on BLM-administered lands. Uranerz would have any discovered cultural materials evaluated for NRHP eligibility by a professional meeting the Secretary of Interior's Standard for Archaeology and History. Documentation of the discovery and evaluation would be promptly provided to the NRC, and the BLM if located on BLM-administered lands. The NRC (and BLM if located on BLM-administered lands) would then consult with WYSHPO on the determination of eligibility and adverse effect. If WYSHPO determines that there is an adverse effect to a historic property, NRC, and BLM if the property is located on BLM-administered lands, would follow the procedure to resolve the adverse effect as described above. Work may continue in other areas of the site; however, work in the area of discovery may not resume until such time as any additional actions are completed or deemed unnecessary.

18) Depending on the location of the discovery, cultural resource(s) would remain under the ownership of the private landowner or the U.S. Government. Applicable federal, state, or local laws would apply to the discovered cultural resources.

19) If human remains are encountered on private land, work would immediately stop in the vicinity of the discovery, the area would be secured, and Uranerz would immediately contact local law enforcement and the county coroner per W.S. 7-4-104. If the remains are not associated with a crime, then Uranerz would contact the NRC, WYSHPO, and the landowner (including BLM if located on BLM-administered lands) to further consult on the treatment of the remains. Uranerz would assure compliance with applicable federal, state, and local regulations relating to burial discoveries through inadvertent construction-related disturbance of graves.

20) If Native American human remains and associated funerary objects as defined in the *Native American Graves Protection and Repatriation Act (*NAGPRA) are encountered on BLM-administrated land, Uranerz would immediately stop all work in the area and notify

NRC, BLM, and WYSHPO. BLM would be responsible for compliance with the provisions of NAGPRA on BLM-administered lands.

Control of Invasive, Nonnative Plant Species

The control of invasive, nonnative plant species is important. Some species can enter the project area on equipment and vehicles, while others may spread from distant areas by seeds blowing onto the site via wind. To minimize and control the spread of invasive, nonnative plant species, Uranerz would design and construct the project so the least amount of surface disturbance occurs, thereby exposing the least amount of soil possible. Large construction equipment traveling off Project roads would be cleaned prior to entering the Project Area. Uranerz would work with the BLM, other surface owners, and county and state agencies as appropriate (including the Campbell County Weed and Pest Board) to control the spread of invasive, nonnative plant species in the Project Area. This may entail spot spraying with an approved herbicide on disturbed areas. A Pesticide Use Proposal would be submitted to BLM, and approval would need to be obtained before the application of herbicides or other pesticides for the control of noxious weeds occurs on BLM-administered lands.

Existing Roads

In accordance with BLM Handbook H-9113 (BLM 2011c), existing roads would be maintained to the same, or better, condition than existed before beginning Project-related activities, and this maintenance would continue until final abandonment and reclamation. Vehicles would remain on roads at all times, except in designated wellfield areas where development is occurring.

Threatened, Endangered, Proposed, and Candidate (TEPC) Animal and Plant Species, and BLM Sensitive Species (SS)

To minimize potential impacts to threatened, endangered, proposed, and candidate (TEPC) animal and plant species, and BLM-sensitive species (BLM SS) on BLM-administered lands, Uranerz would implement the following mitigation measures:

Greater Sage-Grouse (GSG)

To minimize potential impacts to greater sage-grouse, Uranerz would implement the following mitigation measures for the entire proposed project area.

1. Surface occupancy and/or disruptive activities would be prohibited on or within 0.25 mi radius of the perimeter of occupied GSG leks.

2. To the extent possible, Uranerz would not construct any aboveground power lines, permanent high-profile structures such as storage tanks, or other perch sites within 0.5 mi of any active GSG lek near the Hank Unit Project Area. In addition, wherever practical, power lines within 2 mi of the base of the Pumpkin Buttes TCP would be buried. Where the power lines could not be buried (due to local topographic and/or geological conditions), aboveground power lines would be designed and constructed in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (Avian Power Line Interaction Committee 2006).

3. To minimize GSG mortality due to vehicle collisions, Uranerz would advise project personnel of appropriate speed limits for specific access roads, that they are not allowed to haze or harass the animals, and that they should minimize any direct disturbance to the animals whenever possible.

4. Uranerz would minimize the removal of vegetation wherever possible, and revegetate disturbed areas as soon as practicable following completion of Project activities.

Bald and Golden Eagles, and Other Raptors

1. A seasonal minimum ground disturbance-free buffer zone of 1 mi would be established for all bald eagle winter roost sites (November 1-April 1). Buffer zones and timing may be adjusted based on site-specific information through coordination with and written approval from the U.S. Fish and Wildlife Service (USFWS).

2. Within 0.5 mi of bald eagle winter roost sites, additional measures such as remote monitoring and restricting maintenance visitation would be implemented. This includes limiting all site visits to between 9:00 a.m. and 3:00 p.m. to prevent disturbance for the period of November 1-April 1.

3. No surface disturbing activity would occur within 0.5 mi of any identified active raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season.

4. If a raptor nest occupancy survey identifies active raptor nests, a 0.5-mi timing buffer would be implemented. The timing buffer restricts surface disturbing activities within 0.5 mi of occupied raptor nests from February 1 to July 31.

5. Aboveground power lines would be constructed in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (Avian Power Line Interaction Committee 2006).

6. To minimize potential impacts to the local prey base for raptors, Uranerz would minimize the amount of disturbance associated with the Hank Unit Project.

7. Uranerz would also conduct annual raptor monitoring and mitigative planning to minimize conflicts between active nest sites and Project-related activities.

<u>BLM-Sensitive Species (SS)</u>

1. Uranerz would not conduct any ground-disturbing activities within the prairie dog towns in the Hank Unit illustrated on Exhibit D9-3 in Appendix D9 of the POO (Uranerz 2012).

2. To minimize potential impacts to BLM-SS, Uranerz would minimize the amount of disturbance associated with the Hank Unit Project.

Vegetation

Removal or disturbance of vegetation would be minimized by construction site management and by use of previously disturbed areas and existing Rights-of-Way (ROWs), designating limited equipment/materials storage yards and staging areas, and by other appropriate means.

Vegetation and soil removal would be accomplished in a manner that would minimize erosion and sedimentation. On BLM-administered lands, Uranerz would seed and stabilize all disturbed areas in accordance with Section 2.2.3.5.

Air Quality and Noise

Uranerz would control fugitive dust by the application of water or other measures as appropriate during times of high use, and traffic speeds would also be held to appropriate levels. Uranerz would also ensure that all internal combustion equipment would be maintained in accordance with manufacturer recommendations, and noise control equipment would be maintained. In addition, open burning of garbage or refuse at well sites or other facilities would not be allowed. Uranerz has committed to reseeding disturbed surface areas in the interim to minimize erosion from wind and water. Grass seed in the interim seed mixture would likely be reestablished within two years of initial disturbance (Uranerz 2012). In addition, permanent reclamation of all disturbed areas would include re-contouring, topsoil replacement, and seeding and mulching. These activities would minimize long-term impacts to air quality.

Storm Water Pollution Prevention Plan (SWPPP)

To minimize potential impacts to soils resources, Uranerz would develop and implement a SWPPP for the newly affected areas. Uranerz' current Wyoming Pollutant Discharge Elimination System (WYPDES) permit and SWPPP for the Nichols Ranch Unit would be expanded to include the Hank Unit. This permit would be maintained pursuant to the *Federal Water Pollution Control Act* (Public Law 101-380) (also known as the *Clean Water Act*), the *Wyoming Environmental Quality Act*, Wyoming Statutes (W.S.) 35-11-101 through 35-11-1802, and the WDEQ WQD Rules and Regulations Chapters 2 and 18. The SWPPP is designed to

prevent and reduce the release of storm water-related pollution such as sediment and runoff from exposed materials. The SWPPP would include erosion control measures to prevent and limit storm water pollution, and procedures for periodic inspections of storm water pollution prevention devices and practices. Uranerz would install and maintain all appropriate runoff and erosion control measures as described in the SWPPP such as water bars, berms, and interceptor ditches, and copies of the SWPPP and inspection reports would be on file in the Hank Unit SPF.

Soils

Sufficient topsoil to facilitate revegetation would be segregated from subsoils during all construction operations and returned to the surface upon completion of operations. Topsoil stockpiles would be seeded to prevent erosion and to maintain viability of soil microflora and microfauna. Uranerz would keep the area of disturbance to the minimum necessary for development activities while providing for safety. Uranerz would minimize Project-related off-road travel during periods when soils are saturated or when conditions which result in excessive road rutting (>4 inches) may occur.

Interim erosion control measures such as use of mulch or jute netting, or other appropriate techniques (as outlined in the SWPPP) would be used on unstable soils, steep slopes, and wetland areas to prevent erosion and sedimentation until vegetation becomes established. Uranerz would also minimize disturbance to vegetated cuts and fills on new and existing roads.

Uranerz would replace topsoil or suitable growth materials over all disturbed surfaces prior to re-vegetation and would re-vegetate all disturbed sites as soon as practicable following disturbance.

Wildlife

To protect big game, during construction operations and prior to installation of the wellfield fence, all drilling well mud pits would be fenced on at least three sides while drilling, and four sides after the drill rig moves off for the duration of time that the pit is open.

Removal or disturbance of vegetation would be minimized through construction site management, and Uranerz would implement the interim and permanent reclamation procedures outlined in Section 2.2.3.2 and 2.2.3.5.

To minimize wildlife mortality due to vehicle collisions, Uranerz would advise project personnel of appropriate speed limits on designated access roads, they are not allowed to haze or harass animals, and they should minimize any direct disturbance to animals whenever possible. Potential increases in poaching would be minimized by informing employees and contractors they are required to comply with all wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by Uranerz.

Uranerz would also install buried fiber optic communication lines to allow for remote monitoring and controlling of well uranium recovery and aquifer restoration activities at the header houses and/or the SPF. The fiber optic communication lines would thus reduce vehicle traffic and human presence in the wellfields.

Visual Resources

All disturbed lands associated with the project, including access roads, pipelines, well locations, power lines, management facilities, etc. would be expediently reclaimed and reseeded in accordance with the project-specific Reclamation Plan.
Wherever possible, existing roads would be utilized. In order to minimize visual contrast, roads would be placed outside areas containing dense patches of sagebrush, and follow natural contours wherever practicable. The aggregate used on new roads would be of a color that does not create a visual contrast to surrounding topography.

All pipelines would be located in corridors next to or within road areas wherever possible. Pipeline corridors would use existing disturbance areas and would be placed outside areas containing dense patches of sagebrush where practicable.

Wherever practicable, areas of existing disturbance would be used during development and operations. To minimize visual contrast, well locations would not be placed in areas of dense

sagebrush or other vegetation unless absolutely necessary. Brush hogging or other vegetation removal on drilling locations within areas of dense sagebrush or other vegetation would be feathered to reduce visual contrast and limited to 30 ft in diameter around each well.

All aboveground infrastructure related to well production would be painted in a color that best blends in with surrounding topography. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon Tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The aggregate used on surfaces surrounding well locations, if any, would be of a color that does not create a visual contrast to surrounding topography.

Wherever practical, power lines servicing wells would be buried, and buried power lines would be placed inside or within 5 ft of the trench utilized for pipelines whenever possible. Construction of aboveground power lines within 2.0 mi from the base elevation of Pumpkin Buttes would be designed to reduce visual contrast. Any power line should use areas of existing disturbance whenever possible.

All permanent aboveground structures (e.g., recovery equipment, tanks, etc.) not subject to safety requirements would be painted to blend with the natural color of the landscape. The color would simulate the standard environmental colors established by BLM for visual resource management. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon Tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The aggregate used on surfaces surrounding all permanent aboveground structures would be of a color that does not create a visual contrast to surrounding topography.

Minerals

Potential conflicts could arise between numerous and various minerals projects in the area and the Proposed Action. Those most likely to conflict with the Hank Unit project are CBNG wells, as the zones of interest for both types of projects are shallow to relatively shallow. Uranerz

would maintain close communication with CBNG operators in the Project Area to avoid potential conflicts. The uranium ISR process is designed to work on a negative pressure basis, keeping the ISR and CBNG processes separated from a production standpoint. The prospective zones of interest (uranium as opposed to CBNG) would be kept at least 400 vertical ft apart. In addition, Uranerz would comply with all appropriate well completion standards specified by NRC, WDEQ LQD, Wyoming Oil and Gas Conservation Commission (WOGCC), and BLM.

Petroleum Product and Waste Handling

Uranerz and its' contractors would manage, store, handle, and dispose of all petroleum products and wastes in compliance with all appropriate federal and state regulations. In addition, Uranerz would train its personnel to properly handle, transport, and dispose of all petroleum and hazardous products/materials/wastes to avoid and reduce potential occurrences of spills, leaks or releases. Uranerz would also develop and implement an Emergency Response Plan (ERP) to address potential spills, leaks, or releases of such materials. Uranerz would also minimize/mitigate potential spills, leaks, or releases of by conducting routine maintenance and inspections on all appropriate vehicles and equipment to identify and fix problems early.

In the event of a spill, leak, or release of petroleum products/wastes, Uranerz would clean up and dispose of the spill, leak, or release in accordance with state and federal regulations. All spills of petroleum products or hazardous chemicals in excess of the allowable quantity as determined by WDEQ WQD would be reported to WDEQ WQD.
Uranerz would develop and implement waste management programs to meet the applicable WDEQ SHWD regulatory requirements. All wastes generated from these materials would be handled and disposed of in accordance with applicable federal and state regulations.

Any hazardous waste, such as organic solvents, paints, waste oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical waste, and spent batteries, would be disposed of in accordance with a management program developed to meet applicable local, federal, and state regulatory requirements for the disposal of nonradioactive hazardous waste.

During construction, portable self-contained chemical toilets would be provided for human waste disposal. As required, the holding tanks for the chemical tanks would be pumped out and their contents disposed of at an approved sewage facility in accordance with applicable rules and regulations. Upon completion of construction operations, sanitary wastes from restrooms would be disposed of in an on-site septic system that would be constructed and operated by Uranerz. The septic system would be located on private-owned surface lands immediately north of the Hank Unit SPF. The septic system would be designed in order to accommodate the estimated maximum of 35 permanent employees. Prior to construction of this facility, Uranerz would obtain a permit to construct the septic system from WDEQ WQD.

As soon as practicable after completion of construction activities, all debris and other waste materials not placed in the dumpsters or trash cages would be cleaned up, removed from the construction area, and disposed of in an approved landfill. No potentially harmful materials or substances would be left on location, and all solid waste would be disposed at an appropriate solid waste disposal facility. All facilities that would be used by Uranerz would be properly permitted through the appropriate state/local regulatory authority.

All radioactive wastes would be handled and disposed at a properly permitted and licensed waste disposal facility in accordance with applicable federal and state regulations.

#### 2.2.3.7 Monitoring

##### Introduction

In general, monitoring programs are developed for uranium ISR projects to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary. Monitoring programs provide data on operational and environmental conditions to prompt corrective actions can be implemented when adverse conditions are detected. These programs help limit potential environmental impacts at uranium ISR facilities and the surrounding areas. All radiological components are regulated by the NRC, as discussed below.

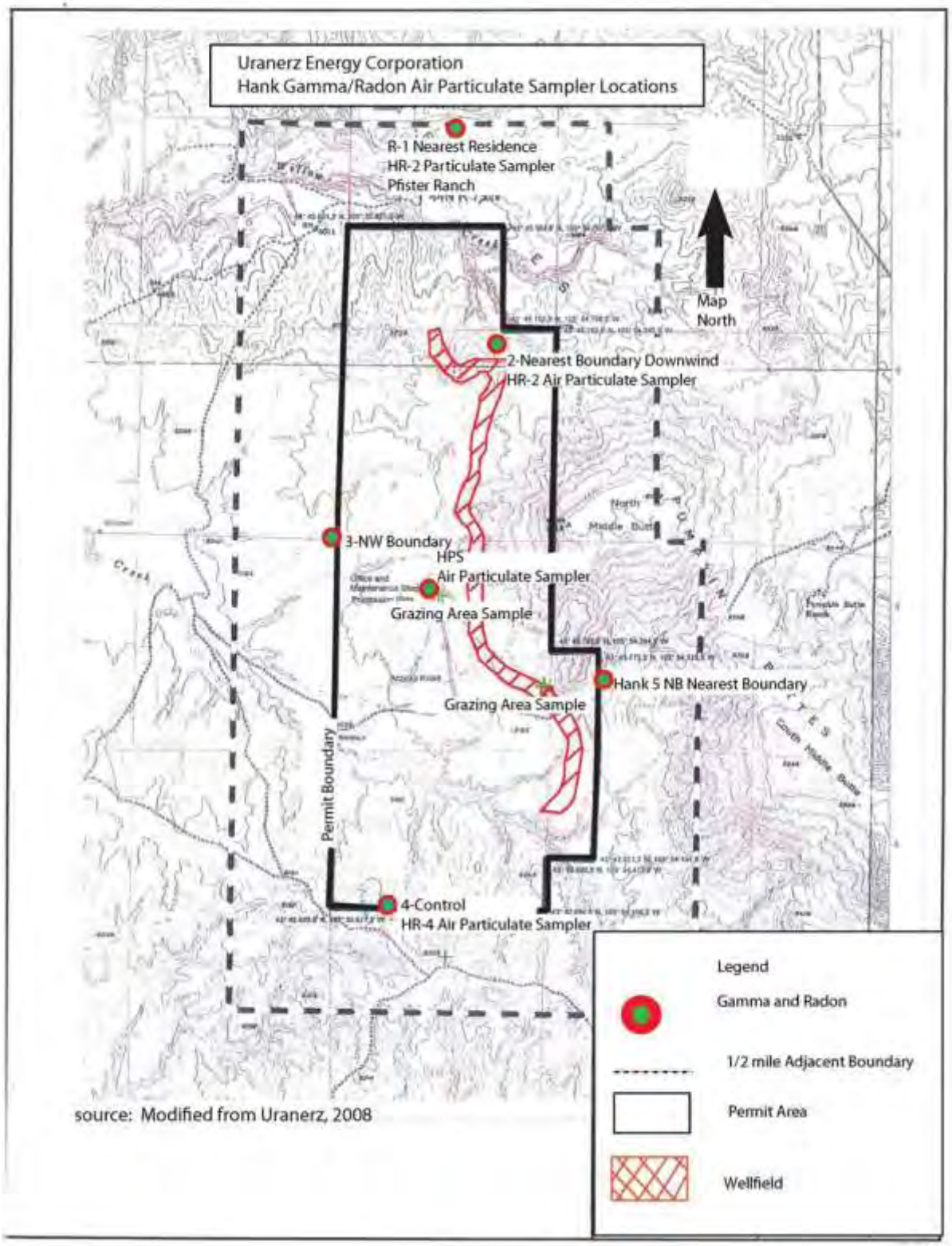
Radiological Monitoring

The purpose of the radiological monitoring program is to 1) characterize and evaluate the radiological environment, 2) provide data on measurable levels of radiation and radioactivity, and 3) provide data on the principal pathways of radiological exposure to the public (NRC 2008b). All radiological components are regulated by NRC in accordance with 10 CFR 40, Appendix A, Criterion 7. A pre-operational monitoring program is required to establish facility baseline conditions. After establishing baseline, ISR facility operators are required to implement operational monitoring program to measure/evaluate compliance with standards and to evaluate environmental impacts of an operating ISR facility. Although not a regulatory requirement, NRC Regulatory Guide 4.14 (NRC 2008b) provides guidance for implementing monitoring programs at uranium mills (including ISR facilities) acceptable to NRC.

Airborne Radiation Monitoring

In accordance with NRC regulations and the NRC SML, Uranerz would conduct continuous air particulate sampling with weekly filter changes, and collect quarterly composite samples and analyze them for natural uranium, and isotopes radon-226 (Ra-226), thorium-230 (Th-230), and lead-210 (Pb-210). Uranerz would implement the airborne radiation monitoring program to detect radon and air particulate releases from the Hank Unit SPF. Results of this would be reported to NRC in semiannual effluent reports, as required by 10 CFR 40.65. Sampling would be conducted at the same six air particulate sampling locations used for air particulate sampling (Figure 2.12). Uranerz would use Track-etch radon detectors, which would be changed quarterly and analyzed for radon concentration.

Uranerz would implement an airborne radiation monitoring program to detect radon and air particulate releases from the Hank Unit SPF. The locations of the samplers are based on the recommendations in NRC Regulatory Guide 4.14 (NRC 2008b), which include air monitoring stations located at/ near site boundaries. Air particulate samplers would be located at four locations within 0.5 mi of the Hank Unit Project Area, including upwind, downwind, at the nearest residence, and at the SPF.




Source: Uranerz 2012.

Figure 2.12 Location of Hank Unit Project Area Air Particulate and Radon Samplers.

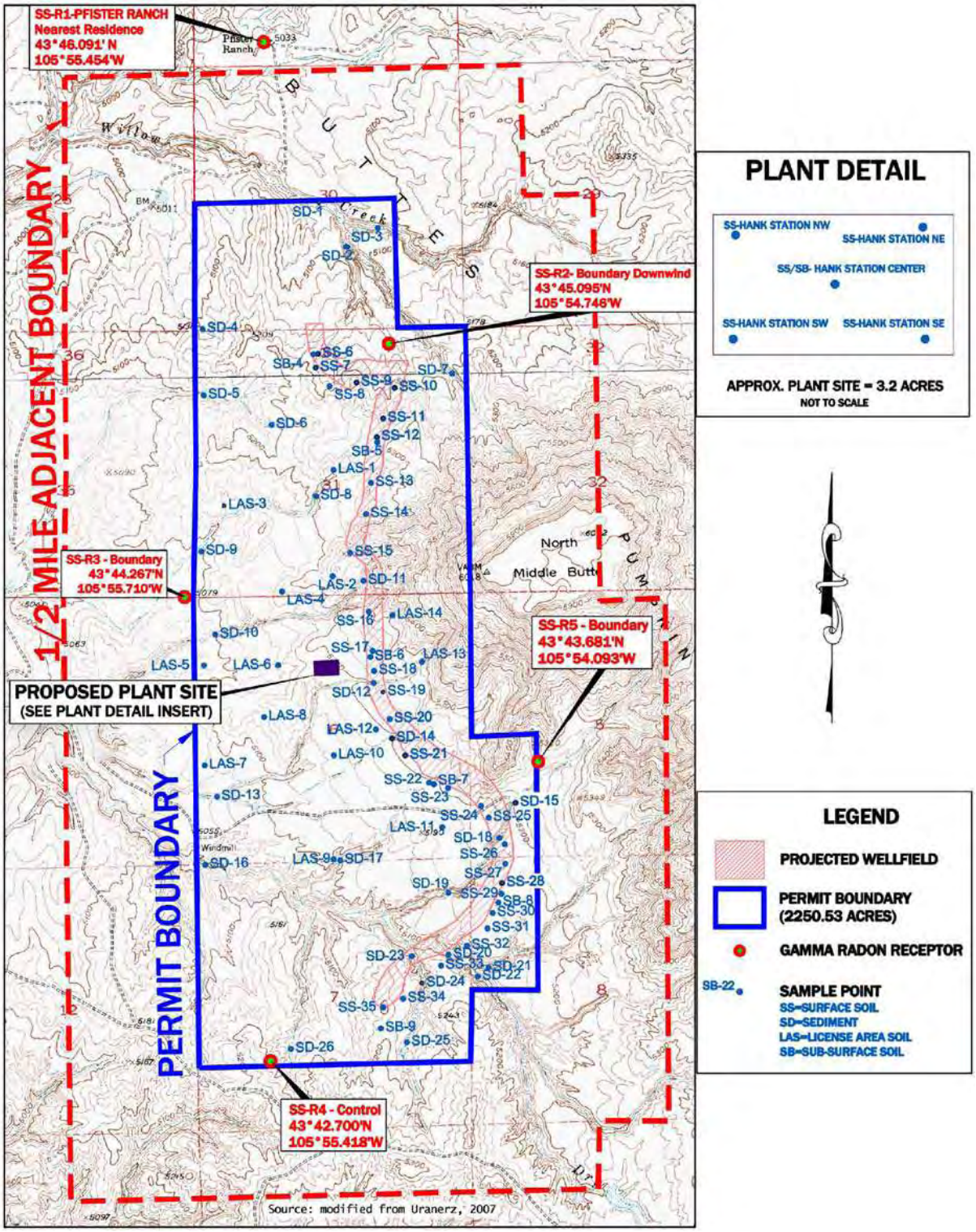
Soils and Sediment Monitoring

During the uranium recovery phase, Uranerz would annually collect surface soil samples at the same locations sampled for radon (see Figure 2.13). Surface soil samples would be collected as grab samples from the surface (0 to 6 inches in depth) and analyzed for total uranium, and isotopes Th-230, Ra-226, and Pb-210, in accordance with Regulatory Guide 4.14 (NRC 2008b). Uranerz would also annually collect grab sediment samples at the same locations in Figure 2.13. The sediment samples would be collected upstream at the Permit boundary, at various locations overlying the ore body, and at the downstream Permit boundary. They would be analyzed for total uranium, Ra-226, Pb-210, and Th-230. Before decommissioning, but after operations cease, subsurface soil samples would be collected to compare with subsurface soil samples collected during the pre-operational monitoring program.

Vegetation, Food, and Fish Monitoring

Uranerz conducted pre-operational vegetation sampling at various locations on and adjacent to the Hank Unit Project Area. In its' NRC SML application, Uranerz stated no liquid effluents would be dispersed via surface water, and the air pathway would be limited to the generation of radon emissions with no uranium particulate emissions. Uranerz would site process equipment at the SPF on curbed reinforced concrete pads to prevent liquids from entering the environment. Any spills or releases within the SPF would be pumped back into the process circuit or sent to a deep disposal well.

Uranerz also evaluated the predicted dose to an individual using the MILDOS-Area model, and the NRC confirmed the ingestion pathway to individuals from vegetation, food, and fish would be insignificant. Therefore, in accordance with NRC Regulatory Guide 4.14 (NRC 2008b), Uranerz is not required to conduct vegetation, food, or fish sampling as the predicted dose to an individual from these pathways would be less than 5% of the applicable radiation protection standard. However, if it is determined there are other significant potential sources of radioactive particulates that could be released from process facilities, then Uranerz may be required by NRC to conduct vegetation, food, and fish sampling in accordance with NRC Regulatory Guide 4.14.




Source: Uranerz 2012.

Figure 2.13 Hank Unit Project Area Sediment Sample Locations.

Surface Water Monitoring

The proposed Project Area contains only ephemeral channels that remain dry for most of the year, and only flow in response to heavy snowmelt and large rainfall events. Uranerz would collect surface water samples at the same location sampled for the pre-operational baseline when water is present and measured for the constituents listed in the POO (Uranerz 2012). This is in Dry Willow Creek in SESE of Section 1, Township 43 North, Range 76 West (see Figure 2.6).

Groundwater Monitoring of Private Wells

In accordance with Uranerz' approved NRC SML, Uranerz would conduct groundwater monitoring of three private water wells located within 0.6 mi of the boundary of the operating wellfield to detect potential radiological contamination. These wells are identified as BR-F, Dry Willow #1, and Means #1 (Figure 2.6). These wells would be sampled quarterly with the surface owner's consent, and analyzed for natural uranium and isotope Ra-226 to monitor for potential radiological impacts from the uranium ISR operation.

Physiochemical Monitoring

The uranium ISR process alters the water quality in the production zone aquifer(s). Therefore, before uranium extraction may occur in a given aquifer, EPA must exempt that aquifer as an underground source of drinking water in accordance with the *Safe Drinking Water Act* (SDWA) under 40 CFR Part 146. Appendix C of the NRC SEIS discusses the criteria EPA uses for an aquifer exemption, and will not be repeated here (NRC 2011). During uranium ISR operations, physiochemical groundwater monitoring is conducted by the NRC licensee to monitor potential impacts to groundwater quality in nonexempt aquifers surrounding the exempt zone aquifer. This monitoring provides data on operational and environmental conditions so prompt corrective actions can be taken if an adverse condition is detected (NRC 2009a). Uranerz would also conduct such monitoring in the Hank Unit Project Area, and include wellfield groundwater, and wellfield and pipeline flow and pressure. The relevant guidance is discussed below.

Wellfield Groundwater Monitoring

Prior to the initiation of uranium ISR operations, Uranerz would install monitoring wells in a ring around each wellfield to monitor for horizontal excursions away from the "ore" production zones (Figure 2.6), specifically the Hank Unit "F" Sand. The F Sand would be monitored because uranium recovery would be from this geological unit. Monitoring wells would be located approximately 500 ft from the production area boundary, and approximately 500 ft apart within each unit. NRC and WDEQ LQD have determined that this well spacing and distance were appropriate to detect potential horizontal excursions. Uranerz would sample these wells four times, at least 14 days apart, prior to wellfield operation on a twice per month basis to establish baseline water quality and upper control limits for operational excursion monitoring. The first and second samples would be analyzed for the full set of WDEQ-required constituents; however, the third and fourth samples could be analyzed for a reduced set of parameters depending on which parameters were not detected in the first and second samples. Uranerz has also proposed to measure groundwater levels in the monitoring wells; however, these data would not be used as excursion indicators.

Uranerz would also install monitor wells in the overlying and underlying aquifer in the wellfields to detect vertical excursions. The overlying and underlying aquifers at the Hank Unit are the "C" Sand and "B" Sand, respectively. Overlying and underlying monitoring wells would be spaced approximately one well to every 4 acres. In narrow areas of the wellfield, the overlying and underlying monitoring wells would be spaced no farther than 1,000 ft apart.

Uranerz would sample overlying and underlying aquifer wells four times prior to wellfield operation at least 14 days apart. The first and second samples would be analyzed for the full set of WDEQ-required constituents (Uranerz 2012, Table D6-6a). However, the third and fourth samples could be analyzed for a reduced set of parameters depending on which parameters were not detected in the first and second samples.

Uranerz installed three additional monitoring wells in the surficial aquifer in the Hank Unit Project Area to better characterize the background groundwater quality. It could be impacted by

(i) spills, or piping and casing leaks, which would provide an artificial connection (e.g., a conduit) between the surficial aquifer and deeper aquifers (NRC 2011), and (ii) discharges from current and future CBNG-produced water to surface impoundments. To comply with NRC and WDEQ LQD requirements, Uranerz would sample the surficial aquifer monitoring wells four times twice per month prior to wellfield operation to establish baseline water quality. The first and second samples would be analyzed for the full set of WDEQ-required constituents (Uranerz 2012), although the third and fourth sample events could be analyzed for a reduced set of parameters depending on which parameters were not detected in the first and second samples.

After completion of monitor well installation and all additional groundwater sampling and wellfield characterization at Hank Unit, Uranerz would conduct hydrogeological wellfield pump tests to verify communication between wellfield and monitoring well ring. This test would occur prior to lixiviant injection, and would be reported to NRC and WDEQ LQD for review and approval. The hydrogeological test would allow Uranerz to demonstrate a hydraulic gradient can be maintained to prevent excursions beyond the perimeter production zone monitoring well ring.

After hydrogeological testing is completed, Uranerz would prepare a recovery area pump test report for each production area describing the production area geology, hydrogeology, pumping test results, baseline groundwater quality for the overlying, underlying, and production zone aquifers within the wellfield. Uranerz' Safety and Environmental Review Panel (SERP), responsible for monitoring any proposed change in the facility or process, would review these reports to ensure the hydrogeological testing results and planned uranium ISR activities were consistent with technical requirements and did not conflict with NRC regulatory requirements. Only the first report would be submitted to NRC for review and approval before ISR operations commence; subsequent reports would be submitted to WDEQ.

The Uranerz POO provides detailed procedures for sampling and analysis, including methods for measuring water levels, well purging and sampling protocols, sample preservation and documentation, analytical methods, and quality assurance/quality control requirements. Uranerz would submit quarterly static water level measurements and water quality monitoring data to WDEQ and maintain copies on-site for NRC and BLM review.

After operations are complete, the wellfields would be restored (see Section 2.2.3.4). Uranerz would sample the same horizontal perimeter and overlying and underlying monitoring wells used during recovery for aquifer restoration. During restoration, lixiviant injection would cease, thereby reducing the potential for an excursion. During the aquifer restoration phase, wells located in the perimeter monitor ring and completed in the overlying and underlying aquifers would be sampled every 60 days for chloride, alkalinity, and conductivity excursion parameters. An excursion would be defined in the same manner as during operations, and subject to the same corrective action requirements.

Wellfield and Pipeline Flow and Pressure Monitoring

Uranerz would implement extensive programs of wellfield and pipeline flow and pressure monitoring in the Project Area. Injection and recovery well flow rates and pipeline pressures would be monitored at each header house to balance injection and recovery in each wellfield pattern and throughout the entire wellfield. Individual well flow readings would be recorded during each shift, and overall wellfield flow rates would be balanced daily. Flow data would also be checked at the Hank Unit SPF and the Nichols Ranch CPP. Recovery and injection trunk lines would be equipped with electronic pressure gauges, with these readings being monitored in the Hank Unit SPF control room. High and low pressure and flow alarms would alert wellfield and plant operators if specified ranges were exceeded. Automatic shutoff valves would stop the flow in the event of significant changes of volume or pressure. The wellfield and pipeline flow monitoring would alert personnel to detect malfunctions that could lead to either wellfield infrastructure or pipeline failures, thus minimizing potential impacts to groundwater.

Wildlife Monitoring

A GSG lek survey would be conducted annually for all known leks within 2 mi of the Hank Unit Permit boundary by a biologist following the most current Wyoming Game and Fish Department (WGFD) protocol. This would include three surveys of known leks in or within 2 mi of the Hank Unit Permit area. Aerial searches for new leks would also be conducted every third year. All annual survey results would be provided to a BLM BFO biologist.

In addition, surveys to document raptor nest occupancy would be conducted annually (between April 15 and June 30) by a qualified biologist following BLM BFO protocol. All survey results would be submitted in writing to a BLM BFO biologist, and approved prior to surface-disturbing activities. Surveys outside this window may not accurately depict nesting activity in the area.

## 2.3 ALTERNATIVE 2 - NO ACTION ALTERNATIVE

Regulations contained in 40 CFR 1502.14(d) and guidance contained in Section 6.6 of BLM's NEPA Handbook H-1790-1 (2008a) requires the analysis of a No Action Alternative to be included in an EA. Analysis of a No Action Alternative provides a benchmark, allowing decision-makers to compare the magnitude of likely environmental effects that would occur from implementation of each alternative. Under the No Action alternative (Alternative 2), there would not be any development or construction within the Hank Unit Project Area for the purpose of uranium ISR. Under this alternative, BLM would not approve or authorize the POO, and there would be no surface disturbance on BLM-administered surface lands within the Proposed Project Area. As discussed in Section 2.1, if the proposed uranium ISR mining of the Hank Unit were not approved to occur on BLM-administered lands in the Project Area, the privately-held lands would not be mined either. Not developing the BLM-administered lands would leave two relatively small, widely separated privately-held portions, which would not be cost-effective to mine. Therefore, if the Hank Unit POO were not approved by BLM, no mining of the uranium would occur in any of the Hank Unit Project Area, and no impacts to the existing physical or biological environment would take place beyond those that are already existing/occurring.

## 2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

### 2.4.1 Use of Conventional Mining and Milling Techniques

Uranium ore deposits may be accessed either by open-pit (surface) or underground mining techniques. Open-pit mining is typically used to recover shallow ore deposits, generally less than 550 ft below ground surface (bgs) (EPA 2008a). To gain access to the deposit, the topsoil is removed and stockpiled for later site reclamation, while the remainder of the material overlying the deposit (overburden) is removed via mechanical shovels, scrapers, or front-end loaders; either these same equipment and/or trucks then transport the overburden to the desired location

(EPA 1995, 2008a). The depth to which an ore body can be reached via surface mining depends on numerous geologic, technical, and economic factors (EPA 1995).

Underground mining techniques vary depending on size, depth, orientation, grade of the ore body, stability of subsurface strata, and economic factors (EPA 1995, 2008a). Typically, underground mining involves sinking a (usually vertical) shaft near the ore body, and extending horizontal levels from that main shaft at different depths to access the ore. Ore and waste rock would need to be removed through the main shaft by elevators, or by using trucks or conveyors to carry these materials up inclined shafts (inclines) to the surface (EPA 2008a).

Once the open-pit or underground workings are begun, the mine may need to be dewatered to allow extraction of the ore. Dewatering an open-pit mine can be accomplished by pumping water directly from the pit. For an underground mine, dewatering can be performed through pumping of interceptor wells, which will lower the water table. Open-pit and/or underground mines may need to be periodically dewatered throughout the mine's life, depending on precipitation levels and other factors. The mine water likely would require treatment prior to discharge, as it may contain radioactive constituents, metals, and/or suspended and dissolved solids. Disposal of these mine waters may have subsequent impacts to surface water drainages and sediments, and near-surface sources of groundwater (EPA 1995).

Following the completion of mining, either by open-pit or underground techniques, reclamation of the mine would need to be accomplished. Stockpiled overburden is often returned to the mine to fill in areas no longer being mined. This can be begun either during extraction operations or following the completion of all mining operations. Overburden and topsoil would be re-applied to reestablish topography consistent with the surroundings. After dewatering is no longer needed, the water table would likely rebound, filling portions of the open-pit or underground workings. Historically, many conventional open-pit and underground uranium mines have impacted local groundwater supplies, and the waste materials from the mines have contaminated lands surrounding the mines (EPA 2008b).

"Ore" extracted from an open-pit or underground mine would typically be processed in a conventional mill. As discussed in Appendix C of the NRC GEIS for ISR milling facilities (NRC 2009a), ore processing in a conventional mill involves a series of steps, such as handling and preparation, concentration, and product recovery. While conventional milling techniques recover approximately 90% of the uranium content of the feed ore (NRC 2009a), the process does generate substantial wastes (known as tailings) since roughly 90-95% of the ore rock is disposed of as waste (NRC 2011). This process also can consume large quantities of water.

Tailings are typically disposed of in large lined impoundments, the design and construction of which are reviewed by NRC to ensure safe containment (NRC 2009a). Reclamation of the tailings pile generally involves evaporation of liquids, settlement of the material over time, and covering the pile with a thick radon barrier and earthen material and/or rocks for erosion control. An area surrounding the reclaimed tailings piles would be fenced off in perpetuity, and the site transferred to either a state or federal agency for long-term care (Energy Information Administration (EIA) 1995). The costs associated with final mill decommissioning and tailings reclamation can run into the tens of millions of dollars (EIA 1995).

As discussed in the NRC GEIS (2009a), the average ore grade of the uranium deposit at the Nichols Ranch/Hank Project is above 0.1%, while the depth to the deposit is approximately 300 to 700 ft bgs in the Nichols Ranch Unit and approximately 200 to 600 ft bgs in the Hank Unit. While the ore grade and depth to ore may be more consistent in deposits likely to be mined by conventional methods, the environmental impacts from conventional mining and milling would likely be much more substantial than from the ISR process at this site (NRC 2009a). In addition, because of the low-grade ore, an underground or surface mine in the Hank Unit Project Area would very likely be uneconomical. Therefore, for these considerations, this alternative is not carried forward for detailed analysis in this EA.

### 2.4.2 Use of Alternate Lixiviants

Alternate lixiviants (such as acid or ammonium carbonate solutions) have been used in the past in uranium ISR operations in the U.S., and are still being used in such operations in countries not

as concerned with environmental impacts. They are not currently used by NRC-licensed facilities due to the difficulties in restoring and stabilizing the affected aquifers. Many metals, including heavy metals, are released from the subsurface formations in much greater numbers and quantities when acid or ammonium carbonate solutions are used than when using sodium carbonate/bicarbonate solutions. In addition, the WDEQ LQD has indicated that typical Powder River Basin (PRB) soil compositions in contact with an acid lixiviant would result in the formation of gypsum, which would eventually plug the wells and reduce efficiency of wellfield circulation. Therefore, this alternative would have technological limitations compared to the Proposed Action, thus making this alternative technically not viable. For these reasons, this alternative was not carried forward for detailed analysis in this EA.

### 2.4.3 Use of Alternative Waste Disposal Methods

Alternate waste disposal methods, such as evaporation ponds or land application (typically spray irrigation) as opposed to deep well injection, have been used in the past and are used at some currently-licensed ISR operations. Both evaporation ponds and land application pose additional environmental impacts compared to the Proposed Action (NRC 2009a). Construction and operation of evaporation ponds involves additional land disturbance with potential for additional impacts to soils and shallow aquifers from leaks. Impacts could be minimized through pond design features (e.g., double synthetic liners with leak detection system) and BMPs (e.g., topsoil and erosion management controls), but likely not eliminated.

The land application of treated wastewater could potentially impact soils, vegetation, and wildlife by allowing accumulation and bioaccumulation of residual radionuclide and/or chemical constituents in the irrigated soils and biotic systems over time. Additionally, the USFWS did not recommend land application of treated waste water (pers. comm. September 28, 2012, with R. Mark Sattelberg, USFWS Field Supervisor, Wyoming Field Office). At existing NRC-licensed facilities, irrigation areas used for disposal are monitored to maintain radionuclide and other constituents within allowable release standards. Additionally, licensees monitor wastewater prior to application to ensure release limits would not be exceeded. The deep well injection disposal method in the Proposed Action would be expected to have fewer potential impacts to

soils, vegetation, and wildlife when compared to evaporation ponds or land application. In addition, these alternative disposal methods have higher LOP costs compared to deep well injection. For these reasons, alternate waste disposal methods were not carried forward for detailed analysis in this EA.

# 3.0 AFFECTED ENVIRONMENT

## 3.1 INTRODUCTION

The proposed Nichols Ranch Project Area is composed of two separate and noncontiguous areas (referred to as units)--the Hank Unit and the Nichols Ranch Unit--that are located in southwest Campbell County and southeast Johnson County in northeastern Wyoming. The Hank Unit comprises the Proposed Action, is the eastern of the two (see Figure 1.2), and is in Campbell County. The Nichols Ranch Unit is not part of the Proposed Action, is situated approximately 4.5 mi west of the Hank Unit, and is in both Johnson and Campbell counties. The Project Area is approximately 46 mi southwest of the city of Gillette and approximately 61 mi northeast of the city of Casper (see Figures 1.1 and 1.2). The project area is located in the Powder River Basin (PRB), a rural and sparsely populated area where the primary land uses are livestock grazing, coal, and oil and natural gas and CBNG development. The PRB is an energy-rich area that possesses some of the largest coal, CBNG, and natural gas deposits in the U.S. (Knight 1994).

The Hank Unit Project Area is located immediately west of the Pumpkin Buttes, which are flat-topped erosional remnants capped by the Oligocene-age White River Formation that once blanketed the area. The Pumpkin Buttes include (north to south) North Butte, North Middle Butte, Indian Butte, South Middle Butte, and South Butte. These features rise up to approximately 1,000 ft above the surrounding area to a maximum elevation of approximately 6,000 ft above mean sea level (AMSL). The Hank Unit Project Area is located on the western slopes of North Middle Butte, and elevations range from 5,055 to 5,209 ft AMSL. Topography includes gently rolling hills and low ridges, as well as steep terrain near North Middle Butte, and some steeply eroded areas in and near Dry Willow Creek, an ephemeral stream in the southern portion of the Hank Unit. Vegetation in the Hank Unit consists primarily of sagebrush shrub land (Uranerz 2012).

This section describes the affected resources within and near the proposed Hank Unit Project Area. The information presented is based on BLM-identified management issues, and comments received during public scoping. BLM's responsibility for resource issues differs from that of the

NRC, and the issues for which BLM has responsibility are analyzed in detail in this EA. This section also provides a summary of information presented in the NRC SEIS (2011) and adds information not included in that document. Additional other detailed descriptive information can be found in the NRC SEIS (2011) and Uranerz' POO (2012). Discussed are the following: air quality, cultural resources (including Native American consultation), geology, mineral resources, geological hazards, land use, vegetation (including special status species), visual resources, surface water and groundwater resources, and wildlife (including special status species).

The following resources are not formally designated, nor are they present in the Project Area and will not be further analyzed: areas of critical environmental concern, prime or unique farmlands, floodplains, wild and scenic rivers, and wilderness values. The Project Area is located outside areas known to contain special status plant species, and identified big game crucial winter range and parturition areas. No perennial streams or wetland areas exist in the Project Area.

## 3.2 AIR QUALITY

The proposed Hank Unit Project Area is located approximately 56 mi east of the Big Horn Mountains within the PRB. The PRB is characterized by semi-arid plains with low hills and buttes, sparse vegetation, and few substantial topographical features. The PRB experiences diverse weather patterns that fluctuate throughout the year, due in large part to its location in the Rocky Mountain system and relatively high elevation. There are no meteorological stations in the immediate Project Area. However, meteorological data were obtained from the closest National Weather Service stations in Glenrock and Midwest, Wyoming, about 75 mi south and 25 mi southwest (respectively) of the proposed Hank Unit Project Area.

The area receives an average of approximately 14 inches of precipitation per year, and the majority of this occurs in the spring and summer months with occasional heavy rains or thunderstorms. The mean temperature in the Project Area ranges from 21.7°F in January to 70.7°F in July, based on data collected from 1971 to 2000 in Midwest, Wyoming (National Oceanographic and Atmospheric Administration (NOAA) 2004). The average annual maximum temperature is 60.1°F, and the average minimum temperature is 31.2°F (NOAA 2004). Refer to

Uranerz' POO (2012) and NRC's SEIS (2011) for a more detailed discussion of the climate in/near the Hank Unit Project Area.

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) set upper limits for concentrations of specific air pollutants at all locations with public access. WDEQ's Air Quality Division (AQD) limits incremental emissions increases to specific levels defined by the classification of air quality in an area. The prevention of significant deterioration (PSD) rules are designed to prevent deterioration of air quality, and to limit incremental increases of nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and particulate matter less than 10 microns in diameter ($PM_{10}$) concentrations to a legally defined baseline level based on the area's classification. PSD Class I areas include areas with special natural, recreational, scenic, or historic value (national parks or wilderness areas) and have the most stringent set of allowable increments. No PSD Class I areas are identified within the Hank Unit. The Hank Unit project area is located in a PSD Class II area and is designated as attainment for all NAAQS and WAAQS. Areas are designated as attainment if atmospheric concentrations for a particular pollutant meet NAAQS and WAAQS.

No site-specific ambient air quality data for the project area are available, but the regional air quality complies with applicable local, state, and national air quality rules and regulations. Regional ambient air quality standards were provided by WDEQ AQD (Table 3.1) and air quality monitoring results from sites closest to the Hank Unit are presented in Table 3.2. The primary airborne pollutant within the project area is particulate matter in the form of fugitive dust generated from natural and human sources. The WAAQS and NAAQS limits, ambient air quality data for the region, and PSD I and II increments are presented in Table 3.1.

## 3.3 CULTURAL RESOURCES AND NATIVE AMERICAN CONSULTATION

This section describes the site-specific cultural resources and the various government and tribal consultations conducted for the proposed Hank Unit Project.

Table 3.1 Selected National and Wyoming Air Quality Standards (in $\mu g/m^3$).

| Pollutant/Averaging Time | NAAQS[1] | WAAQS[2] | PSD Class I Increment[3] | PSD Class II Increment[3] |
|---|---|---|---|---|
| **Carbon Monoxide (CO)** | | | | |
| 1-hour[4] | 40,000 | 40,000 | --[5] | --[5] |
| 8-hour[4] | 10,000 | 10,000 | -- | -- |
| **Nitrogen Dioxide ($NO_2$)** | | | | |
| Annual[6] | 100 | 100 | 2.5 | 25 |
| Ozone | | | | |
| 1-hour[4] | --[7] | --[8] | --[5] | --[5] |
| 8-hour[9] | 157 | 157 | -- | -- |
| **Particulate Matter at Less than 10 Microns ($PM_{10}$)** | | | | |
| 24-hour[4] | 150 | 150 | 8 | 30 |
| Annual[6] | --[8] | 50 | 4 | 17 |
| **Particulate Matter at Less than 2.5 Microns ($PM_{2.5}$)** | | | | |
| 24-hour[10] | 35 | 35 | --[5] | --[5] |
| Annual[7] | 15 | 15 | -- | -- |
| **Sulfur Dioxide ($SO_2$)** | | | | |
| 3-hour[4] | 1,300[11] | 1,300 | 25 | 512 |
| 24-hour[4] | 365 | 260 | 5 | 91 |
| Annual[3] | 80 | 60 | 2 | 20 |

Source: WDEQ AQD.

1 NAAQS = National Ambient Air Quality Standards (adapted from 40 CFR 50.5-50.12). Primary standard unless otherwise noted. National Primary Standards establish the level of air quality necessary to protect public health from any known or anticipated effects of a pollutant, allowing a margin of safety to protect sensitive members of the population.

2 WAAQS = Wyoming Ambient Air Quality Standard.

3 The prevention of significant deterioration (PSD) demonstrations serve informational purposes only and do not constitute a regulatory PSD increment consumption analysis.

4 No more than one exceedance per year.

5 No PSD increments have been established for this pollutant.

6 Annual arithmetic mean.

7 The NAAQS for this averaging time for this pollutant has been revoked by EPA.

8 There is no 1-hour WAAQS established for ozone.

9 Average of annual fourth-highest daily maximum 8-hour average.

10 An area is in compliance with the standard if the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.

11 Secondary standard. National Secondary Standards establish the level of air quality to protect the public welfare by preventing injury to agricultural crops and livestock deterioration of materials and property and adverse impacts to the environment.

Table 3.2 Ambient Air Quality Monitoring Data.

| | Monitoring Station (Distance to Site) | | | | |
|---|---|---|---|---|---|
| | **Gillette** | **Campbell** | **Wright** | **Antelope** | |
| **Pollutant†** | (46 mi) | (34 mi) | (20 mi) | (36 mi) | **Averaging Time (Standard)‡** |
| $NO_2$ | N/A | 0.004 ppm[1] | N/A | N/A | Annual (0.053 ppm[1]) |
| $PM_{10}$ | 20 | 17 | 17 | N/A | 3 year annual (50 μg/m$^3$) State Limit |
| | 0 | 0 | 0 | N/A | Exceedances in 3 year period (any 24-hour average, less than 150 μg/m$^3$) |
| $PM_{2.5}$ | N/A | N/A | N/A | 4.1 | 3 year annual (15 μg/m$^3$) |
| | N/A | N/A | N/A | 10 | 3 year average of the 98th percentile of 24 hr averages (35 μg/m$^3$) |
| Ozone | N/A | 0.067 ppm | N/A | N/A | 4th highest 8-hour average for each year (0.075 ppm) |

Source: NRC 2011.

[1] ppm (parts per million), μg/m$^3$ – (micrograms per cubic meter)

† Only those pollutants that were measured by WDEQ AQD at the monitoring stations are listed. No measurements were taken for sulfur dioxide and carbon monoxide at these monitoring stations. Values are in units of micrograms per cubic meter (μg/m$^3$) unless other units are specified.

‡ Values reported are the 3 year average of annual averages unless otherwise specified. Standards are federal NAAQS unless reported as state limit.

### 3.3.1 Introduction

Cultural resources are the nonrenewable physical remains of past human activity and are protected under the *Antiquities Act* (1906), Section 106 of the *National Historic Preservation Act* (1966, as amended) (NHPA), the *Archaeological Resources Protection Act* (1979, as amended), the *Native American Graves Protection and Repatriation Act* (1990) (NAGPRA), and other federal statutes. The NHPA requires federal agencies to consider the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR Part 60.4 and include (A) association with significant events in history; (B) association with the lives of persons significant in the past; (C) embodiment of distinctive

characteristics of type, period, or construction; and, (D) sites or places that have yielded or are likely to yield important information.

To be listed in the NRHP, a property must not only be shown to be significant under the National Register criteria but also must have integrity. Integrity is defined as the ability of a property to convey its significance. The evaluation of integrity is sometimes a subjective judgment, but it must always be grounded in an understanding of a property's physical features and how they relate to its significance.

Historic properties either retain integrity (that is, convey their significance) or they do not. Within the concept of integrity, the National Register criteria recognize seven aspects or qualities that in various combinations define integrity.

To retain historic integrity, a property will always possess several, and usually most, of the aspects. The retention of specific aspects of integrity is paramount for a property to convey its significance. Determining which of these aspects are most important to a particular property requires knowing why, where, and when the property is significant.

- Location. The place where the historic property was constructed or the place where the historic event occurred.
- Design. The combination of elements that create the form, plan, space, structure, and style of a property.
- Setting. The physical environment of a historic property.
- Materials. The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- Workmanship. The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- Feeling. The property's expression of the aesthetic or historic sense of a particular period of time.
- Association. The direct link between an important historic event or person and a historic property.

The historic preservation review process (NHPA Section 106) is outlined in regulations the Advisory Council on Historic Preservation (ACHP) issued in 36 CFR Part 800.

In accordance with the provisions of the NHPA and 36 CFR Part 800, the BLM is required to make a reasonable effort to identify historic properties in the area of potential effect (APE). The APE for this review is the area that may be physically impacted by construction, operation, aquifer restoration, and decommissioning activities associated with the Proposed Action, as well impacts from the proposed built environment that may affect the overall integrity of the setting surrounding known historic properties.

### 3.3.2 Cultural History

The archaeological cultural sequence for the proposed project is unevenly divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The prehistoric periods encompass about 11,000 years between 12000 before present (B.P.) and 250 B.P. (approximately Anno Domini (A.D.) 1700). The protohistoric/historic era extends from approximately A.D. 1700 to A.D. 1959.

#### 3.3.2.1 Prehistoric Era

As mentioned previously, the prehistoric periods are divided into Paleoindian, Archaic, and Late Prehistoric. These chronologies are all generally based on projectile point typology and other stone tools as culturally diagnostic markers (Kornfeld et al. 2009). The hallmark artifact type for the Paleoindian period (12000 to 8500 B.P.) in the region includes diagnostic projectile points hafted to spear shafts from oldest to youngest, Clovis, Goshen, Folsom, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. These cultures are believed to have been opportunistic hunter and gatherers focused on big game procurement supplemented by plant resources (BLM 2010a). Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts, include the Carter-Kerr-McGee site in the PRB; James Allen site in southwestern Wyoming; Hell Gap and Agate Basin sites in eastern Wyoming, located east and southeast of the proposed project area; and, the Medicine Lodge Creek site in central Wyoming. The Paleoindian period

comes to a close in the terminal Pleistocene/early Holocene era. The Pleistocene megafauna (e.g., mammoth, ancestral bison species, camel, sloth, and muskox) are replaced by modern antelope, bison, deer, and elk. These smaller grazers were better adapted to the change from savannah to grassland communities that resulted from the onset of warmer and drier conditions in the Holocene era. The Archaic period (8500 to 1800 B.P.) in eastern and northeastern Wyoming is broken into three subperiods: Early Archaic (8500 to 5000 B.P.), Middle Archaic (5000 to 3000 B.P.), and Late Archaic (3000 to 1500 B.P).

In general, the regional Early Archaic sites are marked by the presence of various side- and corner-notched projectile points and side-notched knives and the introduction of the atlatl and dart point. The subperiod is known for semi-subterranean houses that are usually marked by the presence of one or more hearths, stone-lined fire pits, storage pits, grinding-stone artifacts, and milling basins. The latter are of particular interest because such features clearly indicate a more intensive use of plant products in subsistence strategies. Middle Archaic site assemblages reflect a relatively broad spectrum of gathering and hunting responses such as a proliferation in grinding stones and stylized food preparation pits and, an emphasis on bison procurement. The earliest stone circle sites appear during this period as well. By Late Archaic times, communal bison kills are common. Recorded examples such as the Powder River site, an arroyo kill site, contained diagnostic Yonkee points (large corner-notched projectile points), which were the preferred method of felling the bison through the subperiod. Late Archaic faunal assemblages demonstrate the presence of smaller game animals and midsize ungulates (deer and antelope).

The Late Prehistoric period (1500 to 300 B.P.) heralds the acceptance of new technologies such as smaller projectile points adapted to use with arrows. Prior to the Late Prehistoric period, the points were hafted on spears and/or darts. Large communal bison hunts increase during this period, as evidenced by the Big Goose Creek and Piney Creek bison kill/jump sites. Earthenware technology is also introduced at this time, which improves food preparation techniques. Stewing, braising, and boiling were now possible, which significantly broadened the number of floral and faunal species that could be used. Sometime between 1000 and 600 B.P. (A.D. 1000 and A.D. 1400), there is considerable movement of people into Wyoming from several directions. The Athapaskan speaking Kiowa-Apache from the Northern Plains and

Black Hills and numerous Uto-Aztecan speaking Shoshone-Comanche groups (originally from the Great Basin to the west) move into the region first, probably in response to several factors, including adopting a bison hunting economy and population pressures from eastern groups migrating west who, have adapted seasonal bison procurement into their established horticultural regimes. Between about A.D. 1300 and A.D. 1700, the Crow, Cheyenne, and Arapaho all move into Wyoming to pursue their bison-oriented lifestyles.

3.3.2.2 Protohistoric/Historic Era

The Protohistoric period dates between approximately A.D. 1700 and A.D. 1840. This period includes the time when European goods and the domesticated horse are introduced into the region: the horse from the south, and the majority of trade goods from the north. There is no appreciable European presence in the region during the early 1700s, with the exception of French fur traders moving up and down the Missouri River. However, across the northern High Plains and Rocky Mountains, there was active trading in European material goods, including guns, powder and ammunition, metal knives, kettles, awls, hatchets, scissors, glass beads, wool blankets, and tobacco. The British Hudson Bay and North West companies in Canada traded a vast amount of merchandise from numerous posts scattered westward across southern Canada throughout the 1700s until the early 1840s. Much of the trade passed through the semi-sedentary Mandan and Hidatsa villages on the upper Missouri River, which was one of the principal Native American trade centers prior to Eurocanadian and American arrival in the region in the early 1800s following the Louisiana Purchase in 1803.

From British ships to the early Hudson Bay trading posts, merchandise passed south from tribes who had direct contact and access to trade such as the Plains Cree, to the Assiniboine, to the Mandan/Hidatsa villages. By the late 1700s, the Crow, Shoshone, and Sioux tribes, among others under truce for trade, brought furs, horses, and leather goods to trade for agricultural products and the stores of European trade goods and guns that accumulated at the Missouri River villages from direct trade with the British fur company representatives who travelled to the villages by the 1790s (Lowe 1992; BLM 2010a). Military dominance among the tribes fluctuated accordingly; by the 1770s, the Blackfeet had horses and guns, as did the Crow by the

early 1800s. Native American material culture clothing, tools, and utilitarian items also continued to be produced. Although Native Americans recognized the superior quality of European trade goods, they only adopted what was necessary without changing their overall traditional cultural lifestyles, including maintaining a vibrant lithic tool technology (Lowe 1992).

The Historic era is subdivided into seven periods: Early Historic (A.D. 1801 to 1842), Preterritorial (A.D. 1843 to 1867), Territorial (A.D. 1868 to 1889), Expansion (A.D. 1890 to 1919), Depression (A.D. 1920 to 1939), World War II (A.D. 1940 to 1946), and Post-World War II (A.D. 1947 to 1959). The Early Historic period witnessed the first fur trade expedition across the PRB and over the Big Horn Mountains in 1811 by the American Fur Company on their way to the Pacific Northwest. From 1820 to the early 1840s, traders and trappers from several American fur companies and the Hudson Bay Company criss-crossed the mountains and valleys of the northern Rockies (including the PRB) in search of fur-bearing mammals and trade with Native American tribes until the fur resources were depleted to near extinction by approximately 1840. Trade in buffalo robes continued through the 1840s into the 1860s (Ray 1974).

The Pre-territorial period witnessed a private hunting expedition throughout the PRB by Sir George Gore and guided by Jim Bridger in 1855-1856. U.S. Army topographic expeditions also traversed portions of the PRB in the late 1850s and early 1860s: Lieutenant Warren in 1855-1857, and Captain Raynolds in 1860-1861. Raynolds traveled south along the eastern flank of the Big Horn Mountains crossing the principal rivers along the way to the Oregon Trail. Emigrants on the Bozeman Trail followed the same route north in 1863, only to be turned back by the Northern Cheyenne and Sioux. Between 1864 and 1866, several emigrant trains followed the Bozeman Trail route to the new gold mines in Montana. Forts were built along the route for protection, and Colonel Sawyers' road building expeditions passed east/west through the PRB in 1865 and 1866 close to Pumpkin Buttes and the current study area. Red Cloud's War was a direct result of the Euroamerican incursions and U.S. Army presence in the PRB during the mid-1860s (Lowe 1992).

The Territorial period began with closing the Bozeman Trail forts as part of the Fort Laramie Treaty in 1868, and the PRB east of the Big Horn Mountains was designated as unceded Indian

Territory as hunting grounds for Lakota Sioux (Larsen 1990). After the close of the Sioux wars in the mid-1870s, the Northern Plains tribes were relocated permanently on their respective reservations: the Lakota Sioux at several locations in South Dakota, the Crow and Northern Cheyenne in southern Montana north of present-day Sheridan, Wyoming, and the Eastern Shoshone and Northern Arapaho in west-central Wyoming. Native American tribes continued to pursue their cultural traditions on the reservations in spite of federal Indian policy that promoted assimilation and acculturation into American society, including boarding schools for Indian children, during the late 1800s and early 1900s. The Tribes witnessed a change in federal policy as a result of the New Deal in the 1930s, one that fostered acceptance of traditional tribal culture, language, and the arts (Prucha 1984).

Euroamerican settlement in the PRB began in the late 1870s after the tribes were relocated on their respective reservations. Thousands of head of cattle were trailed to northern Wyoming creating large ranches, often under absentee ownership. Cattle grazed across the open range and the practiced flourished until the mid-1880s, especially 1886, when severe winters killed approximately half of the herds in the PRB. Small ranchers raised cattle too, but they were discouraged by the larger operators who intimidated them, culminating in the Johnson County War in 1892 between the large operators and those considered to be rustlers living on small ranches and homesteads. Homesteading steadily increased throughout the 1880s and 1890s as land was taken up under the *1862 Homestead Act*, followed by the *Timber Culture Act* and *Desert Land Act* of 1873 and 1877, respectively. Following Statehood in 1890, homesteading and settlement continued in Wyoming during the Expansion period and was further bolstered by the 1909 *Enlarged Homestead Act* and the *Stock Raising Homestead Act of 1916*. The completion of the Burlington Railroad across the northern PRB and into Montana in 1894 further promoted settlement and significant transportation of merchandise and commodities. Sheep followed cattle into the state during the 1880s and 1890s, and after the turn of the century, sheep and wool production rivaled that of the cattle industry. Wool and beef prices fluctuated and often one would increase while the other declined (Larsen 1990).

Discoveries of oil and gas in southern and southeastern PRB fostered the nascent petroleum industry in Wyoming during the early twentieth century; however, the Depression period saw the

passage of the *Taylor Grazing Act* in 1934, which effectively ended homesteading except within federal reclamation projects. Farms and ranches were consolidated during the Depression as farmers and ranchers failed to pay mortgages and lost their properties. Horse-drawn equipment was replaced with farm machinery, and the rural economy improved and prospered during World War II, although sheep prices dropped during the war. Prosperity continued during the post-war era through the 1950s. The oil industry continued to expand, coal production began resurgence in the early 1960s, and dry land farming and ranching continued to dominate the rural economy (BLM 2010a).

The Bozeman Trail is located approximately 3.2 kilometers (km), or 2 mi, west of the proposed Nichols Ranch ISR Project Area. The general route along the eastern flanks of the Big Horn Mountains was first used by Native Americans. The wagon road was blazed in 1863 and 1864 and used until 1866 by prospectors, emigrants, and homesteaders heading northwest to the newly discovered Montana gold fields (Lowe 1992). The Sioux Wars of the 1870s postponed homesteading in the PRB. However, since the 1880s, the proposed project area was used primarily for livestock ranching with limited oil and gas exploration in the nearby vicinity. There is no indication from the sites identified in the WYCRO database for the project area that there were earlier permanent historic occupations of the area, aside from the historic trails/roads, and the abandoned U.S. Army posts along the Bozeman Trail. Therefore, permanent historic occupations are, at best, limited to the historic Expansion and post-Expansion periods.

#### 3.3.2.3 Places of Cultural Significance

Within the Hank Unit, five previous Class III cultural resource inventories identified 25 archaeological sites. Of the 25 sites, seven are eligible for listing on the NRHP, 16 are not eligible for listing, and two remain unevaluated for NRHP eligibility. The sites are summarized in Table 3.3. Except for Sites 48CA268 and 48CA6147, all of the cultural resources identified in the Hank Unit are prehistoric The historic component at Site 48CA6147 is a very small debris scatter consisting of a fragmented clear glass bottle, two cans, and a handful of nails.

Table 3.3 Recorded Sites Within the Hank Unit Project Area.

| Site No. | Time Period | Site Type | NRHP Eligibility Status |
|---|---|---|---|
| 48CA268 | Prehistoric/Historic | Pumpkin Buttes TCP | Eligible |
| 48CA379 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6146 | Prehistoric | Stone circles | Not eligible |
| 48CA6147 | Prehistoric/Historic | Open camp/trash scatter | Not eligible |
| 48CA6148 | Prehistoric | Stone circles/TCP | Eligible |
| 48CA6149 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6151 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6342 | Prehistoric | Open camp | Not eligible |
| 48CA6343 | Prehistoric | Open camp | Not eligible |
| 48CA6344 | Prehistoric | Open camp | Not eligible |
| 48CA6345 | Prehistoric | Open camp | Not eligible |
| 48CA6475 | Prehistoric | Open camp | Unevaluated |
| 48CA6490 | Prehistoric | Open camp | Eligible |
| 48CA6491 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6498 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6499 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6748 | Prehistoric | Open camp/TCP | Eligible |
| 48CA6749 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6750 | Prehistoric | Open camp | Not eligible |
| 48CA6751 | Prehistoric | Open camp/TCP | Eligible |
| 48CA6752 | Prehistoric | Open camp | Not eligible |
| 48CA6753 | Prehistoric | Open camp/TCP | Eligible |
| 48CA6754 | Prehistoric | Open camp | Unevaluated |
| 48CA6926 | Prehistoric | Lithic scatter | Not eligible |
| 48CA6927 | Prehistoric | Open camp | Eligible |

Source: NRC (2011).

The prehistoric sites are marked by the presence of flaked stone artifacts (tools and debris), heat-altered rock, groundstone, stone circles and, at one site, minor amounts of bone. None of the prehistoric sites indicated the presence of temporally diagnostic items such as ceramics or projectile points. The reason for this absence of such sites is unclear, but the artifact assemblages from the sites are suggestive of seasonal processing locations. The absence of Euro-American goods at any of the sites argues against early Historic occupations by Native

American peoples, although it is documented that Pumpkin Buttes have been utilized by Native Americans into the Pre-territorial and Territorial periods (SWCA Environmental Consultants (SWCA) 2006).

3.3.2.4 Traditional Cultural Properties

The Pumpkin Buttes Site (48CA268) are a series of four prominent buttes which are eligible for the NRHP, and was determined by the BLM (in consultation with 15 tribes and WYSHPO) to be a Traditional Cultural Property (TCP) in 2006. A TCP is a historic property that is directly associated with cultural practices or beliefs of a community that are rooted in that community's history and are important in maintaining their continuing cultural identity. The BLM determined that the Buttes are a TCP and established a boundary for the site in consultation with the tribes and WYSHPO. In addition, NRHP-eligible Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 were determined through tribal consultation by the NRC to be TCP's in 2011. Subsequent to the NRC determination and in consultation with several tribal representatives and WYSHPO, BLM extended the boundary of the Pumpkin Buttes TCP to incorporate each individual TCP. Therefore, TCP Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 are physically located within the boundary of the Pumpkin Buttes Site 48CA268.

For the NRC Hank Unit SML (SUA-1597), the NRC conducted Native American consultation with the Cheyenne River Sioux Tribes, the Crow Tribe, the Eastern Shoshone Tribe, Fort Peck Assiniboine/Sioux Tribe, Northern Arapaho Tribe, Northern Cheyenne Tribe, and Oglala Sioux Tribe. Based on this consultation, the NRC determined the project would result in an adverse effect to the Pumpkin Buttes (Site 48CA268) and Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753 (NRC 2011). The NRC determined that the project would have moderate impact to the visual setting of the five TCPs. As a result, the NRC developed a MOA to address and mitigate the adverse effects to the setting of the five TCPs, the "NRC MOA" (NRC et al. 2011). The MOA incorporated many mitigation measures that were described in the earlier Pumpkin Buttes PA (BLM and WYSHPO 2009) and incorporated other mitigation measure at the specific request of the tribes. The NRC MOA was signed by the NRC, WYSHPO, ACHP, the Eastern Shoshone Tribe, the Northern Arapaho, and Uranerz in September 2011. The BLM, the

Cheyenne River Sioux Tribes, the Crow Tribe, the Fort Peck Assiniboine/Sioux Tribe, Northern Cheyenne Tribe, and Oglala Sioux Tribe were invited signatories to the MOA, but these parties declined to sign the NRC MOA. The mitigation measures that were agreed upon in the NRC MOA are operator committed measures in the current Proposed Action.

3.3.2.5 Native American Consultation

As part of the Section 106 process for the review of the Proposed Action, BLM requested assistance from the Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck, Northern Arapaho, Northern Cheyenne, Yankton, Crow Creek Tribe, Lower Brule Tribe, Standing Rock, Rosebud, Sisseton Wahpeton Oyate, and Oglala Tribes in identifying sites that have religious and traditional cultural importance. BLM discussed the Proposed Action with various tribal representatives in face-to-face meetings on November 9, 2010, May 19, 2011, January 12, 2012, January 26, 2012, May 22, 2012, June 12, 2012, and October 17, 2012, and by conference call on November 6, 2012, July 19, 2013.

The tribes had many observations and concerns about the impacts to the TCPs and the proposed project in general. They stated that Pumpkin Buttes are part of the greater landscape and have connections with nearby archeological sites and geographic features such as the Big Horn Mountains, Devils Tower, and Missouri Buttes. They indicated that TCPs cannot be considered individually and that they are all integrally connected. They also indicated that impacts to the setting of Pumpkin Buttes should be considered. They stated that it is difficult to draw boundaries around TCPs that are geographic features, such as Pumpkin Buttes, since there may be significant associated sites or stone features (cairns or stone circles) around their periphery. They expressed that sites and areas such as the Pumpkin Buttes TCP are living things that still have attachments to people living today and that federal agencies need to analyze them as such.

The tribes expressed that it is very difficult for them to take part in consultations because of a lack of funding, they cannot attend meetings or field visits without financial assistance from proponents or federal agencies. They also expressed the necessity for tribal inventories prior to approval of any project since archeologists routinely miss sites that may have religious and

cultural significance to the tribes. Some tribal representatives stated that during the NRC consultation field trips they noted significant geographic features on Pumpkin Buttes near the Project Area that were not noted by the archeologists and that were not addressed in the NRC document. Other tribal representatives indicated that there could be significant unidentified sites, such as burials, on the periphery of the buttes. There are tribal concerns that NRC did not have a specific group tribal consultation and field trip, and that BLM must do so. Aside from the specific impacts to cultural resources, there was a concern that groundwater would be contaminated and concerns with the use of small amount of hydrochloric acid in the lixiviant. Although acid-based lixiviants have been used in past uranium ISR operations, this particular practice would not be part of the Proposed Action (see Section 2.2.2). Under the Proposed Action, small amounts of liquid chlorine (in the form of hydrochloric acid) may be used to adjust the pH level of the lixiviant. As stated in the NRC Source Material License (SML) for the Nichols Ranch and Hank Units, use of any acid in the lixiviant is prohibited.

The tribes routinely expressed the desire for tribal inventories in order to identify cultural sites of religious and traditional importance, but BLM could not facilitate their requests. BLM used available field documentation (primarily from the NRC tribal consultations with the Fort Peck, Northern Cheyenne, Eastern Shoshone, and Northern Arapaho) to re-define and extend the boundary of the Pumpkin Buttes TCP (site 48CA268) to include TCP sites 48CA6148, 48CA6748, 48CA6751, and site 48CA6753 in order to address some tribal concerns.

## 3.4 GEOLOGY, ENERGY, MINERALS, AND GEOLOGIC HAZARDS

### 3.4.1 Geology

#### 3.4.1.1 Geology of the Powder River Basin (PRB)

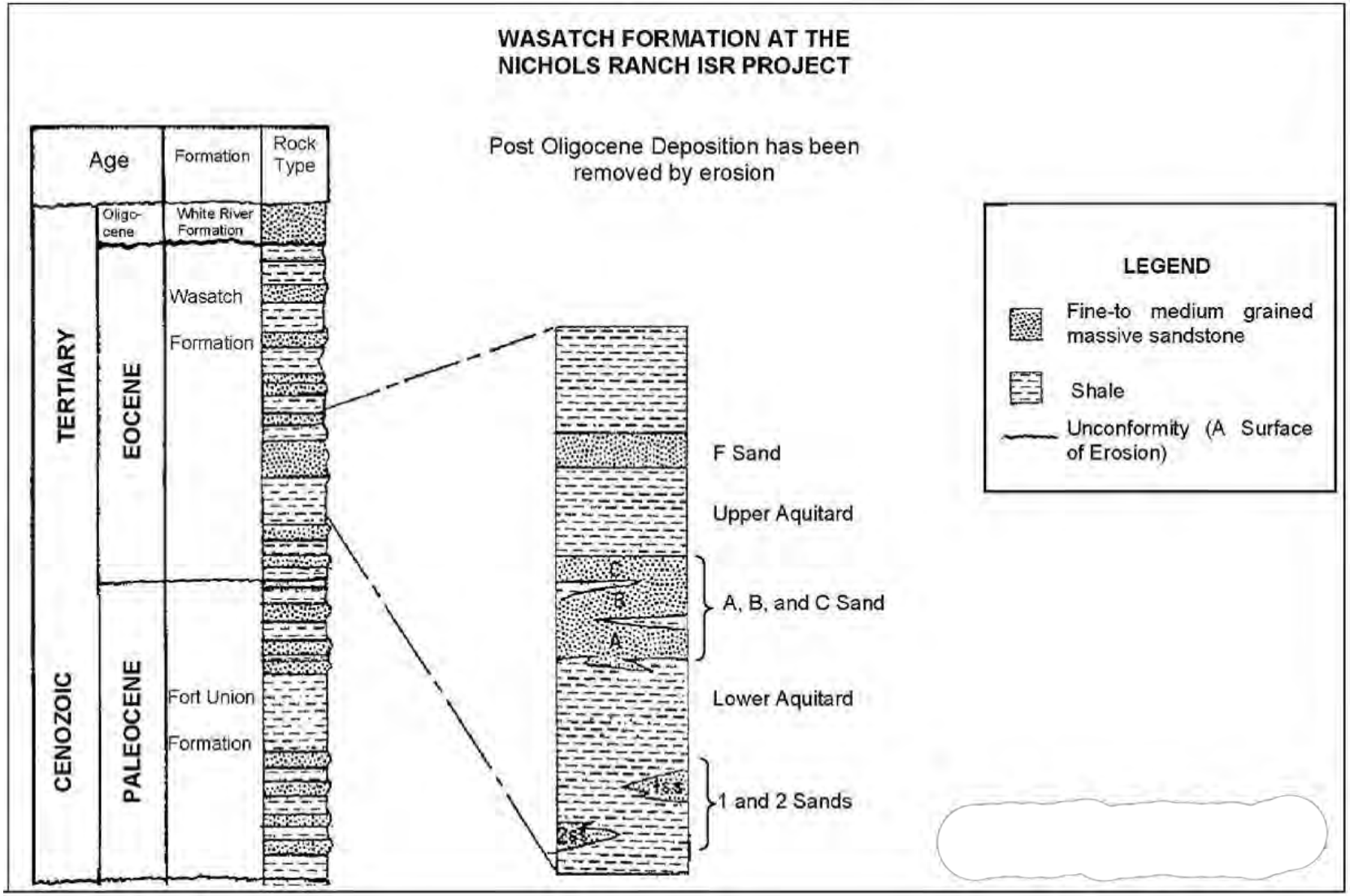
The PRB is a large structural and topographic depression roughly parallel to the Rocky Mountain range. The boundaries of the basin are the Hartville Uplift and the Laramie Range to the south, the Black Hills to the east, the Big Horn Mountains and Casper Arch to the west, and the Miles City Arch in southeastern Montana to the north. Overall, the PRB encompasses an area of

approximately 14 million acres. The dominant source of sediment to the PRB during its formation was Precambrian granitic rock of the Sweetwater Arch and northern Laramie Range. The PRB formed during the Laramide Orogeny (mountain-building era) during the Paleocene to early Eocene epochs. Rapidly subsiding portions of the basin became covered by thick, wedge-shaped layers of predominantly arkosic sediments (sediments containing a significant amount of feldspar), while large more slowly subsiding portions of the basin received a greater proportion of paludal (marsh) and lacustrine (lake) sediments.

The PRB contains a thick sedimentary rock sequence with sediments that range in age from Quaternary to Holocene (recent) to early Paleozoic and overlie a basement complex of Precambrian-aged igneous and metamorphic rocks. The upper part of the sedimentary sequence that is present in other portions of central Wyoming has been eroded away in the PRB, leaving only the Tertiary-aged White River, Wasatch, and Fort Union Formations (Figure 3.1). The White River Formation is of Oligocene age and is the youngest Tertiary unit in the PRB. Underlying the White River Formation is the Wasatch Formation, which is of Eocene age. The Paleocene-age Fort Union Formation directly underlies the Wasatch Formation, which directly overlies the Cretaceous-age Lance Formation.

As indicated above, the White River Formation is the youngest Tertiary unit that still exists in the PRB, with remnants found capping the Pumpkin Buttes. A basal conglomerate of this formation forms the resistant cap rock of the Pumpkin Buttes. In other areas of the PRB where more substantial deposits of the White River Formation still remain, the White River Formation consists of thick sequences of buff-colored tuffaceous sediments mixed with lenses of fine sand and siltstone. This formation is not known to contain significant uranium resources in this area.

Underlying the White River Formation is the Wasatch Formation, which consists of interbedded mudstones, carbonaceous shales, silty sandstones, and relatively clean sandstones. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is approximately 1,575 ft thick. The interbedded mudstones, siltstones, and relatively clean sandstones in the Wasatch Formation vary in their degrees of lithification from uncemented to moderately well-cemented sandstones, and range from weakly compacted and cemented mudstones to fissile shales. The Wasatch Formation




Source: Uranerz 2012.

Figure 3.1 Formations of Interest In the Hank Unit Project Area.

contains significant uranium resources and hosts the mineralized zones ("ore bodies") on which Uranerz is proposing to conduct ISR operations. Numerous coals in the Wasatch Formation also contain significant amounts of CBNG, which is also being developed in the area.

The Fort Union Formation in the PRB is lithologically similar to the Wasatch Formation. The Fort Union Formation includes interbedded silty claystones, sandy siltstones, relatively clean sandstones, claystones, and coal. The claystones, siltstones, and sandstones vary in their degrees of lithification ranging from virtually uncemented sands to moderately well-cemented siltstones and sandstones. The total thickness of the Fort Union Formation in this area is approximately 3,000 ft. The Fort Union Formation contains significant uranium resources at various locations in the PRB and various coals which are the targets for CBNG extraction operations.

The surface geology in the Hank Unit Project Area is almost entirely Wasatch Formation. Exceptions are the Quaternary- to Holocene-age alluvial deposits overlying the Wasatch along Cottonwood Creek, and several other small areas. The stratigraphy of the Wasatch Formation in the Project Area consists of alternating layers of sandstone and shale with interbedded lignite beds. The mineralized (uranium-containing) intervals occur in sandstones ("sands"). These mineralized horizons occur in the lower part of the Wasatch, at an average of 550 ft deep. These host sands are mostly arkosic in composition, friable, and have trace amounts of carbonaceous material and organic debris. There are locally sandy mudstone/siltstone intervals within the sandstone units, which have highly localized variations in thickness.

The uranium "ore" bearing zones in the Hank Unit are typical sandstone-hosted roll-front deposits. However, in this area, the roll-fronts can be "stacked," with more than one sandstone containing a roll-front deposit(s) situated in alternating layers, or "stacks." Roll-front uranium deposits form when oxidized uranium-bearing groundwater moving through rock in the subsurface reaches an area where the sandstone contains reducing agents, such as organic matter. The dissolved uranium comes out of solution as a solid, precipitating onto the minute surfaces within the sandstone. This process occurs over many thousands of years. The sandstones hosting the uranium are typically aquifers. Aquifers are layers of relatively permeable rock from which water can be obtained relatively easily. Often, aquifers are "capped" by less permeable

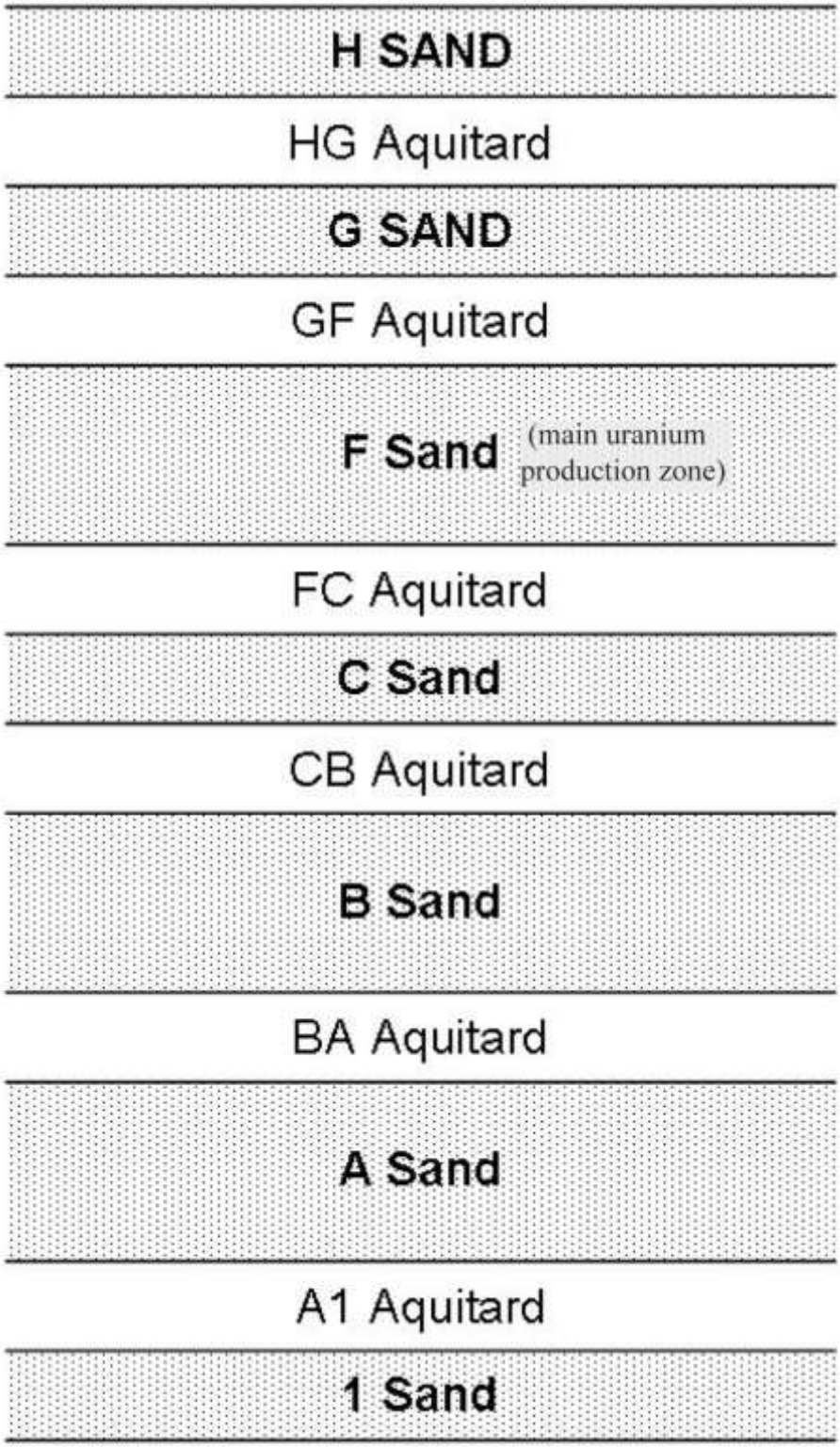
rock layers (often shales, mudstones, or claystones) both above and below, thereby keeping the groundwater contained within the aquifer layer. These less permeable layers are called aquitards or aquicludes: aquitards tend to have low to very low permeability and very little groundwater flows into or through them, and aquicludes are impermeable and with no groundwater flow.

Where present, uranium mineralization is found at the naturally occurring geochemical boundary between the reduced and oxidized sandstone portions. The Hank Unit "ore" zones (zones where uranium grades are at or above that desired) have uranium mineralization composed of amorphous (non-crystalline) uranium oxide, sooty pitchblende, and coffinite. The uranium is deposited on the surface of individual sand grains in the sandstone and clays, and in the void spaces between sand grains. The host sandstones are made up of quartz and feldspar, with small amounts of biotite and muscovite micas, and locally occurring carbon fragments (organic matter). Grain sizes within these sandstones range from very fine-grained sand to conglomerate, and the sandstones are weakly to moderately cemented and friable (Uranerz 2012).

#### 3.4.1.2 Geology of the Hank Unit Project Area

Uranerz has identified four primary sand units and two minor sand units in the Wasatch Formation at the Hank Unit. The primary sand units at the Hank Unit are the F, C, B, and A Sands, and the minor sand units are the G and H Sands (Uranerz 2012) (Figure 3.2). The sand units present are labeled 1, A, B, C, F, G, and H, in geochronological order; 1 Sand is oldest in the sequence, A Sand is next oldest, and so on, with H Sand the youngest. This naming process conforms to conventional geologic naming conventions (U.S. Geological Survey 1986). The main producing uranium "ore" zone sand unit at the Hank Unit is the F Sand. The F Sand is composed of fine- to coarse-grained sand, approximately 75 ft thick, and occurs 200 to 600 ft below ground surface (bgs) in this area.

Underlying the F Sand at the Hank Unit are the FC Aquitard and the C Sand. The C Sand at the Hank Unit is 5 to 20 ft thick, discontinuous, and is composed of fine to very fine-grained sand. The C Sand is not always present below the F Sand at the Hank Unit. When the C Sand is not present, the B Sand underlies the F Sand. The FC Aquitard is composed of mudstones,




Source: Uranerz 2012.

Figure 3.2 Relevant Geological Strata Within the Hank Unit Project Area.

siltstones, gray carbonaceous shales, and poorly developed (low quality) coal. This aquitard ranges 45 to 110 ft in thickness depending on the presence of the C Sand. Where the C Sand is not present, the FC Aquitard merges with the CB Aquitard overlying the B Sand.

Overlying the F Sand at the Hank Unit are the GF Aquitard and the G Sand. The G Sand is comprised of one to three sand units that are fine- to very fine-grained and each 10 to 25 ft thick. The entire G Sand sequence is up to 75 ft thick, and intersand zones (layers between the sandstone layers) are comprised of gray mudstone. The GF Aquitard at the Hank Unit is composed mostly of gray mudstones and is 30 to 55 ft thick (Uranerz 2012).

### 3.4.2 Energy and Mineral Development

#### 3.4.2.1 Introduction

The Hank Unit Project Area is located in the PRB, an energy-rich area that possesses some of the largest coal, CBNG, and conventional oil and natural gas deposits in the U.S. (Knight 1994). The general area near the Hank Unit Project Area has been specifically developed for conventional oil and gas, CBNG, and uranium.

Under federal law and regulations, three classifications of minerals are designated: locatable; leasable; and, salable. Locatable minerals include uranium, gypsum, thorium, gold, silver, sodium bentonite, gemstones, and others. These minerals may be explored and/or developed on mining claims "located" under the *General Mining Law of 1872 (*as amended). These minerals are regulated under 43 CFR 3800. Leasable minerals include oil, gas, coal, geothermal energy, phosphates, sodium, potassium, and others, as designated by the *Mineral Leasing Act of 1920 (*as amended) and the *Mineral Leasing Act for Acquired Lands of 1947 (*as amended). The *Mineral Leasing Act of 1920* was amended by the *Mineral Leasing Act of 1947* to include minerals on lands acquired by the United States, and by the *Geothermal Steam Act of 1970 (*as amended) to include geothermal energy resources. These minerals are regulated under 43 CFR 3100-3500. Salable minerals include common construction and industrial materials including sand, gravel, stone, pumice, cinders, common clay, and others. These minerals are designated under the

*General Mining Law of 1872 (*as amended) and the *Materials Act of 1947* (as amended by the *Surface Resources Act of 1955*), and regulated under 43 CFR 3600.

All leasable and salable minerals are regulated on split estate lands where the U.S. Government reserved specific mineral rights regardless of surface ownership. Locatable minerals are administered by the BLM only where the surface is BLM and all the mineral rights are reserved to the U.S. There are other circumstances in which BLM administers locatable minerals, but these tend to be relatively uncommon.

3.4.2.2 Locatable Minerals

The only locatable mineral being explored for or developed under the Proposed Action is uranium. In 1951, J.D. Love of the U.S. Geological Survey, discovered uranium in the Pumpkin Buttes area, ushering in exploration and development of uranium in the general Hank Unit project area (Lageson and Spearing 1988). Currently there are no uranium (ISR or conventional) projects within the Hank Unit Project Area.

Approximately 1 mile northwest of the Project Area, Cameco Resources, Inc. (Cameco) (also called Power Resources, Inc.), is actively operating their North Butte uranium ISR project, on the south and southwest sides of North Pumpkin Butte. Uranium One Inc.s' (Uranium One's) Willow Creek (formerly Christensen Ranch/Irigaray) uranium ISR project is located approximately 3 mi northwest of the Hank Unit, on the north and west sides of North Pumpkin Butte. This facility temporarily ceased operations in 2000; and became operational again in May 2012. The Willow Creek project is currently licensed to produce a maximum of 1,300,000 lbs of $U_3O_8$ annually (pers. comm., September 17, 2013, with Jon Winter, Manager of Environmental and Regulatory Affairs for Wyoming, Uranium One, Inc., Casper, Wyoming). Uranium One's Moore Ranch uranium ISR Project is located approximately 12 mi south of the Hank Unit. Uranium One now anticipates the Moore Ranch Project will be a satellite ISR operation, with loaded resins being transported to their Willow Creek facility for further processing (NRC 2012). The NRC License and WDEQ LQD Permit for the Moore Ranch project were both issued in late 2010, but construction has not been initiated due to more pressing priorities (pers. comm.,

September 17, 2013, with Jon Winter, Manager of Environmental and Regulatory Affairs for Wyoming, Uranium One, Inc., Casper, Wyoming).

3.4.2.3 Leasable Minerals

Oil and Natural Gas (including CBNG)

Natural gas production has been increasing in Wyoming over the past 10-20 years. In the PRB, this has most recently been from the development of relatively shallow CBNG resources, considered "unconventional" reservoirs for natural gas (BLM 2005). Annual CBNG production in the PRB increased rapidly between 1999 and 2003, with nearly 15,000 producing CBNG wells in the PRB in 2003 and a total production volume of 364 billion $ft^3$ (BLM 2005). There are currently three existing "conventional" oil and gas wells within the Hank Unit Project boundary, and 28 total within approximately 3 mi of the Nichols Ranch and Hank Units. Depths to typically "conventionally"-developed natural gas- and oil-bearing strata in this area range from 4,000 to 13,500 ft bgs (BLM 2005).

There are currently six producing CBNG wells within the Hank Unit, and approximately 380 total within 3 mi of the Nichols Ranch and Hank Units. One of these wells is located within the proposed Hank Unit wellfield. CBNG is typically produced at depths of approximately 1,000 to 1,820 ft bgs in this area. The coal typically developed for CBNG in this area is the Big George Coal, and its' top ranges from 1,000 to 1,620 ft bgs (WOGCC 2014). These depths are approximately 400 to 1,020 ft deeper than the uranium mineralization in the Hank Unit. CBNG support facilities, such as pipelines, are found at/near the surface within and adjacent to the Hank Unit Project Area, and account for the majority of industrial development in the Project Area.

Oil/gas wells and pipeline infrastructure systems occupy vertical subsurface space for product extraction purposes, and horizontal surface areas for pipelines to transport the produced oil and/or gas, or wastewater, to and from each facility (NRC 2011). Prices and interest in CBNG have fallen in recent years; however, interest in "conventional" and directional drilling for oil and natural gas has increased, especially in southern areas of the PRB.

Coal

Between 1990 and 2008, the BLM Wyoming State Office held 25 competitive lease sales and issued 19 new Federal coal leases containing approximately 5.7 billion short tons of coal using the Lease by Application process (NRC 2011). In 2011, PRB coal mines produced 423 million short tons of coal. The 13 mines in the Wyoming PRB make up more than 97% of the coal produced in Wyoming each year (BLM 2012c). There are no surface or underground coal mines in or near the Hank Unit Project Area. The closest coal mine is the Black Thunder Coal Mine located approximately 30 mi east of the Hank Unit.

3.4.2.4 Salable Minerals

Sand, gravel, stone (dimensional, decorative, and building), rip rap and clinker (porcellanite, also locally called "scoria") are being mined in various parts of the PRB. Aggregate, which consists of sand and gravel, is used for construction, road-building, and road maintenance purposes and is found in numerous locations in the PRB; clinker is used for similar purposes as aggregate. Clinker occurs throughout the PRB, including Campbell County where alluvial terrace deposits (sand and/or gravel), or in-place granite/igneous rock, are not available (BLM 2005). There are no known quarries or mines that produce salable minerals in or near the Hank Unit.

### 3.4.3 Geological Hazards

3.4.3.1 Introduction

Geologic hazards include fault-generated earthquakes, subsidence (including resulting from underground coal seam fires), landslides, or other mass movements, and are discussed below.

3.4.3.2 Earthquakes

There have been no recorded earthquakes within the Hank Unit Project Area. The two closest earthquakes were recorded at: Pine Tree Junction (10 mi southeast) in 1967, a 4.8 magnitude

quake on the Richter scale; and, west of Gillette (28 mi northeast) in 1984, a 5.0 magnitude quake on the Richter scale (Wyoming State Geological Survey (WSGS) 2000).

The area of central Wyoming where the Hank Unit Project Area is located is an area with relatively few seismic events, and those tend to be of low intensity. Earthquakes originating at some distance, such as in western Wyoming, may produce shocks strong enough to be felt in the PRB. However, the area is ranked as a one (1) for seismic risk on a scale where zero (0) is the lowest risk and four (4) the highest. Few earthquakes capable of producing damage have originated in this are (WSGS 2000).

The seismically active region closest to the Project Area is the Intermountain Seismic Belt of the Western U.S., which extends in a northerly direction between Arizona and British Columbia. It is characterized by shallow earthquake foci between 10 and 25 mi in depth and normal faulting. Part of this seismic belt extends along the Wyoming-Idaho border, more than 200 mi west of the Hank Unit Project Area (WSGS 2000).

No surface faulting or fault traces in the Hank Unit Project Area have been reported, nor is any faulting evident from geophysical log interpretations collected by Uranerz during baseline data collection (WSGS 2000). No significant surface or subsurface faults are anticipated to be encountered during installation of facilities. Any faults that may be encountered during installation of the proposed facilities are not anticipated to be re-activated by these activities. Anticipated disturbances are not likely to result in forces or pressures great enough to re-activate any existing faults, nor result in causing an earthquake.

A number of sites across the U.S. where liquid wastes have been injected over numerous years and/or in large volumes have resulted in recorded earthquakes. However, no fluid injection-induced earthquakes have been documented in Wyoming. The largest and best known instance of a fluid injection-induced earthquake occurred in the mid-1960s, in association with the waste injection well at the Rocky Mountain Arsenal near Denver, Colorado; the highest recorded magnitude earthquake at this site was 5.5 on the Richter scale (Nicholson and Wesson 1990).

#### 3.4.3.3 Subsidence

No areas of subsidence are known to occur within the Hank Unit Project Area, and no subsidence is expected to result from the Proposed Action. The ISR process geochemically dissolves relatively small quantities of uranium minerals from the surfaces of the subsurface host formation, along with trace quantities of other elements also present. This process leaves the physical structure of the host formation unaffected. The ISR process is not known to lead to subsidence, or increase the void space or create faulting or fracturing in the subsurface host rocks. Also, the installation and removal of the wellfield and associated facilities, such as pipelines and wells, is not likely to lead to subsidence. These structures will be installed to a maximum depth of approximately 800 ft bgs (Uranerz 2012). When these are removed during the final reclamation phase, the subsoil will be replaced and the topsoil respread and re-vegetated (Uranerz 2012). In addition, no project activities are expected to shake the earth sufficiently to cause faulting, fracturing, or subsidence in/near the Project Area.

In the PRB, numerous coal seam fires have occurred, and still occur today. Subsurface coal seams may become exposed via erosion, and catch fire by wildfires, lightning, or spontaneous combustion. Coal seam fires can burn for decades. As the subsurface coal is partially or wholly burned away during these fires, these areas can experience subsidence. The weight of the rocks and sediments over the voids created when coal seams burn often results in collapse of this overburden into these voids. No coal seam fires are known to have occurred, or can be seen, in the Project Area. No subsidence, other than normal settling of materials placed during reclamation, is anticipated to occur in the Project Area (Uranerz 2012; NRC 2011).

#### 3.4.3.4 Mass Movements

There are a number of relatively small areas of landslides or slumps (types of mass movement of soil and/or rock) visible on the flanks of the North Middle Butte, as well as the other Pumpkin Buttes. However, none of these events have been documented, and there is no evidence that these events resulted in any damage to nearby structures, facilities, or buildings. No damage is likely from future mass movements to the proposed facility locations in the Hank Unit, as no facilities will be constructed close to these areas of high relief. In addition, no proposed disturbances or installation/removal of facilities will result in the re-activation of existing

landslides or slumps, due to their distance away, and that no activities are expected to shake the earth sufficiently to cause mass movements in or near the Project Area. Mass movements significant enough to potentially reach and damage Hank Unit facilities would likely occur after a significant earthquake, which is not likely to occur during the project's proposed life.

## 3.5 LAND USE

### 3.5.1 Introduction

The lands within the proposed Hank Unit Project Area have historically been used for cattle grazing and wildlife habitat. Ranching was the first major industry in the project area and remained the predominant industry until the 1970s. Railroads grew simultaneously with ranching as cattle were shipped from Campbell County to markets in the east. The emergence of Wyoming's rich energy resources, including coal, oil, natural gas, and uranium, subsequently attracted energy-producing industries to the project area. Presently, the lands within the project area are used for a variety of purposes. Livestock grazing, conventional oil and gas extraction, CBNG extraction, uranium recovery, and recreational activities are all currently taking place within or adjacent to the proposed project area. The immediate future land uses for the proposed project area and adjacent areas would be continued livestock grazing, uranium ISR activities, CBNG extraction, and oil and gas extraction.

A discussion of land and mineral ownership within the Hank Unit project area is presented in Section 1.1 and will not be repeated here.

Uranerz has established surface use agreements with the surface owners that would be included in the proposed Hank Unit Project. The town of Wright is located approximately 20 mi east of the proposed Hank Unit Project Area, and the towns of Edgerton and Midwest are located approximately 25 mi southwest. No residential sites occur within the Project Area. The Pfister Ranch, however, is approximately 0.6 mi north of the Hank Unit (Figure 1.1). The 280 acres of BLM-administered land in the Hank Unit Project Area is "landlocked" by private land, thereby preventing access by the general public.

### 3.5.2 Grazing

Livestock grazing is one of the main land use activities within the proposed Hank Unit Project Area and adjacent lands. The grazing lessee on the BLM-administered lands within the Project Area is the T-Chair Land Company.

### 3.5.3 Recreation

No developed recreational sites or facilities exist within the Hank Unit Project Area. Numerous dispersed recreational activities such as hunting, camping, hiking, mountain biking, and rock hounding are possible within the PRB. However, as the majority of surface estate surrounding the Project Area is privately-owned, and the federally-owned surface estate is "landlocked" by these privately-owned lands, the public can only conduct these activities on public lands after receiving permission from an adjacent private surface owner to cross their surface land.

Big game and upland game bird hunting are the predominant dispersed recreational activities occurring in the general area. The Proposed Project area is within the Pumpkin Buttes Pronghorn Herd Unit and Hunt Area 23, within the Pumpkin Buttes Mule Deer and White-tailed Deer Herd Unit, which is located in Hunt Area 19, and Savageton Upland Game Bird Management Area 38. Hunting is limited to the allowable seasons set by the WGFD for the respective species.

### 3.5.4 Energy and Mineral Development

Detailed information concerning energy and mineral development within the Hank Unit is presented in Section 3.4.2 above and will not be repeated here.

## 3.6 SOCIOECONOMICS

### 3.6.1 Demographics

Wyoming's 2010 population census numbers indicate a moderate growth rate. The population increased by more than 40% between 1970 and 1980, and then declined by 4% between 1980 and 1990, in response to the boom and bust of energy development in the state. Between 1990 and 2000, the Wyoming population increased by 9% (453,588 to 493,782), and by more than 14% between 2000 and 2010 (493,782 to 563,626) (Ruckelshause Institute 2012). Nationally, Wyoming ranked 11th in population growth in 2011. Campbell County experienced a 36.9% growth in population, the second highest in the state behind Sublette County with a 73.1% population growth rate between 2000 and 2010 (Ruckelshause Institute 2012).

At the end of 2011, Campbell County had 46,618 residents, the majority of which are in the 35 to 54 age group. The population of Campbell County is mostly comprised of white non-hispanics (95.6%), Hispanics (7.7%), and American Indian and other races each comprising less than 5% of the population. Population demographics for Campbell County can be found in Table 3.4. The city of Gillette is the urban center of Campbell County, and is home to over half of the county's population, with 29,389 residents (U.S. Census Bureau (USCB) 2012).

### 3.6.2 Employment Structure

In 2008, Wyoming experienced a 3.4% growth in jobs with the largest increases by percentage in government, educational and health services, and natural resource and mining sectors (Wyoming Department of Employment, Research, and Planning (WDERP) 2009). However, job growth began to flatten in 2009 in response to the global recession. The effects of the national recession on Wyoming employment were not evident until the first quarter of 2009. The most significant job losses occurred in the fourth quarter of 2009, when average monthly employment fell by 6.5% (loss of 18,000 jobs) over the year (WDERP 2012a). From first quarter 2010 to first quarter 2012 (WDERP 2012a), the economy added 9,302 jobs (3.6%).

Table 3.4 2011 Demographics of Campbell County.

| Race | Percent of Population[1] |
|---|---|
| White Non-Hispanic | 95.6 |
| Black | 0.5 |
| Hispanic or Latino | 7.7 |
| American Indian and Alaska Native | 1.4 |
| Asian | 0.6 |
| Two or More Races | 1.8 |
| Native Hawaiian or Other Pacific Islander | 0.1 |

Source: USCB 2012.

[1] Percentages total to more than 100%, as some persons identify themselves as being of more than one race.

In October 2012, the monthly report published by the Wyoming Business Council (WBC), reported that Wyoming's unemployment rate decreased from 5.4% to 5.2% between September and October, and remains well below the current national average unemployment rate of 7.7% (WBC 2012). From April 2011 to July 2012, Wyoming's unemployment rate varied from 5.2% to 6.0% while the U.S. unemployment rate during this same period ranged from 8.1% to 9.0% (WDERP 2012a). The unemployment rate in Campbell County in October 2012 was 3.7%, which was below both the 4.4% statewide unemployment rate for Wyoming and the 7.5% unemployment rate for the U.S. (WBC 2012).

According to the latest long-term projections (2011-2021) from the WDERP, the next 10 years in Wyoming will be similar to the last 10 years. The mining industry will continue to drive the state's economy, and the aging of the baby boom generation will fuel the need for more workers to deliver health care services to Wyoming residents (WDERP 2012a).

### 3.6.3 Income

The estimated median household income in Campbell County is $78,356, above the state median household income of $56,380 (USCB 2012). Mining is the major industrial activity and accounts for over 40% of all earnings in Campbell County (WDERP 2012b).

Campbell County is the third most expensive county in the state in which to live (Wyoming Economic Analysis Division (WEAD) 2012). The 2012 cost of living index for Campbell County was 107, above the national cost of living average of 100 (FindtheData 2012).

### 3.6.4 Housing

In general, workers tend to locate in the largest towns nearest their work. The population centers in the area are Gillette, Casper, and Buffalo. Gillette is approximately 46 mi northeast of the Project Area and is the largest population center to the project area (population 29,389). Wright is located 20 mi east of the project area and has a population of approximately 1,800. Kaycee, approximately 30 mi west of the Project Area with a population of 285, has few vacancies for temporary or permanent housing. Buffalo is located 55 mi northwest from the Project Area and has a population of approximately 4,500 (Uranerz 2011).

It is expected that most of the temporary or permanent workers at the Nichols Ranch/Hank Project would reside in Gillette; more housing is available as compared to other communities. In 2011, the median home price in Campbell County was $208,800 and the median rent for a two bedroom apartment in Gillette was $717 (Campbell County Chamber of Commerce 2012). The housing vacancy rate from 2005 through 2008 showed a high demand for rental units. From 2009 through 2011, vacancy rates demonstrated the slowdown for energy during this three year period. Vacancy rates for rental buildings and manufactured home parks have remained steady (Campbell County Chamber of Commerce 2012).

The number of dwelling units in Gillette eligible for a building permit increased twice in 2012, the second time in the third quarter. This demonstrates that not only are new lots available, but there continues to be investment in homes in the community. The number of lots eligible for a building permit, along with those in final plat or preliminary plat review, was higher in 2011 than at the end of 2010's third quarter. The combination of commercial and residential activity shows that Gillette is doing well within the overall economy (City of Gillette 2012). The average household size in Campbell County is 2.7 (compared to 2.5 stateside); the higher number is likely to reflect group living arrangements (Find the Data 2012).

### 3.6.5 Local Finance

The median property tax rate in Campbell County is $926 per year for a home worth the median value of $208,800. Campbell County collects on average 0.47% of a property's estimated fair market value as property tax (Campbell County Property Tax Calculator 2012).

The state of Wyoming maintains a 4% sales tax and allows counties to increase sales tax up to 4% above the state rate. Gillette has an additional 2% lodging tax; however, Campbell County does not impose a lodging tax. A lodging tax, which cities, towns, and counties may impose up to 4% on all sleeping accommodations for guests staying less than thirty days, also provides additional income from workers and visitors living in local motels. This tax also extends to mobile accommodations such as tents, trailers, and campers (WEAD 2011). Sales tax collection for retail trade, accommodation, and food services increase by 6.1% between fiscal year (FY) 2010 and FY 2011 above the state average of 3.4% for FY 2010-FY 2011 (WEAD 2011).

Campbell County imposes taxes on commercial personal property. All tangible personal property used in business is taxable and must be listed once a year with the County tax assessor (W.S. 39-13-103). In addition to industrial enterprise, contractors and subcontractors must pay a use tax to the Wyoming Department of Revenue on all purchases of materials, fixtures, or other supplies purchased in other states, if those purchases were made tax free or at a lesser tax rate than the applicable Wyoming sales tax rate for the county where the materials are stored, used, or consumed (Wyoming Department of Revenue 2001). Finally, the state imposes an "ad valorem tax" on mineral extraction. In 2007 for uranium alone, the state collected $1.2 million from this tax (NRC 2009a).

### 3.6.6 Education

The Campbell County School district is the third largest school district in Wyoming and is composed of 24 school facilities. The District's 24 facilities include one high school, one junior/senior high school, one alternative transitional school, 2 junior high schools, and 15 elementary schools (3 rural). The District currently enrolls 8,200 students and has

1,323 full-time and part-time employees, including 633 certified staff (teachers, specialists, and administrators), and 690 non-certified staff (clerical, custodial, bus drivers, food service, aids, and maintenance) (Campbell County Educational Services Center (CCESC) 2012). The student to teacher ratio in Campbell County in 2012 is 19.2 to 1 (CCESC 2012) up from 12.5 to 1 in 2011 (Campbell County Chamber of Commerce 2012). Approximately 92.3% of Campbell County residents hold a high school diploma or higher, and 24.1 % have a bachelor's degree or higher (Campbell County Chamber of Commerce 2012).

### 3.6.7 Health and Social Services

The primary health care facility in Campbell County is the Campbell County Memorial Hospital located in Gillette, which provides emergency care, a cancer care center, and clinical outpatient operations. The hospital also has two branch clinics located in Gillette and Wright. The closest medical centers offering full-service emergency services are the Campbell County Memorial Hospital in Gillette and the Wyoming Medical Center in Casper (WEAD 2011).

The closest police stations to the project area are the Campbell County Police Station #9 in Wright, and the Midwest Police Station in Midwest. The Campbell County Fire Station #9 is co-located with the Campbell County Police Station #9, and is the closest fire station to the project area (WEAD 2011).

## 3.7 SOIL RESOURCES

In 2007, Uranerz retained BKS Environmental Associates of Gillette, Wyoming, to conduct a soil survey of the Hank Unit in accordance with WDEQ LQD guidelines. The soils occurring in the Hank Unit are generally fine-textured throughout, with patches of sandy loam on upland areas and fine-textured soils occurring near or in drainages. The Project Area contains deep soils on lower toe slopes and flat areas near drainages with shallow and moderately deep soils located on upland ridges and shoulder slopes. Topography of the area includes gently rolling hills and ridges, as well as steep terrain near North Middle Butte and eroded areas associated with Dry Willow Creek (see Uranerz 2012 for more detailed information).

The soils in the southern portions of Johnson and Campbell counties were mapped to an Order 3 scale by the Natural Resource Conservation Service (NRCS) in 1975 and 1991, respectively (NRCS 1975, 1993). An Order 2 soil survey of the Hank Unit was conducted during the summer/fall of 2006 and covered the entire Project Area and all soils within it (including lands to be disturbed and all lands to be left undisturbed). Twenty-seven map units occur in the Hank Unit (Table 3.5; see also Uranerz 2012 for more information).

Based on physical and chemical parameters collected during the Order 2 soil sampling; there were no physical and/or chemical factors that limit the suitability of topsoil as a plant growth medium. In addition, based on a reconnaissance survey conducted by NRCS, no prime farmland was identified within the Hank ISR project area (Uranerz 2012).

## 3.8 VEGETATION INCLUDING SPECIAL STATUS SPECIES, NOXIOUS WEEDS, AND WETLANDS

### 3.8.1 Vegetation

The proposed project area is comprised of five vegetation/habitat types, with approximately 93% of the area represented by two vegetation communities: sagebrush shrubland and mixed grasslands (Table 3.6). In June and July of 2006, Uranerz retained TRC Environmental Corporation (TRC) of Laramie, Wyoming, to conduct vegetation studies in accordance with a study plan that was approved by the WDEQ LQD for noncoal project areas, including the collection of predisturbance vegetation data for future bond release (see Uranerz 2012 for more detailed information). A full list of species identified in each plant community during the vegetation study is presented in Table 3.7. Sagebrush shrublands are dominated by shrubs, especially Wyoming big sagebrush and perennial grasses such as needle-and-thread, prairie junegrass, Sandberg bluegrass, and blue grama. Annual grasses such as cheatgrasses and sixweeks fescue also are present, and the grasslike threadleaf sedge is a dominant species in the understory. Annual forbs (e.g., woolly plantain, and *Rudolphi alyssum*) are more common than perennial forbs. Scattered plains cottonwoods also occur in this community and generally are found growing along the drainages (see Uranerz 2012).

Table 3.5 Soil Map Units Within the Hank Unit Project Area.

| Map Unit ID | Name of Soil Map Unit | Acres |
|---|---|---|
| 109 | Bidman loam, 0-6 percent slopes | 8.6 |
| 111-1 | Bidman loam, 0-6 percent slopes | 78.8 |
| 111-2 | Parmleed loam, 0-6 percent slopes | 26.2 |
| 121-1 | Cushman loam, 0-6 percent slopes | 29.2 |
| 121-2 | Cambria loam, 0-6 percent slopes | 40.2 |
| 126-1 | Cushman loam, 0-6 percent slopes | 9.7 |
| 126-2 | Theedle loam, 0-6 percent slopes | 26.2 |
| 146-1 | Forkwood loam, 0-6 percent slopes | 124.8 |
| 146-2 | Cushman loam, 0-6 percent slopes | 119.9 |
| 147-1 | Forkwood loam, 6-15 percent slopes | 66.7 |
| 147-2 | Cushman loam, 6-15 percent slopes | 24.6 |
| 148-2 | Ulm loam, 0-6 percent slopes | 10.3 |
| 157-1 | Hiland fine sandy loam, 0-6 percent slopes | 140.0 |
| 157-2 | Bowbac fine sandy loam, 0-6 percent slopes | 89.9 |
| 158 | Hiland-Bowbac fine sandy loams, 6-15 percent slopes | 14.1 |
| 158-1 | Hiland fine sandy loam, 6-15 percent slopes | 48.8 |
| 158-2 | Bowbac fine sandy loam, 6-15 percent slopes | 76.3 |
| 170-1 | Keeline loamy sands, 6-30 percent slopes | 94.1 |
| 170-2 | Tullock loamy sands, 6-30 percent slopes | 129.2 |
| 206 | Samday-Shingle-Badland complex, 10-45 percent slopes | 202.5 |
| 213-1 | Terro sandy loam, 6-30 percent slopes | 24.5 |
| 213-2 | Taluce sandy loam, 6-30 percent slopes | 4.1 |
| 216-2 | Kishona loam, 3-30 percent slopes | 226.2 |
| 217-1 | Theedle loam, 3-30 percent slopes | 119.9 |
| 217-2 | Shingle loam, 3-30 percent slopes | 38.3 |
| 227 | Ulm-clay loam, 0-6 percent slopes | 129.3 |
| 233 | Ustic Torriorthents, gullied | 348.0 |
| | Total Acres | 2,250.4 |

Source: Uranerz 2012.

The mixed grassland vegetation community is common across eastern Wyoming and generally receives more moisture and has greater species diversity than other types of prairie habitats (WGFD 2006a). The community is composed of mainly perennial grasses such as needle-and-thread, Sandberg bluegrass, blue grama, western wheatgrass, and bluebunch wheatgrass and

Table 3.6 Vegetation/Habitat Types and Occurrence Within the Hank Unit Project Area.[1]

| Vegetation/Habitat Type | Number of Acres | Percentage of Total Project Area |
|---|---|---|
| Sagebrush shrubland | 1,792.1 | 79.6 |
| Mixed grassland | 300.8 | 13.4 |
| Juniper outcrop | 149.0 | 6.6 |
| Rock outcrop | 4.3 | 0.2 |
| Disturbed lands[2] | 3.8 | 0.2 |
| Total | 2,250.0 | 100.0 |

[1] Modified from Table D8-1 in Uranerz (2012).
[2] Includes 10.3 acres of previously disturbed lands as evident by annual grasses and weeds, and 8.8 mi (32.0 acres) of roads (30-ft wide disturbance).

grasslike species such as threadleaf sedge. Some perennial forbs, annual forbs, and shrub species are scattered in low-density stands throughout this community. No trees occur in this plant community.

Other vegetative/habitat types present in the Project Area include 149 acres of juniper outcrop (6.6% of the total area), 4.3 acres of rock outcrop (0.2%), and 3.8 acres of disturbed lands (0.2%).

## 3.8.2 Special Status Plant Species

### 3.8.2.1 Introduction

Table 3.8 presents a list of plant species that are federally-designated under the *Endangered Species Act of 1973* (ESA), Wyoming BLM BFO-sensitive species (SS) (BLM 2012b), and species of concern identified by the Wyoming Natural Diversity Database (WYNDD) in Campbell County (WYNDD 2006). Federally-designated species are managed by the BLM in accordance with the ESA and BLM Manual 6840, Special Status Species (BLM 2008c). BLM-SS are designated internally by the BLM and managed in accordance with BLM Manual 6840. Actions authorized by the BLM will further the conservation and/or recovery of federally-

Table 3.7 Plant Species by Habitat Occurrence In the Hank Unit Project Area.[1, 2]

| Scientific Name | Common Name[3] | Sagebrush Shrubland | Mixed Grassland | Juniper Outcrop | Bottomland | Greasewood Shrubland |
|---|---|---|---|---|---|---|
| **Perennial Grasses** | | | | | | |
| *Achnatherum hymenoides* (syn. *Oryzopsis hymenoides*) | Indian ricegrass | X | X | X | | X |
| *Agropyron cristatum* | **Crested wheatgrass** | | X | | | |
| *Aristida purpurea longiseta* | Purple threeawn | X | X | | | |
| *Bouteloua gracilis* | Blue grama | X | X | X | | X |
| *Bromus inermis* | **Smooth brome** | | | | X | |
| *Calamovilfa Iongifolia* | Prairie sandreed | X | X | X | | |
| *Distichlis stricta* | Inland saltgrass | | | | X | X |
| *Elymus spicatus* (syn. *Agropyron spicatum*) | Bluebunch wheatgrass | X | X | X | | X |
| *Hesperostipa comata* (syn. *Stipa comata*) | Needle-and-thread | X | X | X | | X |
| *Hordeum jubatum* | Foxtail barley | | X | | X | |
| *Koeleria macrantha* | Prairie junegrass | X | X | X | X | X |
| *Leymus cinereus* (syn. *Elymus cinereus*) | Basin wildrye | | | X | | |
| *Nassella viridula* (syn. *Stipa viridula*) | Green needlegrass | X | X | | | |
| *Pascopyrum smithii* (syn. *Elymus smithii*) | Western wheatgrass | X | X | | X | X |
| *Poa secunda* | Sandberg bluegrass | X | X | X | X | X |
| *Poa* spp. | Bluegrass | | | X | X | |
| *Sporobolus airoides* | Alkali sacaton | | | | X | X |
| *Thinopyrum intermedium* (syn. *Elymus intermedium* or *Eltrigia intermedia*) | Intermediate wheatgrass | | | | X | |
| Unknown perennial grass | -- | | | X | X | |

Table 3.7 (Continued)

| Scientific Name | Common Name | Sagebrush Shrubland | Mixed Grassland | Juniper Outcrop | Bottomland | Greasewood Shrubland |
|---|---|---|---|---|---|---|
| **Annual Grasses** | | | | | | |
| *Bromus japonicus* | **Japanese brome** | X | X | X | | X |
| *Bromus tectorum* | **Cheatgrass (downy brome)** | X | X | X | X | X |
| *Vulpia octoflora* (syn. *Festuca octoflora*) | Sixweeks fescue | X | X | | | |
| **Grasslike Species** | | | | | | |
| *Carex filifolia* | Threadleaf sedge | X | X | X | X | X |
| *Carex praegracilis* | Clustered field sedge | | | | X | |
| *Equisetum* spp. | Scouring rush | | | | X | |
| *Juncus balticus* | Baltic rush | | | | X | |
| **Perennial Forbs** | | | | | | |
| *Achillea millefolium* | **Common yarrow** | | | X | X | |
| *Arenaria hookeri* | Hooker's sandwort | | | X | | |
| *Asclepias speciosa* | Showy milkweed | | | X | X | |
| *Astralagus bisulcatus* | Two-grooved milkvetch | X | X | X | X | |
| *Chaenactis douglasii* | Douglas' dustymaiden | | | X | | |
| *Cirsium arvense* | **Canada thistle** | | | X | X | |
| *Cryptantha flava* | Brenda's yellow cryptantha | | | | | |
| *Eriogonum ovalifolium* | Cushion buckwheat | X | | | | |
| *Eriogonum* spp. | Buckwheat | | X | | | |
| *Grindellia squarrosa* | Curlycup gumweed | | | | X | |
| *Heterotheca villosa* | Hairy false goldenaster | | X | X | | |
| *Iva axillaris* | Povertyweed | X | | | X | X |
| *Lupinus* spp. | Lupine | X | | X | | |
| *Lygodesmia juncea* | Rush skeletonplant | X | X | | | |
| *Melilotus officinalis* | **Yellow sweetclover** | | | | | |

Table 3.7 (Continued)

| Scientific Name | Common Name | Sagebrush Shrubland | Mixed Grassland | Juniper Outcrop | Bottomland | Greasewood Shrubland |
|---|---|---|---|---|---|---|
| **Perennial Forbs** | | | | | | |
| *Phlox hoodii* | Hood's phlox | | X | | | X |
| *Psoralidium tenuiflorum* (syn. *Psoralea tenuiflora*) | Slimflower scurfpea | X | X | X | | |
| *Sphaeralcea coccinea* | Scarlet globemallow | | X | X | | X |
| *Stenotus acaulis* (syn. *Haplopappus acaulis*) | Stemless mock goldenweed | | X | X | | |
| -- | Unknown forb | | | | X | |
| -- | Unknown aster | | | | X | |
| *Yucca glauca* | Soapweed yucca | | X | | | |
| **Annual Forbs** | | | | | | |
| *Alyssum parviflorum* | **Rudolphi alyssum** | X | X | X | X | X |
| *Bassia scoparia* (syn. *Kochia scoparia*) | **Summercypress** | | | | X | X |
| *Descurainia sophia* | **Flixweed tansymustard** | | | | X | |
| *Lappula redowski* | Flatspine stickseed | X | | X | | |
| *Madia glomerata* | Mountain tarweed | | | | X | |
| *Plantago patagonia* | Woolly plantain | X | X | | X | X |
| -- | Unknown annual forb | | X | | X | |
| **Subshrub** | | | | | | |
| *Artemisia frigida* | Fringed sage | X | X | X | X | |
| *Artemisia pedatifida* | Birdfoot sage | | | | | X |
| *Gutierrezia sarothrae* | Broom snakeweed | X | X | X | | |
| *Leptodactylon pungens* | Granite prickly phlox | X | X | X | | |
| **Succulents** | | | | | | |
| *Opuntia polyacantha* | Prickly pear cactus | X | X | X | | X |

Table 3.7 (Continued)

| Scientific Name | Common Name | Sagebrush Shrubland | Mixed Grassland | Juniper Outcrop | Bottomland | Greasewood Shrubland |
|---|---|---|---|---|---|---|
| **Shrubs** | | | | | | |
| *Artemisia cana* | Silver sagebrush | X | X | X | X | X |
| *Artemisia tridentata wyomingensis* | Wyoming big sagebrush | X | X | X | | X |
| *Atriplex gardneri* | Gardner's saltbrush | | | | | X |
| *Cercocarpus montanus* | Mountain mahogany | X | | X | | |
| *Ericameria nauseosa* (syn. *Chrysothamnus nauseosus*) | Rubber rabbitbrush | | X | X | | |
| *Ericameria viscidiflora* (syn. *Chrysothamnus viscidiflorus*) | Yellow rabbitbrush | | | X | | X |
| *Krascheninnikovia lanata* | Winterfat | X | X | X | X | |
| *Rhus tribolata* | Skunkbrush sumac | | | X | | |
| *Sarcobatus vermiculatus* | Greasewood | | | | | |
| *Symphoricarpos occidentalis* | Western snowberry | | | X | | |
| **Trees** | | | | | | |
| *Juniperus scopulorum* | Rocky Mountain juniper | | | X | | |
| *Pinus flexilis* | Limber pine | | | X | | |
| *Populus deltoides* | Plains cottonwood | X | | | X | |

[1] Modified from Uranerz (2012) and NRC (2011).
[2] Excludes rock outcrops, wetlands, and disturbed habitat types.
[3] Non-native species are bolded.

designated species and conservation of BLM-SS. BLM-SS will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and minimize the likelihood and need for listing under the ESA (BLM 2012b).

Table 3.8 Special Status Plant Species With the Potential to Occur Within or Near the Hank Unit Project Area.

| Scientific Name | Common Name | ESA Status(a)[1] | Sensitivity Status(b)[2] | Comments[3] |
|---|---|---|---|---|
| *Anemone narcissiflora* ssp. *zephyra* | Zephyr windflower | -- | PSC | |
| *Antennaria monocephala* ssp. *Angustata* | Single-head pussytoes | -- | PSC | |
| *Arnica lonchophylla* | Northern arnica | -- | PSC | |
| *Artemisia porteri* | Porter's sagebrush | -- | BLM-SS | Unlikely occurrence based on absence of suitable habitat and because the project area is outside of the known geographic range (Fertig 1994) |
| *Cymopterus williamsii* | Williams' waferparsnip | -- | PSC, BLM-SS | Unlikely occurrence based on elevation and habitat preference |
| *Cypripedium montanum* | Mountain lady-slipper | -- | PSC | |
| *Draba fladnizensis* var. *pattersonii* | White artiv whitlow grass | -- | PSC | |
| *Erigeron humilis* | Low fleabane | -- | PSC | |
| *Eritrichum howardii* | Howard forget-me-not | -- | PSC | |
| *Festuca hallii* | Hall's fescue | -- | PSC | |
| *Juncus triglumis* var. *triglumis* | Three-flower rush | -- | PSC | |
| *Papaver kluanense* | Alpine poppy | -- | PSC | |
| *Parnassia kotzebuei* | Kotzebuei's grass-of-parnassus | -- | PSC | |
| *Pedicularis contorta* var. *ctenophore* | Coil-breaked lousewort | -- | PSC | |
| *Penstemon haydenii* | Blowout penstemon | E | -- | No recorded occurrences in project area based on site-specific surveys (Uranerz 2012); highly unlikely occurrence based on absence of suitable habitat and because the project area is outside of the known geographic range (Greystone Environmental Consultants Inc. 2005) |
| *Physaria lanata* | Woolly twinpod | -- | PSC | |

Table 3.8 (Continued)

| Scientific Name | Common Name | ESA Status(a)[1] | Sensitivity Status(b)[2] | Comments[3] |
|---|---|---|---|---|
| *Pinus flexilis* | Limber pine | -- | BLM-SS | Occurs in the juniper woodlands on the western sideslopes of North Middle Butte within and adjacent to the project area (Uranerz 2012) |
| *Polygala verticillata* | Whorled milkwort | -- | PSC | |
| *Polygonum spergulariiforme* | Fall knotweed | -- | PSC | |
| *Potamogeton amplifolius* | Large-leaved pondweed | -- | PSC | |
| *Puccinellia cusickii* | Cusick's alkali-grass | -- | PSC | |
| *Pyrrocoma clementis* var. *villosa* | Hairy tranquil goldenweed | -- | PSC | |
| *Rubus acaulis* | Northern blackberry | -- | PSC | |
| *Sambucus cerulean* | Blue elderberry | -- | PSC | |
| *Schoenoplectus heterochaetus* | Slender bulrush | -- | PSC | |
| *Sesuvium verrucosum* | Sea purslane | -- | PSC | |
| *Spiranthes diluvialis* | Ute ladies'-tresses | T | -- | No recorded occurrences within the project area based on site-specific surveys (Uranerz 2012); highly unlikely occurrence based on absence of suitable habitat and because the project area is outside of the known geographic range (Fertig 1994) |
| *Sporobolus compositus* | Longleaf dropseed | -- | PSC | |
| *Triodanis leptocarpa* | Slim-pod Venus' lookingglass | -- | PSC | |

Source: Uranerz 2012.

[1] Designations under the ESA; DL = delisted; E = endangered; T = threatened; C = candidate.
[2] BLM-SS = Wyoming BLM-designated sensitive species (BLM 2012b); PSC = plant species of concern (WYNDD 2006).
[3] Comments on the likelihood of occurrence are based on known geographic range and habitat preferences as described in Fertig (1994) and BLM (2002, 2012b).

The WYNDD is a research unit of the University of Wyoming that maintains a comprehensive database on the distribution and ecology of rare plants and rare animals, and important plant

communities in Wyoming. Part of its' mission is to maintain a list of plant and animal species of concern in Wyoming. WYNDD provides information on state abundance, legal status, and distribution of species in Wyoming that are rare, endemic, disjunct, threatened, or otherwise biologically sensitive. Plants and animals are considered for inclusion if they are vulnerable to extirpation at the state level due to: their rarity (e.g., restricted distribution, small population size, low population density); inherent vulnerability (e.g., specialized habitat requirements, restrictive life history); and threats (e.g., significant loss of habitat, sensitivity to disturbances). However, these species do not have any special legal status in Wyoming.

3.8.2.2 Federally-designated Plant Species

As part of the vegetation survey of the Hank Unit Project Area, TRC surveyed suitable habitats for potential federally-designated threatened, endangered, proposed, or candidate (TEPC) plant species. TEPC plant species that have the potential to occur in the Project Area include blowout penstemon (*Penstemon haydenii*) and Ute Ladies'-tresses (*Spiranthes diluvialis*). TRC also mi buffer area immediately adjacent. WYNDD did not have any recorded sightings or listings of any TEPC plant species within this are (WYNDD 2006). Based on the field vegetation survey, no TECP species or their habitat were located or identified, and none are known to occur within or in the vicinity of the Project Area (WYNDD 2006).

Blowout penstemon (*Penstemon haydenii*) is a perennial forb that is federally-designated as endangered. The plant typically inhabits sparsely vegetated early successional blown-out depressions and shifting sand dunes at elevations ranging 5,860 to 7,440 ft AMSL (Greystone Environmental Consultants, Inc. 2005; Fertig 2008). In Wyoming, blowout penstemon is known to occur in three distinct populations south-southwest of Pathfinder Reservoir in Carbon County. The Project Area lacks aeolian dunal deposits, is well outside of the known geographic range of the species (Greystone Environmental Consultants, Inc. 2005), and the species was not observed during TRC's 2006 baseline vegetation inventories (Uranerz 2011). Therefore, its occurrence within the project area is highly unlikely.

Ute Ladies'-tresses (*Spiranthes diluvialis*) is a federally-threatened perennial orchid that occurs along moist stream banks and wet meadows in eastern Wyoming. The species is found at elevations of 4,200 to 7,000 ft AMSL, although known populations in Wyoming do not occur above 5,500 ft AMSL (USFWS 2008b, as cited in NRC 2011). The species was not observed during 2006 baseline vegetation inventories conducted by TRC (Uranerz 2012), and the Project Area lacks suitable habitat (i.e., wetlands and stream banks) for this species. Therefore, its potential occurrence within the project area is extremely low.

3.8.2.3 BLM-sensitive Plant Species

Three BLM-sensitive plant species with the potential to occur within BFO include Porter's sagebrush (*Artemisia porteri*), Williams' wafer-parsnip (*Cymenopterus williamsii*), and limber pine (*Pinus flexilus*) (Table 3.8). Porter's sagebrush (*Artemisia porteri*) occurs primarily in sparsely vegetated birdfoot and long-leaved sagebrush communities on clay flats, badland slopes, and gullies (BLM 2012b). The Project Area lacks such a vegetation community (Uranerz 2011). Therefore, it is unlikely that this plant species occurs within the Project Area.

Williams' wafer-parsnip (*Cymenopterus williamsii*) is a perennial forb that occurs on open ridgetops and upper slopes with exposed limestone outcrops at 6,000 to 8,300 ft AMSL (BLM 2012b). The highest elevation within the project area is 5,209 ft AMSL. Based on habitat and elevation preference, it is unlikely that this species occurs within the Project Area.

Limber pine (*Pinus flexilus*) is distributed throughout the mountains near timberline, and lower elevations, and is associated with many tree species, including lodgepole and whitebark pines, Engelmann spruce, Douglas and subalpine firs, Rocky Mountain and common junipers, and mountain mahogany (BLM 2012b). During the field survey, all BLM-sensitive plant species observed in/near the Project Area were recorded. Limber pine (*Pinus flexilus*) was the only one identified, and was limited to western side slopes and top of North Middle Butte (Uranerz 2012).

#### 3.8.2.4 WYNDD Species of Concern

Twenty-five WYNDD species of concern were identified as having the potential to occur in the Hank Unit Project Area based on county occurrences (Table 3.8). The WYNDD did not have any recorded observations of any plant species of concern within the Project Area or 6-mi buffer around it (Uranerz 2012). During the field survey, no WYNDD species of concern were observed within/near the Project Area (Uranerz 2012).

#### 3.8.2.5 Noxious Weeds and Other Invasive Species

Federal agencies are directed by Presidential Executive Order (E.O.) 13112, Invasive Species (64 *Federal Register* 6183, 1999) to expand and coordinate efforts to prevent the introduction and spread of invasive plant species (noxious weeds) and to minimize the economic, ecological, and human health impacts that such species cause. Weed populations are generally found along main dirt and two-track roads, in areas of livestock concentration, and in areas of intense recreational use where surface disturbance has occurred. Motorized vehicles transporting seeds can also be a major source of new infestations. One designated noxious weed species, Canada thistle (*Cirsium arvense*), was documented in small localized areas associated with existing well pads and heavily grazed areas during on-site surveys conducted in 2006 (see Uranerz 2012).

### 3.8.3 Wetlands and Waters of the U.S. (WUS)

TRC's 2006 survey revealed that no wetland areas exist in the Hank Unit Project Area (Uranerz 2012). Also, no perennial streams, ponds, lakes, or other permanent water bodies exist within the Project Area (Uranerz 2012). However, approximately 9.4 mi of waters of the U.S. (WUS) occur in the Hank Unit (Uranerz 2012, Figure D10-4). Drainage is generally to the northwest and west off North Middle and South Middle Buttes via Dry Willow Creek and Willow Creek. Channel widths generally range 1 to 2 ft in the headwater areas of these WUS, and increase to 20 to 30 ft wide where the WUS leave the western edge of the Project Area. Many of the ephemeral channel beds are vegetated, indicating flows are infrequent and of low intensity. In general, the

WUS are deeply incised with 10- to 50-ft high banks in the southern and northeastern portions of the Hank Unit and less incised in other parts of unit.

## 3.9 VISUAL RESOURCES

The area of the PRB in which the Hank Unit Project Area occurs is characterized as basin and range country with prominent buttes and ridges interspersed by rolling grasslands. Pumpkin Buttes, which flank the northern and southeastern boundaries of the Project Area, are recognized by the BLM as a TCP (discussed in Section 3.3.2.4). Past changes to land surfaces include those associated with human habitation, the development of stock ponds and reservoirs, access roads, and the introduction of gas, oil, and other energy development infrastructure (BLM 2009). Existing facilities located within 2 mi of the Project Area include conventional oil and gas wells, CBNG wells, and supporting infrastructure (well pads, pump jacks, above-ground tanks, access roads, pipelines); reservoirs; fence lines; overhead transmission and distribution power lines; ranch/county roads, water storage facilities; uranium recovery facilities; and ranch buildings (BLM 2007; Uranerz 2012). There are no visually sensitive areas within 2 mi of the Hank Unit.

The BLM evaluates the scenic quality of the land it administers through a Visual Resource Inventory to ensure that the scenic (visual) value is preserved. As part of this inventory, the BLM completed a scenic quality evaluation for the BFO area, a sensitivity level analysis, and a delineation of distance zones to group areas into the four visual resource management (VRM) classes. BLM policy is to assign management classes to BLM-administered lands based on the visual quality, sensitivity and distance from public access corridors in a given area. Class I areas are the most protected visual and scenic resources, while Class IV is the least restrictive in terms of development, and allows for major modification to the landscape (BLM Manual 8400, Visual Resource Management, BLM 2010b) (Table 3.9). The Hank Unit contains lands of VRM Classes III and IV (BLM 2001). Visual resources are evaluated from the perspective of the casual observer, not any specific resource perspective such as historic integrity.

The BLM established VRM classifications for the entire BFO (BLM 2001). The VRM classifications for the Hank Unit project area are shown in Figure 3.3. In the past, the PRB

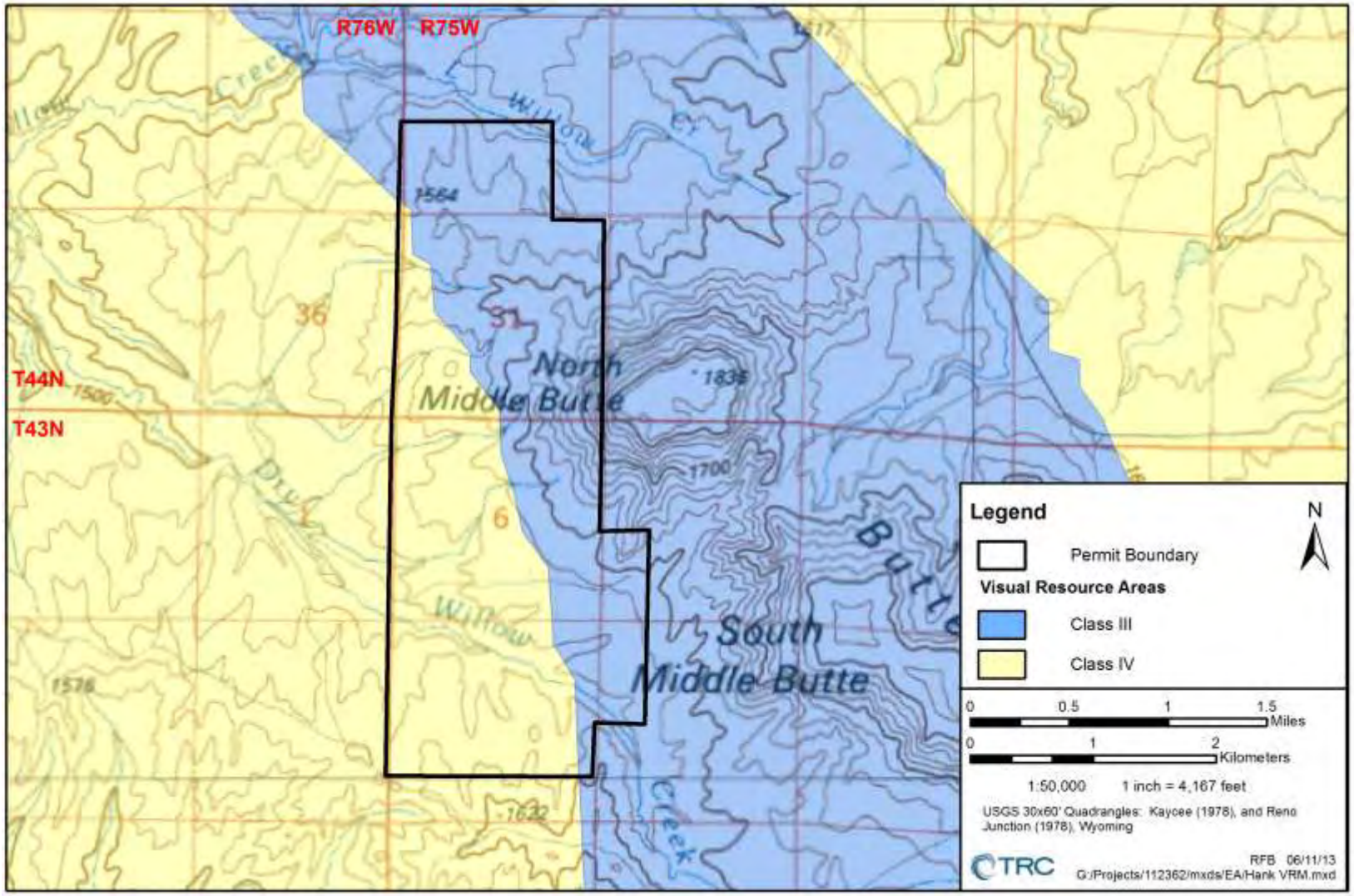
Table 3.9 BLM Visual Resource Management Class Objectives for Classes Occurring Within the Hank Unit Project Area.

| Class | Description |
|---|---|
| III | The objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. The objective is to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. Activities may be visually evident, but should not be dominant |
| IV | The objective is to provide for management activities that require major modifications to the existing landscape. The level of change to the landscape can be high. |

Source: BLM (2010b, 2001).

landscape has been extensively modified by oil, natural gas, and coal production (BLM 2003a). Existing facilities to the west of Pumpkin Buttes potentially visible from the proposed Hank Unit include conventional oil and gas wells, CBNG wells, and supporting infrastructure (well pads, pump jacks, access roads, pipelines), reservoirs, fence lines, overhead power lines, water, storage facilities, uranium recovery facilities, ranch/county roads, ranch buildings, and dust from vehicular traffic (BLM 2007). Nearly half of the Hank Unit Project Area occurs in lands designated VRM Class III (52%), and the rest VRM Class IV (48%). Under VRM plans, Class IV areas allow for major modifications to the landscape.

The area considered for visual resources associated with the Hank Unit includes the project site, access roads, and a 2-mi buffer area around the project site. According to BLM VRM Manual 8400 (2010d) foreground-middleground is typically considered within 3 to 5 mi, and background is beyond 3 to 5 mi (adjusted for specific landscape) (BLM 2010b). Visibility is much greater than 2 mi and development can be obtrusive at distances greater than 2 mi.




Source: Uranerz 2012.

Figure 3.3 BLM Visual Resource Areas Within and Near the Hank Unit Project Area.

## 3.10 WATER RESOURCES

### 3.10.1 Surface Water Resources

#### 3.10.1.1 Introduction

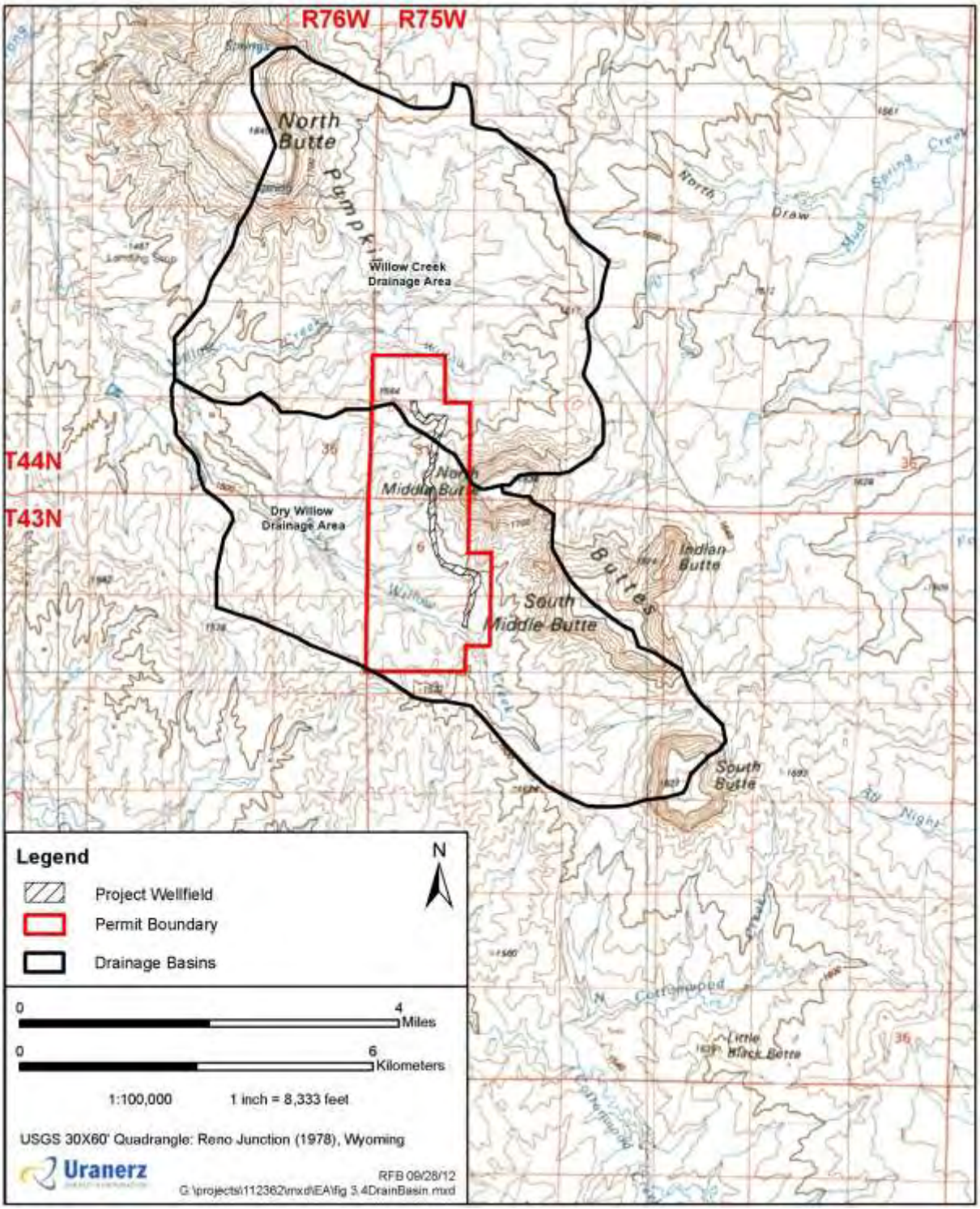
Surface water in the vicinity of the proposed Hank Unit project area includes ranch and CBNG stock ponds and ephemeral streams that flow as a direct result of rainfall or snowmelt. The ephemeral channels in the Project Area flow approximately 12 mi west of the Hank Unit into the Powder River, a tributary of the Yellowstone River in eastern Montana. The WDEQ WQD categorizes the channels within the Hank Unit as Class 3B waters. Such waters are generally intermittent, ephemeral, or isolated waters that support aquatic life other than fish and may include adjacent wetlands along stream channels (NRC 2009a).

#### 3.10.1.2 Drainage Basins

The Hank Unit is located in Willow Creek and Dry Willow Creek drainage areas which encompass approximately 16,300 acres, with an elevation range of 4,995 to 6,022 ft AMSL (Uranerz 2012) (Figure 3.4). The northern approximately one-quarter of the Hank Unit drains west into Willow Creek, and the remaining three-quarters drains northwest into Dry Willow Creek. Dry Willow Creek merges with Willow Creek, a tributary of Powder River.

#### 3.10.1.3 Surface Water Features

There are no perennial streams within the Hank Unit, although there are approximately 49,649 linear ft of ephemeral channels and washes (Uranerz 2012). Channels are deeply incised at the western boundary of the Project Area, with banks ranging 10 to 50 ft high. Typical channel widths range 20 to 30 ft at the western boundary and 1 to 2 ft over the rest of the Project Area. Direction of flow generally occurs from east to west. There are no wetland areas or any natural or man-made surface water features within the Project Area.




Source: Uranerz 2012.

Figure 3.4 Hank Unit Project Area Surface Water Drainage Basins.

3.10.1.4 Surface Water Flow

All channels within the Hank Unit are ephemeral; they are dry during the majority of the year, and only flow in response to precipitation or snowmelt. The rolling terrain and deeply incised channels generally yield confined flow patterns without defined floodplains.

3.10.1.5 Surface Water Quality

Surface water quality samples were collected from the area in 1978 and 1979, and more recently from the site in 2008 and 2009 (Table 3.10). The 2008 data included surface water samples from both upstream and downstream of the Project Area from channels with flowing water, namely Dry Willow Creek (Uranerz 2012). The first sample location was in Dry Willow Reservoir, 0.5 mi upstream of the southern portion of the Hank Unit. The second sample location was in Dry Willow Creek, 0.1 mi downstream of the southwest boundary. Analytical results for all surface water sample sites are presented in Table 3.10. Surface water quality measured on Dry Willow Creek downstream of the Hank Unit did not exceed any Wyoming Class of Use standards or EPA primary or drinking water standards in 2008. However, the results of historical samples collected in 1979 on Dry Willow Creek exceeded the Wyoming Class I and EPA secondary drinking water standards for total dissolved solids (TDS), sulfate, and uranium. In 1978, a sample of the Dry Willow Reservoir did not exceed any Wyoming or EPA drinking water standards. However, it did exceed the Wyoming Class I and EPA secondary drinking water standards for iron in 1979.

### 3.10.2 Groundwater Resources

3.10.2.1 Introduction

Uranerz identified a series of sandstone ("sand") layers in the upper portion of the Wasatch Formation in the Project Area, and labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands (Figure 3.2). The sands within the Hank Unit are considered aquifers in the Project Area. The intervening shales that separate these sands are considered

Table 3.10 Surface Water Quality In the Hank Unit Project Area.

| **Dry Willow Reservoir** | | | |
|---|---|---|---|
| **Water Quality Parameter (units)** | **10/22/1978** | **4/21/1979** | **2/26/2009** |
| Bicarbonates as $HCO_3$ (mg/L) | 116 | 106 | 178 |
| Carbonates as $CO_3$ (mg/L) | --- | 19 | <1.0 |
| Chloride (mg/L) | 2.2 | 1.5 | 1 |
| Fluoride (mg/L) | 0.17 | 0.1 | 0.1 |
| pH (s.u.) | --- | --- | 7.82 |
| Total Dissolved Solids (mg/L) | 174 | 174 | 195 |
| Sulfate (mg/L) | 20 | 19 | 2 |
| Radium-226 (pCi/L) | 0.6 | 0.9 | 0.1 |
| Radium-226(e) (pCi/L) | 0.6 | 1.4 | 0.1 |
| Radium-228 (pCi/L) | --- | --- | 0.4 |
| Radium-228(e) (pCi/L) | --- | --- | 0.7 |
| Nitrogen, Ammonia as N (mg/L) | 0.5 | 0.1 | <0.05 |
| Nitrogen, Nitrate + Nitrate as N (mg/L) | <0.0 | 0.3 | 1.4 |
| Aluminum (mg/L) | <0.10 | <0.10 | <0.10 |
| Arsenic (mg/L) | <0.003 | <0.003 | 0.002 |
| Barium (mg/L) | 0.1 | <0.01 | <0.10 |
| Boron (mg/L) | 0.6 | <0.10 | <0.10 |
| Cadmium (mg/L) | <0.010 | <0.010 | <0.005 |
| Calcium (mg/L) | 30 | 40 | 19 |
| Chromium (mg/L) | <0.010 | <0.010 | <0.050 |
| Copper (mg/L) | 0.01 | <0.01 | <0.01 |
| Iron (mg/L) | 0.03 | 0.57 | 0.08 |
| Lead (mg/L) | <0.010 | <0.010 | <0.001 |
| Magnesium (mg/L) | 5.7 | 6.6 | 5 |
| Manganese (mg/L) | <0.01 | 0.01 | <0.01 |
| Mercury (mg/L) | <0.0005 | <0.0005 | <0.0010 |
| Molybdenum (mg/L) | <0.1 | <0.1 | <0.1 |
| Nickel (mg/L) | 0.02 | <0.010 | <0.050 |
| Potassium (mg/L) | 5 | 4.2 | 8 |
| Selenium (mg/L) | <0.003 | <0.003 | <0.001 |
| Sodium (mg/L) | 5.2 | 6.3 | 35 |
| Uranium (mg/L) | 0.0086 | <0.0010 | 0.0008 |
| Vanadium (mg/L) | <0.100 | <0.100 | <0.100 |
| Zinc (mg/L) | 0.02 | 0.01 | <0.01 |

Table 3.10 (Continued)

| **Dry Willow Creek** | | | |
|---|---|---|---|
| **Water Quality Parameter (units)** | **4/18/1979** | **6/10/2008** | **3/20/2009** |
| Bicarbonates as $HCO_3$ (mg/L) | 316 | 75 | 179 |
| Carbonates as $CO_3$ (mg/L) | 0 | <1.0 | <1.0 |
| Chloride (mg/L) | 7.4 | <1.0 | 8 |
| Fluoride (mg/L) | 0.3 | <0.10 | 0.2 |
| pH (s.u.) | -- | 6.89 | 7 |
| Total Dissolved Solids (mg/L) | 1190 | 184 | 443 |
| Sulfate (mg/L) | 631 | 3 | 83 |
| Radium-226 (pCi/L) | 0.4 | -0.1 | 0 |
| Radium-226(e) (pCi/L) | 0.3 | --- | 0.1 |
| Radium-228 (pCi/L) | --- | 0.3 | 1.6 |
| Radium-228(e) (pCi/L) | --- | --- | 0.8 |
| Nitrogen, Ammonia as N (mg/L) | 0.1 | 0.1 | 0.41 |
| Nitrogen, Nitrate + Nitrate as N (mg/L) | 0.2 | 0.1 | <0.1 |
| Aluminum (mg/L) | <0.10 | <0.10 | <0.10 |
| Arsenic (mg/L) | 0.002 | 0.001 | 0.003 |
| Barium (mg/L) | <0.10 | <0.10 | <0.10 |
| Boron (mg/L) | <0.10 | <0.10 | 0.1 |
| Cadmium (mg/L) | <0.010 | <0.005 | <0.005 |
| Calcium (mg/L) | 242 | 20 | 72 |
| Chromium (mg/L) | <0.010 | <0.050 | <0.050 |
| Copper (mg/L) | <0.01 | <0.01 | <0.01 |
| Iron (mg/L) | 0.24 | 0.25 | 0.13 |
| Lead (mg/L) | <0.010 | 0.002 | <0.001 |
| Magnesium (mg/L) | 53 | 3 | 14 |
| Manganese (mg/L) | 0.03 | 0.04 | 0.02 |
| Mercury (mg/L) | <0.0005 | <0.0010 | <0.0010 |
| Molybdenum (mg/L) | <0.1 | <0.1 | <0.1 |
| Nickel (mg/L) | <0.010 | <0.050 | <0.050 |
| Potassium (mg/L) | 5.4 | 14 | 16 |
| Selenium (mg/L) | <0.003 | 0.003 | 0.003 |
| Sodium (mg/L) | 76 | <1.000 | 5 |
| Uranium (mg/L) | 0.054 | 0.001 | 0.0064 |
| Vanadium (mg/L) | <0.100 | <0.100 | <0.100 |
| Zinc (mg/L) | 0.01 | <0.01 | 0.01 |

Source: Uranerz 2012.

L = liter; mg = milligrams; pCi = picoCuries; s.u. = standard units.

aquitards (i.e., a hydraulically impermeable layer or layer of material with low permeability) that have been identified by the overlying and underlying sands. For example, the shale separating the H and G Sands is designated as the HG aquitard.

The depth at which groundwater is first encountered across the Project Area varies with, and depends on, surface topography. The specific sand that acts as the surficial aquifer similarly varies across the Project Area depending on the outcropping of these sands and the surface topography. In accordance with NRC and WDEQ LQD permitting processes, Uranerz has collected a great deal of groundwater-level data for deeper aquifers associated with the uranium production zone. However, less groundwater-level data are available to define depth to shallow groundwater across the Hank Unit, and additional wells are planned to better define shallow groundwater levels in this area. The H Sand should be the surficial aquifer in this area, with depth to groundwater ranging between 50 ft in the low-lying areas west of the Hank Unit to approximately 200 ft along the eastern border of the Hank Unit (Uranerz 2012). Potentiometric data indicate that groundwater flow in the H Sand at the Hank Unit is expected to be in a westerly direction. The Willow Creek and Dry Willow Creek alluvial materials in the Hank Unit are not expected to contain water except during short periods of time after runoff events.

Groundwater in the surficial aquifers is likely unconfined, although portions of these aquifers may be locally confined. Those sands that underlie the surficial aquifer, particularly at depth, are generally confined (Uranerz 2012).

#### 3.10.2.2 Uranium-bearing Aquifer

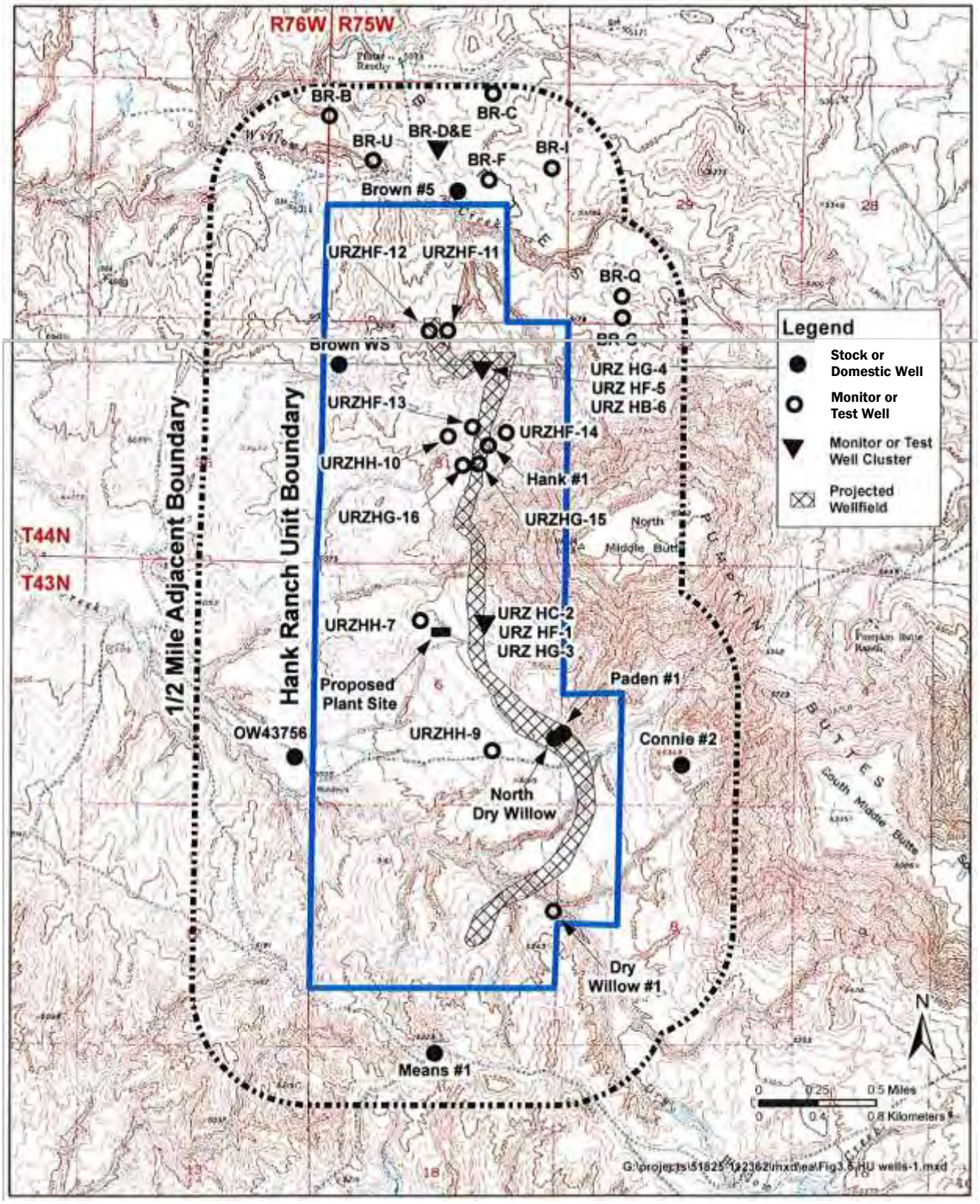
The principal uranium "ore" zone sand unit within the Project Area is the F Sand, approximately 20 to 120 ft thick and 200 to 600 ft below the ground surface. The water levels in the F Sand fall below the base of the overlying GF aquitard in the northern portion of the Hank Unit, and slightly above in the southern portion. Therefore, the F Sand is both an unconfined and slightly confined aquifer across the Hank Unit. The F Sand is underlain by the FC aquitard and the C Sand. The C Sand has been designated as the aquifer underlying the production zone in areas where it is present. The C Sand at the Hank Unit is about 10 to 60 ft thick, discontinuous, and

composed of fine- to very fine-grained sand. The C Sand is not always present below the F Sand at the Hank Unit. Where it is not, the B Sand underlies the production sand. The FC aquitard is composed of mudstones, siltstones, gray carbonaceous shale, and poorly developed coal. This aquitard ranges 45 to 110 ft thick, depending on the presence of the C Sand. Where the C Sand is not present, it merges with the CB aquitard overlying the B Sand (Uranerz 2012).

Water levels have been measured in wells installed in the Project Area to define the direction and gradient of groundwater movement. The locations of wells installed at the Hank Unit are shown in Figure 3.5. While wells have been installed in many of the identified sand aquifers, these wells have been concentrated in the production zones at the Hank Unit. Based on these water level measurements, a potentiometric map has been presented for the A Sand at the Hank Unit (Uranerz 2012). This potentiometric map indicates that groundwater in the A Sand is flowing northwest with an average gradient of 0.0033. Based on this gradient, an effective porosity of 0.05, and an average hydraulic conductivity of 0.5 ft/day, the average rate of groundwater flow is estimated to be 0.033 ft/day (Uranerz 2012). This map indicates water in the F Sand is flowing west with an average gradient of 0.005. Based on this gradient, an effective porosity of 0.05, and an average hydraulic conductivity of 0.6 ft/day, the average rate of groundwater flow in the F Sand aquifer across the proposed project area is estimated to be 0.06 ft/day. Similar gradients and flow directions have been observed in the B and C Sand aquifers as in the A and F Sand aquifers. The shallow sands in the Hank Unit Project Area are more likely to be affected by local topographical changes than the deeper sands. Water level data for the G Sand in the Hank Unit show a much steeper groundwater gradient (Uranerz 2012).

#### 3.10.2.3 Hydrogeological Characteristics

The hydraulic properties of the recovery aquifers, as well as the associated underlying and overlying aquifers, have been evaluated in the Project Area using both multiwell pumping tests and single-well tests. Cleveland Cliffs Iron Company previously conducted aquifer testing in 1978 and 1979 during exploration work in the Pumpkin Buttes area, and data from these sampling efforts were reviewed and incorporated into the state permitting and federal licensing




Source: Uranerz 2012.

Figure 3.5 Location of Existing Wells In and Near the Hank Unit Project Area.

applications. Uranerz conducted additional aquifer testing in 2006 and 2007 and this information was included in the same documents (Uranerz 2012).

The hydraulic properties of the F Sand in the Hank Unit varied greatly from 0.14 to 9.4 ft/day. The applicant estimated hydraulic conductivity of 0.6 ft/day best represents the majority of the F Sand in this area. The water level in the production zone at the Hank Unit is near the top of the sand; therefore, the F Sand is not fully saturated. Accordingly, the F Sand aquifer is an unconfined aquifer. The primary storage property for an unconfined aquifer is specific yield. Uranerz' estimated specific yield of 0.05 ft/day best represents the F Sand in this area. Test results from two G Sand wells yielded hydraulic conductivity measurements for this sand of 0.005 and 0.022 ft/day. A single measurement in the C Sand indicated a hydraulic conductivity value of 0.025 ft/day. Two single-well tests in the B Sand yielded hydraulic conductivity measurements of 0.38 and 2.2 ft/day (Uranerz 2012).

3.10.2.4 Level of Vertical Confinement

Vertical permeabilities of the aquitards in the PRB have been defined at numerous locations, including just north of the Hank Unit during the permitting of Cameco Resources' North Butte uranium ISR Project, approximately 1 mile northeast of the Hank Unit Project Area. These permeabilities have been measured using multiwell pumping tests, a variety of analytical methods, and laboratory measurements. Uranerz reported that data and analysis presented in Cameco Resources' North Butte SML and Mine Permit indicate the vertical permeability for the aquitard separating the F and C Sands was approximately $1.1 \times 10^{-4}$ (0.00011) ft/day. A second multi-well test at North Butte indicated the aquitard permeability between the A Sand and the 1 Sand was about $1.2 \times 10^{-4}$ (0.00012) ft/day. Laboratory measurements of permeabilities of samples from two aquitards were submitted for North Butte and these permeabilities varied from 1.8 to $3.7 \times 10^{-5}$ (0.000018 to 0.000037) ft/day. NRC staff found these data sufficient to demonstrate the confinement of the uranium-bearing sands in the Project Area. Aquifer confinement would be further verified by Uranerz at each of the wellfields during the required wellfield multiwell pumping tests (Uranerz 2012).

3.10.2.5 Groundwater Quality

In Wyoming, the quality of groundwater is measured against either EPA Drinking Water Standards (40 CFR 142 and 143), which establish Maximum Contaminant Levels (MCLs) for specific chemical constituents, or Wyoming Groundwater Quality standards. The Wyoming standards are based on ambient water quality, and divided into six classes (WDEQ WQD 2005):

- Class I is defined as suitable for domestic use;
- Class II is defined as suitable for agriculture;
- Class III is defined as suitable for livestock;
- Class IV is defined as suitable for industrial use;
- Class V is defined as suitable for mineral commercial; and,
- Class Special (A) is defined as suitable for fish and aquatic life.

For uranium ISR operations to be conducted in a mineralized aquifer within the permit boundaries of a proposed ISR area, the uranium-bearing aquifer must be declared an exempted aquifer under the *Safe Drinking Water Act* (SDWA), in compliance with 40 CFR 146. In order to obtain the aquifer exemption, Uranerz is required to obtain a Class III UIC permit from the WDEQ LQD, and WDEQ LQD must obtain concurrence from EPA. Wyoming is a primacy state under both Sections 1422 and 1425 of the SDWA; under Section 1422, WDEQ LQD (rather than EPA) is the delegated authority for regulating Class III UIC facilities for ISR projects. The WDEQ LQD authorization is for the injection of the lixiviant into the production zone as discussed earlier (Section 2.0). Even though WDEQ LQD has primacy to issue the Class III UIC permit for mining operations, WDEQ must still obtain concurrence from EPA for the aquifer exemption. As discussed in Section 2.0, WDEQ LQD has obtained concurrence from EPA for the aquifer exemption, and has issued the Class III UIC permit to Uranerz as part of the state Permit to Mine (PT778) issued on December 29, 2010 (WDEQ LQD 2010).

As part of the federal licensing and state permitting processes, Uranerz evaluated the groundwater quality in the Project Area by sampling numerous wells in all aquifers to be affected in the area. The resulting groundwater quality data are presented in Table 3.11. The data in this summary have been grouped for the F Sand, the B and C Sands, and the G Sand.

Table 3.11 Water Quality of Specific Aquifers In the Hank Unit Project Area.[1]

| Water Quality Parameter (units) | G Sand Overlying Aquifer | F Sand Ore Zone Aquifer | B and C Sands Underlying Aquifer | Water Quality Standards |
|---|---|---|---|---|
| Bicarbonates as $HCO_3$ (mg/L) | 151.1 | 171.43 | 120.65 | na |
| Carbonates as $CO_3$ (mg/L) | 8.8 | 0.63 | 3.43 | na |
| Chloride (mg/L) | 7.6 | 5.53 | 53.22 | 250 |
| Conductivity (umhos/cm) | 804.9 | 1426.96 | 1162.68 | na |
| Fluoride (mg/L) | 0.2486 | 0.15 | 0.174 | 2.0-4.0 |
| pH (s.u.) | 8.4 | 7.82 | 8.15 | 6.5-8.5 |
| Total Dissolved Solids (mg/L) | **504.4** | **1020.95** | **797.11** | 500 |
| Sulfate (mg/L) | 243.1 | **597.33** | **466.24** | 250 |
| Radium-226 (pCi/L) | 0.73 | **44.6** | **15.44** | 5.0 |
| Nitrogen, Ammonia as N (mg/L) | 0.103 | 0.05 | **0.627** | 0.5 |
| Nitrogen, Nitrate + Nitrate as N (mg/L) | 0.05 | 0.05 | 0.069 | 10 |
| Aluminum (mg/L) | **0.425** | **0.05** | 0.095 | 0.05 to 0.2 |
| Arsenic (mg/L) | 0.0033 | 0.0068 | 0.002 | 0.01 |
| Barium (mg/L) | 0.055357 | 0.05 | 0.052 | 2.0 |
| Boron (mg/L) | 0.24643 | 0.08 | 0.110 | na |
| Cadmium (mg/L) | 0.00329 | 0.0034 | 0.004 | 0.005 |
| Calcium (mg/L) | 48.6 | 99.77 | 53.22 | na |
| Chromium (mg/L) | 0.0221 | 0.02 | 0.016 | 0.1 (total) |
| Copper (mg/L) | 0.00714 | 0.02 | 0.012 | 1.0 |
| Iron (mg/L) | **0.499** | **0.30** | 0.109 | 0.3 |
| Lead (mg/L) | **0.0231** | 0.01 | 0.01 | 0.015 |
| Magnesium (mg/L) | 9.8 | 24.37 | 10.94 | na |
| Manganese (mg/L) | **0.051** | **0.07** | 0.025 | 0.05 |
| Mercury (mg/L) | 0.00047 | 0.0005 | 0.001 | 0.002 |
| Molybdenum (mg/L) | 0.05 | 0.05 | 0.069 | na |
| Nickel (mg/L) | 0.0232 | 0.02 | 0.02 | 0.1 |
| Potassium (mg/L) | 6.0 | 7.12 | 6.89 | na |
| Selenium (mg/L) | 0.0026 | 0.02 | 0.00 | 0.05 |
| Sodium (mg/L) | 110.9 | 185.73 | 189.49 | na |
| Uranium (mg/L) | 0.009475 | **0.15** | **0.06** | 0.03 |
| Vanadium (mg/L) | 0.0363 | 0.05 | 0.05 | na |
| Zinc (mg/L) | 0.021 | 0.02 | 0.23 | 5.0 |

Source: NRC 2011.

[1] EPA Drinking Water Standards - 40 CFR 142 and 143, Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water. **Bolded values exceed either EPA or Wyoming Class I Groundwater Standards**. na = not applicable..

Included in this summary table are EPA Drinking Water Standards (40 CFR 142 and 143) and Wyoming Class I, Domestic Ground Water Quality standards.

TDS in the G Sand averaged 504 mg/L, with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers were generally low, averaging 0.009 mg/L. Radium concentrations in the G Sand aquifer average 0.73 picoCuries per liter (pCi/L) with a maximum measured concentration of 1.9 pCi/L. The G Sand aquifer would meet the Wyoming Class II and III groundwater quality standards, and be suitable for agriculture and livestock watering but not Class I standards for domestic use.

Groundwater quality data for the F Sand indicate average TDS concentrations greater than 1,000 milligrams per liter (mg/L); sodium, calcium, bicarbonate, and sulfate are the major dissolved constituents. Uranium concentrations were measured in this uranium-bearing sand at an average of 0.15 mg/L, with a maximum concentration of 5.25 mg/L. Radium concentrations as high as 562 pCi/L were measured, with an average value of 445.6 pCi/L. Consequently, the F Sand does not meet the Wyoming Class I, II, or III groundwater quality standards for domestic, agriculture, or livestock use and exceeds the EPA MCL for domestic water quality standards for uranium.

The B and C Sands lie between the two production zones and are connected in some areas (Figure 3.4). TDS in these aquifers averaged 797 mg/L, with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers averaged 0.06 mg/L, with a maximum of 2.16 mg/L. Radium concentrations averaged 15 pCi/L, with a maximum of 128 pCi/L. Consequently, the water quality in the B and C Sands do not meet the Wyoming Class I, II, or III groundwater quality standards for domestic, agriculture, and livestock, and exceed the EPA MCL for domestic use for uranium.

#### 3.10.2.6 Current Groundwater Uses

Uranerz contacted the WSEO to identify all permitted water wells within a 3-mi radius of each Hank Unit production unit. Numerous wells were identified, including water wells associated with CBNG development, mining and aquifer monitoring, stock watering wells, and domestic

use. Excluding the monitoring and mining-related wells, all wells are used for livestock watering or domestic use through the use of windmills or electric well pumps. The depth of these wells generally ranges 180 to 1,000 ft bgs (Uranerz 2012).

The WSEO data indicates that there are no domestic water wells within the boundary of the Hank Unit; however, there are three domestic wells within 3 mi of the Hank Unit. Doughstick #3 and Garden Wells are located approximately 2.25 mi southwest and upgradient of the Hank Unit, and the Pumpkin Butte Ranch House well is approximately 1.25 mi east on the east side of North Middle Pumpkin Butte. WSEO data also indicates that there are three stock wells within the Hank Unit boundary, and approximately 36 wells used for livestock watering within a 3-mi radius of the Hank Unit with depths of 200 to 600 ft bgs. Several of these wells appear to be completed in the F Sand, while other wells are screened through multiple sands including the A, B, and C Sands (Uranerz 2012).

There are currently six producing CBNG wells within the Hank Unit and approximately 380 CBNG wells within 3 mi of the entire Nichols Ranch/Hank Project. Groundwater from CBNG operations is being collected and disposed of into a deep disposal well.

#### 3.10.2.7 Surrounding Aquifers

The Wasatch and Fort Union Formations are important aquifers for regional water supply. Except at outcrop areas, the Paleozoic aquifers are not usually used for water production, because they are either deeply buried or contain saline water (Uranerz 2012).

Based on the survey of water wells within a 3-mi radius of the Hank Unit project area, water supply wells are generally completed within 1,000 ft of the ground surface in the sands of the Wasatch Formation. The Fort Union Formation is not extensively used in this area as sufficient yields of groundwater are available from the shallower, overlying Wasatch Formation. Deep well injection has been proposed for the disposal of liquid effluent from the Project Area. Typically, deep well injection in the PRB occurs in the Upper Cretaceous Lance Formation (e.g., at Willow Creek uranium project) several thousand feet below the Lower Tertiary production

zones. Uranerz has received a UIC permit from WDEQ WQD for four deep disposal wells in the Hank Unit required for this project. WDEQ WQD and EPA would only grant such a permit if the applicant can demonstrate that liquid effluent could be safely isolated in a deep aquifer in accordance with applicable state and federal regulations. As required by WDEQ WQD UIC regulations, the deep disposal well would be completed (i.e., screened) into an approved subsurface formation, and operated according to specific permit requirements (Uranerz 2012).

## 3.11 WILDLIFE INCLUDING SPECIAL STATUS ANIMAL SPECIES

### 3.11.1 Wildlife and Fisheries

#### 3.11.1.1 Introduction

Uranerz conducted wildlife inventories in the Nichols Ranch/Hank Project Area and surrounding 3.2-km (2-mi) radius (subsequently referred to as the wildlife inventory area (WIA)) from April through July 2006 and in February 2007 (Uranerz 2012). The inventories included a ground-based big game survey, Greater Sage-Grouse (GSG) lek monitoring, raptor nest activity and productivity surveys, and aerial and ground-based bald eagle winter roost surveys. In addition, incidental sightings of big game, upland game birds, waterfowl and shorebirds, mammalian predators, lagomorphs, nongame and migratory birds, reptiles and amphibians, and TECP and special status species were recorded during on-site wildlife studies. Additional information provided by the BLM has been incorporated into this analysis. It should be noted that some raptor species are addressed under nongame/migratory birds; and some raptor species are addressed under special status species.

The vegetative communities in the Project Area provide suitable habitat for a wide variety of wildlife. Many species are yearlong residents of Wyoming, but some species (e.g., migratory birds, etc.) either are more abundant or occur only during migration or breeding periods.

3.11.1.2 Big Game

Formal big game winter surveys of the WIA were conducted in February 2007. The surveys were completed in accordance with WDEQ LQD regulations and policies, and wildlife biologists recorded the number of individuals, sex and age composition, and habitat type for each group of big game observed (Uranerz 2012). Opportunistic big game observations also were recorded during other wildlife surveys in the WIA. Two species of big game (pronghorn antelope and mule deer) were observed during the 2006 and 2007 wildlife and vegetation surveys in the WIA.

Pronghorn antelope mainly were observed in mixed grassland and sagebrush shrubland vegetation types. The majority (approximately 92%) of the Hank Unit is designated as winter/yearlong range by WGFD. Approximately 8% (the steep terrain associated with Pumpkin Buttes) is outside of any pronghorn range designated by WGFD (2010a). The WGFD has not designated any crucial winter range for pronghorn in the Hank Unit area because snow depth is typically not a limiting factor in this area (pers. comm., October 23, 2012, with Tom Bills, BLM BFO Environmental Coordinator). The nearest crucial winter range for pronghorn antelope is approximately 44 mi south-southwest of the Hank Unit.

The Pumpkin Buttes Antelope Herd Unit occupies 1,543 square miles ($mi^2$) and includes the entire WIA (Uranerz 2011). The 5-year population average from 2008 to 2012 was 28,211 individuals; there were 21,593 individuals in 2013, 20% above the population objective of 18,000 individuals (WGFD 2013a). The primary management issue for this herd unit is achieving adequate harvest, which has been affected both by the large percentage of the herd unit held in private landownership and the negative effect CBNG development has had on hunter access (WGFD 2013a).

During the 2006-2007 big game surveys, mule deer generally were observed in mixed sagebrush grassland and juniper outcrop vegetation types within the WIA (Uranerz 2012). The majority (99.5%) of the Hank Unit is designated as mule deer winter/yearlong range, and 0.5% is designated as yearlong mule deer range. The yearlong range is concentrated along the eastern

boundary of the Hank Unit in the vicinity of Pumpkin Buttes. The nearest crucial winter range for mule deer is approximately 44.0 mi due west of the Hank Unit.

Mule deer in the WIA are part of the Pumpkin Buttes Mule Deer Herd Unit, which includes the entire study area and occupies 2,706 $mi^2$, of which 79% is private surface, 15% BLM surface, and 6% state surface (WGFD 2013b). The 5-year population average from 2008 to 2012 was 10,275 individuals; there were 10,080 individuals in 2013, 22.5% below the population objective of 13,000 individuals (WGFD 2013b). The population had been below the objective for the previous 5 years (WGFD 2013b). According to the WGFD, drought conditions and reduced habitat conditions in the area are likely contributors to the reduced mule deer population (pers. comm., January 2, 2013, with Lynn Jahnke, WGFD biologist, Sheridan, Wyoming). As with pronghorn antelope in the area, the primary management issue for this herd unit is achieving adequate harvest as a result of limited access, which has been affected both by the large percentage of the herd unit held in private landownership and the negative effect CBNG development has had on hunter access (WGFD 2013b).

#### 3.11.1.3 Upland Game Birds

During the wildlife inventories conducted for Uranerz from 2006 through 2009, two species of upland game birds (GSG and gray partridge) were recorded in the Hank Unit WIA (Uranerz 2011). In addition, chukar, ring-necked pheasant, sharp-tailed grouse, wild turkey, and mourning dove are known to breed within the Project Area latilong (WGFD 2004, as cited in Uranerz 2012), and individuals of those species may breed within or pass through the WIA. The WGFD defines a "latilong" as a rectangular shaped parcel of land covering one degree of latitude by one degree of longitude (WGFD 2004).

Although sharp-tailed grouse are noted as breeding within the Project Area latilong (WGFD 2004), based on data from the WGFD Buffalo and Casper Field Offices, the nearest identified lek for this species (the Iberlin lek) is approximately 26 mi north-northwest of the project area (WGFD 2009). Thus, use of the WIA by sharp-tailed grouse is probably infrequent.

GSG are considered a federal candidate species, as well as a Wyoming species of concern and a BLM-SS. On March 5, 2010, the USFWS published its 12-month finding for the petition to list the GSG as threatened or endangered (USFWS 2010). The USFWS found that listing was warranted but was precluded by higher priority listing actions and, as a result, the species is a candidate for listing. GSG are addressed in more detail in Section 3.11.2.2.

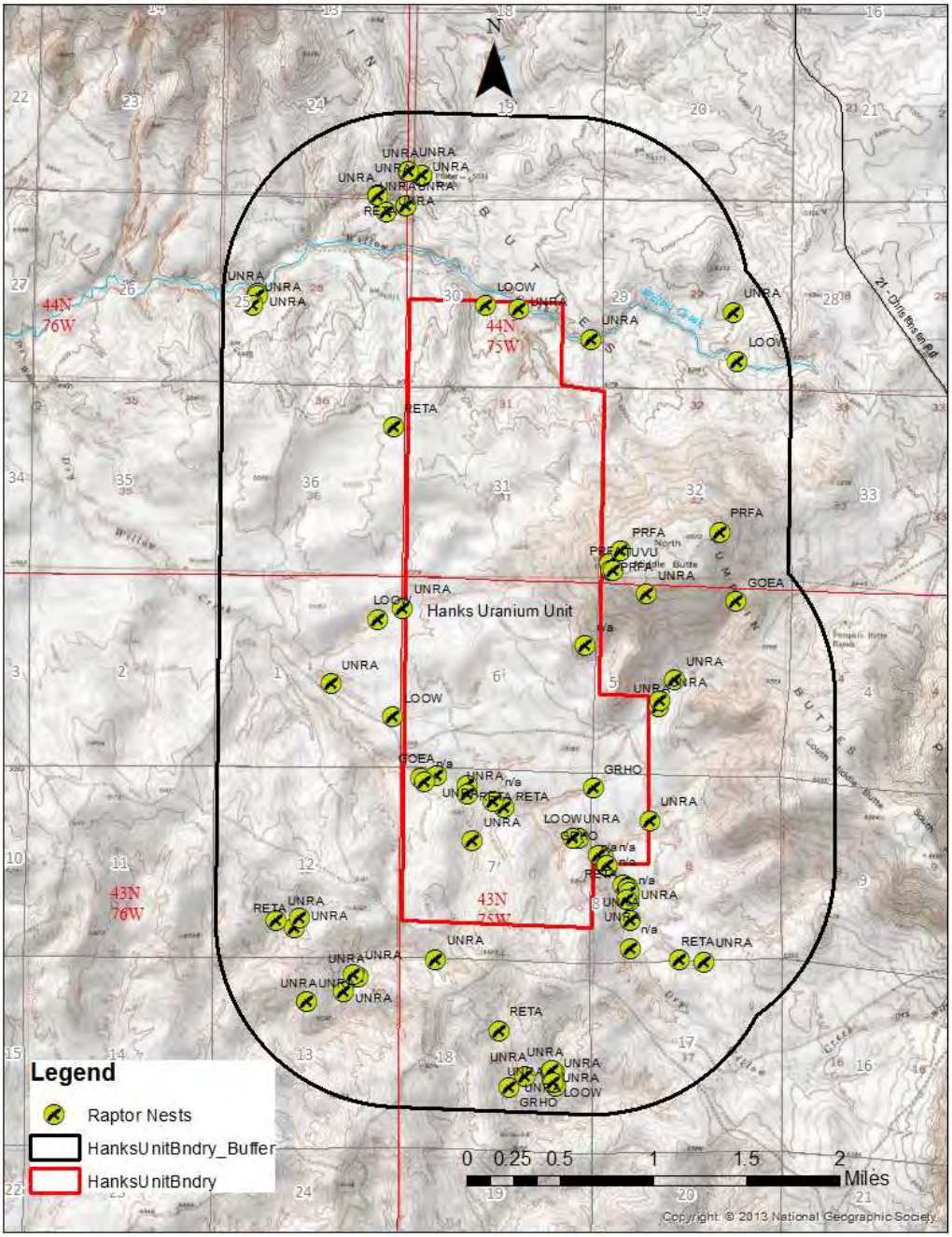
#### 3.11.1.4 Waterfowl and Shorebirds

Limited habitat (i.e., waterbodies, wetlands, streams) exists on or in the vicinity of the Project Area for waterfowl and shorebirds; therefore, formal surveys for these species were not conducted as part of the baseline wildlife studies (Uranerz 2012). Species that may infrequently occur within the WIA include various grebes, herons, swans, geese, ducks, mergansers, rails, plover, yellowlegs, sandpipers, phalaropes, gulls, and terns. WYNDD (2006, as cited in Uranerz 2012) indicated that American dippers also may occur within the Project Area vicinity; however, dippers frequent swift mountain streams, which are absent from the Project Area and vicinity, and the species is not noted to occur within the Project Area's latilong (WGFD 2004).

#### 3.11.1.5 Nongame/Migratory Birds (Including Non-sensitive Raptors)

The BLM BFO raptor database through 2014 shows 79 known raptor or large bird nests within 1 mi of the Hank Unit and this information is presented on Figure 3.6. Based on the BLM data, there are eight red-tailed hawk nests, six long-eared owl nests, three great horned owl nests, four prairie falcon aeries, two golden eagle nests, one turkey vulture nest, and 55 nests of unknown raptor or other large birds such as ravens.

Eight raptor species were observed during on-site wildlife and vegetation studies for Uranerz: bald eagle, red-tailed hawk, rough-legged hawk, golden eagle, American kestrel, prairie falcon, great horned owl, and long-eared owl (Uranerz 2012). With the exception of rough-legged hawks, which winter in the area but migrate to northern latitudes to breed, the remaining abovementioned species may breed within or adjacent to the study area, provided that suitable nesting habitat exists. Based on WGFD (2004) and Uranerz (2012), northern harrier, Cooper's




Source: BLM.

Note: GOEA = golden eagle; GRHO = great-horned owl; LOOW = long-eared owl; PRFA = prairie falcon; RETA = red-tailed hawk; TUVU = turkey vulture; n/a and UNRA = unknown raptor.

Figure 3.6 Location of Known Raptor Nests In and Near the Hank Unit Project Area.

hawk, Swainson's hawk, ferruginous hawk, merlin, burrowing owl, and short-eared owl also may breed in the vicinity of the project area, and osprey, sharp-shinned hawk, peregrine falcon, barn owl, snowy owl, and northern saw-whet owl occasionally may pass through the area.

Several bald eagle winter roosts have been identified by the BLM in the general vicinity of the Hank Unit Project Area (BLM 2003b). These roost sites were identified by the BLM as bald eagle winter roost sites, although these sites are also used by golden eagles. The bald eagle is a Wyoming- and BLM-SS and is discussed in Section 3.11.2.2.

No formal surveys for other nongame/migratory birds were conducted, although incidental sightings were recorded during the course of the wildlife and vegetation studies for the project. Only three species were observed during those studies: horned lark, black-billed magpie, and Brewer's sparrow (a BLM-SS).

Nongame/migratory avian species groups that may occur within the Project Area and the associated WIA include (but are not limited to) swifts, hummingbirds, woodpeckers and sapsuckers, flycatchers, swallows, jays, corvids, chickadees, nuthatches, wrens, thrushes, mimids, thrashers, waxwings, shrikes, vireos, warblers, grosbeaks, towhees, sparrows, buntings, longspurs, blackbirds, and finches. Local, state, or federal species of concern or special status are discussed in further detail in Section 3.11.2.

#### 3.11.1.6 Other Mammals

Incidental sightings of mammals were recorded during the 2006 and 2007 wildlife inventories, but formal species-specific surveys were not (Uranerz 2012). Three species of mammalian predators were observed within the Hank Unit (bobcat, badger, and coyote), and another predator (a swift fox, BLM-SS) was observed approximately 8.0 km (5.0 mi) east of the Project Area (NRC 2011). Desert cottontails and white-tailed jackrabbits were observed in a variety of vegetative communities within the WIA, with the highest concentrations associated with disturbed areas (e.g., CBNG wells, road ROWs). Thirteen-lined ground squirrel and black-tailed prairie dog also were observed (Uranerz 2012). A total of 941.9 acres of black-tailed prairie dog

colonies has been identified within the WIA, with 5.6 acres of this within the Hank Unit (Figure 3.6). The black-tailed prairie dog is a BLM-SS and Wyoming species of concern and is discussed further in Section 3.11.2.2. Based on geographic range and habitat preference, other mammals that might occur within or move through the WIA include various shrews, bats, lagomorphs, chipmunks, sciurids, pocket gophers, mice, woodrats, voles, foxes, weasels, and skunks, as well as Ord's kangaroo rat, porcupine, raccoon, and mountain lion.

#### 3.11.1.7 Amphibians and Reptiles

Although formal surveys for amphibians and reptiles were not conducted in association with the Proposed Action, two species of reptiles (prairie rattlesnake and bullsnake) were incidentally observed during wildlife and vegetation baseline surveys. Prairie rattlesnakes were observed in juniper outcrop and bottomland vegetation approximately 6 mi west of the Project Area. One bullsnake was observed along a road in the northern portion of the Hank Unit (Uranerz 2012). Additional reptile and amphibian species that may occur in the vicinity of the WIA include tiger salamander, northern leopard frog, several toad species, western painted turtle, greater short-horned lizard, and plains hognose and wandering garter snakes (WGFD 2004; Uranerz 2012). Special status or TEPC amphibians and reptiles species are discussed in Section 3.11.2.

#### 3.11.1.8 Fisheries

All of the surface water features in the Hank Unit Project Area are ephemeral in nature, and only flow in response to snowmelt or precipitation events. There are no fisheries in the Project Area and this topic will not be discussed further in this EA.

### 3.11.2 Special Status Animal Species

#### 3.11.2.1 Introduction

Table 3.12 presents a list of animal species that are federally-designated under the ESA, Wyoming BLM-SS (BLM 2012b), and species of greatest conservation needs in Wyoming

Table 3.12 Special Status Animal Species with the Potential to Occur Within or Near the Hank Unit Project Area.[1]

| Scientific Name | Common Name | ESA Status[2] | Sensitivity Status[3] | Comments[4] |
|---|---|---|---|---|
| **Mammals** | | | | |
| *Corynorhinus townsendii* | Townsend's big-eared bat | -- | SGCN, BLM-SS | Uncommon flythrough |
| *Eptesicus fuscus* | Big brown bat | -- | SGCN | Uncommon flythrough |
| *Euderma maculatum* | Spotted bat | -- | SGCN, BLM-SS | Uncommon flythrough |
| *Myotis ciliolabrum* | Western small-footed myotis bat | -- | SGCN | Uncommon flythrough |
| *Myotis evotis* | Long-eared myotis bat | -- | SGCN, BLM-SS | Uncommon flythrough |
| *Myotis lucifugus* | Little brown myotis bat | -- | SGCN | Potential uncommon flythrough |
| *Myotis thysanodes* | Fringed bat | -- | SGCN, BLM-SS | Uncommon flythrough |
| *Myotis volans* | Long-legged myotis bat | -- | SGCN | Uncommon flythrough |
| *Lasiurus cinereus* | Hoary bat | -- | SGCN | Uncommon flythrough |
| *Lasionycteris noctivagans* | Silver-haired bat | -- | SGCN | Uncommon flythrough |
| *Spermophilus elegans* | Wyoming ground squirrel | -- | SGCN | Not known to occur within the project area |
| *Cynomys ludovicianus* | Black-tailed prairie dog | -- | SGCN, BLM-SS | Several colonies known to occur within and adjacent to the project area |
| *Perognathus fasciatus* | Olive-backed pocket mouse | -- | SGCN | Not known to occur within the project area |
| *Microtus ochrogaster* | Prairie vole | -- | SGCN | Not known to occur within the project area |
| *Vulpes velox* | Swift fox | -- | SGCN, BLM-SS | Records of an observation approximately 5 mi east of the project area |
| *Mustela nigripes* | Black-footed ferret | E | SGCN | Black-tailed prairie dog colonies in project area, but surveys are not required by USFWS (2004) |
| **Birds** | | | | |
| *Gavia immer* | Common loon | -- | SGCN | Potential uncommon flythrough |

Table 3.12 (Continued)

| Scientific Name | Common Name | ESA Status[2] | Sensitivity Status[3] | Comments[4] |
|---|---|---|---|---|
| **Birds** | | | | |
| *Aechmophorus occidentalis* | Western grebe | -- | SGCN | Potential uncommon flythrough |
| *Aechmophorus clarkii* | Clark's grebe | -- | SGCN | Potential uncommon flythrough |
| *Pelecanus erythrorynchos* | American white pelican | -- | SGCN | Potential uncommon flythrough |
| *Botaurus lentiginosus* | American bittern | -- | SGCN | Potential uncommon flythrough |
| *Ardea herodias* | Great blue heron | -- | SGCN | Presence limited by paucity of wetlands; potential flythrough |
| *Egretta thula* | Snowy egret | -- | SGCN | Potential uncommon flythrough |
| *Nycticorax nycticorax* | Black-crowned night heron | -- | SGCN | Potential uncommon flythrough |
| *Plegadis chihi* | White-faced ibis | -- | SGCN, BLM-SS | Potential uncommon flythrough |
| *Cygnus buccinator* | Trumpeter swan | -- | SGCN, BLM-SS | Potential uncommon flythrough |
| *Aythya valisineria* | Canvasback | -- | SGCN | Presence limited by paucity of wetlands; potential flythrough |
| *Aythya americana* | Redhead | -- | SGCN | Presence limited by paucity of wetlands; potential flythrough |
| *Aythya affinis* | Lesser scaup | -- | SGCN | Potential uncommon flythrough |
| *Bucephala islandica* | Barrow's goldeneye | -- | SGCN | Potential uncommon flythrough |
| *Rallus limicola* | Virginia rail | -- | SGCN | Potential uncommon flythrough |
| *Accipiter gentilis* | Northern goshawk | -- | SGCN; BLM-SS | Potential uncommon flythrough |
| *Haliaeetus leucocephalus* | Bald eagle | DL | SGCN, BLM-SS | Known winter roost(s) are located within the Hank Unit |
| *Buteo swainsoni* | Swainson's hawk | -- | SGCN | Potential nesting and foraging habitat in the project area |
| *Buteo regalis* | Ferruginous hawk | -- | SGCN, BLM-SS | Potential nesting and foraging habitat in the project area |
| *Falco columbarius* | Merlin | -- | SGCN | Potential nesting and foraging habitat in the project area |
| *Falco peregrinus anatum* | American peregrine falcon | DL | SGCN, BLM-SS | Potential uncommon flythrough |
| *Centrocercus urophasianus* | Greater sage-grouse | C | SGCN, BLM-SS | Known to occur in the project area and 6 known leks are located within 2 mi of the project area. |

Table 3.12 (Continued)

| Scientific Name | Common Name | ESA Status[2] | Sensitivity Status[3] | Comments[4] |
|---|---|---|---|---|
| **Birds** | | | | |
| *Grus canadensis* | Sandhill crane | -- | SGCN | Potential uncommon flythrough |
| *Charadrius montanus* | Mountain plover | -- | SGCN, BLM-SS | Potential nesting |
| *Bartramia longicauda* | Upland sandpiper | -- | SGCN | Potential nesting |
| *Numenius americanus* | Long-billed curlew | -- | SGCN, BLM-SS | Presence limited by paucity of wetlands; potential flythrough |
| *Larus pipixcan* | Franklin's gull | -- | SGCN | Potential uncommon flythrough |
| *Sterna caspia* | Caspian tern | -- | SGCN | Potential uncommon flythrough |
| *Sterna forsteri* | Forster's tern | -- | SGCN | Potential uncommon flythrough |
| *Chlidonias niger* | Black tern | -- | SGCN | Potential uncommon flythrough |
| *Coccyzus americanus* | Yellow-billed cuckoo | -- | SGCN, BLM-SS | Presence probably limited by paucity of wetlands; potential flythrough |
| *Athene cunicularia* | Burrowing owl | -- | SGCN, BLM-SS | May nest and or forage in black-tailed prairie dog burrows within the project area |
| *Asio flammeus* | Short-eared owl | -- | SGCN | Potential nesting and foraging habitat in the project area |
| *Melanerpes lewis* | Lewis's woodpecker | -- | SGCN | Potential uncommon flythrough |
| *Empidonax traillii* | Willow flycatcher | -- | SGCN | Presence limited by paucity of wetlands; potential flythrough |
| *Sitta pygmaea* | Pygmy nuthatch | -- | SGCN | Potential uncommon flythrough |
| *Oreoscoptes montanus* | Sage thrasher | -- | SGCN, BLM-SS | Potential nesting |
| *Lanius ludovicianus* | Loggerhead shrike | -- | BLM-SS | Potential nesting |
| *Spiza americana* | Dickcissel | -- | SGCN | Potential uncommon flythrough |
| *Spizella breweri* | Brewer's sparrow | -- | SGCN, BLM-SS | Potential resident |
| *Calamospiza melanocorys* | Lark bunting | -- | SGCN | Potential nesting |
| *Ammodramus savannarum* | Grasshopper sparrow | -- | SGCN | Potential flythrough |
| *Ammodramus bairdii* | Baird's sparrow | -- | BLM-SS | Potential uncommon flythrough |
| *Artemisiospiza belli* | Sage sparrow | -- | SGCN, BLM-SS | Potential nesting |
| *Calcarius mccownii* | McCown's longspur | -- | SGCN | Potential flythrough |
| *Calcarius ornatus* | Chestnut-collared longspur | -- | SGCN | Potential nesting |

Table 3.12 (Continued)

| Scientific Name | Common Name | ESA Status[2] | Sensitivity Status[3] | Comments[4] |
|---|---|---|---|---|
| **Birds** | | | | |
| *Dolichonyx oryzivorus* | Bobolink | -- | SGCN | Presence probably limited by paucity of wetlands; potential flythrough |
| **Amphibians** | | | | |
| *Rana pipiens* | Northern leopard frog | -- | SGCN, BLM-SS | Low potential to occur in limited wet habitats in the project area and vicinity |
| **Reptiles** | | | | |
| *Crotalus viridus viridus* | Prairie rattlesnake | -- | SGCN | Known to occur within the project area; one observation in the southern end of the Hank Unit |
| *Pituophis melanoleucus sayi* | Bullsnake | -- | SGCN | Known to occur within the project area; one observation in the northern end of the Hank Unit |

1 Animal species included in this table are based on known geographic range and habitat preferences as described in WGFD (2004).
2 Designations under the ESA: DL = delisted; E = endangered; T = threatened; C = candidate.
3 SGCN = species of greatest conservation need as designated by the WGFD (2006a); BLM-SS = Wyoming BLM-designated sensitive species (BLM 2012b).
4 Comments on the likelihood of occurrence are based on known geographic range and habitat preferences as described in WGFD (2004).

(WGFD 2006a). Federally-designated species are managed by the BLM in accordance with the ESA and BLM Manual 6840, Special Status Species (BLM 2008c). In addition, BLM-SS are designated internally by the BLM and managed in accordance with BLM Manual 6840. Actions authorized by the BLM will further the conservation and/or recovery of federally-designated species and conservation of BLM-SS. BLM-SS will be managed consistently with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA (BLM 2008c). While the WGFD has prepared a list of species in Wyoming of the greatest conservation need, these species do not have any special legal status in Wyoming.

3.11.2.2 Federally-designated Animal Species

Only one federally-designated species and one candidate species have the potential to occur within or near the Hank Unit project area, and these species are the black-footed ferret (*Mustela nigripes*) and the GSG *(Centrocercus urophasianus)*.

Black-footed Ferret. The black-footed ferret is federally-designated as endangered. The species is endemic to North America and primarily inhabits the Great Plains region. It is the only species of ferret native to the Americas. The species was believed to be extinct by 1980, but in 1981, a small relic population was discovered near Meeteetse, Wyoming. From this population, 18 individuals were captured to start a captive breeding program, which WGFD initiated. Nonessential experimental populations have been reintroduced to 18 locations in eight states and Mexico (USFWS 2008a). Four of these reintroduced populations--those in Shirley Basin, Wyoming; Aubrey Valley, Arizona; Cheyenne River and Conata Basin, South Dakota--have successfully stabilized and no longer require supplemental individuals from captive breeding (USFWS 2008a). Black-footed ferret occurrence is closely tied to prairie dog towns, as prairie dogs are the primary prey item for the species and prairie dog burrows provide shelter for ferrets as well. Typically, black-footed ferrets favor black-tailed prairie dog colonies over those of other prairie dog species such as the white-tailed species (USFWS 2008a, as cited in NRC 2011).

No black-footed ferrets have been identified within or near the Hank Unit Project Area, and the USFWS has not designated any critical habitat for the species (WYNDD 2006; NRC 2011). The Project Area is located in an area that was block cleared of the need for surveys by the USFWS in 2004 for black-footed ferrets (USFWS 2004). The closest non-survey cleared area is approximately 88 mi west of the Project Area. Therefore, no surveys for black-footed ferrets are required by the USFWS. In addition, the Project Area is located approximately 120 mi north of the closest black-footed ferret reintroduction area, the Shirley Basin/Medicine Bow Management Area. Therefore, black-footed ferrets are highly unlikely to occur within the Project Area. The BLM has not conducted formal or informal consultation with the USFWS because this species was not recommended for consultation by the USFWS (USFWS 2012). Therefore, black-footed ferrets are not discussed further in this EA.

Greater Sage-Grouse (GSG). The GSG is a federal candidate species known to occur within the Project Area. The species was first petitioned for federal listing as threatened or endangered in July 2002. After several additional petitions and court challenges, the USFWS issued a final determination of "warranted for listing but precluded by higher priorities" (i.e., a candidate species) in March 2010. As a result, the GSG was placed on the list of federal candidate species (USFWS 2010).

As a preemptive measure, the Governor of Wyoming initiated the Wyoming Sage Grouse Implementation Team (WSGIT) in July 2007, to make recommendations on GSG population management relative to development in Wyoming, with the goal of maintaining healthy GSG populations and avoiding the species' federal listing. The WSGIT and eight local working groups identified and defined core population areas (CPAs) in Wyoming, addressed the need for connectivity among geographically important populations, recommended guidelines for development activities within and outside of the CPAs, and assessed needs for further research regarding habitat protection and population monitoring (WSGIT 2010a). CPAs encompass habitats and existing populations for at least two-thirds of the GSG in Wyoming (WSGIT 2008). WSGIT (2008) predicted that, based on peak male attendance, approximately 83% of the males attending leks were within initially identified CPAs, as were approximately 61% of the state's occupied leks. After further review, the CPAs were refined in June 2010, and version 3.0 of the core area map was released to the public (WSGIT 2010b). This map excludes some areas where GSG habitat was marginal or the level of human development warranted exclusion, and includes areas required to maintain connectivity between and among important populations particularly in northeast Wyoming where core areas represent less than 24% of the population.

On June 2, 2011, the Governor of Wyoming signed Executive Order (E.O.) 2011-5 (State of Wyoming 2011), updating the previous E.O. (2010-4) (State of Wyoming 2010) regarding the protection of GSG. The most restrictive conservation measures and recommendations are for the GSG CPAs, which are areas identified by the State of Wyoming as high-quality habitat for GSG nesting and brood-rearing and necessary to maintain populations. This E.O. applies to all actions (including issuance of state-authorized permits) undertaken by all Wyoming state agencies including permits issued by WDEQ LQD (State of Wyoming 2011).

In addition, the BLM Wyoming Instruction Memorandum (IM) WY-2012-019 "Greater Sage-Grouse Habitat Management Policy on Wyoming BLM Administered Public Lands including the Federal Mineral Estate" (BLM 2012d) provides guidance on GSG habitat management. Under this, the BLM will manage GSG seasonal habitats and maintain habitat connectivity to support population objectives set by the WGFD. The BLM guidance is consistent with guidelines provided in the WSGIT's CPA strategy, the Wyoming Governor's E.O. 2011-5 (State of Wyoming 2011), and the BLM National GSG Habitat Conservation Strategy (BLM 2004).

The project is not located within GSG CPAs or connectivity areas. Uranerz-proposed management is consistent for that of GSG habitat outside of CPAs and connectivity habitat.

Leks (traditional breeding area) for GSG are important in determining and tracking the general wellness and monitoring population trends of the GSG population in a general area or region. The WGFD has established three categories for managing GSG: occupied, unoccupied, and undetermined (BLM 2012d). The category "Occupied" is a lek that has been active during at least one strutting season within the last ten years. Management protection by WGFD and BLM is provided to occupied leks. An "Unoccupied" lek has not been active during the past 10 years, although there must be sufficient data to justify placing a lek into this category. A lek survey or count must have been conducted during 4 out of 10 years non-consecutive years (i.e., every other year) without activity to be placed in the "Unoccupied" category. The third category is "undetermined" which is a lek that has not been documented as being active in the past 10 years, but does not have sufficient data documentation to be considered unoccupied.

GSG populations have declined overall from 1965 to 2007, with the greatest decline occurring before the mid-1980s. The total range-wide population decline is estimated at 45% to 80% from historic levels (Becker et al. 2009), and populations have been declining by an average of 2% per year from 1956 to 2003 (Knick and Connelly 2011). According to the WGFD, no reliable method for estimating the GSG population in the Northeast Wyoming Sage-grouse Working Group area exists at this time (WGFD 2006b). Both the number of leks (i.e., seasonal breeding areas for GSG) and the number of males attending these leks must be quantified in order to estimate population size. However, the number of males per lek observed provides a reasonable

reflection of the GSG population trend over time in response to environmental conditions. Leks and sagebrush communities surrounding leks are particularly important GSG breeding, nesting, and brood-rearing habitats (WGFD 2006b). Females tend to nest within several mi of a lek (e.g., Wallested and Pyrah 1974; Braun 2002; WGFD 2002), often the lek at which they were bred. Research across more of the GSG's range indicated that nesting may occur much farther than 2 mi from the breeding lek (Knick and Connelly 2011).

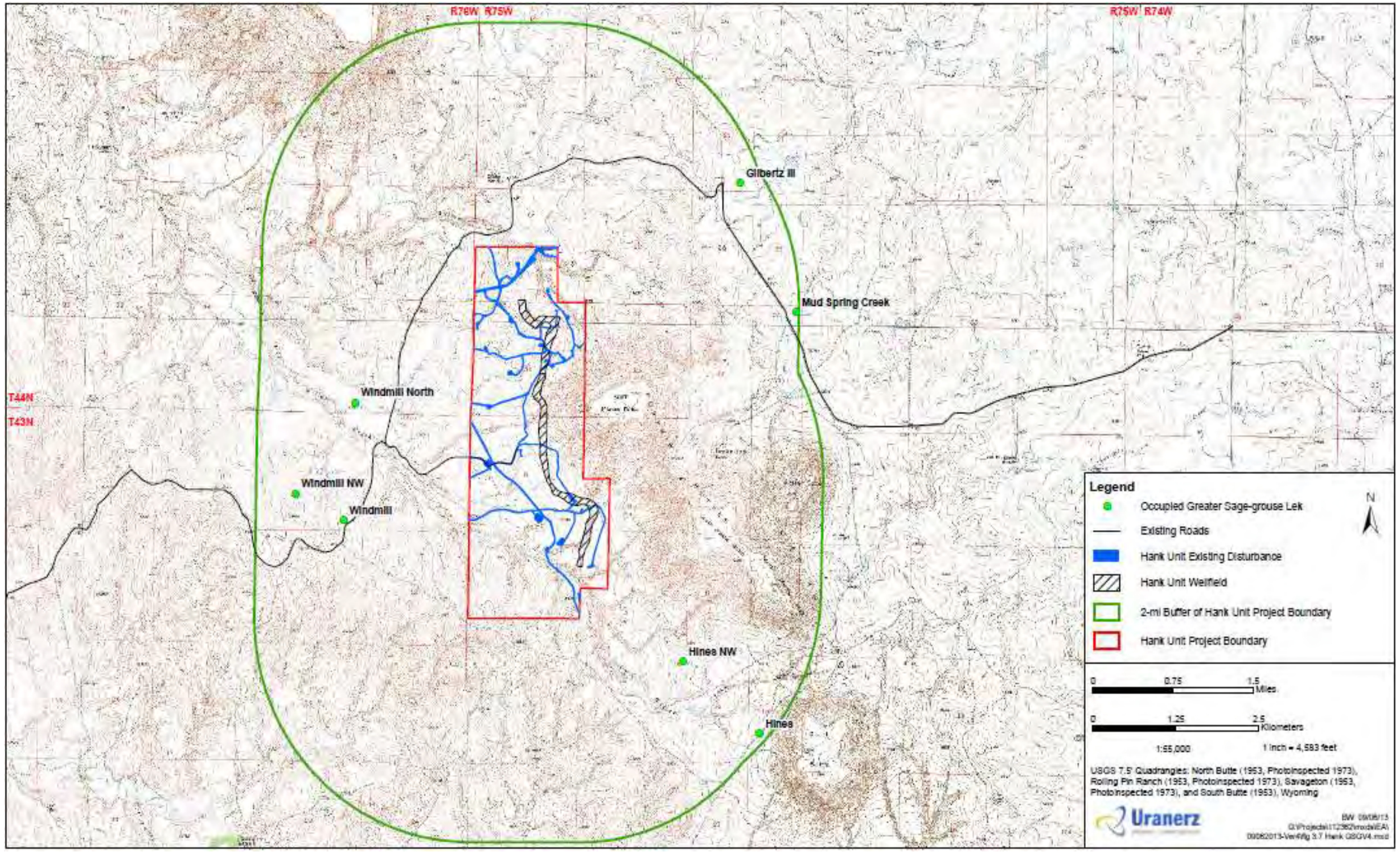
Holloran and Anderson (2005) noted, in a study in the Upper Green River Basin area of west-central Wyoming, only 45% of GSG hens nested within 1.9 mi of the breeding lek. Moynahan and Lindberg (2004) found, in a north-central Montana study, only 36% of GSG hens nested within 1.9 mi of the breeding lek. Habitat conditions in the BFO are more similar to the north-central Montana study area than the Upper Green River study area: mixed-grass prairie and sagebrush steppe, dominated by Wyoming big sagebrush (Moynahan et al. 2007). Furthermore, lek fidelity by both male and female GSG (Eng 1963; Dunn and Braun 1985), and fidelity of females to nest sites (Gates 1983; Berry and Eng 1985; Fischer et al. 1993), has been demonstrated in numerous studies. Because of the fidelity exhibited by individual birds to leks and nest sites across multiple years, if disturbance interferes with lek or nest site fidelity and precludes GSG from using an area, fidelity to the site may be lost in the existing population. Kaiser (2006) reported that yearling males from leks nearest infrastructure in the Pinedale, Wyoming, area were displaced to leks nearer the outer edges of the gas field, and similarly, that recruitment of males to leks decreased as the amount of infrastructure adjacent to the leks increased, indicating the potential for eventual loss of leks within areas of high development. Naugle et al. (2011) also found that lek attendance decreased with increasing infrastructure proximal to the lek, with a 2- to 10-year lag from the time of mineral development to the time measurable impacts on lek attendance were noted.

The long-term trend for attendance of male GSG at leks in the Northeast Wyoming Greater Sage-grouse Area as defined by the WGFD (including the Savageton GSG Management Area) suggests that the population in this area exhibits an approximate 10-year cycle. However, there has been a steadily declining GSG population over at least the past 50 years in northeast Wyoming (Connelly et al. 2004).

This decrease in male attendance at the seasonal leks has also been noted in the area near the Hank Unit Project Area. Occupied lek attendance data presented in Table 3.13 illustrates that there has been a decrease in the attendance of male GSG at several of the leks within 2 mi of the Project Area in the past 10 years. There are several potential explanations for these decreases, including natural population responses to 4 years of drought conditions (2000-2003) in the general area, and natural degradation of sagebrush habitat (Knick et al. 2003; WGFD 2006b). However, recent studies also have documented that intensive conventional or CBNG development can have adverse impacts on GSG populations (Lyon 2000; Lyon and Anderson 2003; Holloran and Anderson 2005; Walker et al. 2007; Harju et al. 2010). Between four and 12 CBNG wells per section have been drilled throughout the general area over the past 5 to 10 years. In addition, there appears to be an indirect impact from energy development associated with an increased number of avian (e.g., corvid) and mammalian (e.g., canid) predators in the area. This impact has been documented to negatively affect nesting GSG (Lyon and Anderson 2003; Holloran 2005). Therefore, any decrease in the attendance of male GSG and related population declines within northeast Wyoming (including the vicinity of the Hank Unit Project Area) likely are the result of a combination of natural (e.g., drought, natural cycles) and other anthropomorphic or introduced (e.g., energy development, West Nile virus) factors (Taylor et al. 2012) and are not associated with the proposed Hank Unit Project. Taylor et al. (2012) explains that West Nile virus outbreaks are a wildcard in GSG management and can reduce populations by half in a single year. This size of population reduction was similar to energy development at a density of 4-8 wells per $mi^2$ in an undeveloped landscape (Taylor et al. 2012).

The Hank Unit Project Area is located in the Savageton GSG Management Area, but it is outside of any CPA. The closest CPA is located approximately 16 mi west-northwest of the Project Area. No GSG leks occur within the Hank Unit (WSGIT 2010b; State of Wyoming 2011). However, seven GSG leks or satellite leks exist within a 2.0-mi radius of the proposed Project Area (Figure 3.7 and Table 3.13).

Other Species. The American peregrine falcon and bald eagle have been delisted under the ESA and are discussed as BLM-SS.




From: Uranerz 2012.

Figure 3.7 Location of Greater Sage-Grouse Leks Within 2.0 mi of the Hank Unit Project Area.

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Table 3.13 Occupied Greater Sage-Grouse Lek Attendance Data for the Past Decade for Leks Located Within 2.0 mi of the Hank Unit Project Area.[1]

| | Maximum Number of Males Attending | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lek Name[2] | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Hines | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hines NW (Hines Satellite) | 11 | 6 | 3 | 5 | 4 | 4 | 2 | 2 | 0 | 8 |
| Mud Spring Creek | 19 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Windmill | 3 | 4 | 4 | 4 | 7 | 11 | 15 | 5 | 8 | 16 |
| Windmill North | 25 | 27 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Windmill NW | 1 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Gilbertz III | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1 Data from WGFD (2010b), Uranerz (2012), and email communication, December 16, 2010, with Dan Doke, Wildlife Resources, LLC. When maximum male numbers differed among databases, the highest number of males was presented in the table.

2 Names in parentheses are the names used in Uranerz (2012) and/or by Wildlife Resources, LLC, whereas the names without parentheses represent WGFD-designated lek names. North Butte Satellite, Gilbertz III Satellite, and Windmill SE are not in the WGFD database. Windmill SE was first reported by Wildlife Resources, LLC in 2009 and may be a slight relocation of the Windmill lek, as it is only 886 ft from the Windmill lek (email communication, December 16, 2010, with Dan Doke, Wildlife Resources, LLC). The Windmill lek counts are from the satellite lek. Gilbertz III Satellite is approximately 1,289 ft northwest of Gilbertz III.

### 3.11.2.3 BLM-sensitive Species and Wyoming Species of Greatest Conservation Need (SGCN)

Mammals. Sixteen mammal species are listed as BLM-SS in the BFO and/or Wyoming species of greatest conservation need (SGCN) (see Table 3.9) (WGFD 2006a; BLM 2012b). Ten bat species are listed as BLM-SS in the BFO and/or Wyoming SGCN BLM 2012b). Four of these species (Townsend's big-eared bat, spotted, long-eared, and fringed myotis) also are listed as a BLM-SS in the BFO (BLM 2012b). All ten species have the potential to migrate through and/or forage within the Project Area and vicinity. However, given the scarcity of wetlands, suitable foraging habitat, and hibernacular and diurnal roost sites for bats, the possibility of these species occurring in the Project Area is limited, and is not discussed further in this EA.

Two sciurid species (e.g., Wyoming ground squirrel and black-tailed prairie dogs) are listed as BLM-SS in the BFO and/or Wyoming SGCN (WGFD 2006a) with the potential to occur in the Project Area (Table 3.12). Of the two species, only the black-tailed prairie dog is a BLM-SSin

the BFO (BLM 2012b). Wyoming ground squirrels are ubiquitous and widespread in the state, and they may occur in or in the vicinity of the Project Area; however, based on baseline wildlife surveys none have been identified. Only a small portion (5.8 acres) of one black-tailed prairie dog colony occurs within the Project Area (Figure 3.6).

Two additional rodents (olive-backed pocket mouse and prairie vole) are listed in Table 3.12 as Wyoming SGCN (WGFD 2006a). Neither of these species are designated as BLM-SS in the BFO. Based on habitat preference and geographic range, both species may occur within the Project Area; however, formal surveys for small mammals were not conducted during baseline wildlife surveys (WGFD 2004; Uranerz 2012), and the presence of these two species within the Project Area is not known.

The swift fox is listed as both a Wyoming BLM-SS in the BFO and a Wyoming SGCN (WGFD 2006a; BLM 2012b). The species was removed from the ESA Candidate List in 2002 as a result of successful conservation measures and reintroduction efforts in western states (NRC 2011). Swift foxes are native to the Great Plains, inhabiting flat short- and mixed-grass prairies in the eastern portion of the state. A swift fox was recorded approximately 5 mi east of the Project Area (NRC 2011), and it is likely they occur at least occasionally within the Project Area. It is also possible that they use prairie dog as a food source.

Birds. A total of 47 avian species with the potential to occur within the Project Area and vicinity are listed as Wyoming SGCN (WGFD 2006a), and 16 of those species also are listed as Wyoming BLM-SS in the BFO (Table 3.12). These 16 species are discussed in more detail below. GSG were discussed above, and this information will not be repeated here.

The bald eagle, which was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 *Federal Register* 37346), remains listed as a BLM-SS and Wyoming SGCN (Table 3.12). The species continues to be protected at the national level by the *Bald and Golden Eagle Protection Act* (BGPA), as well as the *Migratory Bird Treaty Act* (MBTA). Bald eagles generally are associated with lakes, major rivers, and other large bodies of water, and nests typically are constructed in large trees adjacent to perennially open waters that provide fish and

waterfowl as a prey source. During winter, bald eagles often frequent big game winter ranges and roadsides, feeding on the carrion that these locations provide. Prairie dogs can serve as a potential food source for bald eagles.

No bald eagle nests were recorded during recent baseline raptor nest surveys of the Project Area and 1-mi buffer (BLM 2011d; Uranerz 2012). However, bald eagles are known to nest in the general vicinity, with the closest known nest approximately 10 mi west of the Hank Unit, along Powder River (BLM 2011d). Communal night roosting areas are an important component of bald eagle wintering habitat, providing a more favorable microclimate than surrounding areas that enables eagles to conserve energy during inclement weather. Higher ambient temperatures, lower direct precipitation, and shelter from winds at roost locations have been shown to result in a net energy saving of up to 10% (e.g., Keister et al. 1985; Stellini 1987). Tree structure and roost exposure/aspect are important criteria affecting the eagles' choice of roost sites. With their large size and wingspan, eagles usually select the largest and tallest trees in a stand (often dead snags or trees with open branch structure and/or broken crowns) to facilitate access to the perch. Exposure of the roost location directly affects the amount of thermal protection afforded by the roost, with roosts most often located in sheltered or leeward areas with reduced wind speeds.

Bald eagles have been observed within and near the Hank Unit Project Area during winter surveys conducted from 2007 through 2010 (BLM 2011d). As a result, the BLM has designated eight areas along Dry Willow Creek as bald eagle winter roost sites (Figure 3.8).

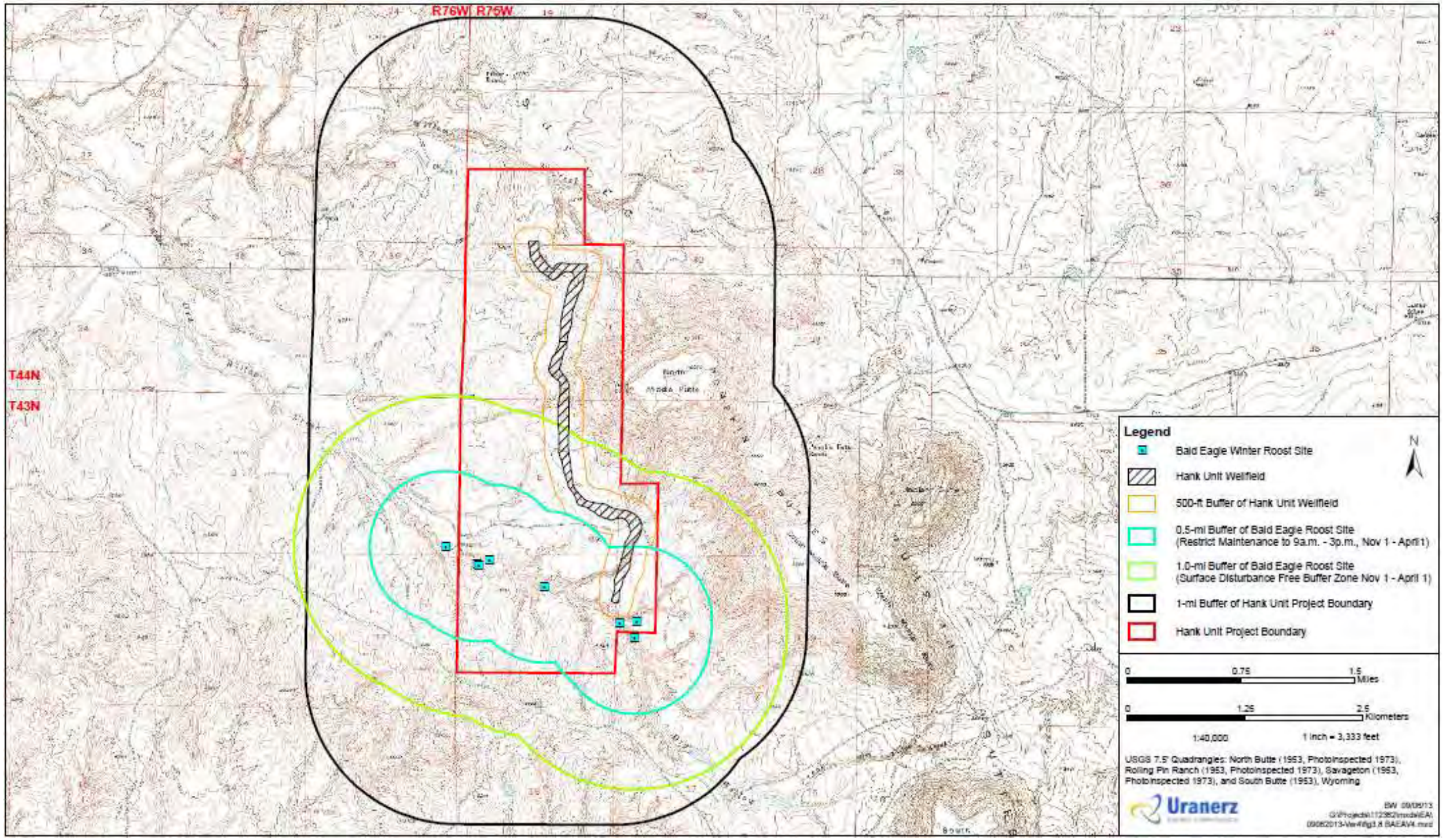
Of the bald eagle observations for which roosting substrate was recorded, approximately 70% used live cottonwood trees, 28% used live ponderosa pine, and 2% used dead ponderosa pine. Bald eagles in 50% of the total observations used roosts associated with drainages, and the remaining 50% roosted in trees on steep ridge slopes, most of which had northern exposure and/or were associated with side slope of canyons or drainages (BLM 2011d). These sites also provide suitable roosting substrate for golden eagles.

Three additional species of raptors have the potential to occur within or near the Project Area and are listed as BLM-SS in the BFO (WGFD 2006a; BLM 2012b). Ferruginous hawks, American peregrine falcon, and western burrowing owls all have the potential to occur within the WIA.

Ferruginous hawks typically nest on ridgetops, cliffs, and rock pinnacles and outcrops, as well as on the ground or in trees (often junipers either in open woodlands or in single isolated trees). They forage for small mammals, with ground squirrels and prairie dogs comprising much of their diet. American peregrine falcon typically nests on a ledge or in a hole on a tall cliff and they feed on birds (Erlich et al. 1988). Passerine birds comprise the majority of the diet of this falcon, which generally inhabits open woodlands and prairies. Western burrowing owls nest within prairie dog or other small mammal burrows in open grassland, shrubland, or disturbed habitats. Their diet consists of insects, small rodents, and lizards. The presence of open juniper woodlands, grasslands, shrublands, and prairie dog colonies provides potential nesting and foraging habitat for all three of these raptor species, and they may occur within or may occasionally pass through the project area.

Based on geographic range and/or habitat preference, six of the remaining eleven species (i.e., white-faced ibis, long-billed curlew, trumpeter swan, yellow-billed cuckoo, Baird's sparrow, and Northern goshawk) are considered uncommon or occasional visitors or migrants through the area (WGFD 2004). The five remaining species are listed as potential flythrough. Brewer's sparrow is the only one of these species that were opportunistically observed in the WIA during baseline wildlife studies (Uranerz 2012). Brewer's sparrows inhabit open sagebrush shrublands throughout Wyoming and nest in shrubs or low trees. In Wyoming, the species is found in close association with sagebrush (WGFD 2004). Sage sparrows and sage thrashers also are found in close association with sagebrush in Wyoming, and all three species are known to breed within the Project Area latilong (WGFD 2004). The latilong for the Hank Unit Project Area is an area between 43° and 44° north latitude and 105° and 106° west longitude. It is possible that these three species may frequent and/or nest in the vicinity of the Project Area.

Loggerhead shrikes generally frequent open woodlands and shrublands, nesting in large shrubs or trees and feeding on birds, lizards, mice, and insects. They are known to breed in the Project




From: BLM 2011a, 2011d; Uranerz 2012.

Figure 3.8 Location of Designated Bald Eagle Winter Roost Sites Within and Near the Hank Unit Project Area.

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Area's latilong, and are likely to forage and possibly nest in the Project Area. Mountain plover preferred habitat is short-grass and mixed grass prairie and they typically nest on bare ground and are associated with prairie dog towns. Mountain plover feed on insects and small arthropods (Erlich et al. 1988). No mountain plovers were observed in the Hank Unit during the two surveys, or during opportunistic observations throughout the 2006 field season. However, the BLM has recorded mountain plover sitings approximately 8 mi west (pers. comm., January 2, 2013, with Diane Adams, GIS specialist, BLM BFO, Buffalo, Wyoming).

Amphibians and Reptiles. One amphibian (northern leopard frog) is listed by the WGFD as potentially occurring within the general area, is listed as a BLM-SS in the BFO, and is a Wyoming SPCN (Table 3.12). The Project Area provides no habitat for northern leopard frogs (i.e., no perennial water sources) and the likelihood that the species occurs in the Project Area is low. It is unlikely that the northern leopard frog occurs in the Project Area.

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# 4.0 ENVIRONMENTAL CONSEQUENCES

## 4.1 INTRODUCTION

In accordance with NEPA (40 CFR 1502.16), this section of the EA discusses the potential environmental consequences of the Proposed Action (Alternative 1) and the No Action Alternative (Alternative 2) on each of the potentially affected resources. An environmental impact is defined as a change in the quality or quantity of a given resource due to a modification in the existing environment resulting from project-related activities. Impacts may be beneficial or adverse, may be a primary result (direct) or secondary result (indirect) of an action, and may be permanent and long term or interim and of short duration. Impacts may vary in degree from a slightly discernible change to a total change in the environment. This impact analysis assumes that the Proposed Action and all design features described therein would be successfully implemented. If these measures were not implemented, additional impacts may occur.

Residual impacts are impacts resulting from the Proposed Action after application of appropriate design features, best management practices (BMPs), and any terms and conditions (T&Cs) attached to the POO's approval (BLM 2008b).

Cumulative impacts result from the incremental effects of an action added to other past, present, and reasonably foreseeable future actions (RFFAs), regardless of who is responsible for such actions. Cumulative impacts may result from individually minor but collectively significant actions occurring over a period of time (40 CFR 1508.7).

Existing and RFFAs considered in the immediate area of the proposed Project include the North Butte Uranium ISR Project, the Willow Creek Uranium ISR Project, the Moore Ranch Uranium ISR Project, conventional oil and gas development, CBNG development, and livestock grazing.

Cameco Resources, Inc.'s (Cameco's) North Butte Uranium ISR Project is approximately 1 mi northwest of the Hank Unit Project Area. This project is in operation, and is a satellite to their Smith Ranch-Highland Uranium ISR project; the uranium-loaded resins from North Butte are

transported to Smith Ranch-Highland for processing. Uranium One, Inc.'s (Uranium One's) Willow Creek Uranium ISR Project area is approximately 3 mi northwest of the Hank Unit on the north side of North Pumpkin Butte. This facility temporarily ceased operations in 2000; and became commercially operational again in May 2012. Uranium One's Moore Ranch Uranium ISR Project is approximately 12 mi south of the Hank Unit. Uranium One anticipates that Moore Ranch will now be a satellite operation, with loaded resins being transported to their Willow Creek facility for processing (pers. comm., December 15, 2014, with Jon Winter, Manager of Environmental and Regulatory Affairs for Wyoming, Uranium One, Casper, Wyoming). Although Moore Ranch is fully approved (NRC SML and WDEQ LQD Permit to Mine issued in 2010), but construction has not yet been initiated due to higher priorities. In 2011, the NRC identified no fewer than six other operating or planned uranium ISR facilities within 50 miles of the Hank Unit (NRC 2011); the BLM has identified up to 14 (pers. comm., February 14, 2015, with Kerry Aggen, Geologist, BLM BFO, Buffalo, Wyoming).

There are currently three existing conventional oil and gas wells within the Hank Unit Project Area and 28 conventional oil and gas wells within 3 mi of the Nichols Ranch and Hank Units (NRC 2011). There are also six CBNG wells within the Project Area and approximately 380 CBNG wells within 3 mi of the Nichols Ranch and Hank Units. Support facilities such as pipelines exist within and adjacent to the Hank Unit and account for the majority of industrial development that has occurred near the Hank Unit (NRC 2011).

## 4.2 AIR QUALITY

### 4.2.1 Proposed Action

All project activities would be required to comply with the provisions of *Wyoming Environmental Quality Act* (W.S. 35-11-201 *et seq*.), the Wyoming State Implementation Plan, and other applicable state and county regulations.

As a general rule, uranium ISR operations are not a major source of air pollutants (NRC 2009a). Construction and wellfield development activities in the Hank Unit would include: preparation

and construction of header houses; construction of the SPF; construction and vehicle traffic along unpaved access roads in the wellfield; pipeline installation; and well drilling (NRC 2011). Air quality would be affected by the release of diesel emissions from drilling and construction equipment, and from fugitive dust from construction activities and vehicle traffic. Under the Proposed Action, the single largest pollutant would likely be particulate matter (i.e., dust) in the form of total suspended particulates and particulate matter (<10µg) (i.e., $PM_{10}$ and $PM_{2.5}$) generated by vehicle traffic, excavations, and other ground-disturbing activities. In addition, there would be tailpipe emissions such as CO, $NO_x$ (one or more nitrogen oxides), volatile organic compounds (VOCs), $PM_{10}$, $PM_{2.5}$, $SO_2$, and hazardous air pollutants (HAPs) from vehicles and the operation of the mobile concrete batch plant. Diesel emissions would be minor and of short duration, and would be readily dispersed into the atmosphere. Fugitive dust generated from construction and drilling activity, as well as vehicle traffic on unpaved roads, would be localized and of short duration. Localized areas affected by construction activities would be reclaimed, topsoiled, and seeded.

Uranerz has committed to reseeding disturbed surface areas in the interim to minimize erosion from wind and water, and vegetation would normally be reestablished within two years of initial disturbance (Uranerz 2012). Reclaimed well sites and access roads would be re-contoured, recovered with topsoil, and reseeded to minimize long-term impacts to air quality.

The NRC GEIS (2009a) concluded that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. Additionally, although excess vapor pressure in pipelines could be vented at many points throughout the system, such emissions would be rapidly dispersed into the atmosphere (NRC 2009a). Operations-related air emissions would include radon gas released (de-solved) from processing solutions. Without implementing appropriate NRC standard operating procedures (SOPs), radon could escape to the atmosphere at each wellhead and/or from process equipment, affecting air quality in the wellfield and/or immediate vicinity of processing buildings. An SOP that Uranerz anticipates using to reduce radon emissions is pressurized down flow ion exchange (IX) columns in the SPF, designed to significantly reduce radon emissions from the processing circuit (Uranerz 2011). Radon releases would occur only when individual

IX columns are disconnected from the circuit and opened to remove the loaded resin for elution. Uranerz would also use other NRC-required SOPs to reduce radon releases in the wellfield. The NRC concluded there would be no adverse impact to air quality from the Proposed Action; the radiological impacts of operations are more fully discussed in Section 4.7 of the NRC SEIS (NRC 2011) and will not be repeated here. The estimated total air emissions from the Proposed Action are presented in Tables 4.1 and 4.2.

Possible air quality impacts from the transportation of uranium-loaded IX resin from the Project Area to the Nichols Ranch and/or the Smith-Highland Ranch CPPs could include exposure to radionuclides and vehicle emissions during shipping. Airborne release of uranium would not occur during shipping: the loaded IX resin would be shipped in closed containers, approved for use by the U.S. Department of Transportation (USDOT), and the uranium would be in solid form, fixed to the resin beads (NRC 2009a, 2009b, 2011).

The approximately one truck per day, or approximately 6 trips per week, to/from Hank Unit to the CPP(s) is minor. Vehicle emissions from the additional traffic are not expected to significantly contribute to the vehicle emissions on these roadways (NRC 2009a, 2011).

Table 4.1 Total Estimated Non-radiological Air Emissions from the Proposed Action (in tons).

| | $NO_x$ | CO | $SO_2$ | $PM_{10}$ | $CO_2$ | Formaldehyde | VOCs |
|---|---|---|---|---|---|---|---|
| Proposed Action | 73 | 19 | 3.6 | 4.3 | 3100 | 0.013 | 4.7 |

Source: NRC 2011.

Table 4.2 Total Estimated Radon Emissions from the Proposed Action (in curies/year).

| | Construction Phase | Uranium Recovery Phase | Groundwater Restoration and Decommissioning Phase |
|---|---|---|---|
| Proposed Action | 0.076 | 520 | 460 |

Source: NRC 2011.

Decommissioning activities would generate the same pollutants as construction activities: fugitive dust, vehicle emissions, and diesel emissions (NRC 2009a). These would be mostly due to increased particulate matter from activities associated with dismantling buildings, associated equipment, and roads, removing any contaminated soil, and final reclamation activities of grading, ripping, re-topsoiling, and seeding. These activities could cause a short-term increase in particulate and tailpipe emissions, decreasing as these activities proceed and are completed.

### 4.2.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No surface would be disturbed and no air quality impacts would occur beyond those that already exist.

### 4.2.3 Applicant Committed Mitigation Measures

Uranerz would commit to controlling air quality emissions occurring during implementation of the Proposed Action. To minimize these levels and long-term impacts to air quality, Uranerz would use several measures including use of water or other dust control measures on heavily-used roads and areas, holding traffic speed to appropriate levels, and revegetating disturbed areas as soon as possible following disturbance. Permanent reclamation of all disturbed areas would include re-contouring, topsoil replacement, and seeding and mulching. Tailpipe emissions would be limited by maintaining vehicles in accordance with manufacturer recommendations. Open burning of garbage or refuse at well sites or other facilities would not be allowed.

### 4.2.4 Residual Impacts

Under the Proposed Action, the single largest pollutant would likely be particulate matter (dust), suspended particulates and particulate matter (<10µg) ($PM_{10}$ and $PM_{2.5}$), generated by vehicle traffic, and during excavations and other ground-disturbing activities. In addition, there would be emissions such as CO, nitrogen oxides ($NO_x$), VOCs, $PM_{10}$, $PM_{2.5}$, $SO_2$, and HAPs from vehicles and the mobile concrete batch plant. Uranerz is committed to controlling air quality emissions; however, some localized temporary increases in dust levels would be unavoidable.

### 4.2.5 Cumulative Impacts

The BLM recently completed a regional technical study, the Powder River Basin (PRB) Coal Review, to help evaluate the cumulative impacts (including on air quality) of mineral and energy development in the PRB (BLM 2009). This study evaluated conditions as of a baseline year (2004), and projected potential development levels and associated likely cumulative impacts related to mineral and energy development for 10 and 15 years into the future (years 2015 and 2020, respectively). The study included existing and RFFA for development of oil and gas (conventional oil/gas and CBNG), coal, uranium (via ISR, including the Proposed Action), wind energy, and other minerals, as well as industrial facilities (BLM 2011b).

Uranium recovery and processing is currently occurring in the PRB, and is very likely to occur into the future. Estimated potential annual contributions from seven proposed ISR facilities are included in the emissions inventory (including Uranerz' Nichols Ranch/Hank) (BLM 2011b). Within a 50-mi radius of the Hank Unit, there are six operating or planned uranium ISR facilities; each would generate emissions comparable to those projected for the Proposed Action. ISR facilities commonly use a phased approach to well drilling and wellfield construction, and all seven facilities would not undergo construction concurrently. Each would go through the average 2-year licensing process to obtain the necessary federal, state, and local permits. The PRB Coal Review assumed a degree of overlap in construction activities which is likely for wellfield drilling activities as each facility would construct more than one wellfield over a period of years (BLM 2011b).

In addition to existing and RFFA for coal mining operations, the PRB Coal Review air quality study also included existing and proposed conventional oil/gas and CBNG development projects in the PRB. Construction and development activities included in the inventory would be similar to the Proposed Action, such as emissions from diesel drilling rigs and water and equipment haul trucks, and dust from construction activities. These are short-term impacts that are replaced by operations maintenance vehicle traffic and crude oil hauling, if the wells are productive. Emissions associated with all forms of oil/gas operations would include $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_x$, CO, and VOCs from combustion activities associated with production equipment (heater

treaters), fugitive emissions from stock tanks and, possibly compressor stations. These would be isolated emissions occurring at each well location and would generate an almost undetectable level of emissions limited to the near-field with no impact in the far-field (BLM 2011b).

As described in the PRB Coal Review air quality study included in the Hay Creek II Coal Lease Application Final EIS and the NRC SEIS, the area around the Hank Unit is in attainment for all NAAQS (BLM 2011b; NRC 2011). Emissions from projected future mineral and energy development have been evaluated for impacts to air in previous EISs and supporting documents (BLM 2003a, 2006, 2009c, 2009d, 2010d, 2011d; NRC 2011). While these concurrent activities would emit a variety of pollutants, the principal emissions from oil/gas development likely to considerably overlap with emissions from the Proposed Action would be $NO_x$, VOCs, and particulate matter (i.e., fugitive road dust). Principal emissions from coal mining include fugitive dust (particulates including coal dust), and diesel-powered equipment exhaust. The BLM cumulative impact analysis focuses on the cumulative impact to air quality from all existing and future air pollutant sources in the PRB of Wyoming (BLM 2011b).

The BLM PRB Coal Review air quality analysis involved executing a state-of-the-art EPA guideline dispersion model, CALPUFF, Version 5.8 (Scire et al. 1999) to calculate local-scale, short-range dispersion as well as region-scale, long-range dispersion, of emissions assuming worst-case meteorological conditions. Emissions in the BLM analysis were developed for base year 2004 and projected for years 2015 and 2020 (BLM 2011b).

The PRB Coal Review generally considers existing regional air quality conditions in the study areas to be very good. There are limited air pollution emissions sources (few industrial facilities including the surface coal mines, and few residential emissions in relatively small communities and isolated ranches) and good atmospheric dispersion conditions (BLM 2011b). The available data show that the region complies with ambient air quality standards for $NO_2$ and $SO_2$. There have been no monitored exceedances of the annual $PM_{10}$ standard in the Wyoming PRB (BLM 2011b). The BLM Coal Review air quality study presents results that show the maximum modeled impacts on ambient air quality at near-field receptors in Wyoming and Montana (BLM 2011b). Results shown represent the maximum impact at any point in each receptor group; data are provided for the baseline year (2004) and existing and all RFFAs (including the Proposed

Action) for 2015 and 2020. Peak impacts occur at isolated receptors and are likely due to unique source-receptor relationships. The model results should not be construed as predicting an actual exceedance of any standard, but are, at best, indicators of potential impacts (BLM 2011b).

The NRC's Uranerz Nichols Ranch Project SEIS used the same air quality analysis, based on the detailed regional air quality analysis presented in the BLM Coal Review air quality study. NRC determined that air pollutant emissions from the proposed Hank Unit would be relatively low, and the project would have a small incremental effect on the cumulative impacts to air quality resulting from existing and RFFAs, including oil/gas, CBNG, surface coal mining, uranium ISR, and other energy and industrial developments identified by the BLM (NRC 2011; BLM 2011b).

## 4.3 CULTURAL RESOURCES AND NATIVE AMERICAN CONCERNS

### 4.3.1 Proposed Action

#### 4.3.1.1 Cultural Resources

On May 10, 2013, BLM determined that 16 sites are not eligible for listing on the National Register of Historic Places (NRHP), seven sites are eligible for listing on the NRHP, and two sites are unevaluated for listing on the NRHP (Table 4.3).

All or a portion of five of the 16 sites not NHRP-eligible may be physically impacted by the Proposed Action. The exact boundary of the "ore" body is still to be determined; therefore, exact placement of wells is not known yet, nor their exact relation to the five sites. The remaining 11 sites not NHRP-eligible, would not be physically impacted by the Proposed Action.

One NRHP-eligible site (Site 48CA6927) is located within the proposed wellfield and two (Sites 48CA6148 and 48CA268) are located outside, but immediately adjacent to, the proposed wellfield. Site 48CA6754 (unevaluated for the NRHP) would be located near the outer monitor well ring but would not be physically impacted by the Proposed Action. NRHP-eligible Sites 48CA6751, 48CA6753, and 48CA6748 are located outside of the wellfield and would not be physically impacted by the Proposed Action. Site 48CA6490 (NRHP-eligible) and Site

Table 4.3 NRHP-eligible or Unevaluated Sites Within the Hank Unit Project Area.

| Site Number | Time Period | NRHP Eligibility | Project Effects |
|---|---|---|---|
| 48CA268 | Prehistoric/Historic | Eligible[1] | No adverse effect with avoidance and mitigation measures |
| 48CA6148 | Prehistoric | Eligible[1,2] | No adverse effect with avoidance and mitigation measures |
| 48CA6475 | Prehistoric | Unevaluated | No adverse effect with avoidance |
| 48CA6490 | Prehistoric | Eligible | No adverse effect with avoidance |
| 48CA6748 | Prehistoric | Eligible[1,2] | No adverse effect with avoidance and mitigation measures |
| 48CA6751 | Prehistoric | Eligible[1,2] | No adverse effect with avoidance and mitigation measures |
| 48CA6753 | Prehistoric | Eligible[1,2] | No adverse effect with avoidance |
| 48CA6754 | Prehistoric | Unevaluated | No adverse effect with avoidance and mitigation measures |
| 48CA6927 | Prehistoric | Eligible | No adverse effect with avoidance |

[1] Denotes designated TCP.
[2] Denotes TCPs that occur within the boundary of TCP Site 48CA268.

48CA6475 (unevaluated) are located outside of the proposed construction area and would not be adversely affected by the Proposed Action (Uranerz 2012).

To avoid physical impacts to the three sites that could be physically impacted by the Proposed Action (Sites 48CA6148, 48CA6754, and 48CA6927), Uranerz would maintain a 50-ft minimum disturbance avoidance buffer around their boundaries. None of the nine total NRHP-eligible sites (including the five TCPs) and unevaluated sites would be physically impacted by the Proposed Action.

The BLM evaluated the potential visual effects of the Proposed Action on the integrity of the historic setting of the nine eligible and unevaluated sites. This evaluation was based on the *State Protocol Between the Wyoming Bureau of Land Management State Director and The Wyoming State Historic Preservation Officer* (State Protocol), which requires a visual contrast rating assessment be performed if a project proposal will be within the setting of a historic property that retains its' integrity of setting. The BLM determined that five sites (Sites 48CA268, 48CA6148, 48CA6748, 48CA6751, and 48CA6753) required visual contrast rating assessment. In early

2012, TRC Environmental Corporation (TRC) performed a visual contrast rating assessment for Uranerz for the proposed project. The assessment utilized standard BLM and WYSHPO methodologies as outlined in Appendix C of the State Protocol (including the Visual Contrast Rating system). TRC's report also included visual simulations from key observation points within the Pumpkin Buttes TCP. The methodologies outlined in State Protocol's Appendix C do not include incorporation of results from tribal consultation. In response to BLM comments, TRC revised their draft report and submitted the final version to the BLM in March 2013.

The visual effects assessment report incorporated all the mitigation measures included in the Proposed Action and required by the Memorandum of Agreement (MOA) prepared by the NRC for the Uranerz project: *Memorandum of Agreement Among the United States Nuclear Regulatory Commission, United States Bureau of Land Management Buffalo Field Office, the Advisory Council on Historic Preservation, the Wyoming State Historic Preservation Officer, Cheyenne River Sioux Tribe, Crow Tribe, Eastern Shoshone Tribe, Fort Peck Assiniboine/Sioux Tribe, Northern Arapahoe Tribe, Northern Cheyenne Tribe, Oglala Sioux Tribe, and Uranerz Energy Corporation Regarding Mitigation of Adverse Effects to Historic Properties From the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming (2011)* ("NRC MOA") (NRC et al. 2011). These same mitigation measures are incorporated into Uranerz' NRC SML and WDEQ LQD Mine Permit. Included are numerous measures to reduce the visual contrast, such as minimizing disturbance, avoiding placement of major project components in dense patches of sagebrush, use of road materials of colors that will not create a strong visual contrast, and painting all permanent aboveground structures with colors to blend with the natural landscape color (see Section 2.2.3.21 for a complete list). Based on the construction of the SPF, extent of bladed areas, removal of vegetation, installation of mine facilities, access roads, and the wellfield, the visual contrast ratings performed for Sites 48CA268, 48CA6148, 48CA6748, 48CA6751, and 48CA6753 revealed that the Proposed Action would produce a moderate contrast to the setting of the sites. According to the State Protocol agreement Part VI(C)(3), a moderate contrast is considered to be an adverse effect.

On September 30, 2013, the BLM determined the Proposed Action will result in an adverse effect to the setting of the Pumpkin Buttes TCP (48CA268) and Sites 48CA6148, 48CA6748,

48CA6751, and 48CA6753. The agreement, *Memorandum of Agreement Among the Bureau of Land Management, The Advisory Council on Historic Preservation, The Wyoming State Historic Preservation Officer and Uranerz Energy Corporation Regarding Mitigation of the Adverse Effects to Historic Properties from The Hank Unit of the Nichols Ranch In-Situ recovery Project in Campbell County, Wyoming* (2015) ("BLM MOA") (BLM et al. 2015), codified the resolution of the adverse effects. The BLM MOA contains the following mitigation measures:

**I. GENERAL MITIGATION MEASURES**

The following operator-committed mitigation measures are to be applied by Uranerz consistently across the entire project, including those portions on private surface:

A. Uranerz will provide for one qualified Tribal Monitor representing all Tribes to be present during the construction activities at the Hank Unit. Construction activities include: ground clearing and excavation activities for the Hank Unit SPF site, initial trunk line installation, and header house placement. Notification of the commencement of construction activities at the Hank Unit will be communicated to the Tribes at least one month prior to the start of construction.

B. The Tribes shall decide how they would like to select the representative of all Tribes who will serve as the Tribal Monitor. The position can be rotated through each of the Tribes, but not shorter than a two week period for each Tribal Monitor.

C. The Tribal Monitor will be compensated at the prevailing rate of a comparable job for the State of Wyoming during periods of active construction only. In the event of a suspension of construction activities, Uranerz will be relieved of its obligation to compensate the Tribal Monitor until construction resumes.

D. The qualified Tribal Monitor will be considered a Contractor to Uranerz Energy Corporation (Uranerz) and must comply with Uranerz' Contractor/Guest Environmental, Safety and Health Guidelines and Site Requirements, OSHA, NRC,

and any other State regulations. The Tribal Monitor must also agree to any NRC/State requirements imposed via license or permit. The Tribal Monitor will be expected to comply with the reasonable requests and instructions of Uranerz' Construction Manager. The Tribal Monitor will be permitted to observe construction, assist in cases of unanticipated discoveries, and ask questions relating to construction activities and receive responses thereto, but he or she shall not participate in the construction activities and shall not impede or hinder construction activities in any way. In the event of any non-compliance by the Tribal Monitor with this paragraph, the Tribal Monitor shall be required to leave the construction site and Uranerz shall be relieved of any further obligation to permit or compensate the attendance of that particular Tribal Monitor thereafter.

E. Uranerz will instruct all employees, contractors, subcontractors, and any additional parties involved in the project not to search for, retrieve, deface, or impact archaeological materials (e.g., arrowhead hunting), and that it is a violation of the federal Archaeological Resources Protection Act (ARPA) (16 U.S.C 470aa-mm) to do so on federal or tribal lands.

Mitigation measures F and G apply only to the portions of the Proposed Action on BLM surface:

F. The BLM will not permit permanent fencing to be constructed around any portions of Sites 48CA268, 48CA6148, 48CA6748, 48CA6751, and 48CA6753. However, during ground disturbing activities within 200 feet of these sites, Uranerz will place a temporary barrier 50 feet from the boundary of each site to prevent physical impacts. Once ground disturbing activities are completed, the temporary buffer barrier(s) will be removed.

G. If any additional new surface disturbance associated with the Hank Unit Project Area that is not already allowed for in the POO is proposed on BLM surface, Uranerz will consult with the BLM.

## II. DISCOVERIES DURING CONSTRUCTION OR OPERATION

The following operator-committed mitigation measures are to be applied by Uranerz consistently across the entire project, including those portions on private surface:

A. Depending on the location of the discovery, cultural resource(s) will remain under the ownership of the private landowner or the U.S. Government. Applicable federal, state or local laws will apply to the discovered cultural resource(s).

B. If human remains are encountered on private land, work will immediately stop in the vicinity of the discovery, the area will be secured, and Uranerz will immediately contact local law enforcement and the county coroner per W.S. 7-4-104. If the remains are not associated with a crime, then Uranerz will contact the NRC, WYSHPO, Invited Signatories and the landowner(s) to further consult on the treatment of the remains. Uranerz will assure compliance with applicable federal, state and local regulations relating to burial discoveries through inadvertent, construction-related disturbance of graves.

C. If Native American human remains and associated funerary objects as defined in the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001), are encountered on federally administrated land, Uranerz will immediately stop all work in the area and notify NRC, BLM, and WYSHPO. BLM will be responsible for compliance with the provisions of NAGPRA on federal land.

Mitigation measure D applies only to the portions of the undertaking on BLM surface:

D. If previously unknown cultural resources are discovered on BLM surface, Uranerz will immediately stop the ground-disturbing activities in the area of the discovery and will immediately notify the BLM. Uranerz will have any discovered cultural materials evaluated for NRHP eligibility by a professional meeting the Secretary of Department of Interior's Standard for Archaeology and History. Documentation of

the discovery and evaluation will be promptly provided to the BLM. The BLM will then consult with the WYSHPO on the determinations of eligibility and effect. Work may continue in other areas of the project; however work in the area of discovery may not resume until such time as any necessary additional actions are completed, or deemed unnecessary, and Uranerz receives written notification to proceed by the BLM authorized officer (AO).

**III. EXCLUSION AREAS**

No ground disturbing activities associated with the undertaking will occur within the boundary of 48CA268 (Pumpkin Buttes TCP) or Sites 48CA6148, 48CA6748, 48CA6751, and 48CA6753.

4.3.1.2 Native American Concerns

The BLM consultations with tribes indicated that the Proposed Action would result in an adverse effect to the setting of the Pumpkin Buttes TCP. The design features included in the NRC MOA reduced visual impacts, but after consultation with the tribes and the WYSHPO, the BLM determined that the project would still create an adverse effect to the setting of the five TCPs. This is consistent with the results of the TRC visual contrast rating assessment. Additionally, though BLM extended the boundary of the Pumpkin Buttes TCP, many tribes do not concur with the boundary change since they did not have the opportunity for a field visit to perform a tribal inventory. They indicated that the boundary may need to be extended to incorporate additional sites. There were also suggestions that the impacts to the Pumpkin Buttes TCP would be too great and that the BLM should not approve the project.

The BLM determined a good faith effort to arrange field visits and inventories for tribal representatives was made; however, this field work was not completed. The BLM determined the good faith effort to consult with the tribes was met by using the best available information. This included the results of the NRC-sponsored field visits, NRC tribal consultation information, information the BLM gathered from meetings and phone calls related to the review of the Mine

Plan of Operations, determination of adverse effect, and resolution of adverse effects. Options for mitigation discussed with the tribes during the resolution of adverse effects included tribal access to the TCP for traditional uses, additional tribal monitoring requirements, listing the Pumpkin Buttes TCP on the NRHP, and additional tribal inventories. These options were all considered by the BLM but were either not feasible or outside the scope of the Proposed Project. All the tribes were offered the opportunity to sign the BLM MOA (BLM et al. 2015) as concurring parties, although none chose to sign.

### 4.3.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. No ground would be disturbed, and no additional impacts to existing cultural resources would take place beyond those already existing. The historic setting near the Pumpkin Buttes TCP would not be impacted.

### 4.3.3 Applicant Committed Mitigation Measures

All the mitigation measures from the Pumpkin Buttes PA and additional mitigation measures developed during the preparation of the NRC MOA (NRC et al. 2011) (see Section 2.2.3.21) are incorporated into the Proposed Action.

### 4.3.4 Residual Impacts

The Proposed Action would result in unavoidable adverse impacts to the visual setting of five of the Sites that are also designated as TCPs. During the construction phase, there would likely be multiple small construction crews using heavy construction equipment in relatively small specific areas across the Project Area. Uranerz has committed to a tribal construction monitor to be present during surface disturbing activities. The tribal monitor may not be able to accompany multiple crews working at the same time. Therefore, there is a risk that unidentified resources could be impacted by crews not accompanied by the monitor. Additionally, unidentified buried cultural resources could be impacted by construction activities even when the crew is accompanied by the monitor. Initial surface disturbance exposing a buried resource can result in

an adverse impact before the monitor could halt construction. The increased human presence during the construction phase may lead to unauthorized collection of artifacts or vandalism of historic properties.

### 4.3.5 Cumulative Impacts

Surface disturbance impacts cultural resources through ground disturbance, unauthorized collection, and visual intrusion of the setting of historic properties. Destruction of any archeological resource results in fewer opportunities to study past human life-ways or changes in human behavior through time, or to interpret the past to the public. Destruction of sites of religious and traditional cultural importance to tribes is irreversible, and tribes indicate this may have inadvertent impacts on individuals living today. Cumulative impacts may compromise the aspects of integrity that make a historic property NHRP-eligible. Recording and archiving basic information about archaeological sites and the potential for subsurface cultural materials in the Project Area may serve to partially mitigate potential cumulative effects to cultural resources.

Actions occurring on non-BLM-administered lands constructed in support of federal actions can result in impacts to historic properties. The BLM has no authority over non-BLM authorized actions, however, and these also can impact historic properties. Historic properties on private surface belong to the surface owner, who is not legally obligated to preserve or protect them. The BLM may go to great lengths to protect a site on private surface from impacts due to a federal undertaking, but the same site can be legally impacted by the private surface owner at any time. Archeological inventories reveal the location of sensitive sites, and although the BLM is obligated to protect site location data, unintentional sharing of this information can potentially result in unauthorized artifact collection or vandalism. The area in which the Hank Unit is located has recently experienced significant oil/gas development, and construction of water pipeline facilities, roads, and uranium ISR mines. Much of the recent development did not require BLM or other federal approval, and did not exist when BLM determined the Pumpkin Buttes to be a TCP. This recent development resulted in a significant cumulative adverse impact to the setting of the Pumpkin Buttes; approval of the Proposed Action will add to this impact.

## 4.4 GEOLOGY (INCLUDING ENERGY AND MINERALS, AND GEOLOGICAL HAZARDS)

### 4.4.1 Proposed Action

#### 4.4.1.1 Geology

The Proposed Action would not affect the geology in the Project Area; the strata present, their location, thickness, and composition would all be basically unaffected. The ISR process is non-invasive, and rock is not actually removed, nor is it likely to be altered in its' mineralogical or chemical composition. Uranium is removed from the surfaces of the strata *in-situ*, in the subsurface, through dissolution of the uranium compounds; some minor amounts of other minerals may be dissolved as well, however.

Minor impacts to topography would occur from the Proposed Action. Interim and/or permanent changes in the land surface and slopes would occur from removal of vegetation, some localized smoothing out of high and low spots (if needed) during construction of surface facilities, access roads, wellfield, and pipelines. Interim and final permanent reclamation activities, performed in accordance with regulatory requirements, would likely reverse some of these topographic changes by necessitating achieving approximation of the original topography. This would lead to long-term minimization of impacts to local topography.

#### 4.4.1.2 Energy and Minerals

The primary impact on mineral resources from the Proposed Action would be the removal of some uranium from portions of certain Wasatch Formation sandstones occurring within the Project Area. Some of the uranium in these zones would not be available in the future.

Currently, all the subsurface federal oil and gas resources (leasable minerals) in the Project Area are leased. No coal resources (leasable mineral) are present at the surface, and subsurface coal mining is not likely in the area; no coal resources are available for leasing. As discussed in

Section 3.0, some of the oil/gas resources have been developed in the Project Area: six CBNG wells and three conventional oil/gas wells currently exist in the Project Area. CBNG is typically produced at depths of approximately 1,000 ft bgs, approximately 400 ft deeper than the uranium mineralization targeted in the Hank Unit (Uranerz 2012). Typical depths to conventional oil/gas-bearing strata in the area generally range 4,000 to 13,500 ft bgs, which is approximately 3,400 to 12,900 ft deeper than the targeted uranium mineralization (BLM 2003a).

It is possible that some surface or subsurface conflicts could occur between the Proposed Action and CBNG or conventional oil/gas development activities. The NRC SEIS provides environmental safeguards as follows: if there are oil, gas, CBNG, or other production layers near the uranium ISR production zone, and if NRC determines that there could be potential for cross contamination between layers based on environmental impact assessments, the NRC may require Uranerz to expand the groundwater monitoring well ring for detection of potential contamination between the ISR production zone and other mineral production layers (NRC 2011). However, the NRC concluded that cross contamination between Hank Unit production zone and CBNG or conventional oil/gas production was unlikely (NRC 2011). The SEIS also indicates that, if excursions are detected, the monitoring well would be placed on excursion status and reported to the NRC. Corrective actions would be taken and the well would be placed on a more frequent monitoring schedule until there is no longer an excursion.

Since CBNG activity is already occurring in the Hank Unit project area, Uranerz would put engineering safeguards in place to preclude cross contamination. For example, both the CBNG and ISR processes are designed to work on a negative pressure basis. Each of these processes pull product from the production zone into recovery wells; however, materials from these two processes do not co-mingle as the production zones are at different depths. The prospective zones of interest (uranium and CBNG) are vertically separated by at least 400 ft. In addition, the respective regulatory processes (NRC and WDEQ LQD for ISR uranium, and WOGCC and BLM for CBNG) require well casing to be cemented from surface to total depth, except the production or injection interval. Uranerz would take care while drilling to avoid interference with other production zones. The NRC could, as stated above, enhance the ISR monitoring requirements should the potential for cross contamination be determined to exist (NRC 2011).

It is also possible oil/gas exploration/development in deeper formations may occur in the future as evidenced by existing oil and gas development in the general area. Uranerz would continue to coordinate with other proponents to ensure any such activities do not compromise the integrity of uranium production zones. The oil/gas formations are 4,000 to 13,500 ft deep, below hundreds of feet of shales (aquitards); thus, there would be no conflict between the Proposed Action and deep oil/gas activities. Deep hydrocarbon wells are cased and cemented in accordance with BLM and WOGCC regulations to preclude cross contamination between formations.

Also previously indicated, there is one CBNG well within the proposed Hank Unit wellfield and five more CBNG wells within the Hank Unit boundary. To minimize potential interference, Uranerz would maintain close communication and coordinate development with the CBNG and oil/gas operators to avoid potential conflicts. No other uranium operations are proposed or being developed in the Hank Project area. Additionally, no coal resources are present at the surface, nor is subsurface mining likely in the area; the area is not available for coal leasing. Therefore, there should be no surface conflicts in horizontal or vertical facilities within or near the project area between the Proposed Action and existing and planned CBNG and conventional oil and gas facilities, existing or planned uranium facilities. There would very likely be no surface or subsurface conflicts between the Proposed Action and the existing CBNG and oil/gas wells.

There are no surface coal resources (leasable mineral), other locatable minerals (other than uranium), or salable mineral deposits known to occur in the Hank Unit area. Therefore, the Proposed Action would likely have no impact on these resources, and no development conflicts with these resources are expected. If conflicts were to arise, development priorities would be in accordance with existing federal law and BLM policies and regulations.

#### 4.4.1.3 Geological Hazards

##### Earthquakes

The NRC GEIS described that aquifer restoration programs typically use a combination of (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection, and

recirculation; (iv) stabilization; and (v) water treatment and surface conveyance. The groundwater sweep and recirculation process does not remove rock matrix or structure; therefore, no significant matrix compression or ground subsidence would be expected. The aquifer water pressure is decreased during restoration by the maintenance of a negative water balance in the wellfield being restored (i.e., thus increasing drawdown); this ensures the direction of water flow is into the wellfield, thereby reducing the potential spread of contamination. However, the pressure change is limited by the recirculation of treated groundwater. Therefore, the GEIS concluded that it would be unlikely that uranium ISR operations in the Wyoming East Uranium Milling Region (in which the Hank Unit is situated) could reactivate local faults, and extremely unlikely that ISR operations could or would cause earthquakes (NRC 2009a).

Subsidence

No subsidence is known to have occurred within the Hank Unit project area, and none is expected to occur because of the Proposed Action. The ISR process removes uranium minerals from the surfaces of the host formation along with trace quantities of other elements that had been deposited in the host sandstones and clays. This process leaves the physical structure of the host formation unaffected. For this reason, the ISR process would not increase the void space in the subsurface, would not lead to subsidence, nor increase the potential for subsidence (NRC 2011; Uranerz 2012).

Mass Movement

While landslides or other mass movements are possible on or near the North Middle Butte, there are no known landslides within or immediately adjacent to the Hank Unit project area. The Proposed Action would not cause landslides or other mass movements.

### 4.4.2 No Action Alternative

Under the No Action Alternative, the mining activities described in the Uranerz POO (2012) and the NRC SEIS (2011) would not be undertaken on any lands within the Hank Unit. Selection of

this alternative would not preclude other minerals (including oil/gas, CBNG, or others) from being explored for or developed. Under separate NEPA analysis, BLM could approve other mineral development activities in the proposed Project Area if the Proposed Action were denied.

### 4.4.3 Applicant Committed Mitigation Measures

Uranerz would maintain close communication with oil/gas and CBNG operators in the project area and work with them to avoid potential conflicts. The prospective zones of interest (uranium as opposed to CBNG) are separated by at least 400 vertical ft. In addition, Uranerz would comply with all appropriate well completion standards specified by NRC, WDEQ, and BLM.

### 4.4.4 Residual Impacts

The primary residual impact to geologic resources would be the removal of some of the uranium resource from the target formation. The amount of uranium resource removed would then be no longer available for future extraction, and would constitute an unavoidable adverse impact to geologic resources.

### 4.4.5 Cumulative Impacts

Several other uranium ISR projects occur in the general area of the Project, including Cameco's North Butte, and Uranium One's Willow Creek and Moore Ranch. Both the North Butte and Willow Creek are operational; Moore Ranch is approved, but has not yet been constructed. North Butte is approximately 1 mi northwest of the Hank Unit on the south and southeast sides of North Pumpkin Butte. It is a satellite to Cameco's Smith Ranch-Highland Uranium ISR project; uranium-loaded resins from North Butte are transported to Smith Ranch-Highland for processing (NRC 2012). Willow Creek is approximately 3 mi northwest of the Hank Unit, on the north and west sides of North Pumpkin Butte. This facility temporarily ceased operations in 2000, becoming commercially operational again in May 2012. Moore Ranch is approximately 12 mi south of the Hank Unit, and will likely be operated as a satellite to their Willow Creek project, with uranium-loaded resins transported to that facility for processing.

These four projects (Nichols Ranch/Hank, North Butte, Willow Creek, and Moore Ranch) would result in the removal of uranium from each of those permit areas; this would constitute the largest impact to geological resources. In addition, the NRC's GEIS concluded it would be unlikely that ISR operations in the Wyoming East Uranium Milling Region (in which all four are situated) could reactivate local faults, and extremely unlikely that ISR operations could or would cause earthquakes (NRC 2009a).

Drilling for conventional oil and gas in the Wyoming PRB had declined considerably in the last 20 years, although it has been rising slightly in more recent years. As discussed in various BLM planning documents, increasing prices have led to increased interest in drilling, and there remains potential for finding and developing these resources in deeper formations in the PRB (BLM 2003a, 2006, 2009c, 2009d, 2010d, 2011d). In addition, current technology now allows economic production from tight oil-bearing shales, which was not possible just 5 years ago. CBNG drilling and production increased rapidly from 1999 through 2003, then began leveling off; it is now occurs at a small fraction of its' former activity level. Oil and gas and related development accounts for most of the projected mineral-related disturbance in the general area surrounding the Project Area.

The Proposed Action would have no discernible cumulative impacts on geological resources, including geology, energy and minerals (e.g., conventional oil/gas, CBNG, coal, uranium, and other minerals), and geological hazards (e.g., earthquakes, subsidence, and mass movements).

## 4.5 LAND USE (GRAZING, RECREATION, AND ENERGY AND MINERAL DEVELOPMENT)

### 4.5.1 Proposed Action

#### 4.5.1.1 Livestock Grazing

As required by NRC regulations, the wellfield and the SPF would be fenced to prevent unauthorized entry. Implementation of the Proposed Action would eventually affect the availability for livestock grazing on approximately 159.4 acres within the Hank Unit Project

Area. As wellfield construction occurs, the first area (Production Area #1) would be fenced out first followed by next area (Production Area #2). Livestock grazing on approximately 123 acres of private surface lands and 32 acres on BLM-administered lands would be prevented over the LOP. Of the 123 private surface acres, approximately 119 would be within the wellfield, and 4 would be the SPF. All 32 acres of BLM surface lands would be within the wellfield; this would be less than 7% of the total Hank Unit acreage. The surface disturbance and resulting loss of foraging opportunity for livestock would occur for 10 years as the two proposed production areas are sequentially developed, reclaimed, produced, restored, and decommissioned. Areas not needed for operations would undergo reclamation and soil stabilization within the year of the disturbance or the first planting season following wellfield construction.

During the LOP, the areas would be fenced to prevent livestock entry and to enhance reclamation success and safeguard equipment. WDEQ LQD Type III fences would be installed to prevent livestock entry, but would not prevent wildlife entry. Grasses and forbs comprise the BLM-approved seed mix, and over the long term locally dominant shrub species would invade the disturbed areas. Approximately 159.4 acres would be unavailable for the majority of the LOP. Assuming an average stocking rate of 6 acres per animal unit month (AUM), the Proposed Action would result in a LOP reduction of approximately 27 AUMs.

Long-term fenced out areas would be unavailable for livestock grazing for approximately 15 years (10 years LOP, plus 5 years for construction and reclamation) until ISR activities are completed, wellfield and facilities abandoned, and all remaining disturbed areas reclaimed and approved for livestock grazing by WDEQ LQD. Once reclamation is deemed successful, project-related fencing would be removed, forage production would return as permanent vegetation is reestablished, and livestock grazing would be allowed when authorized by WDEQ LQD in accordance with the reclamation standards presented in Section 2.0.

#### 4.5.1.2 Recreation

As discussed in Section 3.0, no developed recreational sites or facilities exist within the Hank Unit Project Area. Since access to the area (which includes the Project Area) is controlled by

private landowners, and they will continue to maintain control over access, the Proposed Action would be expected to have limited impacts on recreational opportunities.

#### 4.5.1.3 Energy and Mineral Development

Detailed information concerning the potential impacts on energy and mineral development within the Hank Unit is presented in Section 4.4.1.2 and will not be repeated here.

### 4.5.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional surface would be disturbed and no additional impacts to the existing livestock grazing and recreational opportunities would take place beyond those that already exist.

### 4.5.3 Applicant Committed Mitigation Measures

To mitigate and reduce potential impacts from the Proposed Action on land use resources, Uranerz would implement the following mitigation measure. Once permanent reclamation has been deemed adequate by WDEQ LQD, Uranerz would remove all project-related fencing from the Project Area.

### 4.5.4 Residual Impacts

The Proposed Action would result in the loss of approximately 27 AUMs for the LOP. There would also be unavoidable impacts to few recreational users within and near the Hank Unit for the LOP.

### 4.5.5 Cumulative Impacts

The BLM expects that past and projected disturbance within 15 mi of the Hank Unit, totaling approximately 537,685 acres, would come from additional ISR projects and other forms of

energy development (e.g., conventional oil/gas and CBNG development). Based on various planning documents, no coal, salable minerals, or other locatable minerals extraction projects are planned within 15 mi of the Hank Unit (BLM 2009).

Existing and projected ISR projects within 15 mi of the Hank Unit include the Nichols Ranch Unit (not including the Hank Unit), Cameco's North Butte, and Uranium One Inc.'s Willow Creek and Moore Ranch. These four projects have each undergone separate permitting and environmental analysis and review by the NRC and WDEQ LQD (NRC 2008a, 2010, 2011, 2012). Based on the separate NEPA documents prepared for each project by the NRC, these ISR projects are expected to result in the disturbance of a total of 1,205 acres (Table 4.4); this represents only approximately 0.2% of the area within 15 mi of the Hank Unit.

Based on the BLM PRB Coal Review Cumulative Effects Report referenced in the Nichols Ranch ISR SEIS, past and projected disturbance not associated with ISR projects (that includes conventional oil/gas and CBNG development) are expected to account for approximately 7.4% of the analysis area (BLM 2005, 2009). Since no surface coal mining operations occur within the 15 mi analysis area, this value does not include past or projected disturbance associated with surface coal mining operation that occur in the eastern portion of the BLM PRB Coal Review Cumulative Effects analysis area.

Table 4.4 Expected Disturbance from Permitted ISR Projects Within 15 mi of the Hank Unit Project Area.

| Project Name | Total Expected Disturbance (acres) |
|---|---|
| Nichols Ranch Unit Project (not including Hank Unit) | 114 |
| Moore Ranch Project | 150 |
| North Butte Project | 400 |
| Willow Creek Project | 541 |
| Total | 1,205 |

Source: NRC 2008a, 2010, 2011, 2012.

Assuming all existing and projected disturbances (including conventional oil/gas and CBNG development) within the 15 mi analysis area would disturb approximately 7.4% of this area, this would equate to total of 39,789 acres of disturbance. Including existing and projected disturbance from other approved ISR projects in the analysis area, the total is 40,994 acres over the LOP. Assuming a stocking rate of 6 acres per AUM, total existing and projected disturbance would result in the loss of approximately 6,832 AUM from the analysis area. Including the Hank Unit, this is likely to result in the interim loss of an additional approximately 27 AUMs, a further 0.2% reduction in total AUMs within the 15 mi analysis area.

Except for roads that would remain in use after decommissioning, the impact to livestock grazing would be short term (LOP plus 5 years) because all disturbed lands would eventually be returned to the pre-operational condition. The access roads built to connect existing T-Chair Ranch roads with the Hank Unit SPF would remain in use for some period after decommissioning to facilitate site monitoring.

There would be few cumulative impacts on recreational opportunities within and near the Hank Unit because a vast majority of surrounding lands are privately-owned, making the public lands "land-locked." In addition, the general public does not have access to the public lands without specific authorization from private surface owners to cross their lands.

## 4.6 VEGETATION INCLUDING SPECIAL STATUS SPECIES, NOXIOUS WEEDS, AND WETLANDS

### 4.6.1 Proposed Action

#### 4.6.1.1 Vegetation

Based on the POO, sagebrush shrublands and mixed grasslands cover 93% of the Hank Unit Project Area, and these plant communities would be the most affected by the Proposed Action (Uranerz 2012). A total of approximately 159.4 acres of land would be disturbed by the Proposed Action from construction of the SPF, access roads, and wellfield. A majority of the area to be disturbed would be affected within 4 years of the commencement of operations. This

disturbance would exist over a minimum of 10 years (LOP). Once revegetation is complete, it would likely require 2 to 4 years for grasses to be reestablished, but it could take 10 or more years for shrub communities to be reestablished (refer to Figure 2.1). The majority of vegetation disturbance would result from wellfield development, and each wellfield area would be reclaimed and reseeded with the land-owner approved seed mixtures presented in Section 2.0 of this EA. Interim and permanent reclamation operations would begin as soon as practicable following project completion in accordance with a reclamation plan that would be conducted in accordance with WDEQ LQD regulations and the requirements of Uranerz WDEQ LQD Mine Permit. Some recruitment from native populations bordering disturbed areas can be expected, which would facilitate the revegetation process.

Existing access roads would be used to minimize new disturbance of sagebrush habitat following BLM recommendations to minimize road width, revegetate road shoulders, and limit vehicle speeds. Surface disturbance from the construction activity of the Proposed Action could result in the spread of invasive and noxious weeds. One noxious weed species, Canada thistle (*Cirsium arvense*), is found in the Hank Unit. Canada thistle can crowd out native species and reduce forage yields if not properly controlled. Uranerz has committed to washing, on an as-needed basis, vehicles that enter the Hank Unit, as well as the use of herbicides, as necessary, to eradicate and control the spread of Canada thistle and prevent the introduction of any additional noxious weeds (Uranerz 2012).

Initial disturbance associated with the Proposed Action would affect approximately 159.4 acres that comprise about 7% of the total proposed project area (2,250 acres). However, once construction operations have been completed, approximately 147.6 acres (96% of the total disturbance) would be revegetated for the remaining LOP. Once the wellfield has been decommissioned, all disturbed lands would be reclaimed and revegetated as soon as possible in accordance with the approved reclamation plan. Once permanent revegetation efforts are complete, it would likely require 2 to 4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished. Uranerz would also implement reclamation measures such as use of certified weed-free seed and mulch to minimize the spread of noxious weeds (Uranerz 2012).

#### 4.6.1.2 Special Status Plant Species

As a result of field surveys in the Hank Unit, it was determined that no TEPC plant species occur in the Hank Unit. Only one BLM-sensitive plant species limber pine (*Pinus flexilus*) was documented as occurring within or near the Hank Unit project area, and it was limited to the western sideslopes and on top of North Middle Butte (Uranerz 2012). No disturbance is planned on the western sideslopes or top of North Middle Butte; therefore, the Proposed Action would not impact any special status plant species.

#### 4.6.1.3 Wetlands

Uranerz contracted TRC to conduct a wetland delineation of the Hank Unit project area in 2006 (Uranerz 2012). No wetland areas exist within the Hank Unit, nor any perennial streams, ponds, lakes, or other permanent water bodies exist within the Hank Unit Project Area (Uranerz 2012). Therefore, there would be no impacts to wetlands, perennial streams, ponds, lakes, or other permanent water bodies within the Hank Unit project area.

### 4.6.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional ground would be disturbed and no additional impacts to vegetation resources would take place beyond those that already exist.

### 4.6.3 Applicant Committed Mitigation Measures

To mitigate and reduce potential impacts from the Proposed Action on vegetation (including SS species, noxious weeds, and wetlands), Uranerz would implement the following measures.

- Once the wellfield has been decommissioned, all disturbed lands would be reclaimed and revegetated as soon as possible in accordance with the approved reclamation plan.

- Uranerz would wash all vehicles entering the project area, on an as needed basis, vehicles that come into the Hank Unit.
- Uranerz would apply herbicide, as necessary, to eradicate and control the spread of Canada thistle and prevent the introduction of any additional noxious weeds.
- Uranerz would use of certified weed-free seed and mulch to minimize the spread of noxious weeds.

### 4.6.4 Residual Impacts

The Proposed Action would result in the loss of approximately 159.4 acres of vegetation during initial construction operation; however, interim revegetation would be conducted and only approximately 11.8 acres would remain disturbed for the LOP. Once the project has been decommissioned, all disturbed areas would be revegetated in accordance with the NRC- and WDEQ LQD-approved reclamation plans. Once permanent revegetation efforts are complete, it would likely require 2 to 4 years for grasses to be reestablished, but it could take 10 or more years for shrub communities to be reestablished. There would be no residual impacts to special status plant species or wetlands.

### 4.6.5 Cumulative Impacts

The BLM expects that existing and projected disturbance within 15 mi of the Hank Unit would come from additional ISR projects and other forms of energy development (e.g., conventional oil/gas and CBNG development). Based on various planning documents, no coal, salable minerals, or other locatable minerals extraction projects are planned within 15 mi of the Hank Unit (BLM 2009). The area within 15 mi of the Hank Unit includes a total of 537,685 acres.

Existing and projected ISR projects within 15 mi of the Hank Unit include Uranerz' Nichols Ranch (not including the Hank Unit), Cameco's North Butte, and Uranium One's Willow Creek and Moore Ranch. These four projects have each undergone separate permitting and environmental analysis and review by the NRC and WDEQ LQD (NRC 2008a, 2010, 2011, 2012). Based on the separate NEPA documents prepared for each by the NRC, these ISR

projects are expected to result in a total disturbance of 1,205 acres (Table 4.2), which represents approximately 0.2% of the area within 15 mi of the Hank Unit.

Based on the BLM PRB Coal Review Cumulative Effects Report referenced in the Nichols Ranch ISR SEIS, past and projected disturbance not associated with ISR projects (which includes an additional estimated 3,703 conventional oil and gas wells and 5,890 CBNG wells) are expected to account for approximately 7.4% of the analysis area (BLM 2009; NRC 2011). Since no surface coal mining operations are located in the 15 mi analysis area, this value does not include past or projected disturbance associated with surface coal mining operations that occur in the eastern portion of the BLM PRB Coal Review Cumulative Effects analysis area. Assuming that all past and projected disturbances (including conventional oil and gas development, and CBNG development) within the 15 mi analysis area would disturb approximately 7.4% of the area, this would equate to total of 39,789 acres of disturbance. If the projected disturbance from other approved ISR projects within 15 mi of the Hank Unit are included in this analysis, it would result in a total past and project disturbance of 40,994 acres (7.6% total disturbance) over the LOP.

Except for roads that would remain in use after decommissioning, the impact to vegetation would be short term (10-year LOP, and approximately 5 years for construction and permanent reclamation, although reclamation could take longer). Once permanent revegetation is complete, grass reestablishment would likely require 2 to 4 years, but shrub communities could take 10 or more years. The access roads built to connect existing T-Chair Ranch roads with the Hank Unit SPF would remain in use for some period after decommissioning to facilitate site monitoring. Once construction operations have been completed, approximately 147.6 acres (96% of the total disturbance) would be revegetated for the remaining LOP. Once the wellfield has been decommissioned, the remaining disturbed lands would be reclaimed and revegetated in accordance with the approved reclamation plan. Uranerz would also implement reclamation measures such as use of certified weed-free seed and mulch to minimize the spread of noxious weeds (Uranerz 2012).

## 4.7 SOCIOECONOMICS

### 4.7.1 Proposed Action

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the Proposed Action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (i) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact on the region, and (ii) operation-related jobs in support of facility operations, which have the greater potential for permanent, long-term socioeconomic impacts in the region.

The socioeconomic region of influence (ROI) represents a geographic area where the proposed Hank Unit ISR Project employees and their families would reside, spend their income, and use their benefits, thereby affecting the economic conditions of that region. The focus of the analysis is on the impacts of constructing and operating the proposed Hank Unit ISR facility in Campbell County where the communities of Gillette and Wright are located.

#### 4.7.1.1 Construction Impacts

Socioeconomics impacts from construction would result predominantly from employment, and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local workforce. Uranerz estimates the majority of the construction workers needed would come from Gillette and/or Wright, and also assumed most would choose to live in larger communities with access to more services. During construction of surface facilities and wellfield, it is expected that general practice would be to use local contractors (e.g., drillers, construction workers) and building materials and building supplies to the extent practical. Some construction workers would commute from outside the county, and skilled employees (e.g., engineers, accountants, managers) would likely come from outside the local workforce. Some employees may temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and paying taxes.

The following subsections describe the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services.

Demographics

Because of the short duration of construction (one year) for each wellfield and small size of the construction workforce (45 to 55 workers), the impacts of construction on demographic conditions would be short in duration. Most of these workers would transition from working on the Nichols Ranch Unit for Uranerz, which is already under construction, to working on the Hank Unit. It is assumed that Uranerz would employ workers from the surrounding area, which would reduce demands for public services. Also, due to the short duration of the construction phase, workers would not likely relocate their families to the region.

Employment Structure

Construction of the Hank Unit ISR Project would create short-term employment opportunities for 45 to 55 construction workers of about one year for each wellfield with the potential of up to 30 to 40 additional jobs being generated to support this activity in the local economy.

Income

No changes to regional income levels are anticipated as a result of ISR facility construction activities. It is expected workers would be paid the regional rates typical of the area.

Housing

Construction workers relocating to the area would cause a short-term increase in the demand for temporary (rental) housing units in Campbell County. However, the number of available housing units in Campbell County has kept pace with the average population increase in the county. Any changes in employment would have little to no noticeable effect on the availability

of housing in Campbell County. Due to the short duration of the construction phase and the availability of housing in the region, there would also be little or no employment-related housing impacts. In addition, it is likely that Uranerz would employ workers from the surrounding area, thereby reducing some of the need for additional housing in Campbell County.

Local Finance

Construction of the proposed Hank Unit ISR Project would generate some tax revenue in the local economy through the purchase of goods and services, as well as contributing to county and state tax revenues. The tax revenue increase would be of short duration, occurring for about one to two years due to the construction workforce of an estimated 45 to 55 workers.

Education

Because of the short duration of construction (one to two years), workers would not be expected to bring families and school-aged children with them; therefore, no additional educational services during construction of the proposed Hank Unit ISR Project are anticipated.

Health and Social Services

The number of construction workers would cause a short-term increase in the demand for health and social services in Campbell County. However, it is expected that little or no impact on the availability of health and social services would occur, due to the short duration of the uranium ISR construction phase and the small size of the construction workforce of 45 to 55 workers.

4.7.1.2 Operational Impacts

All phases of operation of the proposed Hank Unit ISR Project (including uranium recovery, groundwater restoration, and decommissioning) are expected to last nine years and employ approximately 20 to 35 workers. Some members of the workforce would be staffed from outside

the region, particularly during initial operations, as the complexity of ISR facility operations would require technically skilled workers who may not be available locally (NRC 2011).

The effects on community services (e.g., education, healthcare, utilities, shopping, and recreation) during operations are expected to be similar to effects during construction, but longer in duration: up to nine years, which includes uranium recovery, groundwater restoration, and wellfield reclamation. The operations workforce would impact the local economy through the creation of jobs, the purchasing of local goods and services, and the increase in county and state tax revenues. Severance tax on the uranium extracted would also be collected at the state level and would contribute to the State of Wyoming general fund.

The following subsections describe the operation impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services.

Demographics

Uranerz estimates that the number of operations workers would be approximately 20 to 35 workers, and during all phases of operations workers would stay in the area for approximately nine years. ISR facility operations require a number of specialized workers, such as plant managers, technical professionals, and skilled tradespeople, many of whom might relocate from outside the area. Assuming the entire direct and indirect workforce comes from outside the region of influence, the combined effect of 40 to 70 new persons in the region would constitute 1% or less of the current civilian labor force in Campbell County. Demographic conditions in Campbell County would not likely change.

Employment Structure

The proposed ISR facility operations at Hank Unit is expected to generate 20 to 35 new direct jobs, such as project managers, plant operators, lab technicians, and drill contractors. Some skilled positions would likely be filled by people moving into the area rather than providing employment opportunities for people living in nearby communities. ISR facility operations

could provide some jobs in the local economy. However, because it is likely that most skilled workers would be drawn from areas outside of the ROI, any the number is relatively small and for a relatively short period of time, the proposed ISR facility operations at the Hank Unit would not noticeably affect employment rates in Campbell County.

Income

The average annual salary for all full-time employees would be roughly $50,000. This is below the Wyoming average of $56,380 (USCB 2012).

Housing

Demand for permanent housing is anticipated to increase in the communities surrounding the proposed Hank Unit project site leading up to the startup of ISR facility operations. The surrounding towns of Wright, Edgerton, and Midwest, as well as larger cities such as Gillette, Casper, and Wright are within commuting distance to the proposed project area. For the purpose of this analysis, it is assumed that a majority of the 20 to 35 workers would live in Gillette, Casper, and/or Wright, because of the size of these communities and the increased availability of suitable housing. Impacts to housing during ISR facility operations are expected to be low because of the small size of the operations workforce (20 to 35 workers) and the potential addition of 20 to 35 (indirect) workers in support of facility operations.

Local Finance

Campbell County would receive some tax revenue during ISR facility operations. Personal property tax would be applied to the value of all equipment used by the proposed project. In addition, a state mineral severance tax would be applied to the extracted uranium; however, this tax would not be directly returned to Campbell County. A county *ad valorem* tax for production would also contribute to local government revenue. Indirectly, the Campbell County would benefit from increased sales tax revenue from the increased number of workers relocating to the ROI and from increased demand for goods and services.

Education

The number of school-aged children could increase, as an estimated 20 to 35 workers (direct and indirect) and their families would relocate to Campbell County during ISR facility operations, impacting local public schools and education-related services. The average family size in Wyoming is 2.46 (USCB 2012); therefore, a conservative estimate is for 49 to 92 school-aged children possibly relocating to the ROI. Comprising various ages and spread across schools and classrooms in both counties (kindergarten and grades 1 through 12), this small number of children would not likely have a noticeable effect on student-to-teacher ratios. County planners indicated schools could accommodate a small increase in the number of students.

Health and Social Services

There would be a small increase in the demand for health and social services during ISR facility operations from workers and their families relocating to the ROI. Operational impacts would not be expected to differ significantly from those during the construction phase of the ISR facility.

### 4.7.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional impacts to socioeconomic resources would take place beyond those that already exist or have been identified.

### 4.7.3 Applicant Committed Mitigation Measures

No additional mitigation measures are recommended.

### 4.7.4 Residual Impacts

The Proposed Action would result in a small increase in population during the construction (45 to 55 employees) and operational phases (20 to 35 employees) for the project. This increase in

population would result in an increase demand on housing, public infrastructure, and public service systems in Campbell County. However, once the project is completed population levels would return to pre-development levels and impacts on housing and public infrastructure and service systems would be reduced.

### 4.7.5 Cumulative Impacts

The geographic boundary for the socioeconomic cumulative impact analysis includes Campbell and Johnson counties because the proposed Hank Unit Project would be located along their adjoining border. Population change in these counties over time can be used as an indicator of future social and economic change. Campbell County grew from 12,957 in 1970 to 46,133 in 2010, and is projected to reach 56,890 in 2020. Johnson County grew from 5,587 in 1970 to 8,569 in 2010, and is projected to reach 9,450 in 2020. By comparison, the population of Wyoming was 332,416 in 1970 and is projected to grow modestly from 2010 to 2020 (from 563,626 to 622,360) (WEAD 2011).

The construction phase of the Proposed Action would require a maximum of 45 to 55 workers with approximately 20 to 35 workers required for operational phases (uranium recovery, aquifer restoration, and decommissioning). A regional economic model (Regional Economic Model, Inc., Policy Insight) that was part of BLM's *Powder River Basin Coal Review: Cumulative Social and Economic Effects* (ENSR Corporation (ENSR) 2005) was also used to develop employment and population projections for RFFAs. Two future scenarios were modeled showing a lower and upper development scenario in the PRB. The two scenarios represent a projected range of economic activity derived by combining the range of future coal production with other identified RFFAs, including oil and gas production and other mining operations. The timeframe for the model analysis spans from 2007 to 2020, and older data were incorporated into the model to build upon historic employment and population trends.

The PRB BLM coal review study area served as the geographic boundary for the development-review study. Across the entire six-county Wyoming portion of the PRB (Campbell, Converse, Crook, Johnson, Sheridan, and Weston), projected increases in

employment from coal mining operations, oil and gas development, and other mining development would range from 12,120 to 28,625 jobs under the lower and upper development scenarios between 2003 and 2020. Most of the gain is expected to take place in Campbell County, which is projected to capture 60% of the new jobs under the lower development scenario and 65% under the upper development scenario (ENSR 2005). The construction phase of the Proposed Action would require a maximum of 45 to 55 workers with approximately 20 to 35 workers required for operational phases. Therefore, the incremental cumulative impacts to demographics from the construction and operational phases of the Hank Unit would be within the range of impacts disclosed and analyzed in the *Powder River Basin Coal Review: Cumulative Social and Economic Effects* (ENSR 2005).

While Campbell County and the entire PRB have been described as possessing an enhanced capacity to respond to and accommodate growth, periods of rapid growth have been known to stress communities and their social structures, housing resources, and public infrastructure and service systems (ENSR 2005). Both the lower and upper development scenarios indicate a strong demand for housing resources through the year 2020. Based on the lower development scenario, Campbell County is expected to require a minimum 58% increase in total housing demand between 2003 and 2020. This demand is anticipated to exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other resources would also be high (ENSR 2005). The incremental cumulative impacts to housing from the construction and operational phases of the Hank Unit would be within the range of impacts disclosed and analyzed in the *Powder River Basin Coal Review: Cumulative Social and Economic Effects* (ENSR 2005).

Because of the short-term nature of the construction phase of the Hank Unit, project construction workers are not expected to relocate their families to the region. In addition, only 45 to 55 construction workers would be expected to be required during this phase of the project. As a result, the construction phase would have no cumulative impacts on public schools in Campbell or Johnson counties. Under the operational phase of the project, only 20 to 35 workers would be required for the project and would result in an increase in the number of worker dependents (students) that would attend regional public schools. A short-term school capacity shortage

could also result from an increase in regional population. Under the lower development scenario, Campbell County is projected to experience a substantial increase in school-aged children through 2020. Based on this scenario, an additional 1,587 students would be added to school enrollments by 2020, representing a 22% increase over the 2009 to 2010 school year enrollment. To address school facilities, the Wyoming School Facilities Commission has approved $88.1 million for 31 new or major facility improvements projects in the six county study area (ENSR 2005). The incremental cumulative impacts to schools from the operational phases of the Hank Unit would be within the range of impacts disclosed and analyzed in the *Powder River Basin Coal Review: Cumulative Social and Economic Effects* (ENSR 2005).

The Hank Unit would also generate tax revenue in the local economy through the purchase of goods and services as well as contributing to county and state *ad valorem* tax revenues. Population increases in affected counties and communities would create across-the-board increases in demand for public services. Increased demand for public services from the proposed construction and operation of the ISR facility at Hank Unit would be limited due to the small number of workers required for the construction and operational phases of the project. Anticipated increased demand for services include water supply and wastewater systems, which are anticipated to meet projected needs through 2020. The incremental cumulative impacts to public services from the construction and operational phases of the Hank Unit would be within the range of impacts disclosed and analyzed in the *Powder River Basin Coal Review: Cumulative Social and Economic Effects* (ENSR 2005).

## 4.8 SOIL RESOURCES

### 4.8.1 Proposed Action

Construction-related activities would result in removal of native vegetation, exposure of the soil, mixing of the soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to wind and water erosion. These impacts could, in turn, result in soil loss due to wind erosion, increased runoff, soil erosion, and sedimentation to receiving waters. Effects of construction activities on soils are limited to the duration and extent of disturbances, and the

extent of the excavations. Soils would be impacted twice by the Proposed Action: first during the development and construction phase, and a second time during groundwater restoration and project decommissioning and reclamation phase.

A total of approximately 159.4 acres of land would be disturbed by the Proposed Action from construction of the SPF, access roads, wellfield, and associated facilities. This disturbance would exist over an anticipated 10 year LOP, and a majority of the area to be disturbed would be affected within 4 years of the commencement of operations (refer to Figure 2.1). The majority of soil disturbance would result from wellfield development. Each wellfield area would be temporarily reclaimed and reseeded with native grasses as soon as practicable following project completion in accordance with a reclamation plan that would conducted in accordance with WDEQ LQD regulations and the requirements of Uranerz WDEQ LQD Mine Permit. Existing access roads would be used and possibly upgraded to minimize new disturbance of soils following BLM recommendations to minimize road width.

Initial disturbance associated with the Proposed Action would affect approximately 159.4 acres that comprise about 7% of the total proposed project area (2,250 acres). However, once construction operations have been completed, approximately 147.6 acres (96% of the total disturbance) would be temporarily reclaimed for the remaining LOP (another nine years).

During construction operations, Uranerz would implement a SWPPP to minimize impacts to soil erosion. In addition, sufficient topsoil to facilitate revegetation would be segregated from subsoils during all construction operations, and returned to the surface upon completion of operations. After replacing the topsoil, areas would be reseeded with a native grass mixture to minimize erosion. Uranerz would keep the extent of disturbance to the minimum necessary for project activities and subsequent production activities while providing for safety. Uranerz would minimize project-related travel during periods when soils are saturated and excessive road rutting (>4 inches) may occur. Once the wellfield has been decommissioned, all disturbed lands would be recontoured, retopsoiled, and revegetated in accordance with the approved reclamation plan. Uranerz would replace topsoil or suitable growth materials over all disturbed surfaces prior to conducting revegetation operations.

### 4.8.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional ground would be disturbed and no additional impacts to soils would take place beyond those that already exist.

### 4.8.3 Applicant Committed Mitigation Measures

Uranerz would minimize potential impacts and disturbance to soil resources during construction operations by using construction site management techniques, and by use of previously disturbed areas to the extent possible. This includes using existing ROWs, designating limited equipment/ materials storage yards and staging areas, and by other appropriate means.

Uranerz would segregate topsoil from subsoils and salvage sufficient topsoil to facilitate revegetation during all construction operations. Topsoil stockpiles would be seeded to prevent erosion and to maintain viability of soil microflora and microfauna. On BLM-administered lands, topsoil would be directly hauled to areas that have been recontoured and are waiting retopsoiling, instead of stockpiling the topsoil. However, if direct replacement of topsoil is not possible, the topsoil would be stored in designated topsoil stockpiles in accordance with WDEQ LQD rules and regulations and seeded.

Uranerz would minimize project-related off-road travel during periods when soils are saturated or when conditions result in excessive road rutting (>4 inches) may occur.

Uranerz would develop and implement a SWPPP for the newly affected areas. Uranerz would install and maintain all appropriate runoff and erosion control measures as described in the SWPPP such as water bars, berms, and interceptor ditches. Copies of the SWPPP and inspection reports would be on file in the Uranerz' SPF.

Interim erosion control measures such as mulching, jute netting, or other appropriate techniques (as outlined in the SWPPP), would be used on unstable soils, steep slopes, and wetland areas to

prevent erosion and sedimentation until vegetation becomes established. Uranerz would also minimize disturbance to vegetated cuts and fills on new and existing roads.

Uranerz would replace topsoil or suitable growth materials over all disturbed surfaces prior to revegetation, and would conduct interim and permanent revegetation operation on all disturbed areas in accordance with the approved reclamation plan as soon as practical following disturbance.

### 4.8.4 Residual Impacts

The Proposed Action would result in the disturbance of approximately 159.4 acres of soils during initial construction operation. This part of the Proposed Action could, in turn, result in soil loss due to wind erosion, increased runoff, soil erosion, and sedimentation into receiving waters. Once the wellfield has been decommissioned, all disturbed lands would be recontoured, retopsoiled, revegetated disturbed in accordance with the approved reclamation plan.

### 4.8.5 Cumulative Impacts

The BLM expects that past and projected disturbance within 15 mi of the Hank Unit would come from additional ISR projects and from other forms of energy development (e.g., conventional oil and gas development, and CBNG development). Based on various planning documents, no coal, or other locatable or salable mineral extraction projects are planned within 15 mi of the Hank Unit (BLM 2009).

Past and projected ISR projects within 15 mi of the Hank Unit include Uranerz' Nichols Ranch (not including the Hank Unit), Cameco's North Butte ISR Project, and Uranium One's Willow Creek and Moore Ranch. These projects have each undergone separate permitting and environmental analysis and review by the NRC and WDEQ LQD. Based on the separate NRC NEPA documents prepared for each project, these four ISR projects are expected to result in the disturbance of a total of 1,205 acres, which represents approximately 0.2% of the area within 15 mi of the Hank Unit.

Based on the BLM PRB Coal Review Cumulative Effects Report, past and projected disturbance not associated with ISR projects are expected to account for approximately 7.4% of the analysis area (BLM 2009). Assuming that all past and projected disturbances (including, ISR, conventional oil/gas and CBNG development) within the 15 mi analysis area would disturb approximately 7.6% of the area; approximately 40,864 acres of authorized disturbance.

Once construction operations have been completed, approximately 147.6 acres (96% of the total disturbance) would be revegetated for the remaining LOP. Except for access roads that would remain in use after decommissioning, the impact to soils would be short term (for the life of the facility), because Uranerz would temporarily stabilize and reclaim all disturbed lands and they would be permanently returned to their pre-operational condition with the completion of decommissioning and permanent reclamation operations. The pre-existing ranch access roads that connect the Nichols Ranch project area with the Hank Unit SPF would remain in use after reclamation bond release for ongoing ranching operations.

## 4.9 VISUAL RESOURCES

### 4.9.1 Proposed Action

Potential visual impacts from the proposed Hank Unit project may occur as part of the Proposed Action. Temporary impacts would occur primarily from the use of equipment such as drill rigs; dust and other emissions from such equipment; the construction of facility buildings (i.e., SPF and header houses) and other structures, and land clearing and grading activities. Dust suppression techniques would reduce some temporary visual impacts. Long-term impacts would result from roads, wells, SPF, and other structures. However, such impacts could be mitigated by the rolling topography, placement of facilities below the visual horizon (where possible), and the use of color considerations for structures.

BLM VRM classification of landscapes was also considered in assessing potential visual impacts. The BLM-administered surface in the Hank Unit is classified as VRM Class III or Class IV. These classes are based on a combination of scenic quality, sensitivity levels, and

distance zones (BLM 2007). Based on the information presented in Section 3.9, a majority of Hank Unit is designated as VRM Class III (52%), and 48% of the area is designated as VRM Class IV. This classification allows for an activity to contrast with basic elements of the characteristic landscape to a moderate extent for a Class III designation and to a much greater degree for a Class IV designation.

As described in the NRC GEIS, visual impacts during construction can result from the presence of equipment (e.g., drill rig masts, cranes), dust/diesel emissions from equipment, and hillside and roadside cuts (NRC 2009a). However, none of the ISR facilities or equipment (including the SPF, access road, wellfield, header houses, drilling rigs, etc.) would be visible from any public road or highway. Some dust generated during the construction phase could be visible from several miles away, although dust suppression techniques would be undertaken by Uranerz, and reduce some temporary visual impacts. There are no PSD Class I areas in the Wyoming East Uranium Milling Region; visual impacts from the Proposed Action would be consistent with the assigned BLM VRM Class III and IV classifications present in the Project Area (NRC 2009a).

The Hank Unit is not located near any U.S. or state highways, the majority is located on private lands, and the BLM-administered lands are not accessible to the general public. The irregular layout of wellfield surface structures, such as wellhead protection and header houses, would further reduce visual contrast, and the numerous mitigation measures (e.g., use of road surface materials that minimize visual contrasts, painting buildings with specific low contrast colors, prompt revegetation of disturbed areas, and where possible avoiding placement of facilities above the horizon, etc.) would be used to mitigate potential visual impact (see Section 2.2.3.6). The Proposed Action complies with BLM VRM policy, and implementation of the mitigation measures identified in Section 2.2.3.6 would reduce visual contrast and visual impacts.

### 4.9.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional ground would be disturbed and no additional impacts to visual resources would take place beyond those that already exist.

### 4.9.3 Applicant Committed Mitigation Measures

Uranerz would control fugitive dust by the application of water or other measures as appropriate during times of high use and traffic speeds would also be held to appropriate levels.

All disturbed lands associated with the project, including access roads, pipelines, well locations, power lines, management facilities, etc. would be expediently reclaimed and reseeded in accordance with the project-specific reclamation plan.

Wherever possible, existing roads would be utilized. In order to minimize visual contrast, roads would be placed outside areas containing dense patches of sagebrush and follow natural contours wherever practicable. The gravel surface of new roads would be a color that does not create a visual contrast to the surrounding topography.

All pipelines would be located in corridors next to or within road areas wherever possible. Pipeline corridors would use existing disturbance areas and would be placed outside areas containing dense patches of sagebrush where practicable.

Wherever practicable, areas of existing disturbance would be used during development and operations. To minimize visual contrast, well locations would not be placed in areas of dense sagebrush or other vegetation unless absolutely necessary. Brush hogging or other vegetation removal on drilling locations within areas of dense sagebrush or other vegetation would be feathered to reduce visual contrast and limited to 30 ft in diameter from each well.

All aboveground infrastructures related to well production would be painted in a color that best blends in with the surrounding topography. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon Tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The gravel surfaces surrounding the well locations, if any, would be a color that does not create a visual contrast to the surrounding topography.

Wherever practical, power lines servicing wells would be buried, and buried power lines would be placed inside or within 5 ft of the trench utilized for pipelines when possible. Construction of aboveground power lines within 2 mi from the base elevation of Pumpkin Buttes would be designed to reduce visual contrast. Any power line should use areas of existing disturbance whenever possible.

All permanent aboveground structures (e.g., recovery equipment, tanks, etc.) not subject to safety requirements would be painted to blend with the natural color of the landscape. The color would simulate the standard environmental colors established by the BLM for visual resource management. These colors are typically Covert Green (PANTONE for Architecture Color Guide 18-0617 TPX) or Carlsbad Canyon Tan (Munsell Soil Color 2.5Y 6/2). It may be determined that different colors are required on a site-specific determination based on visual assessment. The gravel surfaces surrounding all permanent aboveground structures would be a color that does not create a visual contrast to the surrounding topography.

### 4.9.4 Residual Impacts

Residual impacts to visual resources under the Proposed Action would include the short-term disturbance of approximately 159.4 acres and LOP disturbance of approximately 11.8 acres. Additional residual impacts would include the construction and operation of the various ISR facilities in the Hank Unit and the perceived visual impacts. At the end of the LOP, all project-related facilities would be removed and the site revegetated.

### 4.9.5 Cumulative Impacts

The timeframe for the analysis of this resource is 2015 to 2024 (Figure 2.1). The cumulative impact analysis timeframe terminates in 2024, which represents the end of the decommissioning period. No structures associated with the Proposed Action would exist at the end of the LOP. With respect to potential cumulative effects, resource development in the vicinity of the proposed ISR facility may affect the visual and scenic resources. The viewshed within 2 mi of the Hank Unit is classified by BLM as a Class III and IV VRM resource, with no Class I VRM

areas nearby (BLM 2010b). Additionally, there are no visually sensitive areas within 2 mi of the Hank Unit. Therefore, visual impacts from Proposed Action would be consistent with the BLM VRM Class III and IV classification in the region.

Existing facilities that are potentially visible from the proposed Hank Unit include conventional oil and gas wells, CBNG wells, and the supporting infrastructure (well pads, pump jacks, access roads, pipelines), reservoirs, fence lines, ranch/county roads, overhead transmission and distribution power lines, water storage facilities, uranium recovery facilities, and ranch buildings (BLM 2007). CBNG development has occurred and is likely to continue in the Hank Unit area, and wells are present in the Hank Unit Project Area. As noted in the BLM EA analysis for the Dry Willow Phase II Plan of Development (BLM 2007) "The setting of the (Pumpkin) buttes is nearly compromised by modern oil and gas related activities."

Over the next 15-20 years, RFFA's in the vicinity of the proposed Hank Unit could include a continuation of current activities such as livestock ranching and energy resource development (conventional oil and gas, CBNG, and uranium). With an additional estimated 3,703 conventional oil and gas wells and 5,890 CBNG wells projected to be drilled in the Buffalo Planning Area by 2028, it is likely that some of these facilities would be within the viewshed of the proposed Hank Unit project area.

The viewshed within 2 mi of the Hank Unit is already impacted by modern visual distractions associated with CBNG, oil and gas production, and associated facilities discussed above. As described in the Proposed Action, Uranerz would implement mitigation measures (e.g., use of dust suppression, use of road surface materials that minimize visual contrasts, painting buildings with specific low contrast colors, prompt revegetation of disturbed areas, and where possible avoiding placement of facilities above the horizon, etc.) to mitigate potential visual impact. In addition, Uranerz would conduct revegetation reclamation activities to restore the pre-construction landscape and create a more natural viewshed.

Once energy development in the region is completed and all disturbed areas have been revegetated, impacts to visual impacts would return to pre-construction levels.

## 4.10 WATER RESOURCES

### 4.10.1 Proposed Action

#### 4.10.1.1 Surface Water Resources

Under the Proposed Action, approximately 159.4 acres would be disturbed and associated infrastructure would be installed including: various wells, header houses, access road, pipelines, power lines, and the SPF. All of these areas would be located in upland areas. As a result, the Proposed Action would not change any surface water drainage basins. In addition, the Proposed Action would not change any surface water features; neither the alignment nor location of any ephemeral channels located within the project area would be changed or altered. The quantity of surface water flow is also not expected to change. Uranerz would install appropriate culverts to ensure that surface water flow is not impeded. Uranerz has also committed that the stream crossing locations would be at the natural streambed elevation in shallow water and that no fill material would be required at these locations. Uranerz would grade steep and incised channel banks to produce a gentle slope on the approach to channel crossings. The Proposed Action also states that (i) proper sedimentation and erosion control measures, such as riprap, hay bales, or both, would be used to armor erosion-prone areas to minimize channel sedimentation and (ii) disturbed soil would be reseeded to reduce surface water runoff.

Uranerz would also avoid constructing wells in channels and washes, if possible, to minimize damage from erosion and to avoid damage to wellfield infrastructure; however, these areas might not be able to be avoided depending on the location of the subsurface ore bodies, which guides the placement of the supporting infrastructure. If wells were placed in ephemeral channels, Uranerz would use appropriate well and wellhead protection, such as cement blocks, protective steel casing, and other measures, and apply BMPs, such as the use of riprap and rock to protect embankments, culverts, and drainage crossings, in accordance with WDEQ LQD rules and regulations, such as Guideline 8, Hydrology – Coal and Non-Coal (WDEQ LQD 2014b). After well installation, the applicant would implement mitigation measures, such as reseeding and mulching, using standard erosion-control techniques to stabilize loose soil.

Pipelines connecting the injection and production wells with the SPF would be required to cross ephemeral channels at numerous locations. Uranerz would bury pipelines at least 1 ft below the bottom of ephemeral drainages and perform the work when the channels are dry using small-scale excavation equipment to create a narrow, shallow trench. The excavated soil to install the trench would be immediately reapplied after installation at the pre-existing grade, and the area would seeded and mulched for stability.

The probability of a failure to a pipeline carrying pregnant lixiviant located in the wellfield would be limited because pipelines would be buried approximately two to five feet below the surface and made out of corrosion free high density polyethylene. The pipelines would also be inspected and tested prior to burial to ensure that the pipelines are sound and pressure test results would be documented.

If there were to a discharge of pregnant lixiviant from pipelines located in the wellfield Uranerz would implement numerous engineering and management controls. These controls include the installation and use of high and low pressure alarms/shutdowns and flow meters on the piping leading to and from the wellfield to the SPF. This would minimize the amount of process fluid that could be lost if a failure were to occur. If a spill would occur and the release has been controlled, Uranerz would survey the spill area with a gamma meter and soil samples would be collected throughout the affected area. A spill record would be made documenting the volume of the spill, the area affected and the corrective action taken (sampling and results of analysis). Uranerz would comply with all appropriate NRC cleanup criteria contained in 10 CFR 40, Appendix A, I, Criteria 6 (6).

To minimize impacts to surface water quality, Uranerz would develop and implement a SWPPP in accordance with WDEQ WQD requirements to control storm water runoff during construction and to ensure that surface water runoff from disturbed areas met WYPDES permit limits. The sedimentation- and erosion-control measures required in the WDEQ permit would minimize the potential for sediment transfer to surface water. Furthermore, Uranerz would construct berms and recontour where possible to minimize potential erosion and sediment transfer to surface water.

It is also possible that the Proposed Action could impact surface water quality as a result of spills or leaks of fuels and lubricants from construction equipment. These occurrences would be mitigated through proper planning and design, the use of proper construction methods, and the implementation of BMPs discussed below. Spills of petroleum products or hazardous chemicals into surface waters or related habitats must be reported to WDEQ WQD. Uranerz would mitigate potential spills of petrochemicals, such as oil and gasoline, by conducting routine vehicle maintenance and inspection and would also develop and implement an emergency response plan (ERP) to address such occurrences. Uranerz would train personnel to properly handle and transport hazardous materials to reduce the potential occurrence of spills. Uranerz would also dispose of all waste in accordance with appropriate federal or state regulations.

To minimize impacts to surface water quality, Uranerz would also replace stockpiled topsoil in previously disturbed areas and regrade the surface to restore it to the predisturbance contours in a timely manner. Revegetation operations (with the landowner-approved seed mixture) would occur as part of interim and permanent reclamation operations. Seeding operations would take place during the first appropriate growing season.

#### 4.10.1.2 Groundwater Resources

Potential environmental impacts on groundwater at the Proposed Action could occur during all phases of the lifecycle of the project, but primarily during operations and aquifer restoration. ISR activities can impact aquifers located both above and below the uranium-bearing aquifer as well as adjacent aquifers. Surface or near-surface activities that could introduce contaminants into soils would be more likely to impact shallow aquifers, while ISR operations and aquifer restoration would impact the deeper uranium-bearing aquifer and could potentially impact aquifers above and below the uranium-bearing aquifer as well as adjacent aquifers.

ISR facility activities could also impact groundwater resources from potential surface spills and leaks, from shallow surface piping releases, from consumptive water use, from potential horizontal and vertical leaching solution excursions from the production aquifer, by degrading water quality and changing the water chemistry of the production aquifer, and from deep well

injection of liquid effluent. A detailed discussion of the potential impact on groundwater resources from construction, operations, aquifer restoration, and decommissioning the Proposed Action is presented in the NRC GEIS (2009a) and site specific NRC SEIS (2011) and will not be repeated here.

Additional protection to groundwater resources is provided to the public through the SDWA, which provides a series of strict definitions as to what constitutes a safe underground source of drinking water and requirements for providing the public protection from groundwater contamination. The SDWA and UIC programs also provide a series of criteria by which an aquifer can be exempted as an underground source of drinking water; thereby, allowing injection into that aquifer to occur. The EPA and the WDEQ WQD can exempt an aquifer and allow mining operations to go forward while providing the public protection from poor quality aquifers. The NRC staff's review of groundwater issues related to ISR projects states that before an NRC-licensed ISR can begin operations at the project site, the licensee must obtain an UIC permit from the EPA or EPA-authorized State agency. The permit must exempt the portion of the aquifer subject to uranium mining from classification as an underground source of drinking water (NRC 2009a). The SDWA UIC program (40 CFR 146.4) includes the following exemption criteria:

***40 CFR 146.4 Criteria for exempted aquifers***

*An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in Sec. 146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:*

*(a) It does not currently serve as a source of drinking water; and*
*(b) It cannot now and will not in the future serve as a source of drinking water because:*
- *(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.*
- *(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;*
- *(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or*
- *(4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or*

*(c) The total dissolved solids content of the groundwater is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.*

Resulting from the required UIC permit, the NRC and WDEQ WQD have already added a stipulation to their respective approvals for the Nichols Ranch ISR Project (that includes the Nichols Ranch and Hank Units), that Uranerz would apply to the EPA and WDEQ WQD to have the affected aquifers designated as exempt from the drinking water standards.

As stated in the Proposed Action, Uranerz has apply to the WDEQ WQD and the EPA to have the affected aquifers at the Hank Unit designated as exempt from the drinking water standards. As of October 2012, an aquifer exemption permit was issued by WDEQ WQD, with concurrence from EPA, to Uranerz for both the Nichols Ranch Unit and the Hank Unit. This exemption provides future protection to the public as these aquifers would not be considered useable as drinking water sources and would not be permitted as such (WDEQ WQD 2008).

As stated in the NRC GEIS (2009a), site specific supplemental GEIS (2011), and the POO (Uranerz 2012), aquifers suitable for in-situ uranium recovery operations are by their nature confined, minimizing the possibility of cross-aquifer contamination. The extensive monitoring of aquifers above and below all injection and recovery wells associated with the Proposed Action would allow Uranerz and the WDEQ WQD to respond rapidly to any identified excursion of uranium enriched water. In addition, following completion of uranium recovery operations, groundwater undergoes an extensive process of quality restoration to bring the water back to the pre-mining condition and use.

The primary goal of restoration is to return the production zone to pre-operational conditions, which would result in no impact; however, that is usually not attainable for all constituents at most uranium ISR projects (NRC 2009a). NRC regulations allow restoration to other standards that are protective of public health and safety and the environment. However, restoration to these standards results in changes from pre-operational conditions: impacts. Relative to deep well injection disposal operations associated with proposed uranium ISR project, the NRC found that the data indicates that on-site deep well disposal of byproduct material waste would be conducted in a manner that is protective of human health and the environment (NRC 2009a).

### 4.10.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional ground would be disturbed, ISR operation would not be undertaken, and no additional impacts to water resources would take place beyond those that already exist.

### 4.10.3 Applicant Committed Mitigation Measures

To mitigate and reduce potential impacts from the Proposed Action on water resources, Uranerz would implement the following mitigation measures.

- Uranerz would develop and implement a SWPPP for the newly affected areas. Uranerz' current WYPDES permit and SWPPP for the Nichols Ranch Unit would be expanded to include the Hank Unit. The SWPPP would include erosion control measures to prevent and limit storm water pollution and procedures for periodic inspections of storm water pollution prevention devices and practices. Uranerz would install and maintain all appropriate runoff and erosion control measures as described in the SWPPP such as water bars, berms, and interceptor ditches, and copies of the SWPPP and inspection reports would be filed in the Uranerz' SPF.

- Uranerz would train personnel to properly handle and transport hazardous materials to reduce the potential occurrence of spills.

- Uranerz would replace stockpiled topsoil in previously disturbed areas and regrade the surface to restore it to the predisturbance contours in a timely manner. Revegetation operations (with the landowner-approved seed mixture) would occur as part of interim and permanent reclamation operations. Seeding operations would take place during the first appropriate growing season.

- Uranerz and its contractors would manage, store, handle, and dispose of all petroleum products and wastes in compliance with all appropriate federal and state regulations. In

addition, Uranerz would train its personnel to properly handle, transport, and dispose of all petroleum products and hazardous materials and waste to avoid and reduce the potential occurrence of spills. Uranerz would also develop and implement an ERP to address potential spills, leaks, or releases of such materials. Uranerz would also mitigate potential spills, leaks, or releases of petroleum products and wastes by conducting routine maintenance and inspections on all appropriate vehicles and equipment.

- In the event of a spill, leak, or release of petroleum products and wastes, Uranerz would clean up and dispose of the spill, leak, or release in accordance with state and federal regulations and all spills of petroleum products or hazardous chemicals in excess of the reportable quantity as determined by WDEQ WQD would be reported to WDEQ WQD.

- Uranerz would develop and implement waste management programs to meet the applicable WDEQ SHWD regulatory requirements. All wastes generated from these materials would be handled and disposed of in accordance with applicable federal and state regulations.

- Any hazardous waste, such as organic solvents, paints, waste oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical waste, and spent batteries, would be disposed of in accordance with a management program that the facility would develop to meet applicable local, federal, and state regulatory requirements for the disposal of nonradioactive hazardous waste.

- During construction, portable self-contained chemical toilets would be provided for human waste disposal. As required, the holding tanks for the chemical tanks would be pumped out and their contents disposed of at an approved sewage facility in accordance with applicable rules and regulations regarding sewage treatment and disposal. Upon completion of construction operations, sanitary wastes would be disposed of in an on-site septic system that would be constructed and operated by Uranerz. The septic system would be located on private-owned surface lands immediately north of the Hank Unit SPF. The septic systems would be designed in order to accommodate the estimated

maximum of 35 permanent employees. Prior to construction of this facility, Uranerz would obtain a permit to construct the septic system from WDEQ WQD.

- As soon as practical after completion of construction activities, all debris and other waste materials not placed in the dumpsters or trash cages would be cleaned up, removed from the construction area, and disposed of in an approved landfill. No potentially harmful materials or substances would be left on location, and all solid waste would be disposed at an appropriate solid waste disposal facility. All facilities that would be used by Uranerz would be properly permitted through the appropriate state/local regulatory authority.

- All radioactive wastes would be handled and disposed at a properly permitted and licensed waste disposal facility in accordance with applicable federal and state regulations.

- If there were a discharge of pregnant lixiviant from pipelines located in the wellfield Uranerz would implement numerous engineering and management controls. These controls include the installation and use of high and low pressure alarms/shutdowns and flow meters on the piping leading to and from the wellfield to the SPF. This would minimize the amount of process fluid that could be lost if a failure were to occur. If a spill would occur and the released has been controlled, Uranerz would survey the spill area with a gamma meter and soil samples would be collected throughout the affected area. A spill record would be made documenting the volume of the spill, the area affected and the corrective action taken (sampling and results of analysis). In accordance with NRC standards, areas exceeding twice background gamma would receive additional soil sampling to determine whether radiological concentrations (isotopes Ra-226, Th-230, and Pb-210) have increased significantly above background. Soils would also be analyzed for uranium. If soil sampling results show an increase from baseline, 2.5 to 3 pCi/g, for example, the soil would be removed and placed in approved by-product storage containers prior to shipping to a licensed disposal site approved by the NRC.

### 4.10.4 Residual Impacts

#### 4.10.4.1 Surface Water

Residual impacts to surface water resources would include the potential for some increase in sedimentation in local receiving waters as a result of surface disturbing activities. In addition, there is also the chance for impacts to surface water quality as a result of spills or leaks of fuels and lubricants from construction equipment.

#### 4.10.4.2 Groundwater

There would be a residual impact from the use of groundwater from purposes of developing, operating, and restoring the Hank Unit Project. However, such beneficial water use is consistent with Wyoming state water law and all production wells would be permitted. Consumptive use of groundwater during ISR operations could potentially impact a local water user who uses water from the production aquifer outside the exempted zone. Potential impact would result from lowering of the water levels in nearby wells in response to pumping within the production zone. This water-level decrease, referred to as drawdown, if significant enough relative to the original water-level, can potentially reduce well yields. In addition, if the production zone is hydraulically connected to other aquifers above and/or below, consumptive use may potentially impact the water-levels in these overlying/underlying aquifers, causing drawdowns in them, thus reducing potential yield from nearby wells in these aquifers (NRC 2011).

As described in the NRC SEIS, Uranerz predicts the projected drawdown would not impact yields at private wells located outside the Hank Unit. Private wells completed in the production zone within the Project Area would be plugged and abandoned at the end of the project. Uranerz has demonstrated through pumping tests that there is no hydraulic connection with either the overlying or underlying aquifers. The NRC under their existing license condition will require Uranerz to submit information verifying these conditions in its wellfield hydrologic data package. The license condition would require NRC review and approval of at least one wellfield hydrologic package at the Hank Unit before operations begin (NRC 2011).

Estimates for the F Sand (the production zone for the Proposed Action) presented in the POO indicate that the 10-ft drawdown contour would extend a maximum of approximately 1,000 ft on the west side of the Hank Unit wellfield and approximately 600 ft on the east side. These distances are well inside of the project boundary. After production and restoration operations are completed and groundwater withdrawals are terminated, the groundwater levels would recover with time. The complete recovery of water-levels would take tens to hundreds of years, depending on the specific location (NRC 2011).

To minimize impacts to the quality of overlying, underlying, and surrounding groundwater after production operations are completed, Uranerz under their NRC license will be required to return water-quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5). As stated in 10 CFR 40, Appendix A, Criterion 5B(5):

> "….. at the point of compliance, the concentration of a hazardous constituent must not exceed (a) the Commission approved background concentration of that constituent in the groundwater; (b) the respective value given in the table if the constituent is listed in the table and the background level of the constituent is below the value listed; or (c) an alternative concentration limit (ACL) established by the Commission."

Only after demonstrating that it cannot restore a particular hazardous constituent to the background concentration or MCL can Uranerz request a license amendment from NRC for an ACL for a particular hazardous constituent. Appendix C of the NRC SEIS explains the process for granting an ACL. For ACLs to be approved, they must be shown to protect public health at the site. For these reasons, the aquifers surrounding the wellfield production zone aquifer after operations at the Nichols Ranch Project would be protected from undue degradation.

## 4.10.5 Cumulative Impacts

### 4.10.5.1 Surface Water

Cumulative impacts on surface water and wetlands were assessed by the NRC (2011) within the Dry Willow and Willow Creek drainage areas of the Upper Powder River (i.e., Dry Fork Basin). The proposed Hank Unit Project is also located within this drainage basin and could potentially be affected by other activities that discharged surface water to drainages within this basin.

Therefore, the Dry Fork Basin was used as the geographic boundary for the surface water study area; in addition, the impacts from other activities occurring within a 50-mi radius of the site were consolidated because they could potentially drain into the surface water study area. Within this study area, the principal activities contributing to potential surface water impacts are discharges from CBNG operations. The NRC cumulative effects analysis timeframe begins in 2007 and terminates in 2020 and is based on the estimated operating life of the proposed Hank Unit Project.

BLM estimated that 9% to 52% of CBNG-produced water would contribute to surface water flows and perennial flows would be likely to develop in former ephemeral channels (BLM 2003a). CBNG-produced water would increase the availability of surface waters for irrigation and other purposes for downstream users. BLM noted that noticeable changes in water quality would occur in the main channel drainages during periods of low flow and that sodicity and salinity are key water quality parameters because of their impact on water used for irrigation. BLM projected that the concentrations of suspended sediments in surface water would likely rise above baseline levels from increased flow and surface water runoff from disturbed areas. WDEQ WQD adopted the "Most Restrictive Proposed Limit" for sodicity and salinity into its WYPDES permitting process to mitigate potential water quality impacts to downstream users (BLM 2003a).

Other activities occurring within the proposed project area, as well as near the proposed Hank Unit Project, also have the potential to impact surface water. In the POO, Uranerz indicated that CBNG production has occurred and continues to occur within the proposed project area from coal seams within the Fort Union Formation; these occur at a depth greater than 1,000 ft bgs in the Nichols Ranch and Hank Units (Uranerz 2012). Furthermore, Uranerz also stated that all CBNG wells within the Hank Unit project area are total containment (meaning no surface discharge). No discharges from CBNG well within the Hank Unit have been made to any of the permitted outfalls (Uranerz 2012). Therefore, there would be no additional cumulative impacts to surface water quality or flow due to the Proposed Action and existing and RFFA CBNG actions.

The North Butte ISR Project (located north of the proposed Hank Unit), Smith Ranch/Highland ISR Project (located south-southeast of the proposed Hank Unit), the Willow Creek ISR Project (located northwest of the proposed Hank Unit), and the Moore Ranch ISR Project (located southeast of the proposed Hank Unit) are the only operating licensed ISR projects within 50 mi of the proposed Hank Unit project area. The NRC licensees are required to obtain USACE permits their specific projects are anticipated to impact wetlands or waters of the U.S. Moreover, the licensees are required to obtain industrial and construction permits from WDEQ LQD and WDEQ WQD. These permits require BMPs for spill prevention and leak control. Therefore, there would be no cumulative impacts to surface water quality from spills or leaks from the Proposed Action and existing and RFFA oil and gas operations.

Oil wells are scattered within 50 mi of the proposed Hank Unit and at present, six conventional oil and gas wells exist on the lands within and adjacent to the Hank Unit, of which three are within the boundaries of the Hank Unit. According to information from the Wyoming Oil and Gas Conservation Commission, no oil and gas development is currently planned to take place in the proposed Hank Unit project area. Within 50 mi of the proposed Nichols Ranch ISR Project site, oil wells are largely clustered west of Gillette, between the proposed Nichols Ranch ISR Project and the Moore Ranch ISR project site, and south of the Moore Ranch ISR project site. Currently all oil and gas operators within and near the Hank Unit collect all produced water and transport the water off-site for disposal. All oil and gas operators that expect to discharge water are required to obtain WYPDES permits from WDEQ WQD prior to any disturbance, in addition to USACE permits for potential disturbance to jurisdictional waters or waters of the U.S. (NRC 2011). WDEQ WQD has established effluent limits for the protection of game and non-game, aquatic life other than fish, wildlife, and other water uses.

No surface water would be discharged as part of any ISR facility operations, and the potential impact to onsite ephemeral channels would be from increased surface water runoff, primarily during the construction and decommissioning phases of the proposed project. The channels within and surrounding the proposed Hank Unit are ephemeral in nature and flow only in response to precipitation events or snowmelt (i.e., they are dry a majority of the year). No wetlands exist on the Hank Unit site; however, there are approximately 9.4 mi of WUS

within the entire Hank Unit site (Uranerz 2012). A Nationwide Permit 44 under Section 404 of the Clean Water Act (CWA), issued by the USACE, is required for discharges of dredged or fill material into a wetland or WUS exceeding 0.5 acre in area. The potential impact to WUS would be mitigated through the implementation of BMPs for the Uranerz WYPDES storm water permit that would be obtained from the WDEQ WQD before operations commence, securing of coverage under an individual permit or Nationwide Permit 44 from USACE, and the implementation of appropriate BMPs presented in the POO. Furthermore, Uranerz would avoid installing wells in the channels and washes of ephemeral drainages. If a well were to be installed in an ephemeral drainage, then appropriate erosion protection controls would be implemented to minimize damage. Such controls would include: grading and contouring, culvert installation, low-water crossing constructed of stone, water contour bars, and designated traffic routes (Uranerz 2012).

Other energy or mineral development activities within the surface water study area, namely from CBNG development, oil and gas production, and uranium ISR facilities could also result in limited impacts to wetlands and WUSs. However, these potential impacts would be mitigated through implementation of appropriate BMPs that would be required of all operators through the appropriate permitting process that have or would be undertake for development activities in the surface water study area.

#### 4.10.5.2 Groundwater

Potential environmental impacts on groundwater resources from the proposed Hank Unit Project would occur primarily during the operation and aquifer restoration phases of the ISR facility lifecycle. The detailed analysis of impacts to groundwater resources from operation of the proposed Hank Unit Project is presented in the NRC SEIS (2011) which showed that the water yields in some private wells located outside of the proposed project area that are completed in the ore zone aquifer could potentially be affected by the facility's operation at the Hank Unit. Specifically, the NRC concluded the Proposed Action would reduce groundwater levels in the production aquifer around the Hank Unit; however, the predicted drawdown from the Hank Unit represents a small fraction of the current groundwater levels in the affected production aquifer

outside of the license/permit boundary (NRC 2011). Moreover, Uranerz would be required to install monitoring wells around and within the proposed wellfield, as part of its license/permit, for early detection, control, and reversal of potential horizontal and vertical excursions. Therefore, the potential risk of impacts on nonexempted aquifers would be low. Furthermore, after production and aquifer restoration were completed and groundwater withdrawals were terminated at the proposed Hank Unit Project, the groundwater levels would recover with time. The complete recovery of water-levels would take tens to hundreds of years, depending on the specific location (NRC 2011).

To assess the cumulative impacts of the Proposed Action to groundwater resources over the LOP the NRC evaluated ongoing or planned activities within a radius of approximately 50 mi (NRC 2011). Within 50 mi of the Hank Unit, there are a total of seven other planned or operating ISR facilities: Uranerz' Nichols Ranch, 4.5 mi west of the Hank Unit; Cameco's North Butte, Reynolds Ranch, Smith Ranch-Highland, and Ruth, located respectively 2 mi northwest, 43.5 and 40 mi southeast, and 15 mi southwest of the Hank Unit; Uranium One's Willow Creek and Moore Ranch, located respectively 3 mi northwest and 12 mi south of the Hank Unit.

Although the production aquifers at the Hank Unit are known to be present for several miles around the Project Area, their true extent is unknown. The Wasatch Formation, which hosts the extraction zone, does not constitute a regional aquifer. Rather, it is a sedimentary formation containing localized water-saturated lenses that can be locally productive, but not hydraulically interconnected with other sand lenses due to considerable clay content (NRC 2011). Given the heterogeneity of the geology in the PRB, the target aquifers at the Hank Unit are unlikely to cover a 50-mi radius. Therefore, the NRC considered a 50-mi radius to be a conservative estimate of the possible areal extent of potential groundwater impacts. Other ISR facilities occur within a 50-mi radius of the proposed Hank Unit (although production may be from different "ore" zones) and oil/gas and CBNG production also occur within a 50-mi radius; however, the production is from different geologic horizons than the proposed production at the Hank Unit.

BLM estimated that CBNG development in the PRB through the year 2018 would remove about (3 million acre-feet), less than 0.3% of the total recoverable groundwater (nearly 1.4 billion acre-

feet) in the Wasatch and Fort Union Formations within the PRB. Water from CBNG production within the Hank Unit is being collected and transported off-site for disposal (i.e., there is no surface water discharge) (Uranerz 2012).

BLM predicted that within the PRB, the redistribution of pressure within the coal seams after CBNG water production ended would allow the hydraulic pressure head to recover to within approximately 50 ft or less of pre-project levels within 25 years after project completion (BLM 2003a). The complete recovery of water-levels would take tens to hundreds of years, depending on the specific location. Groundwater wells completed in the Fort Union Formation within the areal extent of a 100-ft CBNG well-induced drawdown could experience drops in water-level and possibly encounter methane (BLM 2003a). BLM (2003) noted that the areal extent and magnitude of drawdown effects on coal zone aquifers and overlying or underlying sand units in the Wasatch Formation would be limited by the discontinuous nature of different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation.

Cumulative impacts on groundwater resulting from the interaction between ISR activities and CBNG activities may occur but are not likely because CBNG production and ISR activities are conducted in stratigraphically separate aquifers. For the proposed Hank Unit Project, the ISR activities would take place in sandstone aquifers 1,160 ft above the coal seam at the Hank Unit. Because of the presence of multiple layers of sand/sandstone and low-permeable silt/shale (confining layers) between the coal seams and uranium ore-bearing aquifers, hydraulic communication between them would be very low. As indicated in the POO, the drawdown induced by groundwater withdrawals from CBNG coal seams would be progressively attenuated across impermeable silt/shale layers within 100 to 200 ft above the coal seams; therefore, the potential risk of impacts of groundwater withdrawals from coal seams on groundwater levels in the uranium "ore"-bearing aquifers would be low (Uranerz 2012).

However, the potential impacts could be larger if the coal seams and ore-bearing aquifers are artificially connected through improperly abandoned, deep exploratory oil and gas wells. In such cases, CBNG drawdowns could propagate up into shallower ore-bearing aquifers. However, as indicated in the POO, Uranerz is required to identify all abandoned exploratory wells in

compliance with 10 CFR 51.45, which requires a description of the affected environment containing sufficient data to support an independent analysis by the NRC. Any improperly abandoned wells within the proposed project site would be sealed prior to ISR operations at the proposed Hank Unit site. The POO states that no improperly abandoned borings or oil and gas wells were identified in the Hank Unit (Uranerz 2012). Therefore, the potential cumulative impact of CBNG production in the PRB on the quality and quantity of groundwater at and near the proposed Hank Unit would be unlikely. The North Butte ISR is located approximately 2 mi from the Hank Unit and there is the potential for cumulative groundwater impacts. Of special concern is the potential for an excursion in the Hank Unit to be drawn away from the wellfield by the drawdown created by the North Butte operations. The "ore"-bearing sands at North Butte ISR are located in the B, C, and A Sands of the Wasatch Formation (Figure 3.3 of the NRC SEIS (2011). The B and C Sands extend to and act as the underlying aquifers to the ore bearing F Sand at the Hank Unit. These sands were treated as one unit, the BC Sand, in the North Butte License. The F Sand at both North Butte and the Hank Unit is separated from the underlying BC Sand by a thick shale layer known as the FB Aquitard. No hydraulic connection was demonstrated between the F and BC Sands from pumping tests at either the Hank Unit or the North Butte ISR projects. As described earlier, operations in the F Sand at the Hank Unit are in an unconfined aquifer and the applicant has demonstrated that the drawdown from consumptive groundwater use in the Hank Unit would not extend to the North Butte ISR License boundary.

However, the proposed operations in the North Butte BC Sand may create sufficient drawdown to impact the underlying BC Sand at the Hank Unit where these sands act as the underlying aquifer.

To evaluate this impact, the NRC estimated the amount of drawdown that would occur in the underlying BC Sand aquifer at the Hank Unit after 1 year of operation at the North Butte ISR, using reported values for aquifer hydraulic parameters and proposed consumptive groundwater rates from the North Butte mine unit application (NRC 2011). Using a reported bleed rate of 30 gpm located at one well in the combined BC Sand in the center of Township 44 North, Range 76 West, Section 24 (roughly the centroid of the proposed wellfield at North Butte), a reported transmissivity of 630 gal/day/ft, and a storage coefficient of 2.4 $E^{10-4}$ (0.00024), the project

drawdown in the BC Sand at the Hank Unit was determined using the Cooper-Jacob unsteady drawdown equation for a single well in an homogeneous isotropic aquifer of infinite areal extent and constant thickness. The drawdown in the underlying BC Sand aquifer at the Hank Unit after 1 year of operation at North Butte was determined to be approximately 7 ft under the northernmost edge of the ore body, located approximately 1.75 mi from the North Butte pumping well. This drawdown decreased to about 1.8 ft in the underlying BC Sand aquifer at the center of the ore body at the Hank Unit. The NRC staff finds these drawdowns at these distances are not sufficiently large to increase the chance of an excursion in the underlying BC Sand aquifer being drawn outside of the proposed Hank Unit project area. In addition, the applicant will be required by NRC to conduct sufficient monitoring of the underlying BC Sand aquifer to detect and correct potential excursions. The NRC therefore concluded that operations at the North Butte site would have a low risk of impact on the underlying BC Sand aquifer and the potential for excursions at the Hank Unit (NRC 2011).

The Smith Ranch Highlands ISR (including Ruth and Reynolds Ranch satellites), Willow Creek, and Moore Ranch project areas are located at sufficient distances from the proposed Nichols Ranch ISR Project, such that their potential cumulative impact on groundwater levels at and near the proposed Hank Unit would be limited. Moreover, because the operators of the Smith Ranch/Highland, Willow Creek, and Moore Ranch ISR sites are required to implement excursion detection, control, mitigation, and remediation plans under NRC regulations, the risk of their contribution to the potential cumulative impact on groundwater quality and quantity would be low (NRC 2011).

At present, three oil/gas wells occur on the lands within the Hank Unit (Uranerz 2012). According to the WOGCC, no further oil and gas wells have been proposed within the proposed Hank Unit project area. Oil wells are completed at greater depths (approximately 10,000 ft with some wells less than 1.7 mi from the Hank Unit project boundary) than are the targeted aquifers for ISR uranium production in the Wasatch Formation, which typically occur at depths ranging from 300 to 700 ft bgs. The ISR uranium production wells are completed at depths thousands of feet above the oil-producing horizons. Therefore, the potential cumulative risk of impact on oil production in the PRB from the proposed Nichols Ranch ISR Project would be low (NRC 2011).

The DOE Spook facility, located in Spook, Wyoming (northwest of Douglas), is the only decommissioned conventional mill within a 50-mi radius of the proposed Nichols Ranch ISR Project. Given that the facility has been decommissioned, therefore; meets NRC regulatory standards which demonstrate it will not impact the public health, safety, or environment, the NRC determined the risk of cumulative impacts on groundwater would be low (NRC 2011).

Deep disposal of process wastewater is one of the disposal methods that CBNG, ISR, and oil production facilities practice in the PRB. For deep well disposal, Uranerz has obtained UIC permit(s) for the targeted deep aquifer from WDEQ WQD. The permit documents that the deep disposal practice is safe for public health and safety; therefore, there would be no impacts to potential underground sources of drinking water.

## 4.11 WILDLIFE INCLUDING SPECIAL STATUS ANIMAL SPECIES

### 4.11.1 Proposed Action

#### 4.11.1.1 Big Game

Pronghorn antelope and mule deer are the most likely big game species to be impacted by the Proposed Action. These species would be affected by reduction of available habitat due to fencing of primary facilities, disturbance of a portion of winter/yearlong range, loss of forage, and the potential for vehicular collisions. During baseline wildlife inventories pronghorn antelope were mainly observed in mixed grassland and sagebrush shrubland vegetative communities, which are the vegetative communities most likely to be disturbed during construction. Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetative communities. Juniper outcrop would likely continue to be available for foraging throughout the life of the proposed project.

There is a potential for vehicular collisions with big game species (pronghorn antelope and mule deer). However, Uranerz would enforce speed limits (e.g., 20 to 30 mph) on the access roads, therby likely reducing big game/vehicle interactions (Uranerz 2012).

The Proposed Action would result in the disturbance of approximately 159.4 acres of pronghorn antelope winter/yearlong habitat within the Hank Unit. Total initial disturbance accounts for only 7% of the entire Hank Unit project area. Following completion of project development approximately 149.2 acres would be temporarily revegetated. There would be a total of 11.8 acres of LOP disturbance; 9.6 acres of LOP disturbance on privately-owned lands and 2.2 acres of LOP disturbance on BLM-administered lands. Total LOP disturbance accounts for approximately 0.5% of the entire Hank Unit project area.

Winter/yearlong range carrying capacity for pronghorn antelope within the Hank Unit would be impacted during the life of the Proposed Action and for several years thereafter until vegetative growth is restored and the areas becomes productive enough to support big game. The entire 2,250 acres Hank Unit occurs in the Pumpkin Buttes Antelope Herd which encompasses approximately 1,543 square miles ($mi^2$) (987,525 acres) approximately 0.22% of the Pumpkin Buttes Antelope Herd Unit. The proposed project would result the initial disturbance of approximately 159.4 acres or 0.01% of the Pumpkin Buttes Antelope Herd Unit and the entire disturbance would occur within winter/yearlong range. Additionally, during construction and decommissioning operations pronghorn antelope could be displaced from suitable habitats as a result of construction noise, vehicle traffic, and human presence. The construction phase of the Proposed Action has been projected to last approximately 9 months to 1 year in duration for each production area. Pronghorn antelope are initially expected to move away from areas of disturbance. However, once construction operations have been completed and adequate interim revegetation has been restored pronghorn antelope would likely return to their normal movement patterns and use of the wellfield area. Even though the wellfield would be fenced to prevent livestock from entering the area, the fence would be of a type that would allow antelope to move through the area and would not substantially interfere with their movement.

After mining and decommissioning operations have been completed and reclamation operations have been deemed successful and WDEQ LQD approves reclamation bond release, the wellfield perimeter fence would be removed and pronghorn antelope use of the wellfield would eventually return to pre-mining levels. Use of the revegetated areas by pronghorn antelope would depend on numerous factors including how long it takes for vegetation to become reestablished. It

would likely require 2-4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished. The annual postseason population average from 2008 to 2012 was 28,211 individuals, with 21,593 individuals in 2013. That is 20% above the population objective of 18,000 individuals and the population has been at or above the objective for at least the past seven years (WGFD 2013c). Therefore, the Proposed Action would likely result in some short-term displacement of antelope from the Hank Unit, but the Proposed Action is not expected to have long-term impacts on the antelope population within the Pumpkin Buttes Antelope Herd Unit.

The Proposed Action would result in the disturbance of approximately 159.4 acres of winter/yearlong habitat for mule deer within the Hank Unit. The local winter/yearlong carrying capacity of mule deer in the Pumpkin Butte Mule Deer Herd Unit would likely be reduced during the life of the Proposed Action and for several years thereafter until vegetative growth is restored and the areas and becomes productive enough to support big game. The entire 2,250 acre Hank Unit occurs in the Pumpkin Buttes Mule Deer Herd which encompasses approximately 2,706 $mi^2$ (1,731,840 acres) approximately 0.13% of the Pumpkin Buttes Mule Deer Herd Unit. The proposed project would result the disturbance of approximately 159.4 acres or 0.009% of the Pumpkin Buttes Mule Deer Herd Unit. Additionally, during construction and decommissioning operations mule deer could be displaced from suitable habitats as a result of construction noise, vehicle traffic, and human presence. The construction phase of the Proposed Action has been projected at 9 months to 1 year in duration for each production area. Mule deer are expected to move away from areas of disturbance. However, once construction operations have been completed and adequate interim revegetation has been restored mule deer would likely return to some reduced level of use of the wellfield areas. Even though the wellfield would be fenced to prevent livestock from entering the area, the fence would be of a type that would allow mule deer to move through the area and would not substantially interfere with their movement.

After permanent reclamation operations have been deemed successful and WDEQ LQD approves reclamation bond release, the wellfield perimeter fence would be removed. Use of the revegetated areas by mule deer would depend on numerous factors including how long it takes for vegetation to become reestablished. It would likely require 2-4 years for grasses to be

reestablished but it could take 10 or more years for shrub communities to be reestablished. The annual postseason population average from 2008 to 2012 was 10,275 individuals, with 10,080 individuals in 2013. That is 22.5% below the population objective of 13,000 individuals (WGFD 2013b). According to the WGFD, drought conditions and reduced habitat conditions in the area are likely contributors to the reduced mule deer population (pers. comm., January 2, 2013, with Lynn Jahnke, WGFD biologist, Sheridan, Wyoming). Therefore, the Proposed Action would likely result in some short-term displacement of mule deer from the Hank Unit but the Proposed Action is not expected to have long-term impacts on the mule deer population within the Pumpkin Buttes Mule Deer Herd Unit.

#### 4.11.1.2 Upland Game Birds

Greater Sage-Grouse (GSG) and gray partridge are the most likely upland game bird species to be impacted by construction of the proposed project. GSG is a federal candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species and is specifically discussed in Section 4.11.1.7. Direct impacts to upland birds from the Proposed Action would include habitat loss and fragmentation from wellfield, road, pipeline, and power line construction; alteration of plant and animal communities; increased human activity or noise (including generator noise), that could cause the birds to avoid a specific area or reduce breeding efficiency; increased motorized access to the public, which could lead to harvesting of individuals (legal and illegal); and an greater risk of mortality from vehicular collisions. Approximately 159.4 acres of the proposed Hank Unit site would be initially disturbed and it is possible that some individuals would be displaced and interim habitat loss would occur over the life of the proposed project as development progressed. Uranerz would minimize the removal and disturbance of vegetation, where possible, through the use of existing ranch roads for travel and for the placement of utility lines and pipelines (Uranerz 2012). The land disturbed by the Proposed Action would be revegetated following the reclamation process described in Uranerz' final decommissioning plan. Uranerz' commitment to implement mitigative measures, such as minimizing noise, vehicular traffic, and human proximity, near GSG leks would also benefit gray partridge and other upland bird species and nests within the vicinity of the leks.

#### 4.11.1.3 Waterfowl and Shorebirds

Only limited, seasonal wetland habitat exists on the proposed project site for waterfowl and shorebirds and none of this habitat would be disturbed. It is possible that infrequent nesting of waterfowl and shorebirds could be disturbed by the Proposed Action. Therefore, the Proposed Action would result in limited disruption or disturbance of any breeding or nesting waterfowl or shorebirds or their habitats. No wetland areas would be disturbed by construction activities. Therefore, there would be few impacts to waterfowl, shorebirds, or their habitats.

#### 4.11.1.4 Nongame/Migratory Birds (Including Non-sensitive Raptor Species)

The Proposed Action would result in the disturbance of approximately 159.4 acres within the wellfield, and total initial disturbance would be 7% of the entire Hank Unit Project Area.

If construction operations occur during the nesting/breeding season, it is likely there would be a direct impact to nongame/migratory birds. This would include the potential loss of nests and young in the 159.4-acre disturbance area, and also possibly around the margins. In addition, habitat loss and fragmentation and increased human activity or noise could cause some nongame/migratory birds to either avoid a specific area or to reduce their breeding efficiency. Some habitat loss and potential carrying capacity reduction for these species within the Project Area would likely occur during the 9 to 12 month construction period. After construction is complete, and interim reclamation provides adequate vegetative cover for reuse of the area by nongame/migratory birds. Interim reclamation would be accomplished using only grass species and many nongame/migratory birds may not use the area until permanent reclamation operations have been completed and shrub communities have become reestablished. However, only 7% of the proposed project area would be initially disturbed by the Proposed Action and the loss of nests and young during the breeding season by birds that use the wellfield would be limited to the 9 to 12 month construction period that it would take to complete construction activities.

Following completion of project development approximately 147.6 acres would be temporarily revegetated as described in the Proposed Action. There would be a total of 11.8 acres of the

LOP disturbance; 9.6 acres of LOP disturbance on privately-owned lands and 2.2 acres of LOP disturbance on BLM-administered lands. Total LOP disturbance accounts for approximately 0.5% of the entire Hank Unit area.

There would also be loss of nesting and breeding habitat within the 11.8 acres of disturbed and revegetated area during the LOP. However, during the operational phase of the Proposed Action it is likely that some nongame/migratory birds would return and would likely use some non-disturbed portions of the project area. After permanent reclamation operations have been completed and the disturbed areas have adequate vegetative cover, nongame/migratory bird including raptors use of the wellfield area would return to pre-mining levels. Use of the revegetated areas by nongame/migratory bird would depend on numerous factors including how long it takes for vegetation to become reestablished. It would likely require 2 to 4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished.

The red-tailed hawk, rough-legged hawk, prairie falcon, American kestrel, great horned owl, golden eagle, and long-eared owls could occur on or in the vicinity of the Proposed Action. With the exception of rough-legged hawks, which winter in the area but migrates to northern latitudes to breed, the remaining abovementioned species may breed within or adjacent to the study area, provided that suitable nesting habitat exists. These would be the primary raptor species impacted by the Proposed Action. Raptors are particularly sensitive to noise and the presence of human activity, which would be heightened during the construction period. Direct impacts to raptor species could include loss of nests and nesting sites/habit, displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbance, and the potential reduction in prey populations within the proposed project site.

#### 4.11.1.5 Other Mammals

Mammalian predators such as the bobcat, badger, coyote, and swift fox would experience habitat loss and fragmentation and potential range reduction during the LOP (10 years). Displacement

of prey species may reduce food availability within the area; however, the occasional outbreak of tularemia in the vicinity of the project area as noted during the 2006-2007 wildlife inventories may affect the prey base and cause a shift of predators to neighboring areas. Predator species are also more sensitive to noise and the presence of human activity, which would be heightened during the construction phase, though the species documented onsite are generally nocturnal; therefore, construction that occurred during daylight hours would not be expected to noticeably alter these species' patterns or behavior.

Desert cottontails, white-tailed jackrabbits, ground squirrels, black-tailed prairie dogs, and other species would experience habitat loss or displacement from the 159.4-acre disturbance area. Loss of habitat from construction activities would have a greater effect on these species compared to the mammalian predator species discussed previously. Other potential impacts would include the increased potential for vehicular collision; however, these impacts would be mitigated by the implementation of speed limits within the project area. Mammals by nature are mobile and many of those that are not physically lost during construction operations would likely move away from the construction area.

Because some small mammals are relatively abundant in the proposed project area and some species generally show a preference for disturbed areas, the impacts of the Proposed Action on small mammal populations within the wellfield might be difficult to differentiate from normal population fluctuations. However, after permanent reclamation operations have been completed and the disturbed area can support small mammal populations use of the project area would return to pre-mining levels.

#### 4.11.1.6 Amphibians and Reptiles

Prairie rattlesnake and bullsnake were the only reptile or amphibian species observed during wildlife inventories conducted by Uranerz (Uranerz 2012). During the construction and decommissioning phases, a small amount of land (159.4 acres) would be disturbed. The potential impact to reptile and amphibian species could include loss of some individuals and the loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and

increased risk of vehicular collision. However, after permanent reclamation operations have been completed and suitable habitat is reestablished, use of the project area by reptiles would return to pre-mining levels.

4.11.1.7 Special Status Animal Species

Only one federal candidate species, the GSG, is known to occur in the vicinity of the proposed Hank Unit. There are no other federally-listed TECP animal species in the immediate project area. Several Wyoming species of concern and BLM-sensitive species are known to occur on and in the vicinity of the Hank Unit project area. Raptors, black-tailed prairie dog, and swift fox were recorded during wildlife inventories conducted by Uranerz (Uranerz 2012) and are discussed in Section 3.0.

Greater Sage-grouse (GSG)

The Proposed Action is not located in a core population area (CPA) and would therefore, not impact any GSG CPAs. The closest CPA is located approximately 16 mi west-northwest of the Hank Unit Project Area. The WGFD has not identified any winter concentration areas within or near the proposed project area and based on this information there would be no impacts to winter concentration areas for greater sage-grouse. As indicated in Section 3.11.2.2, there are no leks within the Hank Unit project boundary; however, there are currently seven "occupied" greater sage-grouse leks within a 2.0-mi radius of the Hank Unit (Figure 3.7 and Table 3.8). As a result, the Proposed Action would have no physical impacts to GSG leks as the Hank Unit wellfield is approximately 1.5 mi away from the closest occupied lek. Some GSG could be lost due to vehicle collisions. Additionally, noise from construction activities vehicle traffic could impact breeding and nesting GSG and they would likely avoid using the Hank Unit.

The Proposed Action would also result in the loss or fragmentation of approximately 159.4 acres of potential nesting and brood rearing habitat. Connelly et al. (2004) noted that 75 to 87% of female GSG nest within 3.1 mi of the lek that they attended during the breeding season. Therefore, the Proposed Action could result in the loss or fragmentation of some potential

nesting and brood rearing habitat. This habitat loss or fragmentation would likely continue over the LOP until permanent reclamation has been completed and vegetation has been reestablished. Use of the revegetated areas by GSG would depend on numerous factors including human-activity levels and vegetation reestablishment. It would likely require 2 to 4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished.

Uranium is a locatable mineral and is governed via the *1872 General Mining Law* and administered via federal regulations at 43 CFR 3809. On February 12, 2012, the BLM Wyoming State Office issued internal guidance (IM WY-2012-019) (BLM 2012d) regarding management of GSG habitat in BLM-administered lands in Wyoming, including federal mineral estate (BLM 2012d). Because the Proposed Action is associated with a locatable mineral, the BLM guidance is voluntary relative to the Proposed Action, as it is a nondiscretionary activity under 43 CFR 3809 (BLM 2012a). Also, the Proposed Action is outside any GSG core population area. Consistent with IM WY2012-019, the BLM BFO suggested that Uranerz examine and include conservation measures consistent with the BLM's overall goals and objectives to reduce potential impacts to GSG populations. As outlined in the IM, compliance with such conservation measures is not mandatory. However, to reduce potential impacts to GSG, Uranerz has adopted the mitigation measures identified above and they are included in the Proposed Action.

The first mitigation measure regarding the 0.25 mi buffer for no surface occupancy disturbing and no disruptive activities is consistent with both the Governor of Wyoming E.O. 2011-5 (State of Wyoming 2011) and BLM IM WY-2012-019 (BLM 2012d). The second mitigation measure, the 0.5 mi buffer on high profile facilities such as tanks and power lines, is not contained in either the 2011 Governor of Wyoming E. O. 2011-5 or BLM IM WY-2012-019, but is a recommended mitigation measure presented in the BLM PRB EIS (2003a). Therefore, this commitment exceeds the minimum standard; however, it is consistent with the overall goals of the 2011 Wyoming E. O. and 2012 BLM IM. The third mitigation measure (the commitment to limit speed limits) and the fourth mitigation measure (to limited disturbance) are not contained in either the 2011 Wyoming E. O. or 2012 BLM IM. However, these commitments exceed the minimum standard and are consistent with the overall goals of the 2011 Wyoming E. O. and 2012 BLM IM.

Raptors (Special-status Species)

Potential impacts to special-status raptor species (i.e., golden eagle, bald eagle, Swainson's hawk, ferruginous hawk, merlins, short-eared owls, and burrowing owls), include decreased raptor reproduction success due to physical disturbance of the nest; decreased raptor reproduction due to increased human activities near the nest; disruption of roosting during the wintering for bald eagles; destruction of nest, eggs, and/or young due to direct or indirect human activity; increased predation of eggs or young due to increased predators near raptor nests; impacts to raptors due to vehicle collisions or electrocution by power lines or electrical equipment; and indirect impacts on raptor hunting, foraging, and roosting habitats (National Wildlife Federation 1987). Based on the location of the proposed wellfield, no trees or rock outcrops would be removed. The Proposed Action would result in the loss or fragmentation of some potential raptor hunting and foraging habitat. This habitat loss or fragmentation would likely continue to some degree depending on how long it takes for a vegetative community to become established. Use of the revegetated areas by raptors would depend on numerous factors including how long it takes for vegetation to become reestablished. It would likely require 2 to 4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished.

The bald eagle, which was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 *Federal Register* 37346), remains listed as a BLM-sensitive species and Wyoming species of greatest conservation need (Table 3.8) and the species continues to be protected at the national level by the BGEPA, as well as the MBTA.

No bald eagle nests were recorded during recent baseline raptor nest surveys of the project area and 1-mi buffer; however, bald eagles are known to nest in the general vicinity, with the closest known nest approximately 17 mi west of the site along the Powder River (Uranerz 2011). Bald eagles have been observed during the winter within and near the Hank Unit project area during winter surveys conducted from 2007 through 2010 (BLM 2011a, 2011d). As a result, the BLM has designated eight areas along Dry Willow Creek as bald eagle winter roost sites (Figure 3.8).

Raptors are particularly sensitive to noise and the presence of human activity, which would be heightened during the construction period. Direct impacts to raptor species could include loss of nests and nesting sites/habit, displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbance, and the potential reduction in prey populations within the proposed project site. Due to the close proximity of the well field to known nests, it is anticipated that nests in Dry Willow Creek (NE Section 7 and NW Section 8) will not be used.

Additional eagle winter roosts sites along Dry Willow Creek have been identified since the original 2009 winter roost surveys, (refer to Figure 3.8). While the proposed mitigation measures would reduce some impacts (i.e., no surface disturbance during winter period), eagles would likely be impacted (displaced) by operational activities. If these impacts result in lowered fitness or reproduction, the eagles would be harmed.

Nesting raptors would be protected from disturbance during the construction period by implementation of seasonal timing stipulations and implementation of annual raptor nest monitoring and mitigation planning. It is likely that there will be impacts to nesting raptors from the operational phase of the Proposed Action which are not restricted by the seasonal timing stipulations. Impacts to hunting and foraging habitats would be reduced by Uranerz limiting disturbance to a maximum of 159.4 acres. Additionally, the remaining bald eagle and raptor mitigation measures listed below are consistent with the BFO BLM RMP and would reduce potential impacts to bald eagles and raptors.

Black-tailed Prairie Dog

A black-tailed prairie dog complex, consisting of 11 black-tailed prairie dog colonies comprising approximately 5.6 acres, is located within proposed Hank Unit project area. Uranerz has committed to not disturbing the black-tailed prairie dog towns located in the Hank Unit. Therefore, the Proposed Action would not impact black-tailed prairie dog towns.

Swift Fox

Swift fox is also known to occur within the vicinity of the Project Area; however, no family groups or dens were identified. Construction operations could decrease the range of individuals and shift prey availability (i.e., habitat loss and/or fragmentation). Heightened noise and human activity during the construction phase could cause the species to avoid habitat adjacent to the proposed site. However, the swift fox is nocturnal; the species would likely avoid habitat near construction and decommissioning areas, and the operational phased of the Proposed Action would not noticeably alter these species' patterns or behavior. WGFD considers the swift fox habitat vulnerable, but not in a state of ongoing significant loss (Stephens and Anderson 2005). Therefore, the small amount of land disturbed over the LOP would have limited effects on individual swift foxes, and is unlikely to affect the local population.

Other Sensitive Species

Some of the remaining BLM-SS and Wyoming species of concern in the Project Area may be affected by the Proposed Action. The extent of effects to a given species depends on its life history, habitat preferences, adaptability to disturbance, and population. The likely primary impact would be displacement from suitable habitats in the 159.4 acres to be disturbed. Also, some behavioral changes may occur due to noise, lighting, and human proximity. Impacts to SS would be reduced, though, due to the mobility of most SS, and the small amount of land (159.4 acres) to be disturbed. The Proposed Action could result in potential loss or fragmentation of some habitat for some species, and would likely continue until permanent reclamation has been completed and vegetation reestablished. Use of the revegetated areas by other SS would depend on many factors, including length of time for vegetation reestablishment. Grasses would likely require 2 to 4 years to reestablish, but 10 or more years for shrub communities.

### 4.11.2 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be implemented. No additional surface would be disturbed and no additional impacts to wildlife resources including

special-status species would take place beyond those that already exist. Land would continue to be used for pastureland and extraction activities. CBNG and oil and gas operations in the proposed project area would continue as well as grazing of existing vegetation, particularly in grassland areas.

### 4.11.3 Applicant Committed Mitigation Measures

To minimize potential impacts to big games species Uranerz would implement the following mitigation measures.

- Uranerz would utilize a three-strand fence that would comply with WDEQ LQD Type III fence to prevent livestock from entering the wellfield, but it would allow the safe passage of wildlife through the wellfield.

- Depending on the location of the specific roads, Uranerz would enforce speed limits (e.g., 20 to 30 mph) on access roads.

- To protect big game, during construction operations and prior to installation of the wellfield fence, all drilling well pits would be fenced on at least three sides while drilling and four sides after the drill rig moves off for the duration of time that the pit is open.

- Uranerz would also inform all employees that they are not allowed to haze or harass the animals, and that they should minimize any direct disturbance to the animals whenever possible.

- Potential increases in poaching would be minimized by informing employees and contractors that they are required to comply with all wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by Uranerz.

To minimize potential impacts to non-sensitive raptor species Uranerz would implement the following mitigation measures.

- No surface disturbing activity would occur within 0.5 mi of any identified raptor nests from February 1 through July 31, annually, prior to a raptor occupancy survey for the current breeding season.

- If a raptor nest survey occupancy survey identifies active raptor nests, a 0.5-mi timing buffer would be implemented from February 1 to July 31.

- To the extent possible, Uranerz would not construct any aboveground power lines, permanent high-profile structures such as storage tanks, or other perch sites within 0.5 mi of any active GSG lek near the Hank Unit project area. Aboveground power line would be constructed in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (Avian Power Line Interaction Committee (APLIC) 2006).

- To minimize potential impacts to local prey base populations for raptors, Uranerz would minimize the amount of disturbance associated with the Hank Unit Project.

To minimize potential impacts to GSG, Uranerz would implement the following mitigation measures.

- Surface occupancy and/or disruptive activities would be prohibited on or within 0.25-mi radius of the perimeter of occupied GSG leks.

- To the extent possible, Uranerz would not construct any aboveground power lines, permanent high-profile structures such as storage tanks, or other perch sites within 0.5 mi of any active GSG lek near the Hank Unit project area. In addition, wherever practical, power lines within 2 mi of the base of the Pumpkin Buttes TCP would be buried. Where the power lines could not be buried (due to local topographic or geological conditions), aboveground power line would be constructed in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (APLIC 2006).

- To minimize GSG mortality due to vehicle collisions, Uranerz would advise project personnel of appropriate speed limits for specific access roads, that they are not allowed to haze or harass the animals, and that they should minimize any direct disturbance to the animals whenever possible.

- Uranerz would minimize the removal of vegetation, wherever possible, and would revegetate disturbed areas as soon as practicable following completion of project activities.

To minimize potential impacts to bald and golden eagles and other raptors, Uranerz would implement the following mitigation measures.

- A seasonal minimum surface disturbance-free buffer zone of 1 mile would be established around all bald eagle winter roost sites (November 1-April 1) identified in Figure 3.8. These buffer zones and timing stipulations may be adjusted based on site-specific information through coordination with and written approval from the USFWS.

- Within 0.5 mi of bald eagle winter roost sites illustrated in Figure 3.8, additional measures such as remote monitoring and restricting maintenance visitation would be implemented. This includes limiting all site visits to between 9:00 a.m. and 3:00 p.m. to prevent disturbance to roosting bald eagles for the period of November 1-April 1.

- No surface disturbing activity would occur within 0.5 mi of any identified active raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season.

- If a raptor nest occupancy survey identifies active raptor nests, a 0.5-mi timing buffer would be implemented. The timing buffer restricts surface disturbing activities within 0.5 mi of occupied raptor nests from February 1 to July 31.

- Aboveground power line would be constructed in compliance with *Suggested Practices for Raptor Protection and Power Lines: The State of the Art in 2006* (APLIC 2006).

- To minimize potential impacts to the local prey base for raptors, Uranerz would minimize the amount of disturbance associated with the Hank Unit Project.

- Uranerz would also conduct annual raptor monitoring and mitigative planning to minimize conflicts between active nest sites and project-related activities.

To minimize potential impacts to BLM-sensitive species, Uranerz would implement the following mitigation measures.

- Uranerz would not conduct any ground-disturbing activities within the prairie dog towns in the Hank Unit illustrated on Exhibit D9-3 in Appendix D9 of the POO (Uranerz 2012).

- To minimize potential impacts to BLM-sensitive species, Uranerz would minimize the amount of disturbance associated with the Hank Unit Project.

To minimize potential impacts to general wildlife species, Uranerz would implement the following mitigation measures.

- To protect big game, during construction operations and prior to installation of the wellfield fence, all drilling well pits would be fenced on at least three sides while drilling and four sides after the drill rig moves off for the duration of time that the pit is open.

- Once reclamation is deemed successful, project-related fencing would be removed.

- Removal or disturbance of vegetation would be minimized through construction site management, and Uranerz would implement the interim and permanent reclamation procedures outlined in Sections 2.2.3.2 and 2.2.3.5.

- To minimize wildlife mortality due to vehicle collisions, Uranerz would advise project personnel of appropriate speed limits on designated access roads, that they are not allowed to haze or harass the animals, and that they should minimize any direct disturbance to the animals whenever possible.

- Potential increases in poaching would be minimized by informing employees and contractors that they are required to comply with all wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by Uranerz.

- Uranerz would also install buried fiber optic communication lines to allow for remote monitoring and controlling well uranium recovery and aquifer restoration activities at the header houses and wells from the SPF. The fiber optic communication lines would thus reduce vehicle traffic and human presence in the wellfield.

### 4.11.4 Residual Impacts

The Proposed Action would result in the LOP loss of approximately 159.4 acres of wildlife habitat due to vegetation removal. Some wildlife species could be temporarily displaced from project-related construction and decommissioning activities and some species, especially small mammals, young birds, reptiles, may be lost or displaced during construction, operations, and decommissioning operations. There could also be potential impacts (i.e., displacement) to eagles that use the winter roost areas within the Hank Unit. Residual impacts to raptor species could include loss of nests and nesting sites/habit, displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbance, and the potential reduction in prey populations within the proposed project site. Habitat effectiveness, especially for big game species, would likely be reduced, due to the change in the compaction of vegetation communities as revegetated areas become re-established and evolve toward a sagebrush dominated plant community. There could also be an unavoidable loss of wildlife due to wildlife/vehicle collisions. Greater sage-grouse would likely not use the Hank Unit area during the construction and uranium recovery phases of the project. Habitat loss or fragmentation would likely continue

for the life of the project until permanent reclamation operations have been completed and revegetation has been reestablished. Use of the revegetated areas by other sensitive species would depend on numerous factors including how long it takes for vegetation to become reestablished. It would likely require 2 to 4 years for grasses to be reestablished but it could take 10 or more years for shrub communities to be reestablished.

### 4.11.5 Cumulative Impacts

#### 4.11.5.1 Wildlife

Potential cumulative impacts to wildlife resources may occur and include reduction in wildlife habitat and forage productivity, modification of existing vegetative communities, and the potential spread of invasive species and noxious weed populations. Cumulative wildlife impacts may involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct or indirect mortalities. Land disturbance resulting from other development activities in the proposed project area would have similar impacts as those described above. Numerous development activities across the PRB could cumulatively reduce wildlife and plant populations and alter population structure (BLM 2003a). In the Final EIS for the PRB oil and gas project, the BLM concluded that continued natural resource development across the PRB has the potential to alter the distribution of various types of native vegetation, resulting in cumulative impacts to biodiversity (BLM 2003a).

Because sagebrush shrublands and mixed grasslands cover approximately 93% of the proposed Hank Unit project area, these vegetative plant communities would be most affected by the Proposed Action. Surface disturbance from the construction and operations activities of the proposed Hank Unit project area could result in the spread of invasive and noxious weeds. Because the area of disturbed land area of 159.4 acres would be noncontiguous and comprise approximately 7% of the total proposed project site 2,250 acres, some vegetation would be affected but would not affect a sizeable segment of any species' habitat. Furthermore, disturbed areas would be revegetated according to a reclamation plan, and Uranerz would implement mitigative measures to minimize the spread of noxious weeds (NRC 2011).

Impacts to wildlife species are described in Section 4.11.1.3. Big game species travel across large expanses of land, and the Project Area includes only 0.01% of the range covered by the Pumpkin Buttes Antelope Herd Unit, and 0.13% that of the Pumpkin Buttes Mule Deer Herd Unit. Waterfowl and shorebirds would experience limited impacts, as the Project Area contains very limited seasonal habitat (i.e., waterbodies and wetlands). Limited impacts on most mammal species is anticipated, as most would be able to travel to nearby suitable habitat. Reptiles and amphibians would experience limited impacts as only a small portion of the Project Area's 159.4 acres would be disturbed over the LOP (NRC 2011).

However, the numerous impacts occurring at oil/gas, CBNG, and coal development projects would result in some cumulative impacts to wildlife similar to those previously described by the BLM (2003). BLM reported nearly 10% of the study area would be disturbed by various RFFAs (BLM 2003a). This amount of habitat disturbance would impact vegetation by promoting spread of noxious weeds and fragmenting vegetative communities. Impacts to wildlife could involve loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct or indirect mortalities. The Proposed Action would have limited incremental effect on terrestrial ecology when considered with all other past, present, and RFFAs in the study area. This conclusion is based on small amount of disturbance (159.4 acres) for the LOP, and Uranerz would minimize surface disturbance and implement reclamation operations as soon as practical.

#### 4.11.5.2 Special Status Animal Species

Only one federal candidate species, the GSG, is known to occur in the vicinity of the Project Area As (see Section 4.11.1.7). There are no leks within the Hank Unit, but seven occupied leks are within 2.0 mi. Loss and degradation of native sagebrush shrubland habitats imperil much of this ecosystem type and sagebrush-obligate species, including the GSG (*Centrocercus urophasianus*) (NRC 2011). GSG are found in sagebrush shrubland habitats, essential during all seasons and every phase of their lifecycle. Most of such habitats have been changed by land use, such as livestock grazing, agriculture, or resource extraction. These uses can influence habitats either directly or indirectly, and can alter fire frequency (Naugle et al. 2011). The long-term viability of the GSG rangewide continues to be at risk because of population declines related to

habitat loss and degradation. Populations have declined overall from 1965 to 2007, with the greatest decline occurring before the mid-1980s. The total range-wide decline is estimated at 45% to 80% from historic levels (Becker et al. 2009), declining 2% per year from 1956 to 2003 (Knick and Connelly 2011). The State of Wyoming is critical for GSG as it currently contains 64% of all known habitat and more active leks than any other state (Doherty et al. 2011).

Because of its spatial extent, oil/gas development is regarded as playing a major role in the decline of the species in the eastern portion of the species' range, which includes the study area (Doherty et al. 2011). Future oil and gas development is projected to cause a 7% to 19% decline in GSG lek population counts throughout much of the current and historic GSG range (Knick and Connelly 2011). Forecasts of future population viability across 23 populations and seven GSG management zones (SMZs) suggest that 75% of the populations and 29% of the SMZs are likely to decline below effective population sizes of 500 within 100 years, if current conditions and trends persist. Preventing high probabilities of extinction in many populations and in some SMZs in the long term would require concerted efforts to decrease continuing loss and degradation of habitat that may negatively affect GSG at local scales (Garton et al. 2011). The WGFD has noted that conservation measures such as those included in the 2011 Wyoming E. O. 2011-5 (State of Wyoming 2011) and BLM IM WY-2012-019 (BLM 2012d) are sound strategies that will help maintain sage-grouse population viability (WGFD 2013b).

The Proposed Action would have limited impacts on vegetation because it would involve the disturbance of a maximum of 159.4 acres of disturbance over the LOP. However, for species with specialized habitat requirements, such as GSG, future population viability would be strongly influenced by the quality and composition of any remaining habitat. As such, it is possible that the addition of the Proposed Action would contribute to a decrease in sagebrush shrubland; thereby, reducing the amount of habitat for GSG.

The black-tailed prairie dog habitat within the proposed Hank Unit would be protected from project-related disturbance. The swift fox is nocturnal and the species would likely avoid habitat near construction areas and development of the Proposed Action would not likely alter these species' patterns or behavior within the region.

The Proposed Action would have a limited incremental effect on other special-status species including raptors when considered with all other past, present, and RFFAs in the region. This conclusion is based on the fact that the Proposed Action would disturb 159.4 acres of habitat and the proposed project area does not contain critical habitat for any protected species.

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# 5.0 CONTRIBUTORS, REVIEWERS, AND PREPARERS

Table 5.1 Record of Persons, Groups, and Governmental Agencies Contacted.[1]

| Company/Agency | Individual | Discipline/Position |
|---|---|---|
| U.S. Fish and Wildlife Service, Wyoming Office | Mark Sattelberg | Field Supervisor |
| Wyoming Department of Parks and Cultural Resources | Judy Wolf | Deputy State Historic Preservation Office |
| Wyoming Department of Travel and Tourism | Lori Hogan | |
| Wyoming Game and Fish Department | | |
| Cheyenne | Robin Kepple | Public Information Specialist |
| Sheridan | Lynn Jahnke | Regional Wildlife Coordinator |
| Wyoming Natural Diversity Database | Melanie Arnett | Data and Biological Assistant |

[1] Additional individuals, groups, and agencies were contacted during BLM public scoping.

Table 5.2 List of Preparers, Contributors and Reviewers.

| Organization | Name | EA Responsibility |
|---|---|---|
| **Bureau of Land Management, Interdisciplinary Team:** | | |
| Buffalo Field Office | Thomas Bills | Project Management, NEPA, Technical Editing, Socioeconomics, Quality Control |
| | Kerry Aggen | Geology, Minerals, Technical Editing, Quality Control |
| | Bill Ostheimer | Wildlife, Vegetation, Special Status Species |
| | Don Brewer | Wildlife, Vegetation, Special Status Species |
| | Clinton Crago | Cultural Resources |
| | G.L. Damone, III | Native American Consultation |
| | Kathy Brus | Soils, Water (Surface and Subsurface), Hydrology |
| | Allison Ginn | Recreation, Visual Resources |
| | Kay Medders | Range Management, Invasive Species, BLM-acceptable Seed Mixtures |
| **TRC Environmental Corporation, Interdisciplinary Team:** | | |
| | Scott Kamber | Project Management, EA Preparation - Biological and Physical Resources, Quality Control |
| | Jan Hart | EA Preparation - Wildlife Resource, Quality Assurance |
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| | Genial DeCastro | Document Production, Quality Control |
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| | Adriana Bellah | Technical Editing |
| | Betty Wills | Drafting/GIS |
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