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Protecting People and the Environment

NUREG-1910
Supplement 3

Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming

Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and
Environmental Management Programs

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U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and
Environmental Management Programs

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff.
Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1910, Supplement 3, draft, in your comments, and send them by February 01, 2010 to the following address:

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ABSTRACT

The U.S Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and would be operated in a manner that is protective of public health and safety and the environment. Under NRC's environmental protection regulations in the Code of Federal Regulations (CFR), Title 10, Part 51, which implement the National Environmental Policy Act (NEPA) of 1969, issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an environmental impact statement.

In June 2009, NRC issued NUREG-1910, "*Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*" (the GEIS). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an in-situ leach uranium recovery facility (also known as an in-situ recovery (ISR) facility) located in four specified geographic regions of the western United States. As part of this assessment, NRC determined which potential impacts would be essentially the same for all ISR facilities and which would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine potential impacts. The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses.

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI) submitted a license application to NRC for a new source material license for the Lost Creek Project. The Lost Creek Project would be located in Sweetwater County, Wyoming, which is in the Wyoming West Uranium Milling Region identified in the GEIS. The NRC staff prepared this SEIS to evaluate the potential environmental impacts from LCI's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium milling facility at the Lost Creek Project site. This SEIS also describes the environment potentially affected by LCI's proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes LCI's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings and conclusions in the GEIS that could be incorporated by reference, and areas that needed additional analysis. Based on its environmental review, the NRC staff preliminarily finds that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Lost Creek Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

Paperwork Reduction Act Statement

This SEIS covers information about only one site, does not contain information collection requirements and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

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BACKGROUND

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Lost Creek Project, located in Sweetwater County, Wyoming. LCI is proposing to recover uranium using the in-situ leach (also known as the in-situ recovery (ISR)) process. The proposed Lost Creek Project includes a central processing plant to produce yellowcake slurry, well fields, deep disposal well for liquid effluent wastes, and the attendant infrastructure (e.g., pipelines).

The Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978, authorizes the NRC to issue licenses for the possession and use of source material and byproduct material. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements to protect public health and safety from radiological hazards. Under the NRC's environmental protection regulations in the Code of Federal Regulations, Title 10, Part 51 (10 CFR Part 51), that implement the National Environmental Policy Act of 1969 (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling (see 10 CFR 51.20(b)(8)).

In June 2009, the NRC staff issued NUREG-1910, "*Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*" (herein referred to as the "GEIS"). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Lost Creek Project is located within the Wyoming West Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This draft Supplemental Environmental Impact Statement (SEIS) incorporates by reference from the GEIS and uses information from the applicant's license application and other independent sources to fulfill the requirements in 10 CFR 51.20(b)(8).

PURPOSE AND NEED OF THE PROPOSED ACTION

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." LCI is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Lost Creek site. The purpose and need for the proposed action is to provide an option that allows the applicant to use ISR technology to recover uranium and produce yellowcake slurry at the Lost Creek Project. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce fuel for commercially-operated nuclear power reactors. Based on the application, the NRC's federal action is the decision whether to issue the license to LCI.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, the NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

THE PROJECT AREA

The Lost Creek ISR Project is located in the northeast portion of Sweetwater County, in south-central Wyoming. The nearest population center, located approximately 24 kilometers (km) (15 miles [mi]) northeast of the project site, is Bairoil, a small town with less than 100 people. The City of Rawlins is located approximately 61 km (38 mi) to the southeast; the City of Rock Springs is located approximately 129 km (80 mi) southwest; the City of Casper is located approximately 145 km (90 mi) northeast; and Jeffrey City is located approximately 40 km (25 mi) north of Lost Creek. Planned facilities associated with the proposed project include well fields with injection, production, and monitor wells, header houses, a central processing facility, an access road network, and pipeline system.

The Project Area consists of approximately 1,709 hectares (ha) (4,220 acres [ac]) and is remotely located on public land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM) and the State of Wyoming. Of this land, 1,449 ha (3,580 ac), or 85 percent, is administered by BLM, and 259 ha (640 ac), or 15 percent, is administered by the State of Wyoming.

IN-SITU RECOVERY PROCESS

During the ISR process, an oxidant-charged solution, called a lixiviant, is injected into the production zone aquifer (uranium ore body) through injection wells. The production zone is that portion of the aquifer that has been exempted by the EPA for potable water use. Typically, a lixiviant uses native ground water (from the production zone aquifer), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As it circulates though the production zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution is drawn to recovery wells by pumping, and then transferred to a processing facility via a network of pipes buried just below the ground surface. At the processing facility, the uranium is leached from the solution. The resulting barren solution is then recharged with the oxidant and re-injected to recover more uranium from the well field.

During production, the uranium recovery solution continually moves through the aquifer from outlying injection wells to internal recovery wells. These wells can be arranged in a variety of geometric patterns depending on ore body configuration, aquifer permeability, and operator preference. Well fields are often designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well being located inside a ring of injection wells. Monitoring wells would, then, surround the well field pattern area, terminating in the production zone aquifer as well as in both the overlying and underlying aquifers. These monitoring wells are screened in appropriate stratigraphic horizons to detect lixiviant in case it migrates out of the production zone. The uranium that is recovered from the solution would be processed, dried into yellowcake, and packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 205-L (55-gal) steel drums, and trucked offsite to a licensed uranium conversion facility.

ALTERNATIVES

The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA, require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action before acting on a proposal. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared with the impacts that would result if a given alternative were implemented. This draft SEIS evaluates the potential environmental impacts of the proposed action and two alternatives, including the No-Action alternative. Under the No-Action alternative, LCI would not construct or operate an ISR facility at the proposed site. The other alternative considered is the production of dry yellowcake at the Lost Creek Project. Alternatives considered but eliminated from detailed analysis include conventional mining and milling at the Lost Creek site, and conventional mining and heap leach processing at the Lost Creek site, alternate lixiviants, and alternate waste disposal methods.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts resulting from the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Lost Creek Project site and the two alternatives. The draft SEIS also provides mitigation measures for the reduction or avoidance of potential adverse impacts from the proposed action. The draft SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NRC's NUREG-1748 (NRC, 2003), the significance of potential environmental impacts is categorized as follows:

> **SMALL**: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> **MODERATE**: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource.
>
> **LARGE**: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Chapter 4 provides NRC's evaluation of the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek Project. A list of the significance level of impacts by phase of the ISR facility lifecycle is provided below followed by a brief summary of impacts by environmental resource area and ISR facility lifecycle phase.

Impacts by ISR Facility Phase and Significance Level

Construction

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources (Vegetation); Air Quality; Noise; Visual and Scenic Resources; Socioeconomics (Demographics, Income, Employment Structure, Housing, Local Finance, Education, Health and Social Services); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	Ecological Resources (Wildlife); Historical and Cultural Resources
LARGE impacts:	None

Operation

SMALL impacts:	Land Use; Transportation; Surface Water and Wetlands; Geology and Soils; Ecological Resources (Vegetation); Air Quality; Noise; Historical and Cultural Resources; Visual and Scenic Resources;

	Socioeconomics (Income); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	Groundwater; Ecological Resources (Wildlife); Socioeconomics (Demographics, Housing, Employment Structure, Local Finance, Education, Health and Social Services)
LARGE impacts:	None

Aquifer restoration

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Ecological Resources; Air Quality; Noise; Historical and Cultural Resources; Visual and Scenic Resources; Socioeconomics; Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	Groundwater
LARGE impacts:	None

Decommissioning

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historical and Cultural Resources; Visual and Scenic Resources; Socioeconomics; Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	None
LARGE impacts:	None

Impacts by Resource Area and ISR Facility Phase

Land Use

Construction: Impacts would be SMALL. An estimated 23 ha (57 ac) would be stripped of vegetation and topsoil, which is small in comparison to the 1,709 ha (4,220 ac) of the entire project area. The construction of the planned six production (well field) units would be completed in phases after the construction of the CPP and storage ponds.

Operation: Impacts would be SMALL. Impacts would be similar to, or less than, those during the construction phase. Infrastructure is already in place; for example, buildings and storage areas. Additional well drilling and new two-track roads would be made, but this is much less intensive than the construction phase.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar, or less than those during the operation phase. It is expected that as aquifer restoration proceeds and well fields are closed, some operational activities would diminish.

Decommissioning: Impacts would be SMALL. Land use impacts would be similar to those during the construction phase. Decontamination and dismantling of the project facilities and roads would occur, contouring the land to its natural state, and reseeding and placement of soils would also occur during this phase.

Transportation

Construction: Impacts would be SMALL. Low levels of traffic generated by construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on the roads in the region. Due to the limited duration of construction activities the impact of construction traffic to the roadway network is expected to be short-term. In addition, access roads have been upgraded to BLM standards.

Operation: Impacts would be SMALL. Low levels of facility-related traffic would not noticeably increase traffic or accidents on most roads. Light truck traffic would be expected to decrease from the construction phase. Transportation of hazardous materials increases the probability of potential accidents, the risk would be minimized due to a small number of shipments, comprehensive regulatory controls, and best management practices (BMPs).

Aquifer Restoration: Impacts would be SMALL. Transportation impacts during this phase would be similar to those of the operations phase. As the rate of uranium recovery gradually decreases through the course of aquifer restoration, the number of yellowcake slurry shipments to offsite drying facilities would also decrease.

Decommissioning: Impacts would be SMALL. There would be reduced traffic volumes associated with this phase compared to the operations phase, resulting in a reduced risk of transportation accidents. Regional transportation impacts are expected to be short-term.

Geology and Soils

Construction: Impacts would be SMALL. Most potential impacts would occur during the construction phase with respect to geology and soils. Earth moving activities and well drilling would take place during this phase. Additionally, there would be a limited construction area as well as implementation of the BMPs to mitigate potential impacts.

Operation: Impacts could be potentially MODERATE. The removal of uranium from the target sandstone (aquifer) during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. The uranium mobilization and recovery process in the target sandstone, deep below the ground surface does not result in the removal of rock matrix or structure. No significant matrix compression or ground subsidence is expected. There would be a risk of spills/leaks at the project area, impacts to soils from spills and/or leaks would be mitigated by immediate response time, routine monitoring programs, and spill recovery actions, and impacts would be reduced to SMALL.

Aquifer Restoration: Impacts could be potentially MODERATE. Activities during aquifer restoration would not result in the removal of any rock matrix or structure. No significant matrix compression or ground subsidence is expected, as the net withdrawal of lixiviant would typically be one percent or less. Spill and leak detection would be implemented here in the same way they would during the operations phase, which would reduce impacts to SMALL.

Decommissioning: Impacts would be SMALL. Disruption and/or displacement of existing soils would occur during the decommissioning phase, but these reclamation activities would be short term. The land would be restored to its original condition/use.

Water Resources (Surface Water and Wetlands)

Construction: Impacts would be SMALL. Impacts to surface water would potentially be from construction involving road crossings, filling, erosion, runoff, and spills or leaks of fuels and lubricants for construction equipment. Impacts would be mitigated through proper planning, design, construction, and BMPs. Any construction disturbances such as well field drilling, road and facility construction, and pipeline installations would occur in a small area relative to the overall size of the project.

Operation: Impacts would be SMALL. Potential spills and/or leaks would be mitigated in the same way as the construction phase. The site would have permits (federal and state) for discharge of storm water runoff and process-related water; the licensee would be expected to operate within the conditions of the permit. Vehicles would cross ephemeral channels at right angles to access all well fields during oversight and maintenance of the injection, production, and monitoring wells. This may liberate limited amounts of sediment to downstream areas.

Aquifer Restoration: There would be no impacts for this phase and resource area. While the restoration of groundwater aquifers results in the production of wastewater; however, no wastewater would be released into surface waters, and therefore, no impacts are expected.

Decommissioning: Impacts would be SMALL. Impacts from decommissioning would be expected to be similar to, or less than impacts from construction. Activities to clean up, and re-contour and reclaim the land surface during decommissioning would be expected to mitigate potentially long-term impacts to surface waters. Sediment from loosened soil would be prevented from entering surface waters and downstream wetlands during this phase therefore would minimize impacts.

Water Resources (Groundwater)

Construction: Impacts would be SMALL. Potential impacts to groundwater could occur during consumptive use of groundwater, introduction of drilling fluids and muds into the environment during well installation, discharge of pumped water to the surface during hydrologic testing and surface spills of fuels and lubricants. These impacts would be mitigated due to the expected limited use of consumptive groundwater during this phase and implementation of BMPs to protect groundwater.

Operation: Impacts would be MODERATE. During ISR operations, potential environmental impacts to shallow (near-surface) aquifers are the result of leaks of lixiviant from pipelines, wells, or header houses and to waste management practices such as the use of evaporation ponds and disposal of treated wastewater by land application. Potential environmental impacts to groundwater resources in the production and surrounding aquifers include consumptive water use (drawdown) and changes to water quality. Drawdown impacts could be MODERATE, but water levels would recover once ISR operations and restoration activities are completed. Water quality changes would result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations also can potentially impact groundwater resources.

Aquifer Restoration: Impacts would be MODERATE. Three steps take place will occur during restoration: groundwater sweep, groundwater treatment, and recirculation. During all processes hydraulic control of the former production zone must be maintained; this is accomplished by maintaining an inward hydraulic gradient through a production bleed. During groundwater sweep, water is pumped from the mine unit (without re-injection),resulting in an influx of 'fresh' baseline water into the affected (mined) portion of the aquifer, but also resulting in large drawdown of wells occurring near the project area. The water removed from the aquifer during the sweep first is passed through an ion-exchange system to recover the uranium and then disposed either in evaporation ponds or via deep well injection in accordance with the limits in a UIC permit. This would result in drawdown in nearby surrounding wells. During this phase, disposal of waste fluids via deep well injection of waste is planned in much the same manner as operation.

Decommissioning: Impacts would be SMALL. Potential impacts during this phase would be similar to those during the construction phase. Groundwater consumptive use would be less than that of the operation and restoration phase. All monitoring wells, injection, and production wells would be plugged and abandoned in accordance with the Wyoming underground injection control (UIC) program requirements. Wells would be filled with cement and clay and then cut below plough depth to ensure groundwater does not flow through the abandoned wells. Abandoned wells would be properly isolated from the flow domain.

Ecological Resources (Wildlife)

Construction: Impacts would be MODERATE. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible at the Lost Creek site. Mitigation measures such as the standard management practices issued by the Wyoming Game and Fish Department (WGFD) would limit these impacts. Impacts to sage grouse and big game species could also be mitigated if BLM and WGFD guidelines are followed. Impacts to raptor species from power distribution lines could be mitigated by following the Avian Power Line Interaction Committee (APLIC) guidance. No federally- or state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the project area; therefore, no adverse impacts are anticipated.

Operation: Impacts would be SMALL. Wildlife habitats could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Contamination or alteration of soils would likely occur from operational leaks and spills and possible from transportation or land application of treated wastewater. Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would likely reduce the significance of overall impacts. In addition, the applicant would follow seasonal guidelines for wildlife exclusionary periods.

Aquifer Restoration: Impacts would be SMALL. Impacts could include incomplete habitat disruption. Existing infrastructure would already to be in place, during aquifer restoration activities, which would produce potential ecological impacts similar to during facility operation. Therefore, would produce little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing and netting would reduce impacts.

Decommissioning: Impacts would be SMALL. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation are completed and vegetation and habitat are reestablished.

Ecological Resources (Vegetation)

Construction: Impacts would be SMALL. Approximately 23.5 ha (58 ac) would be stripped of vegetation of the total project area of 1,709 ha (4,220 ac). Based on the disturbed land area compared to the total project area, some individual plants would be affected, but impacts would not generally affect a sizeable segment of the plant species' population over a relatively large area. The construction of the CPP, main access roads, surface impoundments, and mine units would involve removal of vegetation and soil to create level ground for building construction. Topsoil would be removed and temporarily stockpiled on the site for future decommissioning and habitat restoration efforts. To stabilize soils and support the ecosystem, vegetation would be established at disturbed areas with the approved BLM and WDEQ native seed mixture as soon as conditions allow.

Operation: Impacts would be SMALL. Surface disturbance increases the susceptibility of the project area to invasive and noxious weeds; this would be minimized and vehicular access would be restricted to specific roads. Additionally, disturbed areas would be reseeded with WDEQ and BLM approved seed mixture, as soon as conditions allow, preventing the establishment of competitive weeds. Potential impacts to vegetation from facility operations resulting from spills around well heads and leaks from pipelines would be SMALL and would be handled using BMPs.

Aquifer Restoration: Impacts would be SMALL. Existing infrastructure would already be in place, aquifer restoration activities would produce potential ecological impacts similar to facility operation. Adherence to seasonal guidelines established by the WGFD and BLM with respect to noise, vehicular traffic, and human proximity would mitigate potential impacts to affected species.

Decommissioning: Impacts would be SMALL. Impacts from decommissioning would, in part, be similar to those discussed for construction of the facility in terms of increased noise and traffic. The main difference between the decommissioning phase and the construction phase includes the actual loss of vegetation and habitat during construction, whereas decommissioning would restore these systems. These impacts would be temporary and also decrease with time, as reclamation activities preceded.

Air Quality

Construction: Impacts would be SMALL. Air emissions during the construction phase of the Lost Creek ISR project would consist primarily of fugitive dust and emissions from equipment running diesel and gasoline-fueled combustion engines such as drill rigs, water trucks, bulldozers, and light-duty passenger trucks. The site conditions, and proposed activities, at the Lost Creek site are consistent with the conclusions stated in the GEIS for air quality. The air quality within the proposed Lost Creek study area would not be substantially affected by project construction because of: 1) the temporary nature of the activity; 2) the limited footprint of the construction area relative to the project area; 3) the relatively low volume of traffic and heavy equipment compared with conventional uranium mining activities and 4) the low background concentrations of pollutants. Best management practices (BMPs), following BLM and WDEQ guidelines, would ensure that the construction equipment would minimize fugitive dust emissions.

Operation: Impacts would be SMALL. Operating ISR facilities are not major point source emitters and are not expected to be classified as major sources during the operation phase. Potential non-radiological emissions during operations include fugitive dust and exhaust from equipment, maintenance, transport trucks, and other vehicles. NAAQS attainment areas, non-radiological air quality impacts would be SMALL

Aquifer Restoration: Impacts would be SMALL. Air quality impacts from aquifer restoration are expected to be similar to, but less than, those during operations because the same infrastructure is used for aquifer restoration as during operations. Additionally, fugitive dust and exhaust emissions from vehicles and equipment during this phase is expected to be similar to, but less than, the dust and exhaust emissions during operations. A small number of vehicles would be used, and fugitive dust from restoration equipment would be short-term.

Decommissioning: Impacts would be SMALL. Decommissioning activities would be similar to those of construction. Emissions levels would be expected to decrease as decommissioning proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with construction, would be short-term, and would be reduced through BMPs (e.g., dust suppression).

Noise

Construction: Impacts would be SMALL. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the well fields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above the undisturbed background levels. The construction phase sound levels were based upon the reference sound levels, which were projected to receptor locations by established relationships of sound propagation over distance. Construction noise is not expected to be available at the nearest receptor. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection.

Operation: Impacts would be SMALL. Well field equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities), reducing potential offsite sound levels. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. This would be relatively short term increase in noise levels. Overall noise impacts within the project area during the operation phase would be compounded based on the overlapping nature of the each of the phases with respect to noise, but would still remain a SMALL impact due to the distance to the nearest receptor.

Aquifer Restoration: Impacts would be SMALL. Sound levels generated during the restoration phase include cement mixers, compressors, and pumps used for the plugging and abandonment of production and injection wells. Noise impacts from aquifer restoration activities would be expected to be similar to, or lower than, the operation phase activities at the site. Equipment and traffic were assumed to be similar to those of the operation phase, the degree of noise impact is the same as the operation phase.

Decommissioning: Impacts would be SMALL. General noise levels during decommissioning and reclamation would be expected to be similar, or less than, those levels experienced during construction. Noise levels would be temporary; once decommissioning and reclamation activities were complete, noise levels would return to ambient, with occasional vehicle traffic for any longer term monitoring activities. The nearest receptor, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any change in sound levels due to decommissioning activities, resulting in no impact.

Historical and Cultural Resources

Construction: Impacts could be MODERATE. Potential impacts during ISR facility construction could include loss of, or damage to, historic and cultural resources due excavation activities as a part of construction. Three archaeological sites have been recommended as eligible to the NRHP. One of the sites is located within one of the proposed well fields. It is recommended that the site be avoided. If avoidance is not possible, then mitigation measures outlined in a formal treatment plan should be implemented. NRC, BLM, SHPO, and LCI have developed a memorandum of agreement (MOA) to address the implementation of the treatment plan. Implementation of the Treatment Plan, as well as monitoring would reduce the potential for impact from MODERATE to SMALL.

Operation: Impacts would be SMALL. It is expected that potential impacts to historical, cultural, and archaeological resources from operations would be less than during construction, because less land disturbance occurs during the operations phase.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration impacts to historic and cultural resources are expected to be similar to, or less than, potential impacts from operations. Activities during this phase are generally limited to the existing infrastructure and previously disturbed areas.

Decommissioning: Impacts would be SMALL. It is expected that decommissioning and reclamation activities would focus on previously disturbed areas, and that historic and cultural resources within the potential area of effect would already be known.

Visual/Scenic Resources

Construction: Impacts would be SMALL. During construction, visual resources would be affected to some degree by vegetative disturbance, road building, drilling, piping, and facility construction and placement. Most visual and scenic impacts associated with earth-moving activities during construction would be temporary. Process facility construction and drill rigs could be visible; however most of these modifications would not be visible from the public road network, which is lightly traveled. Dust suppression and coloration of well covers would further reduce overall visual and scenic impacts of project construction so that total impacts would be SMALL.

Operation: Impacts would be SMALL. Visual impacts during operations would be expected to be less than those associated with construction. The CPP, storage ponds, ancillary buildings, and pump houses would be the main operational facilities affecting the visual landscape; however, potential impacts would be short-term. Mitigation through BMPs (e.g., dust suppression) as well as limiting building height and painting buildings to blend into the natural landscape would further reduce overall visual and scenic impacts of operations.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities are expected to take place some years after the facility had been in operation and that restoration activities would use in-place infrastructure. As a result, potential visual impacts would be similar to, or less than, those experienced during operations. Visual Resource impacts from aquifer restoration would be similar to those seen in the operations phase.

Decommissioning: Impacts would be SMALL. Similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be similar to, or less than, those experienced during construction. Reclamation efforts are intended to return the visual landscape to baseline contours and should result in reducing the impacts from operations and minimizing permanent impacts to visual resources. Mitigation through BMPs (e.g., dust suppression) would further reduce overall visual and scenic impacts of aquifer restoration so that total impacts would be SMALL.

Socioeconomics

Construction: Overall, impacts would be SMALL. It is anticipated that construction workers would only relocate to the region, temporarily, as construction would take less than a year. Housing would not be affected, as the workers would probably stay in hotels or in trailer parks. Public service systems, such as schools, utilities, and health care, would not be affected, as construction workers are not likely to relocate their families for such a short period. The relatively small workforce, while contributing to the economy of the region, is likely to have only a SMALL impact, as they would be commuting to the work site from larger communities, such as Casper, Rawlins and Rock Springs.

Operation: Overall, impacts would be MODERATE, especially if the workforce was to reside in the smaller communities of the region, such as Bairoil, Jeffrey City and Wamsutter. Unlike construction, which is short-term, operation of the ISR facility would take place over a longer (9-10 year) period. In addition, operation would require different skills that may only be gotten from outside the region. It is likely that much of the workforce would relocate their families to the region, resulting in increased needs for public services (schools, health care and utilities). The smaller communities could experience a MODERATE impact. There would, however, be a positive impact to the region as income from the workforce and taxes from the ISR facility would benefit the local economies.

Aquifer Restoration: Overall, impacts would be SMALL, primarily because this phase of the ISR facility lifecycle is similar to the operation phase. The workforce would already be in place, but would be smaller, as yellowcake would no longer be produced. The potential impacts of this phase would be substantially reduced, because of the reduction in workforce.

Decommissioning: Impacts would be SMALL. This phase of the ISR lifecycle is somewhat similar to the construction phase, in that it is short-term, and the workforce would not be 'settling' into the region as would the operation/restoration workforce. Potential impacts, therefore, would be similar to, but slightly less than, those of the construction phase.

Environmental Justice

All phases: There would be no adverse disproportionate impacts. Within the area potentially affected by the Project, minimal minority populations are affected. Since the economic base of the study area is largely ranching and resource extraction, low-income areas are dispersed within the study area. No concentration of people living below the poverty level and no concentrated minority populations are located near the Lost Creek project; therefore, no adverse environmental impacts would result to minority populations or those living below the poverty level.

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Other than during well construction, the only significant radiation exposure pathway during the construction period would be through worker's potential direct exposure to, inhalation of, or ingestion of high concentrations of radionuclides within and emanating from (in the case of radon) the disturbed soil. Impacts from inhalation of fugitive dust would be SMALL due to the fact that radionuclide concentrations are expected to be low.

Operation: Impacts could be potentially MODERATE. Radiological impacts during normal operations would be SMALL. Worker doses at Lost Creek would be determined with the use of radiation dosimeters and bioassay sampling. All radioactive and potentially toxic liquid waste from the processing operations is to be disposed of by deep well injection. No routine releases of radioactive liquids are anticipated at the proposed facility. Radiological and non-radiological impacts from accidents would be reduced to SMALL (assuming accident procedures are followed), appropriate measures would be taken to ensure the safety of the workers and the public.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities involve activities similar to those during operations (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety are expected to be similar to operational impacts. Some operational activities would be discontinued during this phase; which would decrease impacts further.

Decommissioning: Impacts would be SMALL. The degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to pre-operational conditions. To ensure the safety of the workers and the public during decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for review. During all phases, the plan would also need to show that workers and public doses would be compliant with 10 CFR Part 20 limits. An approved plan would also provide ALARA provisions to further ensure that best safety practices are being use to minimize radiation exposures.

Waste Management

Construction: Impacts would be SMALL. Construction activities at the ISR facility would be relatively small-scale, and sequential well field development would generate low volumes of construction waste. Most of the wastes expected to be disposed of at Lost Creek during the construction phase would be solid wastes, such as building materials and piping. No radioactive wastes are anticipated during this phase; the relatively small amounts of waste generated during construction would include solid municipal wastes such as paper, wood, plastic, scrap metal, municipal sludge, and general construction debris.

Operation: Impacts would be SMALL. Operational wastes are primarily liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate). Additionally, liquid wastes would also be generated from well development, flushing of depleted eluent to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash down water. State permitting actions, NRC license conditions, and NRC inspections ensure that proper practices, as well as obtain appropriate permits, would be used to comply with safety requirements to protect workers and the public. LCI is proposing to dispose of the 11e.(2) by product liquid wastes through deep well injection, at a depth of greater than 2,440 m (8,000 ft). Proper installation and operating procedures would be used and compliance with WDEQ requirements for disposal would ensure adequate protection of public and environmental health and safety.

Aquifer Restoration: Impacts would be SMALL. Waste management activities during aquifer restoration utilize the same treatment and disposal options implemented during normal operations. Some increase in wastewater volumes may be experienced, but most often this increase is offset by the decrease in the uranium production capacity.

Decommissioning: Impacts would be SMALL. The goal of decommissioning is to reduce potential impacts by removing contaminants to allowable (regulatory) levels and restoring the property and lands to pre-operational conditions. LCI has committed to having an agreement for disposal of 11e.(2) radioactive waste materials in-place before construction of the Lost Creek project commences. Due to the size of the Lost Creek project and the intent of LCI to decontaminate and reuse equipment and components, the impact from decommissioning waste would be SMALL. LCI would utilize well field monitoring instrumentation and routine well field visual inspections for timely identification and remediation of well and pipeline leaks and spills, and effectively minimize the potential impact of any well field soil contamination.

CUMULATIVE IMPACTS

The cumulative impact on the environment that results from the incremental impact of the proposed licensing action when added to other past, present, and reasonably foreseeable future actions was also considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Lost Creek Project are not expected to contribute perceptible increases to cumulative impacts, due primarily to the extensive exploration taking place for not only uranium, but oil and gas, as well.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Lost Creek Project are, for the most part, limited to the area surrounding the site.

COMPARISON OF ALTERNATIVES

NRC's analysis indicates that the adverse impacts of the reasonable alternatives that were evaluated would differ from those of the proposed action.

For the No-Action alternative, LCI would not construct and operate ISR facilities at the proposed site. As a result, no uranium ore would be recovered or yellowcake slurry produced from the Lost Creek proposed site. This alternative would result in neither positive nor negative impacts to any resource area.

The other alternative NRC considered is for LCI to product dried yellowcake at the Lost Creek Project site. The potential environmental impacts for this alternative are similar to, or smaller than, the impacts from the proposed action. With the production of dry yellowcake, the number of trucks leaving the facility with final product would be less. The addition of the yellowcake dryer would not change the facility's footprint, as the facility, as designed, would have space allocated for the dryer. Potential air quality impacts would be SMALL as the dryer would operate under a negative pressure.

PRELIMINARY RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation regarding the proposed action. The NRC staff finds that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Lost Creek Project) are not so great as to make issuance of a source material license an unreasonable licensing decision. Additionally, the NRC staff has concluded that the applicable environmental monitoring program described in Chapter 6 would further reduce potential adverse environmental impacts associated with the proposed action.

The NRC staff has concluded that the overall benefits of the proposed action outweigh the environmental disadvantages and costs based on consideration of the following:

- Potential impacts to all environmental resource areas are expected to be SMALL, with the exception of

    1) groundwater during operation

    2) socioeconomics (specifically, demographics, housing, employment structure, local finance, education, health and social services) during operation, and

    3) wildlife and cultural resources during construction

    where such impacts would be MODERATE.

- ISR operations would take place in ore zone aquifers previously exempted by the U.S. Environmental Protection Agency as potential public drinking water sources. Additionally, the applicant would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Finally, the applicant would be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.

- The applicant has agreed to adhere to the guidelines provided by the Wyoming Game & Fish Department for species of concern, such as the sage grouse during construction and operations of the ISR facility.

- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.
- A Memorandum of Agreement (MOA) has been developed for the implementation of a Treatment Plan for a pre-historic site on the Lost Creek Project Area that is eligible for the National Register. The MOA is currently in the process of being executed. Signatories include the applicant (LCI), the Wyoming State Historic Preservation Office, the Bureau of Land Management, the Wyoming State Attorney General's Office, and the NRC. This MOA will implement a Treatment Plan for the Excavation of Prehistoric Site 48SW16604. Terms of this agreement will be negotiated through consultation between the parties.

ABBREVIATIONS/ACRONYMS

AADT	annual average daily traffic count
ADAMS	Agency Wide Documents Access and Management System
ACL	Alternate Concentration Limit
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
AMSL	above mean sea level
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division
ARPA	Archaeological Resources Protection Act of 1979
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	carbon monoxide
CR	County Route
CWA	Clean Water Act
dB	decibels
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENSR	ENSR Corporation
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERP	emergency response plan
ESA	Endangered Species Act of 1973
ESTHPO	Eastern Shoshone Tribal Historic Preservation Office
FHWA	Federal Highway Administration
FONSI	finding of no significant impact
FR	Federal Register
FSME	Office of Federal and State Materials and Environmental Management Programs
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
gpm	gallons per minute

HDPE	high-density polyethylene
I	Interstate
ISR	in-situ recovery
kph	kilometers per hour
LCI	Lost Creek ISR, LLC
LQD	Land Quality Division
Lpm	liters per minute
MBHFI	Migratory Birds of High Federal Interest
MCL	Maximum Contaminant Level
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MSDS	material safety data sheets
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCRP	National Council for Radiation Protection
NATHPO	Northern Arapaho Tribal Historic Preservation Office
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966, as amended
NMSS	Nuclear Materials Safety and Safeguards
NOAA	National Oceanographic and Atmospheric Association
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PDR	Public Document Room
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PVC	plastic polyvinyl chloride
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act
RFFA	reasonably feasible future action
ROD	Record of Decision
ROI	region of influence
RTV	Restoration Target Value
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement

SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SR	State Route
SWCSWD	Sweetwater County Solid Waste District
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TEDE	Total Effective Dose Equivalent
TDS	total dissolved solids
THPO	Tribal Historic Preservation Office
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TR	Technical Report
TSCA	Toxic Substances Control Act
TSS	total suspended solids
UCL	upper control limits
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act
U.S.	United States (or) United States Highway
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USC	United States Code
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VRM	Visual Resource Management
WDE	Wyoming Department of Education
WDEQ	Wyoming Department of Environmental Quality
WDOE	Wyoming Department of Employment, Research, and Planning
WDOR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WNDD	Wyoming Natural Diversity Database
WQD	Water Quality Division
W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	In
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm2	square millimeters	0.0016	square inches	in2
m2	square meters	10.764	square feet	ft2
m2	square meters	1.195	square yards	yd2
ha	hectares	2.47	acres	ac
km2	square kilometers	0.386	square miles	mi2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m3	cubic meters	35.314	cubic feet	ft3
m3	cubic meters	1.307	cubic yards	yd3
m3	cubic meters	0.0008107	acre-feet	acre-feet
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
Temperature (Exact Degrees)				
°C	Celsius	1.8C + 35	Fahrenheit	°F
*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003.).				

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this Supplemental Environmental Impact Statement (SEIS) in response to an application submitted by Lost Creek ISR, LLC (LCI) on March 20, 2008, to develop and operate the Lost Creek Project located in Sweetwater County, Wyoming (Figure 1-1), by the in-situ leach (ISL) uranium recovery process (also known as the in-situ recovery (ISR) process) (LCI, 2008a, 2008b). LCI is a wholly owned subsidiary of UR-Energy USA, Inc. This SEIS supplements the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (referred to herein as the GEIS) in accordance with the process described in Section 1.8 of the GEIS (NRC, 2009) and as detailed in Section 1.4.1 of this chapter. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, "Energy," of the U.S. Code of Federal Regulations (10 CFR) Part 51. These regulations implement the requirements of the National Environmental Policy Act of 1969 (NEPA), as amended (Public Law 91-190) which requires the Federal Government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment.

Subsequently, by letter dated July 2, 2009, LCI submitted an exemption request to the NRC. LCI is seeking an exemption from the "commencement of construction" provisions of 10 CFR Part 40.32(e) for certain activities that were described in its request. The NRC staff is considering granting LCI the request, but at the time of this draft, has not fulfilled the requirements to issue the exemption.

1.2 The Proposed Action

On March 20, 2008, LCI initiated the proposed federal action by submitting an application for an NRC source material license to construct and operate an ISR facility at the Lost Creek Project site and to conduct the consequent aquifer restoration and site decommissioning and reclamation activities. Based on the application, the NRC's federal action is the decision whether to issue the license to LCI. LCI's proposal is discussed in detail in Section 2.1.1 of this SEIS.

1.3 Purpose of and Need for the Proposed Action

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." LCI is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Lost Creek Project site. The purpose and need for the proposed action is to provide an option that allows for the applicant to use ISR technology to recover uranium and produce yellowcake slurry at the Lost Creek Project Site. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce fuel for commercially-operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, the NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.4 Scope of the Supplemental Environmental Analysis

The NRC prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed action and of reasonable alternatives to the proposed action. The scope of this SEIS considers both radiological and non-radiological (including chemical) impacts associated with the proposed action and its alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources.

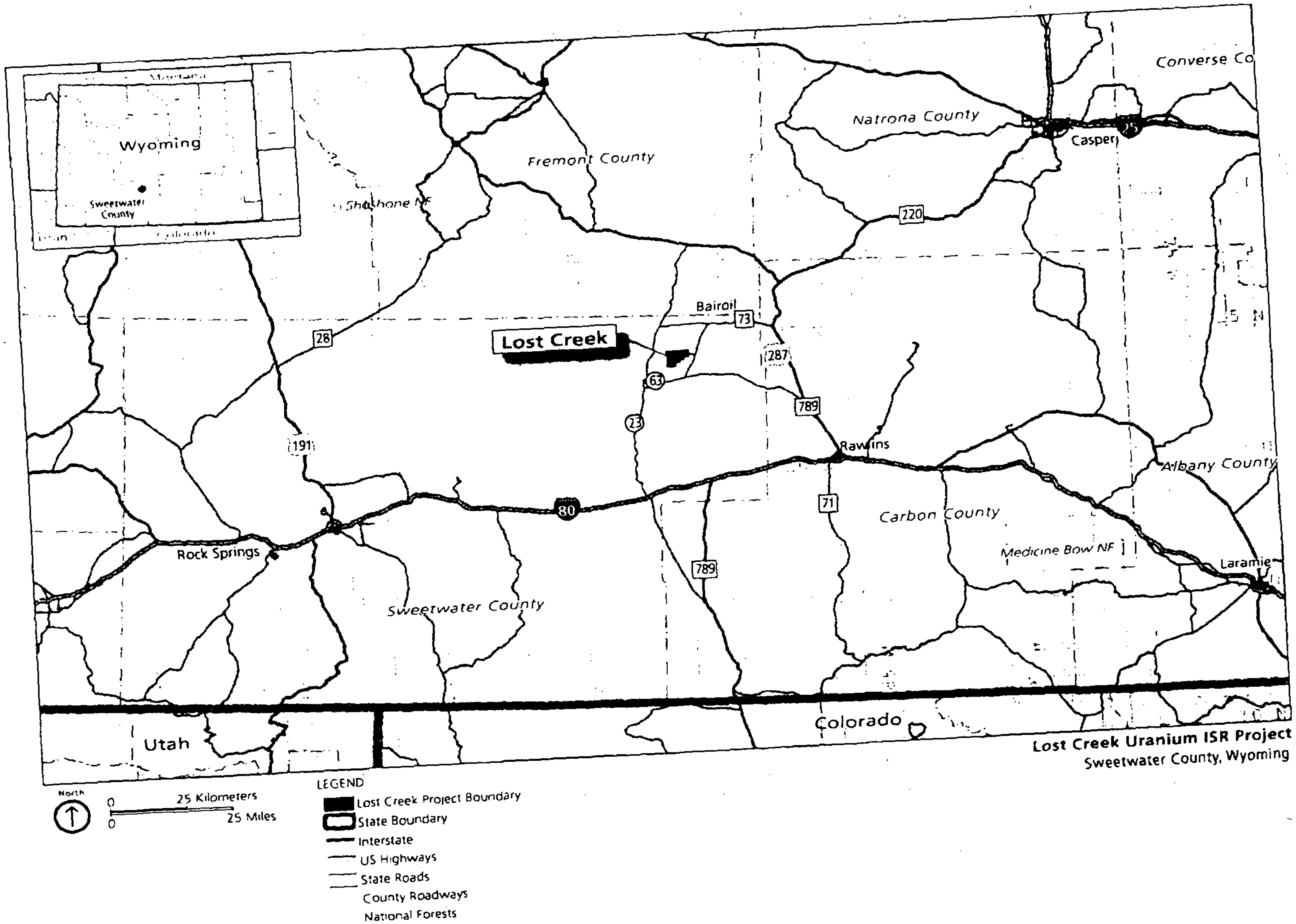

Figure 1-1. Project Location

1.4.1 Relationship to the GEIS

As discussed previously, this SEIS will supplement the GEIS, published as a final report in June 2009 (NRC, 2009). The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specific geographic regions of the western United States. The proposed Lost Creek is located in one such region, the Wyoming West Uranium Milling Region. Table 1-1 summarizes the expected environment impacts by resource area in the Wyoming West Uranium Milling Region based on the GEIS analyses.

Table 1-1. Summary of Expected Impacts in the Wyoming West Uranium Milling Region

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S to L	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S	S to M	S	S
Groundwater	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S to L	S	S
Air Quality	S	S	S	S
Noise	S to M	S	S to M	S
Historical and Cultural Resources	S to L	S to L	S to L	S to L
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S to M	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

S: SMALL impact M: MODERATE impact L: LARGE impact
Source: NRC, 2009

In defining the scope of this SEIS, the NRC staff considers the scope of the GEIS to be sufficient for this purpose. NRC accepted public comments on the scope of the GEIS from July 24 to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming, to aid in this effort. Additionally, NRC held eight public meetings to receive comments on the draft GEIS, published in July 2008. Three of these meetings were held in the State of Wyoming. Comments on the draft GEIS were accepted between July 28 and November 8, 2008. Comments received during scoping and on the draft GEIS are available through NRC's Agency-wide Documents Access and Management System (ADAMS) database on the NRC's website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meeting and draft GEIS comment meetings in Wyoming are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report is provided as Appendix A to the GEIS (NRC, 2009).

The SEIS was prepared to fulfill the requirement at 10 CFR 51.20(b)(8) to prepare either an EIS or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009). The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This SEIS tiers from the GEIS by incorporating by reference relevant information, findings and conclusions concerning potential environmental impacts. The extent to which NRC incorporates GEIS impact conclusions depends on the consistency between LCI's proposed facility and activities and conditions at the proposed Lost Creek Project site and the reference facility description and activities and information or conclusions in the GEIS. NRC's determinations regarding potential environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this SEIS. Section 1.8.3 of the GEIS describes in more detail the relationship between the GEIS and the conduct of site-specific reviews as documented in this SEIS.

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with federal, state, and local agencies and authorities during the course of an expanded visit to the Lost Creek site and vicinity in January 2009. The purpose of these meetings was to gather additional site-specific information to assist in the NRC staff's environmental review and to aid the staff in its determination of the consistency between site and local information and similar information in the GEIS. As part of this effort to gather additional site-specific information, the NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via e-mail and telephone.

NRC published a Notice of Opportunity for Hearing in the *Federal Register* on July 10, 2008 related to the Lost Creek license application (73 FR 39728). NRC also published a Notice of Intent to prepare this SEIS on September 3, 2009 (74 FR 45656).

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Lost Creek license application, the NRC staff has conducted an independent, detailed, comprehensive evaluation of the potential environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Lost Creek site. As discussed in Section 1.8.3 of the GEIS, the GEIS (1) provided an evaluation of the types of environmental impacts that may occur from ISL uranium milling facilities, (2) identified and assessed impacts that are expected to be generic (the same or similar) at all ISL facilities (or those with specified facility or site characteristics), and (3) identified the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS will be addressed in site-specific reviews, certain resource areas would require a more detailed analysis, because the GEIS analysis found that a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result given site-specific conditions (see Table 1-1).

In this SEIS, the following resource areas have received a more detailed analysis:

- Land Use
- Historic and Cultural Resources
- Transportation
- Surface Water
- Groundwater
- Terrestrial Ecology
- Threatened and Endangered Species
- Noise
- Socioeconomics
- Public Health and Safety

Furthermore, certain site-specific analyses not conducted in the GEIS (e.g., assessment of cumulative impacts, analysis of environmental justice concerns) were considered in this SEIS. In addition, the applicant (LCI) submitted an Environmental Report (ER) as part of its license application. This document is available for review from NRC's public web site under ADAMS, and contains detailed site information that is referenced throughout this document.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the scoping process on the GEIS (NRC, 2009; Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns, (e.g., general support or opposition for uranium milling, potential impacts associated with conventional uranium milling, comments regarding the alternative sources of uranium feed material, comments regarding energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of NRC) are also found to be outside the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

A number of NEPA documents (EAs and EISs), primarily prepared by the Bureau of Land Management (BLM) were reviewed and used in the development of this SEIS. They are presented in Table 5-4 of the Cumulative Impact Chapter of this document. Most deal with proposed energy-related projects (oil, gas, coal extraction), but some were prepared for regional plans (e.g., Great Divide Resource Management Plan).

Also reviewed, and used extensively, were the following:

- **NUREG-1910, Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Final Report (June 2009).** As discussed previously, this GEIS was prepared to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four different geographic regions of the western United States, including the Wyoming West Uranium Milling Region where the Lost Creek Project is located. The environmental analysis in this SEIS tiers from the GEIS.

- **NRC's Safety Evaluation Report.** The NRC staff is preparing an SER for the Lost Creek ISR project. In the SER, the NRC staff evaluates whether the licensee's proposed action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The SER evaluates the licensee's proposed facility design, operational procedures, and radiation protection program to ensure that the applicable requirements in 10 CFR Part 20 and 10 CFR Part 40 would be met by the applicant. The SER also provides the staff's analysis of the initial estimate from the applicant of the funding needed to complete site decommissioning and reclamation.
- **BLM, EA, Wind Dancer Natural Gas Development Project (WDNGDP) (BLM, 2004).** This EA was prepared for the Wind Dancer Natural Gas Development Project that would explore and develop natural gas resources within the jurisdiction of the RFO. This EA was prepared to analyze impacts associated with the construction, drilling, production, maintenance, and reclamation of natural gas wells northwest of Rawlins, Wyoming.
- **BLM, Stewart Creek-Lost Creek Excess and Stray Wild Horses Removal (BLM, 2006).** The Great Divide Resource Management Plan (RMP), as amended, identifies three wild horse herd management areas (HMAs) within which wild, free-roaming horses will be managed in a humane, safe, efficient, and environmentally sound manner. This EA analyzed the impacts associated with the BLM's proposal to remove excess and stray wild horses from the Stewart Creek and Lost Creek Wild Horse HMAs and nearby areas (North of I-80 and West of Hwy 287, EA# WY030-06-EA-165).
- **BLM, Final EIS, Rawlins Field Office Planning Area Resource (BLM, 2008).** This Management Plan, Addresses the Comprehensive Analysis of Alternatives for the Planning and Management of Public Land and Resources Administered by BLM, Albany, Carbon, Laramie, and eastern Sweetwater Counties, WY, WY-030-07-1610-DQ.
- **BLM, Red Desert Complex Wild Horse Gather (BLM, 2009).** (Antelope Hills, Crooks Mountain, Green Mountain, Stewart Creek and Lost Creek Wild Horse Herd Management Areas HMAs), 4700 (WYD03), BLM Rawlins and Lander Offices prepared this EA to disclose and analyze the environmental consequences of gathering excess wild horses in the Red Desert Wild Horse Herd Management Area (HMA) Complex. The HMAs included in this complex are Lost Creek, Stewart Creek, Green Mountain, Crooks Mountain and Antelope Hills.

1.5 Applicable Regulatory Requirements

The *National Environmental Policy Act of 1969, as amended* (NEPA) establishes national environmental policy and goals to protect, maintain, and enhance the environment. NEPA provides a process for implementing these specific goals for those Federal agencies responsible for an action. This SEIS was prepared in accordance with NEPA requirements and NRC's implementing regulations in 10 CFR Part 51. Sections 1.6.3.1 and 1.7.5.1 of the GEIS provide a summary of the State of Wyoming's statutory authority pursuant to the ISR process, relevant state agencies that are involved in the permitting of an ISR facility, and the range of state permits that would be required.

1.6 Licensing and Permitting

NRC has statutory authority through the *Atomic Energy Act*, as amended by the *Uranium Mill Tailings Radiation Control Act* (UMTRCA) to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must also obtain the necessary permits from the appropriate federal, state, local and tribal governmental agencies. The NRC licensing process for ISR facilities was described in Section 1.7.1 of the GEIS. Sections 1.7.2 through1.7.5 of the GEIS describe the role of the other Federal, tribal, and state agencies in the ISR permitting process.

This section of the SEIS summarizes the status of the NRC licensing process at the Lost Creek site and the status of LCI's permitting with respect to other applicable Federal, tribal, and state requirements.

1.6.1 NRC Licensing Process

By letter dated March 20, 2008, LCI submitted a final (revised) license application to NRC for the Lost Creek project (LCI, 2008a, 2008b). As discussed in Section 1.7.1 of the GEIS, NRC initial conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Lost Creek license application for detailed technical review by letter dated June 10, 2008 (NRC, 2008).

The NRC's detailed technical review of the Lost Creek license application is comprised of both a safety review and an environmental review. These two reviews are conducted in parallel (see Figure 1.7-1 of the GEIS). The focus of the safety review is to assess compliance with the applicable regulatory requirements in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with the proposed licensing actions. No request for a hearing was received on the Lost Creek license application.

1.6.2 Status of Permitting with Other Federal, Tribal, and State Agencies

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the Lost Creek site, LCI is also required to obtain necessary permits and approvals from other federal, tribal, and state agencies. These permits and approvals would address issues such as (1) the underground injection of solutions and wastewater associated with the ISR process; (2) the exemption of all or a portion of the mining zone aquifer from regulation under the Safe Drinking Water Act; and (3) the discharge of stormwater during construction and operation of the ISR facility.

Table 1-2 provides the status of LCI's efforts to obtain these necessary permits and approvals.

Table 1-2. Environmental Approvals for the Lost Creek ISR Project

License or Permit	Issuing Agency	Status
Source and By Product Material License	U.S. Nuclear Regulatory Commission	Application under review

Table 1-2. Environmental Approvals for the Lost Creek ISR Project		
License or Permit	**Issuing Agency**	**Status**
Plan of Operation	U.S. Bureau of Land Management	To be submitted
Permit to Mine	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Mineral Exploration Permit	Wyoming Department of Environmental Quality	Drill Notice received
License to Mine	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Underground Injection Control Permit Class I (Deep Disposal Wells)	Wyoming Department of Environmental Quality	Submitted Jun. 2009, under review
Aquifer Exemption Permit for Class I Injection Wells	Wyoming Department of Environmental Quality U.S. Environmental Protection Agency	Not required since receiving aquifer is not a SWDA classified
Underground Injection Control Permit Class III (ISR Wells)	Wyoming Department of Environmental Quality	Application submitted Dec. 2007, under review
Aquifer Exemption Permit for Class III Injection Wells	Wyoming Department of Environmental Quality U.S. Environmental Protection Agency	TBD
Permit to Construct Waste Ponds	Wyoming Department of Environmental Quality And State Engineer's Office	Application submitted Dec. 2007 to WDEQ, under review. Application to State Engineer is pending
Permit to Appropriate Groundwater for Mine Units	Wyoming State Engineer's Office	Applications for permits submitted as needed
Permit to Construct Sanitary Leach Field	Sweetwater County	Application submitted Jun. 2009, under review
Air Quality Permit	Wyoming Department of Environmental Quality	Application submitted Jun. 2008, under review
Storm Water Discharge Permit	Wyoming Department of Environmental Quality	
County Development Permits	Sweetwater County Planning Commission	

Source: (LCI, 2009)

1.7 Consultations

As a Federal agency, the NRC is required to comply with consultation requirements in Section 7 of the *Endangered Species Act of 1973*, as amended, and Section 106 of the *National Historic Preservation Act of 1966*, as amended. The GEIS took a programmatic look at the environmental impacts of ISL uranium mining on four distinct geographic regions and acknowledged that each site-specific review would include its own consultation process with relevant agencies. Section 7 and Section 106 consultation conducted for the Lost Creek is summarized in Sections 1.7.1 and 1.7.2 below. Copies of the correspondence for this consultation are provided in Appendix A of this SEIS. Section 1.7.3 discusses NRC coordination with other federal, state, and local agencies that was conducted during the development of the SEIS.

1.7.1 Endangered Species Act of 1973 Consultation

The Endangered Species Act was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the Act requires consultation with the U.S. Fish and Wildlife Service (USFWS) to ensure that actions they authorize, permit or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By letter dated October 3, 2008, NRC staff initiated consultation with the USFWS, requesting information on endangered or threatened species or critical habitat in the Lost Creek area. NRC received a response from the Ecological Services Wyoming Field Office of the USFWS, dated November 12, 2008, that: 1) provided a list of the T&E species that may occur in the project area, 2) discussed obligations to protect migratory birds, 3) noted the negative impacts that can result from the land application of ISR wastewater, and 4) recommended avoidance of wetland and riparian areas and protection of sensitive species, such as the mountain plover and sage grouse (USFWS, 2008).

NRC staff also met with the USFWS Rawlins office on January 13, 2009 to discuss site-specific issues. The main concern expressed by the Rawlins office was potential impacts to sage grouse and typical mitigation measures were discussed.

1.7.2 National Historic Preservation Act of 1966 Consultation

Section 106 of the NHPA requires that federal agencies take into account the effects of their undertakings on historic properties and allow the Wyoming SHPO to comment on such undertakings.

NRC initiated consultation with the Wyoming SHPO via a letter dated October 3, 2008, requesting information from the SHPO to facilitate the identification of historic and cultural resources that could be affected by the proposed project. NRC staff also met with a member of the SHPO's office on January 12, 2009 to discuss site-specific issues, including Wyoming SHPO's review process, cumulative impacts to historic sites, and best management practices (BMPs). The staff also met with the SHPO on June 25, 2009 to discuss protocol for archaeological sites found eligible for inclusion in the *National Register of Historic Places.* The NRC staff will continue to consult with the Wyoming SHPO throughout the environmental review process regarding a determination of effects on cultural and historic resources.

1.7.3 Coordination with Other Federal, Tribal, State, and Local Agencies

The NRC staff interacted with multiple federal, tribal, state, and local agencies and/or entities during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed ISR facility at the Lost Creek site. The consultation and coordination process included, but was not limited to, discussions with the BLM, the Bureau of Indian Affairs (BIA), tribal governments (Eastern Shoshone and Northern

Arapaho), the WDEQ (Land Quality Division [LQD]), the WSEO, and local organizations (Sweetwater County, Town of Bairoil).

1.7.3.1 *Coordination with the Bureau of Land Management*

The BLM is responsible for administering the National System of Public Lands and the federal minerals underlying these lands. The BLM is also responsible for managing split estate situations where federal minerals underlie a surface that is privately held or owned by state or local government. In these situations, operators on mining claims, including ISR uranium recovery operations, must submit a plan of operations and obtain BLM approval before beginning operations beyond those for casual use (for surface disturbance of more than 5 acres). Currently, the NRC and the BLM are finalizing a Memorandum of Understanding (MOU), such that the BLM and NRC would offer each other cooperating agency status for environmental reviews of ISR licensing projects involving BLM-managed lands. NRC staff coordinated with the BLM during preparation of this Draft SEIS, and the BLM has provided information and guidance on energy-related activities in the region, such as coal leases, oil and gas leases, wind energy, and uranium extraction. The BLM conducted EISs for many of these activities and has prepared resource management plans to manage their own lands. The BLM also has a Cooperating Agency agreement with the WDEQ and a programmatic agreement with the Wyoming SHPO.

The NRC met with the staffers from several BLM offices in January 2009, including the State Office in Cheyenne, Rawlins Field Office, and the Casper Field Office. The BLM provided clarification on how mineral leases are administered on BLM lands, and expressed concerns related to water quality and hydrology at ISR sites, cumulative effects due to the other energy operations (coal, oil and gas, wind energy, and operating ISR facilities) in the vicinity of the proposed ISR sites, and the potential impacts to socioeconomics in the communities surrounding the proposed ISR sites. The BLM also provided guidance on typical mitigation measures to protect cultural resources and sage grouse.

In addition to the January 2009 meetings, the NRC staff consults with the Wyoming BLM offices on a regular basis regarding the progress on the staff's environmental review for the Lost Creek Project. The NRC shared its preliminary and draft sections of the SEIS, and ensured that the BLM is copied on all NRC correspondence with LCI.

1.7.3.2 *Coordination with the Bureau of Indian Affairs*

The Bureau of Indian Affairs' (BIA's) mission is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives. BIA is responsible for the administration and management of 66 million acres of land held in trust by the United States for American Indian, Indian tribes, and Alaska Natives.

The NRC staff met with staff from the BIA in Fort Washakie, Wyoming on January 15, 2009. The NRC staff briefed the BIA on potential IRS facilities proposed in Wyoming, and the two staffs discussed how the BIA and Indian tribes would be involved in the environmental review process. The BIA stated that tribal governments should be consulted for any projects in the state. BIA also recommended that tribal elders be involved in cultural and historic surveys.

1.7.3.3 *Interactions with Tribal Governments*

In response to guidance from Wyoming SHPO and to carry out E.O. 13175, "Consultation and Coordination with Indian Tribal Governments," the NRC staff initiated discussions with potentially affected Native American tribes. Letters dated December 24, 2008, were sent to the following nine Tribes to solicit their comments or concerns regarding cultural resources on ISR projects:

- Eastern Shoshone
- Northern Arapaho
- Northern Cheyenne
- Blackfeet
- Three Affiliated Tribes
- Ft. Peck Assinboine/Sioux
- Oglala Sioux
- Crow
- Cheyenne River Sioux

No responses from these Tribes were received on the general inquiry. For reference, only one letter is presented within Appendix A. However, with specific regard to the Lost Creek project, several communications have taken place with the Eastern Shoshone and Northern Arapaho Tribal Historic Preservation Officers concerning an eligible pre-historic site discovered in the project area. Tribal Historic Preservation Officers (THPOs) from each of these two Tribes have been informed on the progress of the Lost Creek project. The THPO from the Eastern Shoshone visited the Lost Creek site and determined that it held no interest to the tribe.

1.7.3.4 *Coordination with the Wyoming Department of Environmental Quality*

NRC staff met with the WDEQ in Cheyenne on January 12, 2009 to discuss the WDEQ's role in NRC's environmental review process for ISR facilities. Issues discussed during the meeting included the WQD storm water program, air quality review and permitting, and noise quality. The WDEQ also provided clarification on the classification of deep well injections. The WDEQ expressed concern related to reclamation and restoration, and noted that groundwater quality should be returned to baseline conditions. The WDEQ requested early involvement in the NRC's review of applications for proposed ISR projects in the State. They also emphasized coordination with the BLM when ISR projects are located on BLM lands.

NRC staff also met with District 2 personnel of the WDEQ-LQD on January 14, 2009. The WDEQ-LQD explained the UIC Class III well application process, and noted that the WDEQ would require well field packages and groundwater restoration standards for future ISR operations. They expressed concern about potential excursions and unconfined aquifers. WDEQ-LQD staff also stated their position that the parameters in groundwater affected by ISR operations need to be restored to original background levels. Two meetings were held with NRC and WDEQ staff (June and September 2009) to discuss groundwater issues.

1.7.3.5 *Coordination with the Wyoming Game and Fish Department*

The WGFD is responsible for controlling, propagating, managing, protecting, and regulating all game and non-game fish and wildlife in Wyoming under Wyoming Statute (W.S.) 23-1-301-303 and 23-1-401. Regulatory authority given to WGFD allows for the establishment of hunting, fishing, and trapping seasons, as well as the enforcement of rules protecting non-game and state listed species.

NRC staff met with a representative of the Lander Regional WGFD office on January 14, 2009. The main issue discussed centered on the sage grouse. The project area includes habitat for a variety of big game animals, raptors, migratory birds, and small mammals that may be affected by the project. In addition, the property is part of a larger region of the state dedicated as a "core breeding area" for the greater sage-grouse. The WGFD's interest includes impacts to migratory behavior patterns, long-term population sustainability, and the effects on local hunting on big game; impacts to nesting raptors; and the loss of nesting habitat for the greater sage-grouse.

1.7.3.6 *Coordination with the Wyoming State Engineer's Office*

NRC staff met with the Wyoming State Engineer's Office (WSEO) on January 12, 2009 to discuss well permitting. The WSEO was primarily concerned that proposed ISR facilities do not degrade the water quality, and that potential groundwater contamination be maintained onsite. They also expressed the need for applicants to ensure that there was close, professional supervision of well construction.

1.7.3.7 *Coordination with the Wyoming Governor's Planning Office*

NRC staff met with the Wyoming Governor's Planning Office on January 13, 2009 and again on June 25, 2009. The Wyoming Governor's Planning Office briefed the NRC on the BLM Resource Management Plan for the Buffalo region. They stated that they are a cooperating agency with the BLM and are involved with anything related to natural resources, particularly BLM resource management plans, and with the Wyoming SHPO and WDEQ. They informed NRC of the statewide conservation and management efforts for sage grouse and noted that the governor has created a management plan for the protection of sage grouse. They emphasized that potential ISR facilities need to be geographically flexible to protect the core sage grouse areas.

1.7.3.8 *Coordination with the Wyoming Community Development Authority*

NRC staff met with the Wyoming Community Development Authority on January 13, 2009 to discuss housing availability for employees of future potential ISR facilities. They noted that employees would typically look for housing in the surrounding communities and this might include hotels, apartments, or single-family homes.

1.7.3.9 *Coordination with Localities*

The NRC staff interacted with several local county and city entities in the vicinity of the project area. This has included phone calls as well as face-to-face meetings. NRC met with several local county and city entities on January 13 and 14, 2009 to discuss site-specific issues for the Lost Creek project. Meetings held in the county offices of both Sweetwater and Fremont Counties focused on local economies, housing availability, and community services. Representatives from the Town of Bairoil were also present at the Sweetwater County meeting.

1.8 Structure of the SEIS

As noted in Section 1.4.1 of this document, the GEIS (NRC, 2009) evaluated the broad impacts of ISR projects in a four-state region where such projects are common, but did not reach site-specific decisions for new ISR projects. In this SEIS, the NRC staff evaluated the extent to which information and conclusions in the GEIS could be incorporated by reference. The NRC staff also determined whether any new and significant information existed that would change the expected environmental impact beyond what was discussed in the GEIS.

Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered for the Lost Creek site, Chapter 3 describes the affected environment for the Lost Creek site, and Chapter 4 evaluates the environmental impacts from implementing the proposed action and alternatives. Cumulative impacts are discussed in Chapter 5, while Chapter 6 provides details on the environmental measurement and monitoring programs proposed for the Lost Creek. A cost-benefit analysis is provided in Chapter 7, and a summary of environmental consequences from the proposed action is tabulated in Chapter 8.

1.9 References

10 CFR Part 2. Code of Federal Regulations, Title 10, *Energy,* Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders."

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 40. Appendix A. Code of Federal Regulations, Title 10, *Energy*, Part 40, Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

Atomic Energy Act of 1954, as amended. 42 USC 2011 et seq.

BLM, 2004. U.S. Department of the Interior, Bureau of Land Management, *Environmental Assessment for the Wind Dancer Natural Gas Development Project, Sweetwater County, Wyoming*, December 2004.

BLM, 2006. U.S. Department of the Interior, Bureau of Land Management, *Removing Excess and Stray Wild Horses from the Area North of Interstate 80 and West of U.S. Highway 287 in the Rawlins Field Office EA#WY030-06-EA-165*, August 2006.

BLM, 2008. U.S. Department of the Interior, Bureau of Land Management, *Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming*, January 2008.

BLM, 2009. U.S. Department of the Interior, Bureau of Land Management, *Wild Horse Gathering for the Red Desert Complex Wild Horse Herd Management Areas (Lost Creek, Stewart Creek, Green Mountain, Crooks Mountain, Antelope Hills)*, June 2009.

Endangered Species Act of 1973. 16 USC 1531–1544.

Executive Order 13175. 2000. *Consultation and Coordination with Indian Tribal Governments.* 65 FR 67249. (November 9).

LCI, 2008a. Lost Creek ISR, LLC. *Submittal of License Application for the Lost Creek ISR Project*, (Docket No. 40-9068). March 20, 2008.

LCI, 2008b. Lost Creek ISR, LLC. *Lost Creek Project Environmental Report, Volumes 1 through 3* (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008.

LCI, 2009. Lost Creek ISR, LLC. *Lost Creek ISR, LLC Exemption Request to Allow Limited Pre-License Activities at the Lost Creek ISR Uranium Recovery Site*, (Docket No. 40-9068). July 2, 2009.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321 et seq.

National Historic Preservation Act of 1966, as amended (NHPA). 16 USC 470aa et seq.

NRC. NUREG-1910, "Generic Environmental Impact Statement for Uranium Milling Facilities. 2009. <http://www.nrc.gov/materials/fuel-cycle-fac/licensing/geis.html> (May 2009).

NRC. "Notice of License Application of Lost Creek ISR, LLC, for a New In-situ Leach Uranium Recovery Facility at the Lost Creek Site, Sweetwater County, Wyoming, and Opportunity to Request a Hearing and Order Imposing Procedures for Access to Sensitive Unclassified Non-Safeguards Information (SUNSI) for Contention Preparation." *Federal Register.* Vol. 73. pp. 39728–39731. July 10, 2008.

NRC. "Lost Creek ISR, LLC; Lost Creek In-Situ Recovery Project; New Source Material License Application; Notice of Intent to Prepare a Supplemental Environmental Impact Statement." *Federal Register:* Vol. 74. p. 45656. September 3, 2009.

USFWS, 2008. Letter from B. Kelly, U.S. Department of the Interior, Fish and Wildlife Service to G. Suber, NRC, Re: Threatened and Endangered Species. November 12, 2008.

Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). 42 USC 7901 et seq.

Wyoming Statute (W.S.) 23-1-301-303 and 23-1-401

2 IN-SITU URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed action and alternatives for issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Lost Creek ISR, LLC (LCI) for the construction, operation, aquifer restoration, and decommissioning of the Lost Creek ISR Project. These alternatives include a consideration of the No-Action alternative as required by the National Environmental Policy Act (NEPA). Section 2.1 provides details on the alternatives considered for detailed analysis, including the proposed action. Section 2.2 discusses those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and other alternatives. Lastly, Section 2.4 provides a preliminary NEPA recommendation on the proposed action.

2.1 Alternatives Considered for Detailed Analysis

NRC staff used a variety of sources to determine the range of alternatives to consider for detailed analysis in this draft SEIS. Those sources included the application, including the Environmental Report (ER) submitted by LCI, the scoping and draft comments on NUREG-1910, the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), the information gathered during the NRC staff's site visit in January 2009, and interdisciplinary discussions held between NRC staff and various stakeholders.

2.1.1 The Proposed Action (Alternative 1)

Under the proposed action, LCI is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of the ISR facilities at the Lost Creek ISR Project as described in the license application. The Lost Creek ISR Project includes several facilities and well fields, which are described in the following sections. The general ISR process is described in Chapter 2 of the GEIS. The schedule for the proposed action is shown in Figure 2-1. The information contained in the following sections was obtained either from the application (LCI, 2008a,b) or from the GEIS (NRC, 2009) unless otherwise stated.

2.1.1.1 *Site Description*

The Lost Creek ISR Project is located in the Great Divide Basin in the northeastern corner of Sweetwater County, Wyoming, within Township 25N, Range 92 West, Sections 16-19, and Range 93W, Sections 13, 14 & 25 (Figure 1-1). The project site covers approximately 1,709 ha (4,220 ac), of which approximately 1,449 ha (3,580 ac) are federally-owned Bureau of Land Management (BLM) land, and the State of Wyoming, Office of State Lands and Investment owns 259 ha (640 ac) (Figure 2-2).

The project area is located approximately 113 km (70 mi) southeast of the City of Lander, 145 km (90 mi) southwest of the City of Casper, and approximately 65 km (40 mi) northwest of the City of Rawlins (Figure 1-1). The nearest population center, located 25 km (15 mi) northeast of the project area, is Bairoil, a small town with less than 100 people. The principal access to the Lost Creek site from the northwest is via U.S. Highway 287 (U.S. 287) / Wyoming Highway 789 (State Route [SR] 789) to Jeffrey City, then south on Wamsutter – Crooks Gap Road (County Road [CR] 23). Access from Casper to the northeast is via SR 220 through Alcova to join U.S. 287 / SR 789 south at Muddy Gap to the settlement of Lamont. From this point on US 287 the project area can be accessed by following SR 73 west to Bairoil Road and then south on Sooner Road (BLM Road 3215) or to the Wamsutter – Crooks Gap Road. Access from the south is via Wamsutter – Crooks Gap Road north from Interstate 80 at Wamsutter on (Figure 2-3).

Lost Creek Project Development, Production and Restoration Schedule

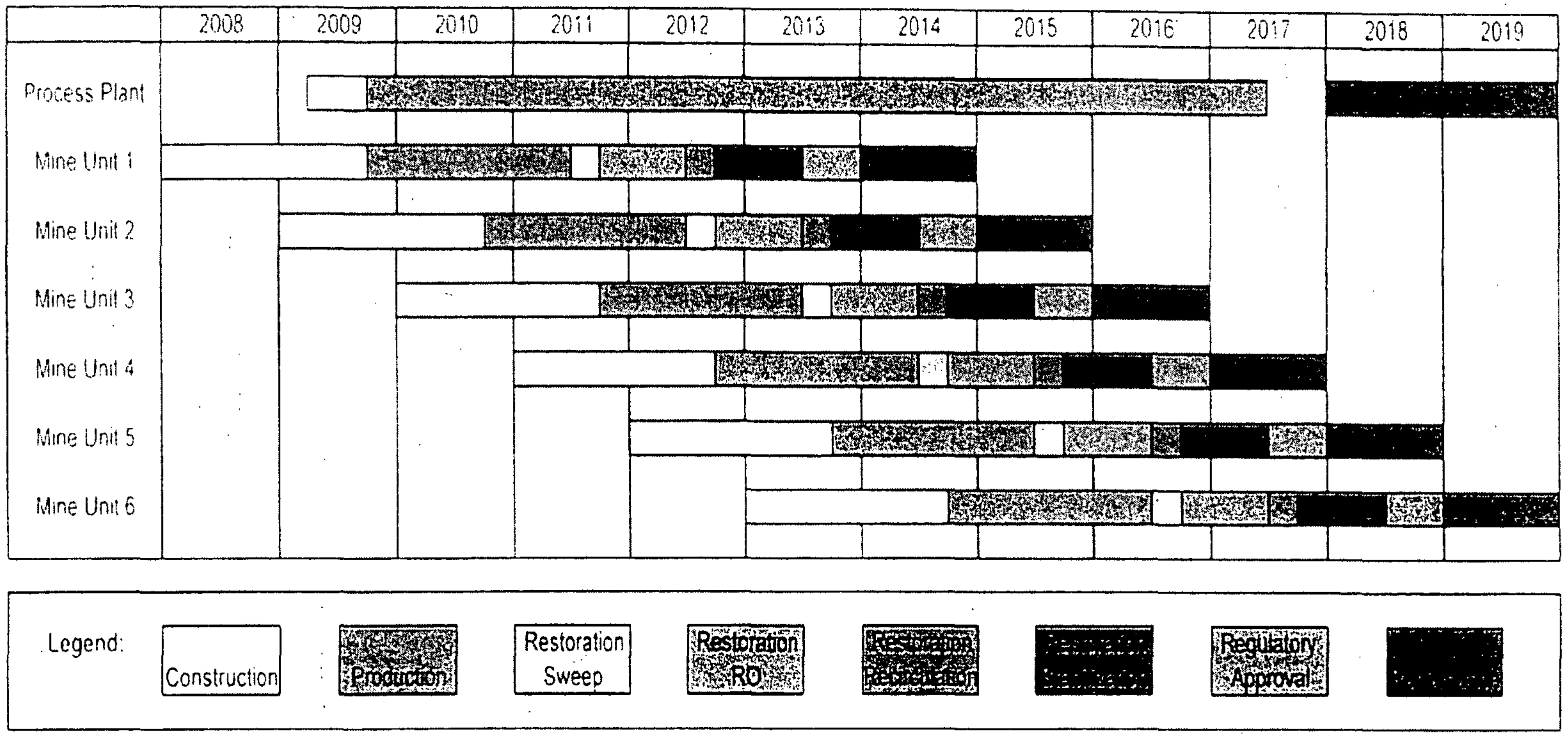

Figure 2-1. Project Schedule

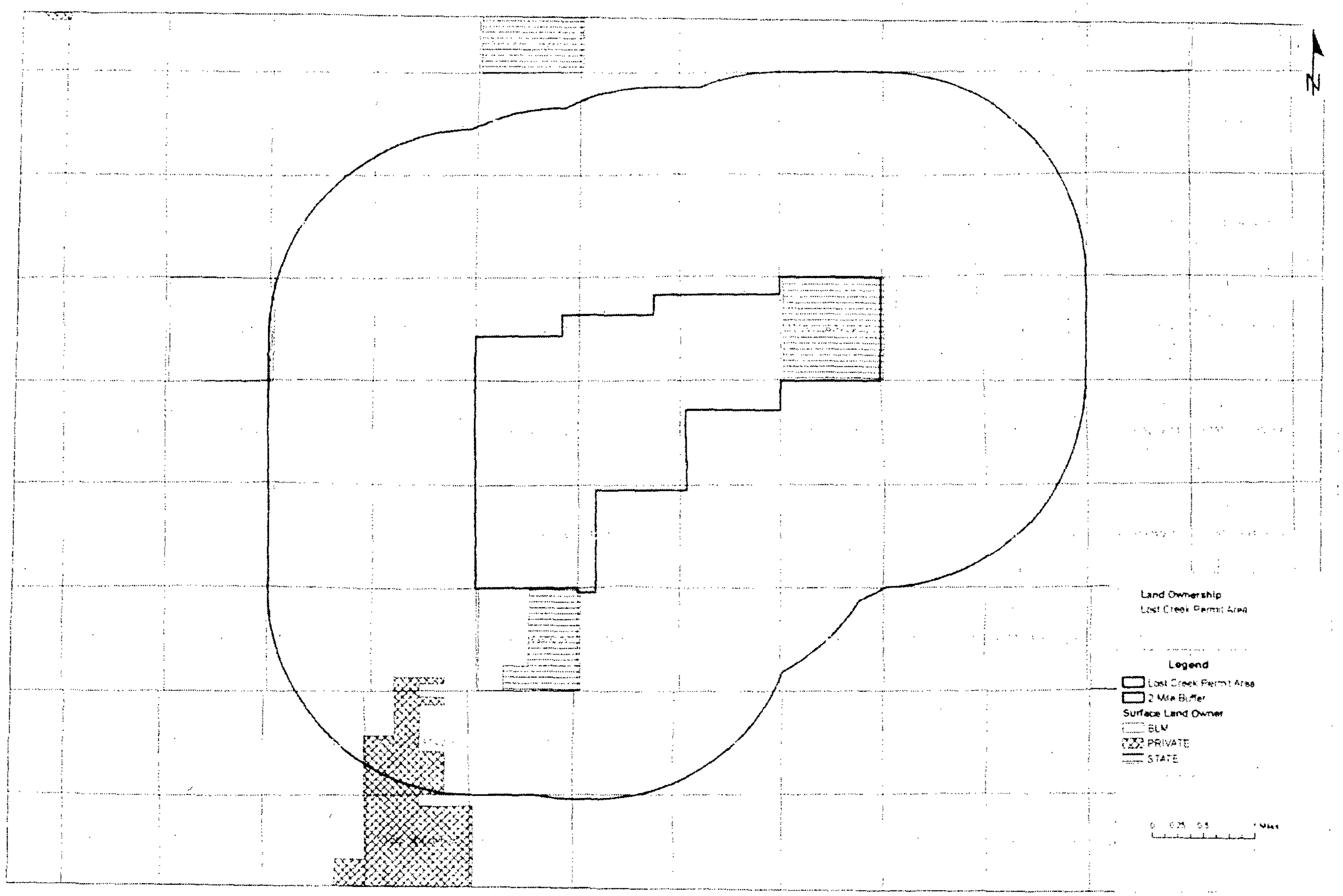

Figure 2-2. Land Ownership

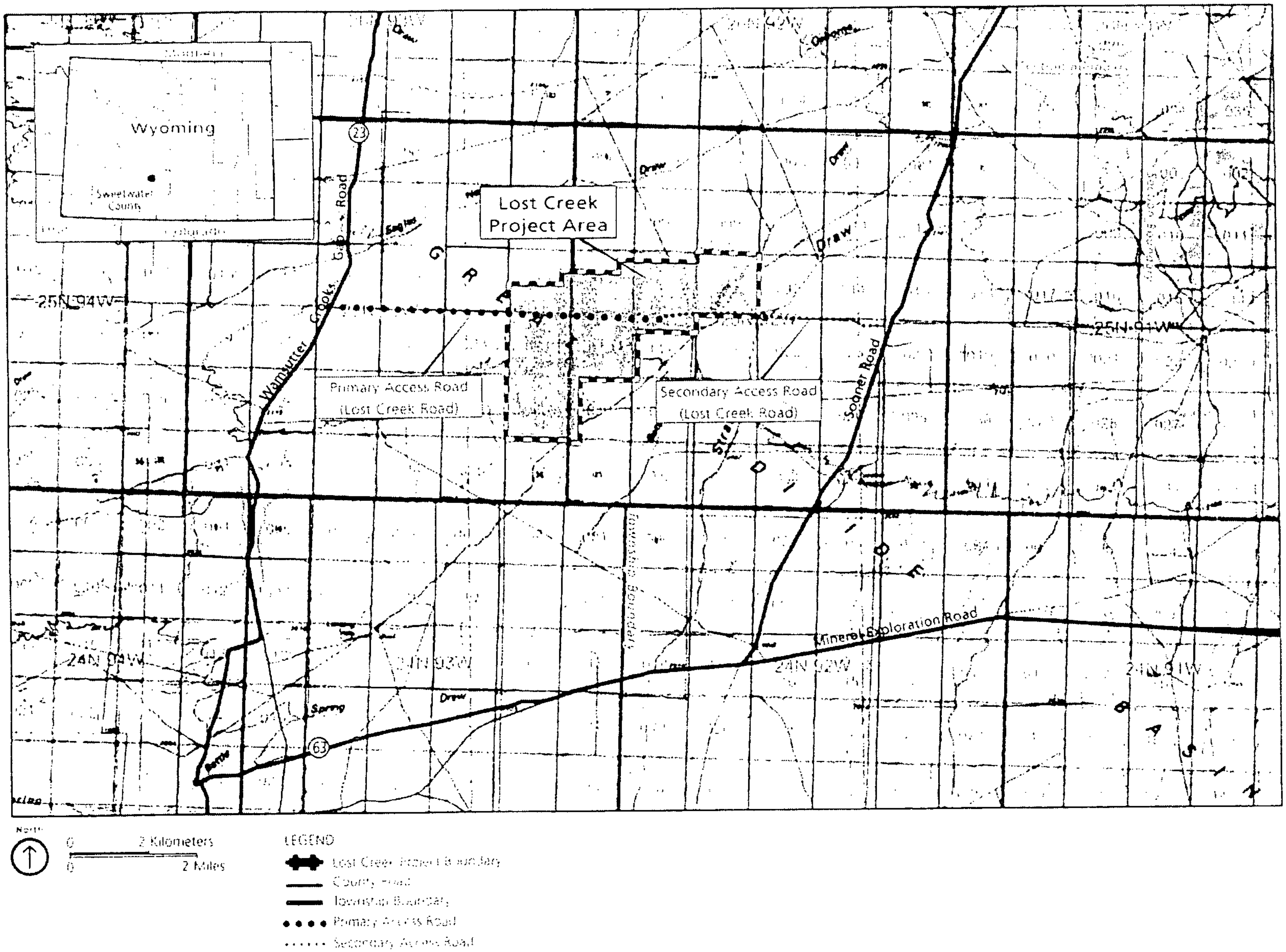

Figure 2-3. Site Access

The proposed ISR project is situated near Battle Spring Draw, which drains to Battle Spring Flat, approximately 15 km (9 mi) southwest of the site. Topography at the site is relatively flat, sloping about 20 m per km (100 ft per mi) southeast toward Battle Creek Draw, which is oriented northeast-southwest along the southeast side of the site. Elevations at the site range from about 2,150 to 2,070 m (7,050 to 6,790 ft) above mean sea level (AMSL). Additional detail describing the existing environment surrounding the proposed site is contained in Chapter 3, Affected Environment.

2.1.1.2 *Construction Activities*

Construction activities necessary for the development of the Lost Creek ISR include: 1) site preparation; 2) buildings; 3) access roads; 4) well fields; 5) other structures and systems; 6) workers; 7) equipment; and schedule.

2.1.1.2.1 Site Preparation

The majority of site preparation is related to the central processing plant (CPP). An area approximately 90 meters by 170 meters (300 feet by 550 feet), comprising approximately 1.5 hectares (3.8 acres), would need to be leveled and surfaced for the CPP and its appurtenant structures (maintenance building, storage areas, parking, etc.) Vegetation would be removed, and topsoil stripped to a depth a one foot over this area. The topsoil would be stockpiled for reuse in accordance with WDEQ guidelines. All suitable material removed from excavations would be used, to the extent practicable to level fill areas in the construction of the 3.8-acre pad area. All 'placed' materials would be compacted in accordance with engineering specifications, and pad surfacing would be compacted gravel, a minimum of 3 inches thick.

LCI estimates that approximately 115 ha (285 ac) of surface area would be disturbed during the project life. Earth-moving equipment such as rubber tire scrapers and front end loaders would be used during construction. Topsoil, as well as subsoil, salvaged during construction activities would be stored in designated topsoil stockpiles located onsite, just northeast of the proposed plant site and done so in such a way to minimize loss of material. Topsoil from building sites, permanent storage areas, main access roads, and chemical storage areas prior to construction would also be salvaged in accordance with Wyoming Department of Environmental Quality-Land Quality Division (WDEQ- LQD) requirements (LCI, 2008b).

Heavy equipment expected to be used during construction include forklifts, backhoes, geophysical logging trucks, flat bed trailers, reel trailers, water trucks, a mechanical integrity testing truck, and cementers.. The workforce is expected to commute from such towns and cities as Rawlins, Casper, Wamsutter, and/or Lander.

2.1.1.2.2 Buildings

The central processing plant (CPP) and storage ponds are shown in Figure 2-4. The CPP generates a wet yellowcake slurry by concentrating the well field recovery solution and processing the uranium-loaded resins. The structure would be a 49 by 79m (160 by 260ft) metal building with a ridge height of 12.5 m (41 ft), and eave heights of 6.9 m (22 ft). The building would house both uranium processing and office space. Major process equipment housed in the CPP would include the ion exchange circuit, the lixiviant make-up circuit, the elution/precipitation circuit, and would include space for the addition (but, currently not being proposed) of a yellowcake drying facility. Bulk chemical storage tanks containing hydrogen peroxide, hydrochloric acid, sodium chloride, soda ash mix, and a bicarbonate mix, would be contained inside the CPP. Oxygen and carbon dioxide tanks would be located outside the CPP (Figure 2-5). An office area would be physically separated from the processing area, and would consist of two floors. Other space (12.2 x 24.4 m, 40 x 80 ft) in the CPP would include change rooms, restrooms, and an on-site laboratory.

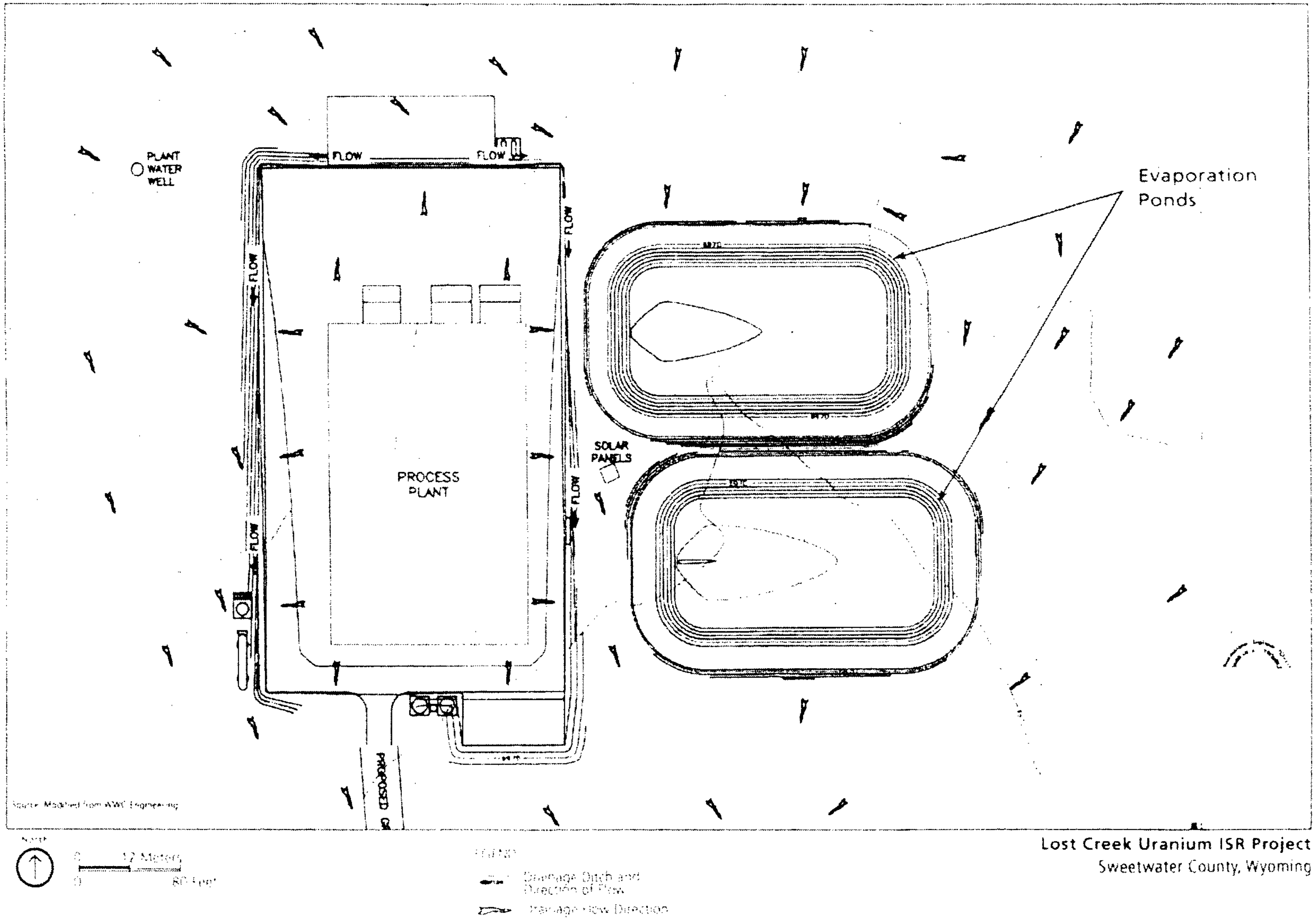

Figure 2-4. Process Facility Layout

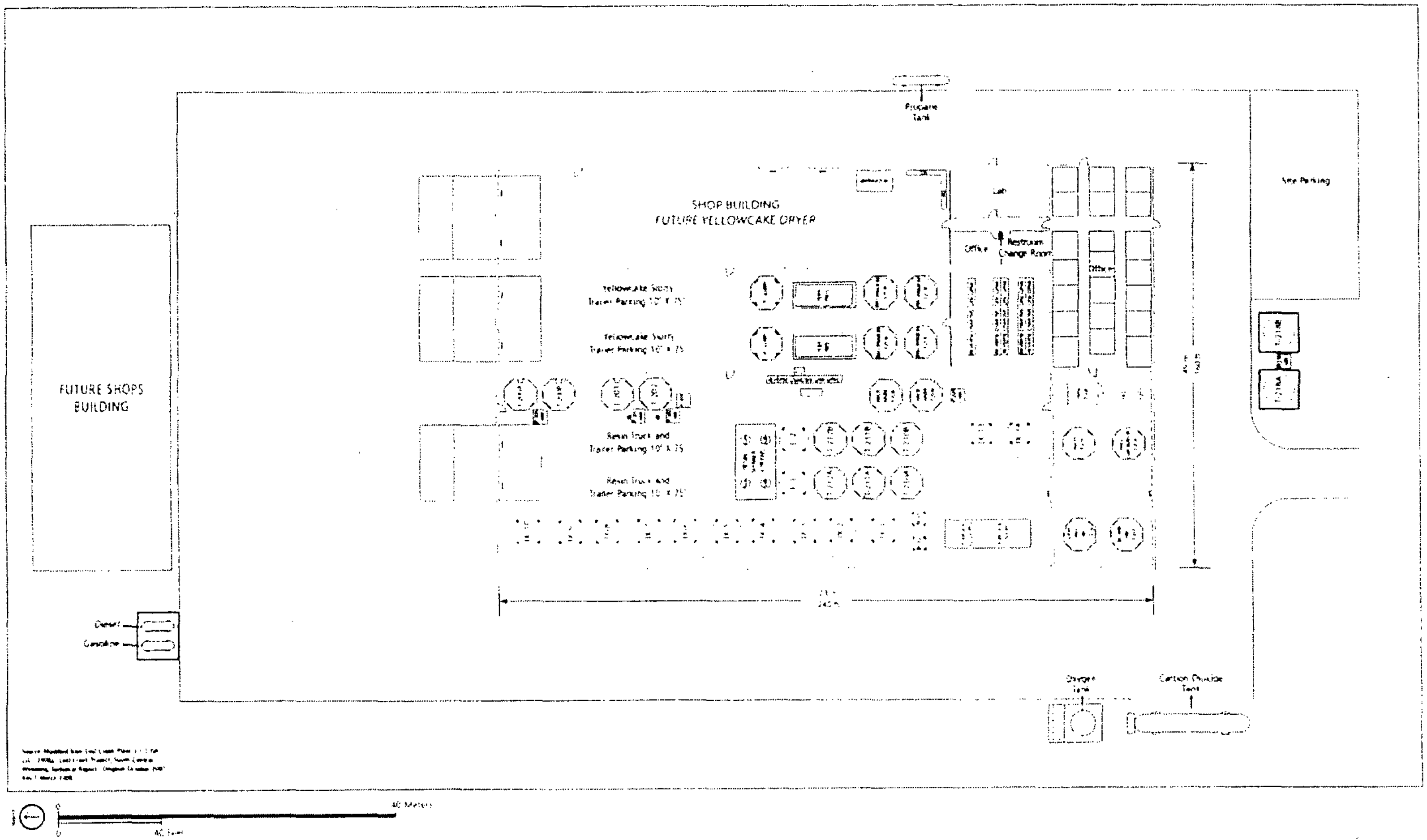

Figure 2-5. Internal CPP Floor Plan

LCI proposes to have at least two auxiliary buildings: 1) a maintenance building consisting of a pre-engineered steel structure (16.8 x 41.2 m, 55 x 135 ft with a 15-foot outside wall height) located adjacent to the CPP; and 2) a driller's shed for storage of control equipment and tools, and storage of inventories (12.2 x 12.2m, 40 x 40 ft, with a 14-foot outside wall height).

The CPP would be constructed on a concrete slab with curbs to contain spills and prevent liquid releases to the environment. The concrete slab (floors) would be designed to support the full weight of any vessel and its contents, and would be designed to meet all building codes and standards. Outside vessel storage locations, including fuel (gasoline and diesel) would be constructed with concrete curbed secondary containment for tanks. LCI's proposed engineering and controls, and operational monitoring program are designed to allow spills and leaks to be quickly detected and minimized. Leaks from vessels and equipment, including water from equipment wash down, would drain to a sump where the liquid effluent would collect for appropriate treatment and disposal (LCI, 2007).

2.1.1.2.3 Access Roads

The proposed Lost Creek ISR project area lies equidistant between Wamsutter – Crooks Gap Road (CR 23) on the west, and Sooner Road (BLM Road 3215) to the east (Figure 2-3). These are currently maintained gravel roads. Principal site access would be provided by upgrading an existing two-track dirt road that bisects the project area and joins these two roads, resulting in an all-season, gravel-surfaced road. Called Lost Creek Road, this primary access road would run from Wamsutter – Crooks Gap Road at the boundary between T25N-R93W Sections 16 and 21, easterly for approximately 7.6 km (4.7 mi) to the plant site. It would then continue east for approximately 7.2 km (4.5 mi) to join BLM 3215 (Sooner Road) between T25N-R92W Sections 13 and 24. Lost Creek Road would be crowned-and-ditched with a 6-m (20-ft) wide driving surface consisting of 15.4 cm (6 in) of compacted road base. The grade from the centerline to the road edge would be developed at 2 percent. Each ditch would be approximately 1.5 m (5 ft) in width with 3:1 side slopes, resulting in an overall cross-sectional width of about 9 m (30 ft). Approximately 20 acres of land surface would be disturbed to develop these two main access roads. At least three culverts would be required, one at the intersection with CR 23, and two near the plant site where the road crosses ephemeral channels. The need for culverts between the plant and Sooner Road has not yet been ascertained, though at least two culverts are anticipated: at the crossings of Battle Spring Draw and Stratton Draw. Also, eastern portion of Lost Creek Road to Sooner Road may not be improved as extensively as the western section to Wamsutter – Crooks Gap Road, as traffic from Sooner road would be chiefly that of commuting site workers in light duty vehicles. The maximum distance that these commuters would travel before reaching a paved surface would be 31 km (19 mi) to SR 73 at Bairoil. All access (main roads into the site) and maintenance roads (site roads) would be constructed in accordance with the BLM's, county's, or state's standards.

2.1.1.2.4 Well Fields

Well fields are the areas at the surface above the ore zones that are delineated by LCI to reach the desired production. Disturbed area (well fields and access roads) is estimated to be approximately 103 ha (254 ac) for the total Lost Creek project. The ore zones, at depth, where the leaching solutions (lixiviant) would be injected and recovered have been divided into six (overlying) surface areas (Figure 2-6). The ore zones lie approximately 91 to 213 m (300 to 700 ft) below the ground surface in long, narrow trends varying from a few hundred to several thousand feet long, and from 15 to 76 m (50 to 250 ft) wide. LCI estimates that the yellowcake (uranium oxide – U_3O_8) content is approximately 500,000 kg (1.1 million pounds), at an ore grade of 0.076 percent.

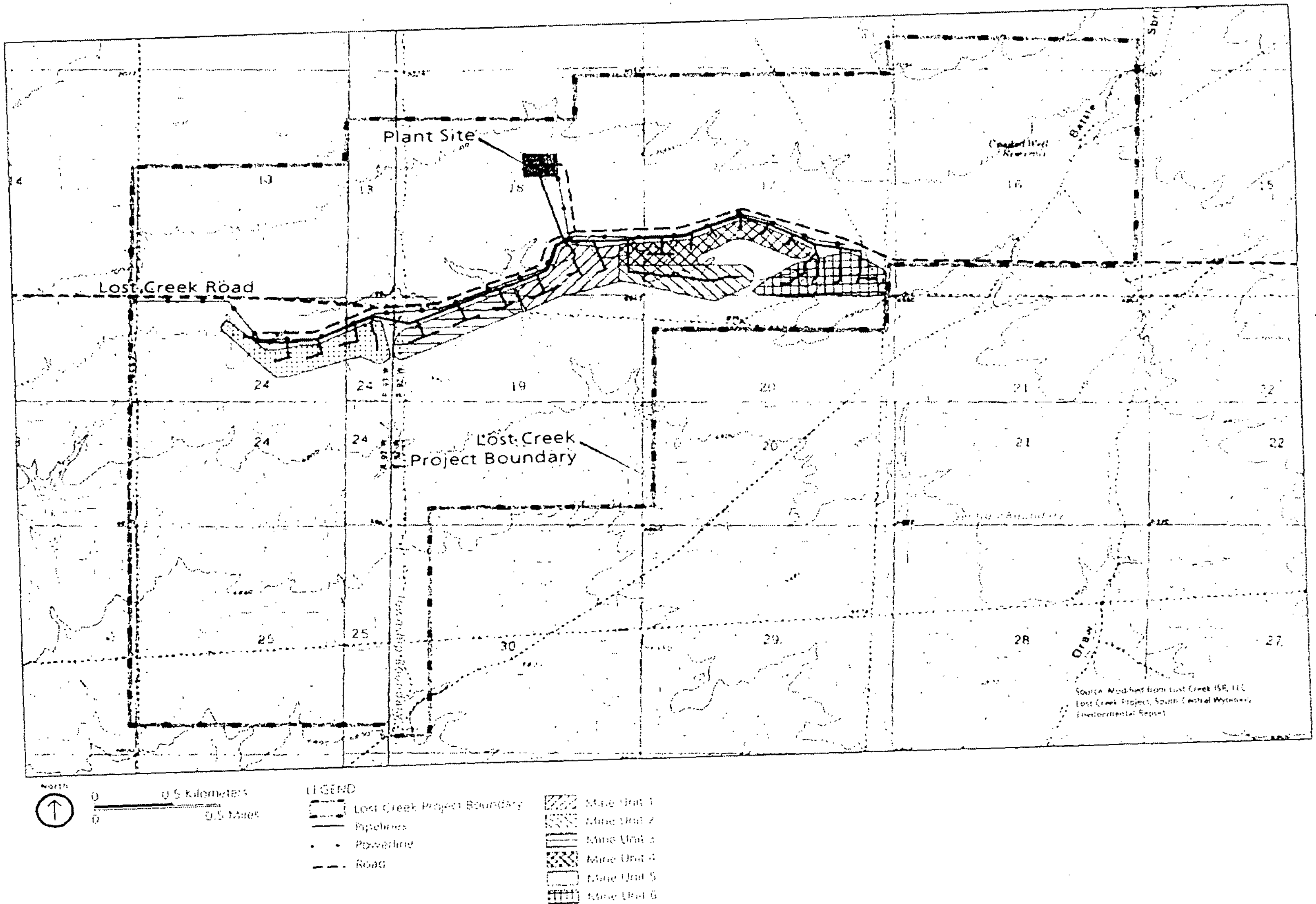

Figure 2-6 Project Well Fields

2.1.1.2.4.1 *Injection and Production Wells*

Injection and production well patterns would be based on conventional five-spot patterns and would be modified, as necessary, to accommodate the characteristics of the ore body (Figure 2-7). While the conventional five-spot pattern consists of four injection wells surrounding a central production well, cell dimensions vary depending on the characteristics of the formation and the ore body. LCI is anticipating the spacing of the injection wells to range from 23 to 46 m (75 to 150 ft).

The injection and production wells (Figures 2-8 and 2-9), when completed, may be used for either injection or production. LCI considers that such a design allows for changes in the solution flow patterns to improve uranium recovery, and to restore groundwater by the most efficient means. The actual number of wells for each given well field is not known at this time.

2.1.1.2.4.2 *Monitoring Wells*

Horizontal and vertical excursion monitoring wells would be installed at each well field, as dictated by geologic and hydrogeologic characteristics. Horizontal monitoring wells would be situated in a ring around the well field, and completed in the targeted mineralized (ore body) zone. Vertical monitoring wells for overlying and underlying aquifers would be installed at a density of about one for every four acres of well field area. LCI proposes the spacing between the mineralized zone monitoring wells at about 152 m (500 ft). It should be understood, however, that actual distances would be based on the actual aquifer characteristics of the mine unit (well field).

2.1.1.2.4.3 *Well Construction and Testing*

Both the materials and methods used in the construction of the three types of wells (injection, production and monitoring) would follow the requirements and guidelines of the WDEQ. All well casings would be constructed of polyvinyl chloride (PVC) pipe. Casing centralizers would be used to make sure casings are centered in the drill hole, and cement would be used to stabilize, strengthen, and prevent the vertical migration of solutions. The well is finally completed by under-reaming the desired interval (mineralized zone) and fitted with a slotted liner or screen assembly.

After completion, and before operation, each well is tested for mechanical integrity. The purpose of the mechanical integrity test (MIT) is to verify that the well casing does not fail, causing water loss during injection or recovery operations. The test is designed to detect imperfections in the casing sections and inadvertent damage resulting from under-reaming, and to ensure the completeness of the connections between casing sections and sealing materials. The test involves sealing off the bottom and top of the casing with an inflatable packer or some other suitable device and pressurizing to a specified pressure the column for 10 minutes. Results would be recorded and submitted to both the NRC and WDEQ for approval. Any well that fails (cannot hold at least 95 percent of the pressure) would be repaired, and if irreparable, the well would be plugged and abandoned.

2.1.1.2.4.4 *Pipelines*

A network of process pipelines and cables are typically installed as part of the underground infrastructure: 1) between the central uranium processing facility or the satellite facility and the header houses for transporting lixiviant; 2) between the header houses and well fields for injecting and recovering lixiviant; and 3) between the central processing facility and wastewater disposal sites (e.g., deep injection wells, evaporation ponds).

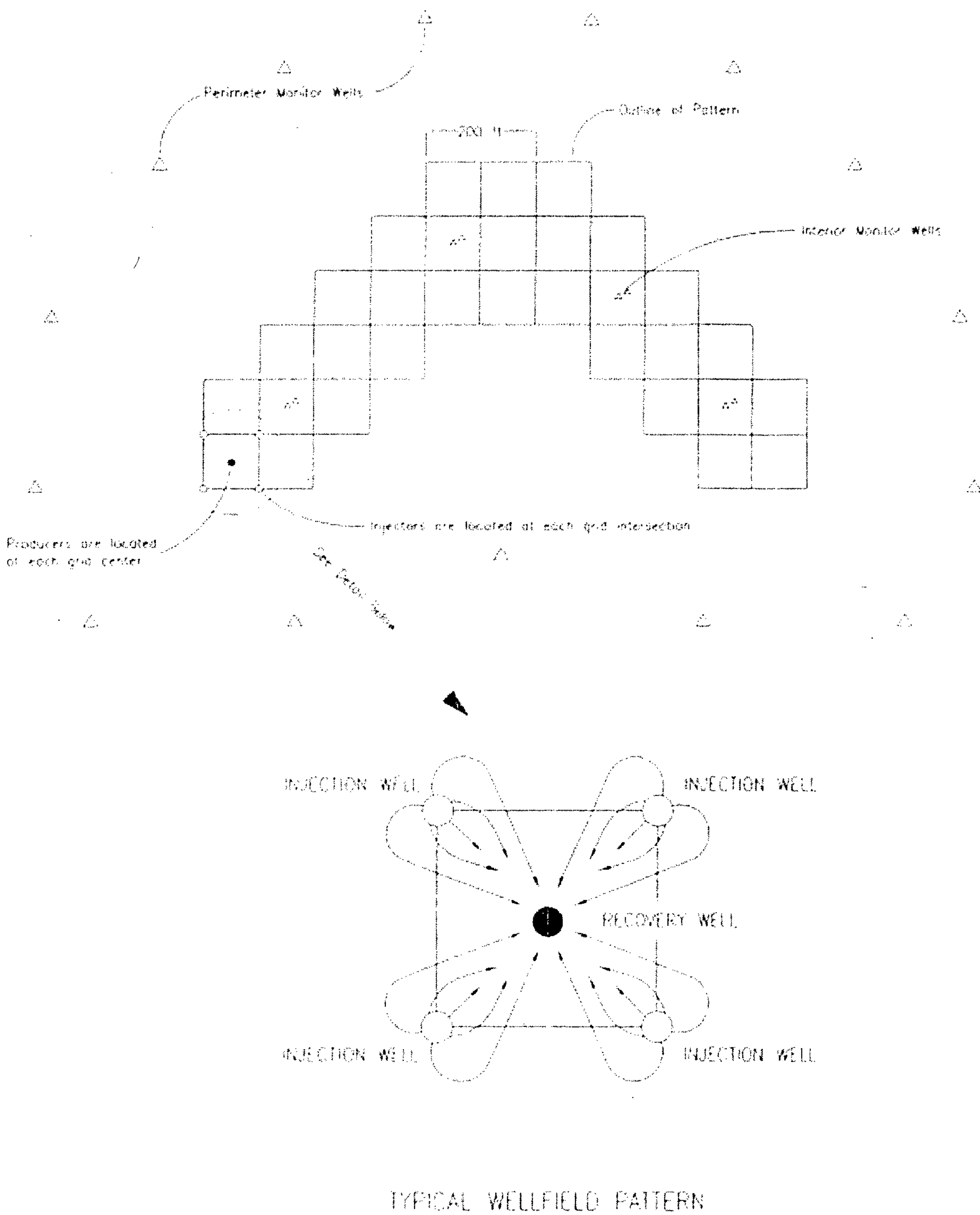

Figure 2-7 Solution Flow Patterns

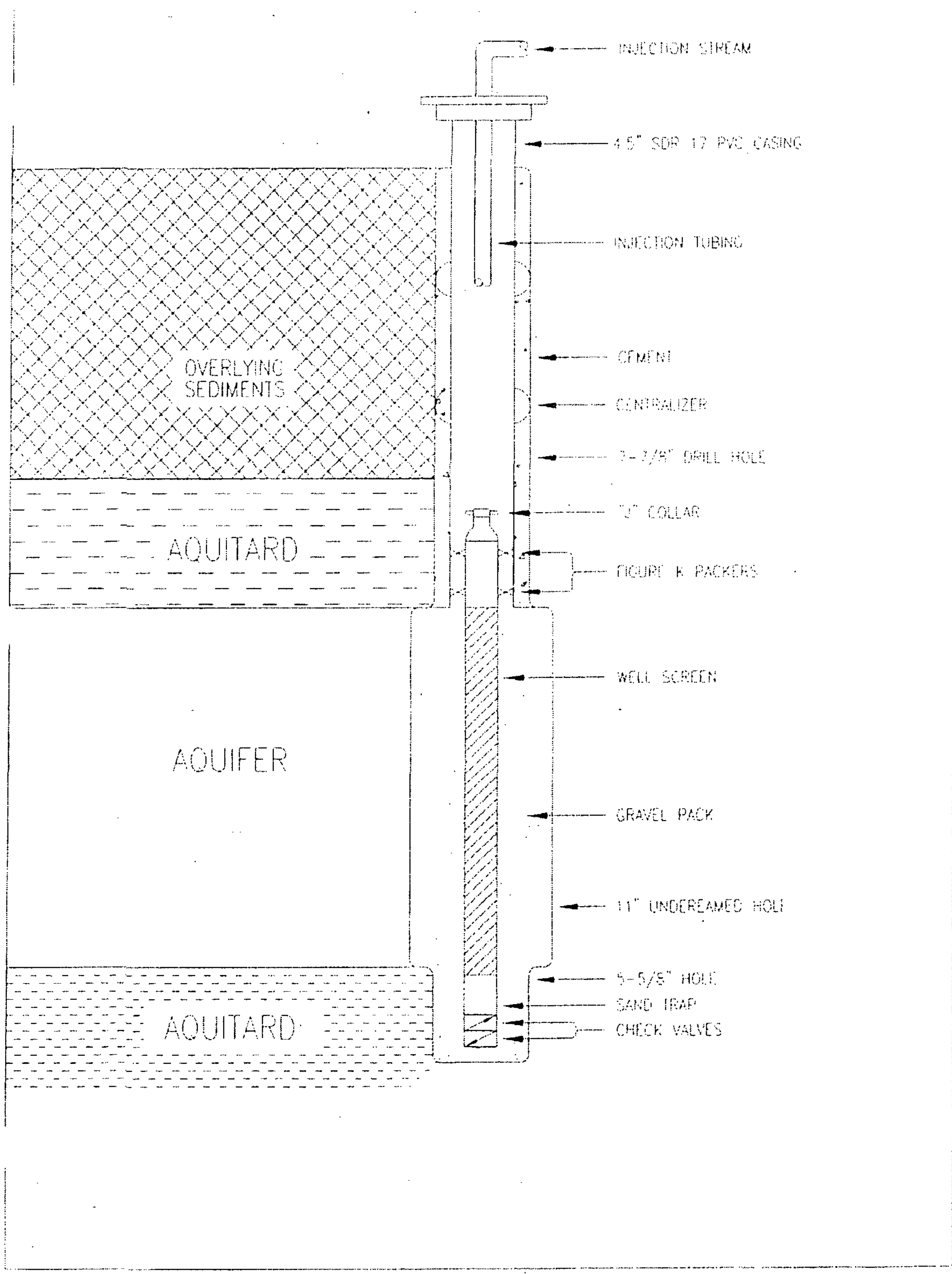

Figure 2-8. Injection Well Construction

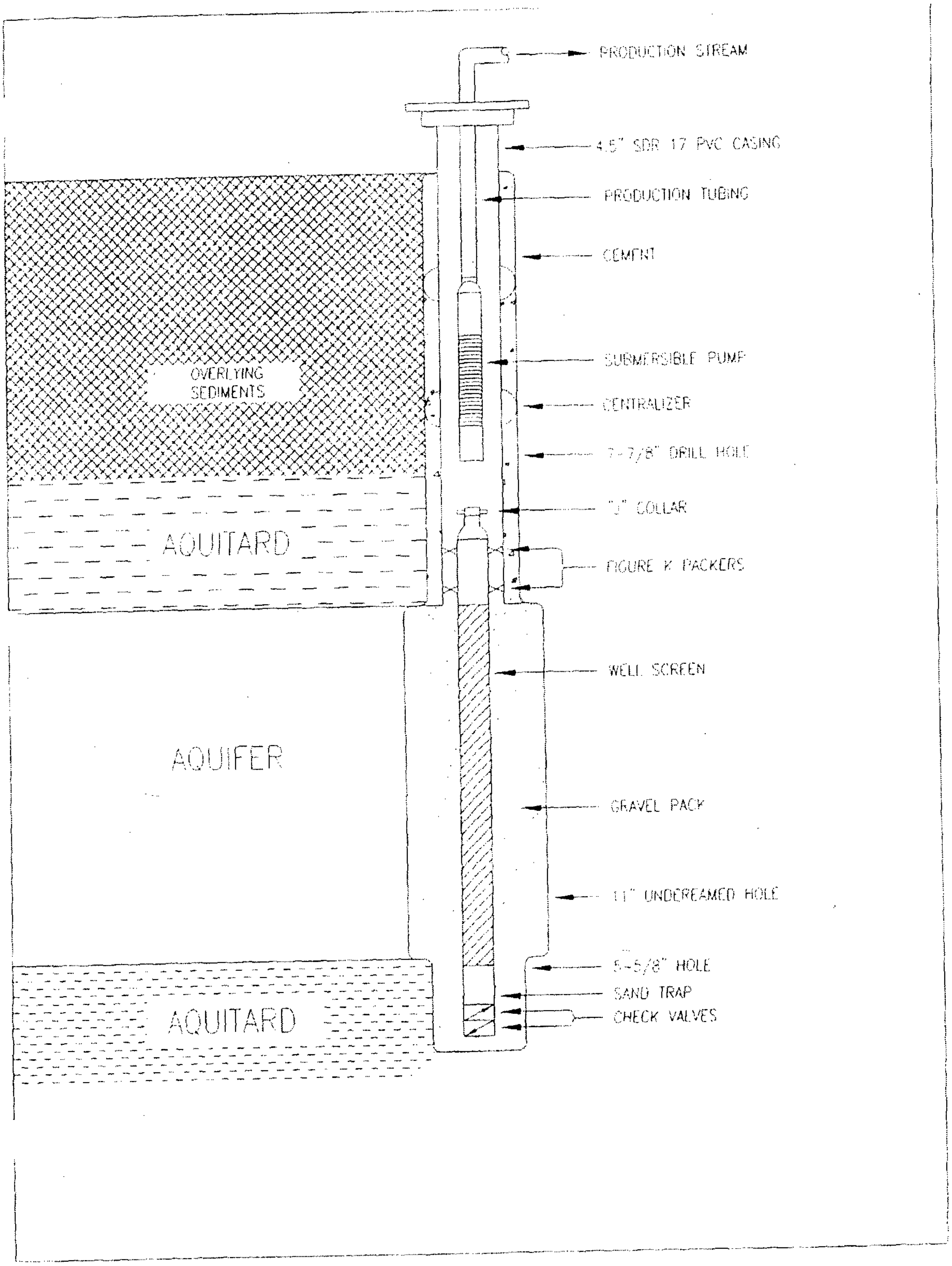

Figure 2-9 Production Well Construction

LCI proposes to use high-density polyethylene (HDPE) pipe, PVC pipe, stainless steel pipe, or an equivalent in its mine unit piping system. While the typical pressure rating for HDPE and PVC piping materials proposed for use is between 160 and 200 psig (pounds per square inch gauge), LCI would operate its mine unit piping at 150 psig. Individual well lines and the trunk lines to the CPP would be buried to prevent freezing. Flow meters and control valves would be installed in individual well lines and linked to the CPP and header houses to monitor and control the individual well flow rates and pressures.

2.1.1.2.4.5 *Header Houses*

A structure called a header house would be constructed in each well field. Their main purpose is to monitor and control (using meters, valves and pumps) the amounts of lixiviant (both injected and recovered) through a system of pipes connected to the injection and recovery wells. These would all be linked back to the CPP for overall monitoring and control. The header houses merely contain these meters and control valves. There may be one or more for any given well field.

2.1.1.2.5 Other Structures and Systems

The proposed CPP and maintenance buildings would be constructed with individual septic systems, with tanks and leach fields. The tanks would consist of a minimum of one chamber providing primary treatment. The septic systems would be for domestic wastes, only, with no process wastes disposal. Both systems were designed according to percolation tests and submitted to the Sweetwater County Engineer's Office.

The Lost Creek facility would be serviced by electric power from a transmission line off the Crooks Gap-Wamsutter Road. A 3,300 m (10,800 ft) long 34.5 kV overhead line would connect the Rocky Mountain Power line to a metering point on the western boundary of the project area, along the proposed western access road. The line would service the CPP, maintenance building and drillers shed, as well as the well field header houses.

A fence is proposed to enclose the entire CPP and maintenance building compound (230 x 260 m, 750 x 850 ft). There would be three main components to the fence: 1) two gates (one remotely operated); 2) 100 x 8 ft chain link fence either side of the main gate; and 3) standard livestock fence for the remaining portion of the CPP and maintenance compound. Security at the Lost Creek facility would involve: 1) maintaining control of NRC-licensed material; 2) providing a safe and secure workplace; 3) managing records that contain sensitive and/or confidential information; and 4) ensuring safe and secure transportation of NRC-licensed material. Security cameras would be placed at strategic locations throughout the CPP, particularly at the security gate and locations where source and by-product material are stored. Signage would warn site personnel and the general public of the potential for exposure to radionuclides prior to entering.

In addition, each mine unit and storage pond would be fenced and have signage to prevent inadvertent entry by people and animals. During production, active mine units would be inspected by site personnel at least once per shift. Visitors to mine units would be required to register and receive training, in addition to being supervised.

2.1.1.2.6 Construction Workers and Equipment

Approximately 30-40 people would be employed by the proposed project during construction. It is anticipated that most would commute from larger communities in Wyoming, such as Casper, Rawlins and Rock Springs, but some (if they are specialized in a particular trade) could come from out-of-state.

The equipment necessary to construct the ISR facility would include both company-owned and contractor-owned equipment. Company-owned equipment would include forklifts, graders, backhoes, geophysical logging trucks, generators, water trucks and cement mixers. Contractor-owned equipment would include mostly drill rigs, but could also include erection cranes and trenching equipment.

2.1.1.2.7 <u>Schedule</u>

It is estimated that construction would take approximately 21 months to construct each mine unit. The CPP and supporting facilities would take about 6 months to construct. A complete schedule showing all of the phases for the development of Lost Creek is presented in Figure 2-1.

2.1.1.3 *Operation Activities*

As discussed in Section 2.4 of the GEIS, the ISR process as part of the Lost Creek ISR Project would involve two operations. First would be the injection of barren lixiviant (new or recharged leaching solution prior to injection into the well field and that has no or low concentrations of dissolved uranium) to mobilize uranium in the underground aquifer and second would be the extraction and processing of the pregnant lixiviant in surface facilities to recover the uranium and prepare it for shipment. Figure 2-10 depicts a typical ISR operation.

2.1.1.3.1 <u>Uranium Mobilization</u>

During the Lost Creek ISR operation, chemicals would be added to the groundwater pumped to the surface from the ore-bearing aquifer to produce a leaching solution or lixiviant. Chemicals used to oxidize the uranium would include oxygen or hydrogen peroxide. Carbon dioxide and sodium bicarbonate would also be added to complex the uranium in the solution. The lixiviant would then be injected into the production zone to dissolve uranium from the underground formation, remove it from the deposit, and transport it to the processing facility where uranium would be removed from solution via ion exchange.

2.1.1.3.1.1 *Lixiviant Chemistry*

The uranium, in the (ore body) aquifer, exists in a reduced insoluble form. As such, to recover it through the ISR process, it must be oxidized and dissolved by the lixiviant solution injected into the ore zone. Once uranium is oxidized, it easily complexes with bicarbonate anions in the groundwater and becomes mobile. The uranium-bearing solution would migrate through the pore spaces in the sandstone and be recovered by production wells.

LCI proposes to use a lixiviant solution composed of a dilute carbonate/bicarbonate aqueous solution because of its selectivity for uranium and minor reaction with the gangue minerals. During injection, oxygen or hydrogen peroxide would be added to oxidize the uranium underground. Carbon dioxide would be provided to both keep the pH around neutral and to provide another source of carbonate and bicarbonate ions. The oxidized uranium would react with the lixiviant to form either a soluble uranyl tricarbonate complex or a bicarbonate complex.

2.1.1.3.1.2 *Lixiviant Injection and Recovery*

LCI estimates that the production flow rates are approximately 22,700 Lpm (6,000 gpm). LCI would pump uranium-enriched pregnant solution from production wells to the CPP for uranium extraction by ion exchange. The resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and oxidant and re-injected into the well field to repeat the leaching cycle.

Uranium mobilization at the proposed Lost Creek ISR Project would produce excess water containing 11e.(2) byproduct material that must be properly managed. The production wells extract slightly more water than is re-injected into the host aquifer, which creates a net inward flow of groundwater into the well field. Production rates would be controlled by withdrawing a small portion of the barren solution from the ion exchange circuit which is then disposed of via the deep disposal wells.

2.1.1.3.1.3 *Excursion Monitoring*

LCI proposes an operational groundwater monitoring program to detect and correct for any condition that could lead to an excursion affecting groundwater quality near the well fields. These excursions can be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly abandoned exploration of drill holes, discontinuity within the confining layers, poor well integrity, or hydro fracturing of the ore zone or surrounding units. The program would include monitoring process variable such as flow rates and operating pressures of operating wells (injection, production, and monitoring) and the main pipelines going to and from the CPP and satellite facility.

The monitoring wells in the ore zone and overlying and underlying aquifers would be sampled twice a month, and samples from these wells analyzed for conductivity, chloride, and total alkalinity (indicator parameters). These data would be compared to the upper control limits (UCLs) for those parameters. LCI would also collect static water level data prior to each sampling event, and would adequately maintain all of the analytical data from the monitoring wells and submit the data to the WDEQ quarterly. If an excursion is suspected, LCI would have to notify the NRC and WDEQ verbally within 24 hours and in writing within 7 days of a verified excursion. Corrective actions such as adjusting the injection and recovery flow rates in the affected area would be implemented as soon as practical and as long as it takes the excursion to be mitigated. Within 60 days of the confirmed excursion, LCI would have to file a written report describing the event and corrective actions taken to the NRC.

2.1.1.3.2 Uranium Processing

Uranium would be recovered from the pregnant lixiviant and processed as yellowcake in a multi-step process. These steps include ion exchange, elution, precipitation, drying, and packaging. These uranium processing activities are shown graphically in Figure 2-11.

2.1.1.3.2.1 *Ion Exchange*

At the proposed Lost Creek ISR, the pregnant lixiviant, estimated to be about 40-50 ppm of uranium concentration, would be pumped from the well fields to the ion exchange systems at the CPP for the extraction of uranium. The Lost Creek CPP would be designed to process up to 22,700 Lpm (6,000 gpm) of lixiviant through the ion exchange circuit. The ion exchange system proposed for Lost Creek would consist of pressurized, 'down-flow' vessels (columns) that are internally screened to maintain resin in-place, but allow the lixiviant to flow through the vessel. Once the resins in the ion exchange columns become saturated with uranium, the column would be taken offline for the elution circuit. The solution leaving the ion exchange circuit would normally contain less that 5 ppm of uranium. Sodium carbonate, sodium bicarbonate, oxidants, and carbon dioxide would be added to this 'barren' solution prior to re-injection, and the process is repeated. The ion exchange process is shown graphically in Figure 2-12.

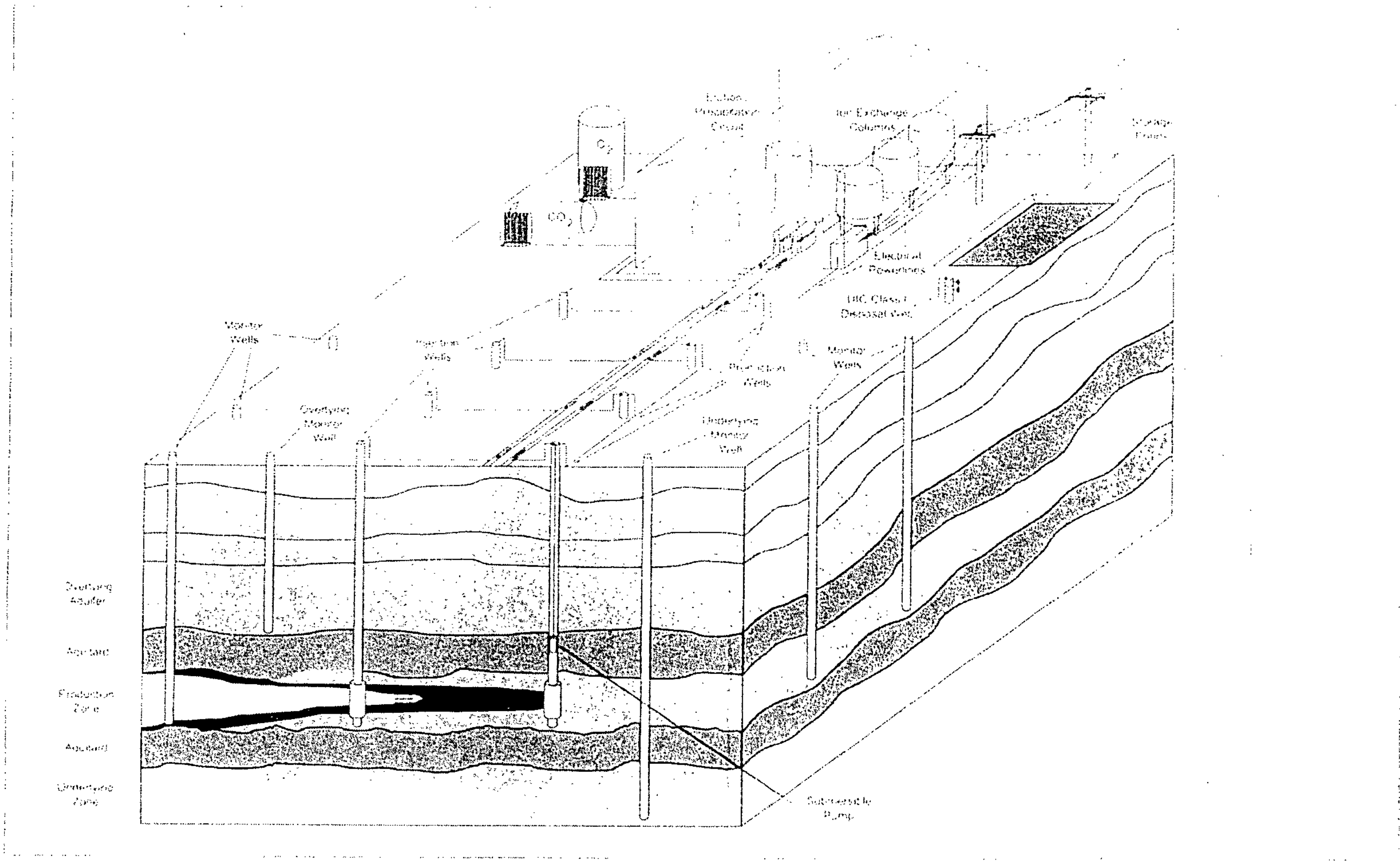

Figure 2-10. Typical ISR Layout

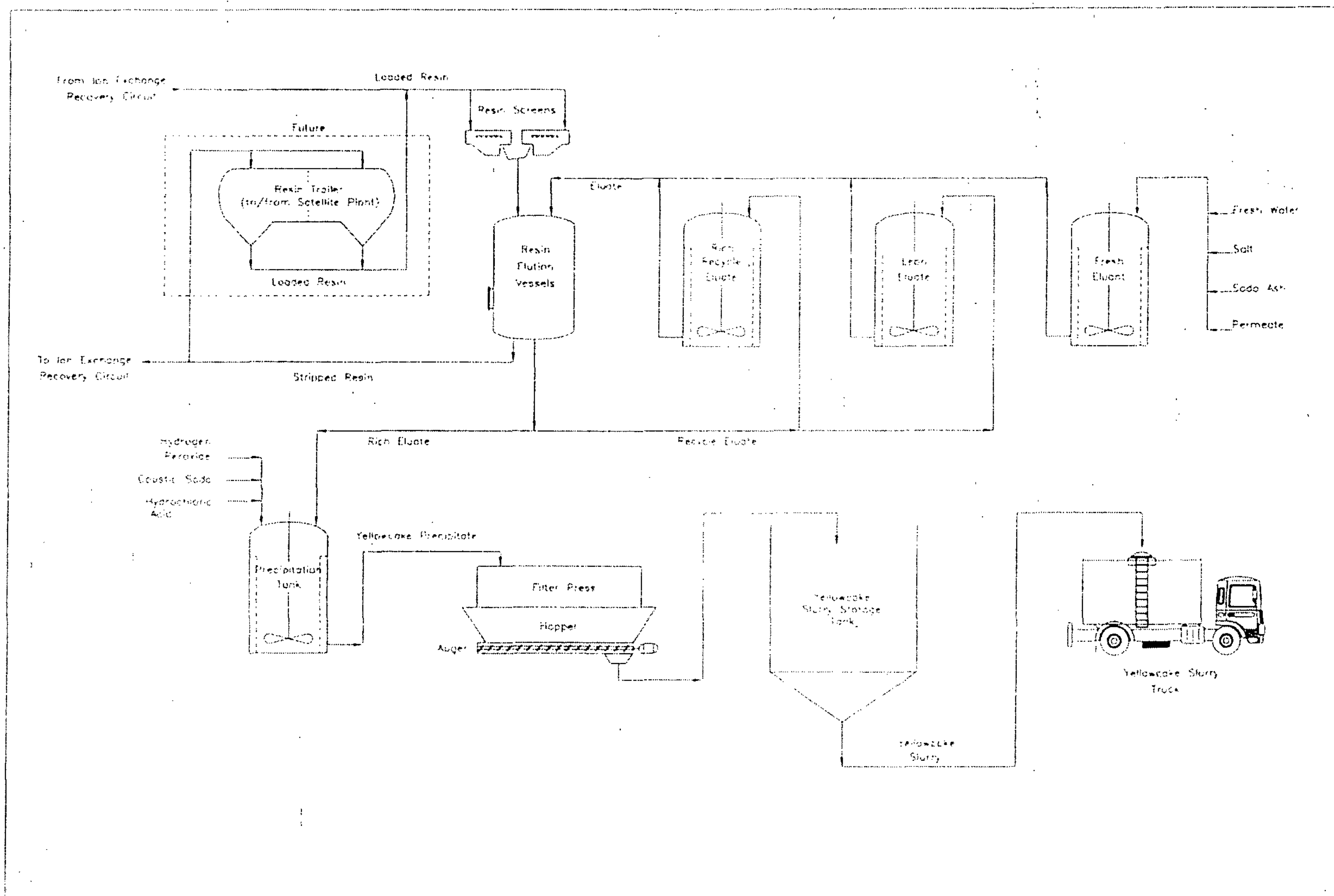

Figure 2-11. Process Flow Diagram

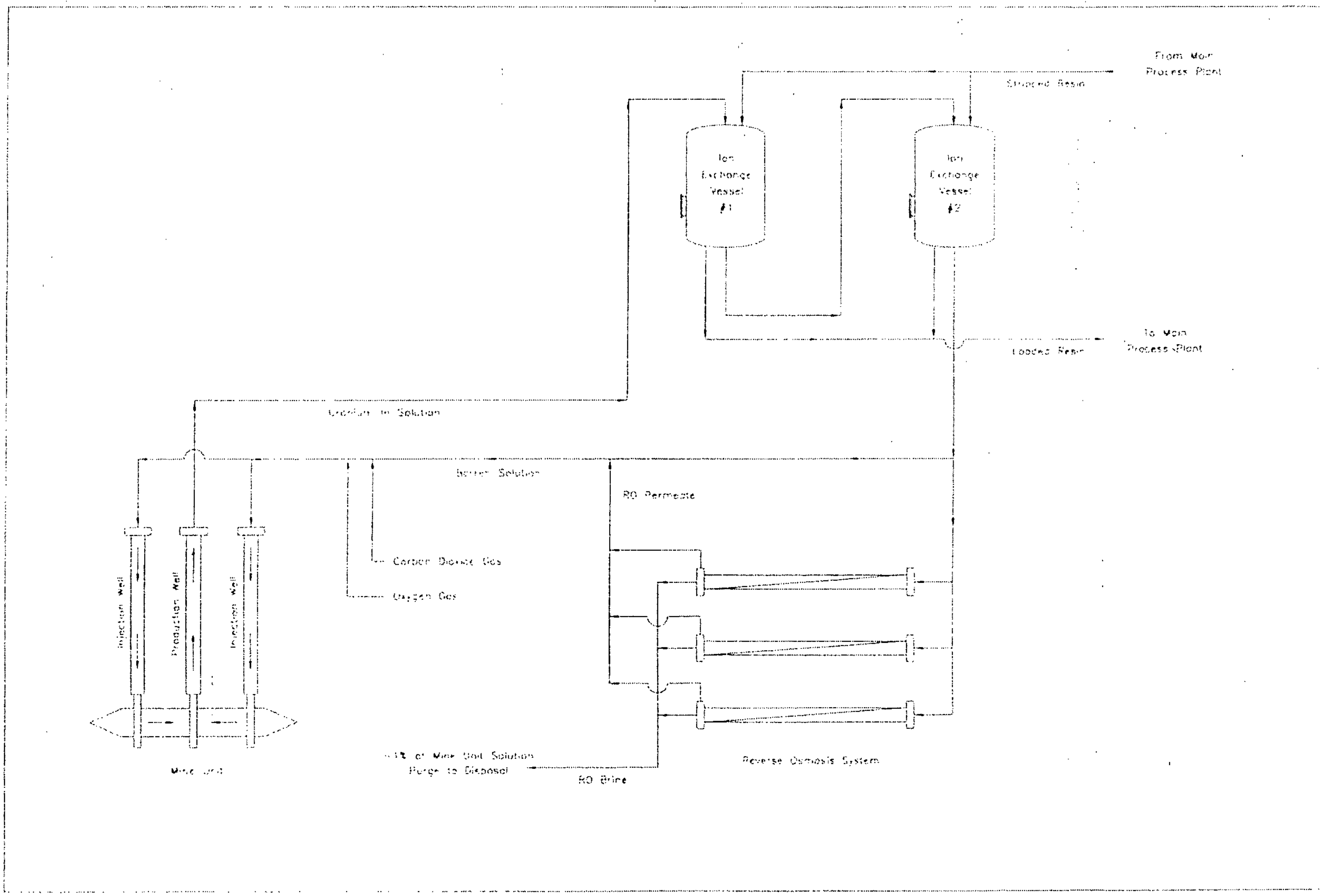

Figure 2-12 Ion Exchange Process Flow Diagram

2.1.1.3.2.2 *Elution*

In the elution circuit, the loaded resin from the ion exchange vessel: 1) passes over vibrating screens with wash water to remove entrained sand particles and other fine 'trash', and 2) moves by gravity from the screens down into 'down-flow' elution vessels for uranium recovery and resin regeneration. The uranium would be released from the loaded ion exchange resin in the dedicated elution vessel by applying an aqueous solution or brine composed of sodium chloride (90 g/L) and sodium carbonate (20 g/L). The process generates an 'eluate' that has a concentration of 10-20 g/L of U_3O_8. The three-stage process is depicted in Figure 1.5-2b of the TR.

2.1.1.3.2.3 *Precipitation/Filtration Circuit*

The precipitation/filtration circuit at the CPP would be initiated when the eluant is treated slowly with hydrochloric or sulfuric acid to break the carbonate portion of the dissolved uranium complex. Hydrogen peroxide would be used to precipitate out the uranium as uranyl peroxide. A caustic soda solution (sodium hydroxide or ammonia) would then be added to elevate the pH, promoting the growth of uranyl peroxide crystals and making the slurry safer to handle in subsequent process steps. Following precipitation, the precipitated uranium would be washed to remove excess chlorides and other soluble contaminants, and dewatered and filtered to form yellowcake slurry (30-50 percent solids). The yellowcake slurry would then be stored in holding tanks (inside the CPP) or in transport tanks parked in a secure (fenced) area of the facility, for ultimate shipment off-site, via authorized transport to a NRC-licensed processing facility.

2.1.1.3.3 Schedule

LCI anticipates operating the Lost Creek project for eight years, based upon the data they have collected in the six mine units proposed. The mine units, while individually operated, would overlap in time, as they come 'on-line' sequentially (Figure 3.1-3 of the TR; LCI, 2008b). There never would be more than two units operating at one time, however. The operation of Mine Unit 1 is anticipated to begin operation in early in 2012 and continue through late 2013 when Mine Unit 6 ceases to become productive. LCI anticipates the workforce requirements during operation to be 50 people, which includes mine unit, as well as CPP personnel. It is anticipated that most of the operations workforce would commute from larger communities in the state, such as Casper, Rawlins and Rock Springs, with some more specialized workers potentially relocating from out-of-state.

2.1.1.4 *Aquifer Restoration Activities*

As described in Section 2.5 of the GEIS, aquifer restoration is necessary to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5). After the uranium is recovered, the groundwater in the well field contains constituents that were mobilized by the lixiviant. The process whereby groundwater constituents are selected for monitoring throughout the life of the project is described in Section 6.3.1.2 (Groundwater Quality Monitoring) of this SEIS. LCI plans to begin aquifer restoration in each well field as the uranium recovery no longer becomes economically feasible and operations end. Consistent with current ISR restoration practices, LCI proposes that restoration criteria or restoration target values (RTVs) be established on a parameter-by-parameter basis and that the primary goal of restoration be to return all parameters to pre-ISR baseline conditions. Prior to operation, background (baseline) groundwater quality would be determined. Baseline water quality data would be collected from the monitoring wells before any ISR operations take place. Restoration must demonstrate that it meets the requirements of 10 CFR Part 40 Appendix A.

Prior to the operation of each mine unit, background (baseline) groundwater quality would be determined. Baseline water quality data would be collected from the monitoring wells in the perimeter ring, the pattern area (of the mine unit), and in the overlying and underlying aquifers before any ISR operations take place. A minimum of four samples would be collected from each well, 14 days apart, and at least one sample from each well would be sent to WDEQ for analysis. Baseline and restoration parameters are presented in Table 6.2-1 of the TR (LCI, 2008b).

The aquifer restoration program for Lost Creek would include three stages: groundwater sweep, groundwater treatment, and recirculation. These three stages would be designed to effectively and efficiently restore the groundwater so that groundwater loss is minimized and restoration equipment is optimized. LCI would monitor the quality of selected wells during restoration to determine the efficiency of the operation, and whether additional, or alternate, techniques may be necessary. Aquifer restoration is presented graphically in Figure 6.2-1 of the TR (LCI, 2008b).

2.1.1.4.1 Groundwater Transfer

Groundwater transfer involves moving groundwater between the well field entering restoration and another well field where uranium leach operations are beginning, or alternately, within the same well field, if one area is in a more advanced state of restoration than another (NRC, 2009). This technique displaces mining-affected waters in the restoration well field with baseline quality waters from the well field beginning leach operations. As a result, the groundwater in the two well fields becomes blended until the waters are similar in conductivity and therefore similar in the amount of dissolved constituents. Because water is transferred from one well field to another, groundwater transfer typically does not generate liquid effluents.

2.1.1.4.2 Groundwater Sweep

During groundwater sweep, water is pumped from the mine unit (without re-injection), resulting in an influx of 'fresh' baseline water into the affected (mined) portion of the aquifer. The water removed from the aquifer during the sweep first is passed through an ion-exchange system to recover the uranium and then disposed either in evaporation ponds or via deep well injection in accordance with the limits in a UIC permit. The pumping rates used will depend on the hydrologic conditions at a given site, and the duration of the aquifer sweep and volume of water removed depend on the volume of the aquifer affected by the ISL process (NRC, 2009). The number of pore volumes of groundwater sweep is dependent on the capacity of the wastewater disposal system and the effectiveness of the sweep in lowering the amount of total dissolved solids (TDS). Pore volume is the term used by the ISR industry to define an indirect measurement of a unit volume of aquifer water affected by ISR recovery. It represents the volume of water that fills the void space in a certain volume of rock or sediment. A detailed description of pore volume is presented in the GEIS (NRC, 2009). Typically, one pore volume, or less, is recovered during the sweep, before moving into the groundwater treatment phase.

2.1.1.4.3 Groundwater Treatment

During the groundwater treatment stage of the Lost Creek project, ion exchange and reverse osmosis treatment circuits would be used to treat groundwater before it is re-injected into the affected aquifer. The ion exchange columns would remove most of the soluble uranium and replace it with chloride or sulfate. (A detailed description of this process is contained in Section 2.5.3 of the GEIS (NRC, 2009). After uranium removal, a small amount of reductant may be introduced to reduce any other oxidized minerals. The purpose of this addition is to reduce those minerals that are solubilized by carbonate complexes.

A portion of the restoration recovery water can also be sent to the reverse osmosis unit. The reverse osmosis unit serves the following purposes: 1) reduces the total dissolve solids (TDS) in groundwater being restored, 2) reduce the quantity of water needed to be removed from the aquifer to achieve the RTVs, 3) concentrates the dissolved contaminants in a smaller volume of brine to facilitate waste disposal, and 4) enhances ion exchange. About 60 to 75 percent of water passes through the reverse osmosis membranes, leaving approximately 25 to 40 percent of the dissolved salts in the resulting brine water. The clean water or permeate would either be re-injected into the well field, stored for use in the mining process, or sent to the deep disposal wells. The permeate may also be de-carbonated prior to re-injection into the well field. The brine water contains most of the dissolved salts and is sent to the deep disposal wells. Make-up water coming from a number of sources may be added prior to reverse osmosis or well field injection stream to control the amount of bleed into the restoration area. These sources would include water from a well field in a more advanced state of restoration, water being exchanged with a new well field production area, water from a different aquifer, or the purge of an operating well field.

2.1.1.4.4 Recirculation

Recirculation consists of pumping from the mine unit and re-injecting the recovered solution to recirculate and homogenize groundwater conditions. Once active restoration activities are complete, LCI would collect groundwater samples to determine if restoration requirements have been met. Documentation would include an evaluation of the water quality data and a description of the techniques used.

2.1.1.4.5 Monitoring and Stabilization

This is the final stage of the aquifer restoration phase of ISR development. Upon demonstrated (NRC and WDEQ approved) completion of aquifer restoration LCI would begin a groundwater stabilization monitoring program. Wells would be sampled once a month for a period of six months. To evaluate stability, sampling parameters would be based on the overall condition of the aquifer at the end of the restoration period, pending WDEQ approval. A well field has to be designated by both the WDEQ and NRC as being restored. The six-month stability period would begin to ensure that RTVs were met. At the end of the six-month stabilization period, LCI would prepare a report documenting data results and methods. If, at the end of this period, the analytical results continue to meet the appropriate standards for each mine unit, and do not exhibit any increasing trends, a request would be made to declare the mine unit restored. Following NRC and WDEQ approval, plugging and abandonment of wells can be performed.

2.1.1.4.6 Schedule

LCI anticipates the restoration of each mine unit to take approximately 30 months (from the beginning of the groundwater sweep through the regulatory approval stage). LCI anticipates aquifer restoration phase of Mine Unit 1 to begin late 2013, and Mine Unit 6 to be completed mid 2016.

2.1.1.5 *Decontamination, Decommissioning, and Reclamation Activities*

Once the Lost Creek project is complete (all the uranium that has been economically extracted and the groundwater restored), all surface structures would be decontaminated and decommissioned, and the land surface reclaimed. Decommissioning of the Lost Creek ISR Project would be based on an NRC-approved decommissioning plan. Unless otherwise specified, LCI would be required under 10 CFR 40.42 to complete site decommissioning within two years from the time the decommissioning plan had been approved. In addition to the CPP and associated structures, all disturbed lands restored to their pre-mining land use of livestock grazing and wildlife habitat. The facilities that would require decommissioning and reclamation include: 1) all processing and water treatment equipment; 2) buildings and structures, including offices; 3) waste storage, treatment, and disposal facilities, including deep disposal wells; 4) buried pipes; 5) control structures, such as impoundments and culverts; and 6) roads. Only those structures and roads that are required (and approved) for post-operational use would remain.

2.1.1.5.1 Well Fields

2.1.1.5.1.1 *Well Plugging and Abandonment*

Once the NRC and WDEQ have reviewed and approved LCI's assessment that the groundwater restoration is complete for a mine unit, the wells can then be abandoned (usually plugged using a bentonite [clay] slurry). All wells, except those needed for continued monitoring purposes, would be abandoned in accordance with appropriate Wyoming statutes and regulations. Once a well is fully abandoned, any disturbed area would be reclaimed and reseeded, and a written report sent to the State Engineer.

2.1.1.5.1.2 *Buried Piping and Engineering Control Structures*

Any contaminated piping would be disposed of at an NRC-licensed facility, and non-contaminated piping would be removed for salvage, or for disposal in accordance with applicable regulations. Topsoil, along the pipeline route would be re-spread and the disturbed area reseeded with a seed mixture prescribed by the BLM and WDEQ.

2.1.1.5.1.3 *Header Houses*

With the exception of any facilities, access roads, or utility corridors required for future operation, all of the features associated with a header house would be removed once groundwater restoration in that header house and mine unit has been deemed complete. The header houses and pump stations would be moved to new locations in other areas of the Permit Area, or dismantled and disposed of in accordance with applicable regulations.

2.1.1.5.1.4 *Soils and Materials*

Soils would be replaced where excavated, whenever possible. Due to the relatively uniform soil characteristics across the site, the similarity of the topsoil and subsoil, and the relative thinness of the topsoil and subsoil, separate handling of the topsoil and subsoil would not be done. The replacement will be along the contour, where necessary to prevent soil erosion. To avoid clods, soils will not be replaced when the ground is wet or frozen. The replaced topsoil will be disked to create an adequate seed bed.

2.1.1.5.1.5 *Access Roads*

Unless approval for leaving a specific road is obtained for post-mine use, all roads would be reclaimed. Improved or constructed roads would be reclaimed by removal of culverts, removal of road surfacing materials, re-contouring, as necessary, preparation of the seed bed, and reseeding in accordance with the procedures outlined in the BLM Plan of Operation.

2.1.1.5.2 Process Buildings and Equipment and Other Structures

Following completion of groundwater restoration in the final production area, the Lost Creek CPP and associated structures would be decommissioned. All process equipment associated with the CPP would be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials unable to be decontaminated would be disposed of at one of the approved facilities mentioned earlier. Materials able to be decontaminated would be reused, sold, or removed and disposed of off-site. Once the buildings have been removed, the former building sites would be contoured to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that radiation levels are within acceptable NRC limits. As mentioned earlier, LCI would provide a land reclamation plan to the NRC and BLM for review and approval within 12 months prior to commencing reclamation of a well field. Soils (topsoil and subsoil) would be replaced at sites where structures are removed according to the BLM's Plans of Operations regulations (43 CFR 3809 Part 400 et seq.). The plan would include a description of the areas to be reclaimed, a description of the planned reclamation activities, a description of methods to be used to protect workers and environment against radiation hazards, a description of the planned final radiation survey, and a cost estimate.

2.1.1.5.3 Engineered Structures and Site Roads

Any site roads, as well as roads accessing the Lost Creek ISR site, would be removed and the surface re-contoured, except those required for post-operational activities. Culverts, as well as road surface and roadbed materials, would be removed, and the land surface reclaimed following BLM regulations and guidelines (from the Plan of Operations).

2.1.1.5.4 Final Contouring and Re-Vegetation

Areas in which reclamation would be required within the Permit Area include the mine units, in particular where the header houses and roads have been removed, and the CPP area. Disturbed areas will be reclaimed to the BLM/WDEQ-approved post-operations land use by re-grading the surface to the approximate pre-operations contour, re-establishing drainages, replacing salvaged soil, and re-vegetating the areas.

2.1.1.5.5 Schedule

Decommissioning is the final step in the ISR process, and takes place in approximately the seventh year (Figure 2-1). Once the aquifer has been restored to the standards established by the WDEQ, the activities described in the previous five sections can begin. The time frame for decommissioning and land surface reclamation is estimated by LCI to be approximately one year.

2.1.1.6 *Effluents and Waste Management*

The ISR process at Lost Creek would generate effluents and waste streams, all of which must be handled and disposed of properly. These would include gaseous emissions, liquid wastes (classified as 11e.(2) byproduct material), and solid wastes. These effluents would be reduced, to the extent practicable, by minimizing disturbance and reusing or recycling materials. In addition, spill prevention and spill response plans would be in-place to prevent and minimize the potential impacts of an accidental release.

2.1.1.6.1 Gaseous or Airborne Particulate Emissions

During the four stages of Lost Creek (construction, operation, aquifer restoration, and decommissioning), gaseous emissions from the ISR process would primarily consist of fugitive dusts (from unpaved roads), combustion engine exhausts (from vehicles and on-site equipment), and radon gas emissions (from well drilling) during various stages of the processing system.

2.1.1.6.1.1 *Fugitive Dust and Diesel Emissions*

Fugitive dusts and engine exhausts would be generated primarily from vehicle traffic within the Lost Creek site and on and off the project site during construction, transportation, and decommissioning activities. The fugitive dust would be generated by travel on unpaved roads and from disturbed land associated with the construction of well fields, roads, and auxiliary facilities. LCI expects that negligible amounts of fugitive dust would be generated from the soil disturbance during construction of the wells. With the prevailing wind direction out of the west-northwest during the daytime, dust produced during operation Lost Creek would generally blow in the east direction. In addition, access roads would be maintained via motorized patrol and LCI would minimize disturbance to natural vegetation when possible to minimize wind erosion.

In addition, combustion engine exhausts would also be generated by: 1) workers' vehicles commuting to and from the project site, 2) trucks transporting construction materials and product, 3) drill rigs, 4) diesel-powered water trucks, and 5) other construction equipment.

2.1.1.6.1.2 *Radioactive Emissions*

Radioactive airborne emissions would be minimal at the Lost Creek facility because yellowcake drying and packaging would not occur on-site. In addition, the storage ponds would be kept wet (sediment would maintained as moist), and not allowed to dry, to prevent having sediments exposed to wind action. Radon gas is the most likely emission to occur, as it is present in the ore body and concentrated in the lixiviant. Radon can be released when the pregnant lixiviant is brought to the surface from the ore zone aquifer, as well as when ion exchange columns are taken offline for resin transfer and opened to the atmosphere. The use of general area and local ventilation systems would aid in controlling the buildup of radon within the onsite facilities. General area ventilation may involve forced air ventilation of work areas in process buildings. Local ventilation for process vessels where radon releases are more likely may involve ducting or piping near the point of release and fans that exhaust to the outside (to the atmosphere).

2.1.1.6.2 Liquid Wastes

Liquid wastes would be generated during all phases of uranium recovery at Lost Creek. Such wastes include well development water, pumping test water, storm water runoff, waste petroleum products and chemicals, wash down water, and domestic (sanitary) wastewater. In addition, three 11e.(2) by-product material liquid wastes (10 CFR Part 40, Appendix A, Crit.6) would be generated: 1) liquid process wastes, including chemicals; 2) 'affected' groundwater generated during well development; and 3) groundwater generated during aquifer restoration. Liquid effluents generated during well development and pumping tests would be expected to at least satisfy WDEQ-WDQ Class IV (groundwater clean-up) standards. Based on a Staff Requirements Memorandum on "Recommendations on Ways to Improve the Efficiency of NRC Regulation at In-Situ Leach Uranium Recovery Facilities", dated March 12, 1999, any waste water generated during, or after, the uranium extraction phase of site operations, and all evaporation pond sludge derived from such waste waters, are classified as 11e.(2) byproduct material.

Uranium mobilization and processing at Lost Creek would produce excess water that must be properly managed. The production wells extract slightly more water (approx. 1.0-1.5 percent) than is re-injected into the host aquifer, which creates a net inward flow of groundwater into the well field. During normal operations, production rates would be controlled by withdrawing a small portion of the barren solution (called production bleed) from the ion exchange circuit which is then disposed via the deep disposal (Class I) wells. These wells would be located in the southwestern portion of the site and would be similar in depth and design to deep wells found at other ISR sites. In addition, two 49- x 79-m (160- x 260-ft) storage ponds would be constructed adjacent (to the east) of the CPP for the purpose of shut down of the Class1 wells (Figure 2-3). The ponds would be designed to handle the maximum facility waste generation flow rate (227 liters per minute [Lpm]; 60 gallons per minute [gpm]). The redundant design is in case a leak is detected in one of the ponds.At maximum design-rated production 22,700 Lpm (6,000 gpm), approximately 230-340 Lpm (60-90 gpm) would be diverted as production bleed. If the Class I deep disposal wells become inoperable, or are shut down for maintenance, two 49- x 79-m (160- x 260-ft) storage ponds would be used to dispose of production bleed.

Other liquid waste streams would be produced during the operation of Lost Creek. These include liquids from storm water, domestic wastewater (sewage), pumping test water, elution circuit bleed, and wash down water (containing waste petroleum products and chemicals). Only the elution circuit bleed would be sent to the deep disposal wells. The project water balance for Lost Creek is shown graphically in Figure 2-13.

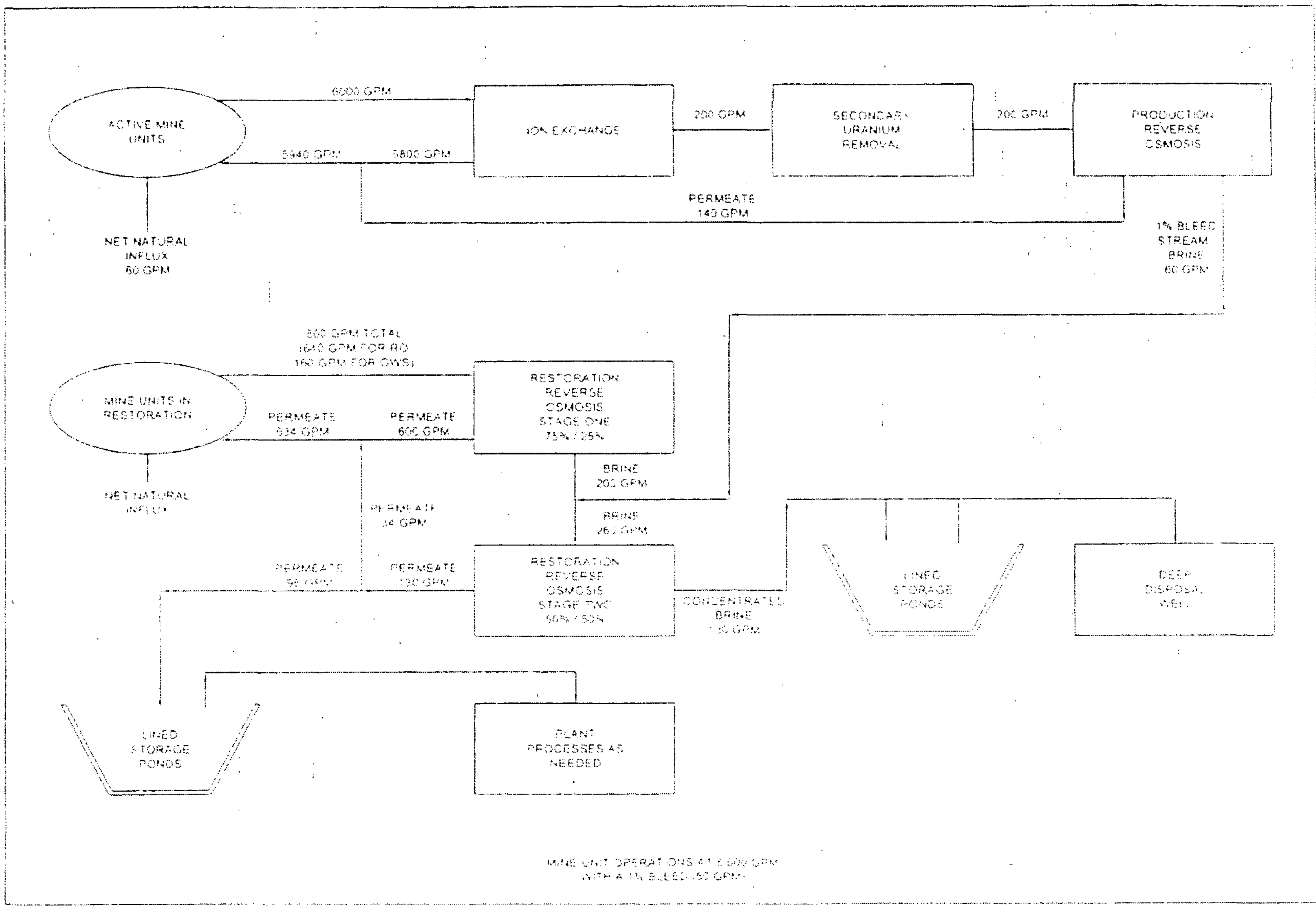

Figure 2-13. Project Water Balance

The restoration water would be treated by reverse osmosis and then re-injected into the production area undergoing restoration. Restoration water bleed would be transferred to the deep disposal wells. Sanitary wastes would also be generated from restrooms and lunchrooms. Sanitary wastes would be disposed of in an onsite septic system.

2.1.1.6.3 Solid Wastes

Solid wastes would be generated during all phases of the Lost Creek project. The storage, treatment, and eventual disposal of these wastes would differ according to their characteristics.

2.1.1.6.3.1 *Non-11e.(2) By-Product Materials*

These materials would include non-hazardous materials such as paper, wood, plastic, steel, biodegradable, and sewage sludge, and hazardous materials such as waste petroleum products and batteries. Materials that can be decontaminated would fall in this category. Non-hazardous waste materials, with the exception of sewage sludge, would be recycled, where possible, or temporarily stored in bins prior to off-site disposal at a licensed solid waste facility. Hazardous wastes would be stored in clearly labeled sealed containers in a secure location, and periodically collected by a commercial hauler for recycling or energy recovery. LCI estimates that the following amounts of solid wastes would be generated annually: 1) 227-318 kg (500-700 lb) of non-11e.(2) by-product material; 2) about 2.3-3.8 m^3 (3-5 yd^3) of sewage sludge; and 3) 4.5-9.1 kg (10-20 lb) of batteries and other hazardous wastes.

2.1.1.6.3.2 *Solid 11e.(2) By-Product Materials*

These materials would include process wastes (spent ion exchange resin, filter media, and tank sludge) and equipment (tanks, vessels, and piping) that becomes contaminated during the ISR process. To the extent practicable, these materials would be decontaminated for disposal or reuse. For equipment and materials that cannot be decontaminated, they would be properly packed, sealed, and labeled for disposal at a licensed facility. LCI estimates that approximately 77 m^3 (100 yd^3) of 11e.(2) by-product material would be generated annually.

2.1.1.7 *Transportation*

Transportation to, from, and within the boundaries of the Lost Creek ISR Project would primarily encompass the use of both light duty and heavy trucks. Light duty trucks and automobiles would transport construction contractors and the operations workforce, as well as deliver smaller equipment and office supply products. During all phases of the project, heavy duty trucks would transport construction equipment and materials, operational processing supplies, ion exchange resins, yellowcake product, and waste materials. Transportation to and from the Lost Creek project area would include shipment of yellowcake slurry from the processing plant to an offsite dryer, delivery of construction-related materials, process chemicals, and maintenance equipment from suppliers, shipments of unrestricted solid waste to local landfills, transfer of 11e.(2) byproduct material to a licensed facility for disposal, and the transport of employees to and from the site.

A final destination for outgoing shipments of yellowcake slurry has not been determined at this time. Construction-related materials, process chemicals, and maintenance supplies would be delivered on varying schedules depending on production rate, usage, time of year, and other needs. Projections of solid waste generation are similarly dependent on production rate. LCI estimates that vehicle traffic would commence at 30 to 35 light trucks and 2 to 5 heavy trucks per day entering and leaving the site during the construction phase. During operation, light truck traffic would diminish slightly to about 20 light trucks with heavy truck traffic remaining constant (and including 1 to 2 trucks per week carrying yellowcake slurry offsite).

Within the Project area, there would be about 15 light trucks traveling to and from the mine units for monitoring and maintenance, and 10 drill rigs operating for well installation and ore delineation. These vehicles would reside on the site and not routinely leave as would the commuting workforce, incoming shipments of supplies, or outgoing yellowcake slurry. The projected types and numbers are provided in Table 2-1.

Table 2-1. Projected Vehicle Needs: Lost Creek ISR Project				
Vehicle Type	**Company Owned (On Site Only)**	**Company Owned (On and Off Site)**	**Contractor Owned (On and Off Site)**	**Total**
Pickup Truck (½, ¾, 1 ton)	24	3	10	37
Van		4		4
Tractor Trailer		1		1
All Wheel Drive Forklift	3			3
Hard Surface Forklift	2			2
Motor Grader	1			1
Backhoe	2			2
Geophysical Logging Truck	3			3
All Terrain Vehicle	1			1
Flat Bed Trailer	3			3
Reel Trailer	3			3
High-Density Polyethylene (HDPE) Fusion Cart	1			1
Generator	9			9
Water Truck	2		10	12
Mechanical Integrity Testing Truck	1			1
Cementers	6			6
Side Dump or End-Dump Trailer		1		1
Truck Mounted Drill Rig			10	10

Source: LCI, 2008a,b

2.1.1.8 *Financial Surety*

As stated in Section 2.10 of the GEIS, NRC regulations (10 CFR Part 40, Appendix A, Criterion (9)) require that applicants cover the costs to conduct decommissioning, reclamation of disturbed areas, waste disposal, dismantling, disposal of all facilities including buildings and well fields, and groundwater restoration. LCI would maintain financial surety arrangements to cover such costs for the Lost Creek ISR Project. The initial surety estimate would be based on the first year of operation, which includes the construction of the Lost Creek central processing plant (CPP). Annual revisions to the surety estimate would be required by the NRC and WDEQ-LQD to reflect existing operations and planned construction or operation the following year. Once the NRC, WDEQ-LQD, and LCI have agreed to the estimate, LCI would submit a reclamation performance bond, irrevocable letter of credit, or other surety instrument to the NRC and

WDEQ-LQD. The NRC reviews financial surety in detail as part of its review for the Safety Evaluation Report (SER).

2.1.2 No-Action (Alternative 2)

The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action before acting on a proposal. The No-Action alternative means that "the proposed activity" would not take place, although activities currently on-going or that would happen at the site over the proposed licensing period would still occur. The resulting environmental effects from taking No-Action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward" (46 FR 18026). Under this alternative, LCI would not be issued a license to construct and operate ISR facilities at the proposed site. Existing activities such as grazing and herding operations would be expected to continue in the case of the No-Action alternative. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.1.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, NRC would issue LCI a license for the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Lost Creek site for uranium recovery and the production of dry yellowcake as the final product. By doing so, the project would differ from the proposed action in that additional equipment for the production of dry yellowcake would be needed. The additional equipment would be installed in the CPP located at the Lost Creek site. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois for the next step in the production of fuel for commercial nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before being shipped to Illinois.

As with the proposed action, yellowcake slurry (30 to 50 percent solids) would be produced. However, under this alternative, the slurry would be filter-pressed to remove additional water, dried, and packaged on-site. This is accomplished, in part, by drying the slurry in a yellowcake dryer. Historically, two kinds of yellowcake dryers have been used, multi-hearth dryers and vacuum dryers.

Older uranium ISL facilities used gas-fired multi-hearth dryers. These use high temperatures that burn all organic contaminants. A scrubber is used so that uranium particulates are removed before they are released to the atmosphere.

Newer ISR facilities usually use vacuum yellowcake dryers. In a vacuum dryer, the heating system is isolated from the yellowcake so that no radioactive materials are entrained in the heating system or its exhaust. The drying chamber that contains the yellowcake slurry is under vacuum, so that any potential leak would cause air to flow into the chamber. Drying takes place at relatively low temperatures.

Emissions from the drying chamber are normally treated through a bag filter to remove yellowcake particulates and any water vapor exiting the drying chamber is cooled and condensed. The dried product (yellowcake) is removed from the bottom of the dryer and packaged in drums for eventual shipping offsite, to Metropolis, Illinois. The packaging area also has a bag filter dust collection system to protect personnel and to minimize yellowcake release. Air from the bag filter dust collection system is typically routed to the dryer off-gas line and scrubber. During drum loading, the drum is also kept under negative pressure via a drum hood with a suction line. Parameters important to the effective operation of the dryer are monitored per NRC regulations at 10 CFR Part 40, Appendix A, Criterion (8). The final, dried product is cooled, packaged and shipped in 208-L (55-gal) drums.

2.2 Alternatives Eliminated from Detailed Analysis

As described in Section 2.13 and Appendix C of the GEIS, alternate methods for uranium recovery include conventional mining/milling and mining/heap leaching at the Lost Creek Project. This section provides the rationale for why these two alternatives, in addition to two other alternatives (alternate lixiviants and alternate waste disposal methods) were considered but not carried forward for detailed analysis. It should be noted that LCI did not consider any of these alternatives in its application. Additionally, the NRC cannot require an applicant to consider alternate methodologies.

2.2.1 Conventional Mining and Milling at the Lost Creek Project

Uranium ore deposits at depth may be accessed either by open pit (surface) mining or by underground mining techniques. Open pit mining is used to exploit shallow ore deposits, generally deposits less than 170 m (550 ft) below ground surface (EPA, 2008a). To gain access to the deposit, the topsoil is first removed and may be stockpiled for later site reclamation, while the remainder of the material overlying the deposit (i.e., the overburden) can be removed via mechanical shovels and scapers, trucks or loaders, or by blasting (EPA, 1995; 2008a). The depth to which an ore body is surface mined depends on the ore grade, the nature of the overburden, and the ratio of the amount of overburden to be removed to extract one unit of ore (EPA, 1995).

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

In addition, once the open pit or underground workings are established, the mine may need to be dewatered to allow the extraction of the uranium ore. Dewatering can be accomplished either by pumping directly from the open pit or through pumping of interceptor wells to lower the water table (EPA, 1995). The mine water likely will require treatment prior to discharge, due to contamination from radioactive constituents, metals, and suspended and dissolved solids. Discharge of these mine waters may have subsequent impacts to surface water drainages and sediments, as well as to near-surface sources of groundwater (EPA, 1995).

Following the completion of mining, either by open pit or underground techniques, reclamation of the mine is needed. Stockpiled overburden can be reintroduced into the mine, either during extraction operations or following and topsoil re-applied in an attempt to re-establish topography consistent with the surroundings. With the end of dewatering, the water table may rebound and fill portions of the open pit and underground workings. Historically, 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 the open pit or underground mine would be processed in a conventional mill. As discussed in Appendix C of the GEIS (NRC, 2009), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While the conventional milling techniques recovers approximately 90 percent of the uranium content of the feed ore (NRC, 2009), the process does generate substantial wastes (known as tailings) since roughly 95 percent of the ore rock is disposed as waste (NRC, 2006). This process also can consume large amounts of water (e.g., approximately 534 liters per minute (Lpm; 141 gallons per minute [gpm]) for the proposed Pinon Ridge mill in Colorado (EFRC, 2009)).

Tailings are disposed in areally extensive lined impoundments, the design and construction of which are reviewed by NRC to ensure safe disposal of the tailings (NRC, 2009). Reclamation of the tailings pile generally involves evaporation of liquids in the tailings, settlement of the tailings over time, and covering the pile with a thick radon barrier and earthen material 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 (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 section 2.1.1.2.4, the average ore grade of the uranium deposit at the Lost Creek Project is above 0.1 percent, while the depth to the deposit is approximately 91 to 213 m (300 to 700 ft) below ground surface (bgs). While the ore grade and depth to ore are consistent with deposits mined either by open pit or underground workings, the environmental impacts from mining and conventional milling are more substantial than impacts from the ISR process at this site (see Chapter 4). For these considerations, this alternative is not carried forward for detailed analysis.

2.2.2 Conventional Mining and Heap Leaching at the Lost Creek Project

Heap leaching is discussed in Appendix C of the GEIS. For low-grade ores, heap leaching is a viable alternative. Low-grade ore removed from open-pit or underground mining operations undergo further processing to remove and concentrate the uranium. Heap leaching is typically use when the ore body is small and situated far from the milling site. The low-grade ore is crushed to approximately 2.6 cm (1 in) in size and mounded above grade on a prepared pad. A sprinkler or drip system positioned over the top continually distributes leach solution over the mound. Depending on the lime content, an acid or alkaline solution can be used. The leach solution trickles through the ore and mobilizes the uranium, as well as other metals, into solution. The solution is collected at the base of the mound by a manifold and processed to extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to 80 percent, resulting in a final tailings material of around 0.01 percent U_3O_8 content. Once heap leaching is complete, the depleted materials are AEA section 11e.(2) byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. While the impacts from heap leaching may be less than those from conventional milling, the impacts from the associated open pit or underground mining would still be substantial. For these considerations, similar to those listed in Section 2.2.1, this alternative is not carried forward for detailed analysis.

2.2.3 Alternate Lixiviants

Alternate lixiviants such as acid or ammonium carbonate solutions have been used in the past in ISR operations but are not currently used by NRC-licensed facilities because of the difficulties in restoring and stabilizing the affected aquifers (NRC, 2009a). For this reason, alternative lixiviants were not carried forward for detailed analysis.

2.2.4 Alternate Waste Disposal Methods

Alternate waste disposal methods such as evaporation ponds or land application (typically spray irrigation) have been used in the past or are in use at currently licensed ISR operations. Both of these disposal methods pose potential environmental impacts (NRC, 2009, section 4.2.12.2). The construction and operation of evaporation ponds involves both land disturbance and the potential for additional impacts to soils and near surface aquifers from pond leaks. These impacts would be expected to be mitigated through pond design features (e.g., double synthetic liners with a leak detection system) and best management practices (e.g., topsoil and erosion management controls). The land application of treated wastewater could potentially impact soils by allowing accumulation of residual radionuclide or chemical constituents in the irrigated soils over time. At NRC-licensed facilities, irrigation areas are monitored to maintain radionuclide and other constituents within allowable release standards. Additionally, licensees monitor the wastewater prior to application to ensure release limits would be met. As discussed in the GEIS, the potential environmental impacts of these waste disposal methods would be expected to be SMALL. Because the impact significance of these disposal methods is the same as would be expected for deep well injection of process-related wastewater (the disposal method proposed by the applicant), these alternate waste disposal methods were not carried forward for detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

NRC's NUREG-1748 (NRC, 2003) categorizes the significance of potential environmental impacts as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

In this section, for each of the three alternatives, the potential environmental impacts to each resource area are summarized for all four of the ISR phases - construction, operation, aquifer restoration, and decommissioning. The significance levels (SMALL, MODERATE, and LARGE) are specific to each resource and are defined in Chapter 4.

The environmental resources found in the project area are discussed in Chapter 3. Based on the description of the ISR process and the historical information on ISR facilities in Chapter 2 and in the GEIS, the potential environmental impacts are described and analyzed in Chapter 4. These impacts are listed in Table 2-2. For resource areas where two significance levels are shown (e.g., MODERATE/SMALL), the first level indicates the potential impact without any mitigation, and second indicates with mitigation.

Table 2-2. Summary of Impacts

Section 4.2 - Land Use Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.2.1.1	NONE 4.2.2	SMALL 4.2.3
Operation	SMALL 4.2.1.2	NONE 4.2.2	SMALL 4.2.3
Aquifer Restoration	SMALL 4.2.1.3	NONE 4.2.2	SMALL 4.2.3
Decommissioning	SMALL 4.2.1.4	NONE 4.2.2	SMALL 4.2.3
Section 4.3 - Transportation Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.3.1.1	NONE 4.3.2.1	SMALL 4.3.3.1
Operation	SMALL 4.3.1.2	NONE 4.3.2.2	SMALL 4.3.3.2
Aquifer Restoration	SMALL 4.3.1.3	NONE 4.3.2.3	SMALL 4.3.3.3
Decommissioning	SMALL 4.3.1.4	NONE 4.3.2.4	SMALL 4.3.3.4
Section 4.4 - Geology and Soils Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.4.1.1	NONE 4.4.2	SMALL 4.4.3
Operation	SMALL 4.4.1.2	NONE 4.4.2	SMALL 4.4.3
Aquifer Restoration	SMALL 4.4.1.3	NONE 4.4.2	SMALL 4.4.3
Decommissioning	SMALL 4.4.1.4	NONE 4.4.2	SMALL 4.4.3
Section 4.5 - Water Resources Impacts (Surface Water and Wetlands)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.5.1.1.1	NONE 4.5.1.2	SMALL 4.5.1.3
Operation	SMALL 4.5.1.1.2	NONE 4.5.1.2	SMALL 4.5.1.3
Aquifer Restoration	NONE 4.5.1.1.3	NONE 4.5.1.2	NONE 4.5.1.3
Decommissioning	SMALL 4.5.1.1.4	NONE 4.5.1.2	SMALL 4.5.1.3
Section 4.5 - Water Resources Impacts (Groundwater)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)

Table 2-2. Summary of Impacts			
Construction	SMALL 4.5.2.1.1	NONE 4.5.2.2	SMALL 4.5.2.3
Operation	MODERATE/SMALL 4.5.2.1.2	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Aquifer Restoration	MODERATE/SMALL 4.5.2.1.3	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Decommissioning	SMALL 4.5.2.1.4	NONE 4.5.2.2	SMALL 4.5.2.3
Section 4.6 - Ecological Resources Impacts (Vegetation)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.6.1.1.1.1	NONE 4.6.2	SMALL 4.6.3
Operation	SMALL 4.6.1.2.1	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	SMALL 4.6.1.4	NONE 4.6.2	SMALL 4.6.3
Section 4.6 - Ecological Resources Impacts (Wildlife)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.6.1.1.1.2	NONE 4.6.2	MODERATE/SMALL 4.6.3
Operation	SMALL 4.6.1.2.2	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.2.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	SMALL 4.6.1.2.4	NONE 4.6.2	SMALL 4.6.3
Section 4.7 - Air Quality Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.7.1.1	NONE 4.7.2	SMALL 4.7.3.1
Operation	SMALL 4.7.1.2	NONE 4.7.2	SMALL 4.7.3.2
Aquifer Restoration	SMALL 4.7.1.3	NONE 4.7.2	SMALL 4.7.3.3
Decommissioning	SMALL 4.7.1.4	NONE 4.7.2	SMALL 4.7.3.4
Section 4.8 - Noise Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.8.1.1	NONE 4.8.2	SMALL 4.8.3
Operation	SMALL 4.8.1.2	NONE 4.8.2	SMALL 4.8.3

Table 2-2. Summary of Impacts			
Aquifer Restoration	SMALL 4.8.1.3	NONE 4.8.2	SMALL 4.8.3
Decommissioning	SMALL 4.8.1.4	NONE 4.8.2	SMALL 4.8.3
Section 4.9 - Historical and Cultural Resources Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.9.1.1	SMALL 4.9.2	MODERATE/SMALL 4.9.3
Operation	SMALL 4.9.1.2	SMALL 4.9.2	SMALL 4.9.3
Aquifer Restoration	SMALL 4.9.1.3	SMALL 4.9.2	SMALL 4.9.3
Decommissioning	SMALL 4.9.1.4	SMALL 4.9.2	SMALL 4.9.3
Section 4.10 - Visual and Scenic Resources Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.10.1.1	NONE 4.10.2	SMALL 4.10.3
Operation	SMALL 4.10.1.2	NONE 4.10.2	SMALL 4.10.3
Aquifer Restoration	SMALL 4.10.1.3	NONE 4.10.2	SMALL 4.10.3
Decommissioning	SMALL 4.10.1.4	NONE 4.10.2	SMALL 4.10.3
Section 4.11 - Socioeconomics (Demographics)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.1	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.1	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11 – Socioeconomics (Income)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.2	NONE 4.11. 2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.2	NONE 4.11. 2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3

Table 2-2. Summary of Impacts			
Section 4.11 - Socioeconomics (Housing)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.3	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.3	NONE 4.11.2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11 - Socioeconomics (Employment Structure)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.4	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.4	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11 - Socioeconomics (Local Finance)			
	Alternative1—Proposed Action	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.5	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.5	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11 - Socioeconomics (Education)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.6	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE 4.11.1.2.6	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11 - Socioeconomics (Health and Social Services)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.7	NONE 4.11.2	SMALL 4.11.3

Table 2-2. Summary of Impacts			
Operation	MODERATE 4.11.1.2.7	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.12 - Environmental Justice			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Operation	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Aquifer Restoration	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Decommissioning	NONE 4.12.1	NONE 4.12.2	NONE 4.12.3
Section 4.13 - Public and Occupational Health and Safety Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.13.1.1	NONE 4.13.2	SMALL 4.12.3.1
Operation	MODERATE/SMALL 4.13.1.2	NONE 4.13.2	MODERATE/SMALL 4.13.3.2
Aquifer Restoration	SMALL 4.13.1.3	NONE 4.13.2	SMALL 4.13.3.3
Decommissioning	SMALL 4.13.1.4	NONE 4.13.2	SMALL 4.13.3.4
Section 4.14 - Waste Management Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.14.1.1	NONE 4.14.2	SMALL 4.14.3
Operation	SMALL 4.14.1.2	NONE 4.14.2	SMALL 4.14.3
Aquifer Restoration	SMALL 4.14.1.3	NONE 4.14.2	SMALL 4.14.3
Decommissioning	SMALL 4.14.1.4	NONE 4.14.2	SMALL 4.14.3

2.4 Preliminary Recommendation

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation regarding the proposed action. The NRC staff recommends that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Lost Creek ISR Project) are not so great as to make issuance of a source material license an unreasonable licensing decision. Additionally, the NRC staff has concluded that the applicable environmental monitoring program described in Chapter 6 and the proposed mitigation measures discussed with the impacts in Chapter 4 would further reduce potential adverse environmental impacts associated with the proposed action.

The NRC staff has concluded that the overall benefits of the proposed action outweigh the environmental disadvantages and costs based on consideration of the following:

- Most of the potential impacts to environmental resource areas are expected to be SMALL, with the exception of geology and soils, groundwater, some areas of socioeconomics, and public and occupational health and safety during operation, and wildlife and cultural resources during construction, where such impacts would be MODERATE.
- ISR operations would take place in ore zone aquifers previously exempted by the U.S. Environmental Protection Agency as potential public drinking water sources. Additionally, the applicant would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Finally, the applicant would be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.
- Both construction and operations at the ISR facility would adhere to the guidelines provided by the WGFd for species of concern, such as the sage grouse.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region.

The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

2.5 References

10 CFR Part 40 Appendix A. *Code of Federal Regulations*, Title 10, Energy, Part 40 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

40 CFR Part 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index."

43 CFR Part 3809. Code of Federal Regulations, Title 43, *Public Lands - Interior*, Part 3809, "Surface Management."

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EIA (Energy Information Administration). 1995. "Decommissioning of U.S. Uranium Production Facilities." Office of Coal, Nuclear, Electric, and Alternate Fuels. DOE/EIA-0592. February 1995.

EPA (Environmental Protection Agency). 2008a. "Technical Report on Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining: Mining and Reclamation Background." Volume 1. Office of Radiation and Indoor Air / Radiation Protection Division. EPA-402-R-08-005. April 2008.

EPA (Environmental Protection Agency). 2008b. "Health and Environmental Impacts of Uranium Contamination in the Navajo Nation: Five-Year Plan." requested by House Committee on Oversight and Government Reform. June 9, 2008.

LCI, 2008a. Lost Creek ISR, LLC. *Lost Creek Project Environmental Report, Volumes 1 through 3* (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008.

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National Environmental Policy Act of 1969 (NEPA). 42 USC 4321 et seq.

NRC, 2009. *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*. NUREG-1910, Vol. 1 and 2. May 2009.

NRC, 2003. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs—Final Report." Washington, DC: NRC. August 2003.

3 AFFECTED ENVIRONMENT

3.1 Introduction

The Lost Creek ISR Project is located in the Great Divide Basin, in a rural northeast area of Sweetwater County, Wyoming. The proposed project is about 113 km (70 mi) southeast of the City of Lander, and approximately 64 km (40 mi) northwest of the City of Rawlins (see Figure 1-1). The project area encompasses approximately 1,709 ha (4,220 ac) of semi-arid land with the area of direct land disturbance from proposed ISR construction and operations consisting of approximately 115 ha (285 ac) (LCI, 2008a).

This chapter describes the existing site conditions of the Lost Creek ISR Project. For the purposes of this SEIS, the term "study area" refers to the 1,709 ha (4,220 ac) project area plus an area extending 3.2 km (2 mi) as suggested in NUREG-1569 unless it is specified as a different radius for a particular resource (NRC, 2003). The resource areas described in this section include land use, transportation, geology and soils, water resources, ecology, noise, air quality, historical and cultural resources, visual and scenic resources, socioeconomics, and public and occupational health. Relevant impact topics were selected based on agency and public concerns, regulatory and planning requirements, and known resource issues. The information provided in this chapter would be used as context for comparing the potential impacts of each alternative, which are presented in Chapter 4: Environmental Impacts.

3.2 Land Use

The proposed Lost Creek ISR Project is located in the southeast quadrant of the Wyoming West Uranium Milling Region (GEIS, NRC 2009) in the rural northeast section of Sweetwater County, Wyoming, and encompasses approximately 1,709 ha (4,200 ac) of land. The project area is about 24 km (15 mi) southwest of the Town of Bairoil (population approximately 100), 61 km (38 mi) northwest of Rawlins (population approximately 8,500), and about 144 km (90 mi) southwest of Casper (population approximately 50,000). The regional landscape consists of rolling plains with some draws, rock outcroppings, ridges, bluffs and some isolated mountainous areas. Vegetation is primarily sagebrush and rabbit brush. The area is sparsely populated, and the closest residence is approximately 24 km (15 mi) from the project area boundaries. The weather is dry and windy, with short, hot summers and cold winters. There is no perennial surface water, and only a few ephemeral drainages that could convey surface runoff during spring snowmelt and following intense rainstorms. Figure 1-1, Lost Creek Project Location Map, shows the location of the proposed project area within Sweetwater County, and within the State of Wyoming. Primary access to the proposed project area is currently from the west via Wamsutter-Crooks Gap Road on the proposed primary access road (Lost Creek Road). Land uses within the proposed project area include rangeland, pastureland, recreation, and mineral and natural resource extraction (Sweetwater County, 2005).

The entire project area is composed of public land, approximately 85 percent of which is owned by the U.S. Federal government and administered by the BLM, with the remaining 15 percent of the land owned by the State of Wyoming. Within the extended study area (3.2 km [2 mi] outward from the property borders of the proposed project area), 96 percent of the area is federally owned, three percent is owned by the State of Wyoming, and one percent is privately owned. Figure 2-2, Land Ownership, shows how the federal and state land ownership is divided within the project area. Their usage is described in the following sections.

3.2.1 Rangeland

Three BLM grazing allotments--Stewart Creek, Green Mountain, and Cyclone Rim encompass the entire project area. The Cyclone Rim allotment occupies the largest land area within the project area at approximately 1000 ha (2,500 ac). The Stewart Creek and Green Mountain allotments occupy the remaining approximately 680 ha (1,700 ac) of land within the project area. All three BLM grazing allotments continue outside the project area and the study area to occupy a large portion of northeast Sweetwater County (Figure 3-1). The grazing allotments are mostly used by cattle, with a small number of horses and sheep.

The productivity of the grazing lands is measured by animal unit months (AUMs). An AUM is defined as the amount of forage to sustain one mature cow or the equivalent, based on an average daily forage consumption of 11.7 kg (26 lb) of dry matter per day. The total AUMs for the study area is 3,662. These grazing allotments are used for rangeland capable of supporting approximately 305 head of cattle with year round grazing sustenance (LCI, 2008b). Large expanses of open land used historically for grazing provide a valuable cultural resource in terms of views and agricultural activity, as well as an economic source of income for ranchers and the State of Wyoming (NRC, 2009).

Two herd management areas (HMAs) for wild horses also overlap the project area, the Stewart Creek HMA and the Lost Creek HMA. These two HMAs cover the same area as the BLM grazing allotments: the Lost Creek HMA coincides with the Cyclone Rim Allotment, and the Stewart Creek HMA coincides with the Stewart Creek allotment.

3.2.2 Hunting and Recreation

Recreational activities that occur within 32 km (20 mi) of the project area include fishing, hiking, river rafting, camping and wildlife viewing. Land within and surrounding the proposed project area is also used for regulated hunting of certain animals that occur in the area. Antelope, deer, elk, and mountain lion are the predominant types of game that are hunted within the region. Both the number of licensed hunters, and the wildlife taken from the area are summarized in Table 3-1.

Table 3-1. Hunting Statistics for Hunt Areas that Include the Project Area

Game	Hunter Days	Active Licenses	Total Harvest	Hunter Success (Percent)	Outfitters	Hunting Area
Antelope	683	233	229	98.30	19	Chain Lakes
Deer	544	126	12	9.50	7	Chain Lakes
Elk	496	82	42	51.20	3	Shamrock Hills
Mountain Lion	NA	NA	1	NA	5	Red Desert

Source: WGFD 2007 NA= No Data

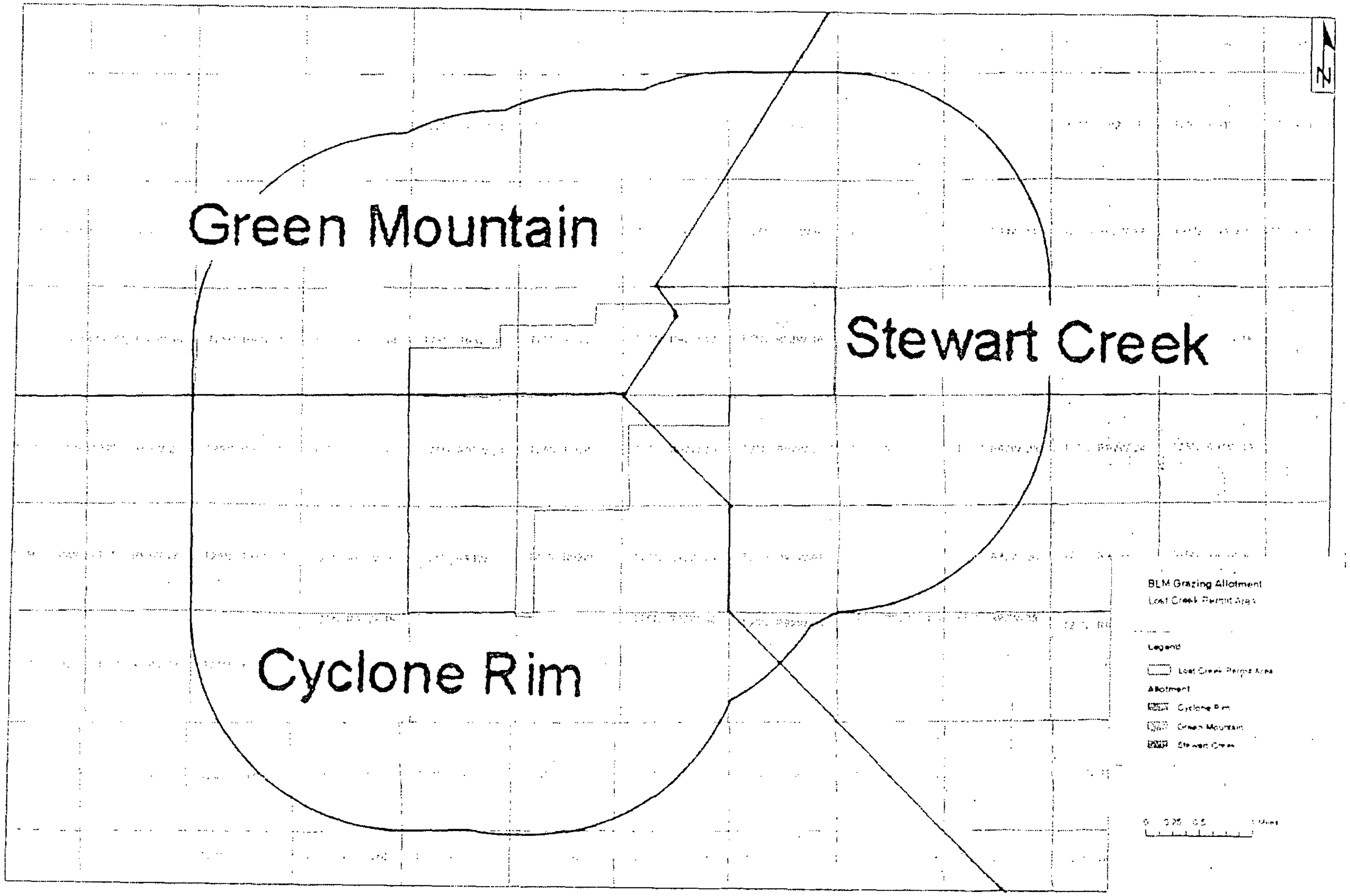

Figure 3-1. BLM Grazing Allotments

There are several fishing outfits that operate within 24 km (15 mi) of the project area. The closest known fishing areas to the project area are Lost Creek and Lost Creek Butte Lake, which are located approximately 16 km (10 mi) from the project area. There are also designated camping sites in the Green Mountains located 13 km (8 mi) to the north of the project area.

3.2.3 Minerals and Energy

While the lands encompassing the project area are occupied by the Stewart Creek, Green Mountain, and Cyclone Rim BLM grazing allotments, portions of these public lands are also used for natural resource extraction, which is classified as a subcategory use of pasturelands and rangelands. The mining industry accounts for approximately 20 percent of all economic activity conducted in Sweetwater County. The principal natural resources that are sought out within the vicinity of the project area are uranium, oil and gas, coal, and other minerals. Oil recovery operations via CO_2 injection are in the final stages in the Lost Soldier-Wertz Fields area, near the town of Bairoil. There are also several conventional and ISR uranium mining facilities that are located within the vicinity of the project area. The closest facility to the project area is the Sweetwater Mill operated by Kennecott Energy, which is a licensed conventional uranium mill located approximately 8 km (5 mi) south-southwest of the project area (NRC, 2009).

3.3 Transportation

The Lost Creek ISR Project lies within the sparsely populated Great Divide Basin in the southern portion of the Wyoming West Uranium Milling Region. Interstate 80 (I-80) traverses the southern portion of the basin from east to west. The main north-south artery is U.S. 287, which traverses the eastern portion of the Great Divide Basin between Rawlins and Muddy Gap. The only other transportation routes in the basin are State Route (S.R.) 73 (Bairoil Road), the County Routes of Carbon, Sweetwater, and Fremont Counties, and BLM roads (Figure 2-5). Both county and BLM roads are maintained gravel surfaces. The maximum posted speed limit for rural portions of interstates is 120 kilometers per hour (kmph), or 75 miles per hour (mph), with urban postings of 96 kmph (60 mph). State highways have a maximum posted speed limit of 104 kmph (65 mph) (NRC, 2009).

Transportation to the project area would be predominantly from I-80 at Wamsutter, Wyoming, north on Wamsutter–Crooks Gap Road to the proposed primary access road (Lost Creek Road) entering the project area from the west (Figure 3-2). Alternate site access would be via I-80 at Rawlins, Wyoming, north for about 24 km (15 mi) on U.S. 287, west approximately 40 km (25 mi) on Mineral Exploration Road (CR 63) then 9.6 km (6.0 mi) north on Sooner Road to the proposed access road entering the project area from the east (LCI, 2008a). Each of these roads is paved with the exception of Sooner Road. The distance from the location of the proposed plant facility to the nearest public road is 7.6 km (4.7 mi) west to Wamsutter – Crooks Gap Road and 7.2 km (4.5 mi) east to Sooner Road. The nearest paved, two-lane road is S.R. 73 in Bairoil, 31 km (19 mi) to the northeast. Bairoil has a population of approximately 100, and is the location of the nearest airstrip, town offices (including a police station) and school.

The primary interstate and U.S. highways are well maintained. The county roads providing access to the project area are generally maintained by the county biannually and are in fair condition, depending on the season and how recently maintenance occurred. These roads are infrequently plowed in the winter. Only two-track dirt roads are now present within the actual project area. These were installed for historical oil and gas and uranium exploration activities, and to support livestock and wildlife grazing. They are currently used for ranching, hunting, off-highway vehicle (OHV) use, antler collecting, and ongoing exploration. These roads have no drainage relief and are sometimes impassible during the winter months. Additional roadway data, such as the speed limit and average daily traffic, are provided in Table 3.3-1 of the ER (LCI, 2008a).

Two roads plan to be upgraded to access the project area. The primary access road would connect the Crooks Gap-Wamsutter Road to the west, while the secondary access road would connect the Sooner (BLM 3215) Road to the east. The western access road would carry the large, heavy-duty trucks carrying materials and supplies, while the majority of the workers (in light-duty trucks) would likely access from the east. It is estimated, during construction, that 30-35 light-duty trucks and 2-5 heavy-duty trucks would ingress and egress the site on a daily basis. During facility operation, activity would drop to about 20 light-duty and 2-5 heavy-duty trucks (including 1-2 trucks carrying yellowcake slurry), daily. These roads would be upgraded to BLM standards, as they involve BLM-administered land (min. 20-foot travelway, 2 percent crown, max. 10 percent grade). Other improvements would include: 1) 6-inch compacted road base; 2) ditch slopes 3:1, or greater; 3) BLM-approved cattle guards; and 4) culverts, posts and signage (LCI, 2009).

Access to the project area, as previously described, can be accomplished from several directions: 1) from Casper (105 miles) via WY 220, US 287, WY 73, CR 22, and BLM #3215; 2) from Rawlins (50 miles) via US 287, CR 63, and BLM #3215; 3) from Wamsutter (40 miles) via Wamsutter-Crooks Gap Road (CR 23); and 4) from Jeffrey City (30 miles) via CR 23.

On-site, approximately 15 light-duty trucks would travel among mine units for monitoring and maintenance, while about 10 drill rigs would be operating at any given time installing wells and delineating the ore body. These vehicles would utilize existing and new two-track roads. On-site roads and shown in Figure 3-3.

Crash data analysis on the regional roads was also conducted for the ER (LCI, 2008a). Data on truck crashes and truck volumes between 2002 and 2006 was used to calculate crash rates. For all of the study area roadways, the truck crash rates were negligible. In fact, on SR 73, no truck crashes occurred during the study period. Additional traffic information is available in Section 3.2.2 of the GEIS (NRC, 2009).

Figure 3-2. Regional Road Network

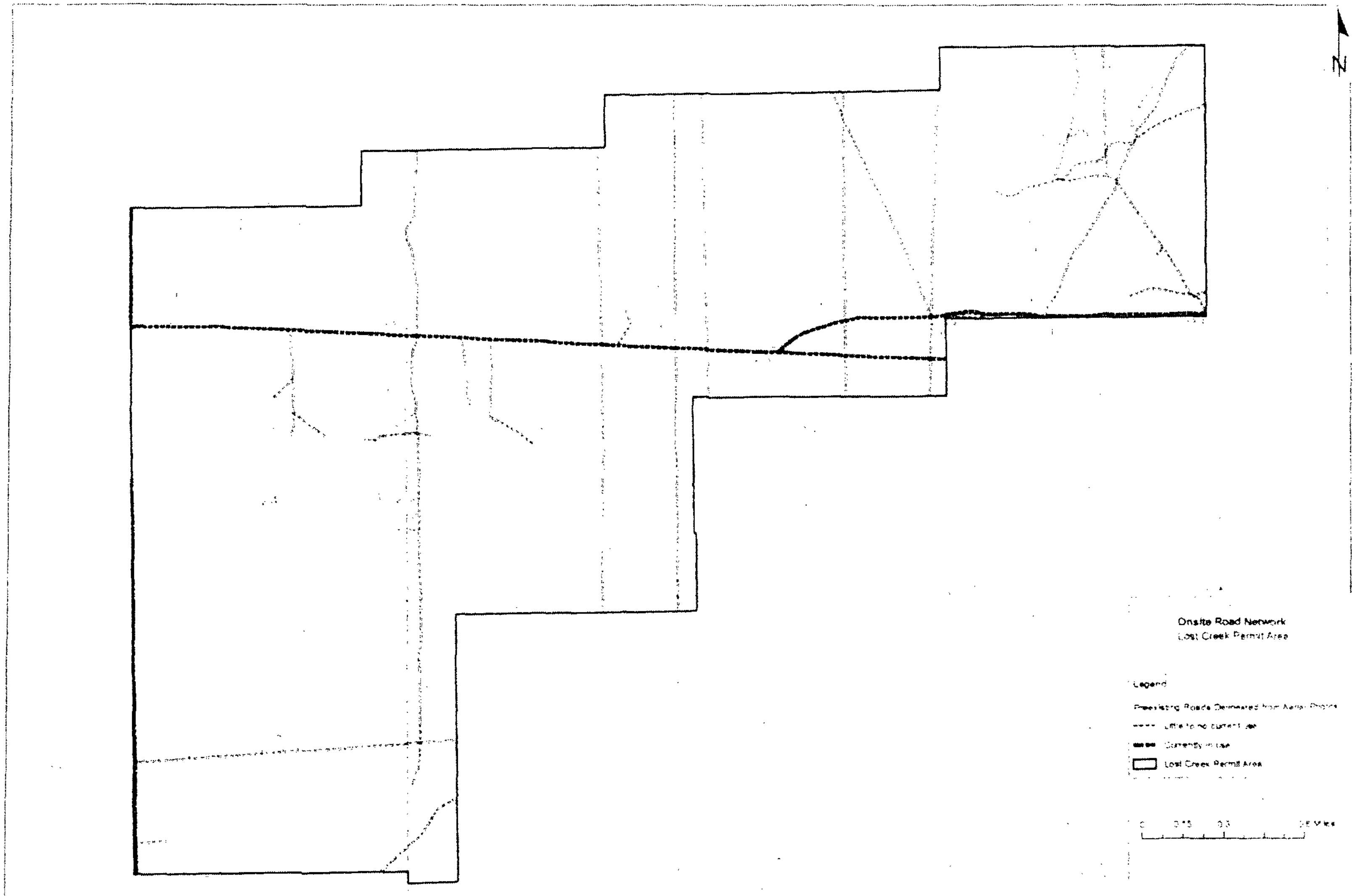

Figure 3-3. On-site Roads

3.4 Geology and Soils

The description of Wyoming West Uranium Milling Region included in the GEIS provided a general description of the regional geology and soils for the project area (NRC, 2009).As indicated in the GEIS, two major uranium districts, the Crooks Gap area of the Great Divide Basin and the Gas Hills area of the Wind River Basin, are found in the Wyoming West Uranium Milling Region. The proposed Lost Creek facility is located in the south-central portion of the Crooks Gap area of the Great Divide Basin. The following is a discussion of the geology and soils of the Crooks Gap area and, more specifically, the Lost Creek project area.

3.4.1 Geology

The Crooks Gap Uranium District is located in the Great Divide Basin, an oval-shaped structural depression, encompassing some 8,960 km^2 (3,500 mi^2) in south-central Wyoming (GEIS, NRC 2009). The project area is located near the north-central part of the basin. The Basin is bounded on the north by the Green and Granite Mountains, on the east by the Rawlins Uplift, on the south by the Wamsutter Arch and on the west by the Rock Springs Uplift. As indicated in the GEIS, the dominant source of sediment in the Great Divide Basin was Precambrian (greater that 540-million-year-old) granitic rock of the Sweetwater Arch. Uplift of the Sweetwater Arch began to affect sedimentation in the adjacent Great Divide Basin in the Late Cretaceous tine (65 to 99 million years ago). Rapidly subsiding portions of the Basins received thick clastic wedges of predominant arkosic sediments, while more slowly subsiding portions of the basin received a greater portion of paludal (marsh) and lacustrine (lake) sediments. Sediment transported southward into the Great Divide Basin was deposited on an apron of alluvial fans. One of the major fans is centered near the Crooks Gap Uranium District. Deposition within the basins probably continued through the Miocene (5.3 to 23.8 million-year-old), but post-Miocene erosion has completely removed the Oligocene and Miocene units.

The formation hosting the major sandstone-type uranium deposits in the Great Divide Basin is the Battle Spring Formation. The Battle Spring Formation outcrops (surfaces) occur throughout the study area. Thus, the Battle Spring Formation lies at the surface of most of the project area, although thin deposits of Quaternary (as old as 2.6 million years) sediments are present within surface drainages in the project area. Generally, in the Great Divide Basin, Battle Spring and Wasatch Formations, which were deposited at equivalent times, inter-finger with one another. In the project area, the upper half of the lithologic units (rock units grouped according to similarity in characteristics such as color, mineralogic composition, and grain size) consists of Battle Spring Formation and the lower half is made up of Wasatch Formation. The applicant indicates that the total thickness of the Battle Spring and Wasatch Formations under the project area is about 1,890 m (6,200 ft). The Fort Union Formation is 1,417 m (4,650 ft) thick beneath the project area and unconformably underlies the Battle Spring/Wasatch Formations. Deeper in the Basin and lying unconformably are various Cretaceous, Jurassic, Triassic, Paleozoic, and Precambrian basement lithologic units (LCI, 2008b). A schematic geologic cross section across the project area is shown in Figure 3-4 depicting the entire lithologic units that are present under the project area (LCI, 2008b).

As indicated by the applicant, the Battle Spring Formation in the project area is part of a major alluvial system, consisting of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones. Conglomerate beds may exist locally. The uranium mineralization is associated with finer-grained sandstones and siltstones, which may contain minor organic matter in a few areas. The upper portion of the Battle Spring Formation is host to the uranium mineralization in the project area.

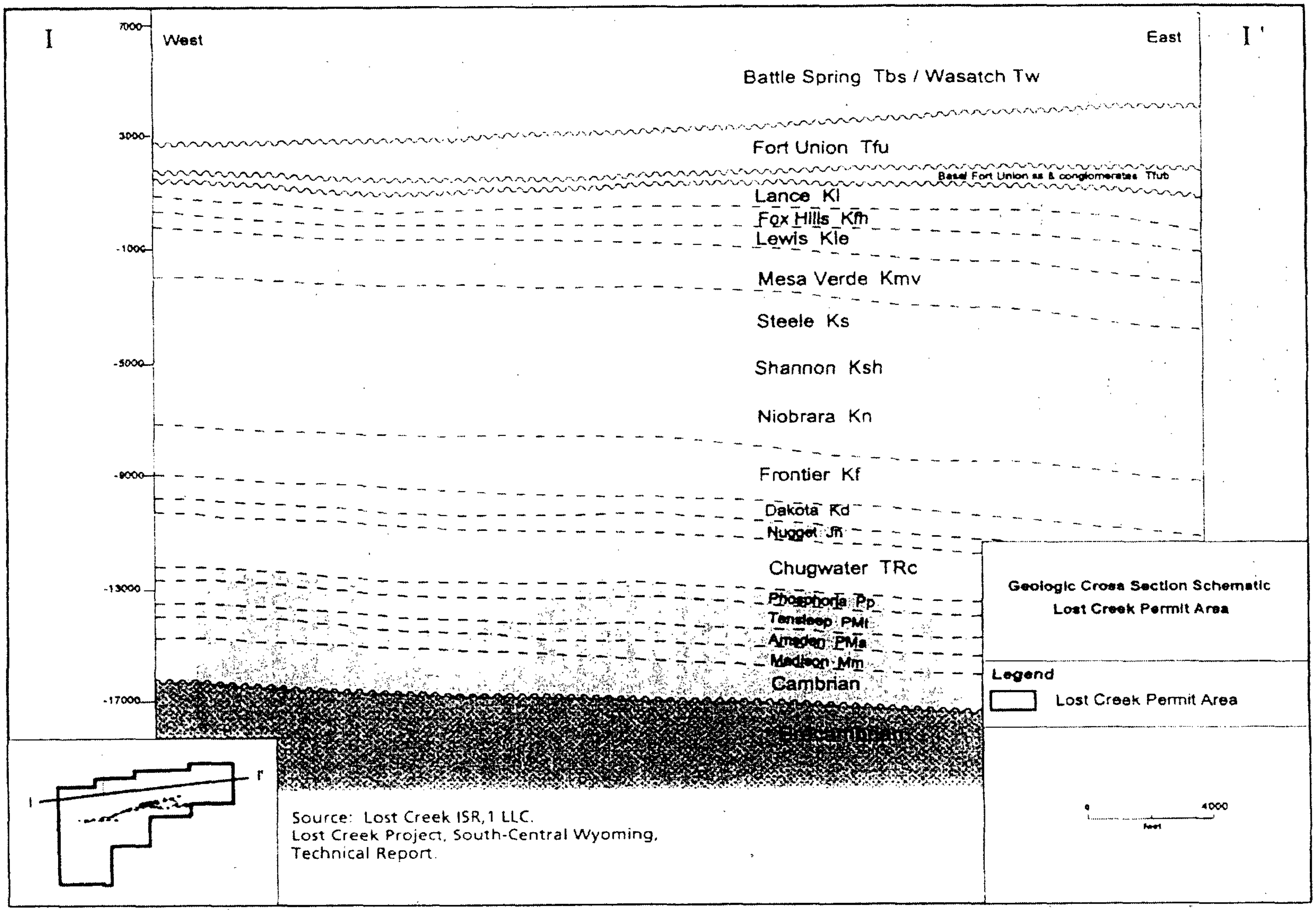

Figure 3-4. Project Geologic Cross-Section

The age of mineralization in the Battle Spring Formation is considered to be between 35 and 26 million years before present. Uranium mineralization in the Basin generally occurs either as tabular or C-shaped roll-front deposits. Oxygen-rich ground water, carrying dissolved uranium, entered various sandstones in the Basin. The water percolated down dip, oxidizing the sandstones on its way down dip. Upon reaching sites rich in organic matter, the water lost its oxidizing potential and deposited the uranium, forming the two types of mineralization mentioned above. The presence of pyrite and carbonaceous material appear to be the major controlling factors for the precipitation of uranium mineralization. Thinning of sandstones and diminishing grain size probably slowed the advance of the uranium-bearing solutions and further enhanced the chances of precipitation in the location of the pumping tests.

The applicant has stated that known mineralized intervals are found at depths ranging from near surface down to 350.5 m (1,150 ft) below the surface in the project area. It is possible that deeper mineralization may exist as well. The main mineralization horizons trend in an east-northeast direction for at least 4.8 km (3 mi), and are up to 609.6 m (2,000 ft) wide. The thickness of individual mineralized beds at the project area ranges from five to 8.5 m (28 ft) and averages about 4.9 m (16 ft). The mineralization grade ranges from 0.03 percent to more than 0.20 percent equivalent uranium oxide (U_3O_8). Four main mineralized horizons, from depths of 106.6 to 182.8 m (350 to 600 ft), have been identified. The richest mineralized zone occurs in the middle part of the HJ Horizon (MHJ Sand) and it is about 9 m (30 ft) thick, 122 to 137 m (400 to 450 ft) deep, and is believed to contain more than 50 percent of the total resource under the project area.

In the project area, the top 213 m (700 ft) of the Battle Spring Formation is divided by the applicant into at least five horizons marked from top to bottom as BC, DE, FG, HJ, and KM (see Figure 3-4). These horizons are sandstone layers separated from one another by various thicknesses of shale, mudstone and siltstone. Each of these sandstones may themselves contain some shale, mudstone, and/or siltstone lenses. The two horizons with most mineralization, the HJ and the KM, have been divided into upper, middle and lower sub-units of these sandstones (UHJ Sand, MHJ Sand, and LHJ Sand; and UKM Sand, MKM Sand, and LKM Sand).

The primary uranium production zone is identified as the HJ horizon, although the KM horizon may be considered for mining at a later date. The HJ horizon is bounded above and below by extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale, respectively. While these shales are aerially extensive, large sections of the Sage Brush Shale are less than 3.4 m (10 ft) thick in the proposed mine area, and several areas of the Lost Creek Shale are less than 3.4 m (10 ft) thick in the proposed project area. The FG sand directly overlies the Lost Creek Shale and the KM Sand directly underlies the Sage Brush Shale. The FG and DM sands are also composed of multiple sand units that are separated by discontinuous shales, mudstones, or siltstones. In a manner similar to HJ Horizon, the FG and KM Sands have been divided by the applicant into upper, middle, and lower subunits (UFG, MFG, LFG, UKM, MKM, and LKM). Geological cross sections through the mineralized zones in the project area are presented in Plates 2.6-1a, b, c, d, and e of the ER (LCI, 2008a). Thickness (isopach) maps of the HJ Horizon and UKM Sand, as well as the shales above HJ (Lost Creek Shale) and below HJ (Sage Brush Shale), are presented in Plates 2.6-2a, b, c, and d of the ER (LCI, 2008a).

The top of the HJ Horizon ranges from approximately 116 to 153 m (340 to 450 ft) below ground surface (bgs). The HJ Horizon is 37 to 44.3 m (110 to 130 ft) thick, averaging about 41 m (120 ft). The thinner part of HJ is generally south of the Fault (see below). A thicker part of the HJ Horizon runs parallel to the Fault. The mineralization is mostly concentrated in the middle part of the HJ Horizon and occurs as both roll front and tabular deposits. The subdivided sand units within the HJ horizon are separated by discontinuous shale, siltstone, and mudstone. The total thickness of the overlying FG Horizon is approximately 30 m (100 ft). The top of the FG Horizon occurs at depths approximately 61 m to 76 ft (200 to 250 ft) on the north side of the Fault and 91 to 107 m (300 to 350 ft) bgs on the south side of the fault within the project area. Directly underlying the Sage Brush Shale, the UKM Sand is typically 9 m to 18 m (30 to 60 ft) thick but can reach over 23 m (75 ft) in thickness. The top of the UKM Sand is usually between 137 and 183 m (450 and 600 ft) bgs within the project area.

The geologic structure in the project area is rather simple. The Battle Spring Formation dips gently to the west at three degrees and only one fault (*e.g.*, the Fault) was identified in the study area. The Fault has previously been identified as a "scissor fault" that extends the length of the project area from the west-southwest to the east-northeast. A scissor fault is a fault in which the offset or displacement of the formations on either side of the fault increases in one direction from an initial point along and decreases in the other direction. However, the applicant (LCI) has recently indicated that the Fault may not actually be a scissors fault and that it may be eventually be reclassified. The Fault was initially interpreted to be a scissor fault, with a reversal of displacement direction occurring in the western third of the Permit Area. Recent interpretation has revealed that it is, instead, a sequence of sub-parallel faults with opposite displacement occurring in an en echelon configuration.

The fault runs through the mineralized area that is intended for mining, and solution mining is planned on both sides of the fault. As a result, the sandstones and alternating confining layers in the mining zone are off-set and not continuous through the mining area. The maximum displacement at the west end of the project area is around 13.7 m (45 ft), dropping down to the north; whereas the displacement on the east side of the project area is about 24 m (80 ft) the down-dropped side to the south, creating the scissor fault.

3.4.2 Soils

The project area has not been surveyed by the Natural Resource Conservation Service (formerly the Soil Conservation Service). The closest third-order soil survey to the project area was conducted in 1994 for the permitting of the Kennecott Uranium Company's Sweetwater Mill, which, at the time, was owned by Sweetwater Syndicate Inc. This survey used soil associations as the mapping unit and described six soil associations within a 31-km^2 (12-mi^2) study area on the Sweetwater property.

A soil survey was conducted according to protocols in the National Soil Survey Handbook (1993), which provides major principles and practices for soil surveys. Data from the soil profiles were used to create soil map units (SMUs) on the base map. SMU boundaries were refined with surface soil pits excavated to a depth of 30.48 cm (12 in). SMUs were numbered from north to south. Because this was the first soil survey to be completed in the project area, the soils were classified to the family level instead of the series level.

The soils within the project area are typical of the semiarid areas of the western U.S. Most of the soil has developed from the sedimentary bedrock of the project area. The precipitation of the region is not enough to leach the majority of calcium and divalent cations from the soil profile. As a result, the soil pH tends to be slightly alkaline. Vegetation is also limited by the amount of precipitation in this region. As a result, the soils tend to have low organic matter.

The vertical relief of the project area is approximately 79 m (260 ft). Due to the relative lack of relief and uniform surficial geology, there are only three exposed soil types within the project area. The three units are very similar in color, depth of horizons, and geomorphic surface. The primary difference between the three soils is the texture; and, therefore, soil texture is the only difference in the three family names when separately designated.

Each of the three soil units is described below; and the distribution of the soil units is shown on Figure 3-5.

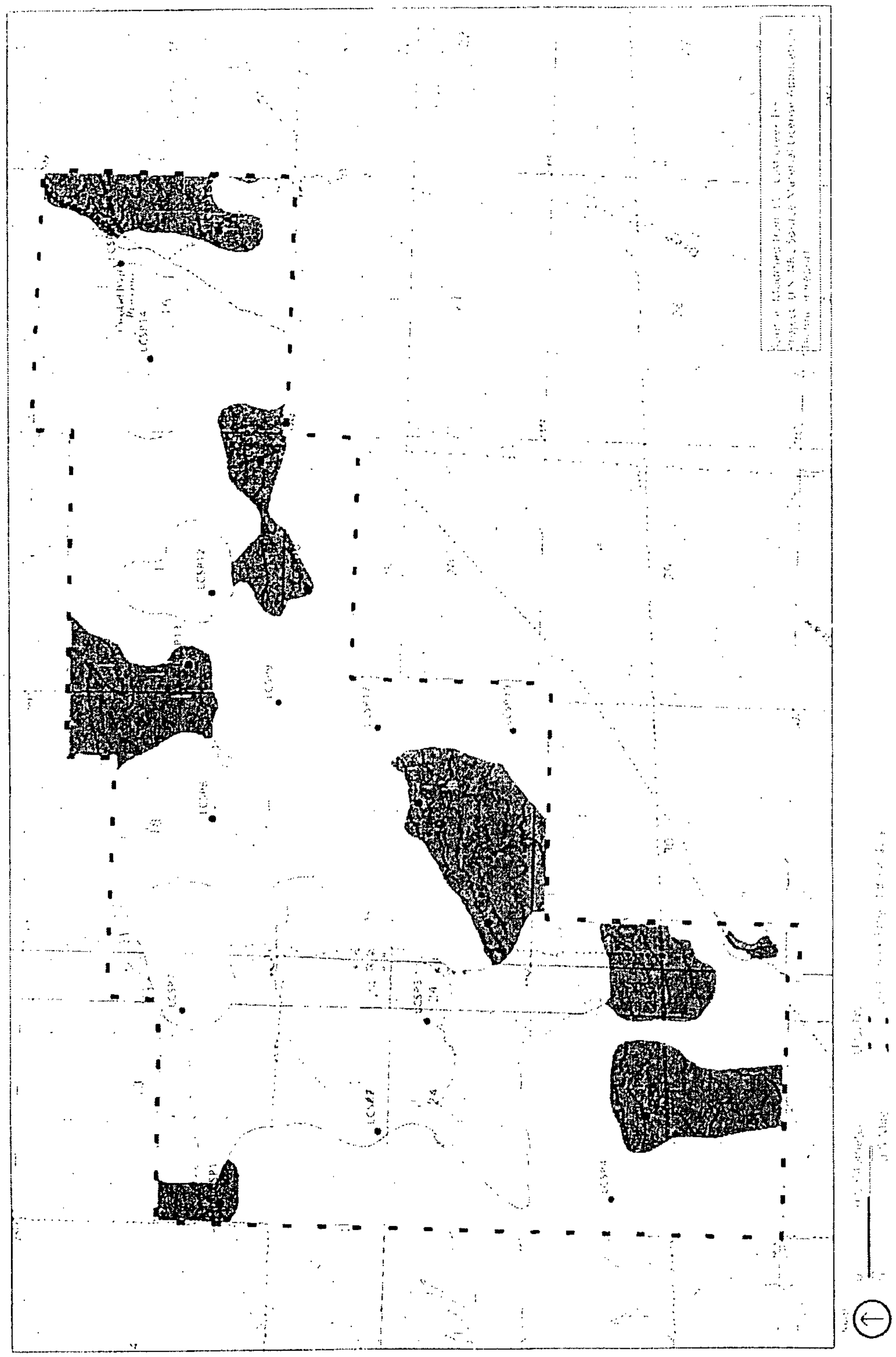

Figure 3-5. Project Soils Map

Thirty-four percent (581 ha [1,435 ac]) of the project area is *Typic Torriorthent*, loamy, mixed mesic. The soil is brown to yellowish-brown, and is typically five to 38 cm (15 in) thick. It generally occurs on the lower foot-slopes, where slopes are less than ten percent, but they can be as steep as 30 percent. The dominant vegetation is low-growing sagebrush with intermittent patches of grasses. The geomorphic surface ranges from bare loamy soil to pebbles and gravel-sized particles. A typical profile of this soil is brown to yellowish brown sandy loam; and the subsoil is a brown to pale-brown sandy loam that extends to depths greater than 76 cm (30 in; LCI, 2008b).

Forty-six percent (786 ha [1,941 ac]) of the project area is *Typic Torriorthent*, fine-loamy, mixed mesic. This soil is abundant in the down-slope areas of the region, where slopes are very gradual. The dominant vegetation is sagebrush, with scattered grasses and cacti. The geomorphic surface consists of bare, fine sandy loam. The upper profile contains a dark, grayish-brown silt loam to loam that is about 23 cm (9 in) thick. The subsoil is a dark yellowish-brown to light yellowish-brown and extends to a depth of at least 68 cm (27 in; LCI, 2008b).

Twenty percent (342 ha [844 ac]) of the project area is *Typic Torriorthent*, fine-loamy over sandy, mixed mesic. The slopes are less than five percent and the dominant vegetation is low-growth sagebrush and scattered grasses. The geomorphic surface is bare loamy soil with approximately 25 percent gravel. The surface layer consists of a brown loam that is ten to 38 cm (15 in) thick. The subsoil is a brown to a light yellowish-brown sandy loam that extends to a depth greater than 51 cm (20 in; LCI, 2008b).

All soil units within the project area support similar vegetation types. The Lowland Big Sagebrush Shrubland is present in and immediately surrounding the ephemeral channels; and the Upland Big Sagebrush Shrubland is present over the remainder of the project area. The uniformity in vegetation across the project area indicates that the three soil units are roughly equally productive, and that plant growth is limited by precipitation and not by soil fertility (LCI, 2008b).

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

The GEIS (NRC, 2009) cites the water bodies within the Wyoming West Uranium Milling Region as ranging between Class 2AB (drinking water) and Class 4C (unsuitable for aquatic life) in reference to the WDEQ classification system. The only channel within the Lost Creek project area classified for water quality by the WDEQ is Battle Spring Draw, achieving a rank of Class 3B. It is presumed that the unnamed tributaries would also be classified as Class 3B water bodies based on the physical similarities those channels share with Battle Spring Draw. The Class 3B designation is given to surface waters that can be used for recreation, wildlife, "other aquatic life," agriculture, industry, and scenic value. Class 3B waters are unsuitable for drinking water, game fish, non-game fish, and fish consumption.

3.5.1.1 *Drainage Basins*

The Lost Creek project area consists of 1,709 ha (4,220 ac) lying within the northeast headwaters of the Great Divide Basin (see Figure 3-6). The Great Divide Basin is a closed basin where surface waters drain to the basin center to feed seasonal playa lakes. Three sub-watersheds occur on the project site (see Figure 3-7). Battle Spring Draw comprises 239 ha (591 ac) in the far eastern end of the property; an unnamed tributary drains 802 ha (1,983 ac) in the center of the site; and another unnamed tributary drains 666 ha (1,646 ac) in the western end of the property (LCI, 2008b). Each of these sub-watersheds conveys surface water towards the south to the Battle Spring Flat, located approximately 14.5 km (9 mi) beyond the project boundary. In most instances, surface water flow infiltrates into the soil before reaching Battle Spring Flat. Any runoff that manages to reach Battle Spring Flat is eventually lost to soil infiltration and evaporation.

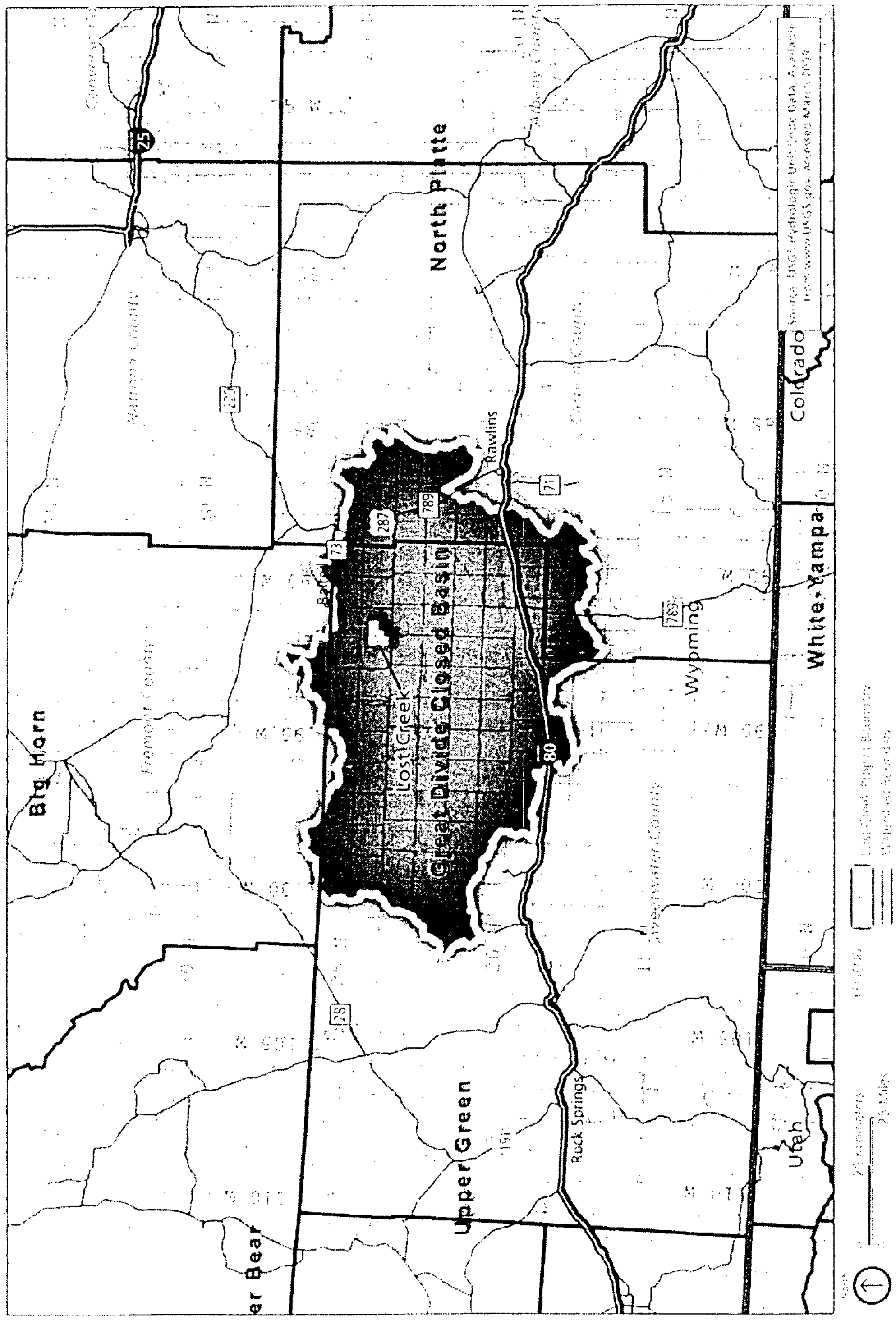

Figure 3-6. Regional Drainage Map

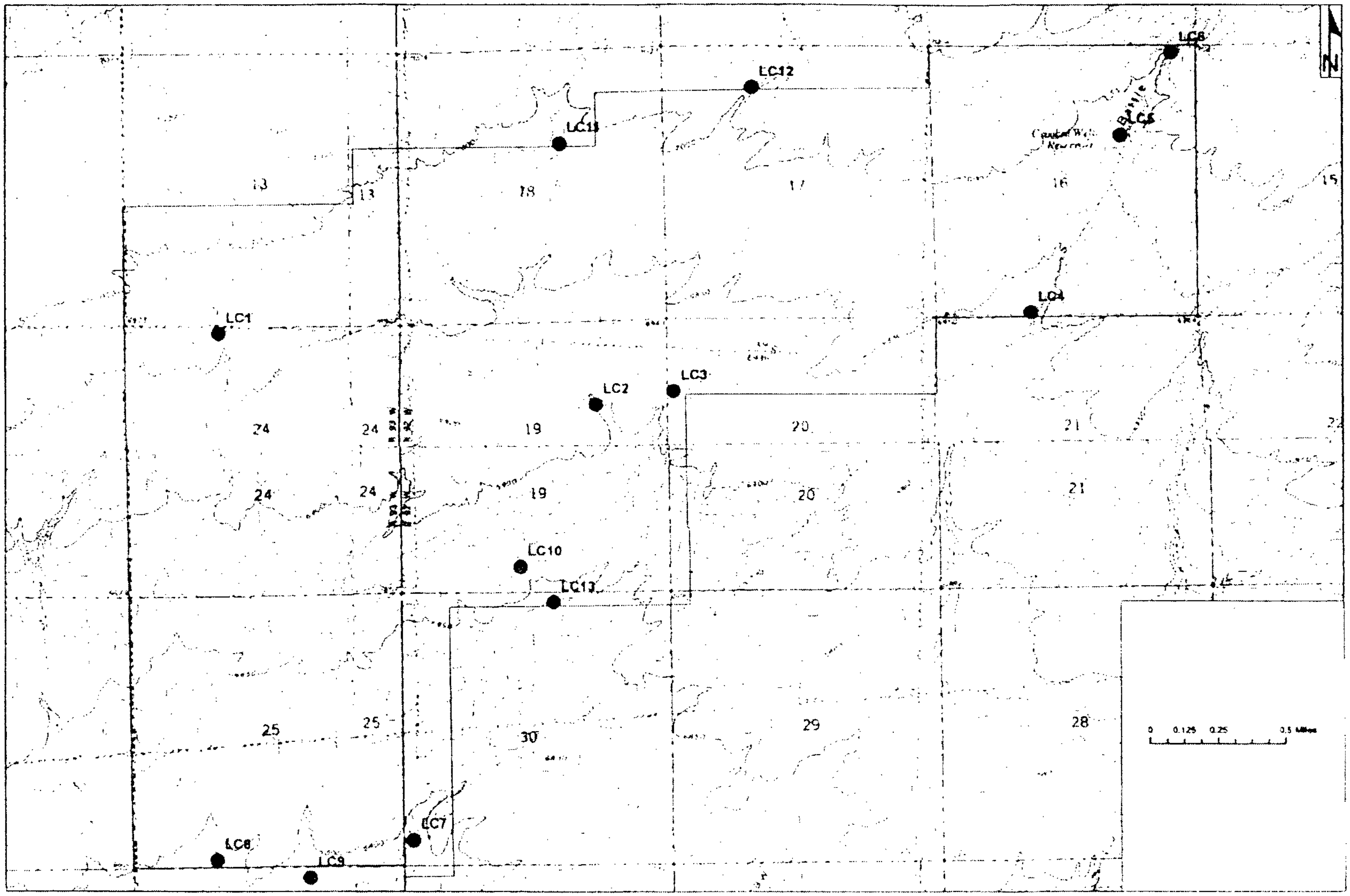

Figure 3-7. Area Watershed Map

3.5.1.2 *Surface Water Features*

Section 3.2.6.1 of the GEIS (NRC, 2009) provides general climate and precipitation information relative to the Lost Creek project area. This information is helpful in understanding the formation of stream channels and episodic nature surface water flow within the project area. In general, the arid conditions limit the formation of year round surface water and wetland features. Surface waters, particularly in the upper headwaters of the basin, are seasonal; associated with springtime snow melt. Alternately, runoff may occur in ephemeral fashion in response to extreme rainfall events. Otherwise, rainfall is sparse and is normally absorbed into the soil.

The Lost Creek project area contains numerous such ephemeral and meandering channels and washes. The only named channel is Battle Spring Draw, occurring on the eastern side of the property. No perennial or intermittent streams are present within the project area. Channels are typically incised approximately 0.9 to 1.8 m (3 to 6 ft) bgs and possess U-shaped, trapezoidal cross sections and steep side slopes. The channels offer limited habitat for aquatic life; rather, the principal function of the surface water features is simply conveyance and groundwater recharge.

One seasonal pond can be found within the project limits, called the Crooked Well Reservoir (LCI, 2008b). This 0.1-ha (0.25-ac) pond is an isolated depression located in the northeastern section of the property. Water from snow melt accumulates in the depression, but during the summer and fall seasons, the pond is dry. The principal functional value of this pond is seasonal drinking water for local wildlife and livestock.

3.5.1.3 *Surface Water Flow*

No actual gauging data are available for any streams within the Lost Creek project area. The peak flood flow was estimated for Battle Spring Draw based on a model developed by Miller (2003). This model utilizes basin characteristics and correlates the calculated results with known flow measurements from data for hundreds of gauged watersheds in Wyoming. Similar outcomes are predicted for the other unnamed channels located within the project area. The results, presented in Table 3.5-1 of the ER, show the calculated peak flow ranges between 0.65 cms (22.9 cfs) for the 2-year storm event to as high as 8.0 cms (282.8 cfs) for the 100-year storm event (LCI, 2008b). In general, the moderate stream channel gradients, rolling terrain, and steeply incised channels result in the containment and retention of peak surface flows within existing stream banks.

3.5.1.4 *Surface Water Quality*

Historic water quality data are available from samples taken in 1974 and 1975 (Table 3.5-2 of the ER). For the most part, the water quality from this period was good, although surface water sampling of Battle Spring Draw revealed high alkalinity (pH 9.5) and uranium concentrations (0.95 mg/l). In April 2006, twelve storm water samplers were installed at various locations upstream and downstream from the project area (Figure 3.5-4 of the ER). Another sampler was added in 2007. These storm water samplers were comprised of 1-L (0.26 gal) containers positioned in a manner that allowed the flow of surface water runoff to enter each container for unmanned collection. Samples were taken during snow melt in March and April. Seven of the twelve samplers were successful in collecting a full liter (0.26 gal) of water. The results from the samples are provided in Table 3.5-3 of the ER.

Most of the parameters measured were found to be below detectable limits, and the pH ranged from slightly acid to neutral (6.39 to 7.12). Wide variations in certain parameters were observed when the data collected in 1974/1975 were compared with that from 2006/2007, yet they remain unexplained. One possibility may be a difference in flow volumes during sampling, and hence, a difference in concentrations.

3.5.1.5 *Wetlands*

Wetlands include "those areas inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted to life in saturated soil conditions" (33 CFR Part 328.3). Wetlands are important resources that provide habitat for aquatic fauna and flora, filter sediments and toxicants, and provide floodwater attenuation. For purposes of this document, wetlands are relegated to vegetated surface waters.

As part of the Lost Creek application, an assessment was performed by the applicant to determine if any vegetated wetlands exist within the project site, and none were found. Crooked Well Reservoir is dry the majority of the year, and wetland vegetation has not been observed around this water feature.

The USACE regulates all "waters of the United States," the definition of which was recently influenced by the U.S. Supreme Court Decision *Rapanos v. United States (04-1034, 376 F. 3rd 629)*. Jurisdiction continues to be exerted for all traditional navigable waters, non-navigable tributaries of traditional navigable waters with relatively permanent flow, and wetlands directly abutting these systems. For systems that are isolated or tributaries that are not relatively permanent, the USACE requires a significant nexus determination to determine whether a particular water body is jurisdictional. A significant nexus determination is needed to evaluate whether the impact of a particular water body would result in more than a speculative or insubstantial effect on the chemical, physical, and biological integrity of a 'traditional' navigable water.

Due to the fact that all of the channels are ephemeral and that the project site lies within a closed, isolated basin, no surface water features on the property connect to a tributary of a navigable water body. As such, no surface waters within the Lost Creek project area are considered waters of the U.S. under the jurisdictional authority of the USACE (personal communication by A. Bjornsen with Omaha District, COE, 2009).

3.5.2 Groundwater

3.5.2.1 *Regional Groundwater Resources*

As indicated in the GEIS (Section 3.2.4.3), the Crooks Gap Uranium District, where the Lost Creek site is located, is part of the Wyoming West Milling Region (NRC, 2009). The Crooks Gap District lies within the Great Divide Basin, an internally closed drainage basin that contains uranium bearing aquifers and encompasses 10,250 km^2 (3,959 mi^2). Hydrologic recharge areas are predominately along the topographically elevated margins of the basin, hence surface and groundwater flow is toward the center of the basin. As the Lost Creek project area is northeast of the basin center, groundwater flow at the site is towards the southwest. Regionally, the Great Divide Basin is part of the regional Upper Colorado River Basin aquifer system, a 51,800 km^2 (20,000 mi^2) system that also includes the Green River and Washakie structural basins of southwestern Wyoming.

The Colorado River Basin aquifer system was subdivided by Whitehead (1996) into five principal aquifers; the Laney aquifer (Tertiary), the Wasatch/Battle Spring-Fort Union aquifer (Lower Tertiary), the Mesa Verde Aquifer (Cretaceous - Mesozoic), and Upper and Lower Paleozoic aquifers. In the project area the stratigraphic units that host the Laney aquifer, the Green River Formation, are not present. As such, at the Lost Creek site, the shallowest Lower Tertiary aquifers consist of sandstone units within the Wasatch/Battle Spring and Fort Union Formations. These formations are up to 3,350 m (11,000 ft) thick in Sublette County; about 2,135 m (7,000 ft) thick near the center of the basin in south-central Wyoming and over 1,890 m

(6,200 ft) thick in the project area. These uppermost aquifers serve as regional water supplies for drinking water and livestock, and also host a series of uranium-rich sedimentary units. While these aquifers are identified as the most important and most extensively distributed and accessible groundwater source in the study area by Collentine et al. (1981), the waters typically contain high levels of radionuclides (greater that EPA MCLs) within the basin and locally contain saline water where they are deeply buried. Below these Tertiary units is the Upper Cretaceous Lance/Fox Hills Formation that consists of very fine-grained sandstone, siltstone, and coal beds, which are not considered to be important aquifer units in the project area. Beneath this hydrologic system is a regionally continuous aquitard, the Upper Cretaceous Lewis Shale, which is between about 191 - 381 m (625 -1250 ft) thick in the project area. Due to its low permeability nature and significant thickness, the Lewis Shale is considered the base of the hydrogeologic sequence of interest within the Great Divide Basin.

Units deeper than the Lewis Shale, the Mesa Verde aquifer system, the top of which is 2286 m (7500 ft) bgs in the project area, consists of interbedded sandstones and shales underlain by Permo-Triasssic confining units approximately 5486 m (18,000 ft) bgs. The Mesa Verde aquifer is generally too deep to economically develop for water supply or have elevated TDS concentration that renders them unsuitable for human consumption. Below the Permo-Triassic confining units the principal aquifers in Paleozoic rocks are the Tensleep Sandstone of Pennsylvanian and Permian age and the Madison Limestone of Devonian and Mississippian age. Sandstone, limestone, and dolomite beds of Pennsylvanian to Cambrian age also are water bearing. Because they are the most deeply buried and contain saline water almost everywhere, the Paleozoic aquifers are rarely used for water supply in southwestern Wyoming. Locally, however, where aquifer units crop out near structural highs along the basin margin (e.g., the Rawlins Uplift and Rock Springs Uplift), water is less saline and contains lower concentrations of radionuclides due to their proximity to the recharge areas and shorter residence time in the formations.

3.5.2.2 *Local Groundwater Resources*

The Lost Creek Site is directly underlain by the Battle Spring Formation, the upper part of the shallow Lower Teritary aquifer system that extends to a depth of over 1,890 m (6,200 ft). The formation is interpreted to represent a major alluvial system, consisting of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones and finer grained beds, with conglomerate beds locally present. The multiple sandstone layers serve as the main water-bearing units and are typically under confined conditions between the finer grained units, but locally unconfined conditions exist. Regionally, the potentiometric surface within shallow aquifer units is usually within 61 m (200 ft) of the ground surface. Most wells drilled for livestock water supply in this unit are less than 305 m (1,000 ft) deep and draw water from the higher permeability sandstone units. Uranium mineralization in the Battle Spring Formation is associated with finer-grained sandstones and siltstones, which may contain minor organic matter in a few areas. This mineralization predominates in several horizons in the upper portion [top 213 m (700 ft)] of the Battle Spring Formation in the project area and its distribution described in more detail below.

3.5.2.3 *Uranium-Bearing Aquifers*

As discussed in Section 3.4.1, the top 213 m (700 ft) of the Battle Spring Formation was divided by the applicant into at least five horizons denoted from top to bottom as BC, DE, FG, HJ, and KM (see Figure 3-8). The primary uranium production zone for the Lost Creek project area is identified as the HJ Horizon. The HJ Horizon is subdivided into the Upper (UHJ), Middle (MHJ) and Lower (LHJ) Sands, which, based on pumping tests, appear to be hydraulically interconnected. As such, the applicant considers the combined HJ Sands as a single aquifer and has designated these sands as the production zone aquifer. The HJ sand units are bounded by areally extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale, which respectively overlie and underlie the proposed production zone. The FG Horizon overlies the Lost Creek Shale and the KM occurs beneath the Sage Brush Shale. The Lower FG (LFG) sand has been designated by the applicant as the aquifer overlying the production zone, and the Upper KM (UKM) sand has been designated as the aquifer underlying the production zone. The UKM, however, is also identified as a potential future production zone. The shallowest occurrence of groundwater within the project area is within the DE Horizon, with the depth to water table varying from approximately 24 to 46 m (80 to 150 ft) below ground surface. The DE Horizon is separated from the FG Horizon below by an unnamed shale layer approximately 9 m (30 ft) thick.

Within the HJ Horizon the bulk of the uranium mineralization is present in the MHJ Sand. The total thickness of the HJ Horizon ranges from 30 to 49 m (100 to 160 ft), averaging approximately 36.5 m (120 ft). The top of the HJ Horizon ranges from approximately 91 to 137 m (300 to 450 ft) bgs within the project area. The upper, middle and lower sand units are generally separated by discontinuous thin clayey units that do not act as confining units to prevent groundwater movement vertically between the HJ Sands horizons (LCI, 2008a).

Monitoring wells have been completed in HJ Horizon, the overlying aquifers (DE and LFG) and the underlying aquifer (UKM). Water levels have been measured in these wells to assess the potentiometric surface, groundwater flow direction, and hydraulic gradient of these units. Water level data is available from 2006 and 2007 monitoring events as well as from historical data taken in 1982. Based on 2007 data taken from wells screened in the HJ Horizon approximately 30.5 m (100 ft) apart on each side on the Fault, the potentiometric surface on the north side of the Fault is 4.6 m (15 ft) higher than on the south side of the Fault. The difference between water levels on either side of the Fault suggests that the Fault is a barrier to groundwater flow. Pumping tests conducted on site seem to support this view. However, some hydraulic influence was noted across the Fault during these tests, indicating that while the Fault acts as a barrier to flow, it is not impervious to groundwater flow. Based on the potentiometric maps, groundwater is inferred to flow to the west-southwest, generally consistent with the regional flow system. The Fault may direct groundwater in a more westward direction than would be the case if the Fault were not present.

The horizon hydraulic gradient for the HJ Sand, determined from water level data from 1982, 2006, and 2007, ranged from 0.0034 to 0.0056 m/m (ft/ft) (3.4 to 5.6 m/km [18.0 to 29.6 ft/mi]). The potentiometric surfaces developed from water level data for the LFG Sand are similar to those developed for the HJ Horizon. However, the data for the UKM Sand indicate that the difference in hydraulic heads across the Fault does not appear as pronounced for the UKM sand as for the other shallow sands. However, this observation may be influenced the limited number of monitoring wells in the UKM Sand. Horizontal hydraulic gradients calculated for the UKM Sand from available water level data ranged from 0.0053 to 0.0063 m/m (ft/ft) (5.3 to 6.3 m/km [28 to 33.3 ft/mile]). The available water level data were also used to evaluate vertical gradients. The data indicate that vertical gradients range from 0.05 to 0.34 between the LFG, HJ, and UKM aquifers and consistently indicate decreasing hydraulic head with depth.

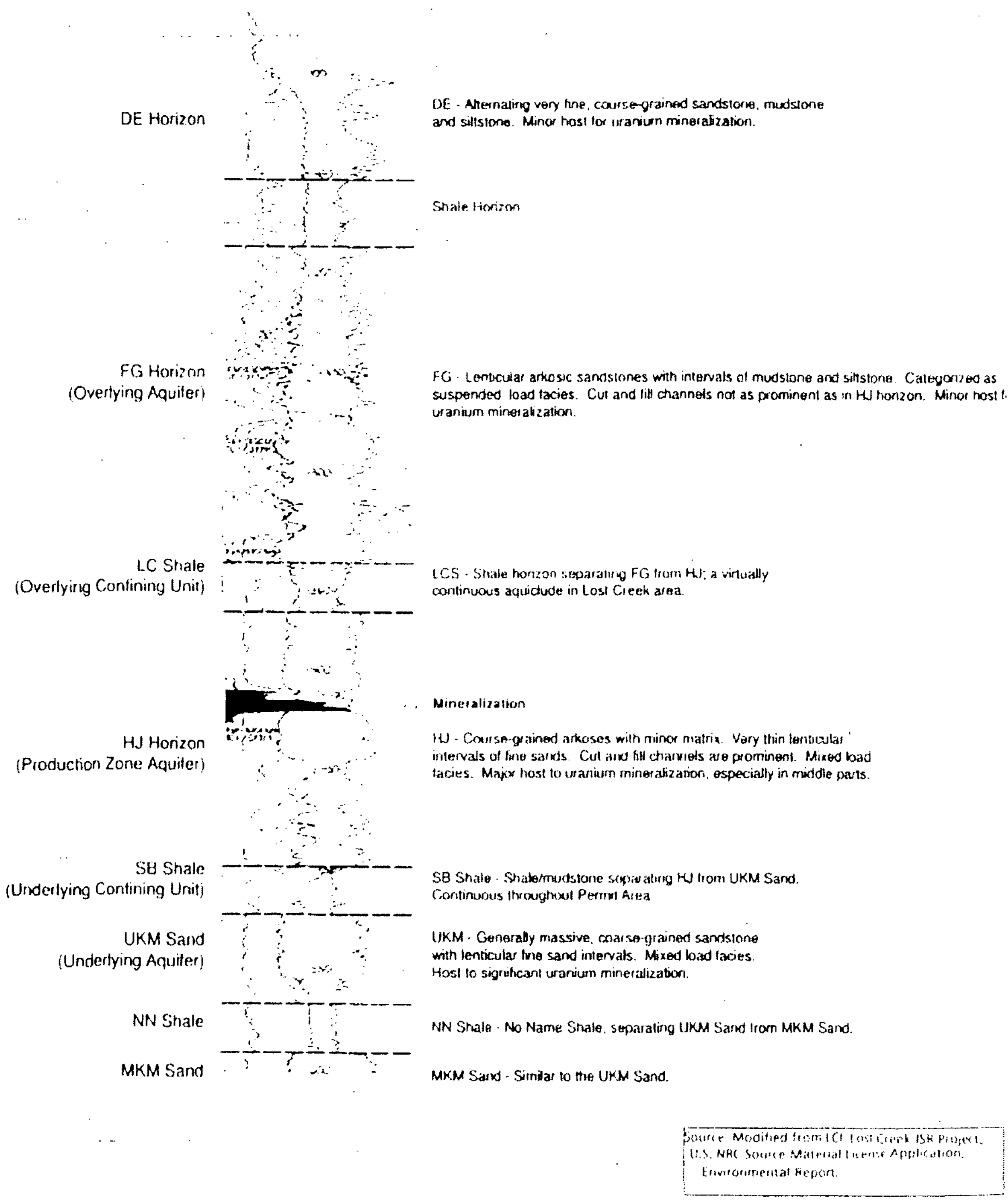

Figure 3-8 Hydrostratigraphic Units

3.5.2.3.1 Hydrogeologic characteristics

Aquifer properties for the Battle Spring aquifers within the project area have been estimated from historic and recent pumping tests. Hydro-Search Inc. performed a hydrologic evaluation in 1982 to determine the feasibility of in-situ production of the Conoco uranium ore body at Lost Creek. More recently in October 2006, several short-term single-well pumping tests and three longer multi-well pumping tests were performed (Hydro-Engineering, Inc., 2007). The range of transmissivity values for the HJ aquifer calculated from the data collected during the 2006 tests was from 4.1 to 37.2 m^2/day (44 to 400 ft^2/day [330 to 3,000 gallons per day/ft]). Although the 2006 testing was limited, none of the 2006 pumping tests of the HJ horizon indicates significant communication with the overlying or underlying aquifers. There was also no indication of hydraulic communication across the Fault in any of the 2006 pumping tests.

In June and July 2007, another long-term pumping test was conducted in the HJ aquifer at Well LC19M (Petrotek Engineering Corporation, 2007). While well LC19M had previously been tested during the 2006 pumping tests, the objectives of this test was to further develop aquifer characteristics of the HJ Horizon, to evaluate the hydraulic impacts of the Fault, and to demonstrate confinement of the production zone (HJ Horizon) aquifer. While LC19M is located on the north side of the Fault, HJ monitor wells were included on both sides of the Fault within distances likely to be impacted by the test were included as observation wells. The transmissivity calculated from five wells completed in the HJ aquifer on the north side of the Fault were similar, ranging from 2.8 to 7.0 m^2/day (30.0 to 75.5 ft^2/day) and averaging 6.3 m^2/day (68.3 ft^2/day). Storativity calculated from those wells range from 6.6×10^{-5} to 1.5×10^{-4} and averaged 1.1×10^{-4}.

In October 2007, an additional long-term pumping test was conducted in the HJ aquifer on the south side of the Fault in LC16M (LCI, 2008b). During the test, water levels were measured in monitoring wells in the HJ aquifer on both sides of the fault, as well as in the overlying and underlying aquifer on the south side of the Fault. The transmissivity calculated from five wells completed in the HJ aquifer on the south side of the Fault were similar, ranging from 5.6 to 9.3 m^2/day (60.3 to100.5 ft^2/day) and averaging 7.1 m^2/day (76.2 ft^2/day). Storativity calculated from those wells range from 3.5×10^{-5} to 9.1×10^{-4}.

The calculation of the transmissivity values in the two 2007 long-term pumping tests did not consider the effect of the fault, which limits groundwater flowing from the south in the first test and from the north in the second test, resulting in reduced estimates of transmissivity. As a result these transmissivities have been considered effective rather than actual transmissivities by the applicant. Actual transmissivities are likely to be larger than those calculated from the 2007 test data.

Minor responses to pumping were also observed across the Fault during both pumping tests. This response suggests that the Fault, while not entirely sealing, significantly impedes groundwater flow, even under considerable hydraulic stress. Small responses in water levels in the overlying and underlying aquifers were also observed during the both 2007 long-term pumping tests. While their cause is not clear, these responses suggest some hydraulic communication between the proposed HJ production zone and the overlying FG and underlying UKM aquifers.

3.5.2.3.2 Level of confinement

As discussed in Section 3.4.1, the HJ horizon is bounded above and below by a really extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale, respectively. While these shales are extensive, large sections of the Sage Brush Shale are less than 3.4 m

(10 ft) thick in the proposed project area, and several areas of the Lost Creek Shale are less than 3.4 m (10 ft) thick in the proposed project area. Data presented by the applicant indicate that in some locations within the mining units these confining units are only 1.5 m (5 ft) thick. These areas of thinning in the overlying and underlying confining layers suggest that there may be some hydraulic connection between the production aquifer and the overlying and underlying aquifers. These concerns are supported by the results of the 2007 pumping tests. Minor responses in the overlying and underlying aquifer were observed during these tests. A number of potential causes for these responses have been suggested in addition to leakage across the confining layers, including potential impacts from off-site pumping, leakage through abandoned boreholes, or communication across the Fault. However, the cause of these responses observed in the overlying and underlying aquifers during the 2007 pumping test have not been clearly identified. Thus, there remain some concerns regarding the degree of confinement of the HJ production aquifer. The applicant indicates that each mine unit would be subject to further extensive testing during the Mine Unit Test required before initiating solution extraction in each mine unit. This addition testing would employ a greater density of monitoring wells within the production zone aquifer and overlying aquifer on both sides of the fault. This additional hydrologic testing would provide better information regarding the cause of the drawdown response in overlying and underlying wells. These results will be provided in the Mine Unit Data Packages.

3.5.2.3.3 Groundwater Quality

In Wyoming, the quality of groundwater is measured against either US EPA Drinking Water Standards (40 CFR Part 142 and 40 CFR Part 143) which establish Maximum Contaminant Levels (MCLs) for specific chemical constituents or Wyoming Ground Water Quality standards. The Wyoming standards are based on ambient water quality and are divided into three Classes: Class 1 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, and Class Special (A) is defined as suitable for fish and aquatic life (WDEQ, 2005).

Lost Creek ISR, LLC established the site pre-operational groundwater quality in the Lost Creek license area from well data collected by recent sampling in 2006 and 2007 and historical sampling performed by Conoco in the late 1970s and early 1980s. The recent data included four quarters of water sampling in fall and winter 2006 and spring and summer 2007. The groundwater quality was measured in three wells in the DE surficial aquifer, four wells in LFG overlying aquifer, six wells in HJ ore zone aquifer and four wells UKM underlying aquifer. The location of the wells is shown in Figure 3-9. The applicant presented the groundwater quality data for all four quarters for all wells in Table 2.7-13 of the TR. The groundwater quality parameters measured included all suggested analytes in Table 2.7.3-1 of the standard review plan except silver.

NRC staff determined the average ground water quality in the Lost Creek license area from wells in the surficial DE aquifer, overlying LFG aquifer, HJ ore zone aquifer and UKM underlying aquifer from the data. The results are shown in Table 3-2. The table indicates that the average water quality in the surficial DE aquifer exceeded the WDEQ Class I, II and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra 226 and 228. These standards were exceeded in all wells for all quarters. One well, LC 31M in the far southwest corner of the license area exceeded the WDEQ Class I and EPA primary drinking water standards for sulfate and selenium for all four quarters.

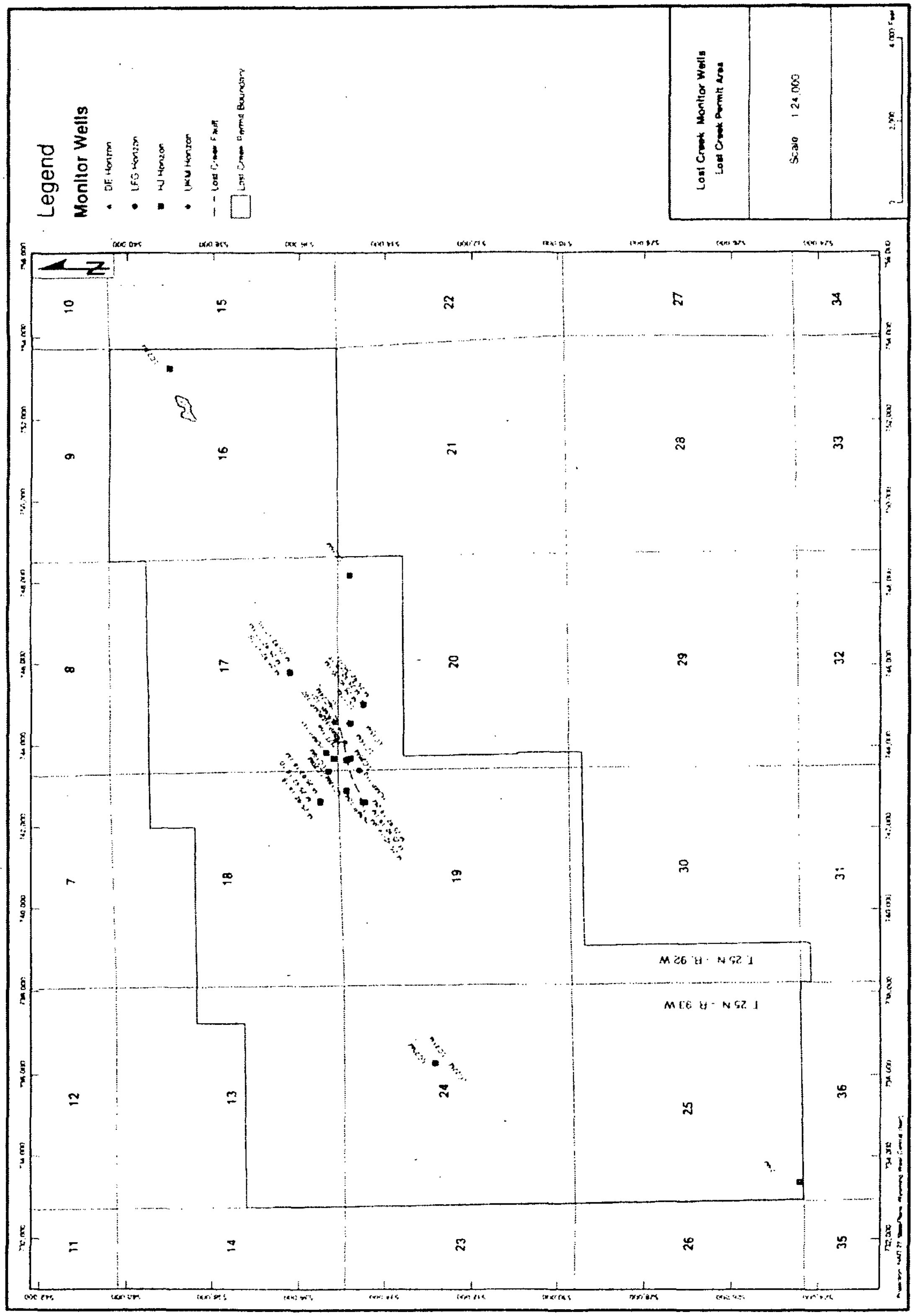

Figure 3-9. Monitoring Wells

Table 3-2. Average Pre-Operational Baseline Groundwater Quality for the Lost Creek License Area Aquifers

Water Quality Parameter	Lost Creek License Area				
	Water Quality Standards*	DE Surficial Aquifer	LFG Overlying Aquifer	HJ Ore zone Aquifer	UKM Underlying Aquifer
Bicarbonates as HCO3 (mg/l)		150	114	111	82
Carbonates as CO3(mg/l)		ND	2.5	3.5	27.8
Alkalinity (mg/l)		104.5	102.2	105.5	84.5
Chloride (mg/l)	250	6.3	5.3	5.5	5.5
Conductivity (umhos/cm)		566.8	463	485.9	558
Fluoride (mg/l)	2.0 - 4.0	0.3	0.21	0.21	0.20
pH (s.u.)	6.5 - 8.5	7.68-8.07	**7.32-8.57**	**7.85-9.51**	**7.66-11.6**
Total Dissolved Solids (mg/l)	500	347	296	311	297
Sulfate (mg/l)	250	135.7	121.5	131.9	117.6
Radium 226 (pCi/l)	*5*	**2.8**	**26.6**	**143.3**	**9.1**
Radium 228 (pCi/l)	*5*	**2.4**	**3.8**	**6.6**	**3.49**
Uranium (mg/l)	0.03	**0.74**	**0.41**	**0.17**	**0.031**
Gross Alpha (pCi/l)	0.01	**495.9**	**356**	**395.4**	**41.3**
Gross Beta (pCi/l)	2.0	157.7	107.9	117.5	23.1
Nitrogen, Ammonia as N (mg/l)	0.5	0.027	0.08	0.015	0.39
Nitrogen, Nitrate+Nitrite as N (mg/l)	10	0.7	0.6	ND	ND
Aluminum (mg/l)	0.05 to 0.2	ND	ND	ND	ND
Arsenic (mg/l)	0.1	0.003	0.003	0.006	0.006
Barium (mg/l)	2.0	ND	ND	ND	ND
Boron (mg/l)		ND	ND	ND	ND
Cadmium (mg/l)	0.005	ND	ND	ND	ND

Table 3-2. Average Pre-Operational Baseline Groundwater Quality for the Lost Creek License Area Aquifers

Calcium (mg/l)		68.1	58.8	67.7	51.5
Chromium (mg/l)	0.1 (total)	ND	ND	ND	ND
Copper (mg/l)	1.0	ND	ND	ND	ND
Iron (mg/l)	0.3	0.21	**0.37**	0.09	0.12
Lead (mg/l)	0.015	ND	ND	ND	ND
Magnesium (mg/l)		4.3	3.31	3.65	2.45
Manganese (mg/l)	0.05	ND	ND	ND	ND
Mercury (mg/l)	0.002	ND	ND	ND	ND
Molybdenum (mg/l)		ND	ND	ND	ND
Nickel (mg/l)	0.1	ND	ND	ND	ND
Potassium (mg/l)		2.3	3.1	4.4	10.9
Selenium (mg/l)	0.05	**0.079**	0.024	0.002	0.002
Silica (mg/l)		15.6	14.1	14.9	14.4
Sodium (mg/l)		40.3	32.3	31.5	36.2
Vanadium (mg/l)		ND	ND	ND	ND
Zinc (mg/l)	5.0	ND	ND	ND	ND

10 CFR Part 141 and 10 CFR Part 143
Wyoming Water Quality, Rules and Regulations, Chapter 8, Class 1, Domestic Ground Water
Note: Numbers in bold exceeded Wyoming Class I or EPA drinking water standards.

This well also had the highest values of uranium (1.4-2.1mg/l) and gross alpha (967-1430 pCi/L) of all wells at the site. The average water quality in the LFG overlying aquifer also exceeded the WDEQ Class I, II, and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra 226 and 228 in all of the wells over all four quarters. These standards were exceeded in all wells for all quarters. The four wells across the license ranged from 0.251-0.546 mg/l uranium.

The average water quality in the HJ ore zone aquifer also exceeded the WDEQ Class I, II, and III and EPA primary drinking water standards for gross alpha and combined Ra 226 and 228 in all but two of the wells over all four quarters. The exceptions were wells LCM27M and LCM28M, whose uranium concentrations were below the MCL of 0.03 mg/l; averaging 0.002 mg/l and 0.008 mg/l, respectively. Nonetheless, their gross alpha and combined Ra 226 and 228 values exceeded the aforementioned standards, which is consistent with the presence uranium ore bodies in the aquifer unit. Uranium concentrations in the waters from the other HJ sands monitoring wells had an average range of 0.065 to 0.552 mg/l, which is between 2 and 18 times the MCL for uranium. One well, LC 26M, in the eastern part of the license area, exceeded the WDEQ Class I and EPA secondary drinking water standards for sulfate and TDS.

The average water quality in the UKM underlying ore zone aquifer also exceeded the WDEQ Class I, II, and III and EPA primary drinking water standards for gross alpha and combined Ra 226 and 228 in all of the wells over all four quarters. Two of the wells, LC20M and LC24M, located in the ore zone area, also exceeded these standards for uranium.

The water quality data demonstrate that none of the aquifers tested near and within the ore zone in the Lost Creek license area meet WDEQ Class I, II, III or EPA primary drinking water standards for radionuclides. Nonetheless, for ISR operations to be conducted in an aquifer, it must be declared as an exempt aquifer by the EPA. An exempt aquifer is one that is not nor will ever be used for drinking water given its water quality. The water quality of the HJ sand production zone aquifer in the project area is Class VI under WDEQ standards, which under the State's classification means the groundwater can not be used for drinking, livestock or agricultural use as a consequence of its uranium and radium 226 concentrations. It would therefore be a candidate for an exempt aquifer declaration.

3.5.2.3.4 Current Groundwater Uses

The applicant has identified the groundwater users within 3.2-km (2-mi) and 8-km (5-mi) radii of the project area using the WSEO Water Rights Database (WSEO, 2006) and correspondence with the BLM. The majority of the groundwater-use permitted in the vicinity of the project area is for monitoring or miscellaneous mining-related purposes, and do not represent consumptive use of groundwater. Many of these permits are associated with the Kennecott Sweetwater Mine, which is in standby mode. Within a 3.2-km (2-mi) radius of the project area, all water use permits are those of the BLM. Each of these permits is associated with a well that supplies a stock pond (or tank). In addition, there is a fourth BLM well supply; a stock pond for which no water-use permit was found. These aforementioned wells are depicted on Figure 3-10 of the ER and are represented by well numbers 6, 10, 11, and 15 in the table below.

Table 3-3. Existing Wells within 5 Miles of Project Area					
Well No. (Map)	Well Permit Number/Name.	Well Depth (ft.)	Depth (ft.) to Static Water	Projected Aquifer Horizons	Projected Drawdown
1	P6572W	216	60	DE, FG	15 ft
2	P8444P	280	250	FG, HJ	160 ft
3	P8461P	600	-1	DE, FG	16 ft
4	P8462P	600	60	DE, FG	16 ft
5	P10696P	237	-1	DE, FG, HJ	160 ft
6	P13834P/4451	900	104	DE, FG, HJ, KM	40 ft
7	P47137W	unknown	unknown	unknown	unknown
8	P55108W	220	138	DE, FG	15 ft
9	P5111W	300	199	KM	15 ft
10	P5112W/4775	280	155	HJ, KM	199 ft
11	P55113W/4777	220	109	DE, FG	22 ft
12	P55114W	320	237	KM	15 ft
13	P63765W	380	140	DE, FG	15 ft
14	P183470W	unknown	unknown	unknown	unknown
15	Eagle Nest Draw	370	269	DE, FG	15 ft

Source: LCI, 2008a

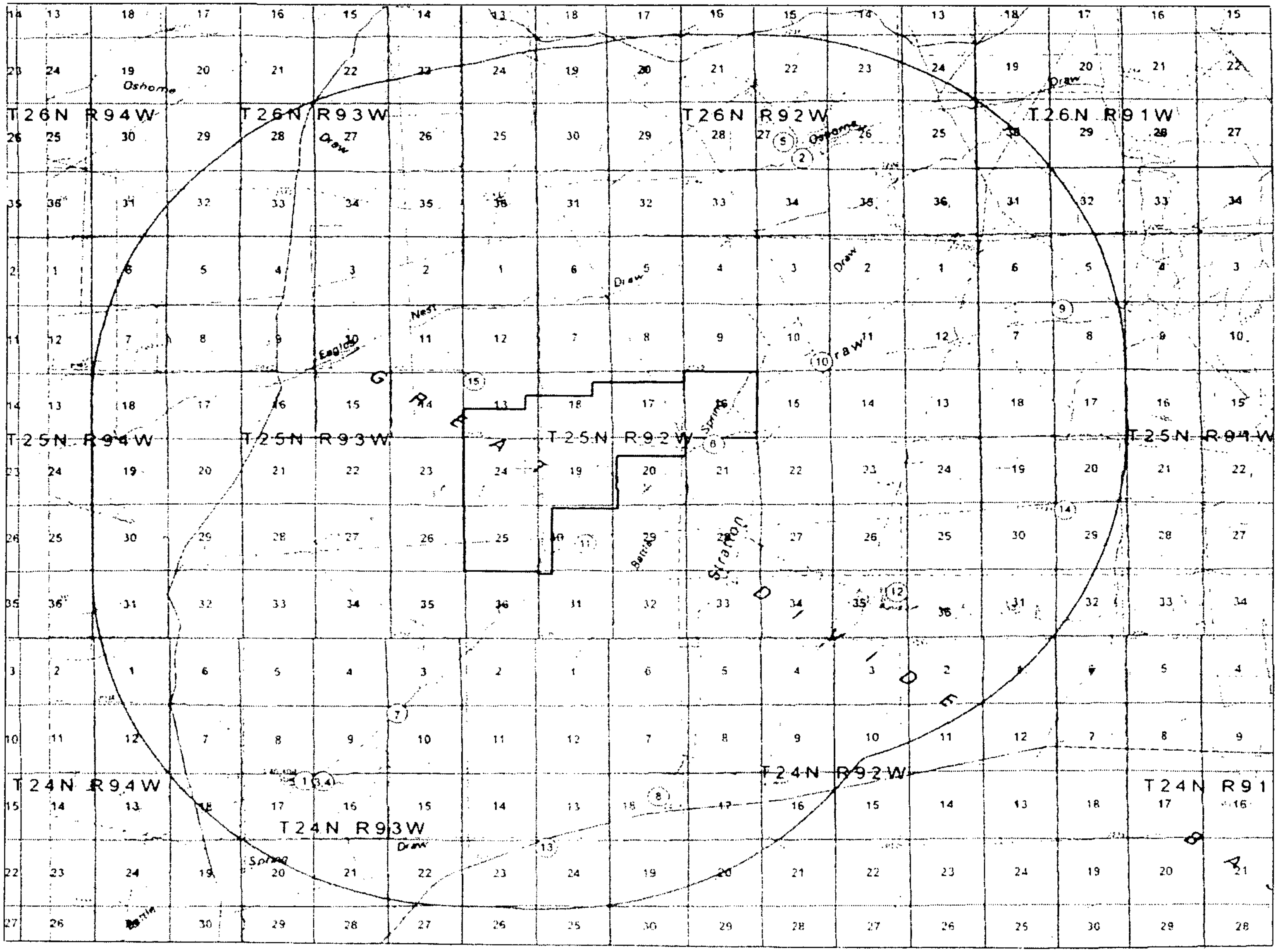

Figure 3-10. Domestic and Stock Wells within 5 Miles of Lost Creek Project Area

Within an 8-km (5-mi) radius, the applicant has identified fifteen active domestic or stock wells (including the four stock wells within a 3.2-km [2-mi] radius). Of these fifteen wells, the BLM has ten active or potentially active wells (and four associated stock ponds), located outside of the project area, but within an 8-km (5-mi) radius of impact around the project area boundary (LCI, 2008b). All of these wells are used for livestock watering. There are four other stock wells and one used by Kennecott Uranium within the 8-km (5-mi) radius of the project area. Eight of the BLM wells are at or shallower than the proposed the HJ Horizon production zone (~370 – 500 ft.), however, because the Battle Spring formation is said to dip 3 degrees to the west (Section 2.6.1.2, LCI TR, 2008), the HJ Horizon is expected to be progressively shallower to the east and deeper to the west of the site. As such, a projection of the HJ horizon would place three of the shallower wells to east and northeast (wells 2, 5 and 10) within the production horizon. The applicant has predicted potential drawdowns in the production zone aquifer of 54m (177 ft) at 3.2-km [2-mi] and 45m (148 ft) at 8-km (5-mi) (LCI, 2008c – RAI responses). Consequently, wells 2, 5 and 10 could be potentially be affected out to 8-km (5-mi) by ISR operations at Lost Creek.

3.5.2.4 *Surrounding Aquifers*

As indicated above, the Wasatch/Battle Spring Formation, the Fort Union Formation, and the Lance Formation are all of Tertiary age. They are considered part of the Tertiary aquifer system, which has been identified as the most important source of groundwater in the study area. Although some stock wells are known to be present in the Lance Formation along the formation's outcrop areas along the border of the Great Divide Basin, the groundwater in Lance Formation is largely undeveloped. Similarly, the Fort Union aquifer is largely undeveloped and unknown as a source of groundwater supply except in areas where it occurs at shallow depth along the margins of the basin. These surrounding aquifers are hydrologically upgradient of the proposed production zone at Lost Creek and are separated stratigraphically as well.

The most important aquifers within the Great Divide Basin are in the Wasatch and Battle Spring Formation. Most wells drilled for water supply in the Battle Spring Formation are less than 305 m (1,000 ft) deep. (Collentine et al., 1981) reports that wells completed in the Battle Spring aquifers typically yield 114 to 152 Lpm (30 to 40 gpm); but that yields as high as 568 Lpm (150 gpm) are possible. Water quality within the Battle Spring aquifer is generally good in the northeast portion of the basin with TDS levels usually less than 1,000 mg/L and frequently less than 200 mg/L. Sulfate levels are also generally low in the shallow aquifers of the Battle Spring aquifer. Notable exceptions to the relatively good water quality include waters with elevated radionuclides. The presence of high levels of uranium in Tertiary sediments and groundwater of the Great Divide Basin has been well documented.

Deep well injection has been proposed for the disposal of RO brines. Typically, deep well injection in the Great Divide Basin occurs in Upper Cretaceous formations several thousand feet below the Lower Tertiary production zones. The applicant has proposed four injection wells 2560m (8400 ft) deep (LCI, 2009); which is at the level of the Mesa Verde formation under the project area. The Mesa Verde formation is beneath the Lewis Shale aquitard. The applicant has indicated that it will apply for the requisite Class I Underground Injection Control (UIC) permits through WDEQ. As required, the disposal well will be completed (i.e., screened) in an approved subsurface formation(s) and will be operated according to the permit requirements.

3.6 Ecology

This section describes the terrestrial and aquatic ecological environments of the Lost Creek ISR project area and addresses T&E species that may potentially be present. The project area is within the Rolling Sagebrush Steppe of the Wyoming Basin ecoregion of the U.S. (Chapman et al., 2004). The Wyoming Basin ecoregion is a broad arid intermontane basin interrupted by hills and low mountains and dominated by grasslands and shrublands. Surrounded by sparsely-vegetated mountains, the region is drier than the Northwestern Great Plains ecoregion to the northeast and does not have the extensive cover of pinyon-juniper woodland found in the Colorado Plateaus ecoregion to the south. Much of the region is used for livestock grazing, although many areas lack sufficient forage to support this activity (Chapman et al., 2004).

Overall, this region is less hilly than the Foothill Shrublands and Low Mountains ecoregion. Average annual precipitation is 15 to 41 cm (6 to 16 in) and varies with elevation and proximity to mountains. The region has a continental climate with cold winters and mild summers. Natural vegetation is mostly sagebrush steppe, with the eastern edge of the region having more mixed grass prairie. Wyoming big sagebrush is the most common shrub with silver and black sagebrush occurring in the lowlands and mountain big sagebrush in the higher elevations. Frequent fires have affected the sagebrush steppe and, in some places, European annual grasses have replaced it. Most of the land is in rangeland, cattle and sheep ranches, or wildlife habitat (Chapman et al., 2004).

The elevation of the project area is approximately 2,100 m (7,000 ft) AMSL. With approximately 80 m (262 ft) of relief, sub-zero winter temperatures, and less than 25 cm (10 in) of annual precipitation, vegetation development and species diversity are limited.

3.6.1 Terrestrial Ecology

3.6.1.1 *Vegetation*

Vegetation surveys were conducted during the 2006 and 2007 growing seasons to obtain vegetative cover and species diversity data, with the study design being reviewed and accepted by the WDEQ (LCI, 2008b). Based on the vegetation surveys, two vegetation types were identified within the project area and mapped (Figure 3-11). The Upland Big Sagebrush Shrubland type dominates the flat upland areas and the gentle slopes, while the Lowland Big Sagebrush Shrubland type occurs in deeper soils along the gently sloped, south-facing ephemeral dry washes.

3.6.1.1.1 <u>Upland Big Sagebrush Shrubland</u>

The Upland Big Sagebrush Shrubland type covers most of the project area, occupying approximately 85 percent of the total land area (LCI, 2008b). Trees are sparsely scattered in this region, and grasses and sagebrush intermix with exposed ground. The only settings in the project area that do not support the Upland Big Sagebrush Shrubland habitat are in the deeper soils of the bottomlands and along the drainages, where the Lowland Big Sagebrush Shrubland type is found.

Big sagebrush (*Artemisia tridentate*) accounts for 54 percent of the cover by all species (LCI 2008a). Some associated grass species that occur in the Upland Big Sagebrush Upland include Sandberg bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), Indian ricegrass (*Oryzopsis hymenoides*), and thickspike wheatgrass (*Agropyron dasystachyum*). Cushion plants (compact, low growing, mat forming plants) are most common, but collectively account for only six percent of the cover by all species. The mean total vegetation cover in the Upland Big Sagebrush Shrubland was 26 percent; cover by litter and rock combined was 22 percent; bare soil cover was 52 percent; and the total ground cover (vegetation plus litter and rock) was 48 percent (LCI, 2008b). The percent cover by bare soil is a reflection of the sparseness of the vegetation in the Upland Big Sagebrush Shrubland type. Even though there is a considerable amount of bare soil, the vegetation development is very homogeneous across the upland parts of the project area. In general, vegetation development in the region is sparse due to the limited amount of annual precipitation. In all, 36 plant species were observed in the Upland Big Sagebrush Shrubland type.

3.6.1.1.2 Lowland Big Sagebrush Shrubland

The Lowland Big Sagebrush Shrubland type occurs along and immediately adjacent to the ephemeral drainages that cross the project area from north to south. Overall, the Lowland Big Sagebrush Shrubland covers approximately 15 percent of the project area (LCI, 2008b). The soils along the drainages tend to be deeper than those on the adjacent uplands and, thereby, have the potential for holding more moisture than the upland areas. Individual big sagebrush shrubs along these drainages tend to be larger than the shrubs growing on the upland areas.

The major species in the Lowland Big Sagebrush Shrubland type is big sagebrush, accounting for 72 percent of the cover by all species. Rabbitbrush (*Chrysothamnus)* accounts for eight percent of the total vegetation cover (LCI 2008a). These two shrub species dominate the vegetation to an extent that herbaceous species account for limited amounts of cover. Combined, all native perennial grasses encompassed a mean cover of seven percent (16 percent of the total vegetation cover) with Sandberg bluegrass *(Poa secunda),* thickspike wheatgrass *(Agropyron dasystachyum),* and squirreltail grass *(Sitanion longifolium)* occurring as the most prevalent perennial grass species. Forb species are present throughout the Lowland Big Sagebrush Shrubland, but all occurred at mean cover values that were less than one percent. As a group, all forbs and cushion plants accounted for approximately three percent of the total vegetation cover. The mean total vegetation cover in the Lowland Big Sagebrush Shrubland was 43 percent; with 34 percent cover by litter and rock; 23 percent bare soil cover; with a total ground cover (vegetation plus litter and rock) of 77 percent (LCI, 2008b). Overall, the vegetation cover in the Lowland Big Sagebrush Shrubland type was 17 percent greater than the cover in the Upland Big Sagebrush Shrubland type. In all, 43 plant species were observed in the Lowland Big Sagebrush Shrubland type.

3.6.1.2 *Wildlife*

General ranges for wildlife species in the Wyoming West Uranium Milling Region are presented in the GEIS (NRC, 2009). However, detailed inventories of the project area were conducted by LCI in 2006 and 2007 (LCI, 2008b). Wildlife inventories were designed to provide baseline data for licensing the ISR Project and to ensure that wildlife species and habitats are afforded adequate protection during construction, operations, and restoration. Data collection included file searches of state and federal agency documents, as well as field surveys for raptors, sage-grouse, and breeding birds. Wildlife studies focused on T&E species, Migratory Birds of High Federal Interest (MBHFI), raptors, sage-grouse leks and nesting habitat, breeding bird surveys, and Pygmy rabbits, as well as a general wildlife inventory of the project area (LCI, 2008b).

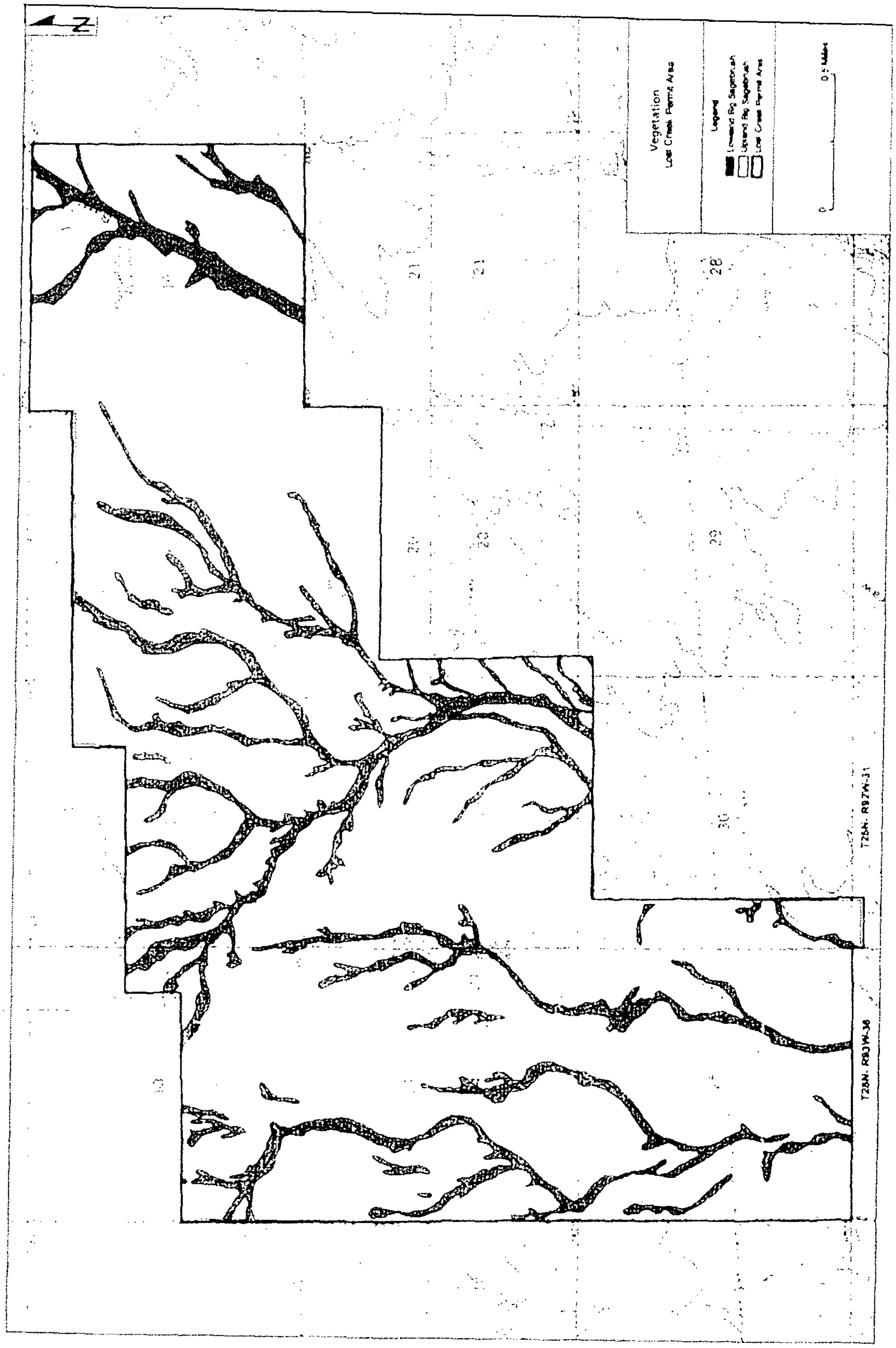

Figure 3-11. Site Vegetation Map

3.6.1.2.1 Wildlife Habitat Description

The Upland Big Sagebrush Shrubland wildlife habitat is generally found on flat and rolling hills. This habitat is important for pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), sage-grouse (*Centrocercus urophasianus)*, white-tailed prairie dogs (*Cynomys leucurus)*, and reptiles. Raptors, including eagles, falcons, hawks, harriers, and owls, often hunt in big sagebrush shrubland habitat.

The Lowland Big Sagebrush Shrubland wildlife habitat is found along drainages. This habitat type has significantly more vegetation cover than the Upland Big Sagebrush Shrubland and provides important food and cover for resident and migratory birds, reptiles, and small mammals. The taller big sagebrush provides nesting sites for raptors and critical forage for ungulates and sage-grouse during winters with extreme snowfall.

A total of 224 wildlife species potentially occur in the Lost Creek project area. Of these, 164 species are birds; 51 species are mammals; four species are amphibians; and five species are reptiles. Species that are known to exist in the study area, from observation or the presence of identifying signs, are listed in Table 3-5.

3.6.1.2.2 Big Game

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus canadensis*) were the only big game animals recorded in the project area during field surveys conducted by the applicant in 2006 and 2007. No crucial big game habitat occurs on or within several kilometers of the Lost Creek project area (University of Wyoming, 2008).

According to Wyoming Game & Fish Department (WGFD) Wildlife Observations System Data, pronghorn antelope are the most abundant big game species in the study area (LCI, 2008b). The project area is classified as Winter/Yearlong Range; an area where a population of animals makes general use of the habitat on a year-round basis. There is a significant influx of animals between December and April. The study area comprises a portion of the Red Desert Pronghorn Herd Unit (WGFD Hunt Area 61). Based on the 2007 Annual Big Game Herd Unit Job Completion Report, the Red Desert Pronghorn Herd had a nine-year (1998 through 2007) average population of 14,119 pronghorns (WGFD, 2007).

The project area is outside of any known mule deer range. Areas described as "out of range" contain few animals or the available habitat is of limited importance to the species (LCI, 2008b).

Elk use of the study area is presented in the GEIS. Elk only use the project area as transitional range while moving to other areas. The 2005 WGFD data defines the seasonal range of the elk to be outside of the project area. The 2007 WGFD Herd Unit Data describes two herds, the Shamrock Elk Herd Unit (#643) and the Steamboat Elk Herd Unit (#426), as being situated on or near the project area (WGFD, 2007).

Table 3-4. Wildlife Species Observed in the Project Area

Scientific Name	Common Name	Abundance Code[1]	Status[2]
Birds			
Branta canadensis	Canada Goose	Uncommon	
Anas platyrhynchos	Mallard	Fairly Common	
Cathartes aura	Turkey Vulture	Common	
Circus cyaneus	Northern Harrier	Common	

Table 3-4. Wildlife Species Observed in the Project Area

Scientific Name	**Common Name**	**Abundance Code[1]**	**Status[2]**
Accipiter striatus	Sharp-shinned Hawk	Uncommon	
Buteo swainsoni	Swainson's Hawk	Common	BCC, MBHFI, NSS4
Buteo jamaicensis	Red-tailed Hawk	Common	
Buteo regalis	Ferruginous Hawk	Common	BCC, MBHFI, SSS, NSS3
Buteo lagopus	Rough-legged Hawk	Common	
Aquila chrysaetos	Golden Eagle	Common	BCC
Falco sparverius	American Kestrel	Common	
Falco mexicanus	Prairie Falcon	Uncommon	BCC
Centrocercus urophasianus	Sage Grouse	Common	MBHFI, SSS, NSS2
Charadrius vociferus	Killdeer	Common	
Zenaida macroura	Mourning Dove	Abundant	
Eremophila alpestris	Horned Lark	Abundant	
Corvus brachyrhynchos	American Crow	Fairly Common	
Corvus corax	Common Raven	Abundant	
Turdus migratorius	American Robin	Common	
Oreoscoptes montanus	Sage Thrasher	Common	MBHFI, SSS, NSS4
Lanius ludovicianus	Loggerhead Shrike	Common	BCC, MBHFI, SSS
Spizella arborea	American Tree Sparrow	Uncommon	
Spizella passerina	Chipping Sparrow	Uncommon	
Spizella pallida	Clay-colored Sparrow	Rare	
Spizella breweri	Brewer's Sparrow	Common	BCC, MBHFI, SSS, NSS4
Pooecetes gramineus	Vesper Sparrow	Common	MBHFI
Chondestes grammacus	Lard Sparrow	Common	MBHFI
Amphispiza belli	Sage Sparrow	Fairly Common	MBHFI, SSS, NSS4
Sturnella neglecta	Western Meadowlark	Abundant	
Mammals			
Brachylagus idahoensis	Pygmy Rabbit	Common	SSS, NSS3
Sylvilagus audubonii	Desert Cottontail	Common	

Table 3-4. Wildlife Species Observed in the Project Area			
Scientific Name	**Common Name**	**Abundance Code[1]**	**Status[2]**
Sylvilagus nuttallii	Mountain Cottontail	Fairly Common	
Lepus townsendii	White-tailed Jackrabbit	Common	
Tamias minimus	Least Chipmunk	Common	
Spermophilus elegans	Wyoming Ground Squirrel	Common	
Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel	Common	
Dipodomys ordii	Ord's Kangaroo Rat	Common	
Peromsycus maniculatus	Deer Mouse	Abundant	
Canis latrans	Coyote	Abundant	
Vulpes vulpes	Red Fox	Common	
Procyon lotor	Raccoon	Rare	
Mastela frenata	Long-tailed Weasel	Fairly Common	
Taxidea taxus	American Badger	Common	
Mephitis mephitis	Striped Skunk	Common	
Lynx rufus	Bobcat	Fairly Common	
Cervus elaphus	American Elk	Common	
Odocoileus hemionus	Mule Deer	Abundant	
Antilocapra americana	Pronghorn	Common	
Equus caballus	Feral Horse	Common	
Reptiles			
Phrynosoma hernandesi	Greater Short-horned Lizard	Common	
Thamnophis elegans	Western Terrestrial Garter Snake	Fairly Common	
Crotalus viridis	Prairie Rattlesnake	Uncommon	

Reference: LCI, 2008b

1 Abundance Codes

Abundant - A species that inhabits much of the preferred habitat within its range. The species or its sign is typically encountered while using survey techniques that could be expected to indicate its presence.

Common - A species that inhabits much of the preferred habitat within its range. The species or its sign is usually encountered while using survey techniques that could be expected to indicate its presence.

Uncommon - A species that is common only in limited areas within its range or is found throughout its range in relatively low densities. Intensive surveying is usually required to locate the species or its sign.

Rare - A species that occupies only a small percentage of the preferred habitat within its range or is found throughout its

Table 3-4. Wildlife Species Observed in the Project Area

Scientific Name	Common Name	Abundance Code[1]	Status[2]

range in extremely low densities. The species or its sign is seldom encountered while using survey techniques that could be expected to indicate its presence.

2 Status

Federal - Migratory Bird Treaty Act

BCC - Birds of Conservation Concern species identified by the USFWS as those migratory non-game birds that without conservation actions are likely to become candidates for listing under the Endangered Species Act.

Federal - Migratory Birds of High Federal Interest in Wyoming

MBHFI - Listed utilized by the USFWS, Wyoming Field Office for reviews concerning existing or proposed coal mine leased land.

BLM - Special Status Species

SSS - BLM Special Status Species are species protected under the Endangered Species Act and those designated by the State Director as Sensitive. Sensitive species are those under status review by the FWS/National Marine and Fisheries Service (NMFS), or whose numbers are declining so rapidly that Federal listing may become necessary, or with typically small or widely dispersed populations, or those inhabiting ecological refugia or other specialized or unique habitats. The minimum level of policy protection for these designated sensitive species would be the same as policy for candidate.

State - Native Species Status

NSS1 - Native Species Status 1 - Populations are greatly restricted or declining, extirpation appears possible and on-going significant loss of habitat.

NSS2 - Native Species Status 2 - Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent on-going significant loss; species may be sensitive to human disturbance.

NSS3 - Native Species Status 3 - Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS4 - Native Species Status 4 - Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

3.6.1.2.3 Upland Game Birds

Sage-grouse and mourning doves (*Zenaida macroura*) were the only upland game birds noted in the study area. Sage-grouse may inhabit the area year-long; but mourning doves are migrants and only inhabit the area from spring into early fall.

According to the sage-grouse surveys conducted in 2006 and 2007, no active sage-grouse leks were located in the project area (LCI, 2008b). The Crooked Well Lek, which is a known strutting ground along the northeast boundary of the project area, was inactive during three site visits in April 2006. Four males were observed on the lek on April 4, 2007, but no sage-grouse were present in two additional lek surveys; therefore, it is considered inactive (LCI, 2008b). No other birds were observed on the lek during 2007. According to LCI, no birds displaying lek behavior have been observed on the Crooked Well Lek since 1994. LCI intends to request the WGFD to reclassify the lek as Unoccupied/Abandoned based on this information. Six active leks were located within 3.2-km (2.0 mi) of the project boundary. The locations of these leks with a 3.2-km (2.0 mi) buffer are presented in Figure 3-12.

3.6.1.2.4 Raptors

Agency files were reviewed by LCI for data on raptor nests in the area. Raptors that are monitored include: ferruginous hawk (*Buteo regalis)*, great horned owl (*Bubo virginianus)*, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni)*, golden eagle (*Aquila chrysaetos*), and short-eared owl (*Asio flammeus*). File searches identified 12 previously documented raptor (ferruginous hawk) nests within a 1.6-km (1.0 mi) buffer zone of the project area. The status and details are presented in the table below (Table 3-6).

Table 3-5. Raptor Nest Status

Nest ID Number	Species	Nest Status	Nest Substrate	Nest Condition	Notes
AFH25921004	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Within 1-mile buffer
FH25922801	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
FH25923201/AF H25923203	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
No BLM ID Assigned	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer

Reference: LCI, 2008b

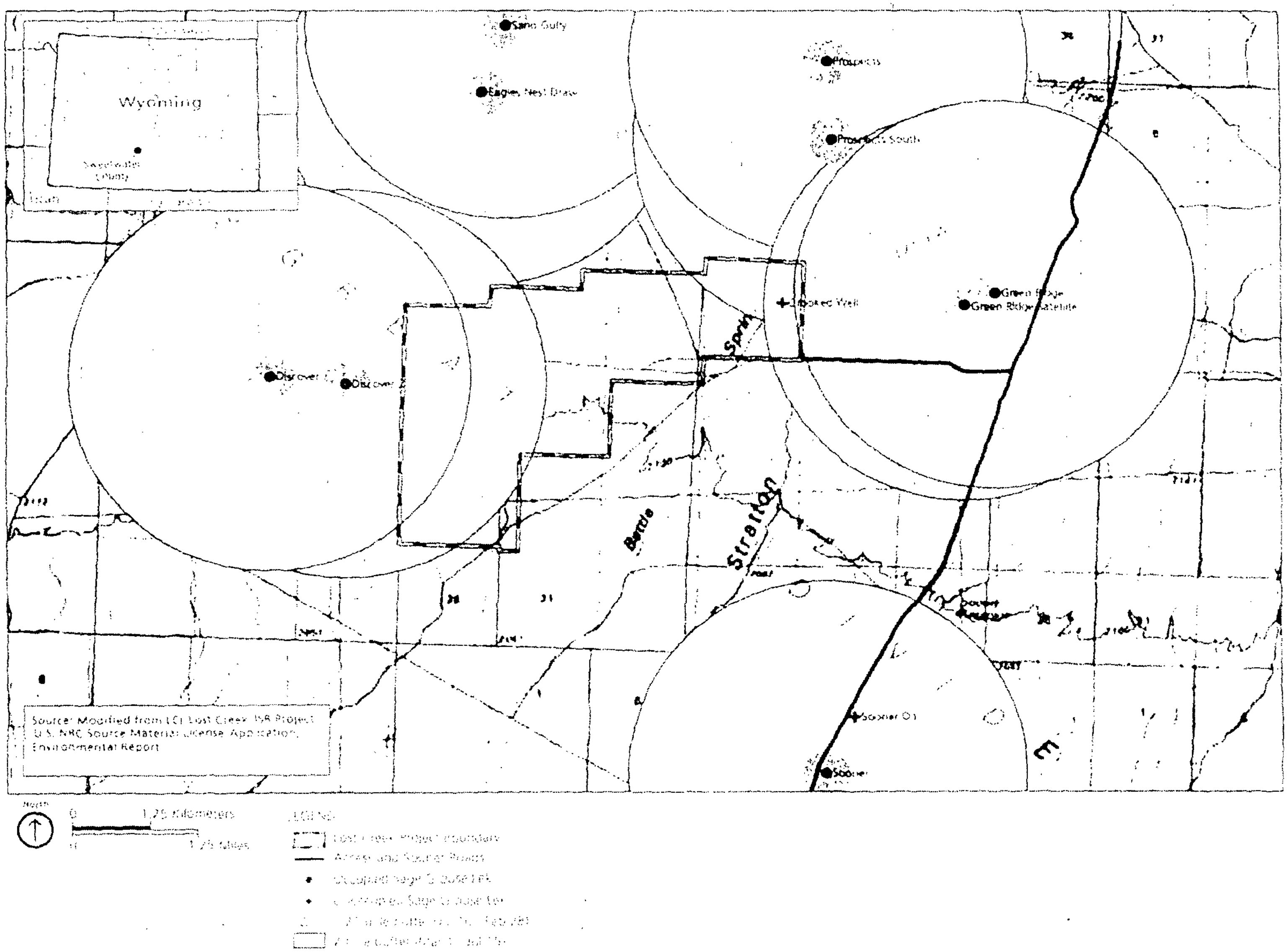

Figure 3-12. Sage Grouse Leks

Based on the 2006 and 2007 surveys conducted by LCI, no active raptor nests occur within the project area. Other nests previously documented by BLM in the 1.6-km (1.0 mi) buffer zone (Table 3-2 above and Figure 3-13) were not located during the 2006 and 2007 surveys. Global Positioning System (GPS) units were used to locate these nest sites; but none were found. No new raptor nests were identified during the 2006 or 2007 field surveys.

Several other raptor species were recorded within the study area; but nesting was not documented. These species include the Swainson's hawk, red-tailed hawk, northern harrier (*Circus cyaneus*), golden eagle, American kestrel (*Falco sparverius)*, prairie falcon (*Falco mexicanus*), and turkey vulture (*Cathartes aura)*. While the conditions are present for the northern harrier and American kestrel nests within the project area, specific nest sites were not located. Northern goshawk (*Accipiter gentilis)*, merlin (*Falco columbarius*), and peregrine falcons (*Falco peregrinus*) were not observed in the study area.

3.6.1.2.5 Waterfowl and Shorebirds

One shorebird species, the killdeer (*Charadrius vociferus*), was observed during bird and wildlife surveys, which is noted in the wildlife species table (Table 3-5). Most recorded waterfowl and shorebird species are designated "uncommon" to "fairly common" in the region.

In the study area, habitat for waterfowl and shorebirds is sparse. The man-made Crooked Well Reservoir was dry during the 2006 field survey and contained a small amount of water during the spring of 2007. Waterfowl and shorebird species would be expected in the project area during migrations in the spring and fall, with additional use in the summer months. Late fall and winter use of the project area by waterfowl and shorebirds is believed to be limited.

3.6.1.2.6 Passerine and Breeding Birds

All avian species that were observed during the wildlife inventories are listed in Table 3-5. A total of 31 passerine species were recorded during surveys. The most common species in the project area were the horned lark (*Eremophila alpestris*), Brewer's sparrow (*Spizella breweri)*, and sage sparrow (*Amphispiza belli*).

Species observed in the Upland Big Sagebrush Shrubland habitat were similar to species observed in the Lowland Big Sagebrush Shrubland habitats. There were 12 breeding species seen in each of the big sagebrush habitats during breeding bird surveys.

3.6.1.2.7 Migratory Birds of High Federal Interest

MBHFI and other wildlife species were inventoried during all site visits. This was accomplished by searching all suitable or potentially suitable habitats and recording all species encountered. Several MBHFI species are known to occur in the region (USFWS, 2002). Level I MBHFI species are described by the USFWS as in need of conservation, while Level II MBHFI species are described as in need of monitoring. Level I MBFHI species documented in the project area include the ferruginous hawk, sage-grouse, Brewer's sparrow, and sage sparrow; the mountain plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*) have been noted in adjacent areas (LCI, 2008b). Level II species documented in the project area include the sage thrasher (*Oreoscoptes montanus)*, loggerhead shrike (*Lanius ludovicianus*), vesper sparrow (*Pooecetes gramineus)*, and lark sparrow (*Chondestes grammacus)*.

The ferruginous hawk nests in the study area are discussed in Section 3.6.1.2.4. Sage-grouse observations and lek locations are discussed Section 3.6.1.2.3. The breeding Brewer's sparrow and sage sparrow were found throughout the big sagebrush habitats of the project area. The breeding sage thrasher, loggerhead shrike, vesper sparrow, and lark sparrow were also located within the project area.

No mountain plover were observed on or near the project area during spring and early summer of the 2006 and 2007 field studies. The extensive tall shrub cover and absence of grassland or open shrub habitats make the project area poorly suited to the mountain plover. Small open areas (grassland and disturbed blowouts) do occur in the project area, but are isolated.

3.6.1.2.8 Other Mammals

All mammal species and identifying signs observed during the field studies were recorded and are documented on the species list in Table 3-5. A total of 19 mammal species were recorded in the study area (LCI, 2008b). The majority of mammalian species were observed in big sagebrush habitats. The most common species seen were the whitetailed jackrabbit (*Lepus townsendii)*, desert cottontail (*Sylvilagus audubonii*), Wyoming ground squirrel (*Spermophilus elegans*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), deer mouse (*Peromsycus maniculatus)*, and meadow vole (*Microtus pennsylvanicus*). The coyote (*Canis latrans*) was the most abundant predator.

Two wild horse (*Equus caballus)* Herd Management Areas (HMA) overlap with the project area. The project area is within the Stewart Creek HMA and the Lost Creek HMA (BLM, 2004). The Stewart Creek HMA encompasses 93,572 ha (231,124 ac), of which 87,194 ha (215,369 ac) are BLM-administered public lands (BLM 2008). The Continental Divide (eastern boundary of the Great Divide Basin) traverses the HMA in a north-south direction in its eastern portion along Lost Soldier and Bull Springs rims. The surrounding landscape transitions to gently rolling uplands which comprise the majority of the HMA.

The Lost Creek HMA lies within the Great Divide Basin and encompasses 101,215 ha (250,000 ac), of which 95,140 ha (235,000 ac) are BLM-administered public lands (BLM 2008). Some vegetation desert playa and vegetated dune areas are interspersed throughout the HMA (BLM 2008). Several sensitive desert wetland riparian areas also occur throughout the area, including both intermittent and perennial lakes and streams. Similar to the Stewart Creek horses, the present population has also interbred with domestic stock. Testing on the Lost Creek herd revealed that the horses are genetically related to the Spanish Mustang and other New World Iberian breeds (BLM 2008). This characteristic makes the Lost Creek herd unique among the wild horse herds of Wyoming (BLM 2008).

Prairie dog towns provide suitable habitat for the black-footed ferret (*Mustela nigripes*). Black-footed ferrets are members of the weasel family (Mustelidae) and are considered one of the most endangered mammals in the United States (FWS 2000). Typical wild ferret behavior revolves around prairie dog towns, and hunt prairie dogs mostly at night (FWS 2000). Main causes of the decline in the ferret population included habitat loss from farming; efforts to eliminate prairie dogs, which competed with livestock for available prairie forage; and sylvatic plague, a disease that wiped out large numbers of prairie dogs and has also killed ferrets (FWS 2000).

3.6.1.2.9 Reptiles and Amphibians

During the planning and coordination stages of the wildlife inventories, BLM wildlife biologists informed LCI that specific reptile and amphibian surveys were not required for the project (LCI, 2008b). These included the greater short-homed lizard (*Phrynosoma hernandesi)*, prairie rattlesnake (*Crotalus viridis)*, and western terrestrial garter snake (*Thamnophis elegans)*.

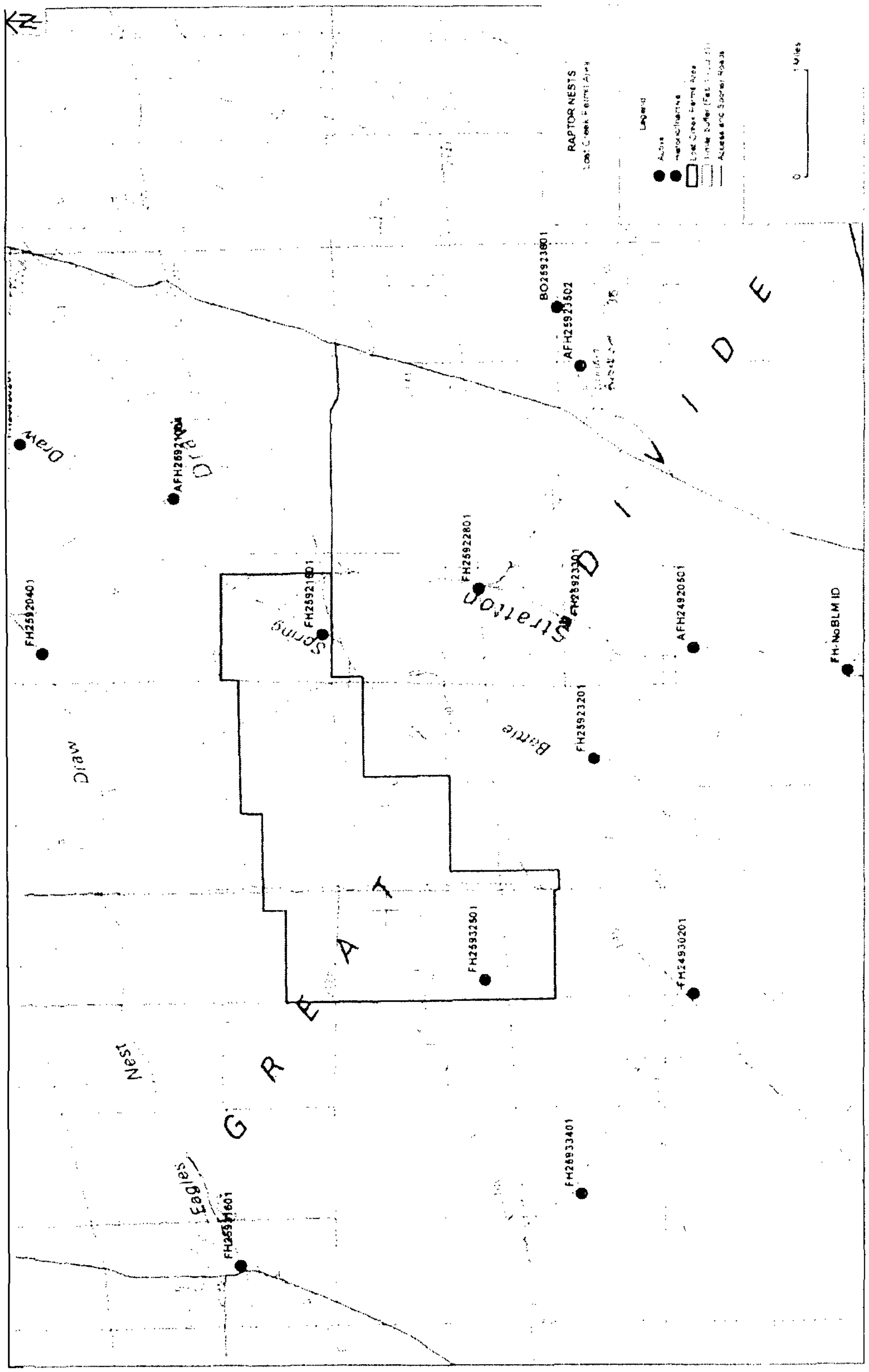

Figure 3-13. Raptor Nests

3.6.2 Aquatic Ecology

After conducting field investigations and research, aquatic life and wetlands were determined to not exist within the boundaries of the project area. Surface water may be present seasonally depending on precipitation, but does not sustain aquatic life or wetland species. A more detailed discussion of surface water features and wetlands can be found in Sections 3.5.1 and 3.5.2, respectively.

3.6.3 Protected Species

Based on consultation with the USFWS, federally listed T&E species (or their designated habitat) that may potentially be present in the project area include the following:

- The Ute ladies'-tresses orchid *(Spiranthes diluvialis)* is listed as a threatened species, which is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges.

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is Federally-listed as threatened. The species is a perennial, terrestrial orchid that occurs in Nebraska, Wyoming, Colorado, Utah, Idaho, Montana, and Washington. Within Wyoming, it inhabits moist meadows with moderately dense, but short vegetative cover. The species is found at elevations of 1,280 to 2,130 m (4,200 to 7,000 ft), though no known populations occur in Wyoming above 1,680 m (5,500 ft) (FWS, 2008). Generally, this orchid is found in low densities of four to eight flowering plants per square meter (Fertig, 2000). The species is likely to inhabit silt, sand, or gravely soils in areas with ample sunlight (FWS, 2008). It is characterized by 12- to 50-cm (4.7- to 20-in) stems with linear basal leaves up to 28 cm (11 in) long and spikes of small white to ivory flowers that bloom between early August and early September (Fertig, 2000). Urbanization, livestock grazing, pesticide use, competition with noxious weeds, and loss of pollinators threaten this species survival (Fertig, 2000). This species was not observed, nor is it known to occur within the project area.

- The black-footed ferret (*Mustela nigripes*) is listed as an endangered species that inhabits prairie dog colonies.

The black-footed ferret (*Mustela nigripes*) is Federally-listed 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 the late 1980s, but in 1981, a small relic population was discovered near Meeteetse, Wyoming (WGFD, 2005a). From this population 18 individuals were captured to start a captive breeding program, which was initiated by the WGFD (WGFD, 2005a). Nonessential experimental populations have been reintroduced to 18 locations in 8 states and Mexico (FWS, 2008). Four of these reintroduced populations – those in Aubrey Valley, Arizona; Cheyenne River and Conata Basin, South Dakota; and Shirley Basin, Wyoming – have successfully stabilized and no longer require supplemental individuals from captive breeding (FWS, 2008). Six additional locations are considered marginal to improving (FWS, 2008).

The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored body and black face, feet, and tail. Generally, black-footed ferret occurrence coincides with prairie dog habitat (black-tailed [*Cynomys ludovicianus*], Gunnison's [*C. gunnisoni*], and white-tailed [*C. leucurus*]) because prairie dog is the main prey of the ferret, and the ferret also uses prairie dog burrows for shelter (FWS, 2008). Black-footed ferrets are more likely to occur in black-tailed prairie dog habitat than in other prairie dog species' habitat; historically, it is estimated that 85 percent of all black-tailed ferrets occurred in black-tailed prairie dog habitat, 8 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat (FWS, 2008a). A black-footed ferret survey was not required, since black-footed ferrets live exclusively in prairie dog colonies, which are not present within the project area.

In a 2004 letter (FWS, 2004a), the FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations. Incidental takes of individual ferrets in black-tailed prairie dog habitat, which is "block cleared," is considered by the FWS to not be an issue and would not result in an effect on any wild population. However, this block clearance does not relieve federal agencies of the need to assess a proposed action's effect on the species' survival and recovery. Further, the FWS directs federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004a).

- The bald eagle (*Haliaeetus leucocephalus*) was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), but is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, and at the State level as a species of concern.

Bald eagle nesting habitat does not exist within the study area; but they might be found in the project area during migration. According to WGFD Wildlife Observations System Data, the bald eagle has not been recorded in the study area (LCI, 2008b). The bald eagle is a large raptor species with a white head and tail, brown body feathers and is generally associated with lakes and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and occasionally carrion.

Species of Concern

Twelve rare plant species are known to occur in Sweetwater County. These plant species are listed in Table 3-7. During the vegetation surveys, special consideration was given to these species of concern (vascular plant species considered to be of extremely high, high, or medium conservation concern within the state of Wyoming) and the micro-environments capable of supporting these species. However, no plant species of concern were observed within the project area.

The state-listed wildlife species of special concern (WGFD, 2005b) not included under other wildlife categories discussed in previous sections, and their probability of occurrence in the project area, are listed below in Table 3-8.

State-listed species that may occur in the project area are classified as Native Species Status (NSS) 2, 3, or 4 (WGFD, 2005b). Although there are no Status 1 species listed as potentially occurring in the project area, Status 1 species have populations that are restricted or declining with the threat of extirpation, and have significant habitat loss. Status 2 species have declining populations that are threatened with extirpation, and have restricted or vulnerable habitat. These species may also be sensitive to human disturbance or have significant habitat loss. Status 3 species have: a) populations that are restricted or declining with the threat of extirpation, b) habitat that is restricted or vulnerable, or c) a wide distribution and unknown population, with significant habitat loss. Status 4 species have: a) populations that are restricted or declining with stable habitat, b) widely distributed stable populations with restricted habitat that are sensitive to human disturbance, or c) stable or increasing populations with significant loss of habitat.

Listed waterfowl and shorebird species such as the American white pelican (*Pelecanus erythrorhynchos*), upland sandpiper (*Bartramia longicauda)*, and long-billed curlew (*Numenius americanus)*, and passerines, such as McCown's longspur (*Calcarius mccownii)*, chestnut-collared longspur (*Calcarius ornatus)*, and bobolink (*Dolichonyx oryzivorus)*, are unlikely to be in the project area because there is no suitable habitat for these species, though they may pass through the project area during migration. The sage thrasher, Brewer's sparrow, and sage sparrow (all Status 4 species) were observed in the project area. Suitable habitat exists for the wouldow lark bunting (*Calamospiza melanocorys)*, though this species was not observed.

State-listed mammal species that may occur in the project area have been classified as NSS 2, 3, or 4 (WGFD, 2005b). Several listed shrew and bat species, such as the dwarf shrew (*Sorex nanus*), vagrant shrew (*Sorex vagrans*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*), have ranges that include the project area. There is no suitable habitat in the study area so they are unlikely to be present. Suitable roosting habitats for the western small-footed myotis (*Myotis ciliolabrum*), little brown myotis (*Myotis lucifugus*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and pallid bat (*Antrozous pallidus*) might be found in rock crevices, rock outcrops, or trees near the Stratton Rim to the north of the project area. These species could also potentially roost in the vertical walls of eroded streambeds in the project area. None of these species was observed in the project area. The state-listed olive-backed pocket mouse (*Perognathus fasciatus*) and prairie vole (*Microtus ochrogaster*) were not observed in the project area; however, suitable habitat exists in the project area and these species are known to be in the region (WGFD, 2004).

Surveys were conducted for pygmy rabbits (*Brachylagus idahoensis*; Status 3 species) at the project area during the summer of 2007. Based on these surveys, pygmy rabbits were found sporadically in the Lowland Big Sagebrush Shrubland habitat. Scat, burrows, and individual Pygmy rabbits were observed along all transects completed within the Lowland Big Sagebrush Shrubland communities at the project area.

Table 3-6. Rare Plant Species Known to Occur in Sweetwater County

Scientific Name	Common Name	Local Distribution	Heritage[1]/State Rank[2]	Federal Status[3]
Artemisia biennis var diffusa	Mystery Wormwood	Central Sweetwater Co.	G5T1Q/S1	C2
Asclepias uncialis	Dwarf Milkweed	Northwestern Sweetwater Co.	G3/SH	C2, S-R2
Astragalus jejunus var jejenus	Starveling Milkvetch	Eastern and Western edges of Sweetwater Co.	G3T1/S1	C2
Astragalus proimanthus	Precocious Milkvetch	Extreme southwestern Sweetwater Co.	G1/S1	C2
Cirsium ownbeyi	Ownbey's Thistle	South-central Sweetwater Co.	G3/S1	C2
Descurainia torulosa	Wyoming Tansy Mustard	South-central Sweetwater Co.	G1/S1	C2, S-R2, S-R4
Lesquerella macrocarpa	Large-fruited Bladderpod	North-central Sweetwater Co.	G2/S2	C2
Oryzopsis contracta	Contracted Indian Ricegrass	Northeast, northwest, and southwest Sweetwater Co.	G3/S3	C2
Penstemon acaulis	Stemless	Extreme southwestern	G3/S1	C2, S-R4

Table 3-6. Rare Plant Species Known to Occur in Sweetwater County

Scientific Name	Common Name	Local Distribution	Heritage[1]/State Rank[2]	Federal Status[3]
var acaulis	Beardtongue	Sweetwater Co.		
Penstemon gibbensii	Gibben's Beardtongue	Extreme southeastern Sweetwater Co.	G1/S1	C2
Phlox opalensis	Opal Phlox	Central part of western Sweetwater Co.	G1/S1	C2
Thelesperma caespitosum	Green River Greenthread	Southwestern Sweetwater Co.	G1/S1	C2, S-R4

Reference: LCI, 2008b

[1] **Heritage Rank Codes:**

G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction (Critically endangered throughout its range).

G2: Imperiled globally because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range).

G3: Very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). (Threatened throughout its range).

G4: Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.

G5: Demonstrably secure globally, though it may be quite rare in parts of its range especially at the periphery.

T1: The variety is critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction (Critically endangered throughout its range).

Q: Indicates uncertainty about taxonomic status.

[2] **State Rank Codes:**

S1: Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state (Critically endangered in state).

S2: Imperiled in state because of rarity (6 to 20 occurrences) or because of other factors demonstrably making it very vulnerable to extirpation from the state (Endangered or threatened in state).

S3: Rare in state (21 to 100 occurrences).

SH: Of historical occurrence, not documented in Wyoming since 1920.

[3] **Federal Status Codes:**

C2: Notice of Review, Category 2: taxa for which current information indicates that proposing to list as endangered or threatened is possible, but appropriate or substantial biological information is not on file to support an immediate rulemaking.

S: Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by :

a. Significant current or predicted downward trends in population numbers or density.

b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

R: Forest Region

Table 3-7. Wildlife Species of Special Concern				
Species	**Status[1]**	**Preferred Habitat**	**Potential Occurrence**	**Identified on the Project Site**
Birds				
American White Pelican	NSS3	Big rivers, lakes, reservoirs, estuaries, islands, peninsulas	Unlikely	
Great Blue Heron	NSS4	Wetlands, water banks, rivers, lakes, fields, meadows	Present	
Snowy Egret	NSS3	Marshes, water banks, and shallow rivers, lakes, ponds	Possible	
Northern Pintail	NSS3	Riparian/wetlands, rivers, lakes, ponds in grasslands, fields, boreal forest	Likely	
Canvasback	NSS3	Riparian/wetlands, big rivers, lakes	Present	
Redhead	NSS3	Wetlands, lakes, rivers	Likely	
Sandhill Crane	NSS3	Wetlands, grasslands, banks of rivers, lakes, ponds	Possible	
Upland Sandpiper	NSS4	Fen, cropland, grassland, fields	Unlikely	
Long-billed Curlew	NSS3	Wetland/riparian, grassland, meadows	Unlikely	
Western Burrowing Owl	NSS4	Grasslands, deserts, and savannas in burrows	Likely	
Short-eared Owl	NSS4	Wetland, fen, grassland, cropland	Possible	
Wouldow Flycatcher	NSS3	Riparian, shrubland, woodland	Possible	
Sage Thrasher	NSS4	Desert, shrubland, sagebrush plains	Present	X
Brewer's Sparrow	NSS4	Desert, shrubland, sagebrush plains	Present	X
Sage Sparrow	NSS4	Desert, shrubland, sagebrush	Present	X
Lark Bunting	NSS4	Cropland, desert, grassland	Likely	
Grasshopper Sparrow	NSS4	Grasslands, fields, savanna	Present	X
McCown's Longspur	NSS4	Cropland, grassland	Unlikely	
Chestnut-collard Longspur	NSS4	Cropland, desert, grassland	Unlikely	
Bobolink	NSS4	Wetland, cropland, grassland	Unlikely	

Table 3-7. Wildlife Species of Special Concern

Species	Status[1]	Preferred Habitat	Potential Occurrence	Identified on the Project Site
Mammals				
Dwarf Shrew	NSS3	Wetlands in alpine, scree, conifer forest, grassland, shrubland, woodland	Possible	
Vagrant Shrew	NSS3	Wetland/riparian, fen, conifer forest, woodland, grassland, field, shrubland	Possible	
Western Small-footed Myotis	NSS3	Roost in rock-crevices, caves, tunnels, under boulder, loose bark, buildings, mines in desert, badland, semiarid habitat	Possible	
Little Brown Myotis	NSS3	Roost in buildings, caves, hollow trees in fens, wetland/riparian, forest, shrublands, woodlands	Possible	
Lond-legged Myotis	NSS2	Roosts in caves, mines, buildings, rock crevices, under bark, hollow tress in riparian, desert, forest, woodland	Possible	
Hoary Bat	NSS4	Roosts in tree foliage, rock crevices, tree trunks and cavities in riparian, conifer forest, woodland	Unlikely	
Silver-haired Bat	NSS4	Tree cavities of conifer forest adjacent to lakes, ponds, streams	Unlikely	
Big Brown Bat	NSS3	Roost in buildings, trees, rock crevices, tunnels, caves in woodlands and conifer forests	Possible	
Townsend's Big-eared Bat	NSS2	Roost in caves, mines, buildings, tree cavities in conifer forest, woodland sagebrush, riparian	Possible	
Pallid Bat	NSS2	Roost in rock crevices in desert and grasslands	Possible	
Pygmy Rabbit	NSS3	Burrows in dense big sage brush	Present	X
Olive-backed Pocket Mouse	NSS3	Burrows in cropland, grassland, shrubland	Likely	
Prairie Vole	NSS3	Burrows in grasslands, fields	Likely	

Reference: LCI, 2008b

[1] **State - Native Species Status**

NSS1 - Native Species Status 1 - Populations are greatly restricted or declining, extirpation appears possible

Table 3-7. Wildlife Species of Special Concern				
Species	Status[1]	Preferred Habitat	Potential Occurrence	Identified on the Project Site

and on-going significant loss of habitat.

NSS2 - Native Species Status 2 - Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent on-going significant loss; species may be sensitive to human disturbance.

NSS3 - Native Species Status 3 - Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS4 - Native Species Status 4 - Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

3.7 Meteorology, Climatology, and Air Quality

3.7.1 Meteorology and Climatology

The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky Mountains and high plains. The mountain ranges are perpendicular to the prevailing westerly winds and provide effective barriers to the significant pacific-generated weather systems. Much of the moisture produced from these systems is dropped along the western slopes, thereby leaving the State east of the mountains, in a semiarid condition.

The Continental Divide traverses the State from the northwest corner to the center of the southern border with Colorado. This high altitude uplift separates the major drainages that flow to the Pacific Ocean from those that flow to the Atlantic Ocean. Along the way, the divide splits and creates an oblong basin. This approximately 8960 sq km (3,500 sq mi) basin was created during the uplift in south-central Wyoming. Precipitation, averaging only 18 to 25 cm (7 to 10 in) a year, that falls within this basin is trapped and doesn't drain to either ocean, but rather evaporates or percolates into the ground.

The Lost Creek Project area is located within the Great Divide Basin, at an elevation of approximately 2,133 m (7,000 ft). This region of the state experiences diverse weather patterns that fluctuate throughout the year, due in large part to its proximity to the Rocky Mountain system and its relatively high elevation. The area is characterized by long winters, generally from December to April, which can bring frequent snow storms. Summer can be hot in the Great Divide Basin due to the lack of moisture; however the summer season tends to be short, with occasional hail, thunder, or snow storms. While the climate has remained relatively stable in this region, a discussion of global climate change is presented in Chapter 5. Meteorological stations operated by the National Oceanographic and Atmospheric Administration (NOAA) within a 80-km (50-mi) radius of Lost Creek are shown in Figure 3-14.

3.7.1.1 *Temperature*

Temperatures fluctuate greatly throughout the year in the Great Divide Basin. Located in a semi-arid climate, summer temperatures at the project site can be quite warm, while winters are commonly quite cold. The average minimum daily temperature in the region is approximately -2 °C (10 °F), with January yielding the coldest temperatures. The average maximum daily temperature is approximately 30 °C (85 °F), with July being the hottest month on average (NCDC, 2009).

Summer nights are normally cool although daytime temperatures may be quite high. The fall, winter, and spring can experience rapid changes with frequent variations from cold to mild periods. Freezes in early fall and late spring are typical and result in long winters and a short growing season. In the mountains and high valleys, freezes can occur any time in the summer. During winter warm spells, night time temperatures can remain above freezing. Valleys protected from the wind by mountain ranges can provide ideal pockets for cold air to settle and temperatures in the valley can be considerably lower than on nearby mountainsides (NRC, 2009).

3.7.1.2 *Wind*

Wyoming is quite windy, and frequently during winter winds reach 48 to 64 km/h (30 to 40 mph) with gusts to 80 to 97 km/h (50 or 60 mph). Prevailing wind directions vary from west-southwest through west to northwest. In many localities winds are so strong and constant that trees (when present) show a definite lean towards the east or southeast. Many wind farms have been established over southern Wyoming in places such as Arlington, Medicine Bow, Rock River and just south of Cheyenne to take advantage of this renewable energy source. Figure 3-15 shows a wind rose that reflects annual wind patterns for the Lost Soldier site, 12 notheast of the Lost Creek project area (NOAA, 2009).

The high plains area near the project site experiences moderate westerly winds throughout the year. These prevailing winds are generated by high pressure systems that originate in the north Pacific and Canadian Rocky Mountains. These systems move east across the mountainous western U.S. and Canada, where most of the precipitation is released, leaving fairly dry, steady winds that empty into the eastern foot hills and plain regions such as the Great Divide Basin.

The following wind data was collected at two climate stations in proximity to the Lost Creek project area. The first station, installed in 2006 is near the Town of Bairoil, approximately 19 km (12 mi) northeast of the project area, and the second station was constructed on the Lost Creek project area in 2007. The annual average wind speed was 7 meters per second (m/s), or 16 miles per hour (mph) during May, 2006 to April, 2007. The wind speed was highest in February and November and was 9 m/s (20mph). The lowest wind speed occurred in July and August and was 5 m/s (11 mph) (LCI, 2008a).

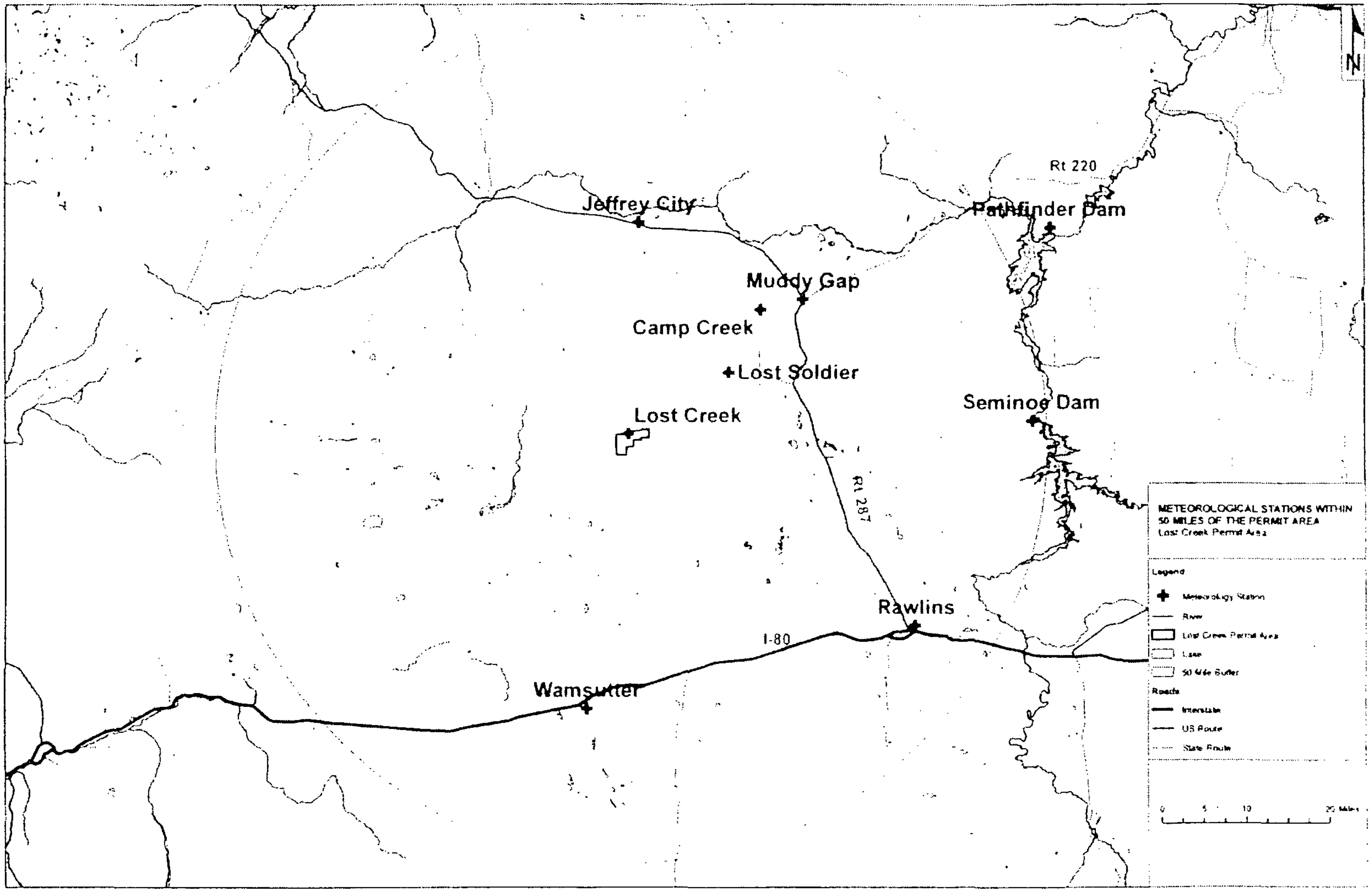

Figure 3-14. Regional NOAA Weather Stations

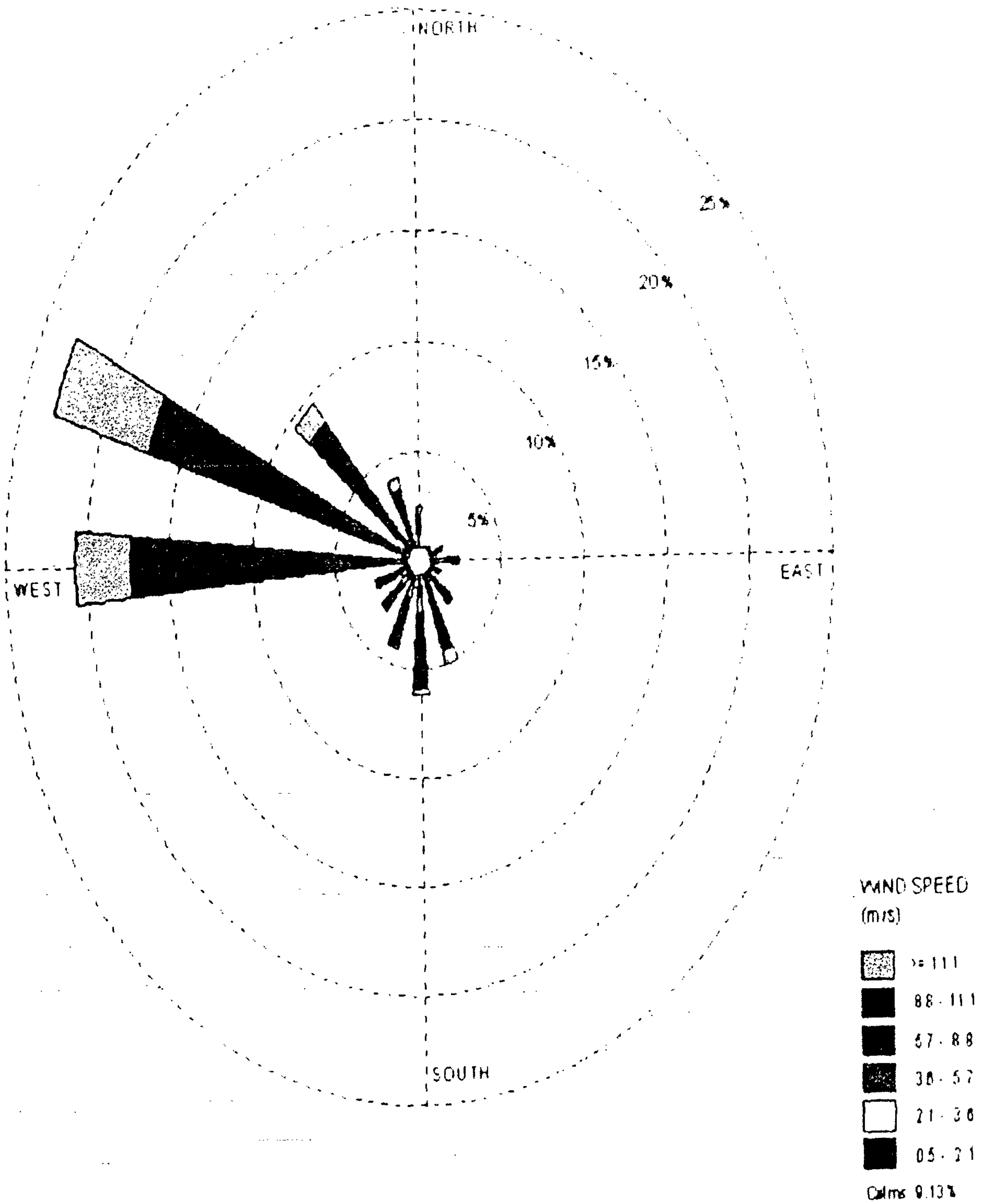

Figure 3-15. Wind Rose (Lost Solider Station)

3.7.1.3 *Precipitation*

The Lost Creek project area receives relatively little rainfall, lending itself to semi-arid conditions. Generally, the Rocky Mountain range that surrounds the Great Divide Basin absorbs the majority of the rain and snow that falls. The mean annual precipitation within the area is approximately 25 cm (10 in; LCI, 2008a). While precipitation occurs throughout the year; the mean monthly precipitation exceeds one inch only in April, May, and June. May is the wettest month, with 5 cm (2 in) of mean precipitation. Due to the extreme windy conditions in the winter, gages may actually underestimate the annual snowfall moisture. Storms generated from severe weather conditions could bring wind, rain, snow or hail from any given direction. However severe storms are rare in this area due to the surrounding mountains that effectively block or weaken storms (LCI, 2008a).

Table 3-9 highlights the low and high monthly mean, and the annual mean temperature, precipitation, and snowfall within the Lost Creek project area climatic zone. Climate data was received from a weather station in Jeffery City, approximately 38 km (24 mi) north of the project area. The climate data covers the period 1971-2000 (NOAA, 2004).

Table 3-8. Climate Data for Jeffery City, Wyoming Climate Station, 2005

Temperature (°C/ °F)	Mean-Annual	5.3/ 41.5
	Low-Monthly Mean	-7.0/ 19.4
	High-Monthly Mean	19.0/ 66.2
Precipitation (cm/ inches)	Mean-Annual	27.1/ 10.6
	Low-Monthly Mean	0.89/ .35
	High-Monthly Mean	5.71/ 2.2
Snowfall (cm/ inches)	Mean-Annual	143/ 56.2
	Low-Monthly Mean	0/ 0
	High-Monthly Mean	26.9/ 10.5

Source: NOAA, 2004

3.7.1.4 *Evaporation*

The majority of the US west of the 105th meridian has evaporation rates that exceed precipitation. The exceptions are the coastal Pacific Northwest and high mountain areas of the Rockies, Sierras, and in the Basin and Range. In the area of the Great Divide Basin, the average annual evaporation is about 3.5 times the annual precipitation. Stations at Rock Springs (west of the Lost Creek project area) and the Pathfinder Reservoir (east of the Lost Creek project area) average 95.6 and 84.6 cm (37.7 and 33.3 in) of evaporation, annually (Pochop 1985). The highest rates are during the months of June, July and August, when 12.7 to 17.8 cm (5 to 7 in) per month evaporate. The lowest months are December and January, when less than I one inch evaporates. Pochop, et al. (1985) also studied evaporation rates of a variety of wastewaters. He found that uranium wastes water evaporated at a rate 3 percent lower than tap water.

3.7.2 Air Quality

The EPA has established air quality standards to promote and sustain healthy living conditions. These standards, known as the National Ambient Air Quality Standards (NAAQS), have been adopted by the WDEQ, and are presented in Table 3.2-8 of the GEIS (NRC, 2009). Every state is required by EPA to evaluate baseline conditions by conducting an air quality monitoring program. Based upon the results of the monitoring, counties were placed into one of two categories: attainment and non-attainment. Attainment means that the pollutant levels measured do not exceed the NAAQS. The entire area within the Wyoming West Uranium Milling Region is classified as attainment for all primary pollutants (NRC, 2009). The Lost Creek project area is located in this region in Sweetwater County. Currently, there is little activity on the proposed project site that generates any air emissions. Although there are several energy facilities located in the vicinity, the rural project area is classified as an attainment (clean air) area for all the primary pollutants. The air quality conditions for four locations in south-central Wyoming are presented in Table 3-11 (WDEQ, 2009). The hilly terrain with sparse sagebrush vegetation and windy conditions lends itself to good conditions for dispersion of air pollutants. There are no occupied residential units in the project area. The nearest residential receptors are located in the community of Bairoil, which is approximately 24 km (15 mi) northeast of the Lost Creek site (LCI, 2008a).

Table 3-9. Existing Conditions - 2007 Ambient Air Quality Monitoring Data

Monitoring Stations	**Wamsutter**	**Casper**	**Lander**	**Murphy Ridge**	
Distance to Site	**40 km (25 mi)**	**161 km (100 mi)**	**80 km (50 mi)**	**241 km 150 mi**	
Pollutant	**Standards**				**Averaging Time**
Carbon Monoxide	N/A	N/A	N/A	0.7 ppm	8-hour
	N/A	N/A	N/A	0.9 ppm	1-hour
Lead	1.5 ug/m^3	N/A	N/A	N/A	Quarterly Average
Nitrogen Dioxide	0.007 ug/m^3	N/A	N/A	0.003 ug/m^3	Annual (Arithmetic Mean)
Particulate Matter (PM_{10})	227.0 ug/m^3 (Note: 2006 was 73.0 ug/m^3)	30 ug/m^3	40 ug/m^3	64 ug/m^3	24-hour
Particulate Matter ($PM_{2.5}$)	N/A	N/A	26.0 ug/m^3	N/A	Annual (Arithmetic Mean)
	N/A	N/A	7.6 ug/m^3	N/A	24-hour
Ozone	0.064 ppm	N/A	N/A	0.068 ppm	8-hour
Sulfur Dioxide	0.001 ppm	N/A	N/A	0.001 ppm	Annual
	0.010 ppm	N/A	N/A	0.002 ppm	24-hour

Source: WDEQ, 2009

3.8 Noise

Existing ambient noise levels are used to establish baseline conditions and determine potential site-specific disturbances associated with ISL milling activities. As described in the GEIS, the Wyoming West Uranium Milling Region is predominantly rural and undeveloped. Rural areas tend to be quiet, open sagebrush-grass and forested areas where natural phenomena such as wind, rain, insects, birds, and other wildlife account for most natural background sounds. Baseline noise levels for typical undeveloped desert or arid environments range from day-night sound levels of 22 dB on calm days to 38 dB on windy days (NRC, 2009).

Considering this setting, land uses within the project area, and those beyond, generate very little noise for offsite receptors. The relatively isolated setting currently experiences typical rural sound levels. The hilly terrain, sparse sagebrush vegetation, and windy conditions contribute to attenuating sound levels as they travel over distances.

Sound level measurements were attempted on June 13, 2007, but yielded no results, as all sound pressure levels fell below the instrument range of 40 dB (LCI, 2008a). As a result, it was assumed that the existing (ambient) sound levels were less than 40 dBA, and is consistent with the statement in the GEIS stating that existing ambient noise levels in this region would be 22 to 38 dBA (NRC, 2009).

Noise is only a concern to the areas surrounding the project site because it can interfere with wildlife activities. There are no occupied residential units, or other sensitive receptors, in, or near, the project area. The nearest residential receptors are located in the community of Bairoil, which is approximately 24 km (15 mi) northeast of the Lost Creek site (LCI, 2008a). With regards to onsite wildlife receptors, observations suggest that noise from oil and gas operations may affect lek activity for the greater sage-grouse (Braun et al., 2002). However, as of 2007, no active leks are located within the project area (LCI, 2008a). The closest known lek just outside the northeast project boundary (called the Crooked Well Lek) was deemed to be inactive. Six active leks were observed in the study area.

3.9 Historical, Cultural, and Paleontological Resources

The historical and cultural resources investigations for the Lost Creek project included archaeological surveys, a paleontological survey, ethnographic review, and tribal consultation. A single man-made structure is located within the project area. The structure is the Crooked Well Reservoir, located in the northeastern quadrant of the project. The reservoir is a stock pond covering about 0.1 ha (0.25 ac). The structure is a common landscape feature in the region and it was not evaluated for cultural resources significance

3.9.1 Cultural History

The project lies on the desiccated High Plains within the Great Divide Basin which is most commonly regarded as a high elevation, closed basin with semi-arid characteristics. The basin is marked by the presence of shallow drainages and rolling topography characterized by breaks and occasional buttes. In the project proper there are no permanent or intermittent water sources. Three ephemeral drainages are located in the project and study areas. The largest of these is Battle Spring Draw northeast of the project well field. There is no mention of springs in the project vicinity except for one that may be associated with Crooked Well Reservoir which is on a side draw of Battle Spring Draw. The ephemeral drainages and any springs would have supplied seasonal potable water to both humans and wildlife.

Floral and faunal resources that could have been exploited in the prehistoric periods are present in the project. Except for Indian rice grass, most of the floral resources represent species used ethnographically for basketry, dyes, or medicines rather than foodstuffs. This is not the case with the faunal resources. In the historic eras, large mammals including pronghorn antelope, bison, mule deer, and elk were present and supported Shoshone and Ute populations and westward-bound emigrants using the Cherokee, Mormon, Oregon, and Overland trails that cut through the basin though not through the project.

The archeological cultural sequence for the project is divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The former encompasses about 11,000 years between 12,000 B.P. (before present; A.D. 1950) and 250 B.P. (about A.D. 1700). The latter extends from about A.D. 1700 to A.D. 1959, which is the 50-year cutoff date for possible inclusion on to the *National Register of Historic Places* (NRHP).

3.9.1.1 *Prehistoric Era*

The Paleoindian period (12,000 to 8500 B.P.) is not formally broken in phases however named complexes have been developed based on changes in projectile point styles such as Clovis, Folsom, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. Few Paleoindian sites have been identified in Wyoming, but those that have represent some of the most important in the nation.

According to Kinneer et al. (2007:10), the closest possible Paleoindian site to the project is the Union Pacific Mammoth site, located in Rawlins. The site, which contained bison (*Bison bison*), Columbian mammoth (*Mammuthus columbi*), and Woodland muskox (*Bootherium bombifions*) remains, did not yield Paleoindian artifacts but the bone appeared to show signs of butchering. The site dates to approximately 11,280±350 B.P. based on associated charcoal which is roughly contemporaneous with Clovis-age sites in the region (Pitblado, 2009). Confirmed Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts, include the James Allen site in southwestern Wyoming; Hell Gap and Agate Basin in eastern Wyoming; and Medicine Lodge Creek in central Wyoming.

The Paleoindian period comes to a close in the terminal Pleistocene/early Holocene era. The Pleistocene megafauna (mammoth, muskox for example) are replaced by modern bison, elk, deer, and antelope. 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. The Archaic period (8500 to 1800 B.P.) in southwestern Wyoming is broken into four phases. The Early Archaic (8500 to 5000 B.P.) phases are Great Divide and Opal; the Late Archaic (5000 to 1800 B.P.) phases are Pine Spring and Deadman Wash.

Early Archaic sites are marked by the presence of various side- and corner-notched projectile points and side-notched knives. Basin houses are identified in both phases. The economic focus continues to be broad spectrum hunting and gathering with increasing emphasis on smaller game species in the Opal phase. The emphasis shifts, however, in the subsequent Late Archaic phases. Modern bison was the preferred game of Late Archaic hunters. Diagnostics recovered from these sites show that large corner-notched projectile points was the preferred weapon. Late Archaic faunal assemblages are also marked by the presence of smaller game animals and mid-size ungulates such as deer and antelope.

The acceptance of new technologies heralds the subsequent Late Prehistoric period (1800 to 250 B.P.). Smaller projectile points adapted to use with arrows are accepted by the Native American hunters. Prior to the Late Prehistoric, the points were hafted on spears. Earthenware technology also is introduced to the region from the south and east and this technology allows for additions to food preparation techniques. Techniques such as stewing, braising, and boiling were now possible and this significantly broadened the number of species, both floral and faunal, that could be utilized.

3.9.1.2 *Protohistoric/Historic Era*

The Protohistoric Period dates between about A.D. 1700 and 1840. It represents the period when European goods and the domesticated horse are introduced into the region but Late Prehistoric lifeways were still predominate. There is no appreciable European presence in the region though French fur traders are moving up and down the Missouri River. Across the northern High Plains, there was active trading in European material goods including metal knives, pots, and glass beads (Brooks, 2009; Johnson, 2009). However, Native American goods in similar styles also continued to be produced.

The Historic era is subdivided into seven periods: Early Historic (A.D. 1801-1842), Pre-territorial (A.D. 1843-1867), Territorial (A.D. 1868-1889), Expansion (A.D. 1890-1919), Depression (A.D. 1920-1939), World War II (A.D. 1940-1946), and Post-World War II (A.D. 1947-1959). Various themes have been identified which crosscut the periods. The themes that are called out in Kinneer et al. (2007) include Early Transportation and Oil and Mineral Exploration.

The project area was historically used for cattle ranching with limited oil and gas exploration in the nearby vicinity. There is no indication from the sites identified to date in the project area that there were earlier historic occupations of the area. This suggests that historic occupations are limited to the Expansion and post-expansion periods

3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance

3.9.2.1 *Previous Cultural Resources Investigations*

Three Class III surveys were conducted in the project area. Two surveys were completed for earlier projects not related to the Lost Creek project. These two included Wyoming State Historic Preservation Office Cultural Resources Office (WYCRO) project Numbers 80-278 and 88-875. Project 80-278 was completed by Western Wyoming College for a proposed uranium drill site. Project 88-875 was conducted by BLM for a proposed fence line.

The current project and associated study areas were subjected to systematic cultural resources investigations in 2007 (Kinneer et al., 2007). The work was conducted under BLM Cultural Resource Use Permit (CRUP) No. 033-WY-SR06. The archaeological work was completed in two phases: July to October 2006 and May 2007.

The Class I site file search was conducted prior to fieldwork. The site file research identified the two previous surveys and also found that Project 88-875 located archaeological site 48SW7633, a possible sheepherder's camp. The camp was recommended not eligible by the original investigators (BLM; Kinneer et al. 2007). Kinneer et al. (2007) relocated the site and also recommended the site not eligible to the NRHP.

Systematic survey of the project area covered 1,523 ha (3,764 ac) of BLM-managed land and 270 ha (666 ac) of State of Wyoming land. The 2007 fieldwork was conducted using a BLM-mandated survey approach consisting of the use of standard interval survey transects, not exceeding 30 m (100 ft) in separation. All sites and isolated resources were documented when initially found. No part of the project area was excluded from survey (Kinneer et al., 2007).

The survey resulted in the relocation of Site 48SW7633 and the identification of 17 new sites and 75 isolated resources. The isolated resources are summarized in the Table below (Table 3-12). Under the State Protocol between BLM and the Wyoming SHPO, the isolated finds are ineligible to the NRHP and no further archaeological consideration of them is recommended.

Table 3-10. Archaeological Sites Located within the Area of Potential Effect

Site Number	Site Type	Recommendation
48SW16593 CA-2475	Historic: trash scatter	Not eligible
48SW16594 CA-2478	Historic, Prehistoric: Lithic and trash scatters with windmill base	Not eligible
48SW16595 CA-2483	Historic:, trash scatter	Not eligible

Table 3-10. Archaeological Sites Located within the Area of Potential Effect

Site Number	Site Type	Recommendation
48SW16601 CA-2529	Historic:, trash scatter	Not eligible
48SW16602 CA-3151	Historic, Prehistoric: Lithic and trash scatters	Not eligible
48SW16603 CA-3158	Historic: trash scatter	Not eligible
48SW16764 CA-2608	Historic, Prehistoric: Lithic and trash scatters	Not eligible
48SW16596 CA-2488	Historic, Prehistoric: Lithic and trash scatters	Not eligible; all items were surface finds.
48SW16597 CA-2489	Historic, Prehistoric: lithic and trash scatters	Not eligible; no significant subsurface deposits.
48SW16604 CA-3163	Prehistoric: lithic scatter with hearth	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16605 CA-3167	Prehistoric: lithic scatter	Not eligible; all cultural items were surface finds.
48SW16606 CA-3175	Prehistoric: lithic scatter with hearth	Not eligible; subsurface finds were evaluated as rodent redeposited. There has been deflation also.
48SW16607 CA-3180	Prehistoric: lithic scatter	Not eligible; no significant subsurface deposits.
48SW16608 CA-3182	Prehistoric: lithic scatter with Paleoindian paleosol	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16763 CA-2604	Historic, Prehistoric: Lithic and trash scatters	Not eligible; no significant subsurface deposits.
48SW16765 CA-2610	Historic, Prehistoric: Lithic and trash scatters	Eligible; avoidance recommended. If not possible, then data recovery.
48SW16766 CA-2613	Prehistoric: lithic scatter	Not eligible; no significant subsurface deposits.

Source: Kineer et. al 2007

Seven of the newly identified archaeological sites were recommended ineligible to the NRHP as well. The sites are dominated by historic debris with minor Native American components. The latter are of indeterminate age and could date to either the prehistoric or historic periods.

Of the new sites identified, 10 sites were tested and evaluated for listing. Based on the identification and testing results, three prehistoric sites (48SW16604, 48SW16608, and 48SW16765) were recommended as eligible to the NRHP.

3.9.2.1.2 Ethnology – Identification and Evaluation

The only Tribe to have shown an interest in the Lost Creek site was the Eastern Shoshone. The THPO visited the site in 2008 but found it to be of no interest to the Tribe.

3.9.3 Historic Properties Listed in the National and State Registers

No cultural resources in the project area are currently listed on the State or National Registers of Historic Places. Kinneer et al. (2007) recommended three archaeological sites eligible to the NRHP and the BLM and Wyoming SHPO concurred. If the Proposed Action is selected, two of the sites, 48SW16608 and 48SW16765, would not be impacted by the project and no further investigation would be conducted. The third site, 48SW16604, lies within the project well field and it would be subjected to data recovery following the development of a MOA between the NRC, BLM, and Wyoming SHPO. Additional consulting parties may include the Eastern Shoshone who indicated that the proposed data recovery treatment plan was acceptable.

The sites recommended as eligible to the NRHP are prehistoric lithic scatters with and without features. Site 48SW16604 encompasses about 14,973 m^2 (161,708 ft^2) but the artifact densities are lighter in the western part of the site than in the east along an ephemeral drainage (Kinneer et al., 2007). Testing at the site found a basin-shaped hearth. Diagnostic artifacts and radiocarbon dating suggested that intermittent occupation of the site occurred between the Paleoindian and Late Prehistoric eras. Kinneer et al. (2007:48) noted that the site has the potential to address research issues concerning chronology, lithic technology, paleoenvironments, and subsistence strategies. Subsequently, Kinneer (2008) developed a treatment plan for this site and the plan was submitted to the BLM. BLM accepted the plan and has issued Wyoming BLM CRUP No. 568-WY-AR09 which authorizes data recovery at the site. The plan was submitted by BLM to Wyoming SHPO; by letter dated 24 July 2008, Wyoming SHPO concurred with BLM's determination of eligibility and acceptance of the treatment plan. Subsequently, NRC has also reviewed and accepted the treatment plan on June 30, 2009.

Site 48SW16608 encompasses about 4,613 m^2 (49.820 ft^2) with the highest artifact densities in the deflated eastern half of the site (Kinneer et al., 2007). Diagnostic artifacts and the radiocarbon dating suggested that the site had been occupied during Paleoindian times. Site 48SW16608 has the potential to address research issues concerning chronology, lithic technology, paleoenvironments, and subsistence strategies (Kinneer et al 2007).

Site 48SW16765 encompasses about 1,079 m^2 (11,653 ft^2) and the area is marked by a thin but persistent scatter of chipped stone tools and debitage. There is also a small amount of historic trash (Kinneer et al., 2007:70). Testing at the site found an ill-defined pit feature in association with a well-defined, stratified midden. A single fragmentary Archaic point was recovered. Kinneer et al. (2007) noted that the site has the potential to address research issues regarding Archaic subsistence strategies. If the site cannot be avoided, then a treatment plan would be needed to address the affects of the proposed action on the resource.

3.9.4 Tribal Consultation

No Indian reservation land is located within or near the project area (LCI, 2008a). The only Tribal reservation in Wyoming is the Wind River Indian Reservation which is about 168 km (105 mi) northwest of the project area. Additionally, no properties having religious and/or cultural significance to contemporary Native Americans are known to exist within or near the project area" (LCI, 2008a). NRC has initiated consultation with the Native American tribes who have aboriginal ties to the project area to determine if properties are present. To date, only the Eastern Shoshone and Northern Arapaho have responded to the NRC requests for information through a series of telephone conversations.

3.9.5 Paleontological Resources

BLM Instruction Memorandum No. 2008-009 (October 15, 2007; Memo 2008-009) was used to evaluate the potential for geologic units to occur within the Lost Creek project area. As defined in memorandum, "geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential." The BLM's system rates the likelihood that specific geological units would contain fossils. It is not a substitute for on-ground survey as site-specific conditions must be evaluated as well.

According to the Geologic Map of Wyoming (Love and Christianson, 1985), the project area is marked by the presence of Quaternary age, near surface deposits and Tertiary age formations. Under the BLM's Potential Fossil Yield Classification (PYFC) system the Quaternary age deposits are assigned a Class 2 ranking. Class 2 rankings are assigned to recent, sedimentary units considered unlikely to have vertebrate fossils or significant nonvertebrate fossils. The near surface deposits are usually younger than 10,000 years old, may include aeolian materials, and deposits that have undergone significant diagenetic alteration. While important localities might exist in such deposits, their level of occurrence is considered low.

The project area Tertiary age deposits are capped by Battle Spring Formation sandstone and shale. The unit is thick in the project area and the underlying Wasatch Formation, of the same age, is considered unlikely to be exposed. Under the PFYC system, the Battle Spring Formation is assigned a ranking of Class 3A to 3B. These rankings range from moderate (3A) to unknown (3B) sensitivity for the occurrence of significant vertebrate or invertebrate fossils. Because the sensitivity is moderate to unknown, survey by a BLM permitted paleontologist is recommended.

3.10 Visual and Scenic Resources

The Lost Creek project area is characterized by low-relief, sagebrush-dominated land, dissected by a small network of ephemeral drainages. The scenery is characteristic of surrounding areas in the Great Divide Basin, though less visually appealing than many other locations. Few intermittent meandering streams, creeks and associated riparian vegetation cross the open steppe, providing localized visual diversity to the otherwise homogeneous landscapes. More rugged mountainous landscapes can be seen in the background to the north and to the south. Previous modifications to the natural environment of the project area include fencing, power lines, and four-wheel drive (two-track) roads. Drilling rigs can currently be seen in the project area.

The BLM administers 85 percent of the land (1,449 ha [3,580 ac]) in the project area and evaluates the scenic quality of the land it administers through a "Visual Resource Inventory." the objective of which is "to manage public lands in a manner which will protect the quality of the scenic (visual) values of these lands" (BLM, 1984). The BLM Visual Resource Inventory process consists of a scenic quality evaluation, a sensitivity level analysis, and a delineation of distance zones. Together, these evaluations are used to group areas into Visual Resource Management (VRM) classes, which provide guidance for management decisions. Areas are classified on a four-level scale, with Class I being the most protective of visual and scenic resources (and restrictive on allowable land uses), and Class IV being the least restrictive on uses due to the lack of visual landscape concerns (BLM, 1984).

Visual resources consist of landforms, vegetation, rock and water features and cultural modifications that create the visual character and sensitivity of landscapes. Examples in the Lost Creek project area would include the ephemeral drainages crossing the landscape, as well as the views of the mountains in the distance. Important visual resources are areas that have landscape qualities of unusual or intrinsic scenic value and areas of human and cultural use that are valued for their visual settings. Factors considered in evaluating the importance of visual resources include the visual quality and visual sensitivity, as discussed in further detail below (BLM, 1984).

Distance zones also influence the potential impact of scenery changes on receptors. Potentially sensitive view areas are discussed with respect to three distance zones:

- Fore ground (within 0.8 km, [0.5 mi]),
- middleground (0.8 to 3.2 km, [0.5 to 2 mi]), and
- background (beyond 3.2 km, [2 mi]).

The BLM has established VRM classifications and has resources management plans for all of the Wyoming West Uranium Milling Region, which includes the Lost Creek site (NRC, 2009). The VRM classifications for the region are shown in Figure 3.2-20 of the GEIS (NRC, 2009). The landscape has been modified in some of the more urban areas, and in a number of rural areas by mineral extraction activities. The bulk of the Wyoming West Uranium Milling Region is categorized as VRM Class III (along highways) and Class IV (open grassland, oil and gas, urban areas). The BLM resource management plans for this region do not identify any VRM Class I resource areas.

The area considered for visual resources, includes the project area, access roads, and a 3.2 km (2 mi) buffer area outside of the project area. Beyond this distance, any changes to the landscape would be in the background distance zone, and either unobtrusive or imperceptible to viewers.

"Visual quality", defined by the overall visual impression or attractiveness of an area, considers the variety, vividness, coherence, harmony or pattern of landscape features and is characterized according to three levels: 1) distinctive resources that are unique or exemplary in quality; 2) representative resources that are typical of the physiographic region and commonly encountered; and 3) indistinctive resources that are landscape or cultural areas that either lack visual resource amenities or have been degraded.

The scenic quality inventory was based on methods provided in BLM Manual 8410 – Visual Resource Inventory as well as a review of the factors that contribute to the existing VRM Class IV inventory for the project area. The key factors of landform, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modifications were evaluated and scored according to the rating criteria. According to *Standard Review Plan for In-situ Leach Uranium Extraction License Applications* (NUREG-1569), if the visual resource evaluation rating is 19 or less, no further evaluation is required (NRC, 2003). The scenic quality field inventory score calculated for the Lost Creek Site according to BLM methodology was 7 out of a possible 32 (LCI, 2008a).

"Visual sensitivity", defined as a measure of an area's potential sensitivity to visual change, considers types of viewers and viewer exposure. Visual sensitivity considers viewer types and numbers, as well as viewing distance zones. Areas and associated viewer types considered to be potentially sensitive to visual changes include: park, recreation and wilderness study areas, major travel routes, and residential areas.

Visually sensitive areas include parks, recreation and natural areas, major travel routes, and residential areas within 3.2 km (2 mi) of the project area. Potentially sensitive areas located 3.2 km (2 mi) or more from the project area are not considered in this study since beyond this distance changes from the project would be indistinct compared to the existing conditions. The viewer groups and use areas described below are considered to be moderately or highly sensitive to visual impacts when in the foreground or middle-ground distance.

No developed parks or recreation areas are located within the visual resources study area. Travel routes in the visual resources study area include CR 63, CR 23, and Sooner Road. The project area is not visible from any of these transportation corridors from viewpoints within the visual resources study area. Additionally, there are no residences within the visual resources study area.

The project area is approximately 48 km (30 mi) southwest from the Ferris Mountain Wilderness Study Area, but no Wilderness Areas or Areas of Critical Environmental Concern are located within the visual resources study area. The project area is in near recreation areas, activities, such as hiking, sight-seeing, antler collecting, OHV use, hunting, and wild horse viewing are dispersed. There are no designated wildlife viewing locations in the study area (LCI, 2008a), though the project area does include Wyoming Game and Fishing Department hunting areas for antelope, deer, elk, and mountain lion.

The project area is not visually pristine or of special visual interest due to existing infrastructure and other industrial facilities in the area. The sole visually sensitive receptors within the visual resources study area are a small number of dispersed recreationists. The project area has been designated VRM Class III by the BLM (LCI, 2008a).

3.11 Socioeconomics

The proposed Lost Creek ISR project site is located in the rural northeast section of Sweetwater County, Wyoming. The site is located approximately 61 km (38 miles) northwest of Rawlins (population of approximately 8,500) and is approximately 24 km (15 miles) southwest of the town of Bairoil (population of approximately 100). There were approximately 40,000 residents in Sweetwater County in 2008, which includes approximately 27,000 square km (10,425 square miles). The primary population centers in Sweetwater County are located in the cities of Rock Springs (population of approximately 19,500) and Green River (population of approximately 12,300), which are located approximately 130 km (80 miles), and 150 km (94 miles) respectively, to the southwest of the project area. It is likely that ISR employment could be drawn from the larger population centers such as Rawlings, Green River, Rock Springs, Casper (population of approximately 53,000) and Lander (population; approximately 7,000), which are within commuting distance to the proposed project area. Small towns in the area such as Bairoil, Wamsutter (population of approximately 270), and Jeffery City (population; approximately 100) could also contribute to the ISR work force (US Census Bureau, 2009).

Rock Springs, the largest population center in Sweetwater County, and the center for mining and energy activity in this portion of Wyoming, became a symbol for boomtowns following the oil boycott in 1973 and experienced all the problems associated with rapid population growth: inadequate public services, social disruption and inadequate funding for public services. Social disruption, associated with the earlier Rock Springs boomtown period, became the subject of national television coverage. Over the last thirty years, the State of Wyoming, Sweetwater County, and the City of Rock Springs have developed the institutional capacity to manage boom and bust cycles and are therefore much better prepared to manage change associated with new projects. The minerals industry accounts for a substantial source of revenue to the state and local governments. Produced minerals are classified as personal property, and mineral producers pay two types of taxes (1) a county property tax (ad valorem-gross products) on production and (2) a state severance tax (LCI 2008). Severance taxes are distributed according to Wyoming Statute (WS) 39-14-801. The Permanent Wyoming Mineral Trust Fund is a fund that holds in reserve 25 percent of all severance taxes paid to the State. This fund acts like a savings account where monies are distributed state funds (LCI 2008). In addition, local government bodies have developed a variety of tax programs which help fund public services and infrastructure needs.

The principal industries in Sweetwater County are mining, construction, and retail trade. Mining and natural resources account for the largest job market in Sweetwater County. The workforce is young (median age of 35.6 years relative to the state as a whole, which is 37 years). Wyoming has a history of "boom and bust" trends that have occurred within the mining industry. Isolated areas similar to the proposed project area whose economies have become overly dependent on mining activities can quickly become depressed once the natural resources are exhausted or once the markets for the resources become depressed. In order to avoid these unfavorable economic trends, much of the work force typically comes from larger, more economically diversified population centers, such as those mentioned above (Wyoming Business Council, 2009).

3.11.1 Demographics

Sweetwater County is the fourth most populated county in the state, but because of physical size, has a relatively low population density at 8.5 people per square km (approximately 4 people per square mile). The population of Sweetwater County is primarily concentrated near the cities of Rock Springs and Green River, in the western portion of the County, while the northeastern section of the county, where the proposed project site is located has a relatively low population. The population of Sweetwater County is mostly comprised of White non-Hispanics, with Hispanic, American Indian, Black, and other races each comprising less than 10 percent of the population. The breakdown is detailed in Table 3-13 (US Census Bureau, 2009). Population projections by the Census Bureau show the State of Wyoming is projected to grow through 2010 then stabilize around 2020 with a slight decline in population into 2030. Counties with resource based economies would likely continue in bust and boom cycles dependent on the demand for resource and energy.

Table 3-11. Demographics of Sweetwater County

Race	Percent of the Population
White Non-Hispanic	86.9
Hispanic	9.4
Two or More Races	2.4
American Indian	1.8
Black	0.7

Source: US Census Bureau, 2009

3.11.2 Income

The mining industry is the biggest employer in Sweetwater County, accounting for approximately 20 percent of the work force, followed by U.S. Government jobs, which employ approximately 14 percent of the county population, while retail trade and construction also collectively provide approximately 20 percent of the job market. When compared to the state as a whole, Sweetwater County is more dependent on the mining industry, and is less dependent on the education, healthcare, and social services industries. The estimated median household income in Sweetwater is $63,533, which is higher than the estimated median household income in the entire State of Wyoming, which is $50,000 (US Census Bureau, 2009).

Unemployment in Sweetwater County is low as is typical of counties with extractive industries, ranging from 2-3 percent throughout 2008 (Wyoming Department of Employment. 2009). However, the rate doubled by the first quarter of 2009, a result of the global recession reducing demand/prices for energy.

3.11.3 Housing

The average household size in Sweetwater County is 2.6 persons. The median single family home value is $171,931, and the median monthly contract for rent is $514. There is an overall shortage of available housing in Sweetwater and in neighboring counties due to the demand fueled by transient workers that strain the housing inventory. Bairoil is the closest town to the project area, and while it is difficult to determine the current housing vacancy rate in Bairoil, and other towns and cities in the area, due to changes in the housing and real estate market, the housing supply is limited and could be easily exhausted by the addition of new residents. When compared to the rest of Wyoming, Sweetwater County has a larger average household size, and the median single family home value is also higher than the state average of $52,433 (US Census Bureau, 2009).

3.11.4 Employment Structure

The mining industry is the largest employer Sweetwater County. The local, state, and federal government is the next biggest employer, followed by the retail trade and construction industries. The employment data is broken down into state and county data in the following sections (U.S. Census Bureau, 2009).

3.11.4.1 *State Data*

As mentioned earlier, the State of Wyoming has been experiencing an economic boom over the last several years due to the increased demand for energy and minerals. This has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. With the global recession affecting the demand for energy, the associated decline in price for natural gas, oil and coal, exploration/extractive activities have decreased. This has led to an increase in unemployment from 2.9 percent in May 2008 to 5.0 percent in 2009 (Wyoming Department of Employment, Research and Planning, 2009).

The federal government is the largest employer in the State of Wyoming, accounting for 23.2 percent of Wyoming's jobs. Leisure and hospitality businesses are the second largest employers, holding 11.6 percent of the job market. The retail trade industry is close behind, employing approximately 11 percent of the state population, and the mining industry accounts for 9.5 percent of the state work force.

3.11.4.2 *County Data*

Mining and natural resources account for the largest job market in Sweetwater County. The predominant natural resources sought out in the county include coal, oil, trona, and uranium. Mining operations are responsible for 20 percent of the county work force at this time, and with diversified and abundant natural resources, mining operations are likely to continue in the foreseeable future in Sweetwater County. Government and government enterprises also employ a large proportion of the county's work force (14 percent). The retail trade industry follows as the third largest employer in the county, accounting for 10 percent of the job market (US Census Bureau, 2009). The unemployment rate, however, has risen from 2.4 percent in May of 2008 to 5.0 in May of 2009 (Wyoming Department of Employment, Research and Planning, 2009).

3.11.5 Local Finance

There are no corporate or personal state income or inventory taxes in Sweetwater County. The state allows, and the County does, tax commercial personal property. All tangible personal property used in business is taxable and must be listed once a year with the County tax assessor (Wyoming Statute 39-13-103). The County determines assessed valuation of commercial property at 11.5 percent of the market value and applies a mill levy of 63.088 (set by the County Commissioners) (Sweetwater County, 2009a). In addition, industrial enterprises, contractors, and subcontractors operating in the state must pay a use tax to the 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).

Sweetwater County has a 6 percent sales and use tax (statewide base of 4 percent, plus 1 percent optional county tax, plus one percent capital facilities). The average property tax rate in Sweetwater County is 7.06 percent. Wyoming also imposes "ad valorem taxes" on mineral extraction properties. Taxes levied for uranium production were 4 percent in 2007 and totaled $17 million. Sweetwater County generated $7,159 in 2007 via ad valorem tax collection (NRC, 2009). Additionally, under Wyoming statute, cities, towns, and counties, by voter approval, may impose an excise tax of up to 4 percent on all sleeping accommodations for guests staying less than thirty days. This tax also extends to mobile accommodations such as tents, trailers, and campers. In addition there is a lodging tax which provides additional income from workers and visitors living in local motels. In addition, Sweetwater County imposes a 2 percent lodging tax (Liu, 2008).

3.11.6 Education

The annual Sweetwater County School District enrollment is 6,964 students, which is divided into two separate districts. The average student teacher ratio is 14.9 to 1, while the state student to teacher ratio for school year 2007 was 12.4 to 1 (Wyoming Department of Education, 2007).

The Carbon County School District 1 is the closest public school district to the project area, and includes Bairoil School, and Bairoil Elementary School, as well as several elementary, middle, and high schools located in Rawlins. Rawlins is located approximately 58 km (38 miles) southeast of the project area in Carbon County. The annual enrollment for Carbon County School District 1 is 1,787 students with an average student teacher ration of 9.26 to 1 (based on 2006 data) (Wyoming Department of Education 2009).

3.11.7 Health and Social Services

The closest health care facility with emergency care to the project area is the Carbon County Memorial Hospital, which is a 35 bed acute care facility which includes an Emergency Room, Intensive Care Unit, Medical, Surgical, Obstetric, Ambulatory Surgery, and a 10-bed Long Term Care Unit. It is located approximately 62 km (38 miles) to the southeast of the project area in Rawlins. The shortest route from the project area is to the east via Sooner Road, CR 22 and SR

73 to U.S. 287, then south to Rawlings. The main health care facility in Sweetwater County is the Memorial Hospital of Sweetwater, located approximately 130 km (80 miles) to the southwest of the project area in Rock Springs. It is a non-profit, 99-bed, rural acute-care facility. Among the health services offered are intensive care, cardiopulmonary/respiratory, and emergency care. There are also a number of private and state-operated social services facilities in Sweetwater County. Among them are the Family Services Department, the United Way, and the Child Support Services of Wyoming.

The closest waste collection and transfer station is the Sweetwater County Solid Waste District #2, located approximately 32 km (20 mi) from the project area in Bairoil. Waste from the transfer station is taken to the Sweetwater County landfill in Rock Springs, approximately 110 (road) miles south-southwest of Bairoil.

The Town of Bairoil is served by a wastewater treatment system which consists of two separate lagoons. Discharge point 001 is the outfall from a single cell non-aerated lagoon which discharges to Able Creek and serves the south side of town. Discharge point 002 is the outfall from a two cell non-aerated lagoon which serves the north side of town and discharges to Reed Creek. Drinking water in the area comes from Bairoil via groundwater extraction (Battle Springs Formation). The municipal water supply system capacity is 946,250 Lpd (250,000 gpd) with a peak day demand of 946,250 Lpd (250,000 gpd) (WSEO, 2009). Electric service in the area comes from Merit Energy Company, a Texas-based oil and gas company that has an office located at 101 Primrose Avenue in Bairoil.

3.12 Public and Occupational Health and Safety

The purpose of this section is to summarize the natural background radiation levels in and around the Lost Creek project area. Descriptions of these levels are known as "pre-operational" or "baseline" radiological conditions, and they would be used for evaluating potential radiological impacts associated with ISR operations. Also included in this chapter of the document are descriptions of applicable safety criteria and radiation dose limits that have been established for protection of public and occupational health and safety.

Radiation dose is a measure of the amount of ionizing energy that is deposited in the body. Ionizing radiation is a natural component of the environment and ecosystem and members of the public are exposed to natural radiation continuously. Radiation doses to the general public occur from radioactive materials found in the earth's soils, rocks, and minerals. Radon-222 is a radioactive gas that escapes into ambient air from the decay of uranium (and its progeny radium-226) found in most soils and rocks. Naturally-occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of radiation. In addition to natural sources of radiation, there are also artificial or manmade sources that contribute to the dose received by the general public. Medical diagnostic procedures using radioisotopes and x-rays are a primary manmade radiation source. The National Council for Radiation Protection (NCRP) in its Report No. 160, estimates the annual average dose to the public from all natural background radiation sources (terrestrial and cosmic) is 3.1 millisieverts [mSv; 310 millirem (mrem)]. The annual average dose to the public from all sources (natural and manmade) is 6.2 mSv (620 mrem) (NCRP, 2009).

3.12.1 Background Radiological Conditions

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a pre-operational monitoring program was developed and implemented to establish baseline conditions at the proposed Lost Creek ISR site. Results of the baseline radiological environmental monitoring provide data on background levels that can be used for evaluating future impacts from routine facility operations or from accidental or unplanned releases. The scope of the baseline program conducted for the proposed Lost Creek ISR site meets the intent of the NRC's guidelines in Regulatory Guide 4.14, Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1.

In the ER Section 3.12, Background Radiological Characteristics, the applicant describes methods and results of the baseline radiological survey initiated in November of 2006 and completed in 2008. The goal of the survey was to describe surface areas that exhibit anomalously high radioactive concentrations and/or external radiation levels. These data would establish a background radiological condition in water resources, provide source data for MILDOS dispersion and dose modeling, and would be used in comparing operational impacts considered during decommissioning, (LCI, 2008a).

Using the guidance of Regulatory Guide 4.14 (NRC, 1980), some of the specific sampling methods included:

- An integrated overland gamma scan survey using gamma sensitive NaI (Tl) detectors with GPS positioning for mapping the ambient gamma radiation levels across the site;
- Sampling of ten 100 m^2 (1076 ft^2) sampling grids with ten sub-surface soil samples to a depth of 15.4 cm (6 in). Each group of ten samples per grid was combined into one composite sample and analyzed for radium-226, uranium, thorium-230, and lead-210.
- Groundwater and storm water samples were collected on a quarterly basis and analyzed for radium-226, uranium, thorium-230, and lead-210;
- Vegetation samples were collected at three downwind locations at three different times during the summer of 2008; and
- Passive air samples were collected to measure gamma and radon-222 at locations within and outside the proposed operational project area.

The intent of the overland gamma survey was to characterize and quantify natural background or pre-operational radiation levels and radionuclide concentrations in soils throughout the Lost Creek project area. As discussed in ER Section 3.12.1.3, results of the overland gamma survey and soil sampling show higher than expected variability of radioactive concentrations in surface soils. However, averaged results for measured gamma radiation and soil concentrations are within the range of concentrations typically measured in this region of Wyoming. Elevated areas were identified by the applicant as likely attributable to different types of soil and rocks with elevated levels of natural background radioactivity. Similar variability in surface or near-surface measurements taken at other Wyoming sites have been attributed to natural radioactivity potentially influenced by weathering factors such as erosion and/or deposition (Whicker et al., 2008).

Soil samples were analyzed for radium-226, uranium, thorium-230, and lead-210. As presented in ER Section 3.12, measured concentrations for the majority of the sampled radionuclides were higher than typical background ranges for the U.S. though consistent with typical background ranges for this region of Wyoming. For comparison, background radium levels in soil in the U.S. typically average 1 picocurie (pCi) per gram (NCRP, 2009). The typical range of background concentrations is 0.5 to 2 pCi/g for the sampled radionuclides. The average radium-226 concentration for surface samples taken at the Lost Creek site was 6.0 pCi/g with a maximum concentration of 8.8 pCi/g. The uranium average was 4.4 pCi/g with a maximum concentration of 12.9 pCi/g. The thorium-230 average was 0.9 pCi/g with a maximum concentration of 2.1 pCi/g. The lead-210 average was 0.9 pCi/g with a maximum concentration of 4.9 pCi/g.

The concentrations of radionuclides in groundwater can be strongly correlated with the location of the uranium mineralization. The average concentration of uranium in all the samples collected during baseline monitoring was 0.306 milligrams per liter (mg/L) while the EPA drinking water Maximum Contaminant Level (MCL) is 0.03 mg/L. Radium concentrations were also high, e.g., the radium-226 (Ra-226) concentration in HJ monitor well LC19M is 420.5 picoCuries per liter (pCi/L). The MCL for Ra-226 is 5 pCi/L.

Baseline surface water samples were collected and analyzed for natural uranium, radium-226, radium-228, gross alpha, gross beta, lead-210, and thorium-230. Results are presented in ER Table 2.7-4 and are all below detection limits except for uranium and gross alpha. Uranium values were all less than 0.001 mg/L and gross alpha samples were less than 5 pCi/L. These values are within levels measured at other background locations across the region (LCI, 2008a).

Vegetation samples were collected at three downwind locations at three different times during the summer of 2008. The samples were analyzed for natural uranium, radium-226, lead-210, polonium-210, and thorium-230. The reported average uranium concentration values were 0.18 mg/kg and 0.00012 μCi/kg. Reported average values for remaining radionuclides are Ra-226 (1.2×10^{-4} μCi/kg); Th-230 (2.5×10^{-5} μCi/kg); and Po-210 (6.2×10^{-5} μCi/kg), and Pb-210 (9.2×10^{-4} μCi/kg). These values are within levels measured at other background locations across the region (LCI 2008a).

Six radon samplers placed in downwind and upwind locations were used for baseline measurements. Sampling results for four quarters are presented in Table 3.7-11 of the applicant's ER (LCI, 2008a). Reported outdoor radon-222 results range between 22.5 and 370.6 pCi/L/day, which approximately equals an average daily concentration range for the quarterly sampling periods of 0.27 to 3.8 pCi/L in air. These values are within levels measured at other background locations across the region (NCRP, 2009). The applicant also conducted radon dose and radon flux modeling for six emission sources using the computer code MILDOS-AREA and the Uranium Mill Tailings Radon Flux Calculator. Modeling results performed by LCI show that the maximum dose at the project boundary is roughly 3 percent of the annual public limit of 1 mSv (100 mrem) total effective dose equivalent (TEDE).

Air particulate samples were collected at five locations during four quarters starting in November 2007. Consistent with guidance in Regulatory Guide 4.14, air samplers were placed at the location of the nearest resident, upwind (background) location, and selected downwind locations within the project area. Quarterly composite samples for each location were analyzed for natural uranium, radium-226, thorium-230, and lead-210. Reported results are summarized below:

- Uranium: Sixteen of twenty samples for uranium were below the detection limit of 1.0×10^{-16} μCi/mL, and the maximum was 5.61×10^{-16} μCi/mL, which is less than 1 percent of the 10 CFR Part 20, Appendix B effluent release limit of 9.0×10^{-14} μCi/mL.
- Th-230: Sixteen of twenty samples for Th-230 were below the detection limit of 1.0×10^{-16} μCi/mL, and the maximum was 2.59×10^{-16} μCi/mL, which is less than 1 percent of the 10 CFR Part 20, Appendix B effluent release limit of 3.0×10^{-14} μCi/mL.
- Ra-226: Sixteen of twenty samples for Ra-226 were below the detection limit of 1.0×10^{-16} μCi/mL, and the maximum was 2.23×10^{-15} μCi/mL, which is less than 1% of the 10 CFR Part 20, Appendix B effluent release limit of 9.0×10^{-13} μCi/mL.

- Pb-210: All twenty samples for Pb-210 were measured above the detection limit, with concentrations ranging from 3.02×10^{-15} to 2.38×10^{-14} µCi/mL. The maximum value was 4% of the 10 CFR Part 20, Appendix B effluent release limit of 6.0×10^{-13} µCi/mL.

These radionuclide air particulate concentrations are within levels measured at other background locations across the region and the U.S. (NCRP, 2009).

No livestock were sacrificed to obtain samples. Cattle are not expected to be exposed to a significant amount of contamination from the site. Although cattle would be able to graze up to the fenced site boundary, cattle are only in the region during 6 months of the year. Also, the scarcity of food in the area would keep cattle from remaining near the site for extended periods of time. It is expected that the doses associated with the potential beef tissue-to-human exposure pathway would be indistinguishable from the doses due to natural background radiation levels. The information provided for the Lost Creek project area does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS.

Results provided to date indicate that a reasonable baseline for radiological conditions can be established for the Lost Creek project area.

3.12.2 Public Health and Safety

The NRC has the statutory responsibility, under the AEA to protect the public health and safety. NRC's regulations in 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv (100 mrem) TEDE and 0.02 mSv (2 mrem) per hour from any external radiation sources. This public dose limit from NRC licensed activities is a fraction of the background radiation dose as discussed above in Section 3.12.1.

The Kennecott uranium mine is located approximately 3 km (2 mi) south of the Lost Creek project area. An ISR application has been received for the Antelope & Jab site, located approximately 5 km (3 mi) to the north, and there are several inactive and decommissioned conventional uranium mills within the 80 km (50 mi) radius. However, because of their relative distances, none of these projects are considered to represent a significant source of radiation exposure in and around the Lost Creek project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the Lost Creek project area.

Other than slightly elevated background readings in a limited number of boundary locations at the proposed site, the information provided for the Lost Creek project area does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS. The limited number of locations with elevated readings is most likely due to natural conditions and variability in the background conditions, or past exploration activities. The baseline gamma surveys presented in the ER and TR provide adequate documentation of pre-operational conditions for the Lost Creek project area and would be used as part of the overall baseline data package during operational and decommissioning activities.

3.12.3 Occupational Health and Safety

Occupational health and safety risks to workers from exposure to radiation are regulated by the NRC, mainly through the Radiation Protection Standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses "as low as reasonably achievable" (ALARA) such as through the use of proper worker safety training, engineering, and administrative controls to prevent or minimize radiation exposures and effluents, and monitoring of radiation doses and effluents. The ALARA principle takes into consideration the purpose of the licensed activity and its benefits, weighs the associated costs and benefits to reduce radiation doses as appropriate (including selecting the most cost-effective and efficient technology for reducing doses), and quantifies the net benefits for each considered option to reduce radiation doses or exposures to other hazardous materials (e.g., chemicals) used at an ISR facility. Radiation safety measures are required for protecting and minimizing worker doses at uranium ISR facilities, ensuring that radiation doses are less than the occupational limits and are maintained ALARA.

Also of concern with respect to occupational health and safety are industrial hazards and exposure to non-radioactive pollutants, which for an ISR operation can include normal industrial airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust from access roads and wellfield activities, and various chemicals used in the in-situ extraction process. Industrial safety aspects associated with the use of hazardous chemicals at the Lost Creek project area would be regulated by the Wyoming Division of Mine Inspection and Safety (Wyoming, Title 30- Mines and Minerals, Chapter 2-Mining Operations, Article 2- Inspector of Mines). The type of chemicals and permitted levels are discussed in Section 4.13.

3.13 Waste Management

Wastes in Wyoming are regulated by the State and managed by both the counties and the State. Solid wastes generally go to county-run facilities, while liquid wastes are managed by the larger cities. Hazardous wastes, if small in quantity (less than 6.8 kg/yr [15 lb/yr]), may be handled at county-run facilities; otherwise, larger quantities are shipped out-of-state, to either Colorado or Utah.

3.13.1 Solid Waste

Solid wastes generated in Sweetwater County are managed by the Sweetwater County Solid Waste Disposal District (SWCSWD) #1, located in Rock Springs. The SWCSWD #1 operates the largest landfill in the County. Under its current program, the SWCSWD #1 handles municipal solid wastes (MSW), construction and demolition (C&D) wastes, ISR well fields wastes, auto engines, electronic wastes, landscape wastes, and small amounts of household hazardous wastes. In addition, the landfill in Rock Springs has: 1) a composting facility; 2) a used materials warehouse (e.g., building materials); 3) bulk disposal drop off; 4) used oil and batteries disposal; and 5) commercial tire disposal.

The Rock Springs Landfill has a capacity of 2.7 million cubic meters (3.1 million cubic yards), and accepts, on an average day, about 250 tons of waste (approximately 607 cu m/day [667 cu yd/day], at a compaction rate of about 260 kg/cu m [750 lb/cu yd], without daily cover included). The majority of the waste accepted is MSW (about 65 percent). The remaining waste (35 percent) is made up mostly of C&D wastes, with minor amounts of other wastes described earlier (Sweetwater County, 2009b).

SWCSWD #2 is located in Wamsutter, but only accepts residential solid waste at its landfill. There is a small transfer station in Bairoil, however, it only accepts residential solid waste, as well.

Lander County, to the north, operates several small landfills, as well as a transfer station, but much smaller in size than the SWCSWD #1 facilities. In the City of Rawlins, in Carbon County, the landfill no longer accepts solid wastes, but transfers them to a larger landfill in Casper. There are no large commercially operated landfills in, or near, the Great Divide Basin.

3.13.2 Liquid Waste

Sanitary wastes are regulated by the WY DEQ Water Quality Division (WQD). For rates less than 2000 gallons per day (gpd), a septic system or small package plant may be used. For larger rates, a large municipal system is required. The nearest large municipal systems to the Lost Creek site are in Rock Springs and Casper.

Production 'bleed' wastes would be disposed of in deep wells permitted under the Underground Injection Control (UIC) program administered by the WDEQ, Water Quality Division.

3.13.3 Radioactive Wastes

The only existing facility that is licensed by NRC to accept 1 le.(2) byproduct material wastes for disposal in Wyoming is the Pathfinder-Shirley Basin uranium mill tailings impoundment in Mills, Wyoming. Additionally, two sites are licensed to accept 11e.(2) byproduct material for disposal are the EnergySolutions site in Clive, Utah, and the White Mesa uranium mill site in Blanding, Utah. The EnergySolutions facility, the largest licensed commercial low-level radioactive waste disposal facility, is in a remote area, located approximately 80 miles west of Salt Lake City, Utah. The facility is permitted to receive 11e.(2) byproduct Material and mixed waste (combined radioactive and hazardous wastes). It is also permitted to receive soil, sludges, resins, dry active waste, and other radioactively contaminated debris. The facility is accessible by both rail and highway (EnergySolutions, 2009).

3.14 References

33 CFR Part 328. *Code of Federal Regulations*, Title 33, Navigation and Navigable Waters, Part 323, "Definition of Waters of the United States."

40 CFR Part 142. *Code of Federal Regulations*, Title 40, Protection of the Environment, Part 142, "National Primary Drinking Water Regulations Implementation."

40 CFR Part 143. *Code of Federal Regulations*, Title 40, Protection of the Environment, Part 143, "National Secondary Drinking Water Regulations."

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4 ENVIRONMENTAL IMPACTS AND MITIGATIVE ACTIONS

4.1 Introduction

This chapter describes the potential environmental consequences associated with the alternatives presented in "Chapter 2: In-situ Recovery and Alternatives." It is organized by resource area and by each stage of the proposed action (*i.e.* construction, operation, aquifer restoration, and decommissioning), which distills the issues and concerns into distinct subjects for discussion analysis.

NRC's regulations at 10 CFR Part 51 that implement NEPA require consideration of the potential environmental impacts of the proposed action and reasonable alternatives. NRC's NUREG-1748 (NRC, 2003) categorizes the significance of potential environmental impacts as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

4.2 Land Use Impacts

As described in the GEIS, much of the land in the Wyoming West Milling Region having milling interests is unpopulated rangeland, federally owned and administered by the U.S. Bureau of Land Management. Most of the remainder of the land are also publicly owned (by the State of Wyoming), with some land privately held. Land is used primarily for recreation, wildlife management, and mineral extraction (NRC, 2009)

Potential environmental impacts to land use at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. Impacts could include land disturbance as part of construction and decommissioning, grazing and access restrictions, and competing access for mineral rights. Potential impacts to ecological, historic, and cultural resources may be impacted as well (they are described in later sections of this chapter).

Detailed discussion of the potential environmental impacts to land use from construction, operation, aquifer restoration, and decommissioning are provided in the following sections for the alternatives considered.

4.2.1 Proposed Action (Alternative 1)

LCI is applying for a source and byproduct material license in order to facilitate the production of a wet yellowcake slurry from the ore body contained within project area. The applicant is proposing the construction, operation, and reclamation of facilities for ISR operations within the project area. The entire project footprint would affect an estimated 115 ha (285 ac) within the 1,709 ha (4,220 ac) project area. There could be adverse impacts from the proposed action on current land uses, such as recreation, wildlife management, natural resource exploration and extraction, cultural and historical resources, and grazing. These impacts would be short-term (less than 20 years), and would not have large impacts on current land uses. Additional mitigation measures beyond the proposed decommissioning and reclamation by the applicant would not be needed. The impacts for each stage of the ISR processed are analyzed below.

4.2.1.1 *Construction Impacts*

In the GEIS (Section 4.2.1.1), land use impacts during construction may occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations on other mineral extraction activities, grazing activities, or recreational activities). It was expected that land disturbances during construction would be temporary and limited to small areas within permitted boundaries, and that well sites, staging areas, and trenches would be reseeded and restored. Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the small size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical, and cultural resources, the GEIS determined that potential impacts would be SMALL. The potential impacts to these resources are described in later sections of this chapter. In situations involving grazing restrictions and competing access to mineral rights on the site, it was expected that agreements between the parties would serve to mitigate impacts.

The construction phase would have the largest impact on current land uses in the area due to the high level of concentrated disturbance to the natural environment. Of the disturbed region, an estimated 23 ha (57 ac) would be stripped of vegetation and topsoil. A 3.3 km (2.1 mi) long, 9 m (30 ft) wide gravel access road would be constructed, linking the project area to the Wamsutter-Crooks Gap Road to the west of the project area. Shoulders and culverts for drainage would be constructed on the edges of the road. Facility construction activities would include the construction of the central processing plant (CPP), storage ponds, maintenance buildings, and ancillary production units that would include injection wells, monitoring wells, and production wells, as well as header houses. The construction of the planned six production (mine) units would be completed in phases after the construction of the CPP and storage ponds, and would commence sequentially over a period of seven years (see Figure 2-1, Project Schedule) as each production unit would move into production.

Ranching activities associated with grazing has been, and continues to be, an important social and cultural use (a way of life) in rural Wyoming. Recreational activities, such as hunting and off road vehicle exploration would be restricted in the CPP construction area. Construction activities for the CPP would have a potentially SMALL impact on the existing grazing leases and recreational activities due to the necessary relocation of all grazing livestock and relocation of recreational activities that would normally use the area of CPP. This is because the amount of disturbed land is small compared to the total ranchland that is available. . However, the noise and dust disturbance generated from the concentrated construction activities could affect land outside the restricted areas.

The construction of the six planned production (mine) units within the project area would be phased as the respective injection, production, and monitoring wells, together with the pipeline systems are constructed. While there would be subsurface disturbance as the production units are constructed, there would be smaller impacts to existing land uses than those seen in the construction of the CPP. There would be fewer contractors needed to develop the production units when compared to the higher volume of workers needed during the construction of the CPP and appurtenant facilities. Therefore, the noise, traffic, and overall disturbance would be less than that expected during the construction of the CPP. When each production unit is fenced, grazing livestock would be affected to the extent that they would be prevented from entering the fenced areas. Once again, the amount of land that would be affected is small in comparison with the large amount of grazing land available. There would also be a potential impact to the rural ranching use in the area during the construction of the production units since there would be less land available. Wild horses, prevalent in the Lost Creek area, would also be potentially affected, but would instinctively avoid those areas undergoing construction due to the heavy human activity.

The visual presence of wells and header houses could also impact the natural setting and overall cultural landscape. However, since much of the production unit construction activities would occur in the subsurface, as the pipelines would be below the frost line, there would be less impact to the overall visual aspect of the place than those seen in the construction of the CPP. Recreational activities would also be prohibited in the production units while construction occurs, and therefore, potentially affected.

Overall, the low intensity of all the impacts mentioned above implies that the impact of construction of the Proposed Action on land use would be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Land Use and incorporates by reference the GEIS' conclusions that the impacts to Land Use during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.2.1.2 *Operations Impacts*

As described in the GEIS (Section 4.2.1.2), the types of land use impacts from operational activities would be expected to be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not be expected to occur from conducting operational activities. Because access restriction and land disturbance related impacts would be similar to, or less than, those for construction, the GEIS determined that overall potential impacts to land use from operational activities would be SMALL

The primary difference between operation and construction impacts would be the timing and magnitude of each phase. Operations at the proposed LCI facility are estimated to occur for approximately 8 to 9 years, versus the relatively short construction period of 12 to 18 months. During operations, the current land uses would be curtailed within the affected portions of the project area. Livestock would be prevented from entering the fenced areas surrounding the CPP, storage ponds and the production units. This would create an adverse impact (albeit SMALL) on livestock grazing allotments, in the area in that livestock ranching patterns would be altered, and livestock might be moved to other grazing lands away from the project area. Wild horses would also tend to avoid those areas of human disturbance. The reason the operational impacts would be small is though lasting for a longer period, its activities are less intensive than construction. Construction is the principal land disturbing activity, with excavation and land clearing, and has a greater impact on land use. By the operations phase, the buildings would have all been constructed, and the storage areas would all be in use. There would be additional well drilling and new two-track roads made, but their disturbance is much less intensive than the construction phase.

Recreational activities, such as off-road exploration and hunting, would also be adversely impacted during the operation of the ISR facilities since public access would be restricted within the project area. Other mining activities, such as oil and gas, coal, and other uranium operations could also be affected by the operation of the ISR facility. Once the production units and CPP are in place, other mining activities would be restricted within the project area to activities that would be physically compatible with ISR projects.

By contributing to a change in the natural environment, the operational phase would impact the long history of ranching and livestock grazing that has occurred in the area. Also, there has been extensive exploratory drilling for various other natural resources that has been going on in the area since the 1970's. The operation of the ISR facility would have an overall impact on mining in the area by contributing to additional natural resource extraction operations in the area. Operations would also deplete the uranium within the underling ore body, which would impact the availability of this resource. The total concentration of the impacts anticipated during operation, however, would be smaller than the overall anticipated construction impacts. Nevertheless, operation impacts would last longer than the construction impacts. A site-specific analysis confirms, and is consistent with, the assessment made in the GEIS, that the overall impacts to land use during the operations phase would be SMALL (NRC, 2009a; LCI, 2008a).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Land Use and incorporates by reference the GEIS' conclusions that the impacts to Land Use during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.2.1.3 *Aquifer Restoration Impacts*

In Section 4.2.1.3 of the GEIS, aquifer restoration impacts to land use are discussed. Due to the use of the same infrastructure as during operations, land use impacts from aquifer restoration would be similar to, or less than, those from operations. It is expected that as aquifer restoration proceeds and well fields are closed, some operational activities would diminish. Therefore, aquifer restoration impacts to land use are expected to be SMALL.

LCI expects that restoration would take at least one year for each production unit. Since the potential impacts would be temporary, and since the restoration work force would be relatively small, the overall impacts from aquifer restoration are consistent with the assumptions stated in the GEIS. Therefore the potential impacts from aquifer restoration would be SMALL (NRC, 2009a).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Land Use and incorporates by reference the GEIS' conclusions that the impacts to Land Use during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.2.1.4 *Decommissioning Impacts*

Decommissioning impacts to land use are discussed in Section 4.2.1.4 of the GEIS. It was expected that land use impacts from decommissioning would be similar to those described for construction, with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Access restrictions may remain until decommissioning and reclamation are completed; although it is possible that a licensee could decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses would help mitigate long-term potential impacts. The GEIS determined that impacts to land use during decommissioning would be SMALL.

The decommissioning phase of the Lost Creek project would include the decontamination and dismantling of the project facilities and roads, contouring the land to its natural state, and reseeding and placement of soils. Land use impacts would be similar in scale to those seen in the construction phase. Current land uses would be affected to a similar extent as construction as the land is returned to its natural state. Since these impacts would be temporary, the natural environment would be returned to its pre-ISR operations state. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts decommissioning are expected to be SMALL. (NRC, 2009a; LCI, 2008a).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Land Use and incorporates by reference the GEIS' conclusions that the impacts to Land Use during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.2.2 No-Action (Alternative 2)

Under the No-Action alternative there would be no impacts from ISR development at Lost Creek to any of the current land uses through added traffic, noise, or land disturbances. The current land uses, including grazing lands, natural resource extraction, and recreational activities would continue. There could still be impacts to land uses from other activities occurring in the area. For example, the two herd management areas, Lost Creek and Stewart Creek, currently have 45 and 28 active mining claims, respectively, according to the BLM (2009). However, when compared to the potential impacts from the other alternatives, the No-Action Alternative would have no impacts to land use from any of the phases of ISR development, and therefore, would have no need for mitigation.

4.2.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the NRC would issue LCI a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of dry yellowcake as the final product. This alternative differs from the Proposed Action only by the addition of the equipment for the processing of dry yellowcake from a wet slurry. The dryer equipment would be installed in the CPP (which would be constructed with a space allocated for drying equipment) at the Lost Creek site. The dry yellowcake would, then, be transported from the Lost Creek site directly to Metropolis, Illinois for ultimate processing into fuel for nuclear reactors. Addition of the drying process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate facility before being shipped to Metropolis, Illinois for further processing. The potential impacts to land use for this alternative resulting from each of the four phases of ISR project development would not differ from that of the proposed action, and are expected to be SMALL.

4.3 Transportation Impacts

The GEIS states, while the volume of traffic on the roads of the Wyoming West Milling Region is low, the estimated low additional volume of traffic associated with all phases of ISR development is not expected to change the overall amount of traffic or number of accidents. A possible exception, however, may be from commuting workers during construction of an ISR. At such a time, the peak workforce would be driving to and from the construction site on a daily basis, using roads with normally low traffic volumes. The low-trafficked roads may be more susceptible to wear and tear from increased traffic, and experience localized, intermittent (temporary) SMALL to MODERATE impacts associated with dust, noise and incidental wildlife kills. The magnitude of these potential impacts would be influenced by site-specific conditions, including the proximity to local residences, wildlife habitats, and grazing areas (NRC, 2009)

As stated in the GEIS (NRC, 2009) potential environmental impacts to transportation at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. Impacts would be due to the movement of workers to and from the site, and to the shipment of materials and chemicals on and off the site. Impacts may be experienced in the form of dust, noise, and incidental wildlife or livestock kills, increased traffic on local roads, and from the consequences of accidents.

4.3.1 Proposed Action (Alternative 1)

4.3.1.1 *Construction Impacts*

In the GEIS (Section 4.2.2.1), it was anticipated that low levels of traffic generated by ISR construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on many of the roads in the region. Roads that currently experience low traffic counts could potentially be impacted to a moderate degree by the additional worker commuting traffic during periods of peak employment, such as during construction. Additionally, moderate dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads). For these reasons, the GEIS determined that construction impacts to transportation would be SMALL to MODERATE

Most construction workers are expected to travel to the project area from Casper and Rawlins. They would travel US287 to Lamont, then west to Bairoil approximately 10 km (6 mi) on WY 73, then about 20 km (12 mi) west on CR 22 to Sooner Road (BLM #3215) to the project area access road. The speed limit through the Town of Bairoil is 48 kmph (30 mph), and the nearest residence to CR 22 is 275 meters (300 yards). The Sooner Road (eastern) point of access would be used almost exclusively for commuting construction workers (with light-duty trucks) arriving from points east such as Casper and Rawlins. This eastern access road has been upgraded to BLM standards.

Most of the heavier transports of materials and equipment into and from the site, however, would use the unpaved Wamsutter-Crooks Gap Road to the west of the project area that connects Wamsutter and Jeffrey City. This western access road has been upgraded to BLM standards. Virtually no traffic, however, is expected to come south from Jeffrey City, rather, trucks would travel north from I-80 at Wamsutter. The section of the Wamsutter-Crooks Gap Road near Wamsutter is used heavily by the oil and gas industries, therefore, the additional truck traffic anticipated during construction of the Lost Creek project is not likely to be noticed. In addition, there are no residences along this route that would be affected by noise, dust and odor from the vehicles. Sweetwater County has plans to re-surface the southernmost 16 kilometers (10 miles) of the Wamsutter-Crooks Gap Road with crushed asphalt during 2009, which would substantially reduce the amount of dust generated.

During construction, an estimated 30 to 35 light-duty trucks and 2 to 5 heavy-duty trucks would travel to and from the site each day. Light-duty traffic would likely approach the site from either the west or east, whereas heavy-duty traffic would be required to use Wamsutter–Crooks Gap Road from the west. Because of the remote location of the site, annual average daily traffic counts (AADT) are not available for those unpaved roads in proximity to the project area. The nearest road with available data is S.R. 73, which enters Bairoil from U.S. 287 at Lamont. This highway averages 230 vehicles per day. Assuming a maximum number of 40 vehicles per day carrying out two way trips, the potential increase in traffic along Bairoil Road, while noticeable, would still be well below the threshold at which traffic volume would be a concern. Project related increases in traffic along larger roadways such as U.S. 287 and I-80 (maximum AADT of 1,870 and 13,840, respectively) would also be considered negligible.

Tractor trailer trucks would deliver the materials and equipment necessary to construct the facilities and well fields at the Lost Creek ISR Project. Because ISR facilities are relatively small-scale construction projects (compared to oil and gas extraction), the magnitude of trucking activities required to support this stage of the project would be minor. Though a variety of construction vehicles would likely be required, many would be transported to the sites on standard flatbed trailers. Exceptions may include graders, cranes, drill rigs, water trucks and perhaps oversized loads carrying ion exchange vessels or other non-standard loads related to the construction of the processing plant. Beyond outgoing commuter traffic, trucks would transfer unrestricted solid waste (*e.g.*, rags, trash, packing materials, broken parts or equipment) to local permitted landfills.

Crash data for the project area roadways was analyzed in the ER (LCI, 2008a). According to documented crashes that occurred between 2002 and 2006, truck crashes rarely occur. For SR 73 (from Lamont to Bairoil), no truck crashes occurred during the study period. Based on the current crash rates and the estimated minimal increase in volumes due to site development, there would likely be no measurable increase in crashes on the area roadways.

Six mine units are proposed for ISR uranium extraction at the Lost Creek project. The construction of the associated well fields would be staggered over time as opposed to carried out as a single endeavor. This means that some form of construction related traffic would persist at the site for about seven years, or roughly half of the project lifespan. Road construction represents a long-term impact on land use in the project area, with approximately 7.8 ha (19.3 ac) being converted from rangeland to road surface. However, most of these impacts are temporary, as ISR operations are sequential and because of ongoing reclamation. All roads except for those roads specifically requested by the BLM to remain would be reclaimed (see section 4.3.2.4).

Even with the increase of daily trucks traveling to and from the project site, due to the limited duration of construction activities (12-18 months) the impact of construction traffic to the roadway network is expected to be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.3.1.2 *Operation Impacts*

As described in the GEIS (Section 4.2.2.2), during operations, the low levels of facility-related traffic would not noticeably increase traffic or accidents on most roads, although local, less-traveled roads could be moderately impacted during periods of peak employment. Dust, noise, and possible incidental wildlife or livestock kill impacts on or near site access roads would continue to be experienced.

The GEIS also assesses the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. While the GEIS recognizes the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area, the probability of such accidents occurring is determined to be low owing to the small number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion-exchange resins, waste materials), compliance with transportation regulations is expected to limit radiological risk for normal operations. Additionally, the GEIS estimates that there is a low radiological risk for accident conditions. Emergency response protocols would also help mitigate long-term consequences of severe accidents involving release of uranium. The GEIS determined that potential impacts to transportation from operations would be SMALL to MODERATE.

LCI estimates that light truck traffic associated with the operation phase would decrease from 30 to 35 light during construction to 20 trucks traveling to and from the site each day. The number of heavy trucks would remain constant between 2 and 5 to and from the site daily. Shipments of yellowcake slurry to an offsite drying facility would be required approximately every 5.5 days with the project running at capacity.

Transportation related risks during the operation phase can be broken down into four categories of vehicle contents: 1) supplies to the processing facility; 2) outgoing yellowcake slurry to a drying facility; 3) offsite disposal of unrestricted solid waste and process-contaminated radioactive solid waste, or 11e(2) by-product material; and 4) ISR workers. These risks are summarized below in the following paragraphs. LCI has described these risks in detail in their Environmental Report (LCI, 2008a).

Because the development of the six mine units of the Lost Creek ISR project would follow a phased (sequential) schedule, construction and operations phases would overlap for all but the final unit (Mine Unit 6, see Figure 2-6). Weekly to monthly shipments of various supplies would be required. For construction, these include steel, PVC, HDPE pipe, wire, valves, fittings, structural steel, and so on. Operations would require process chemicals including carbon dioxide, oxygen, salt, soda ash, and peroxide, along with gasoline and diesel. Both phases would require potable water, office supplies, grease, and oils. These chemicals and supplies are commonly used in other industrial applications and their transport is regulated by the USDOT. The potential for a shipping accident depends on the frequency of deliveries, the distance traveled, and the accident rates described in Table 3.3-2 of the ER (LCI, 2008a). In general, truck accidents occur at a rate of 4.0×10^{-7} accidents per km (6.4×10^{-7} accidents per mi) on interstates in rural areas and 1.4×10^{-6} accidents per km (2.2×10^{-6} accidents per mi) for interstates in urban areas and for two-lane roads similar to those in the project vicinity. The environmental impacts would depend in the severity of the accident, the magnitude of the release, and the unique properties of the chemicals involved.

The operation phase includes transporting yellowcake slurry from the processing facility to an offsite dryer (at this time, its location is unknown). With the project operating at full capacity, approximately 70 shipments of slurry would be required per year. The roads from the project area to the nearest major highways are shown in Figure 4-1. The risk of an accident involving the shipping of yellowcake slurry was investigated by assuming transport to two representative facilities: the closest is Smith Ranch in the Powder River Basin, Wyoming (Figure 4-2), and the most distant is Alta Mesa near Falfurrias, Texas (Figure 4-3). Using published truck accident rates for two-lane and interstate highways in Table 4-1. The probability of an accident involving yellowcake slurry en route to Smith Ranch was calculated at 0.00039 and to Falfurrias at 0.0024. Based upon WDOT traffic data (2002-2005), the probability in any given year of an injury-causing or fatal accident involving a loaded (outgoing) or unloaded (returning) Lost Creek ISR tanker truck is estimated to lie between 14 and 89 in 1,000, or a 1.4 to 8.9 percent probability of an accident (WDOT, 2007a, 2007b).

The risk of an accident involving a yellowcake slurry spill would be minimized by the exclusive use of USDOT-approved vehicles, drivers holding appropriate licenses, and adherence to existing NRC transportation regulations in 10 CFR Part 71. Should a spill occur, yellowcake slurry would pour onto the ground surface and infiltrate into soil, but would not become airborne until the slurry dried. The viscosity of yellowcake slurry would also reduce the chance that a spill would travel a sufficient distance, and thereby reduces the likelihood of slurry entering a waterway before being contained. The drying time of the slurry should provide adequate to for responding personnel to contain and salvage the affected soil. The disturbed surfaces would then be restored and re-vegetated in accordance with all applicable state and NRC regulations.

LCI's Radiation Safety Training Program would instruct employees on contamination and spill control, as well as security and emergency procedures. An emergency response manual would be developed, including actions to minimize and monitor the exposure to employees and members of the public in the event of an unplanned release (External Radiation Exposure Monitoring Program, LCI 2008b). All drivers transporting bulk quantities of licensed material would be familiar with the shipment and how to properly respond to accidents involving the material. In addition to these precautions, the risks of the accidental release of and exposure to radioactive materials would be further minimized by LCI engaging in regular road maintenance. Employees would also be trained how to respond to emergency scenarios. LCI staff would be the primary responders to accidents within the project site (LCI, 2008b). The actual consequences of a yellowcake slurry spill are small due to the appropriate use of such safety controls and emergency response protocols (NRC, 2009a).

Any solid waste generated by the Lost Creek ISR project would be sorted into unrestricted solid waste and by-product material. Unrestricted waste is that refuse that is determined to be uncontaminated or has been sufficiently decontaminated to be disposed of in the Sweetwater County District No. 1 Landfill. Process-contaminated radioactive waste would be transported to a licensed 11e.(2) disposal facility. The estimated annual number of loads of 11e(2) waste is four to five, based on 61 to 77 m^3 (80 to 100 yd^3) of such waste being generated per year and truck capacity at 15 m^3 (20 yd^3). The probability of an accident occurring for any given trip is the same as discussed above with regards to shipments of process chemicals. However, the potential risks for radiation exposure are lower than for a spill involving yellowcake slurry as the waste material is generally less radioactive and consists largely of solid materials that are easy to contain and less likely to aerosolize. The potential impacts of a radioactive waste or yellowcake slurry release on public and occupational health and safety is beyond the scope of this Section and is discussed in Section 4.12.2.

The frequency of heavy-duty truck transport is estimated to remain the same from the construction to the operation phase. Shipments of process chemicals to the site and the shipment of product from the site would contribute to minimal transportation risks on the roads in the region of the proposed project. As was the case with the construction phase, increases in traffic and the potential for road wear would be most noticeable onsite, on the local, unpaved county roads, and on BLM roads. Impacts to road surfaces would be minimized by restricting and minimizing site access to non-project vehicles during operations, and by posting speed limits. However, if improvements to offsite roads are deemed necessary, permits would be obtained from the BLM and Sweetwater County, and their relevant guidelines would be followed. Beyond these local roads to paved surfaces, the overall volume of traffic and impacts to regional transportation networks is anticipated to be low.

As most of this traffic would be related to commuting, there would be some risk to employees, including fatigue, collisions with animals, and adverse weather. Crash rates for the local highways are low (Table 3.3-2 of the ER) and the volume of expected traffic relative to published traffic counts suggests commuting would not significantly change traffic conditions or accident rates. The width of the existing county roads is sufficient to allow two tractor trailer trucks to pass one another, and have been constructed for year round travel. As no divided lanes are provided on Sweetwater County roads in the vicinity of the proposed site, traffic must stop when students are boarding onto or disembarking from school buses.

Even with the decrease of daily trucks traveling to and from the project site, the impact of operations traffic to the roadway network is expected to be long-term, and risks are low, given the expected frequency of accidents and emergency procedures employed. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS, that "yellowcake can be shipped with a low potential of affecting the environment," assuming that safety controls and compliance with existing transportation regulations are met. Therefore, impacts from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.3.1.3 *Aquifer Restoration Impacts*

The GEIS (Section 4.2.2.3) estimates the magnitude of transportation activities during aquifer restoration to be lower than for construction and operations. Aquifer restoration-related transportation activities are expected to be primarily limited to supplies (including chemicals fro reverse osmosis), chemical waste shipments, onsite transportation and employee commuting. The GEIS considers transportation impacts from aquifer restoration to be SMALL to MODERATE, for the same reasons discussed under the Operations Phase.

Transportation impacts during the aquifer restoration phase would be similar to those of the operations phase. However, as the rate of uranium recovery gradually decreases through the course of aquifer restoration, the number of shipments of yellowcake slurry to offsite drying facilities would also decrease. However, because aquifer restoration would proceed concurrently with the construction and operation of other mine units, impacts during this phase are expected to be long-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for

Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.3.1.4 *Decommissioning Impacts*

As discussed in the GEIS (Section 4.2.2.4), the types of transportation activities during decommissioning, and therefore the types of potential impacts, would be similar to those discussed for construction and operations, except that the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks from transportation during decommissioning would be bounded by the estimates of yellowcake transportation risk during operations. The GEIS determines that potential impacts during decommissioning would be SMALL, due to the lower levels of transportation activities expected.

Though no estimates for vehicular trips are currently available, onsite traffic may increase slightly after the aquifer restoration phase is complete for the following: 1) radiological surveys, infrastructure inspection and decontamination; 2) extraction of buried pipelines and in-situ well abandonment; 3) re-grading and reclaiming disturbed areas; 4) removal of contaminated materials and 5) follow-up monitoring of the restored site. Waste materials generated during decommissioning would be segregated by type and transported to approved disposal facilities. These range from ordinary municipal solid waste streams to those NRC-approved facilities capable of receiving 11e.(2) waste materials. Approximately 90 percent of the waste materials is expected to be suitable for disposal in a local, unrestricted landfill (NRC, 2009). The remaining 11e.(2) materials would be transported to a licensed facility, such as the one in Clive, Utah. The probability of an accident en route would be the same as that discussed under the operation phase and is dependent on the route taken, facility location and required number of trips.

The eventual fate of the access roads built to connect Sooner Road and Wamsutter – Crooks Gap Road with plant facility and the well fields would rest with the BLM, though it is anticipated that these roads would remain in use for some period after decommissioning in order to facilitate site monitoring. Should the BLM so request, these access roads would be reclaimed at the applicant's expense. This includes removal of culverts, removal of road surfacing materials, re-contouring as necessary, preparation of the seedbed, and reseeding. Unimproved roads may require scarification, ripping, or disking to reduce compaction before seed application.

Because of the relatively low traffic counts associated with decommissioning and the reduced risk of transportation accidents in comparison to the operations phase, regional transportation impacts are expected to be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.3.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in traffic flows and routings, service levels, or the integrity of the road surfaces and profiles associated with the Lost Creek project. This alternative would have no impact to transportation resources.

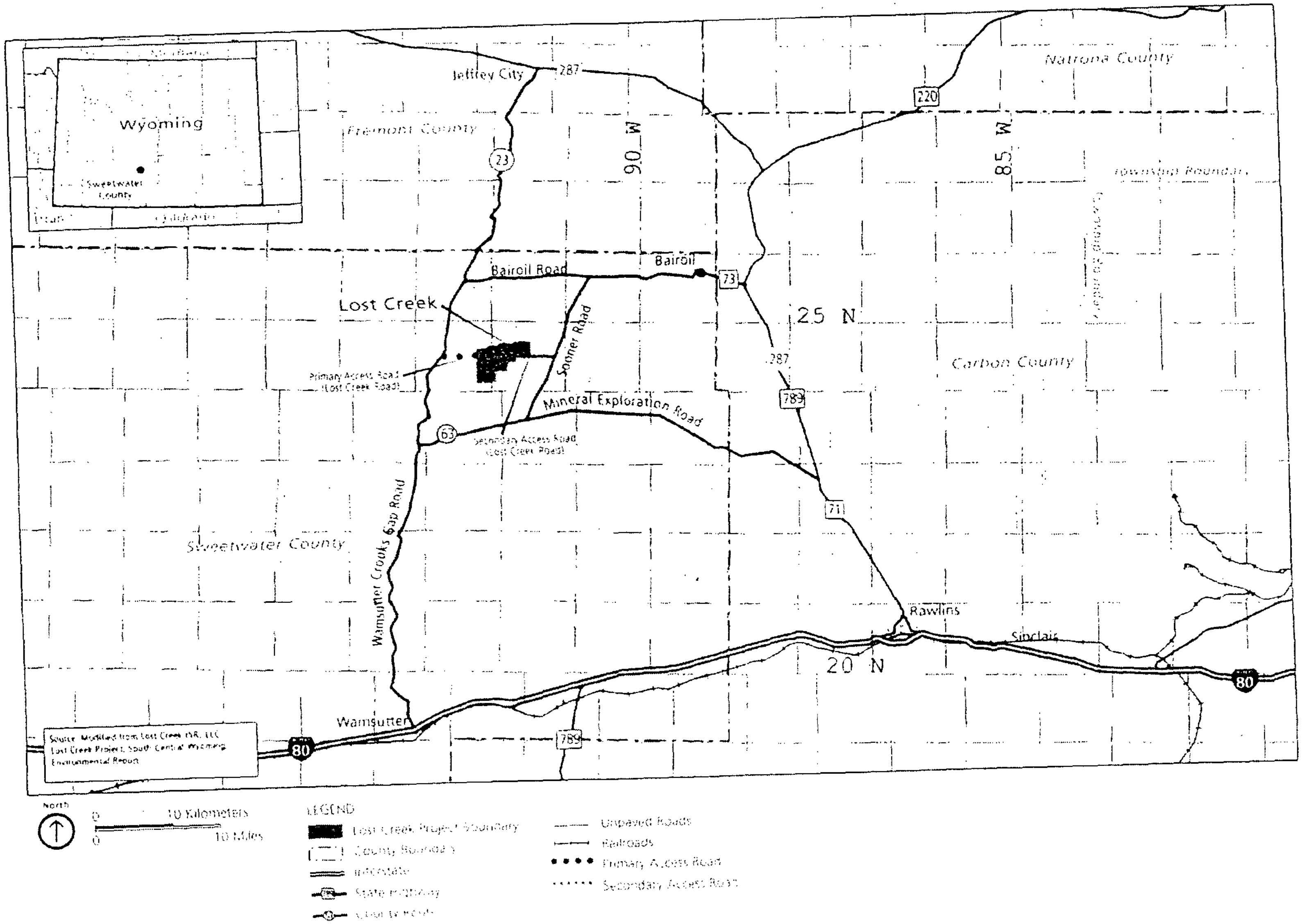

Figure 4-1. Area Roads

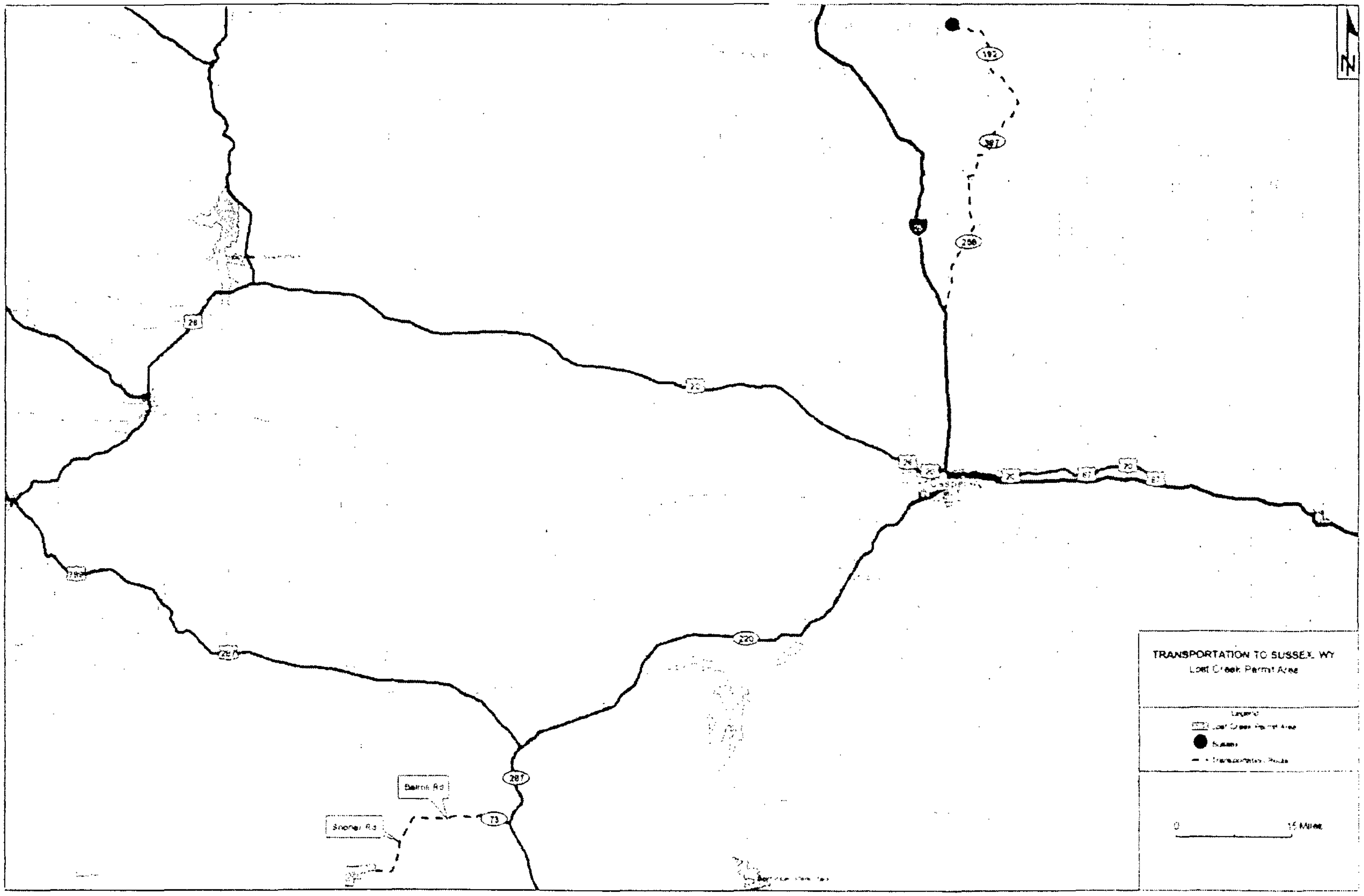

Figure 4-2. Regional Roads to Sussex, WY

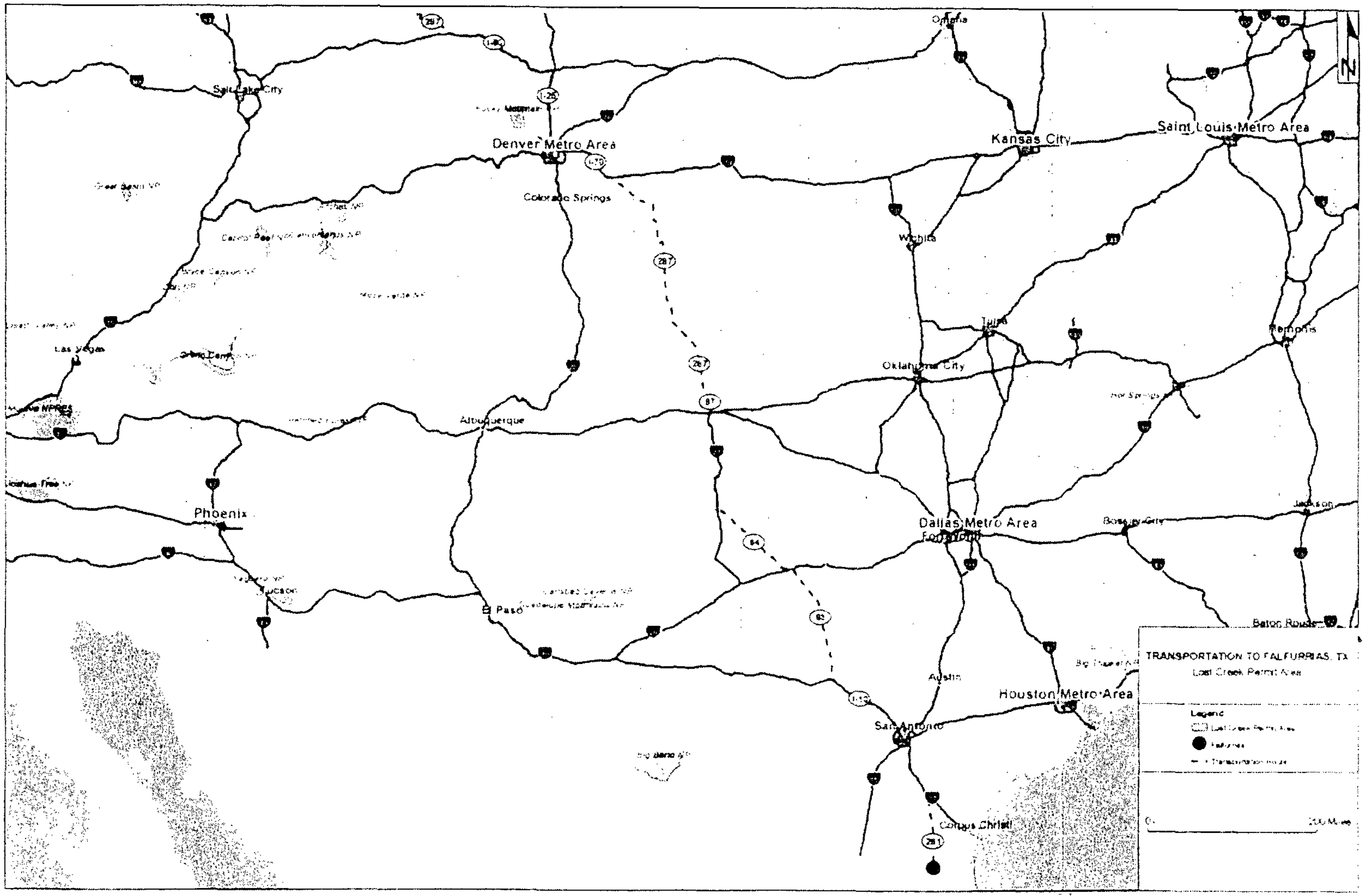

Figure 4-3. Interstate Roads to Falfurrias, TX

4.3.3 Dry Yellowcake (Alternative 3)

4.3.3.1 *Construction Impacts*

The physical components of the ISR facility would be the same as described in the Proposed Action, with the exception of the addition of a yellowcake dryer in the CPP. Since the CPP would be designed to house a yellowcake dryer, the addition of the dryer equipment would not change the footprint of the ISR facility. Additional tractor trailer traffic, however, would be required to supply parts for the yellowcake dryer, but traffic counts for heavy trucks would be expected to remain within the range of 2 to 5 per week. Proposed local and regional routes for incoming and outgoing traffic, traffic counts, and vehicle types would all remain the same as Proposed Action. Therefore, impacts to transportation under this alternative would be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.3.3.2 *Operation Impacts*

LCI estimates that light truck traffic associated with the operation phase would decrease from 30 to 35 light during construction to 20 trucks traveling to and from the site each day. The number of heavy trucks would remain constant between 2 and 5 to and from the site daily. These numbers are the same as for the Proposed Action (Alternative 1). However, as dry yellowcake, rather than yellowcake slurry, would be produced for Alternative 3, departing truckloads of uranium would be notably less frequent. It is anticipated that outgoing shipments would occur approximately once a week or once every two weeks, or about half as often as for slurry shipments.

Transportation related risks during the operation phase can be broken down into four categories: 1) shipments of supplies to the processing facility; 2) outgoing shipments of drummed yellowcake to Metropolis, Illinois; and 3) offsite disposal of unrestricted solid waste and low-level radioactive solid waste, or 11e.(2) waste; and 4) ISR workers. The risk associated with each category, and the implications of an accident, is discussed in section 4.2 of the ER (LCI, 2008a). Risks for incoming shipments of supplies and of solid waste would be identical to those discussed in the preceding section 4.3.1.2 for the Proposed Action. However, transportation risks associated with the shipment of dried yellowcake would be slightly different from that of yellowcake slurry, and are described in the GEIS (NRC, 2009).

The potential for a shipping accident depends on the frequency of deliveries, the distance traveled, and the accident rates described in Table 3.3-2 of the ER (LCI 2008a). In general, truck accidents occur at a rate of 4.0×10^{-7} accidents per km (6.4×10^{-7} accidents per mi) on interstates in rural areas and 1.4×10^{-6} accidents per km (2.2×10^{-6} accidents per mi) for interstates in urban areas for two-lane roads similar to those in the project vicinity. The risk of an accident involving the shipping of dried yellowcake slurry can be calculated by applying the latter, more conservative accident rate of over the 2,012 km (1,250 mi) distance to the Honeywell Uranium Conversion Facility in Metropolis, Illinois. The probability of an accident involving a shipment of dried yellowcake would be 0.0028. This is approximately the same as the risk of shipping yellowcake slurry to the most distant drying facility (Alta Mesa) in Falfurrias, Texas. With the project operating at full capacity, approximately 35 outgoing shipments of drummed yellowcake would be required per year, or roughly half the number (70) of shipments of yellowcake slurry for the proposed action. Assuming 35 one-way trips per year, the risk of any kind of transportation accident is 88 in 1,000 (based on the calculations in Section 2.3.8 of the TR, which uses 50 percent solid slurry as basis for calculations; LCI, 2007b).

Between 2002 and 2005, 0.9 percent of Wyoming traffic accidents caused a fatality and 25.4 percent of accidents resulted in an injury (LCI, 2008a). Therefore, the probability in any given year of an injury-causing or fatal accident involving a loaded (outgoing) or unloaded (returning) Lost Creek ISR tanker truck is at 45 in 1,000.

The safety precautions and security measures described for the Proposed Action in Section 4.3.1.2 also apply to transportation of dried yellowcake drums under Alternative 3. These include using exclusive use shipments and properly licensed and briefed drivers, compliance with existing NRC transportation regulations, strict adherence to LCI's Security Plan, employee training regarding contamination and spill control and security and emergency procedures, implementation of an emergency response plan (ERP [as required]), and routine road maintenance. The potential impacts of a radioactive waste or yellowcake release on public and occupational health and safety is beyond the scope of this Section and is discussed in Section 4.12.3.

With regards to transportation risks to the commuting workforce and potential impacts to road surfaces, these issues also remain the same as for the Proposed Action, as described in Section 4.3.1.2. Considering that transportation risks and impacts are similar and that unplanned releases of uranium from transportation accidents could be minimized through established safety protocols and remediation in accordance with ERPs, the impact of operation phase traffic to the roadway network is expected to be long-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.3.3.3 *Aquifer Restoration Impacts*

Potential impacts to transportation during aquifer restoration would be the same as stated for the Proposed Action (Section 4.3.1.3), and would thus be long-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during aquifer restoration are expected to be SMALL. Furthermore, the NRC

Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.3.3.4 *Decommissioning Impacts*

Potential impacts to transportation during decommissioning would be the same as stated for the Proposed Action (Section 4.3.1.4), and would thus be long-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Transportation and incorporates by reference the GEIS' conclusions that the impacts to Transportation during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.4 Geology and Soils Impacts

Potential environmental impacts to geology and soils can occur during all phases of the Lost Creek ISR Facility lifecycle, much as they would in any other area of the Wyoming West Uranium Milling Region. However, these impacts would occur largely during the construction phase of the project when most of the earth moving and well drilling takes place.

4.4.1 Proposed Action (Alternative 1)

4.4.1.1 *Construction Impacts*

As indicated in the GEIS (Section 4.2.3) during construction of ISR facilities, the principal impacts on geology and soils would result from earth-moving activities associated with constructing surface facilities, access roads, well fields, and pipelines. Earth-moving activities that might impact soils include the clearing of ground or top soil and preparing surfaces for the processing plant, satellite facilities, pumping and distribution houses, access roads, drilling sites, and associated structures. Similarly, excavating and backfilling trenches for pipelines and cables may impact soils in the project area.

The GEIS indicates that the impact of construction activities on geology and soils will depend on local topography, surface bedrock geology, and soil characteristics. The earth moving activities are normally limited to only a small portion of the project. Consequently, earth-moving activities would result in only SMALL and temporary (months) disturbance of soils-impacts that are commonly mitigated using accepted best management practices (BMPs). Construction activities at the Lost Creek ISR Project would also increase the potential for erosion from both wind and water due to the removal of vegetation and the physical disturbance from vehicle and heavy equipment traffic. However, these activities would result in SMALL impacts if equipment operators adopt construction BMPs that prevent or substantially reduce erosion (NRC, 2009).

The GEIS further indicates that ISR mining activities would not result in the removal of any rock matrix or structure. No subsidence would result at the site from the collapse of overlying rock strata in the mining zone, which could happen in underground mining operations. No other geologic impacts are anticipated to occur with the ISR mining method.

The potential environmental impacts to geology and soils at the Lost Creek project area are described in Section 4.3 of the ER. The disturbance to soils would be limited to approximately

23.5 ha (58 ac) of the total 1,709 ha (4,220 ac) of the project area and include the area of the plant facilities, well fields, and any access roads that would be constructed. Potential impacts to soils include soil loss, sedimentation, compaction, salinity, loss of soil productivity and soil contamination. Effect to soils in the project area will result from the clearing of vegetation, excavating, leveling, stockpiling, compacting, and redistributing of soils during construction and, later, during reclamation. While some of these disturbances are short-term in weeks or months (e.g., mud pits, pipelines, field construction, lay down areas, etc.), other disturbances last the duration of the project (e.g., main access roads and the Plant site). However, these longer-term disturbances would also be temporary as any disturbance affected by the project would be restored and reclaimed after the project has reached the end of its life. The activities planned by the applicant for surface reclamation are detailed Section 6.0 of the TR.

Wind erosion is a concern in the project area. Most of the soils in the project area have a significant percentage of silt, which is directly related to dust emissions from unpaved roads. Vehicular traffic on these unpaved roads and construction presents the greatest threat to soils with a potential for wind erosion. Wind erosion would be controlled by removing vegetation only where it is necessary and by techniques that may include surface roads with gravel, limiting traffic speeds, watering unpaved roads, spreading soil binding agents, and timely reclamation (LCI, 2008b).

Water erosion is not a large concern in the project area due to very low (flat) surface slopes, limited amount of precipitation, and the lack of perennial and intermittent streams. However removal of vegetation for any activity exposes soils to increased erosion. Soil loss would be reduced by timely reclamation, installing drainage controls and reseeding and installing water bars across reclaimed areas.

Both construction and operation activities have the potential to compact soils due to heavy trucks driving over bare soils. While soils sensitive to compaction, such as clay loams, do not exist in the project area, the amount of surface-disturbing activity could damage soil properties and cause compaction. Compaction of soils could decrease infiltration, promoting and increase in runoff. The applicant plans to address this concern by disking and reseeding soils compacter during construction and operation activities as soon as possible following use.

Based on the limited construction area and the implementation of the BMPs discussed above, the potential environmental impacts of construction activities on geology and soils at the Lost Creek ISR Project would be temporary. The foregoing analysis for site-specific conditions is consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Geology and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and Soils during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.4.1.2 *Operation Impacts*

As described in the GEIS (Section 4.2.3.2) during ISR operations, a non-uranium-bearing (barren) solution, or lixiviant, is injected through wells into the mineralized zone. The lixiviant moves through the pores in the host rock, dissolving uranium and other metals. Production wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other dissolved metals, and pump it to a CPP or to a satellite processing facility for further uranium recovery and purification.

The removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones, deep below the ground surface, does not result in the removal of rock matrix or structure and, therefore, no significant matrix compression or ground subsidence is expected. Therefore, impacts on geology from ground subsidence at ISR projects are expected to be SMALL (GEIS, Section 4.2.3.2)

The GEIS (Section 4.2.3.2) further indicates that a potential impact to soils from ISR operations arises from the necessity to move barren and pregnant uranium- bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant can be released and (1) pond on the surface, (2) run off into surface water bodies, (3) infiltrate and adsorb in overlying-soil and rock, or (4) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to establish immediate spill responses through onsite standard operation procedures. As part of the monitoring requirements at ISR facilities, licensees must report certain spills to the NRC within 24 hours. Licensees in the State of Wyoming must also comply with applicable WDEQ requirements for spill response and reporting.

Additionally, depending on the method of disposal for process-related liquid effluents (i.e., through the use of evaporation ponds and/or by land application), failure of the pond liner or embankment system and buildup of certain constituents in land-applied water may negatively impact soils. Licensees would be expected to construct and monitor evaporation pond liners and embankments in accordance with NRC-approved plans, and licensees would be expected to obtain the appropriate permits from state regulatory agencies for land application and to conduct regular soil monitoring. Such actions would tend to mitigate impacts to soils from these waste disposal methods.

Based on these considerations, the GEIS (Section 4.2.3.2) concludes that impacts to soils from spills during operation could range from SMALL to LARGE depending on the chemical composition of the liquid spilled and the volume of soil affected by the spill. Because of the required immediate responses at ISR facilities, spill recovery actions, and routine monitoring programs, impacts from spills are temporary, and the overall long-term impact to soils would be SMALL.

Potential tank, pipeline, and pond failures are described in Sections 7.4.1, 7.4.2, and 7.4.3 of the applicant's TR. Containment of tanks within the CPP is designed to prevent releases to soil from tank failure. The design and monitoring of ponds and pipelines should similarly limit any release to soil that may occur from these structures. During operations, the applicant would have in place a program to monitor well field and pipeline flow and pressure. This program is discussed in the Section 6.3.2 and is designed to ensure the timely detection of any releases from leaks from pipeline breaks or ruptures and minimize the volume of such releases. However, should a release from a pipeline occur that represents an environmental concern, the applicant indicates that the area would be surveyed and the contaminated soils would be removed and disposed of according to NRC and/or state regulations. Pipelines would be buried 1.5 to 1.8 m (5 to 6 ft) below ground surface (bgs), below the frost line, and constructed of a corrosion-free HDPE material. Consequently, the probability of such a failure, after the pipelines have been tested and place is service, is considered small. The storage ponds would be constructed with a liner and leak detection systems, and these systems would be monitored daily. In the event a leak is detected, the fluid in the compromised unit would be transferred to the second pond and the liner would be repaired as need. The pond area would be surveyed and reclaimed as part of the final reclamation, eliminating any long-term impact.

Based on these considerations, the potential environmental impacts to soils from spills during operation at the Lost Creek ISR Project could range from SMALL to LARGE depending on the chemical composition of the liquid spilled and the volume of soil affected by the spill. However, because of the required immediate responses at ISR facilities, spill recovery actions, and routine monitoring programs, impacts from spills are temporary, and the overall long-term potential impact to soils would be SMALL.

There would be no significant matrix compression or ground subsidence expected, and it is unlikely that the proposed ISR activities operations would reactivate the fault. Documented cases where fluid withdrawal, or injection has impacted fault transmissivity, so that small earthquakes have occurred when the change of reservoir pressure was on the order of 450 to2275 kg (1,000 to 5,000 lb) per square inch (psi) or higher. Operations at Lost Creek, however, are expected to induce only small pressure changes (e.g., approximately 23 to 68 ksi [50 to 150 psi]). Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Geology and Soils and incorporates, in part, by reference the GEIS' conclusions that the impacts to Geology and Soils during operation are expected to be MODERATE, but may be reduced to SMALL, providing monitoring and spill recovery programs are carried out. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.4.1.3 *Aquifer Restoration Impacts*

As indicated in the GEIS (Section 4.2.3.3), aquifer restoration programs typically use a combination of (1) groundwater transfer, (2) groundwater sweep, (3) reverse osmosis, permeate injection, and recirculation, (4) stabilization, and (5) water treatment and surface conveyance. The groundwater sweep and recirculation process does not result in the removal of rock matrix or structure and, therefore, no significant matrix compression or ground subsidence is expected. The water pressure in the aquifer is decreased during restoration because a negative water balance is maintained in the well field being restored to ensure water flows into the well field from its edges, reducing the spread of contamination. However, the change in pressure is limited by recirculation of treated groundwater and, therefore, it is very unlikely that ISR operations will reactivate any local faults and extremely unlikely that any earthquakes would be generated. Therefore, in the Wyoming West Uranium Milling Region, where the Lost Creek site is located, the potential environmental impacts to geology from aquifer restoration are expected to be SMALL.

Based on the same considerations as used when evaluating the potential impact to soils from spills and leak, the GEIS (Section 4.2.3.3) has concluded that impacts to soils from spills during operation could range from SMALL to LARGE depending on the chemical composition of the liquid spilled and the volume of soil affected by the spill. Because of the required immediate responses at ISR facilities, spill recovery actions, and routine monitoring programs, impacts from spills are temporary, and the overall long-term impact to soils would be expected to be SMALL.

The same spill and leak detection program would be used during restoration as during operations. Similarly, the applicant would be required to conduct the same spill response and cleanup program during restoration as required during operations (GEIS Section 4.2.2.2). Consequently, the impact to soils from spills and pipeline leaks during aquifer restoration should be similar to that indentified for the operation phase to the project. Thus, the potential environmental impacts to soils from spills during aquifer restoration at Lost Creek project are expected to be SMALL. The required immediate response, the spill recovery actions, and the routine monitoring programs, impacts from spills would be temporary, and the overall long-term potential impact to soils at the Lost Creek ISR Project would be expected to be SMALL.

In addition, ISR mining activities during aquifer restoration at Lost Creek would not result in the removal of any rock matrix or structure. No significant matrix compression or ground subsidence is expected, as the net withdrawal of lixiviant (bleed) would be typically one percent or less. No subsidence would result at the site from the collapse of overlying rock strata in the mining zone during the restoration phase, as the target aquifer lies far below the ground surface. Similarly, no impacts on the fault are expected during aquifer restoration. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Geology and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and Soils during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.4.1.4 *Decommissioning Impacts*

As indicated by the GEIS (Section 4.2.3.4), decommissioning of ISR facilities includes: (1) dismantling process facilities and associated structures, (2) removing buried piping, and (3) plugging and abandoning wells using accepted practices. The main impacts to geology and soils at the project site during decommissioning would be from activities associated with land reclamation and cleanup of contaminated soils.

As further indicated in the GEIS, before decommissioning and reclamation activities begin, the licensee is required to submit a decommissioning plan to NRC for review and approval. Any areas potentially impacted by operations would be included in surveys to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CER Part 40, Appendix A, Criterion 6(6). Additionally, a goal of reclamation is to return the site to pre-production conditions through return of topsoil and re-establishment of vegetative communities.

The GEIS concluded that most of the impacts to geology and soils associated with decommissioning would be detectable but SMALL. Disruption and/or displacement of existing soils would be relatively slight. Changes in amounts and locations of impervious surfaces would be measurable but would not be large enough to noticeably alter existing natural conditions. Mitigation may be needed to offset adverse impacts but would be relatively simple to implement, and likely be successful.

The surface reclamation and decommissioning activities planned for the Lost Creek project area indicates that all lands disturbed by the mining project would be restored to their pre-mining land use of livestock grazing and wildlife habitat. Any buildings or structures would be decontaminated to regulatory standards, and either demolished and trucked to a disposal facility or turned over to the landowner, if desired. Baseline soils, vegetation, and radiological data would be used as a guide in evaluating final reclamation. The final decommissioning plan would be sent to the NRC for review and approval.

While there may be some short-term impacts as reclamation is in progress, the outcome of these activities should be to return the project area to pre-mining land use. As a result, the potential environmental impacts to geology and soils associated with decommissioning at the Lost Creek project area would be noticeable. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Geology and Soils and incorporates by reference the GEIS' conclusions that the impacts to Geology and Soils during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.4.2 No-Action (Alternative 2)

The No-Action Alternative would result in no change to existing soil and/or topographic and geologic conditions at the proposed project area or in the region. Land and disturbance would be avoided and the area would retain its soil and/or topographic and geologic characteristics for the region. The existing soils and/or topography and geology present within the project area would not be affected. Therefore, there would be no impacts. There still would be other land use activities (mineral exploration, recreation and hunting) that would have impacts particularly on the soils of the area.

4.4.3 Dry Yellowcake (Alternative 3)

Alternative 3 would include issuing LCI a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling, but processing the recovered uranium into a dry powder instead of yellowcake slurry. The potential environmental impacts to geology and soils for this alternative would not differ from those identified for Alternative 1. Consequently, the potential environmental impacts to geology and soils for Alternative 3 are identical to those identified for the proposed action, SMALL.

4.5 Water Resources Impacts

4.5.1 Surface Waters and Wetlands Impacts

Potential environmental impacts to surface water at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. Impacts can result from road construction and crossings, erosion runoff, spills or leaks of fuel and lubricants, discharges of storm water and process-related fluids, and discharge of well field fluids as a result of pipeline or well head leaks.

This section will focus on the potential impacts to surface waters. No wetlands occur on the Lost Creek project area that would be impacted by the proposed action or any of its alternatives. Detailed discussion of the potential environmental impacts to surface water from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.5.1.1 *Proposed Action (Alternative 1)*

4.5.1.1.1 Construction Impacts to Surface Waters and Wetlands

As described in the GEIS (Section 4.2.4.1.1), potential impacts to surface waters from construction involve road crossings, filling, erosion, runoff, and spills or leaks of fuels and lubricants for construction equipment. These impacts, should they occur, would be mitigated through proper planning, design, construction methods, and best management practices. U.S. Army Corps of Engineers (USACE) permits may be required when filling and crossing wetlands or working in the bed or banks of a stream. The GEIS considered that temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase is complete. Additionally, while impacts from incidental spills of drilling fluids into local streams could occur. They would also be expected to be temporary due to the implementation of monitoring equipment. The GEIS estimates that impacts from roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed by license applicants. Overall, the GEIS determined that construction impacts to surface water would be SMALL because the ephemeral channels within the Great Divide Basin are not considered Waters of the U.S.; they do not drain to a Water of the U.S. (A. Bjornsen personal communication with Matthew Bilodeau of the Corps of Engineers, 2009).

The primary disturbances to the ground surface occurring during the construction phase include well field drilling, road and facility construction, and pipeline installations. Construction related disturbances would occur within small areas relative to the overall project area, and over a relatively short duration. All construction work would occur during the summer and fall months when the ephemeral channels are dry.

Roads: An existing and relatively well-traveled two-track road traverses the project area from Wamsutter-Crooks Gap Road to Sooner Road. This road (Lost Creek Road) would be improved for heavy truck usage and would likely remain as a permanent feature beyond site decommissioning. Additional details regarding Lost Creek Road are provided in Section 2.2.2.2. Other, temporary access roads would also need to be constructed, branching out from Lost Creek Road and providing access to the well fields for the drill rigs required to install the injection and production wells. The proposed road network would involve a minimum of seven crossings of ephemeral channels. Two of the crossings already exist, but would require improvements. Five new crossings would also need to be constructed. Crossings would be designed to be the minimum width necessary (using BLM standards) for safe vehicular traffic. Where crossings (without using culverts) are feasible, they would occur at the natural streambed elevation and perpendicular to flow. No fill material would be needed for these crossings. Steeply incised channel banks may be graded to create gently sloping approaches to these channel crossings. Proper sedimentation and erosion control, such as silt fences and hay bales, would be installed to minimize sedimentation into the channels, and disturbed soil would be re-seeded.

Temporary disturbances to the soil from vehicular passes may cause some sediment transport during periods of surface flow (storm water runoff). However, the amount of sediment transport would be expected to have a negligible effect on the stability of the channel and water quality. Accidental spills of petrochemicals such as oil and gas would be mitigated by routine vehicle maintenance and inspection. In addition to applying for a general Wyoming Pollutant Discharge Elimination System (WYPDES) permit, LCI would prepare a Storm Water Pollution Prevention Plan (SWPPP).

Impacts associated with road construction and vehicular traffic would thus be considered to be long-term and adverse, but SMALL. The scope of the impact would range from typically site-specific to potentially regional, but only in the rare instance when a sediment plume or accidental petrochemical discharge is conveyed outside the study area by flowing water.

Electric Lines: Electricity would enter the project area from the west, and is expected to cross overhead above six ephemeral channels. Lines would be elevated above ground using utility poles placed outside of the ephemeral channels, resulting in no impacts to surface waters.

Wells: The uranium ore body at Lost Creek has a narrow, elongated configuration approximately 60.7 ha (150 ac) in size that would be perpendicular to surface drainage features (see Figure 2-6). Complete avoidance of ephemeral channels would not be possible-it may be necessary to install wells in an ephemeral channel. This work would be done during the dry season, and impacts would be minimized through the installation of erosion and sedimentation control features described earlier (LCI, 2008a).

Drilling fluid associated with well installation would be contained in proximity to the drill rig within a temporary pit. At locations in ephemeral channels or washes, the drilling fluid and residual cuttings in the pit would be emptied and cleaned upon the completion of the installation, with the waste materials being trucked offsite for proper disposal (NRC, 2009). Pits for wells installed in uplands may be removed in the same manner, or may be backfilled and graded flush with the surrounding terrain.

Wellheads installed within stream channels would be designed to withstand storm water flows using exterior protection measures such as diversion swales and/or riprap. Temporary pumps would be attached to the newly created well casing to pump out impurities and turbid water until such time that the well becomes clean of debris. For wells located in ephemeral channels, pumped water would be released directly into ephemeral channels where the water is expected to quickly be absorbed into the soil. Once the installation of each well is completed, measures would be taken to stabilize loose soil such as re-seeding and mulching using standard erosion control techniques.

Surface water impacts associated with well field installation are expected to be temporary, as the wells would eventually be removed and the area reclaimed. However, because they would persist for the life of the mine unit, they would thus be classified as long-term. The scope, nature and extent of surface water impacts associated with well installation would be SMALL.

Pipelines: The injection and production wells would be interconnected and tied to the CPP via flexible, PVC pipes buried at a depth below the soil surface to prevent freezing. This would require that pipes bisect ephemeral channels at numerous locations. Work would be performed when the channels are dry using small-scale excavation equipment capable of creating a narrow, shallow trench. Excavated soil would be returned to the trench at the pre-existing grade after the pipes have been installed. Bare soil would be re-seeded and mulched for stability (LCI, 2008a). Impacts to the channels and water quality are expected to be the same as discussed above for well installation: SMALL.

CPP: The CPP would be constructed north of the uranium ore body in an upland area. The CPP would have no direct impacts to surface waters channels or to the Crooked Well Reservoir, to the northeast. In the event of a heavy rainfall event during construction, concentrated runoff would be diverted to ditches and/or energy dissipaters. These measures would insure that overall impacts to surface waters and downstream wetlands from the construction of the CPP would be short-term (*i.e.*, episodic and rare). Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Surface Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to Surface Water and Wetlands during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.1.1.2 Operation Impacts to Surface Waters

The GEIS (Section 4.2.4.1.2) states that through permitting processes, federal and state agencies regulate both the discharge of storm water runoff and process-related water. Impacts from these discharges would be controlled, as licensees would be expected to operate within the conditions of their permits. The potential impact of spills to surface waters would depend on the size of the spill, the chemical composition of the liquid spilled, the success of remediation, the use of the surface water, and the proximity of the spill to surface water. For these reasons, overall, the GEIS determines the potential impacts to surface waters during operations to be SMALL to MODERATE.

Upon completion of the necessary infrastructure and initiation of the uranium recovery process at Lost Creek, the CPP would be constructed on a concrete slab with a protective berm erected around the perimeter to prohibit any spills from escaping the area. A storm water management plan would be implemented in accordance with WDEQ requirements to detain or treat runoff from the CPP. Runoff would be diverted away from the facility, where it is expected to become absorbed into the soil. Wastewater would not be discharged to surface water channels (LCI, 2008a).

Crews would be required to check and maintain the injection, production and monitoring wells during the uranium recovery process, primarily to identify leaks or spills, and to remediate them quickly. During these activities, vehicles would need to cross ephemeral channels to access all portions of the well fields. Temporary disturbances to soil from such vehicular passes may occur, liberating limited amounts of sediment to downstream areas. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a SMALL impact. Therefore, impacts from operation (potential spills and contaminated runoff) are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Surface Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to Surface Water and Wetlands during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.5.1.1.3 Aquifer Restoration Impacts to Surface Waters

The GEIS (Section 4.2.4.1.3) states that through permitting processes, federal and state agencies regulate the discharge of storm water runoff and process-related water. Impacts from these discharges would be controlled, as licensees would be expected to operate within the conditions of their permits. The potential impact of spills to surface waters would depend on the size of the spill, the success of remediation, the use of the surface water, and the proximity of the spill to surface water. For these reasons, the GEIS determines that impacts to surface waters during operations would be SMALL.

The Lost Creek project requires the restoration of groundwater aquifers once the uranium recovery process is completed. The process of aquifer restoration is more fully described in Section 2.5 of the GEIS (NRC, 2009a), in Section 2.1.1.6 of this SEIS, and in Section 6.2.3 of the Lost Creek TR (LCI, 2008b).

The restoration of groundwater aquifers results in the production of wastewater. However, no wastewater would be released into surfaces waters, and therefore, no impacts to surface waters are expected.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Surface Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to Surface Water and Wetlands during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.5.1.1.4 Decommissioning Impacts to Surface Waters

As described in the GEIS (Section 4.2.4.1.4), impacts from decommissioning would be expected to similar to, but less than, impacts from construction. Activities to clean up, and re-contour and reclaim the land surface during decommissioning would be expected to mitigate potentially long-term impacts to surface waters. Nevertheless, potential impacts to surface water from decommissioning would be expected to be SMALL.

Section 2.1.1.5 of this SEIS and Section 6.4 of the Lost Creek ISR, LLC TR (LCI, 2008b) provides details on the decommissioning process for the project. In summary, all buildings and pipelines would be removed, and wells would be plugged and abandoned. The removal of property improvements would be similar to construction impacts in the context of potential surface water impacts (see Section 4.5.1.1.1).

As buildings and associated structures are decontaminated and removed, temporary soil disturbances would occur. Sedimentation from loosened soil would be prevented from entering surface waters and downstream wetlands during the decommissioning of buildings, minimizing impacts. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Surface Water and Wetlands and incorporates by reference the GEIS' conclusions that the impacts to Surface Water and Wetlands during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.5.1.2 *No-Action (Alternative 2)*

Under the No-Action Alternative, there would continue to be minimal anthropogenic impacts to surface water features. The prevailing land uses in the project area are livestock ranching, recreational activities, and natural resource exploration. There are no coal bed methane (CBM) or oil and gas activities that occur on, or in the vicinity of, Lost Creek the project area.

The project area currently maintains a network of two-track ranch roads for vehicular access. The roads consist of unimproved and unmaintained dirt paths that bisect natural drainage channels and washes at various locations. These 'trail' roads would continue to be utilized in their existing conditions, with the result having the potential for airborne particulates to reach surface water channels, and potentially increase the risk for petroleum products from vehicular activity leaking or running off into channels during ranching, recreation, or geophysical explorations. Under the No-Action alternative, no additional impacts to surface water would occur. Local long-term impacts would persist due to the continued use of existing roads

Under the No-Action Alternative, livestock would continue to have access to channels/washes and Crooked Well Reservoir resulting in the grazing of wetland vegetation, defecation in channels, soil disturbances, and soil compaction. Cattle entering stream channels tend to create instabilities along banks, resulting in higher than normal soil erosion during periods of storm water runoff. In combination, these actions may cause long-term but SMALL impacts to surface water quality.

4.5.1.3 *Dry Yellowcake (Alternative 3)*

Alternative 3 consists of the same construction, operation, aquifer restoration, and decommissioning phases as the Proposed Action, but with only a slight modification to processing the production of a dry yellowcake product. The yellowcake slurry (as would be produced as a final product in the Proposed Action) would be dried on-site within the CPP. No changes to the development footprint, wells, road network, electric lines, pipelines, or ponds would be proposed under this alternative compared to the Proposed Action. As such, the potential impacts to surface waters under this alternative would be the same as described for the Proposed Action, SMALL.

There are no wetlands located on the Lost Creek site, and therefore, there would be no impacts.

4.5.2 Groundwater Impacts

Potential environmental impacts to groundwater resources in the Lost Creek ISR Project can occur during each phase of the ISR facility's lifecycle. ISR activities could potentially impact aquifers above and below the uranium-bearing production zone, as well as the uranium-bearing aquifer itself outside of the license area. Surface or near surface activities that can introduce contaminants into soils are more likely to impact shallow (near-surface) aquifers while ISR operations and aquifer restoration will likely impact the deeper uranium-bearing aquifer, and potentially impact any aquifers above and below, and adjacent surrounding aquifers.

ISR facility impacts to groundwater resources can occur from surface spills and leaks, releases from shallow Surface piping, consumptive water use, horizontal and vertical excursions of leaching solutions from production aquifers, degradation of water quality from changes in the production aquifer's chemistry, and waste management practices involving land application, evaporation ponds, or deep well injection. Detailed discussion of the potential impacts to groundwater resources from construction, operations, aquifer restoration, and decommissioning are provided in the following sections.

4.5.2.1 *Proposed Action (Alternative 1)*

4.5.2.1.1 <u>Construction Impacts to Groundwater</u>

As indicated in the GEIS (Section 4.2.4.2.1), potential impacts to groundwater during construction is primarily from consumptive use of groundwater, injection of drilling fluids and muds during well drilling, and spills of fuels and lubricants from construction equipment. During the construction of the well fields and facility at Lost Creek, potential impacts to groundwater could occur from the consumptive use of groundwater, introduction of drilling fluids and muds into the environment during well installation, discharge of pumped water to the surface during hydrologic testing and surface spills of fuels and lubricants.

The consumptive water use during construction at the Lost Creek site would be generally limited to dust control, drilling support, and cement mixing. Most water used for construction at the Lost Creek project would be extracted from a well completed in the FG horizon. The sands in this horizon constitute an aquifer unit located at depths from 55 to 107 m (180 to 350 ft) below surface, which are hydrologically separated from the HJ production sand and DE surficial aquifer. The consumptive water use during construction is expected to be small and temporary relative to the water supply available in the FG Sands.

The volume of drilling fluids and muds used during well installation is expected to be limited and best management practices would be applied to prevent, identify and correct impacts to soils and the surficial DE aquifer at Lost Creek. Drilling fluids and muds would be placed into mud pits to control the spread of the fluids, to minimize the area of soil contamination and to enhance evaporation. According to the site potentiometric data, the depth to the water table in the surficial DE aquifer at Lost Creek ranges from 24 to 46 m (80 to 150 ft) below ground surface and a low permability BC horizon overlies the DE horizon. Therefore any small amount of leakage from the pits or spills from drilling activities should result in only a small amount of infiltration and not cause noticeable changes in the DE surficial aquifer water quality. The introduction of drilling fluids to the DE, FG, and HJ aquifers may occur during drilling of production wells and monitoring wells, but is expected to be minimal, as drilling muds are designed to seal the hole so that casing may be set.

As wells are installed, some water may be pumped from aquifers for hydrologic tests for pumping tests. This water would be discharged to the surface in accordance with approved permits from the State of Wyoming that the applicant would obtain prior to any release. The surface discharge permits protect near surface aquifers by limiting the discharge volume and prescribing concentration limits to waters that can be discharged.

During all construction operations at Lost Creek, the groundwater quality of near surface aquifers would further be protected if best management practices are employed during facility construction and well field installation. The volume of fuels and lubricants to be kept in the license area during construction is usually small and minor leaks or spills would not be expected to contaminate the groundwater. Such spills would principally be surficial in nature and would have a SMALL impact on surface soils and vegetation.

Based on this analysis, consumptive groundwater use during the construction phase is limited and is expected to have a SMALL and temporary impact. The impacts to soil and groundwater resources during well field and facility construction would be SMALL based on the limited nature of construction activities and implementation of best management practices to protect soils and shallow groundwater. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Groundwater and incorporates by reference the GEIS' conclusions that the impacts to Groundwater during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.2.1.2 Operation Impacts to Groundwater

As indicated in Section 4.2.4.2.2 of the GEIS, during ISR operations, potential environmental impacts to shallow (near-surface) aquifers are related to leaks of lixiviant from pipelines, wells, or header houses and to waste management practices such as the use of evaporation ponds and disposal of treated wastewater by land application. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality. Water quality changes would result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations also can potentially impact groundwater resources (NRC, 2009).

4.5.2.1.2.1 *Operation Impacts to Shallow (Near-Surface) Aquifers*

The GEIS (Section 4.2.4.2.2.1) discusses the potential impacts to shallow aquifers during ISR operations. A network of buried pipelines is used during ISR operations for transporting lixiviant between the pump house and the satellite or main processing facility and also to connect injection and extraction wells to manifolds inside the pumping header houses. The failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers could result in leaks and spills of pregnant and barren lixiviant, which could impact water quality in shallow aquifers. The potential environmental impact of such pipeline, valve, well integrity failure, or pond leakage depends on a number of factors, including the depth to shallow groundwater, the use of shallow groundwater, and the degree of hydraulic connection of shallow aquifers to regionally important aquifers. As indicated in the GEIS, potential environment impacts could be MODERATE to LARGE if 1) the groundwater in the shallow aquifers is close to the ground surface, 2) the shallow aquifers are important sources for local domestic or agricultural water supplies, or 3) the shallow aquifers are hydraulically connected to other locally or regionally important aquifers.

As previously discussed in Sections 3.4 and 3.5.3 of this EIS, the top 213 m (700 ft) of the Battle Spring Formation in the study area has been divided into at least five horizons marked from top to bottom as BC, DE, FG, HJ, and KM. These horizons are sandstone layers separated from one another by various thicknesses of shale, mudstone and siltstone. The first saturated horizon is the DE Horizon. The overlying BC Horizon is unsaturated and separated from the underlying DE Horizon by a shale sequence. The DE Horizon is described as comprised of alternating very fine to coarse-grained sandstone, mudstone and siltstone. The top of the DE Horizon ranges from 30 to 61 m (100 to 200 ft) bgs. Water level data indicate that a water table generally exists within DE Horizon, although it may be locally confined. The shallow water table in this area is typically 24 to 46 m (80 to 150 ft) bgs. Directly underlying the DE Horizon is the FG Horizon, which hosts the aquifer directly overlying the production zone (HJ Horizon).

A survey of groundwater wells in the area (see Section 3.5.3 of this EIS) indicates that shallow groundwater is an important source of water and is used within 3.2-km (2-mi) radius of the project area. However, the depth to the water table and its separation from the land surface by the relatively impermeable BC horizon and the intervening impermeable shale overlying the DE Horizon indicates that the potential for infiltrating fluids released at the surface to reach the shallowest aquifer would be minimal. Any releases would likely be slowed or attenuated by the low permeability beds within the BC Horizon or the underlying shale unit separating the BC and DE Horizons. Thus the potential impacts during operations to the shallow aquifer from releases from the surface would be localized and SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a SMALL impact.

As indicated by the GEIS, any potential impact of releases at or near the ground surface on shallow groundwater can be greatly reduced by leak detection programs required by the NRC. The applicant plans a leak detection and spill cleanup program as outlined in section 5.7.8.3 (Storage Pond Leak Detection) and section 4.0 (Effluent Control Systems) of the TR (LCI, 2008). In addition, preventative measures such as well mechanical integrity testing would limit the likelihood of well integrity failure during operations.

Moreover, the potential leakage from the planned storage ponds can be minimized by the design and operation of these ponds. The applicant has indicated that these ponds would be built with impermeable liners with leak detection systems underlying the liner. Any detection of leaks beneath the liner would lead to the closure of that pond and the necessary repairs to the liner. During operations, the leak detection standpipes would be checked for evidence of leakage. Visual inspection of the pond embankments, fences and liners and the measurement of pond freeboard would also be performed during normal operations. A Pond Inspection Program would be developed for the project and would meet the guidance contained in NRC Regulatory Guide 3.11 and commitments made by the applicant in section 5.3.2 of the TR (LCI, 2008).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Near Surface Aquifers and incorporates by reference the GEIS' conclusions that the impacts to Near Surface Aquifers during operation are expected to be MODERATE, but may be reduced to SMALL, providing monitoring and detection systems function properly, and responses are made quickly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.2.1.2.2 *Operation Impacts to Production and Surrounding Aquifers*

The potential environmental impacts to groundwater supplies in the production and other surrounding aquifers are related to consumptive water use and groundwater quality.

Water Consumptive Use: As discussed in the GEIS (Section 4.2.4.2.2.2), groundwater is withdrawn and re-injected into the production zone during ISR operations. Most of the water withdrawn from the aquifer is returned to the aquifer. The portion that is not returned to the aquifer is referred to as consumptive use. The consumptive use is due primarily to production bleed (about 1 to 1.5% of groundwater withdrawal) and also includes other smaller losses. The production bleed is the net withdrawal maintained to ensure groundwater gradients toward the center of the production network. This net withdrawal ensures there is an inflow of groundwater into the well field to minimize excursions of lixiviant and its associated contaminants out of the well field.

Consumptive water use during ISR operations could potentially impact local water users who use water from the production aquifer outside the exempted zone. This potential impact would result from lowering the water levels in nearby wells thereby reducing the yield of these wells. In addition, if the production zone is hydraulically connected to other aquifers above and/or below the water zone, consumptive use may potentially impact the water levels in these overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water from these aquifers.

Assuming an average withdrawal rate over the life of the Lost Creek project of 656 Lpm (175 gpm), the applicant has provided predictions of the drawdown (reduction in hydraulic head) at the end of production/restoration operations (LCI, 2008b). The average withdrawal used in making these predictions is based on withdrawals during both production and restoration phase of the project. These predictions assume that all withdrawals are from the HJ Horizon and that the HJ Horizon is extensive and confined from above and below. The predictions also assume that the Fault acts as barrier to flow and, consequently, all flow comes from one side of the Fault. The drawdown at the end of production/restoration operations is predicted to be 53 m (177 ft) at 3.2 km (2 mi) from the centroid of production, 50 m (164 ft) at 4.8 km (3 mi) and 45 m (148 ft) at 8 km (5 mi). Actual drawdown during operations will be dependent on the behavior of the Fault barrier under production conditions and vertical flow from overlying and underlying FG and UKM aquifers. Leakage through these barriers would have the effect of reducing the drawdown relative to those predicted above. Excessive drawdown could also be mitigated by providing pumps to flowing wells that stop flow in response to mine unit groundwater withdrawals. Similarly, greater pumping capacity and/or drilling wells to a deeper level mitigate these impacts. The applicant has committed to a program of monitoring water levels in nearby wells and to provide additional pumping capacity, as necessary (LCI, 2008a).

As discussed in Section 3.5.3.1 of this EIS, fifteen wells have been identified within 8 km (5 mi) of the project area that could be impacted by drawdown. Water levels in any of these wells open to the HJ horizon could be significantly impacted. Although many of these wells are not installed at the same depth as the production wells, the estimated 3-degree dip (west) of the Battle Spring formation may allow potential drawdown to affect several shallower wells to the east and northeast. Because the assumption used in making the predictions that the HJ Horizon is extensive and confined may not be accurate, some groundwater may be drawn from overlying and underlying aquifer units during production as well. This would result in an accompanying reduction in water levels in wells penetrating these sands and could result in drawdowns in the nearby stock wells. Based on the information supplied by the applicant, three of the wells within an 8-km (5-mi) radius, particularly to the east and northeast of the facility, could be significantly impacted by consumptive use of groundwater during operation and restoration at the proposed facility. After production and restoration are complete and groundwater withdrawals are terminated at the Lost Creek ISR Project, water levels would tend to recover. However, the recharge in this area is limited and recovery may be slow. Rebound to pre-operation water levels may take many years to occur.

A reduction in water levels in nearby wells could increase the pumping requirements for these wells, with complete dewatering possible in two wells; P5112W/4775 and P8444P. It appears that one of the nearby BLM wells, P10696P, taps a confined aquifer that has sufficient hydraulic head for groundwater to flow to the surface by artesian pressure, negating the need for a pump. Reduction in hydraulic head at this well may stop it from naturally flowing to the surface and require a pump to raise water to the ground surface. Under the conservative drawdown scenario presented by the applicant, only a few (3) of the 15 stock wells would be adversely affected by ISR operations, hence the short-term impact of consumptive groundwater use during mine operation and restoration would expected to be MODERATE. Mitigation of excessive drawdown by the applicant during operation and restoration, using the methods mentioned earlier in this section would change this impact to SMALL. Although there would be potentially slow recovery of water levels to preoperational depths after restoration is complete, the available hydraulic head in the existing wells is great enough that the long-term environmental impact from consumptive use during the operational phase at Lost Creek is expected to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a MODERATE impact assessment, as local water users near a well field could be affected in the short-term in the same aquifer.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Consumptive Use to Production and Surrounding Aquifers and incorporates by reference the GEIS' conclusions that the impacts to Consumptive Use to Production and Surrounding Aquifers during operation are expected to be MODERATE, but may be reduced to SMALL, providing monitoring and detection systems function properly, and responses are made quickly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Excursions and Groundwater Quality: As discussed in the GEIS, groundwater quality in the production zone is degraded as part of ISR operations. In Wyoming, the portion of the production aquifer used for the ISR process must be exempted as an underground source of drinking water by the U.S. Environmental Protection Agency. After production is completed, the licensee is required to initiate aquifer restoration activities to restore the production zone water quality to preoperational baseline levels, MCLs or ACLs. If the aquifer cannot be returned to preoperational baseline conditions, NRC requires that the production aquifer be returned to the MCLs provided in Table 5C of 10 CFR Part 40 Appendix A or to Alternate Concentration Limits (ACLs) approved by NRC. For proposed ACLs to be approved, they must be shown to be protective of public health at the site. For these reasons, potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations would generally be expected to be SMALL and temporary. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a SMALL impact determination.

To prevent horizontal excursions, inward hydraulic gradients are expected to be maintained in the production aquifer during ISR operations. These inward hydraulic gradients are created by the net groundwater withdrawals (production bleeds of 1 to 1.5%) maintained through continued pumping during ISR operations. Groundwater flows in response to these inward hydraulic gradients, thus ensuring that groundwater flow is toward the production zone. This inward groundwater flow toward the extraction wells prevents horizontal excursions of lixiviant solutions away from the production zone.

The NRC also requires the licensee to take preventive measures to reduce the likelihood and consequences of potential excursions. A ring of monitoring wells within and encircling the production zone is required for early detection of horizontal excursions. If excursions are detected, corrective actions are required outside of the exempted portion of the production aquifer in order to control the excursions.

Vertical excursions may also potentially occur into aquifers overlying or underlying the production zone aquifer. As analysis presented in the GEIS indicates, the potential for migration of lixiviant solution into an overlying or underlying aquifer is small if the thickness of the aquitard separating the production zone from the overlying and underlying is sufficient and the permeability of the aquitard is low. Hydraulic gradient between the production zone and overlying or underlying aquifers also help to determine the potential for vertical excursions. Vertical excursions can also occur due to improperly sealed boreholes, to poorly completed wells, or to a loss of mechanical integrity of ISL injection and extraction wells. To ensure the detection of vertical excursions, NRC also requires monitoring in the overlying and underlying aquifers. A program of mechanical integrity testing of all ISL well is also required. Corrective action is required if any vertical excursions are detected.

In Section 2.11.4 of the GEIS, the NRC staff documented, that based on historical information, excursions have occurred at operating ISR facilities. Separately, the NRC staff analyzed the environmental impacts from both horizontal and vertical excursions at three NRC-licensed ISR facilities. In that analysis, which involved 60 events at the three facilities, the NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, however, none resulted in environmental impacts (NRC, 2009b).

Many of the hydrogeologic conditions at the proposed Lost Creek ISL facility are similar to those found at other ISL facilities. Groundwater in the HJ production aquifer may be confined locally and the aquifer displays sufficient hydraulic conductivity to minimize excursions during ISL mining. The drawdown created by pumping in the production zone should facilitate containment of the lixiviant in the mining zone and allow the recovery of any horizontal or vertical excursions, should they occur. The site-specific hydrogeology, however, has several unique features that present challenges for the Lost Creek site. Foremost among these features is the Fault that runs through the project area (see Section 3.4 of this EIS). Displacement along the fault results in geologic beds that are offset across the Fault. Thus, the production zone, overlying, and underlying aquifers do not appear to be laterally continuous across the Fault. The Fault has also been shown to be a barrier to groundwater flow but does not appear to be impermeable. These factors present a number of complications when trying to ensure hydraulic control and monitoring of the production zone and overlying and underlying aquifers, particularly for those areas adjacent to the Fault. The fault may similarly complicate efforts to restore the aquifer.

In addition to the Fault, the extent of confinement provided by the overlying Lost Creek Shale and the underlying Sage Brush Shale is uncertain (See Sections 3.4 and 3.5.2.1 of this EIS). While these shales are areally extensive, large sections of the Sage Brush Shale are less than 3.4 m (10 ft) thick in the proposed project area, and several areas of the Lost Creek Shale are less than 3.4 m (10 ft) thick in the proposed project area. Data presented by the applicant indicate that in some locations within the mining units these confining units are only 1.5 m (5 ft) thick. These areas of thinning in the overlying and underlying confining layers suggest that there may be some hydraulic connection between the production aquifer and the overlying and underlying aquifers. These concerns are supported by the results of the 2007 pumping tests. Minor responses in the overlying and underlying aquifer were observed during these tests. A number of potential causes for these responses have been suggested in addition to leakage across the confining layers, including potential impacts from off-site pumping, leakage through abandoned boreholes, or communication across the Fault. However, the cause of these responses observed in the overlying and underlying aquifers during the 2007 pumping tests have not been clearly identified.

The applicant indicates that each mine unit would be subject to further extensive testing during the Mine Unit Test required before initiating solution mine in each mine unit. This addition testing would employ a greater density of monitoring well within the production zone aquifer and overlying aquifer on both sides of the fault. This additional hydrologic testing would provide better information regarding the cause of the drawdown response in overlying and underlying wells. These results would be provided in the Mine Unit Data Packages, which require review and approval by the NRC. The applicant indicates that engineering practices are available to isolate the lixiviant from overlying and underlying aquifers, but has not provided supporting information. The applicant, however, must be able to design and install monitoring network that is capable of detecting both horizontal and excursions from the production zone, and must demonstrate that restoration is feasible.

This all being said, the aquifers bounding the proposed HJ production zone, as well as the HJ horizon itself, contain naturally high levels of radionuclides and exceed the WDEQ Class I, II and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra 226 and 228. Consequently, any impacts to water quality due to excursions, either horizontally in the production zone or vertically into the bounding aquifer units, during operations are expected to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for a potentially SMALL environmental impact, so long as the applicant (LCI) installs and maintains the monitoring well network properly.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Excursions and Groundwater Quality and incorporates by reference the GEIS' conclusions that the impacts to Excursions to Groundwater Quality during operation are expected to be MODERATE, but may be reduced to SMALL, providing monitoring and detection systems function properly, and responses are made quickly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.2.1.2.3 *Operation Impacts to Deep Aquifers Below the Production Aquifers*

Potential environmental impacts to confined deep aquifers below the production aquifers could be due to deep well injection of processing wastes into deep aquifers. Under different environmental laws such as the Clean Water Act, the SDWA, and the Clean Air Act, the EPA has statutory authority to regulate activities that may affect the environment. Underground injection of fluid requires a permit from the EPA or from an authorized state UIC program. The WDEQ has been authorized to administer the UIC program in Wyoming and is responsible for issuing any permits for deep well disposal at the Lost Creek site.

The GEIS indicates that the potential environmental impact of disposal of leaching solution into deep aquifers below ore-bearing aquifers would be expected to be SMALL, if water production from deep aquifers is not economically feasible or the groundwater quality from these aquifers is not suitable for domestic or agricultural uses (*e.g.*, high salinity), and they are confined above by sufficiently thick and continuous low permeability layers.

The GEIS (Section 4.2.4.2.2.3) indicates that in the Wyoming West Uranium Milling Region, where the Lost Creek ISR Project is located, the Cretaceous Mesa Verde aquifer included in the Upper Colorado River Basin aquifer system is typically deeply buried, contain saline water and are not commonly tapped for water supply (Whitehead, 1996). The Mesa Verde aquifer is separated from the overlying aquifers (including the ore-bearing aquifer) by the regionally extensive Lewis Shale. Hence, the Mesa Verde aquifer could be suitable for disposal of brine solutions and other liquid wastes.

Lost Creek plans to dispose of waste fluids using deep well injection and is seeking a permit for a Class I injection well from the WDEQ. The WDEQ would evaluate the suitability of the proposed deep injection wells. The WDEQ would only grant such a permit if the waste fluids can be suitably isolated in a deep aquifer and not affect any overlying potable aquifers. Consequently, it is assumed that the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste would be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Deep Aquifers Below the Production Aquifer and incorporates by reference the GEIS' conclusions that the impacts to Deep Aquifers Below the Production Aquifer during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.2.1.3 Aquifer Restoration Impacts to Groundwater

As indicated in GEIS (Section 4.2.4.2.3), the potential environmental impacts to groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including discharge to waste storage ponds, and potential deep disposal of brine slurries resulting from reverse osmosis. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the well field being restored.

Lost Creek is planning three phases of restoration: groundwater sweep, groundwater treatment, and recirculation. A reductant may be added anytime to the fluids circulated during restoration to lower the oxidation potential of the production zone, in order to render uranium less mobile. During groundwater sweep, water is pumped from the mine unit, without re-injection, resulting in an influx of baseline quality water from the perimeter of the mine unit. This baseline quality water effectively sweeps the affected portion of the aquifer. Following the sweep phase, water would be pumped from the mine unit to treatment equipment and then re-injected into the mine unit. Ion exchange and reverse osmosis circuits are used during this phase to treat the groundwater. At completion of the groundwater treatment phase in a mine unit, recirculation would be initiated. Recirculation consists of pumping from the mine unit and re-injecting the recovered solution to recirculate solutions and homogenize the groundwater conditions.

Regardless of the process, hydraulic control of the former production zone must be maintained during restoration. This is accomplished by maintaining an inward hydraulic gradient through a production bleed (see Section 4.5.2.1.4). As discussed in the GEIS, the impacts of consumptive use during aquifer restoration are generally greater than during ISR operations. This is particularly true during the sweep phase when a greater amount of groundwater is generally withdrawn from the production aquifer. During the sweep phase, groundwater is not reinjected into the production aquifer and all withdrawals are considered consumptive.

As discussed in Section 4.5.2.1.4 of this SEIS, the applicant has provided predictions of drawdown based on an average consumptive use of 656 Lpm (175 gpm) during the project period. The applicant plans to concurrently restore individual well fields while moving on to ISR operations at other areas. Thus, it is anticipated that only a limited portion of the proposed wellfields would be in restoration phase at any particular time. This mix of well fields in production and restoration was considered when developing the above estimate of average consumptive use. As discussed in Section 4.5.2.1.4, significant drawdown in hydraulic head have been calculated. The drawdown at the end of production/restoration operations is predicted to be 53 m (177 ft) at 3.2 km (2 mi) from the centroid of production 50 m (164 ft) at 4.8 km (3 mi), and 45 m (148 ft) at 8 km (5 mi). Although the prediction is for drawdown in the HJ Horizon based on the assumption that the HJ Horizon is fully confined above and below, there may be potential cause drawdown in units overlying and underlying the HJ Horizon which can impact water levels and groundwater usage in a number of nearby stock wells. Consequently, the temporary impact of consumptive groundwater use during aquifer restoration is likely to be MODERATE. These temporary effects could span many years; however, the final impact would likely be SMALL since water levels should eventually recover after aquifer restoration is complete.

A network of buried pipelines is used during ISR restoration for transporting restoration fluids between the pump house and the satellite or main processing facility and also to connect injection and extraction wells to manifolds inside the pumping header houses. Although the liquids carried in these pipes during restoration are less potent, the failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers could result in leaks and spills of these fluids, which could impact water quality in shallow aquifers. Similarly, the waste storage ponds would operate and could result in leakage to shallow groundwater. These potential impacts to shallow groundwater have previously been evaluated in Section 4.5.2.1.4. As this evaluation indicated, the potential environmental impact to shallow aquifer during the restoration phase from releases from the surface would be SMALL.

The disposal of waste fluids via deep well injection of waste is planned during aquifer restoration in much the same manner as during ISR operation. As previously indicated in Section 4.5.2.1.4, it is assumed that the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste would be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Groundwater and incorporates by reference the GEIS' conclusions that the impacts to Groundwater during aquifer restoration are expected to be MODERATE, but may be reduced to SMALL, providing monitoring and detection systems function properly, and responses are made quickly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.5.2.1.4 Decommissioning Impacts to Groundwater

The environmental impacts to groundwater during dismantling and decommissioning ISR facilities are primarily associated with consumptive use of groundwater, potential spills of fuels and lubricants, and well abandonment. The consumptive groundwater use could include water use for dust suppression, re-vegetation, and reclaiming disturbed areas. The potential environmental impacts during the decommissioning phase are expected to be similar to potential impacts during the construction phase. Groundwater consumptive use during the decommissioning activities would be less than groundwater consumptive use during ISR operation and groundwater restoration activities. Spills of fuels and lubricants during decommissioning activities could impact shallow aquifers. Implementation of BMPs during decommissioning can help to reduce the likelihood and magnitude of such spills and facilitate cleanup. Based on consideration of BMPs to minimize water use and spills, potential environmental impacts to the groundwater resources in shallow aquifers from decommissioning would be expected to be SMALL.

After ISR operations are completed, improperly abandoned wells could impact aquifers above the production aquifer by providing hydrologic connections between aquifers. As part of the restoration and reclamation activities, all monitoring, injection, and production wells would be plugged and abandoned in accordance with the Wyoming UIC program requirements. The wells would be filled with cement and clay and then cut off below plough depth to ensure that groundwater does not flow through the abandoned wells (Stout and Stover, 1997). If this process is properly implemented and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts would be expected to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS (NRC, 2009).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Groundwater and incorporates by reference the GEIS' conclusions that the impacts to Groundwater during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.5.2.2 *No-Action (Alternative 2)*

The No-Action Alternative would result in no construction or operational activities on site that might impact shallow groundwater. This alternative also would not require the injection of lixiviant into the production aquifer or the consumptive use of groundwater. The disposal of waste liquids and solids would no longer be necessary and therefore would pose no threat to groundwater quality or affect the functioning of existing BLM stock wells in the affected environment. Consequently, the No-Action alternative would result in no impacts to groundwater.

4.5.2.3 *Dry Yellowcake (Alternative 3)*

Alternative 3 would include issuing LCI a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling, but processing the recovered uranium into a dry powder instead of a yellowcake slurry. The potential environmental impacts to groundwater for this alternative would not differ from those identified for the proposed action. Consequently, the potential environmental impacts to groundwater for Alternative 3 are identical to those identified for the proposed action.

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources at the Lost Creek site, to both flora and fauna, may occur during all phases of the ISR facility's lifecycle. Impacts may include the removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); the modification of existing vegetative communities as a result of site activities; the loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities.

Detailed discussion of the potential environmental impacts to ecological resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.6.1 Proposed Action (Alternative 1)

4.6.1.1 *Construction Impacts*

As discussed in the GEIS (Section 4.2.5.1), during construction, terrestrial vegetation may be affected through (1) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion);

(2) the modification of existing vegetative communities; (3) the loss of sensitive plants and habitats as a result of clearing and grading; and (4) the potential spread of invasive species and noxious weed populations.

Ecological resources could be affected from the land disturbance of ISR facility construction. Construction would involve vegetation removal during clearing for facilities (*e.g.*, individual well sites, header houses, the plant, roads, parking, lay down areas, and storage ponds), which would result in destruction of habitats and relocation of mobile wildlife. Facility construction would be completed in phases, with restoration following each stage to minimize impacts to vegetation and wildlife.

The off-site impacts of construction would be minimal. Construction activities would produce a minor increase in vehicle traffic and, hence, could increase the potential number of animals killed on the roadways. Construction would also produce a temporary increase in dust, some of which could be deposited on vegetation both on- and off-site. However, vegetation in this naturally dusty, arid region is expected to be adapted to moderate, temporary increases of dust coverage.

4.6.1.1.1 <u>Construction Impacts to Terrestrial Ecology</u>

4.6.1.1.1.1 *Construction Impacts to Vegetation*

As further indicated in the GEIS, the percent of vegetation removed and land disturbed by construction activities (from less than 1 percent up to 20 percent of the permit area) would be a SMALL impact in comparison to the total permit area and surrounding plant communities. Additionally, the clearing of herbaceous vegetation in an open grassland or shrub steppe community is expected to have a short-term, SMALL impact given the rapid colonization by annual and perennial species in the disturbed areas and restoration of the vegetative cover. The clearing of wooded areas may have a long-term impact given the pace of natural succession, and such impacts would be SMALL to MODERATE, depending on the amount of the surrounding wooded area. Noxious weeds are expected to be controlled with appropriate spraying techniques and therefore, impacts would be SMALL (NRC, 2009).

ISR uranium recovery facility construction primarily affects terrestrial vegetation through: (1) the removal of vegetation from the facility site during construction; (2) the modification of existing vegetative communities as a result of maintenance; (3) the loss of sensitive plants and habitats as a result of construction clearing and grading; and (4) the potential spread of invasive species and noxious weed populations as a result of construction (NRC, 2009).

During the life of the proposed Lost Creek project, the land area that would be disturbed would be about 115 ha (285 ac, or 7 percent) of the approximate total project area of 1,709 ha (4,220 ac). Of these 115 disturbed hectares (285 ac), 23.5 ha (58 ac) would be stripped of vegetation. The remaining 91.9 ha (227 ac) would be part of the mine units, consisting of the production well fields and monitoring rings, and would be disturbed during periods of access to these areas. However, Lost Creek operations would be conducted in a series of six mine units that are installed, produced, and reclaimed sequentially; therefore, only small portions of the project area would be disturbed at a given time. The approximate land areas of various habitat types that would be stripped and disturbed are presented below in Table 4-1. Unless otherwise arranged and approved by the relevant agencies, all disturbed areas would be reclaimed to support the pre-operational land uses, livestock grazing and wildlife habitat.

The construction of the CPP, main access roads, surface impoundments, and mine units would involve removal of vegetation and soil to create level ground for building construction. This would occur within the big sagebrush community type. Topsoil would be removed and temporarily stockpiled on the site for future decommissioning and habitat restoration efforts.

The processing plant, roads, and impoundments would have long-term disturbance (the life of the project), while the mine unit areas would have a shorter period of disturbance (approximately two years). To stabilize soils and support the ecosystem, vegetation would be established at disturbed areas with the approved BLM and WDEQ native seed mixture as soon as conditions allow. Only a relatively small portion of vegetation would be affected compared to the overall project area. Impacts from mud pit and pipeline constructions would be short-term, with re-grading and seeding beginning immediately upon completion of construction.

Surface disturbance increases the susceptibility of the project area to invasive and noxious weeds, including Canada Thistle (*Cirsium arvense*), Russian Knapweed (*Centaurea maculosa*), Perennial Pepperweed (*Lepidium latifolium*), and Quackgrass (*Elytrigia repens*). These species are perennial and may quickly invade large areas depending on the season of the year. As such, surface disturbance would be minimized and vehicular access would be restricted to specific roads (LCI, 2008a). Disturbed areas would be temporarily reseeded with WDEQ and BLM approved seed mixture, as soon as conditions allow, preventing the establishment of competitive weeds. Invasive and noxious weeds would be monitored and if they become an issue, other alternatives, such as spot-spray herbicide application, would be considered. The revegetation methods are detailed in the applicant's Plan of Operations submitted to the BLM (LCI, 2008c).

There are no known federally-listed endangered plant species within the project area. Therefore, no impacts to listed species are expected, and no mitigation is needed.

Therefore, from the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to vegetation from construction are expected to be SMALL. Based on the disturbed land area compared to the total project area, some individual plants would be affected, but impacts would not generally affect a sizeable segment of the plant species' population over a relatively large area.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Vegetation and incorporates by reference the GEIS' conclusions that the impacts to Vegetation during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Table 4-1. Stripped and Disturbed Land by Vegetation Type

Disturbance Location	**Term of Disturbance** [1]	**Disturbed Vegetation - hectares (acres)**				**Total Stripped Area hectares (acres)**	**Total Disturbed Area hectares (acres)**
		Upland Big Sagebrush Shrubland		**Lowland Big Sagebrush Shrubland**			
		Stripped	**Disturbed**	**Stripped**	**Disturbed**		
ROADS							
Permanent main access road	LT	4.0 (9.8)	4.0 (9.8)	0.6 (1.6)	0.6 (1.6)	4.6 (11.4)	4.6 (11.4)
Permanent main roads	LT	1.2 (2.9)	1.2 (2.9)	0.2 0.2(0.5)	0.2 (0.5)	1.4 (3.4)	1.4 (3.4)

Secondary roads	LT	1.6 (3.9)	IPA [3]	0.2 (0.6)	IPA	1.8 (4.5)	IPA
Two-track roads (OPA) [2]	LT	0	1.0 (2.5)	0	0.2 (0.4)	0	1.2 (2.9)
PIPELINES AND HEADER HOUSES							
Header Houses	LT	0.1 (0.3)	IPA	<0.1 (0.1)	IPA	>0.1 (0.4)	IPA
Main Pipeline Ditch	ST	0.4 (0.9)	0.4 (0.9)	<0.1 (0.1)	<0.1 (0.1)	0.4 (1.0)	0.4 (1.0)
Secondary lines (OPA)	ST	0.5 (1.3)	0.5 (1.3)	0.1 (0.2)	0.1 (0.2)	0.6 (1.5)	0.6 (1.5)
Tertiary lines	ST	1.9 (4.6)	IPA	0.3 (0.8)	IPA	2.2 (5.4)	IPA
MUD PITS							
Mud Pits (I/P wells)	ST	3.6 (9.0)	IPA	0.6 (1.4)	IPA	4.2 (10.4)	IPA
Mud Pits (Monitoring wells)	ST	0.4 (1.1)	0.4 (1.1)	<0.1 (0.1)	<0.1 (0.1)	0.5 (1.2)	0.5 (1.2)
Mud Pits (Delineation Holes)	ST	2.6 (6.4)	IPA	0.4 (1.0)	IPA	3.0 (7.4)	IPA
FIELD CONSTRUCTION LAYDOWN AREAS	ST	0.5 (1.2)	IPA	0.1 (0.2)	IPA	0.6 (1.4)	IPA
PATTERN AREAS	MT	--	88.7 (219)	--	14.2 (35)	--	102.9 (254)
PLANT COMPOUND	LT	2.1 (5.1)	3.5 (8.6)	2.0 (4.9)	0.6 (1.4)	4.0 (10.00)	4.0 (10.00)
Totals		18.8 (46.5)	99.6 (246.1)	4.7 (11.5)	15.9 (39.3)	23.5 (58.0)	115.5 (285.4)

Reference: LCI, 2008a

[1] LT = long term (greater than or equal to the Project life)

MT = mid-term (mine unit life- 3years)

ST = short term (two weeks to six months)

[2] OPA=the portion that is Outside Pattern Areas

[3] IPA = Inside Pattern Areas (production field + monitoring ring = mine unit)

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4.6.1.1.1.2 *Construction Impacts to Wildlife*

The GEIS also states that, in general, wildlife species are expected to disperse from the project area as construction activities approach, although smaller, less mobile species may die during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible, and thus construction impacts would be SMALL to MODERATE (NRC, 2009). These impacts could be mitigated if standard management practices issued by the Wyoming Game and Fish Department (WGFD) are followed. Impacts to sage grouse and big game species could also be mitigated if BLM and WGFD guidelines are followed. Impacts to raptor species from power distribution lines could be mitigated by following the Avian Power Line Interaction Committee (APLIC) guidance, and avoid disturbing areas near active nests and prior to the fledgling of young (APLIC 2006).

Direct wildlife habitat loss from construction is estimated to be approximately 7 percent of the project area (LCI, 2008). The two major vegetation/habitat types disturbed by project construction include Lowland and Upland Big Sagebrush Shrub land. Project construction would result in the long-term loss of about 1.6 ha (4 ac) of Lowland Big Sagebrush Shrub land and 9.7 ha (24 ac) of Upland Big Sagebrush Shrub land (Table 4-1). In addition, approximately 14.2 ha (35 ac) of Lowland Big Sagebrush Shrub land and 89.8 ha (222 ac) of Upland Big Sagebrush Shrub land would be temporarily disturbed, *e.g.*, without total removal of vegetation (Table 4-1).

The Lowland Big Sagebrush Shrub land habitat had the highest diversity and density of nesting birds at the project area (LCI, 2008b). Long-term loss of 1.6 ha (4 ac) of Lowland Big Sagebrush Shrub land habitat would occur with project construction. Depending on the timing of construction, direct mortality of individuals or loss of nests could occur.

During the construction phase of the project, impacts to small mammals, reptiles, and amphibians would include habitat loss and possibly direct mortality due to contact with equipment. Because only a small percent of the total project area would be disturbed, most species are likely to disperse to neighboring areas with minimal habitat loss. Construction activities are not expected to measurably affect any wildlife species' populations; therefore, impacts from construction to wildlife would be SMALL.

Direct impacts to passerine birds, small mammals, reptiles, and amphibians could include mortality from motor vehicle collisions with the addition of traffic due to construction; however, these impacts would be SMALL because they would affect only a few individuals and would not be expected to have any long-term impacts on the general population of the individual species.

Indirect impacts to passerine birds would include the displacement of shrub-dependent species while construction activities are on going. Birds are mobile and would likely disperse into adjacent habitat areas where there is an abundance of similar habitat. Impacts to passerine birds would not be expected to be outside the natural range of variability and would not be expected to have any long-term impacts on the general population. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to wildlife from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Wildlife and incorporates by reference the GEIS' conclusions that the impacts to Wildlife during construction are expected to be MODERATE, but may be reduced to SMALL, by following exclusionary periods for specified species. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Big Game

All wildlife management practices are established in conjunction with the BLM, WGFD and USFWS guidelines. The applicant would implement measures and BMPs in order to minimize and mitigate impacts to wildlife. These measures are designed to be consistent with regional recommendation by land and wildlife management agencies (BLM, 2008a; WGFD 2008; and WGFD 2009). These measures would also help minimize impacts to plant communities. Standard construction, erosion control, and other BMPs described in other sections would also help to minimize ecological impacts.

Road and Right of Way Measures

- Main access roads would be upgraded and access roads within the project area would use existing two-track roads to the extent possible to help minimize new disturbance of sagebrush habitat. The roads would be upgraded or constructed following BLM and WGFD recommendations to minimize the road width, re-vegetate road shoulders, and limit vehicular speeds.
- All utilities would be located in the same ROW. The proposed pipeline and transmission line would be placed in or adjacent to the access road ROW to help minimize habitat impacts where possible.
- All Project access by employees and visitors would be restricted to the main access road.
- Existing two-track roads that are adjacent to the main access road and project facilities would be gated and or signed to help prevent additional traffic disturbances in the area. This measure would help prevent disturbance of nesting raptors and sage-grouse leks.

Fencing and Screening Measures

- Well fields would be fenced to keep out cattle and wild horses and would be designed to minimize mortality rates. Fences would be temporary and would be removed after ISR operations at the well field are complete. Fences would be constructed to BLM specifications.
- All mud pits outside of fenced areas would be fenced during the drilling phase, while the pits are open and contain drilling liquid.
- If the fluid in the storage ponds is determined to be harmful to birds, netting or other appropriate deterrents would be placed to eliminate any hazard to migratory birds, sage-grouse or other wildlife. The deterrent would be consistent with agency recommendations.
- Vent pipes would be covered by netting or other methods to prevent bats, birds, or small mammals from being trapped.

Transmission Lines

- To prevent the electrocution of raptors in the project area, the primary transmission line and power poles would be built to the latest approved methods (APLIC, 2006). This would include cross-arm design, transformer design, and perch guards.

- To help minimize raptor roosting on power poles and to minimize predation on sage grouse, appropriate roost guards would be attached to power poles and cross arms. The design would follow BLM guidelines (Oles, 2007) or other appropriate guidelines.
- Secondary and tertiary transmission lines would be buried in order to minimize risks to raptors and large birds.

Restoration/Reclamation

- Reclamation would be phased during all stages of the construction and operation of the operations plan. Areas that are temporarily disturbed would be restored and reseeded after disturbance at the next available seeding opportunity. Temporary access roads would be restored and reseeded when no longer needed. Non-maintained road shoulders would be seeded and left undisturbed.
- All seed mixes used for restoration would be approved by the BLM. Only native species would be used in seed mixes. All seed mixes designed for permanent restoration would include sagebrush.
- Weed control is an important issue for restoration and protection of existing habitats for sage grouse and other species, and plant communities. Weed prevention measures following BLM guidelines and recommendations would be implemented (BLM, 1996 and 2008).

Reduce Human Disturbance and Incidental Loss of Wildlife

- It is important that all employees be informed of applicable wildlife laws and penalties associated with unlawful taking and harassment of wildlife.
- It is also required that employees undergo training that describes: 1) the types of wildlife in the area susceptible to collisions with motor vehicles; 2) the circumstances when collisions are most likely to occur; and 3) measures that should be taken to avoid wildlife/vehicle collisions.
- All new and improved roads related to the project are required to be signed and or gated to minimize public traffic.
- All two-track roads that connect to project access road(s) would be signed or gated as needed to minimize disturbance of nesting ferruginous hawks or sage-grouse leks. This would be coordinated with appropriate staff from the BLM and/or WGFD.
- Prior to any ground disturbance activities in potential sage-grouse nesting habitat, a survey would be completed for sage grouse and sage grouse nests following BLM guidelines.

Wildlife Closures and Timing Windows

- The wildlife species in the following table have been selected by the BLM and WGFD as needing stipulations during development activities to protect their populations and habitats. Although not all of these species are present in the project area, the standard wildlife exclusion periods recommended by the BLM and WGFD are presented in Table 4-2. The applicant would follow exclusion periods, as applicable, by species during construction and operation to protect key wildlife resources in the project area (LCI, 2008).

Table 4-2. Seasonal Wildlife Stipulations

Affected Areas/Species	Restriction	Restricted Area
Big game crucial winter ranges	November 15–April 30	Antelope, elk, moose, bighorn sheep, and mule deer crucial winter ranges
Parturition areas	May 1–June 30	Identified parturition areas
Sage-grouse non-core area	(1) Prohibit surface disturbance/occupancy year round; March 1–May 20 avoid human activity 6:00 p.m.–9:00 a.m. (2) Avoid surface disturbing activities March 15–July 15	(1) Within ¼ mile of occupied sage-grouse leks (2) Within 2-mile radius for sage-grouse identified nesting/early brood rearing habitat
Sage-grouse core area	See Stipulations for Development in Core Sage-grouse Population Areas (WGFD, 2009; Appendix C)	See Stipulations for Development in Core Sage-grouse Population Areas (WGFD, 2009; Appendix C)
Sage-grouse winter concentration areas	November 15–March 14	Within identified winter habitat
Mountain plover	April 10–July 10	Potential and occupied habitat
Burrowing owl	April 15–September 15	Within ¾-mile radius
Ferruginous hawk nest	March 1–July 31	Within 1-mile radius
Golden eagle nest	February 1–July 15	Within 1-mile radius
Goshawk nest	April 1–August 31	Within ¾-mile radius
Great horned owl nest	February 1–July 15	Within ¾-mile radius
Kestrel nest	April 1–July 31	Within ¾-mile radius
Merlin nest	April 1–July 31	Within ¾-mile radius
Northern harrier nest	April 1–July 31	Within ¾-mile radius
Peregrine falcon nest	March 1–July 31	Within ¾-mile radius
Prairie falcon nest	April 1–July 31	Within ¾-mile radius
Red-tailed hawk nest	February 1–July 15	Within ¾-mile radius
Short-eared owl nest	March 1–July 31	Within ¾-mile radius
Swainson's hawk nest	April 1–July 31	Within ¾-mile radius
Other raptor nests	February 1–July 15	Within ¾-mile radius
Active raptor nests	Year round	Within 825 feet (ferruginous hawks, 1,200 feet)
Big game crucial winter ranges	November 15–April 30	Antelope, elk, moose, bighorn sheep, and mule deer crucial winter ranges

Table 4-2. Seasonal Wildlife Stipulations

Affected Areas/Species	Restriction	Restricted Area
Parturition areas	May 1–June 30	Identified parturition areas
Sage-grouse non-core area	(1) Prohibit surface disturbance/occupancy year round; March 1–May 20 avoid human activity 6:00 p.m.–9:00 a.m. (2) Avoid surface disturbing activities March 15–July 15	(1) Within ¼ mile of occupied sage-grouse leks (2) Within 2-mile radius for sage-grouse identified nesting/early brood rearing habitat
Sage-grouse core area	See Stipulations for Development in Core Sage-grouse Population Areas (Appendix C of WGFD, 2009)	See Stipulations for Development in Core Sage-grouse Population Areas (Appendix C of WGFD, 2009)
Sage-grouse winter concentration areas	November 15–March 14	Within identified winter habitat
Mountain plover	April 10–July 10	Potential and occupied habitat
Burrowing owl	April 15–September 15	Within ¾-mile radius

Source: BLM, 2008b; WGFD, 2009.

4.6.1.1.1.3 *Wildlife Enhancements*

LCI would work with the BLM and WGFD to complete wildlife enhancements in the project area or nearby areas that are not proposed for operations or disturbance. These enhancements could include placement of new raptor nest platforms, creation of new water sources, or habitat modifications/improvements to improve specific habitat conditions for sage-grouse or other high interest species. All seeding would be completed with native species; sagebrush would be included in all seed mixes.

4.6.1.1.2 Construction Impacts to Big Game

The project area provides winter/year-long range to pronghorn antelope and is not considered mule deer range, but is considered transitional range for elk. The project site also provides range to the Stewart Creek and Lost Creek wild horse herds (BLM, 2004). Because the site provides only marginal habitat to mule deer and elk, no impacts on these species are anticipated. There would be no impact to big-game critical or key winter or summer ranges or migration corridors (University of Wyoming, 2008).

About 115 ha (285 ac) of pronghorn antelope and wild horse habitat (Lowland and Upland Big Sagebrush Shrub land) would be disturbed by project construction. Direct impacts to pronghorn antelope and wild horses may include direct loss and modification of habitat, increased mortality from increased traffic on local and regional roads, and increased disturbances due to human presence. Direct impacts to pronghorn antelope and wild horses would be SMALL because they would affect only a few individuals and are not expected to threaten the continued existence of the species' population in the project area.

Indirect impacts to pronghorn antelope and wild horses may include displacement from increased human activity and increased poaching and/or harvest from improved access on new roads. In addition, increased human presence due to construction and operation would affect pronghorn antelope and wild horse use of areas adjacent to the project. Pronghorn antelope have been shown to become habituated to increased traffic volumes and heavy equipment if the traffic and equipment move in a predictable way (Reeve, 1984). However, initial well drilling activities and unpredictable traffic flows may cause pronghorn to disperse from the area. Some long-term disturbance (during the life of the milling operation) of pronghorn antelope habitat would occur with project construction. Pronghorn antelope displacement of up to 1.0 km (0.6 mi) has been observed from construction activities (Easterly et al., 1991). There is adequate pronghorn antelope habitat in the surrounding area and antelope would possibly return to the project area once initial construction activities have concluded. Wild horses are more transitory and would likely move away from areas of human disturbance. Vegetative forage losses due to construction would be mitigated via staged reclamation of disturbed areas providing grass and forb forage within a few years of habitat disturbance. Indirect impacts to pronghorn antelope and wild horses would be SMALL because these species are highly mobile and long-term impacts on the total population of these species are not anticipated.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Big Game and incorporates by reference the GEIS' conclusions that the impacts to Big Game during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Sage-Grouse

No active sage-grouse leks are located in the project area; however, six active leks are located within the 3.2-km (2.0 mi) buffer zone (LCI, 2008b). The potential impacts to sage-grouse that may be associated with construction activities include loss of nesting/brood-rearing habitat, loss of wintering habitat, decreased population productivity due to loss of nesting/brood-rearing habitat, increased predation due to increased roosting sites for raptors on power poles and other structures, mortality due to exposure from toxic chemicals, loss of nests due to construction activities, and displacement of birds into adjacent areas. Seasonal guidelines with respect to noise, vehicular traffic, and human proximity have been established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b).

The project area is located within a sage grouse Core Population Area as delineated by the Wyoming governor's Sage-Grouse Implementation Team (WGFD, 2008). The Wyoming governor issued an Executive Order (E.O.) in August 2008 regarding management and development in Core Population Areas. Therefore, activities associated with ISR uranium recovery facility construction would conform to the Governor's policy on the Stipulations for Development in Core Sage Grouse Population Areas (WGFD, 2008).

Project construction could result in the short- and long-term loss of 115 ha (285 ac) of potential habitat for sage grouse within the project area. Construction of project facilities, pipelines, transmission lines and roads creates a long-term loss of sage-grouse habitat and increases fragmentation of existing habitat. Transmission line poles, power lines and other facilities provide roosting sites to raptors and corvids, which can result in increased predation during the life of the milling operation. Other sources of direct impacts may occur from disruptive human activities near leks or other key habitat areas. Human activities can also disrupt normal sage grouse behavior related to breeding, brood rearing, or foraging. Increased human-caused noise may reduce lek attendance and reduce wintering habitat suitability. Increased dust from project roads may reduce the palatability of sagebrush plants (LCI, 2008b). The increased traffic adjacent to the Sooner Lek (located approximately 91.4 m [300 ft] from Sooner Road) could result in lower lek attendance.

Seasonal guidelines for greater sage grouse with respect to noise, vehicular traffic, and human disturbance have been established by the WGFD (WGFD 2009) and BLM (BLM 2008b). If BMPs are implemented that minimize noise, vehicular traffic, and human proximity in the vicinity of leks (within the 2-mile radius of an active lek), direct and indirect impacts to sage-grouse would be reduced from MODERATE to SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Sage Grouse and incorporates by reference the GEIS' conclusions that the impacts to Sage Grouse during construction are expected to be MODERATE, but may be reduced to SMALL, by following exclusionary periods for specified species Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Raptors

No active raptor nests occur within the project area (LCI, 2008b). Twelve historic ferruginous hawk nests were documented by the BLM within a 1.6-km (1.0 mi) buffer zone, but were not located during the 2006 and 2007 surveys (LCI, 2008b). Several other raptor species were recorded within the study area; but nesting was not documented.

Raptors are particularly sensitive to noise and the presence of human activity. Potential impacts to raptors include loss of nesting and foraging habitat, collisions with structures and vehicles, nest abandonment and reproductive failure due to increased human activities, reduction in prey populations, and displacement of birds into adjacent areas. Seasonal guidelines with respect to noise, vehicular traffic, and human proximity have been established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b).

Ferruginous hawks have shown to be sensitive to human disturbance, especially during periods of courtship, nest building, incubation, and brood rearing (Collins and Reynolds, 2005). Nest abandonment and loss of eggs or fledglings could occur with human disturbance during the early nesting period.

Mortality from power lines would be minimized by the use of raptor deterrent products and the burial of transmission lines from the transformer to the header houses, and the header houses to the wells. To minimize avian mortality, power lines should be constructed to the most current standards using publications such as those from the Avian Power Line Interaction Committee (APLIC; 2006).

If WGFD guidelines and APLIC (2006) power line construction standards are implemented in the vicinity of known raptor nests, impacts to raptors would be reduced from MODERATE to SMALL. Impacts may affect a few individuals, but are not expected to threaten the continued existence of the species in the project area.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Sage Grouse and incorporates by reference the GEIS' conclusions that the impacts to Raptors during construction are expected to be MODERATE, but may be reduced to SMALL, by following exclusionary periods for specified species Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.6.1.1.3 Construction Impacts to Aquatic Ecology

Baseline surveys indicate that aquatic life and wetlands do not exist within the boundaries of the project area. Surface water may be present for a short period of time mainly during snow melting season, but does not substantially sustain aquatic wildlife or wetland species. Therefore, no impacts to aquatic wildlife or wetlands are anticipated.

4.6.1.1.4 Construction Impacts to Threatened and Endangered Species

If threatened or endangered species are identified in the project site during surveys, impacts may be SMALL to LARGE, depending on site conditions (NRC, 2009). Mitigation plans to avoid and reduce impacts to potentially affected species would be developed.

No federally- or state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the project area; therefore, no adverse impacts are anticipated. The bald eagle (formerly listed as threatened, currently delisted) and black-footed ferret (endangered) are the only federally-listed, previously listed, or candidate wildlife species that may potentially occur in the local vicinity (USFWS, 2008). The bald eagle may occur as a sporadic migrant, and may forage on the site occasionally. The nearest known bald eagle nest to the site is greater than 8 km (5 mi) away. The black-footed ferret is found in active prairie dog colonies. There are no active black or white-tailed prairie dog colonies in the project area and the nearest active prairie dog colonies are 1.6 to 3.2 km (1.0 to 2.0 mi) south and southwest of the project area. No impacts are anticipated from project construction and operation to the bald eagle or black-footed ferret.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Threatened and Endangered Species and incorporates by reference the GEIS' conclusions that the impacts to Threatened and Endangered Species during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.1.1.5 Construction Impacts to Species of Concern

The project area supports habitat for several species of concern, including passerine and breeding birds, pygmy rabbits, olive-backed pocket mouse, and prairie vole. These species would all potentially be affected by construction activities.

The sage thrasher, Brewer's sparrow, and sage sparrow (all Status 4 species) were observed in the project area. Suitable habitat exists for the wouldow lark bunting, though this species was not observed. Lowland Big Sagebrush Shrub land habitat provided the highest densities of breeding birds; however, birds were also located in the Upland Big Sagebrush Shrub land Habitat. Project construction and operation may result in the short-term and long-term loss of 115 ha (285 ac) of nesting habitat for these bird species within the proposed permit area. Construction and operation activities may displace birds to lower quality habitat areas and could result in localized lower reproduction and increased predation. Another potential direct impact to sagebrush obligate birds is mortality from motor vehicle collisions. Impacts would be SMALL because only small areas of land would be disturbed at any given time during the lifespan of the project. This would enable birds to relocate to neighboring areas. In addition, the applicant (LCI) would follow seasonal guidelines for wildlife exclusion periods (Table 4-2), which would further reduce any disruption to nesting activities.

Pygmy rabbits were found sporadically in the Lowland Big Sagebrush Shrub land habitat during surveys conducted by the applicant during the summer of 2007 (LCI, 2008b). Figure 3-7 shows pygmy rabbit habitat (Lowland Big Sagebrush Shrub land) at the project area. Project construction and operation would result in the short-term and long-term loss of 16 ha (39 ac) of pygmy rabbit habitat (Lowland Big Sagebrush Shrub land) within the project area. Pygmy rabbits stay within limited habitat areas. Mortality of individual pygmy rabbits may occur as a result of construction activities in Lowland Big Sagebrush Shrub land habitat. Project facilities, mine units, mud pits, storage ponds, and access roads may result in exposure to pygmy rabbits from harmful substances or materials. These impacts would be SMALL because they would affect only a few individuals and are not expected to threaten the continued existence of the species in the project area. The size of the impacted pygmy rabbit habitat (16 ha [39 ac]) is small in relation to the overall area of habitat available in the project area.

The state-listed olive-backed pocket mouse and prairie vole were not observed at the project area; however, suitable habitat exists and these species are known to be in the region (WGFD, 2004). Loss of potential habitat would occur with project construction and operation and direct mortality could occur during the construction and clearing phase of the project; however, local populations should recover rapidly. These impacts would be SMALL because only a few individuals would be affected. These species would likely travel to suitable habitat adjacent to the construction areas.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Species of Concern and incorporates by reference the GEIS' conclusions that the impacts to Species of Concern during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.1.2 *Operation Impacts*

As discussed in the GEIS (Section 4.2.5.2), wildlife habitats could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. However, the WGFD specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing and netting would limit impacts.

As further indicated in the GEIS, temporary contamination or alteration of soils would likely occur from operational leaks and spills possibly from transportation or land application of treated wastewater. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soils would limit the magnitude of overall impacts to terrestrial ecology. Spill detection and response plans would also reduce impacts to aquatic species from spills around wellheads and leaks from pipelines. Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would likely reduce the significance of overall impacts to SMALL.

4.6.1.2.1 Operational Impacts to Vegetation

During operation activities, well fields and supporting facilities would be accessed frequently using the defined road network. Surface disturbance increases the susceptibility of the project area to invasive and noxious weeds. As such, surface disturbance would be minimized and vehicular access would be restricted to specific roads. Disturbed areas would be reseeded with WDEQ and BLM approved seed mixture, as soon as conditions allow, preventing the establishment of competitive weeds. Invasive and noxious weeds would be monitored and if they become an issue, other alternatives, such as herbicide application, could be considered.

Impacts to vegetation from facility operations resulting from spills around well heads and leaks from pipelines would be SMALL and would be handled using BMPs. Based on the foregoing analysis, activities at the Lost Creek site are consistent with the assumptions stated in the GEIS (NRC, 2009a). Leak detection systems and spill response plans to quickly remove affected soils and capture release fluids would be expected to reduce impacts.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Vegetation and incorporates by reference the GEIS' conclusions that the impacts to Vegetation during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.1.2.2 Operational Impacts to Wildlife

The primary impacts of ISR facility operation on terrestrial wildlife are described in the GEIS: (1) habitat alteration and incremental habitat fragmentation; (2) displacement/stress to wildlife from human activity; and (3) direct and/or indirect mortalities from project construction and operation (NRC, 2009a).

Movement of big game through the project area is not expected to be impacted by most ISR operations. The limited use of fencing that impedes ingress and egress to the project area would further mitigate impacts to wildlife's use of the area. Fencing recommended by the WGFD (WGFD, 2004b) would be used.

Wildlife use of areas adjacent to ISR operations is anticipated to increase as animals become habituated to the activity. Because wildlife may be in proximity to facility buildings, roads, and mine units, some impacts to wildlife would be expected to occur from direct conflict with vehicular traffic and the presence of on-site personnel. Generally these impacts would be SMALL because they would affect only a few individuals and would not threaten the continued existence of any particular species in the project area. However, proximity to active sage-grouse leks or raptor nests has the potential to adversely affect their reproduction, and thus, would have a SMALL to MODERATE impact. The applicant would adhere to seasonal guidelines established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b) with respect to noise, vehicular traffic, and human proximity would reduce the impact to these species to be SMALL.

Potential impacts to migratory birds and other wildlife from exposure to toxic chemicals in the storage ponds may occur. Netting or other appropriate deterrents would be installed to eliminate any hazard to migratory birds, sage grouse or other wildlife. The deterrent would be consistent with agency recommendations. With the use of mitigation measures including perimeter fencing and surface netting, impacts to wildlife from the storage ponds would be SMALL.

During facility operations, spills around wellheads and leaks from pipelines could expose wildlife to toxic chemicals. The applicant's leak detection systems and spill response plans to remove affected soils and capture release fluids would be expected to reduce impacts. If spills or leaks are handled using BMPs, impacts to wildlife would be SMALL.

No impacts to federal T&E species are anticipated during facility operation. Impacts to species of concern during facility operation would be similar to those discussed for construction, but at a significantly lesser degree, because facilities would remain in place during the life of the milling operation. Potential direct impacts would include loss of habitat and displacement of affected species, mortality from motor vehicle collisions for mobile species, exposure to toxic chemicals, and avoidance due to human activity. If BMPs discussed above are followed, impacts to species of concern during facility operation would be SMALL because they would affect only a few individuals and would not threaten the continued existence of any particular species in the project area.

Based on the analyses above, site-specific conditions are consistent with the assumptions in the GEIS. Therefore, the overall impacts to wildlife from operation of the Lost Creek ISR are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Wildlife and incorporates by reference the GEIS' conclusions that the impacts to Wildlife during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.1.3 *Aquifer Restoration Impacts*

GEIS Section 4.2.5.3 discusses the potential impacts to ecological resources during the aquifer restoration phase. Impacts could include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing and netting would reduce impacts.

Contamination of soils and surface waters could result from leaks and spills and land application of treated wastewater (NRC, 2009). However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils and sediments, would limit the magnitude of overall impacts to terrestrial and aquatic ecology. Mitigation measures such as perimeter fencing, netting, and leak detection and spill response plans would reduce the significance of overall impacts to SMALL.

Impacts to threatened and endangered species would be similar to those from operations (i.e., SMALL), because existing infrastructure would continue to be used.

Since the existing infrastructure is already to be in place, aquifer restoration activities would produce potential ecological impacts similar to facility operation and, therefore, potential impacts would be SMALL (NRC, 2009a). Adherence to seasonal guidelines established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b) with respect to noise, vehicular traffic, and human proximity would mitigate potential impacts to affected species. Only a small number of individuals would be affected, therefore, the impact would be SMALL.

Based on the foregoing analyses, activities at the Lost Creek site are consistent with the assumptions in the GEIS. Therefore, impacts to ecological resources from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Ecology and incorporates by reference the GEIS' conclusions that the impacts to Ecology during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.1.4 *Decommissioning Impacts*

As discussed in GEIS Section 4.2.5.4, decommissioning and reclamation activities, would result in temporary land disturbance as soils are excavated, buried piping is recovered and removed, and structures are demolished and removed. Re-vegetation and re-contouring would restore habitat previously altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation are completed and vegetation and habitat are reestablished. Decommissioning and reclamation activities could also result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

As stated in the GEIS, with respect to threatened and endangered species, potential impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. An inventory of threatened or endangered species developed during the site-specific environmental review of the detailed decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would further assist in reducing impacts. Upon completion of decommissioning, re-vegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited. Impacts to threatened and endangered species may be SMALL to LARGE, depending on site conditions.

Impacts from decommissioning would, in part, be similar to those discussed for construction of the facility in terms of increased noise and traffic. The main difference between the decommissioning phase and the construction phase includes the actual loss of vegetation and habitat during construction, whereas decommissioning would restore these systems. These impacts would be temporary (12 to 18 months) and reduced with time as decommissioning and reclamation proceed (NRC, 2009a).

Decommissioning would involve abandonment of the mine units and removal of the supporting facilities and roads. Stockpiled topsoil would be used to re-grade the processing plant and storage ponds to pre-construction contours and seeded with native vegetation once the buildings are removed. No loss of additional vegetative communities is expected beyond those previously lost disturbed during construction. The removal of piping would impact vegetation that has reestablished itself, although this, too, would be temporary once the disturbed soil is re-seeded. The decommissioning process is expected to create added noise and traffic as buildings are taken down and hauled away. During this time, wildlife could come in conflict with heavy equipment, or may move elsewhere on the property due to higher-than-normal noise.

Much of the disturbances to vegetation described in previous sections would occur within the sagebrush vegetative community type. This community type is gaining increasing importance within its range as areas are being lost and converted to grass due to wildfire and human disturbances. Compounding the issue is the difficulty in successfully re-establishing sagebrush, resulting in long-term impacts to vegetation, wildlife habitat, and visual and scenic resources. Refined techniques in seeding sagebrush have shown significant improvements in successful establishment of the species (Lambert, 2005). Such improved methods may include the use of cased-hole punched seeding with polypropylene casings as described by Seefeldt and Booth (2005). For those areas previously dominated by sagebrush, the applicant would re-establish sagebrush using such techniques.

As required, the applicant would submit an updated reclamation plan to the BLM for approval, which would be reviewed and approved by the appropriate state and federal agencies. It is expected that temporarily displaced wildlife would return to the area once decommissioning and reclamation are completed.

Decommissioning impacts would be temporary, and implementation of BMPs would reduce any of the impacts associated with the decommissioning process. The activities proposed at the Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Ecology and incorporates by reference the GEIS' conclusions that the impacts to Ecology during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.6.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no ISR facility construction associated with this project, and therefore no land disturbance or vegetation removal associated with construction, operation, aquifer restoration, or decommissioning. The area would continue to provide vegetation communities and wildlife habitat typical of the region. Land would continue to be used for pastureland and grazing leases would continue. When compared to the action alternatives, there would be no impacts to ecological resources under this alternative.

4.6.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the NRC would issue LCI a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of dry yellowcake as the final product. By doing so, the project would consist of adding equipment for the processing of dry yellowcake. The additional equipment would be installed in the CPP building with the same footprint size located on the Lost Creek site as Alternative 1. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois for ultimate processing into the fuel for nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before being shipped to Illinois.

The potential impacts to ecological resources from the four phases of the proposed ISR facility development under Alternative 3 would be the same as those described under Alternative 1 (proposed action). There would be no increased land disturbance, as the only change would be the installation of a yellowcake dryer, which would be installed in the CPP already fitted to house the unit. There would be no other construction of roads, buildings, storage areas required for this alternative. In addition, the potential impacts to ecological resources would be the same for the operation, aquifer restoration and decommissioning phases as the proposed action.

4.7 Air Quality Impacts

As stated in the GEIS (Section 4.2.6) ISR facilities "are not major non-radiological air emission sources." As a result, an ISR impacts on air quality would be SMALL, if the following conditions were met:

- Gaseous emissions are within regulatory limits and requirements;
- Air quality in the region of influence is in compliance with NAAQS; and
- The facility is not classified as a major source under New Source Review or operating (Title V) permit programs.

Potential environmental impacts to air quality at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. Impacts primarily involve fugitive dust and combustion emissions from vehicles and diesel equipment associated with construction, operation, and decommissioning activities. Other dust-type emissions may be associated with the suspension of dried spill areas and radon releases from well system relief valves, resin transfer, or elution. A factor of concern would be the presence of Prevention of Significant Deterioration (PSD) Class I areas. However, there are no PSD Class I areas in, or near, the Wyoming West Uranium Milling Region where the Lost Creek facility is located.

Detailed discussion of the potential environmental impacts to air quality from construction, operation, aquifer restoration, and decommissioning are presented in the following sections.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 *Construction Impacts*

The GEIS, in Section 4.2.6.1, describes fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction as expected to be short-term, and being reduced through best management practices (e.g., wetting of roads and cleared land areas to reduce dust emissions). Estimated fugitive dust emissions during ISL construction are expected to be well below the NAAQS for $PM_{2.5}$ and for PM_{10}. Additionally, particulate, sulfur dioxide, and nitrogen dioxide emissions from ISR facilities are expected to a small percentage (1 to 9 percent) of the PSD Class II allowable increments.

Air emissions during the construction phase of the Lost Creek ISR project would consist primarily of fugitive dust and emissions from equipment running diesel and gasoline-fueled combustion engines such as drill rigs, water trucks, bulldozers, and light-duty passenger trucks. Construction activities would create air pollution resulting from incoming, outgoing and onsite motor vehicle traffic, heavy equipment use, and mine unit drilling. During construction, truck transport of materials would be the primary source of air pollution that would affect offsite receptors, but this impact would be minor. Most of the combustion emissions would be confined to the project area. Fugitive dust would be generated by travel on unpaved roads and disturbed lands both on and off the site.

During construction, it is estimated that 35 light trucks and 5 heavy trucks would travel to and from the site each day. The majority of the construction workforce would be commuting from the

Rawlins, Casper, Wamsutter, and/or Lander areas (LCI, 2008a). This traffic is not expected to impact other off site communities because of the temporary nature of construction and the low volumes of vehicles in comparison to the average traffic volume of nearby public roads (see Section 4.3.2.1 of this SEIS).

The air quality within the proposed Lost Creek study area would not be substantially affected by project construction because of: 1) the temporary nature of the activity; 2) the limited footprint of the construction area relative to the project area; 3) the relatively low volume of traffic and heavy equipment compared with conventional uranium mining activities and 4) the low background concentrations of pollutants. Both CO and PM impacts caused by the emissions from the operation of construction machinery and by fugitive dust would be short-term and SMALL. The foregoing analysis of site-specific conditions are consistent with the assumptions in the GEIS.

Best management practices (BMPs), following BLM and WDEQ guidelines, would ensure that the construction equipment would minimize fugitive dust emissions. These practices include wetting and stabilization of unpaved roads and disturbed land to suppress dust generation, cleaning paved roadways, and scheduling (phasing) construction activities to minimize the amount and duration of exposed earth. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, for NAAQS attainment areas, like the area around the Lost Creek site, non-radiological air quality impacts would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.1.2 *Operation Impacts*

GEIS Section 4.2.6.2 states that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources during the operation phase. Additionally, although excess vapor pressure in the uranium recovery pipelines could be vented throughout the system, such emissions would be rapidly dispersed in the atmosphere and so potential impacts are expected to be SMALL.

Other potential non-radiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles (NRC, 2009). For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

The GEIS notes that radiological impacts can result from: 1) dust releases from drying of lixiviant pipeline spills; 2) radon releases from well system relief valves; 3) resin transfer or elution; 4) and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials are expected to be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. Compliance with the NRC-required radiation monitoring programs would ensure releases are well within regulatory limits. The impacts from radiological emissions are addressed under Section 4.2.12, Public and Occupational Health Impacts.

Sources for air emissions generated during operations include: 1) building production processes (*e.g.*, operation of pumps, use of generators), 2) onsite motor vehicle activity, 3) vehicles used by the commuting workforce, and 4) heavy truck traffic. Trucking activities would include maintenance and inspection visits and the transportation of incoming supplies and outgoing yellowcake slurry and waste materials. It is estimated that about 20 light trucks and 5 heavy trucks would travel to and from the site each day (LCI, 2008a). CO impacts from engine combustion and heating, ventilation, and air conditioning (HVAC) equipment at the CPP would be short-term. The activities proposed at the Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.1.3 *Aquifer Restoration Impacts*

GEIS Section 4.2.6.3, states that air quality impacts from aquifer restoration are expected to be similar to, but less than, those during operations because the same infrastructure is used for aquifer restoration as during operations. Additionally, fugitive dust and fuel emissions from vehicles and equipment during aquifer restoration is expected to be similar to, but less than, the dust and fuel emissions during operations. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

Potential air impacts during the aquifer restoration phase would result from fugitive dust and combustion emissions from many of the same types of emission sources identified earlier in the operations phase. Vehicular traffic would be limited to delivery of supplies and the commuting staff, with a decreasing frequency of offsite shipments of yellowcake slurry as restoration proceeds. Therefore, there would be fewer trips than during the operation phase. This phase of the Lost Creek ISR Project would use existing infrastructure and equipment similar to that employed during the operation phase. Accordingly, impacts would be similar to the operation phase.

Air quality would not be substantially affected by the aquifer restoration activities because of the low number of vehicles used. PM impacts caused by the emissions from restoration equipment and by fugitive dust would be local, short-term, and adverse, but SMALL. CO impacts from engine combustion would be short-term. The activities at the proposed Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.1.4 *Decommissioning Impacts*

Decommissioning activities would be similar to those of construction (NRC, 2009). In the short term, emission levels are expected to increase given the activity (demolishing of process and administrative buildings, excavating and removing contaminated soils, grading of disturbed areas). However, such emissions would be expected to decrease as decommissioning proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with construction, would be short-term, and would be reduced through best management practices (e.g., dust suppression). For NAAQS attainment areas, non-radiological air quality impacts would be SMALL (NRC, 2009).

Potential air impacts during the decommissioning phase would include fugitive dust, vehicle emissions. Diesel emissions from many of the same sources identified earlier in the construction phase would have similar results. In the short term, emission levels could increase, especially for particulate matter from activities such as dismantling buildings and milling equipment, removing any contaminated soil, and grading the surface as part of reclamation activities. The plugging and abandonment of production and injection wells would use equipment that generates gaseous emissions, as would the heavy trucks required to ship non-contaminated waste to local landfills and 11e.(2) waste to a licensed facility. These emissions would also be expected to be limited in duration, similar to the operation and aquifer restoration phases.

PM impacts caused by the emissions from decommissioning equipment and by fugitive dust would be local, short-term, and adverse, but SMALL. CO impacts from engine combustion would be short-term. The activities at the proposed Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in the air quality at this site or at any surrounding receptors. While natural resource exploration activities would continue and perhaps expand in the future, these activities would typically be of short duration and would involve few vehicles and no permanent, pollutant-emitting infrastructure. The generation of fugitive dust is currently minimized by the fact that there is an existing two-track road traverses the site from east to west, allowing both prospective miners, grazing managers, and recreational traffic to gain access to the site without additional land disturbance.

The Lost Creek project area currently meets the NAAQS for attainment status and because there are no significant air pollution sources at the proposed site, and it is expected that this area would continue to meet the NAAQS. This alternative would result in neither beneficial nor negative impacts to air quality.

4.7.3 Dry Yellowcake (Alternative 3)

Alternative 3 would be the same as Alternative 1 (the Proposed Action), except that the uranium processing of yellowcake slurry would be changed to processing dry yellowcake. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility. This change, however, would have no substantial effect on air quality impacts. A discussion of the potential radiological impacts of air quality is presented in Section 4.12 of this SEIS.

4.7.3.1 *Construction Impacts*

Under Alternative 3, the emission of PM and CO during construction would only be slightly elevated at the project site relative to the Proposed Action. This is because the construction of the CPP would accommodate a yellowcake dryer, involving potentially different heavy equipment utilization from the proposed action. Traffic counts may also increase slightly as associated supplies are delivered to the site. These additional trips would result in the generation of additional fugitive dust from traffic along gravel ranch roads, as well as particulate and CO from diesel fuel combustion.

While the construction activities associated with Alternative 3 may result in a slightly greater intensive use of heavy equipment, there would, nevertheless, be no incremental change in the air emission levels in the project area or at any surrounding receptors, when compared to Alternative 1. The nearest residential receptors, which are located approximately 24 km (15 mi) northeast of the project area, would not experience any increases in air pollution levels from construction activities at the proposed project site for the following reasons: 1) they do not lie in the path (direction) of the prevailing winds; and 2) the pollutants would have dispersed over the 24 km (15 mi) distance before reaching the receptor. PM impacts caused by the emissions from the operation of construction machinery and from fugitive dust would be short-term and SMALL. CO impacts from engine combustion would be short-term. The activities proposed at the Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Land Use during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.3.2 *Operation Impacts*

The impacts of operation of Alternative 3 would be the same as those stated for Alternative 1. In fact, because the end product would be dried yellowcake as opposed to yellowcake slurry, outgoing shipments would be relatively less frequent (see Section 4.3.3.2 of this SEIS). Fewer trips would result in potentially less fugitive dust being generated by rolling traffic of tractor trailers, and less PM and CO from diesel truck exhaust. Nevertheless, because PM and CO disperses rapidly, impacts would be localized at the area of disturbance, or at the point source of emission. HEPA filters and vacuum dryer designs would reduce particulate emissions from operations, and ventilation reduces radon buildup during operations.

The nearest residential receptor location, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any incremental change in air pollution levels due to the activities during operations at the proposed site. PM impacts caused by the emissions from operations equipment and from fugitive dust and. CO impacts from engine combustion would be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from facility operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.3.3 *Aquifer Restoration Impacts*

The impacts of aquifer restoration for Alternative 3 would be the same as those stated in the preceding Section 4.7.3.2, though perhaps limited even further by the fact that fewer shipments of process chemicals would be required. The nearest residential receptor location, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any incremental change in air pollution levels due to aquifer restoration activities at the proposed project area. PM impacts caused by the emissions from restoration equipment and by fugitive dust and CO impacts from engine combustion would be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.7.3.4 *Decommissioning Impacts*

The impacts of the decommissioning of Alternative 3 would be the same as those stated for Alternative 2, though perhaps increased slightly to account for the additional CPP components. The nearest receptor, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any incremental change in air pollution levels due to the decommissioning activities. Though offsite haulage may increase to account for the disposal of additional infrastructure, the low level of traffic and the resulting emissions would not contribute noticeably to the traffic volumes on the routes between the project area and the disposal facilities.

PM impacts caused by the emissions from decommissioning equipment and from fugitive dust and CO impacts from engine combustion would also be short-term. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to air quality from decommissioning are expected to be SMALL. These impacts would be SMALL because of: 1) the relative small size of the project; 2) the short duration of the activity; and 3) excellent atmospheric dispersion characteristics of the region.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Air Quality and incorporates by reference the GEIS' conclusions that the impacts to Air Quality during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.8 Noise Impacts

Potential environmental impacts from noise at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. These impacts would be associated with the operation of equipment such as trucks, bulldozers, and compressors; from traffic due to commuting workers or material/waste shipments; and well field and central processing plant activities and equipment. These impacts may affect both humans and wildlife in the vicinity of the site.

Detailed discussion of the potential environmental impacts from noise due to construction, operation, aquifer restoration, and decommissioning are provided in the analysis of the Proposed Action (Alternative 1).

4.8.1 Proposed Action (Alternative 1)

4.8.1.1 *Construction Impacts*

As discussed in the GEIS (Section 4.2.7.1), potential noise impacts are expected to be greatest during construction of the ISR facility, due to the heavy equipment involved and given the likelihood that these facilities would be built in rural, previously undeveloped area where background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the well fields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above the undisturbed background levels. Noise levels are expected to be higher during daylight hours when construction is more likely to occur, and more noticeable in proximity to the operating equipment. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. For individuals living in the vicinity of the site, ambient noise levels would be expected to return to ambient (background) conditions at distance more than 300m (1,000 ft) from the construction activities (based upon free-field attenuation rates [a decrease of 6 dB for every doubling of distance from the source]). Wildlife is expected to avoid areas where noise-generating activities were ongoing; although for certain wildlife (e.g., sage grouse) continuous elevated noise levels may reduce their breeding success. Overall, these types of noise impacts would be SMALL, given the use of hearing controls for workers and the expected distance of nearest residents from the site.

Additionally, as stated in the GEIS, traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) is expected to be localized and limited to highways in the vicinity of the site, access roads within the site, and roads in the well fields. Relative short-term increases in noise levels associated with passing traffic would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities such as Bairoil, Lamont and Jeffrey City.

The construction phase of the Lost Creek ISR Project would involve the use of heavy equipment to create and improve road surfaces, furnish supplies, excavate footings, erect buildings, and install the wells and pipelines at the mine units. Equipment such as bulldozers, graders, tractor trailers, excavators, cranes, and drill rigs would create noise that would be audible onsite above the 40 dBA of the background noise levels. Table 4.2-1 in the GEIS presents the typical equipment and their sound levels that would be anticipated to be used in the construction of the Lost Creek ISR Project.

The total sound levels generated by the Lost Creek ISR Project include construction equipment, motor vehicles, and drill rigs. The construction phase sound levels were based upon the reference sound levels, which were projected to receptor locations by established relationships of sound propagation over distance. Specifically, for a stationary source of sound and beginning at a distance of 15 m (50 ft), noise levels diminish by 6 dB (decibels) for each doubling of the distance from the source (FHWA, 1980). This is known as free-field attenuation, and does not consider factors such as frequency, terrain or atmospheric conditions.

In general, construction activity would be restricted to daylight hours, which would result in a 24-hour average sound level on-site that is below the criteria of 70 dBA (A-scale)for hearing protection (EPA, 1978).

Stationary onsite sources of noise at the proposed Lost Creek site are expected to have no impact on offsite receptors, based on the 6dB reduction factor for each doubling of distance. However, truck transport of construction materials would be the primary noise source that would affect offsite receptors. However, because of the limited traffic volume associated with the project as a whole (see Section 4.3), this impact would be regional, adverse and SMALL. The incremental increase in project-related traffic on the relatively well-traveled public roadways in the area (*e.g.*, I-80, US 287) would not be expected to be noticeable. Because uranium would be recovered from a total of six mine units and no more than two are operational at one time, well field construction would take place in a sequential manner over approximately seven years. As such, noise impacts would be considered a short-term impact, regardless of receptor location. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, noise impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Noise and incorporates by reference the GEIS' conclusions that the impacts to Noise during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.8.1.2 *Operation Impacts*

As described in Section 4.2.7.2 of the GEIS, noise-generating activities associated with the CPP would be indoors, thus reducing potential offsite sound levels. Well field equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities), also reducing potential offsite sound levels. As for construction, traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative short-term increases in noise levels associated with this traffic would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities. Thus, the overall impact to noise levels from operations is expected to be SMALL to MODERATE.

Because of the sequential manner of mine unit development proposed for the Lost Creek ISR project, operation phases overlap with construction phases for all but the sixth and final mine unit. As such, impacts during the operation phases would be the same as described in Section

4.8.1.1 above for approximately the first five years of the total seven years of operation. The final two years of operation would coincide with aquifer restoration and decommissioning activities in the preceding mine units. This means that overall noise impacts within the project area during the operation phase would be compounded. However, since there are no receptors close to the site, the potential impacts would be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Noise and incorporates by reference the GEIS' conclusions that the impacts to Noise during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.8.1.3 *Aquifer Restoration Impacts*

The GEIS (Section 4.2.7.3) states that general noise levels during aquifer restoration would be expected to be similar, or less than, those levels experienced during operations. Additionally, workplace noise exposure would be managed using the same administrative and engineering controls as during operations. Pumps and other well field equipment contained in buildings would reduce sound levels to offsite receptors. Existing operational infrastructure would be used, and traffic levels would be expected to be less than that seen during construction and operations. Impacts, therefore, would be expected to be SMALL to MODERATE.

Sound levels generated during the restoration phase include cement mixers, compressors, and pumps used for the plugging and abandonment of production and injection wells. Noise impacts from aquifer restoration activities would be expected to be similar to, or lower than, the operation phase activities at the site. Vehicular traffic is expected to be limited to delivery of supplies and staff accessing the site, therefore resulting in fewer trips than during the operation phase. Sound levels from the aquifer restoration activities would be localized and would be reduced with distance, similar to the sound levels of the other phases of activities. Since equipment and traffic were assumed to be similar to those of the operation phase, the degree of noise impact is the same as the operation phase. Therefore, noise impacts attributable to restoration activities at the project area would be expected to be long-term. The activities proposed at the Lost Creek site are consistent with the assumptions stated in the GEIS. Therefore, noise impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Noise and incorporates by reference the GEIS' conclusions that the impacts to Noise during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.8.1.4 *Decommissioning Impacts*

The GEIS (Section 4.2.7.4) discusses the potential noise impacts during decommissioning. General noise levels during decommissioning and reclamation would be expected to be similar, or less than, those levels experienced during construction. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities would generate noise levels that would be expected to exceed the background. These noise levels would be temporary; once decommissioning and reclamation activities were complete, noise levels would return to ambient, with occasional vehicle traffic for any longer term monitoring activities. As with construction, noise levels are expected to be higher during daylight hours when decommissioning and reclamation is more likely to occur, and more noticeable in proximity to the operating equipment. Noise generated during decommissioning would be noticeable only in proximity to equipment and temporary (typically daytime only). Workplace noise exposure would be managed using the same administrative and engineering controls as during construction and operations, and given the likely distance of nearby residents from the activity (i.e., greater than 300 m [1,000 ft]), it is not expected that the noise would be discernable to offsite residents or communities. Therefore, the GEIS considered noise impacts from decommissioning to be SMALL

Sound levels generated at the proposed site during decommissioning would be similar to the construction activities and would include earth moving, excavation, and building demolition. Noise impacts from decommissioning activities would be expected to be similar to, or lower than, the construction activities at the site. Decommissioning activities would result in a substantial, but temporary, noise impact to the areas surrounding the proposed area.

It is expected that the nearest receptor, which is located approximately 24 km (15 mi) northeast of the project area, would not experience any change in sound levels due to decommissioning activities, resulting in no impact. There would be no noise impacts at the nearest residential receptor locations, which are more than 24 km (15 mi) from the project site. Site-specific conditions are consistent with the assumptions stated in the GEIS in Section 4.2.7.4. Therefore, noise impacts from decommissioning are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Noise and incorporates by reference the GEIS' conclusions that the impacts to Noise during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.8.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in the sound levels in the project area or at any surrounding receptors. While natural resource exploration activities would continue and perhaps expand in the future, these activities would typically be of short duration and would involve few vehicles and no permanent, noise-emitting infrastructure. These activities, coupled with the remote and rural setting of the project area, would result in sound levels remaining at or below 40 dBA. This alternative would result in neither beneficial nor adverse impacts to noise.

4.8.3 Dry Yellowcake (Alternative 3)

Alternative 3 would be the same as the proposed action except that the uranium processing of dry yellowcake would be changed. The project would add equipment for the processing of dry yellowcake. However, since the equipment would be installed inside the CPP, the noise increase impact at the project boundary would be SMALL. In addition, this additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility, but is expected to have no substantial effect on transportation noise impacts. Alternative 3 is expected to have the same potential impacts in each of the four project phases as the proposed action.

4.9 Historical, Cultural, and Paleontological Resources Impacts

Three resource types are considered in this section: historical, cultural and paleontological. The first two resource types are linked under a series of common federal laws. Paleontological resources, however, are not subject to the same federal regulations. Under State of Wyoming regulations, archaeological and paleontological resources are subject to the same statute (see Section 1.7.6.5).

Detailed discussion of the potential environmental impacts to historic and cultural resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.9.1 Proposed Action (Alternative 1)

Under Alternative 1 (Proposed Action), the NRC would issue LCI a license for ISR uranium milling and processing at the Lost Creek site. The facilities would be contained within about 115 ha (285 ac); of this, about 102 ha (254 ac) are accounted for by the well fields and access road. For archaeological sites, the impacts from various actions are linked to the physical footprints of the infrastructure. In the case of Alternative 1, the following facilities would directly impact the cultural settings: the well fields, CPP, secondary access roads, powerline corridors, and storage ponds.

4.9.1.1 *Construction Impacts*

4.9.1.1.1 Historical and Cultural Resources

As discussed in the GEIS, the potential impacts during ISR facility construction could include loss of, or damage to, historic and cultural resources due excavation activities as a part of construction. Additionally, access to, historical, cultural, and archaeological resources could be temporarily restricted during construction.

It is expected that an applicant would conduct the appropriate historic and cultural resource surveys as part of pre-license application activities. Further, it is anticipated that the determination of eligibility for listing in the *National Register of Historic Places* (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties (TCP) would be conducted as part of the site-specific review.

TCPs are historic and cultural resources that are important for a group to maintain its cultural heritage. Traditional cultural properties are most often associated with Native American religious or cultural practices. Most traditional cultural properties can be identified only through consultation with Federally-recognized Native American Tribes. To determine whether significant cultural resources would be avoided or mitigated, consultations involving the NRC, the applicant, State Historic Preservation Offices (SHPO), other government agencies, and Native American Tribes (Tribal government or designated THPO) would occur. An NRC licensee would be likely be required, under conditions in its license, to stop work upon discovery of previously undocumented historic or cultural resources and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures. The GEIS determined that potential impacts to historic and cultural resources from construction could be SMALL to LARGE depending on the presence or absence of historic and cultural resources on the site.

The construction would have a direct impact on specific archaeological sites determined eligible to the NRHP. The effect would be short-term; therefore the impact would be MODERATE as mitigation would be required (Section 106 of the NHPA). If mitigation measures were not implemented, then the impacts could range from MODERATE to LARGE.

Archaeological sites and isolated finds were identified within project areas that would be directly affected during construction (Kinneer et al. 2007). These locations include the well field, plant area, and any location that would be cleared or otherwise surface modified. With the exception of three of the archaeological sites, the remaining sites and isolated finds were recommended as not eligible to the NRHP (Kinneer et al. 2007).

Three archaeological sites (48SW16604, 48SW16608, and 48SW16765) are recommended as eligible to the NRHP (Kinneer et al. 2007). Archaeological site 48SW16604 is located within the proposed well field and could be impacted during the construction phase of the project. It is recommended that the site be avoided; if avoidance was not possible, then mitigation measures should be outlined in a formal treatment plan. The impact from the project on site 48SW16604 could be MODERATE as one or more conditions of integrity could be affected.

In 2008, LCI's contractor developed the treatment plan for the site. In the plan, Kinneer (2008) noted that "Site 48SW16604 lies within the proposed impact area where construction related to the well field, an access road, and a pipeline would occur." Since this site is proximate to an access road, a pipeline, and well site locations, it is likely that damage to it would occur during one or more phases of the project. Thus, avoidance does not seem to be a practical option. If the project is licensed by the NRC, the site would be subjected to data recovery. The impact from the project on site 48SW16604 would be MODERATE as the consequences of the proposed action would be mitigated. In the case of Site 48SW16604, mitigation must be completed prior to the implementation of the construction phase of the project according to Section 106 of the NHPA. To mitigate this MODERATE finding, the NRC, BLM, SHPO, and LCI have developed a memorandum of agreement (MOA) to address the potential impacts to site 48SW16604. The MOA is currently being reviewed by all parties and will be in place prior to construction. Prior to construction, the Unexpected Discovery Plan presented in abbreviated form in Kinneer (2008) would also be formalized to more fully outline the response steps required in the event that unexpected historical and cultural resources are encountered during the construction phase.

Archaeological site 48SW16608 is intersected by two existing two-track roads. Avoidance of this site is recommended, but if avoidance is not possible, then a treatment plan would be developed and submitted to the BLM and Wyoming SHPO for review (Kinneer, 2007). The treatment plan would be implemented after the license is issued but before construction proceeds. To date, no treatment plan has been developed for this site. Assuming the site can be avoided, the impact from the project on site 48SW16608 would be SMALL as there would be no impact from the proposed action.

Archaeological site 48SW16765 is outside of the well field. The Cultural Resource Incentory (Kinneer, 2007) recommended that the site be avoided; however, if avoidance is not possible, then mitigation would be warranted. Assuming the site can be avoided, the impact from the project on site 48SW16765 would be SMALL as there would be no impact from project actions. If this site cannot be avoided, then a treatment plan would be developed by the applicant's consultant and submitted to the NRC, BLM and Wyoming SHPO for review. The treatment plan would be implemented after the license is issued but before construction proceeds. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts to historical and cultural resources from construction are expected to be MODERATE.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Historical and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to Historical and Cultural Resources during construction are expected to be MODERATE to LARGE, but may be reduced to SMALL, providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.9.1.1.2 Paleontological Resources

As stated in Section 3.9.5, the project area is marked by the presence of Class 2 Quaternary age, near surface deposits and Class 3A to 3B Tertiary age formations. Class 2 deposits are not likely to yield vertebrate fossils or significant non-vertebrate fossils. Tertiary age deposits are unlikely to be exposed. Under the Potential Fossil Yield Classification system, the Battle Spring Formation is assigned a ranking of Class 3A to 3B (moderate to unknown). Since the classification of these deposits ranges from moderate to unknown, the impacts could be MODERATE. Proposed surface-disturbing activities would require sufficient assessment by a BLM-approved paleontologist to determine whether significant paleontological resources occur in the area of the proposed action. If such deposits are present, then a MOA would be developed between the BLM, NRC, and Wyoming SHPO that would outline the procedures to be followed for avoidance, mitigation, and/or monitoring.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Paleontological Resources and incorporates by reference the GEIS' conclusions that the impacts to Paleontological Resources during construction are expected to be MODERATE, but may be reduced to SMALL, providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.9.1.2 Operation Impacts

It is expected that potential impacts to historical, cultural, and archaeological resources from operations would be less than during construction, because less land disturbance occurs during the operations phase (NRC 2009). Additionally, conditions in the NRC license require the licensee to stop work in the event of an inadvertent discovery of historic or cultural resources and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures. For these reasons, the GEIS determined that ISR operational impacts to historic and cultural resources would be SMALL.

Based on the information presented in Section 2.2.4, there would be no impacts from facility operation on historical and cultural resources recommended eligible to the NRHP. Any impacts to historic and cultural resources from construction would be mitigated prior to any ground-disturbing activities. There are no cultural resources known in the project area that would be affected by facility operation or maintenance. In sum, there are direct or indirect effects on the cultural resources in the project area; however, these effects would be mitigated prior to construction. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS, and the impacts to historic and cultural resources from facility operation would be SMALL, as long as no ground-disturbing activities occur outside of the surveyed areas. Should ground disturbing activities occur outside of previously surveyed areas, then archaeological surveys would be conducted prior to the activity.

Operational impacts to paleontological resources could occur during routine maintenance actions that involve ground-disturbing activities. However, the degree to which this might be an issue cannot be determined until confirmation that significant vertebrate or invertebrate fossil resources are present in the project area. If such resources are not present, then there would be no impacts to paleontological resources from facility operations. If fossils determined significant are present, then the impacts could be SMALL to MODERATE. Proposed ground-disturbing activities would be outlined in a BLM-reviewed treatment plan for this resource class.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Historical and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to Historical and Cultural Resources during operation are expected to be SMALL, providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.9.1.3 *Aquifer Restoration Impacts*

Aquifer restoration impacts to historic and cultural resources are expected to be similar to, or less than, potential impacts from operations (NRC 2009). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing facility). Additionally, NRC license conditions regarding inadvertent discoveries historic or cultural resources and to notification of the appropriate federal, tribal, and state agencies would remain in effect. For these reasons, the GEIS determined the potential impacts from aquifer restoration to historic and cultural resources to be SMALL.

Based on the information presented in Section 2.2.5, there would be no aquifer restoration impacts on historical and cultural resources recommended eligible to the NRHP, therefore, the impact to historic and cultural resources is SMALL, as long as no ground-disturbing activities occur outside of the surveyed areas. Any areas not previously surveyed should be investigated by a professional archaeologist prior to any land disturbing activities.

Aquifer restoration impacts to paleontological resources are unlikely to occur as operations do not involve exposure of potential fossil bearing strata beneath the Battle Spring Formation. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from aquifer restoration are expected to be SMALL. If fossils determined significant are present, then steps for the mitigation of the proposed action would be outlined in a BLM-reviewed treatment plan for this resource class.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Historical and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to Historical and Cultural Resources during aquifer restoration are expected to be SMALL, providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.9.1.4 *Decommissioning Impacts*

It is expected that decommissioning and reclamation activities would focus on previously disturbed areas, and that historic and cultural resources within the potential area of effect would already be known (NRC 2009). As a result, the GEIS considered the potential impacts to historical, cultural, and archaeological resources during decommissioning and reclamation to be SMALL.

Based on the information presented in Section 2.2.6 of this document, there would be no decommissioning impacts on historical, cultural and paleontological resources. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS, and the impacts to historical and cultural resources from decommissioning would be SMALL, as long as no ground-disturbing activities occur outside of the surveyed areas. Any areas not previously surveyed should be investigated by a professional archaeologist prior to any land disturbing activities.

Impacts to paleontological resources are unlikely to occur as decommissioning does not involve exposure of potential fossil bearing strata beneath the Battle Spring Formation; therefore, the impact is SMALL. If fossils determined significant are present, then steps for the mitigation of the proposed action would be outlined in a BLM-reviewed treatment plan for this resource class.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Historical and Cultural Resources and incorporates by reference the GEIS' conclusions that the impacts to Historical and Cultural Resources during decommissioning are expected to be SMALL, providing no ground disturbing occurs in non-surveyed areas, and monitoring and treatment (mitigation) plans are implemented properly. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.9.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no impacts associated with the proposed ISR facility and therefore no impacts to subsurface or surface cultural resources related to this project. When compared to the action alternatives, there would be no effect in regards to cultural and paleontological resources (*i.e.* no archaeological sites, isolated cultural resources, or paleontological resources) would be affected by direct or indirect effects as a result of this alternative.

It is expected that other actions that are ongoing in the general area would continue, including oil and gas exploration and production. Cultural and ethnographic resources have to be inventoried or evaluated for oil and gas exploration and production. State and federal level permits are required and cultural and ethnographic resources are routinely identified and evaluated as part of the permitting process.

Although no known archaeological sites identified within the project area would be impacted by the ISR facility, it is likely that most of the surficial archaeological sites have been disturbed by routine cattle grazing. Some sites may have been disturbed by two-track roads and cattle related operations such as fences. Overall, there are impacts to cultural resources from actions not related to the current project.

Regarding paleontological impacts from other projects in the general area, the same types of actions may affect this resource category. Impacts from cattle grazing would be very minor and inconsequential. However, geologic units which might contain significant paleontological resources could be affected by the construction of features like reservoirs which might exceed the depth of the Quaternary surface unit. Similarly, subsurface water lines or other infrastructure might also affect geologic units of concern. It should be noted, however, that the footprint of oil, gas, and other drill types is small. Drills may extend for several hundred feet below grade. Damage from this action to geologic units at depth is minimal. Thus, consideration of the impacts to geologic units bearing potentially significant paleontological resources is not warranted unless the drill field units are exceptionally tightly spaced.

In sum, many prior (cumulative) actions may have impacted the cultural, historical, and paleontological resources but the extent of this impact is unknown. If the current action is not licensed, then impact to the cultural, historical and paleontological resources are likely to continue as they have in the past.

4.9.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the wet yellowcake slurry currently proposed would be processed to a dry powder form on-site. Additional equipment to process the yellowcake would be installed in the CPP located at the Lost Creek site; however, the facility configurations outlined in Alternative 1 would be the same. Because there would be no change in the physical layout of the site, the impacts to historical, cultural, and paleontological resources described under the proposed action would also apply here, to Alternative 3.

4.10 Visual and Scenic Resources Impacts

Potential visual and scenic impacts from the proposed Lost Creek facility may occur during all phases of the ISR facility's lifecycle. These impacts primarily would be associated with the use of equipment such as drill rigs; dust and other emissions from such equipment; the construction of facility buildings, other structures, and site and well field access roads; land clearing and grading activities; and lighting for nighttime operations. Such impacts would be mitigated by rolling topography, color considerations for structures, and dust suppression techniques.

Also of consideration in the significance of visual impacts is the use of the BLM Visual Resource Management (VRM) classification of landscapes. Most of the landscapes in the Wyoming West Uranium Milling Region identified in the GEIS are identified as VRM Class II or Class IV, thus allowing for an activity to contrast with basic elements of the characteristic landscape to a limited extent (Class II) or to a much greater extent (Class IV).

4.10.1 Proposed Action (Alternative 1)

Under Alternative 1 (Proposed Action), the NRC would issue LCI a license for ISR uranium milling and processing at the Lost Creek site. The facilities would be contained within about 115 ha (285 ac); of this, about 102 ha (254 ac) are accounted for by the well fields and access road. Potential visual and scenic impacts would be associated with the physical presence of the well fields, buildings and infrastructure. In the case of Alternative 1, the following facilities would directly impact the visual and scenic settings: the well fields, CPP, secondary access roads, power line corridors, and storage ponds.

The proposed action would result in temporary, SMALL impacts to the visual and scenic resources of the area. The nature of the impacts would be in keeping with the visual resource classification as a Class III area (see Section 3.10.3 of this EA) by BLM. The management objective for Visual Resource Class III areas, as defined, is to:

"Partially retain the existing character of the landscape. The level of change to the landscape should be moderate. Management activities may attract the attention of the casual observer but should not dominate the view of the casual observer. Changes should repeat the basic natural elements found in the predominant natural features of the characteristic landscape" (BLM, 1984).

4.10.1.1 *Construction Impacts*

As discussed in GEIS Section 4.2.9.1, visual impacts during construction can result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of a proposed ISL facility relative to viewpoints such as highways, process facility construction and drill rigs could be visible. For nighttime operation, the drill rigs would be lighted, and this would create a visual impact because the drill rigs would be most visible and provide the most contrast if they were located on elevated areas. Most impacts would be temporary as equipment is moved and would be mitigated by best management practices (e.g., dust suppression). Additionally, because these sites are expected to be in sparsely populated areas and there would be generally rolling topography of the region, most visual impacts during construction would not be expected to be visible from more than about 1 km [0.6 mi]. As previously discussed, Prevention of Significant Deterioration Class I areas require more stringent air quality standards that can affect visual impacts; however, there are no PSD Class I areas in the Wyoming West Uranium Milling Region. Finally, proposed ISR facilities are expected to be located more than 16 km [10 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV classification, therefore, visual impacts associated with ISL construction would be expected to be SMALL.

During construction, visual resources would be affected to some degree by vegetative disturbance, road building, drilling, piping, and facility construction and placement. These impacts are anticipated to be SMALL.

The greatest potential impact to visual resources would result from well field development, when drilling rig masts contrast with the general topography. Visual impacts from facilities construction (*e.g.*, drilling and land disturbance) would generally be temporary (short-term) and visual impacts from buildings would be SMALL. Additional impacts would include dust from clearing for parking, access roads, well sites, storage pads, retention (evaporation) ponds, monitoring wells, and piping. The potential visual and scenic impacts would be greatest for new ISR facilities developed in rural, previously undeveloped areas. The project area, however, currently has other land uses (fencing, power lines, and four-wheel-drive roads) that have disturbed the landscape, and thus impacts would be expected to be SMALL for the proposed action.

Due to of the number of wells that may be involved in this ISR operation, multiple drill rigs are likely to be operating during well field construction. For the project area, a maximum of approximately 67 ha (165 ac) would be disturbed at any one time. This estimate includes the CPP, all on-site roads, operating mine units, mud pits for resource and delineation and monitoring wells, and pipelines. No more than four percent of the project area would be disturbed at any time. A typical truck-mounted rotary drill rig may be about 9-12 m (30-40 ft) tall (USAGE, 2001). Once a well is completed and conditioned for use, the drill rig would be moved to a new location to drill the next hole. Because temperatures in the affected environment drop below freezing, wellheads for completed wells would be covered to prevent freezing and protect the well. These covers would be low structures (1-2 m [3-6 ft] high) and present only a slight contrast with the existing landscape. Unless the topography is extremely flat and void of vegetation, it is likely that these structures would not be visible from distances on the order of 1 km (0.6 mi) or more. Actual boundaries of well fields and the number of wells would not be known until final preoperational exploration was completed. Planned access roads, pipelines, and potential locations of retention ponds would also be uncertain within each well field.

Most visual and scenic impacts associated with earth-moving activities during construction would be temporary. Roads and structures would be more long-lasting, but would be removed and reclaimed after operations cease.. As noted in Section 3.9, the project area has been classified as VRM Class III according to the BLM classification system. This classification allows for an activity to contrast with basic elements of the characteristic landscape to a moderate extent. Mine unit development would occur sequentially, with reclamation in the first mine unit concurrent with construction and operations in later mine units. No more than four percent of the project area should be disturbed at any time. Process facility construction and drill rigs could be visible, however most of these modifications would not be visible from the public road network, which is lightly traveled (LCI, 2008a). The visual presence of the pipelines and wells would also impact the natural setting and overall cultural landscape. However, since much of the well field construction activities would be underground, there would be less impact to the overall view of the place than those seen in the construction of the central plant. During construction of ISR well fields and facilities, dust suppression and coloration of well covers would further reduce overall visual and scenic impacts of project construction so that total impacts would be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, visual impacts from construction are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Visual and Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to Visual and Scenic Resources during construction are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.10.1.2 *Operation Impacts*

GEIS (Section 4.2.9.2) states that visual impacts during operations would be expected to be less than those associated with construction. Most of the well field surface infrastructure would have a low profile, and most piping and cables would be buried. The tallest structures would be expected to include the central uranium processing facility (10 m [30 ft]) and power lines (6 m [20 ft]). Because these sites are in sparsely populated areas and there is generally rolling topography of the regions, most visual impacts during operations would not be visible from more than about 1 km (0.6 mi). Irregular layout of well field surface structures such as wellhead protection and header houses would further reduce visual contrast. Best management practices, and design (e.g., painting buildings) and landscaping techniques would be used to mitigate potential visual impact. The uranium districts in the four regions are all located more than 16 km (10 mi) from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV. Therefore, the GEIS considered visual and scenic impacts from operations to be SMALL.

Most of the pipes and cables associated with well field operation are anticipated to be buried to protect them from freezing, and they would not be visible during operations. As uranium ore is depleted in one area, operations (wells) shift from that area to the next sequential area, and drilling begins in another area. As a result, there is generally not a large amount of land undergoing development at one time (NRC, 2009). Because the location of uranium deposits is typically irregular, the network of pipes, wells, and power lines (power lines would be 6 m [20 ft] tall) would not be regular in pattern or appearance (i.e., not a grid), reducing visual contrast and associated potential impacts. The wellhead covers would be typically low (1-2 m [3-6 ft]) structures, and the overall visual impact of an operating well field would be SMALL.

The CPP, storage ponds, ancillary buildings, and pump houses would be the main operational facilities affecting the visual landscape. The project area would be located 7.2 km (4.5 mi) from the nearest county road, and the distance, coupled with the rolling topography would screen the facilities from travelers. There are no locally important or high-quality views that would be affected by the proposed action. Project facilities would not be a dominant landscape feature to observers outside the project area. Impacts would also be temporary, since buildings and roads would be decommissioned and removed at the project's end, probably within 10 to 12 years of permit approval, and vegetation would be restored to its previous condition. Operation impacts to visual and scenic resources would be SMALL.

Mitigation through BMPs (*e.g.*, dust suppression) as well as limiting building height and painting buildings to blend into the natural landscape would further reduce overall visual and scenic impacts of operations. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, visual impacts from operation are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Visual and Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to Visual and Scenic Resources during operation are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.10.1.3 *Aquifer Restoration Impacts*

Section 4.2.9.3 of the GEIS addresses visual and scenic impacts from aquifer restoration. The GEIS states that aquifer restoration activities are expected to take place some years after the facility had been in operation and that restoration activities would use in-place infrastructure. As a result, potential visual impacts would be similar to, or less than, those experienced during operations. Additional mitigation measures (e.g., dust suppression) could be used to further reduce visual and scenic impacts. Therefore, such impacts are expected to be SMALL.

Visual Resource impacts from groundwater sweep and aquifer restoration would be similar to those seen in the operations phase. It is anticipated that the aquifer restoration staff would be smaller than the operations staff since efforts would be solely focused on restoring the groundwater to its previous natural chemical levels. Production units would still be restricted from other uses during the aquifer restoration phase. LCI expects that aquifer restoration would take a least a year for each production unit. Aquifer restoration would cause no modifications to scenery or topography that would persist after restoration and reclamation. Any impacts would be temporary, since buildings and roads would be decommissioned and removed at the end of the project, probably within 10 to 12 years of permit approval, and vegetation would be restored to its previous condition. Restoration and reclamation would occur sequentially, with reclamation in the first production unit concurrent with construction and operations in later production units. In general, less than 10 percent of an ISR project area is expected to be disturbed at any given time, thus, the final decommissioning event would not involve a large areal footprint. Most of the modifications would not be visible from the public road network, which is lightly traveled. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, visual impacts from aquifer restoration are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Visual and Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to Visual and Scenic Resources during aquifer restoration are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.10.1.4 *Decommissioning Impacts*

As discussed in the GEIS (Section 4.2.9.4), because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be similar to, or less than, those experienced during construction. It would be expected that most potential visual impacts during decommissioning would be temporary as equipment is moved and would be mitigated by best management practices (e.g., dust suppression). Additionally, visual impacts would be low, because these sites are expected to be in sparsely populated areas, and that impacts would diminish as decommissioning activities decrease. NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions (expected to remain predominantly VRM Class III and IV). While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, the GEIS analysis expects visual and scenic impacts from decommissioning to be SMALL.

ISR operations would cause no modifications to scenery or topography that would persist after restoration and reclamation. Once project operations are completed (probably within 10 to 12 years of permit approval), all facilities would be decommissioned and removed. Reclamation efforts are intended to return the visual landscape to baseline contours and should result in reducing the impacts from operations and minimizing permanent impacts to visual resources. Before the NRC license is terminated, the licensee must submit an acceptable site reclamation plan according to 10 CFR Part 40. Re-contouring disturbed surfaces (including access roads) and reseeding them with native vegetation that can adapt to the climate and soil conditions would help return the facility to its natural state prior to ISR construction and operations.

No more than about 4 percent of the project area is expected to be disturbed at any time, thus the final decommissioning event would not involve a large areal footprint (LCI, 2008a). During decommissioning and reclamation, temporary impacts to the visual landscape would be expected to be similar to or less than those during the construction period. For example, equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities would generate temporary visual contrasts. Overall impacts to the visual landscape would be expected to be SMALL, and temporary; once decommissioning and reclamation activities were complete, the visual landscape would be returned to baseline with the potential exception of equipment related to longer term monitoring activities. Most of the modifications, including decommissioning, would not be visible from the public road network, which is lightly traveled. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, visual impacts from decommissioning are expected to be SMALL.

Mitigation through BMPs (*e.g.*, dust suppression) would further reduce overall visual and scenic impacts of aquifer restoration so that total impacts would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Visual and Scenic Resources and incorporates by reference the GEIS' conclusions that the impacts to Visual and Scenic Resources during decommissioning are expected to be SMALL. Furthermore, the NRC Staff has not identified new and significant information during its independent review that would change the expected environmental impact beyond what was described in the GEIS.

4.10.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no ISR facility construction and therefore, no change to existing visual and scenic resources at the proposed project area, or in the region. The fencing, power lines, and four-wheel-drive roads in place within the project area from current and previous activities would remain, and are considered a minimal disturbance to the landscape, and thus, the impacts would be SMALL. No additional structures or uses would be introduced that would cause the existing viewscape to be affected, and the existing scenic quality would be unchanged. The scenic quality classification used by the BLM would be a C (the lowest possible), and the visual resource classification would be Class III (LCI 2008a).

4.10.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of dry yellowcake as the final product. By doing so, the project would consist of adding equipment for the processing of dry yellowcake. The additional equipment would be installed internal to the CPP at the Lost Creek site. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois for ultimate processing into the fuel for nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before being shipped to Illinois. As a result, the potential impacts would be the same as those of the proposed action for all four of the ISR phases, SMALL, and the mitigation measures would also be the same.

4.11 Socioeconomic Impacts

Potential environmental impacts to socioeconomics from activities at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force.

Detailed discussion of the potential environmental impacts to socioeconomics from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 *Construction Impacts*

In the GEIS (Section 4.2.10.1), the potential impacts to socioeconomics from construction of an ISR facility are discussed. Impacts would result predominantly from employment at an ISL facility and demands on the existing public services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. The GEIS estimated total peak employment to be approximately 200 people, including company employees and local contractors, depending on timing of construction with other stages of the ISR lifecycle. Additionally, an estimated 140 ancillary jobs could be created associated with the ISR facility (NRC 2009). During construction of surface facilities and well fields, it is expected that a general practice would be to use local contractors (drillers, construction), as available, and that local building materials and building supplies would be used to the extent practicable.

The GEIS also considered that most employees would choose to live in larger communities with access to more services. However, is expected that some construction workers would commute from outside the county to the ISR facility, and that skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. The potential also exists that some employees could temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and taxes. Depending on where the work force and supplies came from, the GEIS determined that potential impacts to towns and communities, in terms of housing and employment structure, could be SMALL to MODERATE.

Given the expected short duration of construction activities (12 to 18 months), it was not expected that families would relocate closer to the site. For this reason, potential impacts to education and use of local services was determined to be SMALL.

Because of the small, relative size of the ISR construction workforce, the overall potential impacts to socioeconomics from construction would be expected to be SMALL to MODERATE.

The construction phase (construction of the CPP, associated buildings, access roads and storage areas) at Lost Creek is estimated to last approximately six months, but would avoid the winter and spring months because of weather and ecological limitations. The estimated workforce during the life of the construction period would include an estimated 70-90 workers. It is expected that approximately 70 percent of the work force would come from outside the local area (LCI, 2008a). Rural areas in Wyoming are especially vulnerable to the boom and bust trends that have occurred in the energy sector of Wyoming. Counties and towns whose economies are centered on extractive industry, generally do not have diversified economy, and have suffered when the natural resources are exhausted, or when the market for the resource becomes depressed. Impacts in each component of the socioeconomic system are discussed below.

4.11.1.1.1 Demographics

Most workers are expected to commute to the project area from larger, economically diversified centers such as Rock Springs, Rawlins, and Casper, which is consistent with the assumptions stated in the GEIS for the Wyoming West Uranium Milling Region. The added construction workforce is expected to have a SMALL impact on the populations of these cities.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Demographics and incorporates by reference the GEIS' conclusions that the impacts to

Demographics during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.1.2 Income

No changes to income to Sweetwater County, surrounding counties, or the remainder of the State of Wyoming are anticipated under the Proposed Action. It is expected that workers would be paid wage rates typical of the area. Site-specific conditions are consistent with the assumptions stated in GEIS Section 4.2.10.1. The construction phase is expected to be short term; therefore, impacts would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Income and incorporates by reference the GEIS' conclusions that the impacts to Income during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.1.3 Housing

Changes in population drive changes in housing demand. In the case of the Lost Creek project, there are no communities within a 32 km (20 mi) radius to house construction workers (LCI 2009). The nearest city is Rawlins, which is located 64 km (40 mi) from the project area. Construction workers would likely commute to and from the project site from their residences or would stay in a hotel in Rawlins or Wamsutter (LCI 2009). Hotel rooms are affordable in Rawlins due to low natural gas prices. Additionally, a new hotel is also being built in Wamsutter, however, given the short construction schedule (6 months), workers are unlikely to relocate their families (LCI 2009). Housing demand is not anticipated to increase as construction workers would either commute or stay in hotels during this time period. Site-specific conditions are consistent with the assumptions stated in the GEIS for SMALL impacts. As a result, housing impacts would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Housing and incorporates by reference the GEIS' conclusions that the impacts to Housing during construction are expected to be SMALL. Furthermore, may actually be less than the expected MODERATE environmental impact described in the GEIS.

4.11.1.1.4 Employment Structure

Employment structure represents the resource based extractive industries of the area. Given the existing downturn in the economy and the associated unemployment, the Lost Creek project would bring an increase in construction and service industry jobs to the area. This type of development does not add to the economic diversity of the resource dependent area. Site-specific conditions are consistent with the assumptions stated in the GEIS for SMALL impacts. These impacts to employment would be positive, but SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

along with the actions proposed, are comparable to those described in the GEIS for Employment Structure and incorporates by reference the GEIS' conclusions that the impacts to Employment Structure during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it expected environmental impact beyond what was described in the GEIS.

4.11.1.1.5 Local Finance

The construction workforce would have an impact on the local economy through the purchasing of goods and services such as food, entertainment, gas, and retail items. Tax revenue would accrue to Sweetwater County based on the value of construction equipment on the site. Typically, this equipment would be registered at the County Assessor's Office, and a discount applied to the market value (50 percent) then 11.5 percent of the adjusted value is taxed at a rate of 63.088 mills (Williams, 2009). This income would help offset the increased needs for public services. To the extent that project contractors and subcontractors register equipment as required by Wyoming statute, the greater the benefit to the counties and the more capable the counties would be to manage growth through increased services. Other tax revenue accrues as described in Section 3.11 (*e.g.* use tax, lodging tax).

Local finance represents income associated with economic activity in the area (minus the cost associated with providing services for a changing population). The economic activity is expected to increase during this period, leading to an increase in the tax base especially for the state and county. Cities and towns may not benefit at a level that keeps pace with increased demand for services. Distribution of tax revenue can be a problem in some areas. Specifically, because of the structure of the taxing system, taxes may not accrue or be distributed to the localities proportionate to the population/public service impacts experienced by those entities. Tax revenue would accrue mainly in Sweetwater County and to the state. Similarly, small towns experiencing increased population/public service demand may not receive a proportionate level of tax increase as sales tax accrues in the larger population centers. This would be the case, for instance, were workers to choose to live in other counties such as Natrona or small towns such as Jeffrey City or Lamont, nearer the project (but not in Sweetwater County). Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. In general, impacts are anticipated to be SMALL during the construction phase because the activity is of short duration.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Local Finance and incorporates by reference the GEIS' conclusions that the impacts to Local Finance during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.1.6 Education

The relatively small construction workforce would not have a noticeable impact on local schools. The construction phase is expected to be short term; it is unlikely that workers would relocate their families to the project area for such a short period. Site-specific conditions are consistent with the assumptions stated in the GEIS. As a result, the impact to education would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

along with the actions proposed, are comparable to those described in the GEIS for Education and incorporates by reference the GEIS' conclusions that the impacts to Education during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.1.7 Public Services

The small size of the construction workforce would not increase the demand for public services, such as water supply, health and emergency services, public safety, local government services, and transportation. While a small population increase is expected during this time period due to workers commuting to, or temporarily living in, the area, local governments have developed the ability to plan for, and manage, change. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS for SMALL impacts. Therefore, it is anticipated that impacts to public services would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public Services and incorporates by reference the GEIS' conclusions that the impacts to Public Services during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2 *Operation Impacts*

As discussed in Section 4.2.10.2 of the GEIS, employment levels during ISR facility operations (50 to 80 workers) would be expected to be less than those for construction. Use of local contract workers and building materials would diminish, because drilling and facility construction would diminish. Revenues would be generated from federal, state, and local taxes on the facility and the uranium produced. Types of jobs would be more technical, and it was expected that the majority of the operational work force would be staffed from outside the region, particularly during start up.

Effects on public services (e.g., education, health care, utilities, shopping, recreation) during operation are expected to be similar to, but longer in duration than, the effects during construction.

Overall, the GEIS determined that potential impacts to socioeconomics from operations would be expected to be SMALL to MODERATE.

The operation of the proposed Lost Creek ISR facility is expected to last approximately nine years, and would employ an estimated 80 workers (LCI, 2008). The average annual salary for all full-time employees would be approximately $50,000, with a total annual payroll is estimated at $2,900,000. The impacts from operations would include the creation of new jobs during the life of the project, such as project managers, plant operators, lab technicians, and drill contractors. This additional work force is expected to have an impact on the local economy as these workers would purchase local goods and services throughout the estimated nine years of operations. If members of the operations workforce choose to reside in neighboring towns in the project area, there is the potential for an increased demand for local housing; the operations work force could exhaust the limited local housing inventory and could drive up local rental and sales prices.

4.11.1.2.1 Demographics

Operations would require a number of specialized workers, such as plant managers, technical professionals, and skilled tradesmen. For this reason, operation workers would likely come from outside the local area. The added operation workforce would stay in the area for longer than the construction staff (approximately nine years). This would cause a higher number of children and other full-time residents to move into the area. In addition, this increase in population would cause additional jobs to be created to service the larger population. These new jobs could also cause other workers to move into the area (along with their families). Site-specific conditions are consistent with the assumptions stated in the GEIS for MODERATE impacts. Therefore, impacts are expected to be MODERATE.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Demographics and incorporates by reference the GEIS' conclusions that the impacts to Demographics during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.2 Income

The average annual salary for full-time Lost Creek ISR employees (approximately 60 of 80 total) would be approximately $45,000, with a total annual payroll is estimated at $2,900,000. Site-specific conditions are consistent with the assumptions stated in GEIS Section 4.2.10.2. Therefore, budgetary impacts to Sweetwater County are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Income and incorporates by reference the GEIS' conclusions that the impacts to Income during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.3 Housing

Changes in population drive changes in housing demand. Housing demand is anticipated to increase in the next few years as specialized workers in the extraction mineral industry relocate to Wyoming. This would further stress a housing market that is currently over-stressed. Site-specific conditions are consistent with the assumptions in GEIS Section 4.2.10.2. Therefore, impacts could be MODERATE, particularly if employees chose to live in some of the smaller communities.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Housing and incorporates by reference the GEIS' conclusions that the impacts to Housing during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.4 Employment Structure

The impacts from operations would include the creation of new jobs during the life of the project, such as project managers, plant operators, lab technicians, and drill contractors. Employment structure represents the resource based extractive industries of the area. As essentially another extractive industry, no changes are expected to the employment structure during this time period, however, the overall level of employment would increase. The ISR project would contribute negatively to the area's economic diversity, however. In general the more diversified the economy, the healthier. Diversified economies can weather fluctuations in one industry without going through a "bust" cycle. As mentioned in Section 3.11, the State of Wyoming has been experiencing a boom over the last several years, which has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. This is also true for Sweetwater County (Wyoming Department of Employment, Research and Planning 2009).

Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS for MODERATE impacts. Therefore, impacts are expected to have a MODERATE impact on the local economy while not, however, increasing the diversification of the economy from extractive industries.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Employment Structure and incorporates by reference the GEIS' conclusions that the impacts to Employment Structure during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.5 Local Finance

Tax revenue would continue to accrue to the County through all stages of operation. Regarding the direct operation of the proposed project, the personal property tax would be applied to the value of all equipment used by the project (as discussed in the previous section). In addition, a state mineral severance tax would be applied to the uranium extracted from the site. State severance tax does not come back to the county directly however. The county imposes an ad valorem tax to production also.

Indirectly, the county would benefit from increased sales tax revenue. Under Wyoming law, there is a 4 percent sales and use tax to which local governments may add up to 3 percent optional tax. Sweetwater County also has a 2 percent lodging tax. Currently, Sweetwater County has an additional tax of 1 percent (Wyoming Department of Revenue, 2009). Thus, the impact of tax revenue to Sweetwater County due to the proposed action would be regional, long-term, beneficial, but SMALL. As mentioned in the previous discussion of construction impacts, the distribution of tax dollars may place an uneven benefit/burden on some localities. Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS. Therefore, impacts are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Local Finance and incorporates by reference the GEIS' conclusions that the impacts to Local Finance during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.6 Education

The added workforce (approximately 80 workers) and family population (up to 200) would expect to impact local schools and their infrastructure, particularly if they are small school districts with limited resources. Site-specific conditions are consistent with the assumptions in GEIS Section 4.2.10.2. Therefore, operation impacts to the local schools could be regional, long-term, and may be MODERATE, as workers would have their families with them (LCI, 2008a).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Education and incorporates by reference the GEIS' conclusions that the impacts to Education during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.2.7 Public Services

Changes in the size of the population and the population (potentially up to 200) characteristics cause changes in demand for health and human services. Specifically, increased demand would be expected for doctors, hospitals, police and fire in order to service the ISR project workers, worker families and others who migrate to the area to respond to the increased demand for services. Operational impacts to public services and public infrastructure, as a result of the workforce relocating with their families would be area-specific, long-term and adverse (LCI, 2008a). Site-specific conditions are consistent with the assumptions in the GEIS. Therefore, it is anticipated that impacts to health and social services would be MODERATE, particularly if the area of settlement had limited services to start.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public Services and incorporates by reference the GEIS' conclusions that the impacts to Public Services during operation are expected to be MODERATE. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.3 Aquifer Restoration Impacts

The GEIS indicates that aquifer restoration impacts to socioeconomics would be similar to impacts experienced during operations. The level of employment and demand on services would be similar to operations. The GEIS determined potential impacts to socioeconomics to be SMALL.

Impacts from aquifer restoration would be similar to those experienced during operations. The same ISR facility components and workforce would be involved in aquifer restoration as during operations use. Thus, the number of personnel involved would also be the same, and the potential impacts would be similar (NRC, 2009a). The restoration staff would have an impact the local economy by purchasing goods and services in the area. Site-specific conditions are consistent with the assumptions in the GEIS. Therefore, impacts to the local economy, the local housing inventory, and public services and infrastructure are expected to be SMALL. Impacts could be minimized by employing project workers from the operations stage of the project.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Socioeconomics and incorporates by reference the GEIS' conclusions that the impacts to Socioeconomics during aquifer restoration are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.1.4 *Decommissioning Impacts*

The GEIS describes the potential impacts of decommissioning on socioeconomics. It is expected that decommissioning and reclamation activities would draw on a skill set similar to the construction workforce. Employment levels (up to 200 personnel) and use of local contractors would be similar to those required for construction. Decommissioning activities would be short in duration (24 to 30 months), so employment would be temporary. Impacts to employment and housing were expected to be similar to those for construction. The GEIS determined that overall, potential impacts to socioeconomics from decommissioning would be SMALL to MODERATE.

Impacts from decommissioning activities would be similar to those seen during construction. While there may be a slight change in work force personnel due to the change in work activities during the decommissioning period, these changes would be small. Similar to the construction phase, there would be a temporary number of specialized workers that would likely commute from larger population centers, such as Rawlins, Lander, Casper, Green River, and Rock Springs. If workers and their families choose to live in the area, there could be impacts to local housing, temporary lodging, and campgrounds. However, given the short time period involved in decommissioning activities (possibly, as little as 6-8 months), not including groundwater restoration activities, most workers are not expected to relocate themselves or their families to the local area. Site-specific conditions are consistent with the assumptions in GEIS Section 4.2.10.4. Therefore, impacts to the local economy, infrastructure, and the local housing inventory are expected to be short-term and SMALL, depending on the number of ISR operations employees who remain from the previous stages of the ISR project.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Socioeconomics and incorporates by reference the GEIS' conclusions that the impacts to Socioeconomics during decommissioning are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.11.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no changes in the population for the area due to the No-Action Alternative (not proceeding with any of the action alternatives). Other forms of energy development such as CBM and coal mining would continue to impact the regional socioeconomic climate. The changes associated with the continued development of energy resources and the associated socioeconomic impacts are discussed in Chapter 5 under Cumulative Impacts. Under the No-Action Alternative, population associated with the proposed action would not increase and no associated public service impacts would occur.

4.11.3 Dry Yellowcake (Alternative 3)

The qualitative socioeconomic methods used to identify impacts associated with the ISR project are not sensitive enough to identify impacts associated with small changes in project design, employment and location of facilities, or to help discriminate between alternatives (given the relatively small differences).

Therefore, socioeconomic impacts from the construction, operation, aquifer restoration, and decommissioning phases of the proposed ISR facility under Alternative 3 would be similar to the impacts from construction under the proposed action. While there would be additional machinery and infrastructure developed for the production of the dry yellowcake within the central plant and some added construction efforts, it is assumed that these changes in workforce and taxable equipment involved would not be significant. Therefore, the impacts associated with this alternative would be the same as described for the proposed action.

4.12 Environmental Justice Impacts

Under Executive Order 12898 (59 FR 7629), Federal agencies are responsible for identifying and addressing potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. In 2004, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), which states "The Commission is committed to the general goals set forth in E.O. 12898, and strives to meet those goals as part of its NEPA review process."

Some deviation from the policy is required in the following analysis because some Census geographic units are larger in the sparsely populated areas around the proposed project (*e.g.* block groups) and specific populations in the radius around the site (6.4 km [4 mi] in rural areas). Block group level data is included for this analysis, but the minority and low income populations within a 6.4 km (4 mi) radius cannot be determined using 2000 Census data because the block groups in this portion of Wyoming cover large geographic areas with few people. This is analytically unimportant given the homogeneous nature of the state population (both in terms of race/ethnicity and poverty).

4.12.1 Proposed Action (Alternative 1)

Within the area potentially affected by the Project, minimal minority populations are affected (Table 3-8 in Section 3.11.1 describes the demographics of the Sweetwater County). Income levels throughout the study area are diverse. The most recent estimate of per capita personal income was $28,438 for Carbon County and $34,656 in Sweetwater County in 2004. The median income in 2004 was $40,750 in Carbon County and $54,700 in Sweetwater County. These numbers are fairly consistent with the economic base of the area, which is mineral resource and agriculturally driven. The most recent poverty status statistics are from 2003 census data. These data showed a poverty status of 11.8 percent in Carbon County and 8.6 percent in Sweetwater County (US Census Bureau, 2003). These rates are similar to the state-wide average of 10.3 percent, which is lower than the national average of 12.5 percent (US Census Bureau, 2003). Since the economic base of the study area is largely ranching and resource extraction, low-income areas are dispersed within the study area. People with incomes below the poverty status do reside within the study area, but are statistically not shown to be disproportionately represented.

Census Block Group data are available from the 2000 Census. Table 4-5 below shows the percent living in poverty and the percent minority in the block group which included the proposed project, in the county, in the state and in the U.S. As can be noted the differences are negligible (within the state) and well within the 20 percent threshold established by the NRC. While the data are dated, the racial/ethnic and income distribution of the state has changed slowly and no major distributional changes in income and poverty should be expected (U.S. Census, 2009).

Table 4-3. Percent Living in Poverty in 2000

Geographic Unit	Percent Low Income	Percent Minority
U.S	13.0	30.9
Wyoming	11.4	11.2
Sweetwater County	8.4	13.4
Project Block Group	10.7	10.0

Source: US Census Bureau, 2009

Based on the data above, there is no concentration of people living below the poverty level and no concentrated minority populations located near the Lost Creek Project.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed for any of the life cycle stages, would have no impact on Environmental Justice issues. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, is consistent with the general description presented in the GEIS.

4.12.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change to the area demographics due to the proposed Lost Creek Project. No construction workers or employees would be attracted to the area due to the proposed action and the relative proportion of minority or low-income residents would not be affected. Therefore, there would be no disproportionately high and adverse impacts to minority or low-income populations expected from the No-Action alternative.

4.12.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the impacts to environmental justice during construction would be the same as stated for the proposed action. There would be no disproportionately high and adverse impacts to minority and low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

The standards for protecting public and occupational health and safety from exposure to ionizing radiation are established by the NRC in Title 10 CFR, Part 20, Standards for Protection Against Radiation. These standards are used in establishing specific criteria for evaluating impacts resulting from the proposed action and alternatives. The standards for protecting occupational exposure to chemical hazards are established by OSHA in Title 29 CFR, Part 1910, Occupational Health and Safety Standards. Public exposures are addressed in Section 4.7.

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 *Construction Impacts*

As described in Chapter 2 of this SEIS, construction activities associated with the Lost Creek ISR Project would include those construction activities (drilling wells, clearing and grading associated with road construction and building foundations, trenching, and laying pipelines) described in the GEIS. Other than during well construction (discussed below) the only significant radiation exposure pathway during the construction period would be through worker's potential direct exposure to, inhalation of, or ingestion of high concentrations of radionuclides within and emanating from (in the case of radon) the disturbed soil. Inhalation of fugitive dust from vehicle traffic during construction activities could also contribute to radiation dose.

The GEIS concludes, in Section 4.2.11.1, that impacts from inhalation of fugitive dust would be SMALL due to the fact that radionuclide concentrations are expected to be low. However, based on baseline radiological environmental monitoring for the proposed facility, some survey locations exhibit concentrations of radioactive materials in soil that are well above natural background levels. Yet, because the average concentrations of radionuclides in the soil are low, it is not expected that the inhalation of fugitive dust would result in any significant dose. Therefore, the conclusions stated in the GEIS are valid for the proposed facility. Construction is expected to have a SMALL impact on workers and the general public. Construction equipment would likely be diesel powered and would result in diesel exhaust which includes small particles. The impacts and potential human exposures from these emissions would be expected to be SMALL because the releases are usually of short duration and are readily dispersed into the atmosphere.

The drilling of wells would be performed via a common technique known as mud rotary drilling. This uses drilling fluid induced through the drill stem, out the drill bit, and back to the surface between the drill stem and host rock. When the fluid has returned to the surface, it passes through a trough to a mud pit, where the cuttings settle out and the fluid is recycled down the hole. Once the drilling is complete, the mud pit is allowed to dry and is covered with native soil and revegetated. Because the cuttings are taken from very near and within the ore deposits, they have the potential to be more contaminated than soil samples at the surface. To ensure that the cuttings do not create an external occupational or public health hazard, the applicant would ensure that semi-annual gamma radiation surveys are performed on at least 12 of the completed drill mud pits.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during construction are expected to be

SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.2 *Operation Impacts*

4.13.1.2.1 Radiological Impacts to Public and Occupational Health and Safety from Normal Operations

As described in the GEIS, some amounts of radioactive materials would be released to the environment during ISR operations. The potential impact for these releases were evaluated by the MILDOS-AREA computer code, which was developed by Argonne National Laboratory for calculating radiation doses to individuals and populations from releases that occur at uranium recovery facilities. MILDOS uses a multi-pathway analysis for determining external dose, inhalation dose, and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is radon-222; other key radionuclides that may be released, which are also in the uranium decay scheme, include uranium, thorium-230, radium-226, and lead-210. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

The GEIS presents historical data for ISR operations, providing a range of estimated off-site doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations ranged between 0.004 mSv (0.4 mrem) per year for the Crow Butte facility and 0.32 mSv (32 mrem) per year for the Irigaray facility in Campbell County, well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv (100 mrem) per year (NRC, 2009a).

Table 4-4. Estimated Radon-222 Releases (Ci yr-1)

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017
New Well fields	5.1E-03	5.7E-03	5.7E-03	5.7E-03	5.7E-03	5.7E-03	6.1E-04	0.0E+00	0.0E+00
Production Venting	4.2E+00	1.2E+02	1.5E+02	1.4E+02	1.5E+02	1.5E+02	1.6E+02	3.4E+01	0.0E+00
IX + Prod Purge	9.5E-01	2.7E+01	3.4E+01	3.4E+01	3.4E+01	3.4E+01	3.3E+01	6.8E+00	0.0E+00
Restoration Venting	0.0E+00	0.0E+00	3.7E+01	1.1E+02	1.1E+02	1.1E+02	1.2E+02	1.3E+02	8.5E+01
Restoration Purge	0.0E+00	0.0E+00	1.9E+01	5.8E+01	5.8E+01	5.8E+01	5.8E+01	5.8E+01	3.9E+01
TOTAL	5.1E+00	1.5E+02	2.4E+02	3.4E+02	3.5E+02	3.5E+02	3.7E+02	2.3E+02	1.2E+02

Source: LCI, 2008b

The application for the Lost Creek facility addresses several normal operation activities that have the potential for exposing workers and members of the public to sources of radiation. The primary source of exposure is the release of radon-222 during various processing activities, which include well field extraction activities, processing of the pregnant lixiviant from the well field extraction for uranium removal on the ion exchange columns, the elution of the uranium from the ion exchange columns and subsequent precipitation of uranium. At this time the drying of the yellowcake slurry is not planned for the Lost Creek project; the liquid would be transported to another licensed facility for further processing.

The potential source term (i.e., atmospheric releases) for new well installation, production, and reclamation activities were calculated using the modeling of MILDOS-AREA. The MILDOS-AREA code represents the modeling as used by the NRC for its assessments included in the GEIS. The application of this methodology for the Lost Creek facility and the resultant source terms are discussed in the applicant's TR, Attachment 7.2-1. The following table summarizes releases for each major functional activity, noting that not all activities occur concurrently, such as production and restoration.

Based on the ISR facility radioactive source term presented in the ER and TR, the applicant evaluated the potential radiation doses at 17 site boundary locations using the MILDOS-AREA code. The highest dose at the site boundary (a hypothetical occupant living in the southeast corner of the project area, referred to as Site 1) is 0.03 mSv (3.01 mrem) per year TEDE, which is 3 percent of the 1 mSv (100 mrem) per year dose limit for a member of the public specified in 10 CFR 20.1301 and within the dose range for similar facilities as reported in the GEIS (refer to above paragraph). The estimated dose results are summarized in ER Section 4.12.1.2 and TR 7.2.1.

The GEIS also provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses are expected to be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 50 mSv (5,000 mrem). The largest annual dose average over a 10-year period [1994-2006] was 7 mSv (700 mrem). More recently, the maximum total dose equivalents reported for 2005 and 2006 were 6.75 and 7.133 mSv (675 and 713 mrem), respectively (Section 4.2.11.2.1 of the GEIS).

ER Section 4.12 and TR 7.2 provide information regarding occupational exposure of workers at the facility. An estimate of worker dose was made using the MILDOS-AREA modeling for a worker located in the well field area. Doses are expected to be well within 10 CFR Part 20 limits based on operational experience at similar ISR facilities (NRC, 2009). Worker doses at Lost Creek would be determined with the use of radiation dosimeters and bioassay sampling as described in the applicant's ER and TR. Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS. Therefore, overall, radiological impacts to public and occupational health and safety are expected to be SMALL.

All radioactive and potentially toxic liquid waste from the processing operations is to be disposed of by deep well injection. Therefore, there are no anticipated routine liquid releases or pathways of exposure from the facility operations. Leaks and spills in the well field are evaluated as abnormal conditions in the section 4.12.2.2. No routine releases of radioactive liquids are anticipated at the proposed facility. As discussed in ER Section 1.3, the applicant would obtain the necessary license and permits from NRC, WDEQ, and other applicable agencies for liquid waste disposal prior to operation. Radiological impacts to public and occupational health and safety associated with these disposal aspects of facility operations are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety during normal operation, and incorporates by reference the GEIS' conclusions that radiological impacts are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.2.2 Radiological Impacts to Public and Occupational Health and Safety from Accidents

The GEIS provided an identification, discussion, and consequence assessment for the abnormal and accident conditions that may occur with an ISR operation. As discussed, a radiological hazard assessment was performed (Mackin et al., 2001) that considered the various stages of an ISR facility. Four separate accidents, which represent the sources containing the higher levels of radioactivity for all aspect of operation, were considered in the hazard assessment:

- Thickener failure and spill;
- Pregnant lixiviant and loaded resin spills (radon release);
- Yellowcake dryer accident release (not relevant to Lost Creek).

In addition to these accidents, leaks in the well field pose minimal radiological risk to workers, but pose a radiological concern because of the potential for undetected leaks to result in significant quantities of low level contaminated soils.

An overview for each of these accident scenarios as evaluated in the GEIS along with a specific application to the Lost Creek facility is presented below.

Thickener Failure and Spill. Thickeners are used to concentrate the yellowcake slurry before it is transferred to the dryer or packaged for off-site shipment. Radionuclides could be inadvertently released to the atmosphere through thickener failure or spill. The accident scenario as evaluated in the GEIS assumed a tank or pipe leak that releases 20 percent of the thickener inside and outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 500 m (1,640 ft) was selected because it is found to be the shortest distance between a processing facility and an urban development for current operating ISR facilities. Off-site, unrestricted doses from such a spill could result in a dose of 0.25 mSv (25 mrem), or 25 percent of the annual public dose limit of 1 mSv (100 mrem) per year with negligible external doses based on sufficient distance between facility and receptor.

As discussed in the GEIS, doses to unprotected workers inside the facility have the potential of exceeding the annual dose limit of 0.05 Sv (5 rem) if timely corrective measures are not taken for protecting workers and remediating the spill. Typical protection measures such as monitoring, respiratory protection, and radioactive material control, which would be a part of the applicant's Radiation Protection Program, would reduce the worker exposures and resulting doses to a small fraction of those evaluated.

Under the Proposed Action, Lost Creek would not be producing yellowcake and would not be using thickeners. However, the applicant's facility would have bulk quantities of yellowcake uranium slurry that would be stored in tanks which could accidentally be released inside the processing buildings. The applicant reports that the tank area would use berms to contain leaks or spills and reduce the likelihood that such a release would migrate to the outside environment. The applicant further asserts that emergency response and mitigation procedures would be available to direct workers to minimize or eliminate the possibility of the material leaking to outside environment. In ER Section 4.3.3, Mitigation and Monitoring of Soil Impacts, impacts to soils from spills would be mitigated through the use of a Spill Prevention, Control, and Countermeasure (SPCC) plan. The plan contains accidental discharge reporting procedures, spill response, and cleanup measures. Therefore, it is expected that the potential impacts of tank releases are SMALL.

As stated in ER Section 1.2.2.3, Instrumentation and Control and described in more detail in the applicant's December 2008 responses to the November 2008 RAIs, impacts to soil from wellfield leaks would be minimized through a series of multi-parameter (e.g., pressure, flow rate) monitors and alarms, and an automatic emergency shutdown system. The applicant also stated that routine visual inspections of plant operations would be conducted as additional protective measures.

Pregnant Lixiviant and Loaded Resin Spills. Process equipment (e.g. ion exchange columns) would be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment of the facility. Therefore, except for wellfield leaks, the potential for an accidental liquid release with liquid pathways of exposure are not considered realistic. The primary radiation source for liquid releases within the facility would be the resulting airborne radon-222 as released from the liquid or resin tank spill.

The radon accident release scenario assumes a pipe or valve of the ion exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneous) all the radon-222 at a high activity level (8×10^5 pCi/L). For a 30-minute exposure, dose to a worker located inside the building performing light activities without respiratory protection was 13 mSv (1,300 mrem). The estimated dose is below the 10 CFR Part 20 occupational dose limit. The GEIS did not evaluate public dose; however, considering that atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv (100 mrem) public dose limit of 10 CFR Part 20. Radiation Protection Program controls and monitoring measures would be expected to minimize the magnitude of any such release and further reduce the consequences of this type of accident. In ER Section 4.3.3, Mitigation and Monitoring of Soil Impacts, impacts to soils from spills would be mitigated through the use of a SPCC plan. The plan contains accidental discharge reporting procedures, spill response, and cleanup measures. As such, it is expected that the potential impacts of tank releases are SMALL.

As stated in ER Section 1.2.2.3, Instrumentation and Control and described in more detail in the applicant's December 2008 responses to the November 2008 RAIs, impacts to soil from wellfield leaks would be minimized through a series of multi-parameter (e.g., pressure, flow rate) monitors and alarms, and an automatic emergency shutdown system. The applicant also stated that routine visual inspections of plant operations would be conducted as additional protective measures.

Yellowcake Dryer Accident Release. This accident scenario does not apply to Lost Creek since the applicant has indicated that yellowcake would not be produced at the proposed facility. A further assessment of this scenario is not warranted for this SEIS. Table 4-4 presents generic accident dose analysis for Lost Creek using data adapted from the GEIS (NRC, 2009a).

Table 4-5. Generic Accident Dose Analysis for ISR Operations for Lost Creek

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill[1]	50 mSv (5,000 mrem)	0.25 mSv (25 mrem)
Pregnant lixiviant, resin spill	13 mSv (1,300 mrem)	<0.13 mSv (<13 mrem)

[1] Doses for a tank release at Lost Creek are expected to be much lower given that yellowcake slurry exists in liquid-like form and has a very low potential to be released to the atmosphere or become airborne. In the event of an accidental slurry release, the potential for radiological airborne contamination is SMALL due to a facility's use of engineering and administrative controls (e.g., spill/leak response plans).

Accident Analysis Conclusions. The GEIS appropriately captures the type of accidents and their potential consequences that can occur at the Lost Creek facility. The NRC Staff has not identified any new and significant information during its independent review of the Lost Creek ER, the site audit, the scoping process, or evaluation of other available information. Therefore, it has been determined that there would be no significant radiological impacts from potential accidents to the public or occupational exposed workers beyond those discussed in the GEIS. Based on this finding and the conclusions of the GEIS, the impacts from potential accidents for both occupationally exposed workers and members of the public are expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety during an accident sequence, and incorporates by reference the GEIS' conclusions that radiological impacts are expected to be MODERATE for workers, SMALL for the general public. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.2.3 Non-radiological Impacts to Public and Occupational Health and Safety from Normal Operations

The GEIS includes an identification of the various chemicals, hazardous and non-hazardous, along with typical quantities that are typically used at ISR facilities. The use of hazardous chemicals at ISR facilities are controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to the use and storage include:

- 40 CFR Part 68, Chemical Accident Prevention Provisions. This regulation includes a list of regulated toxic substances and threshold quantities for accidental release prevention.
- 29 CFR 1910.119, OSHA Standards (which includes Process Safety Management [PSM]). This regulation provides a list of highly hazardous chemicals, including toxic and reactive materials that have the potential for a catastrophic event at or above the Threshold Quantity (TQ).
- 40 CFR Part 355, Emergency Planning and Notification. This regulation contains a list of extremely hazardous substances and their threshold planning quantities for the development and implementation of ERPs. A list of Reportable Quantity (RQ) values is also provided for reporting releases.
- 40 CFR Part 302.4, Designation, Reportable Quantities, and Notification - Designation of Hazardous Substances. This regulation provides a list of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances compiled from the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act (RCRA), and the Toxic Substances and Control Act.

As discussed in ER Section 1.3, Regulatory Requirements, Permits, and Required Consultations, Lost Creek would obtain all the necessary permits and licenses prior to the startup of operations.

As identified in ER Section 4.2, chemical used in bulk quantities at the Lost Creek facility would include:

- sodium carbonate (soda ash)
- sodium chloride (salt)
- drilling mud
- gasoline
- diesel fuel
- propane
- oxygen
- carbon dioxide
- sulfuric acid
- hydrogen peroxide

Typical on-site quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. Compliance with applicable regulations reduces the likelihood of a release. Off-site impacts would be SMALL and do not typically pose a significant risk to the public, while workers involved in a response and cleanup can experience moderate impacts if the proper emergency and cleanup procedures and worker training are not adequate or are absent.

In general, the handling and storage of chemicals at the Lost Creek facility would follow standard industrial safety standards and practices. As identified in the ER, industrial safety aspects associated with the use of hazardous chemicals at Lost Creek are regulated by the Wyoming State Mine Inspector.

In response to questions asked by the WDEQ (LCI, 2009), the applicant stated that hydrochloric acid at 37 percent solution would be delivered to the facility via bulk shipments. It would be stored in a vessel fitted with a scrubber. The sources of acid fume emissions would be from downloading the acid into the storage vessel and during storage. An analysis of potential emissions indicated that with the assistance of pollution control mechanisms, the annual emission of hydrochloric acid would be approximately 4.5 kg (10 lb) per year.

The facility would store soda ash in a dry storage bin equipped with a fabric bag house. Material would be blown into the storage bin from the delivery truck. The soda ash would be conveyed with a screw auger or drag chain to a sealed tank filled with water. Using EPA methods, the applicant calculated a total of 6 kg (14 lb) per year airborne soda ash emission.

Salt would be delivered in bulk and offload into a water filled tank equipped with a bag house. Since the salt dissolves readily in water, the only air emissions would be during off-loading. The applicant estimated a total of 8 kg (17.5 lb) per year emission.

Other process-related chemicals to be stored in bulk at the Lost Creek central plant include carbon dioxide, oxygen, sodium sulfide, ammonia, and hydrogen peroxide.

In the State of Wyoming, industrial safety at ISR mills is regulated by the Wyoming State Mine Inspector. The applicant has proposed an overall chemical safety program that is compliant with the following regulations:

- Risk Management Planning, as required in 40 CFR Part 68;

- PSM of Highly Hazardous Chemicals standard contained in 29 CFR §1910.119;
- Threshold Planning Quantities (TPQs) listed in 40 CFR Part 355;
- RQs for spills from CERCLA in 40 CFR § 302.4.

The types and quantities of chemicals (hazardous and non-hazardous) for use at Lost Creek are the same as those evaluated in the GEIS. Generally, information provided for Lost Creek does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS regarding potential impacts to public or occupational health and safety. Impact from use of chemicals at the facility is expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety during normal operation, and incorporates by reference the GEIS' conclusions that non-radiological impacts are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.2.4 Non-radiological Impacts to Public and Occupational Health and Safety from Accidents

The risks from accidents associated with the use of the typical hazardous and non-hazardous chemicals for an in-situ uranium recovery facility are not different from those for other typical industrial applications. In general, these risks are deemed acceptable as long as design and facility's safety policies and practices meet industry and regulatory standards. Past history at current and former ISR facilities has shown these facilities can be designed and operated with appropriate measures to ensure proper safety for workers and the public (Section 4.2.11.2.4 of the GEIS).

Appendix E, Hazardous Chemicals, of the GEIS provides an accident analysis for the more hazardous chemicals. As discussed, chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS did not evaluate potential hazards to workers or the public due to specific types of high consequence low probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to lower the likelihood of these severe release events and therefore lower the risk to

Spills of reportable quantities from chemical bulk storage areas are to be reported to WDEQ in accordance with WDEQ-WQD Rules and Regulations, Chapter 17, Part E and 40 CFR Part 302 (CERCLA).

The types and quantities of chemicals (hazardous and non-hazardous) for use at Lost Creek are the same or similar as those evaluated in the GEIS. Information provided for Lost Creek does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS regarding non-radiological impacts on public and occupational health and safety from chemical accidents. Impact from potential accidents related to use of chemicals could pose a significant health risk to workers at the facility; however, storage and handling facility design and chemical safety programs minimize those risks both in terms of likelihood and consequences. Site-specific conditions are consistent with the conclusions in GEIS Section 4.2.11.2.4.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety during an accident sequence, and incorporates by reference the GEIS' conclusions that non-radiological impacts are expected to be MODERATE, but may be reduced to SMALL through proper implementation of emergency procedures and training. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.3 *Aquifer Restoration Impacts*

As described in the GEIS, aquifer restoration activities involve activities similar to those during operations (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety are expected to be similar to operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the assessments of Section 4.12.2.2.1 for operations. Similarly, non-radiological hazards are covered by the discussions in Section 4.12.2.2.3. Accident consequences are expected to be smaller than those evaluated in Section 4.12.2.2.2 and 4.12.2.2.4. Therefore, aquifer restoration is expected to have a very localized, SMALL adverse impact on workers (primarily from radon gas) and the general public.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during aquifer restoration are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.1.4 *Decommissioning Impacts*

As addressed in the GEIS, environmental impacts during decommissioning of an ISR facility are expected to be SMALL. The degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to pre-operational conditions. Typically, the initial decommissioning steps include removal of hazardous chemicals, so that the majority of safety issues that are addressed during decommissioning involve radiological hazards at the facility.

To ensure the safety of the workers and the public during decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for review. The plan includes details of the radiation safety program that is implemented during decommissioning activities that ensure that the workers and public are adequately protected and that their doses are compliant with 10 CFR Part 20 limits. An approved plan would also provide ALARA provisions to further ensure that best safety practices are being use to minimize radiation exposures. Adequate protection of workers and the public during decommissioning is further ensured through NRC plan approval, license conditions, and inspection and enforcement.

Following decommissioning, the site could be released for unrestricted use; which could result in an increase in potential exposure to individuals for future use to any residual radioactive contamination. Decommissioning, and any subsequent NRC approval for release of the site for unrestricted access, would have to be in conformance with NRC's radiation protection standards as developed for decommissioning. Therefore, any potential radiation dose to members of the public would also be in conformance with standards established for protecting public health and safety.

Information provided by the applicant does not contain any new or significant information that is contrary or varies with the information and conclusions presented in GEIS Section 4.2.11.4 regarding potential impacts to public and occupational health and safety. Impact from and following decommissioning is expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during decommissioning are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.2 No-Action (Alternative 2)

If No-Action is taken, there would be no occupational exposure. There would be no additional radiological exposures to the general public from project related effluent releases, and there would be no impact on long term environmental radiological conditions. Radiation exposure and risk to the general public would continue to be determined by exposure from natural background, medical-related exposures, consumer products and exposures from existing residual contamination. Under the No-Action Alternative, the existing residual radioactivity would remain in these areas and would not be remediated.

4.13.3 Dry Yellowcake (Alternative 3)

This evaluated alternative is for allowing the processing of wet yellowcake into a dry powder as the final product at the Lost Creek facility.

4.13.3.1 *Construction Impacts*

Construction of a new facility and equipment to perform the drying operations would not change the impact on public and occupational health and safety. Radioactive material would not be generated or handled during the construction phase, so there would be no public or occupational exposure.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.3.2 *Operation Impacts*

Operations of a dryer facility would require additional handling of radioactive material, which could increase both operational and accidental occupational or public exposures. However, the current state of yellowcake drying technology is to use a vacuum dryer, which is designed to capture virtually all escaping particles and does not produce a radiological airborne effluent (NRC, 2009a). If a vacuum dryer were used at Lost Creek, only a negligible impact to public and occupational safety would occur to the population in the area immediately surrounding the facility. Under unmitigated dryer accident conditions, 10 CFR Part 20 Subpart C exposure limits could be exceeded for occupational workers. The dose limits in 10 CFR Part 20 Subpart D would not be exceeded for the general public, due to the facility containment of any contaminant and the distance to a member of the public. Site-specific conditions are consistent with the assumptions in GEIS Section 4.2.12.2. Therefore, in this scenario, doses to workers could have an adverse MODERATE impact, whereas doses to the general public would have an adverse SMALL impact.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during operation are expected to be potentially MODERATE for workers, but SMALL for the general public. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.3.3 *Aquifer Restoration Impacts*

Processing wet yellowcake into a dry powder is not expected to change the nature or magnitude of aquifer restoration activities. Impacts under this scenario would be similar to those from the proposed action. Therefore, this alternative would have short-term SMALL adverse impacts to public and occupational health and safety.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during aquifer restoration are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.13.3.4 *Decommissioning Impacts*

The decommissioning impacts of this alternative would be related to the additional activities required to decontaminate or dispose of the drying equipment and facilities. The exact magnitude of this impact would depend on the type and quantity of additional equipment installed to perform the drying activities and could be expected to result in an appreciable but relatively small increase in the total worker radiation doses for decommissioning activities. Regardless of the magnitude of the expected decommissioning activities, the NRC requires a decommissioning plan to be submitted and reviewed. The NRC's review of this plan, application of site-specific license conditions, and NRC inspection and enforcement activities would keep the magnitude of potential public and occupational health and safety impacts from all decommissioning activities, including dryer facilities, SMALL (NRC, 2009a).

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Public and Occupational Health and Safety and incorporates by reference the GEIS' conclusions that the impacts to Public and Occupational Health and Safety during decommissioning are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.14 Waste Management Impacts

The GEIS states that ISR facilities generate both radiological and non-radiological liquid and solid wastes that must be handled and disposed of properly (NRC, 2009). Waste streams and waste management practices for the proposed Lost Creek facility are described in Section 2.1.1.6 of this SEIS. Potential environmental impacts from waste management at the Lost Creek site may occur during all phases of the ISR facility's lifecycle. The primary radiological wastes to be disposed are process-related liquid wastes, possible evaporation pond sludge, and process-contaminated structures and soils, all of which are classified as 11e.(2) byproduct material. Before operations begin, however, the NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material.

This section addresses the generation and management of radiological and non-radiological waste. Gaseous waste management is addressed above (Section 4.12) via radioactive airborne releases and impacts. Non-radioactive waste disposal would be conducted in accordance with State of Wyoming (WY) Department of Environmental Quality (DEQ) requirements, and local and county programs.

As described in the GEIS, the majority of radioactive waste that requires, treatment and disposal occur during operation and restoration of the well field. Wastes are also generated from well development, flushing of depleted eluant, resin treatment wash, filter washing, the precipitation process and plant wash down. Typical disposal methods can include evaporation ponds, land application, deep well injection, and surface discharge. For the Lost Creek facility, radioactive liquid wastes would be disposed of through deep well injection. Radioactive solid waste, including process tanks and components, would be treated as licensed 11e.(2) by-product materials, and disposed at NRC-licensed facilities. Materials that cannot be decontaminated would be shipped to such a facility that is approved for the processing and/or disposal of radioactive waste.

The proposed Lost Creek ISR facility would be a "Conditionally Exempt Small Quantity Generator (CESQG) of Hazardous Waste" (generating less than 6.8 kg [15 lb] of non-radioactive hazardous waste per year) under the EPA designated classes, in accordance with 40 CFR 260.10. As such, any approved hazardous wastes generated at the facility would be sent to the Sweetwater County District # 1 Landfill in Rock Springs, where they would be disposed of as non-11e.(2) byproduct material.

Detailed discussion of the potential environmental impacts from Lost Creek wastes from the construction, operation, aquifer restoration, and decommissioning phases are provided in the following sections.

4.14.1 Proposed Action (Alternative 1)

4.14.1.1 *Construction Impacts*

As described in the GEIS (Section 4.2.12.1), waste management impacts from construction would be SMALL. This is because construction activities at an ISR facility are relatively small-scale, and sequential well field development would generate low volumes of construction waste. Most of the wastes expected to be disposed of at Lost Creek during the construction phase would be solid (non-radioactive) wastes, such as building materials and piping.

The relatively small amounts of waste generated during construction would include solid municipal wastes such as paper, wood, plastic, scrap metal, municipal sludge, and general construction debris (wooden pallets, pipe pieces, broken grout, etc.). Site-specific conditions are consistent with the assumptions in GEIS Section 4.2.12.1. Therefore, the overall, the potential impact from waste generation during the construction phase is expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Waste Management and incorporates by reference the GEIS' conclusions that the impacts to Waste Management during construction are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.14.1.2 *Operation Impacts*

As described in Section 2.7 of the GEIS, operational wastes are primarily liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate) and aquifer restoration water. In addition, liquid wastes would also be generated from well development, flushing of depleted eluent to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash down water. The methods used for handling and processing these wastes (water treatment followed by disposal utilizing evaporation ponds, land application, deep well injection, and/or surface water discharge) would reduce waste volumes destined for off-site disposal at an approved facility, thereby reducing waste-related environmental impacts. State permitting actions, NRC license conditions, and NRC inspections ensure that proper practices would be used to comply with safety requirements to protect workers and the public, and overall impacts would be SMALL.

Depending on the waste disposal method(s) selected, the GEIS (Section 4.2.12.2) notes that licensees must obtain the necessary permits and approvals from federal and state agencies. These permits and approvals would serve to mitigate impacts from liquid waste management so long as the licensee operates in accord with the provisions of the permits and approvals. For example, a UIC permit from EPA or the appropriate state agency (in the case where the state has primacy), and NRC approval is needed prior to construction and injection of liquid wastes down a deep well. The licensee would conduct monitoring of the well and of the disposed wastes, and the NRC and state would inspect to ensure that permit requirements are met. Other liquid waste disposal methods (i.e., surface discharge of treated wastewaters to local waterways, including ephemeral stream channels; evaporation ponds; and land application of treated wastewaters) would require similar approvals, monitoring and oversight. Site-specific activities are consistent with the assumptions in GEIS Section 4.2.12.2. Therefore, the potential waste management impacts from the disposal of process-related liquid wastes would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Waste Management and incorporates by reference the GEIS' conclusions that the impacts to Waste Management during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Deep Well Injection Discharges of Treated Liquid Waste. As stated in the Lost Creek ER and TR documents (LCI, 2008a, 2008b), surface water discharge is not planned during operation of the ISR facility. The facility operation and design calls for waste waters to be processed through the combination of ion exchange and reverse osmosis and to the extent possible, reused in the uranium extraction process. The highly-contaminated wastewater from this processing would be disposed of by deep well injection.

The use of deep well injection for disposal of both radioactive and non-radioactive liquid wastes is regulated by the NRC and WDEQ. Through the permitting and approval processes, contaminant levels are evaluated for maintaining acceptable safe levels for discharge through deep well injection, ensuring impacts from waste management to worker and the public health and safety are acceptable.

LCI is proposing to dispose of the both 11e.(2) by product liquid wastes and some of the hazardous liquid wastes (e.g., acids, strong bases, and solvents) through deep well injection, at a depth of greater than 2440 m (8,000 ft). Proper installation and operating procedures would be used to ensure adequate protection of public and environmental health and safety. Under the Safe Drinking Water Act (SDWA), the Underground Injection Control (UIC) Program is used and regulated by the WDEQ, which has been delegated primacy from the EPA for Class I injection activities that would be utilized at Lost Creek. By design, Class I UIC is protective of all underground sources of drinking water (no discernable pathway to drinking water) and permanently removed from the accessible environment. The Class I UIC is approved as part of the EPA and WDEQ programs.

By definition, the WDEQ cannot issue a permit for Class I injection if a complete exposure pathway exists that leads to public consumption. When conducted in accordance with UIC regulations and approved by NRC, this type of disposal of by-product waste is protective of human health and the environment. Based on an average flow rate of 643 L (170 gal) over a 9-year period, approximately 1,015 kg (2,235 lb) of natural uranium and 4.6 Ci of radium-226 would be disposed of in the wells. Radiation doses to the public are expected to be near zero (due to isolation of the injection aquifer from any potential exposure pathway to the public) and well below the public limit of 1 mSv (100 mrem) per year.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Deep Well Disposal and incorporates by reference the GEIS' conclusions that the impacts to Deep Well Disposal during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

Solid Waste Storage and Disposal. As described in the GEIS, solid waste generated during operations that is classified as radioactive waste is to be sent to a waste disposal facility that has been licensed for the receipt and disposal of radioactive materials. Non-radiological hazardous wastes would be segregated and disposed of at the Sweetwater County District # 1 (Landfill) waste disposal facility which can accept small quantities of hazardous wastes. Common wastes (*i.e.*, non-radiological and non-hazardous) would be sent to the same Sweetwater County solid waste disposal facility in Rock Springs.

The types of solid radioactive waste that can be expected during operations include maintenance and housekeeping rags/trash, packing materials, replacement components, filters, protective clothing, and solids removed from process pumps and vessels. LCI estimates that approximately 61 to 77 m^3 (80 to 100 yd^3) of solid radioactively contaminated 11e.(2) by-product waste materials would be generated each year during operations. These materials would be stored on-site inside a secure (fenced or inside a structure) area until sufficient volume is generated for shipment to a facility that is licensed for treatment and/or disposal. The 11e.(2) waste would be temporarily stored on-site in containers called "super-sacs". Sacs that are full would be sealed and stored in the plant or outdoors in a tightly-sealed container capable of preventing the spread of contamination from high winds or precipitation. The ISR facility would use covered-roll off containers approved by the USDOT for transport of Low Specific Activity (LSA) material to store material outdoors, and would be transported to, and disposed of at a licensed facility.

Hazardous waste, as generated at the site, would be regulated under the Hazardous Waste Management regulations of the WDEQ, Solid and Hazardous Waste Division. LCI would be classified as a CESQG, defined as a generator that generates less than 100 kg (220 lb) of hazardous waste per month and complies with applicable hazardous waste program requirements. Examples of the types of hazardous wastes that would be generated, include rechargeable batteries, fluorescent light bulbs, and used oil. All wastes would be disposed of according to State and Sweetwater County regulations.

Overall impact from waste generation at the Lost Creek during operation is expected to be SMALL. Based upon the permitting and NRC requirements related to the proposed off-site waste disposal methods, the proposed impact would be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Solid Waste (including hazardous waste) Storage and Disposal and incorporates by reference the GEIS' conclusions that the impacts to Solid Waste Storage and Disposal during operation are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.14.1.3 *Aquifer Restoration Impacts*

As described in Section 4.2.12.3 of the GEIS, waste management activities during aquifer restoration utilize the same treatment and disposal options implemented during normal operations. This is expected to be the case at the Lost Creek site. Some increase in wastewater volumes may be experienced, but most often this increase is offset by the decrease in the uranium production capacity. Impacts from aquifer restoration to waste management and worker and public health and safety would be SMALL, and consistent with those impacts associated with ISR facility operations and described in the GEIS.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions,

along with the actions proposed, are comparable to those described in the GEIS for Waste Management and incorporates by reference the GEIS' conclusions that the impacts to Waste Management during aquifer restoration are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.14.1.4 *Decommissioning Impacts*

The GEIS (Section 4.2.12.4) states that radioactive wastes from the decommissioning of ISR facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as 11e.(2) by product material at a licensed facility. A pre-operational agreement with a licensed disposal facility to accept radioactive wastes would ensure that sufficient disposal capacity would be available for by-product wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required decommissioning plan for NRC review prior to starting decommissioning activities. Such a plan would detail how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning to ensure the safety of workers and the public and compliance with applicable safety regulations. Overall, the GEIS expects that volumes of radioactive, chemical, and solid wastes generated during decommissioning would be SMALL. Overall, waste management impacts from decommissioning would be SMALL.

The goal of decommissioning is to reduce potential impacts by removing contaminants to allowable (regulatory) levels and restoring the property and lands to pre-operational conditions. As described in the GEIS, radioactive wastes from decommissioning include excavated soils, evaporation pond sludge, and process equipment. Radioactively-contaminated wastes would be disposed of as 11e.(2) by-product material at a licensed disposal facility in accordance with 10 CFR Part 40, Appendix A, Criterion 2. Disposal plan and/or agreements with disposal facility are required to be in place prior to operations. Handling, storage and disposal of decommissioning waste would be performed in accordance with license conditions, the decommissioning plan, and would be evaluated at the time through the NRC inspection process.

At the time of decommissioning, much of the process equipment and materials would be reusable at other ISR sites. Materials would be surveyed for residual radioactive material contamination. Uncontaminated materials would be removed for reuse or disposal. Contaminated materials may be decontaminated, transferred to another licensed facility for use, or disposed of as radioactive waste. The cement foundations for the buildings would be removed for appropriate disposal as construction and demolition material, or crushed for reuse.

LCI has committed to having an agreement for disposal of 11e.(2) radioactive waste materials in-place before construction of the Lost Creek project commences (LCI, 2008). Transport of radioactive materials (waste and reusable materials) would be in accordance with USDOT (49 CFR Part 173) and NRC (10 CFR Part 71) transportation requirements.

Because of the size of the Lost Creek project and the intent of LCI to decontaminate and reuse equipment and components, the impact from decommissioning waste would be SMALL. LCI would utilize well field monitoring instrumentation and routine well field visual inspections for timely identification and remediation of well and pipeline leaks and spills, and effectively minimize the potential impact of any well field soil contamination.

Based on the analysis above, site-specific conditions are consistent with the assumptions in the GEIS. Therefore, the overall impact from waste generation during decommissioning is expected to be SMALL.

After its independent review of the Lost Creek Environmental Report, the site visit, meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, BIA, and other potential stakeholders, and the evaluation of available information, the NRC Staff concludes the site-specific conditions, along with the actions proposed, are comparable to those described in the GEIS for Waste Management and incorporates by reference the GEIS' conclusions that the impacts to Waste Management during decommissioning are expected to be SMALL. Furthermore, while the NRC Staff has identified additional new information during its independent review; it nevertheless, does not change the expected environmental impact beyond what was described in the GEIS.

4.14.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no waste generated at the Lost Creek site. There would be no deep well injection of liquid wastes, and a decommissioning plan would not be submitted. In addition, there would be no need for agreements with a licensed radioactive waste disposal facility to dispose of radioactive wastes generated during operation and decommissioning. When compared to the action alternatives, there would be no impacts to waste management associated with this Alternative.

4.14.3 Dry Yellowcake (Alternative 3)

Under this alternative the thickened yellowcake slurry would be further pressed to remove additional water, dried into a dry "yellowcake" powder, and packaged on site. A yellowcake vacuum dryer would be added to the system to perform these functions. The heating system would be isolated from the yellowcake so no radioactive materials are entrained in the heating system. The dried product (yellowcake) would be removed from the bottom of the dryer and packaged in drums for eventual shipping offsite. Processing wet yellowcake into a dry powder is not expected to change the nature or magnitude of aquifer restoration activities. Waste management activities would typically use the same treatment and disposal options as for operations of the Proposed Action.

4.15 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, Energy, Part 20, "Standards for Protection Against Radiation."

29 CFR Part 1910. *Code of Federal Regulations*, Title 29, Labor, Part 1910, "Occupational Safety and Health Standards."

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5 CUMULATIVE IMPACTS

5.1 Introduction

The CEQ NEPA regulations, as amended (40 CFR Parts 1500-1508) define cumulative effects as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative effects or impacts[1] can result from individually minor but collectively significant actions taking place over a period of time. The proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this SEIS, other past, present, and future actions in the project area include (but are not limited to) coal mining, oil and gas production, other in-situ uranium recovery (ISR) operations, conventional uranium mining, wind farms, and cattle and sheep grazing.

The analysis of the cumulative impacts of the proposed action were based on publicly available information on existing and proposed projects, information in the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable changes to existing conditions. The primary concern is the resurgence in interest in mineral mining and oil and gas development within the last few years. This resurgence has not necessarily translated into active projects as of yet, thus there is a lack of information available. It is estimated that there would be no long-term changes within about 8 km (5 mi) of the site, except for the possible installation of a small number of dirt roads. No long-term changes are anticipated within this area due to extensive restoration and reclamation activities planned by the applicant. Approximately 32 km (20 mi) from the site, there are several ISR and conventional uranium projects in the decommissioning, and pre-licensing stages, as well as oil and gas operations that could contribute to the cumulative effects in the area. At greater distances, it has been assumed that the resurgence in extractive industries along with government and industry efforts to develop infrastructure would continue.

The GEIS (NRC, 2009) provides an example methodology for conducting a cumulative impacts assessment. The methodology used in this SEIS is provided in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The Lost Creek project area is located within the Wyoming West Uranium Milling Region, which includes approximately 23,309 km^2 (9,000 mi^2) of land, 61 percent of which is administered by BLM. Only 24 percent of the land area is privately owned. Land uses include BLM grazing land, wildlife habitat, wilderness areas, hunting, dispersed recreation and off-road vehicle use, oil and gas recovery, gas and carbon dioxide pipelines and transmission lines, and cultural and historic sites (NRC, 2009a). This region encompasses parts of Carbon, Fremont, Natrona, and Sweetwater Counties, and is part of the Rocky Mountain System.

There are various oil and gas, uranium, and other natural resource extraction and exploration that have been ongoing, and that are planned for future operation within the Great Divide Basin. The Lost Soldier Wertz oil fields are located proximate to the project area, and have been a significant source of exploratory drilling and oil extraction. These, along with other uses such as rangeland and recreational activities contribute to the overall cumulative impacts seen in the area.

[1] For the purposes of this analysis, "cumulative impacts" is deemed to be synonymous with "cumulative effects"

The various past, present, and reasonably foreseeable future actions in the Great Divide Basin are discussed separately below. Applicable and relevant projects are listed in Table 5-1 of this Section.

5.1.1.1 *Uranium Recovery Sites*

Past, existing, and potential uranium recovery sites in the Great Divide Basin are listed in Table 5-1. There are eight ISR facilities and seven conventional uranium milling facilities in the area (see Table 5-1). Four of the eight conventional sites are in the decommissioning process, one is licensed and on standby, one is listed as a potential site, and one is listed as a UMTRCA Title I processing site.

Along with the proposed Lost Creek ISR project, there are other ISR and conventional uranium (underground and pit) operations that are in various stages of the licensing process within the Great Divide Basin. Some of the mining exploration sites in the area include; the Sweetwater Uranium Project, which is operated by Kennecott Uranium Company, and owned by Green Mountain Mining Venture. This operation is an open pit/conventional uranium mill. Other ISR facilities that are in various stages of the licensing process are the West Alkali Creek, and the Sweetwater ISR projects operated by Wildhorse Energy. The Lost Soldier Deposit is a planned uranium ISR operation that is owned and operated by UR Energy. The JAB and Antelope site is a proposed ISR facility that is currently under NRC review and would be operated by Energy Metals Corporation (NRC, 2009a).

Table 5-1. Uranium Recovery Sites[1] in the Wyoming West (Great Divide Basin) Uranium Milling Region

Site Name	Company/Owner	Type[2]	County, State	Status[3]
Lost Soldier	UR-Energy Corp.	ISR	Sweetwater, WY	Potential site
West Alkali Creek	Wildhorse Energy	ISR	Sweetwater, WY	Potential site
Nine Mile Lake	Rocky Mountain Energy Co.	ISR[1]	Natrona, WY	License terminated
Gas Hills	Power Resources Inc.	ISR[2]	Natrona & Fremont, WY	Licensed - on standby
Bison Basin	Ogle Petroleum	ISR[3]	Fremont, WY	License terminated
Jab & Antelope	Uranium One	ISR[2,3]	Fremont, WY	Potential site - license application under review by NRC
Lucky MC	Pathfinder Mines Corp.	Conv.	Fremont, WY	Decommissioning
Split Rock	Western Nuclear, Inc.	Conv.	Fremont, WY	Decommissioning
Riverton	U.S. Department of Energy (DOE)	Conv.	Fremont, WY	UMTRCA Title I processing site
Gas Hills	Strathmore Minerals Corp.	Conv.	Natrona & Fremont, WY	Potential site

Table 5-1. Uranium Recovery Sites[1] in the Wyoming West (Great Divide Basin) Uranium Milling Region

Site Name	Company/Owner	Type[2]	County, State	Status[3]
Gas Hills	Umetco Minerals Corp.	Conv.	Natrona & Fremont, WY	Decommissioning
Sweetwater	Kennecott Uranium Co.	Conv.	Sweetwater, WY	Licensed - on standby
Sweetwater	Wildhorse Energy	ISR & Conv.	Sweetwater, WY	Potential site

[1] Information on potential future uranium recovery applications is based on indication from industry summarized in NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 3/11/2009" <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf> (November 2009).

[2] Type:

1 = Research and Development/Pilot

2 = Satellite

3 = Commercial scale

Conv. = Conventional uranium mill

[3] Status: Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. The U.S. Department of Energy is the long-term custodian of these sites.

5.1.1.2 *Coal Mining*

Surface mining of coal can cause adverse impacts on land use, geology and soils, water resources, ecology, air quality, noise, historical and cultural resources, visual and scenic resources, socioeconomics, and waste management. Two surface coal mining operations in the Great Divide Basin are located in Sweetwater County (NRC, 2009a): the Bridger Coal mine (approximately 88 km [55 mi] to the southwest), which includes approximately 145 km^2 (56 mi^2) of disturbed land, and the Black Butte Coal mine (approximately 97 km (60 mi) to the southwest), which encompasses approximately 181 km^2 (70 mi^2) of disturbed land. Production for the two mines in 2008 was approximately 5.2 million tonnes (5.7 million tons) for Bridger Coal and 3.6 million tones (3.9 million tons) for Black Butte. The Bridger Coal Company submitted a coal "lease by application" to convert surface mining operations to underground mining to extend the life of the mine. The Carbon Basin Coal Lease is a proposed application that will involve a total of 1983 ha (4,896 ac) of surface disturbance throughout the life of the mine, which is projected at 11 years (BLM, 2008b). This same operation would include an underground mine that would last for approximately 17 years. The total coal projected from the Carbon Basin Coal Lease is 31.1 million tons for the surface operation and 112 million tons for the underground operation.

Table 5-2. Coal Mines in the Wyoming West (Great Divide Basin)[1]				
Site Name	Company/Owner	Type	County, State	Production in 2008 – Tonnes (Tons)
Jim Bridger	Bridger Coal	Surface	Sweetwater, WY	5,157,000 (5,667,021)
Black Butte	Black Butte Coal	Surface	Sweetwater, WY	3,355,300 (3,687,169)

Wyoming Mining Association. "Wyoming Coal." 2008 <http://www.wma-Minelife.com/coal/coalfrm/coalfrm1.htm> (15 October 2009)

5.1.1.3 *Oil and Gas Production*

Regional oil and gas development activities (e.g., exploration, production, and pipeline development) have the likelihood to generate potential cumulative impacts (BLM, 2008b). Carbon County currently has 47 gas production units (13 active, 34 inactive) while Sweetwater County currently has 26 gas production units (23 inactive, 3 active). The Lost Soldier-Wertz Oil fields are the primary source for oil and gas extraction in the Great Divide Basin. The Rawlins RMP summarized oil and gas development projects previously or currently subject to NEPA analysis in Southwestern Wyoming; 6,469 producing wells, and 8,030 wells that can still be drilled/produced, encompassing approximately 121,405 ha (300,000 ac) of land (BLM, 2008b).

5.1.1.4 *Wind Power*

There is potential in the Great Divide Basin for wind power, and these facilities can contribute to meeting forecasted electric power demands. However, they are dependent on available transmission capacity to send power to users. The transmission capability is a constraining factor (BLM, 2008a). There are a total of 20 wind energy projects currently operating in Wyoming, ranging in capacity from 1 turbine (produces 2.0 to 2.5 MW) to 80 turbines (produces 144 MW) (AWEA 2009). There are 4 additional projects under construction ranging in capacity from 20 turbines (produces 42 MW) to 66 turbines (produces 99 MW) (AWEA 2009).

Table 5-3. Wind Energy Projects in Wyoming[1]			
Owner	Number of Turbines	Location	Capacity
Airforce	1	near Cheyenne	2 MW
PacifiCorp	26	near Cheyenne	39 MW
PacifiCorp	66	near Cheyenne	99 MW
PacifiCorp	66	near Cheyenne	99 MW
PacifiCorp	79	near Cheyenne	118.5 MW
Duke Energy	14	near Cheyenne	29.4 MW
Edison Mission Group	38	near Cheyenne	79.8 MW

Table 5-3. Wind Energy Projects in Wyoming[1]

Owner	Number of Turbines	Location	Capacity
Edison Mission Group	29	near Cheyenne	60.9 MW
F.E. Warren Air Force Base	2	Cheyenne	1.32 MW
Clipper Windpower	1	Medicine Bow	2.5 MW
FPL Energy	80	Evanston	144 MW
Shell Wind Energy	50	Arlington/Carbon County	50 MW
Caithness	28	Carbon County	16.8 MW
Platte River Power Authority	2	Medicine Bow	1.32 MW
PacifiCorp/Eugene Water & Electric Board	69	Carbon County	41.4 MW
Caithness	3	Carbon County	1.8 MW
Caithness	33	Carbon County	24.75 MW
Platte River Power Authority	5	Medicine Bow	3.3 MW
Platte River Power Authority	2	Medicine Bow	1.2 MW
Platte River Power Authority	1	Medicine Bow	0.07

[1] Information on wind energy operations is from American Wind Energy Association (data through June 27, 2009). U.S. Wind Energy Projects – Wyoming. <http://www.awea.org/projects/Projects.aspx?s=Wyoming> (September 15, 2009).

5.1.1.5 *EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions*

One indicator of present and reasonably foreseeable future actions (RFFAs) in the region of interest is the number of NEPA documents prepared by federal agencies within a recent time period. Using information in the GEIS Section 5.2.2 and publicly available information, several EISs were identified for the Great Divide Basin in addition to draft and final programmatic EISs for large-scale actions related to several states including Wyoming (See GEIS Tables 5.2-1 and 5.2-2). The Rawlins BLM Field Office web site provides a list of projects in the Great Divide Basin along with the associated environmental documents. A list of projects is provided in Table 5-2. These projects could contribute to both local and regional cumulative impacts on air quality, land usage, terrestrial plants and animals, and groundwater and surface water resources.

Table 5-4. Draft and Final National Environmental Policy Act (NEPA) Documents Related to the Great Divide Basin

January 31, 2003	**BLM, RMP, Great Divide RMP Revision** Identifying resource issues and concerns, management alternatives, or other ideas in determining future land use decisions for the Rawlins Management Field Office. Refer to 1790.
September 5, 2003	**BLM, EA, Hay Reservoir CBNG Pilot Project** Proposed coalbed natural gas pilot project 40 km (25 mi) northwest of the town of Wamsutter in Sweetwater County, WY. Drilling and development of eight coalbed natural gas wells and a single water disposal well. Appurtenant facilities include roads, gas and water collection pipelines, water disposal system, and a power supply system.
December 17, 2004	**BLM, EA, Wind Dancer Natural Gas Development Project (WDNGDP)** Planned for an area approximately 48 km (30 mi) northwest of Wamsutter, WY. Drilling and development of up to 12 natural gas wells. Refer to 1790.
March 17, 2004	**BLM, EA, Scotty Lake Coalbed Natural Gas (CNBG) Pilot Project** Drilling and development of 18 exploratory coalbed natural gas wells 72 km (45 mi) northwest of the town of Wamsutter, WY. Appurtenance facilities include access roads, gas collection systems, and a possible power supply pipelines, produced water discharge system. Refer to 1790.
March 24, 2004	**BLM, EA, Hay Reservoir Natural Gas Infill Development** Natural gas infill development within the existing Hay Reservoir Federal Oil and Gas Unit. The Hay Reservoir Unit lies approximately 48 km (30 mi) northwest of the town of Wamsutter, in Sweetwater County, Wyoming. The proposed project includes the drilling and development of up to 25 additional infill natural gas wells within the Unit. Appurtenant facilities include access roads, gas collection pipelines, and gas production facilities on the well pads. Refer to 1790.
December 17, 2004	**BLM, Draft EIS/Draft Resource Management Plan** Rawlins (Great Divide) RMP, Description and analysis of alternatives for the planning and managing of public lands and resources administered by BLM Rawlins Field Office, Wyoming, WY-030-1610-DS (resource management)
March 11, 2005	**BLM, EA for Cherokee West 3D Seismic Survey Project** Conduct Geophysical Operations with the BLM, Rawlins, Rock Springs, and Little Snake River, Field Offices, for a seismic survey project on public, fee, and state lands within Sweetwater County, Wyoming and Moffat County, Colorado. The proposed project is located within Townships 12 and 13 North, Ranges 96, 97, 98, and 99 West, 6th Principal Meridian, in Wyoming and Colorado. Refer to 1790.

Table 5-4. Draft and Final National Environmental Policy Act (NEPA) Documents Related to the Great Divide Basin	
March 20, 2006	**BLM, Continental Divide-Creston Natural Gas Development Project EIS** Natural gas infill development proposal arose from BP America Production Company and several other companies to further develop natural gas resources within the existing Continental Divide and Creston Blue Gap natural gas fields. Refer to 1790.
August 8, 2006	**BLM, Stewart Creek-Lost Creek Excess and Stray Wild Horses Removal** The Great Divide Resource Management Plan (RMP), as amended, identifies two wild horse herd management areas (HMAs) within which wild, free-roaming horses will be managed in a humane, safe, efficient, and environmentally sound manner. North of I-80 and West of Hwy 287, EA# WY030-06-EA-165
August 13, 2007	**BLM, Hay Reservoir Coalbed Natural Gas (CBNG) Infill and Impoundments Project** Environmental Assessment (EA), Analyzes the impacts associated with the drilling of eight additional CBNG wells and the construction and operation of produced water disposal impoundments, north of Wamsutter, WY, 1790 (030), (CBNG)
January 4, 2008	**BLM, Final EIS, Rawlins Field Office Planning Area Resource** Management Plan, Addresses the Comprehensive Analysis of Alternatives for the Planning and Management of Public Land and Resources Administered by BLM, Albany, Carbon, Laramie, and eastern Sweetwater Counties, WY, WY-030-07-1610-DQ (resource management)
June 12, 2009	**BLM, Red Desert Complex Wild Horse Gather** (Antelope Hills, Crooks Mountain, Green Mountain, Stewart Creek and Lost Creek Wild Horse Herd Management Areas HMAs), 4700 (WYD03), BLM Rawlins and Lander Offices propose to gather approximately 968 wild horses in the various areas listed above, (Population Management Action)

5.1.2 Methodology

In determining potential cumulative impacts, the following methodology was developed, based on the CEQ guidance (CEQ, 1997):

1. Identify for each resource area, the potential environmental impacts that would be of concern from a cumulative impacts perspective. These impacts are discussed and analyzed in Chapter 4.
2. Identify the geographic scope for the analysis for each resource area. This scope is expected to vary from resource area to resource area, depending on the geographic extent to which the potential impacts could be at issue. In this document, the scope for the different resource areas is found in both Chapters 3 and 4.
3. Identify the time frame over which cumulative impacts would be assessed. For this project, the time frame selected was the license period (i.e., the time from issuance of the license with subsequent commencement of construction to license termination and the end of site decommissioning and reclamation).

4. Identify existing and anticipated future projects and activities in and surrounding the project site. These projects and activities are identified in this chapter.

5. Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives, and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

In conducting this assessment, the staff recognized that for many aspects of the activities proposed by Lost Creek ISR, LLC (LCI), there is expected to be a SMALL impact on the affected resources. As defined previously in this SEIS, SMALL impacts are those for which the environmental effects "are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered." Therefore, the staff considers that, for these resource areas (i.e., those for which all phases of the proposed ISR facility's would have a SMALL impact), the activities at the proposed ISR site would not be expected to provide a perceptible increase in potential impacts to the resource beyond those resulting from past, present, and anticipated future actions.

The following terminology was used to define the level of cumulative impact:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

5.2 Land Use

Cumulative impacts to land use are assessed within the immediate vicinity of the Lost Creek ISR Project site and its access roads.

The Great Divide Basin encompasses approximately 10,250 km^2 (3,960 mi^2) in land area and is one of the more promising areas of mineral exploration and extraction, including uranium, oil, and gas. Land use in much of the Great Divide Basin is used for multiple purposes (diversified and cooperative), with coal and oil and gas extraction activities sharing land with livestock grazing and herd management. Most rangeland is used for grazing cattle and sheep, and wild horse management. Most of the land is federally-owned, with some state-owned land, and scattered private land.

Land use impacts related from the Lost Creek ISR project are anticipated to be SMALL for all stages of the project and are described in detail in Chapter 4 of this SEIS. In addition to the Lost Creek ISR project, a variety of ongoing natural resource extraction and production facilities exist within the vicinity of the Lost Creek ISR Project site that potentially could impact land use. Currently, there are three grazing allotments that coalesce at the proposed Lost Creek project area; the Cyclone Rim, Green Mountain, and Stewart Creek allotments (Fig. 3-1). The proposed project area would directly affect approximately 115 ha (285 ac) of the grazing allotments, primarily by fencing off areas during operations. The three BLM grazing allotments together cover approximately 243,000 ha (600,000 ac) of land. Therefore, the impact of the Lost Creek facility on these allotments is less than 0.1 percent.

Land use impacts include interruption to, reduction or impedance of, livestock grazing and herd management areas, hunting areas, sagebrush habitat, open wildlife areas, overall land access, and natural resource extraction activities related to active coal operations, and oil and gas production units. Other proposed uranium ISR facilities and wind energy operations are also located in the Great Divide Basin; however, only proposed ISR facilities are located within the near vicinity of the Lost Creek ISR Project. None of the more than 50 gas and oil extraction projects occur within the area around the proposed project.

Construction and operational improvements and activities such as roads and infrastructure systems associated with the multiple facilities represent a long-term impact, as they would likely be present throughout the Lost Creek ISR Project lifespan and would remain beyond this time to accommodate the processing of other potential projects in the vicinity of the site. However, most facility and road construction impacts to the project area are impermanent, since the land would ultimately be returned to its natural condition.

Cumulatively, the SMALL and mitigated impacts to land use from the Lost Creek ISR Project described in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to land use in the immediate vicinity of the Lost Creek ISR Project site and access roads when added to past, present, and reasonably foreseeable future actions. Therefore, is no cumulative effect on land use.

5.3 Transportation

Cumulative impacts to transportation are assessed within the immediate vicinity of the Lost Creek ISR Project site and access roads.

Project related transportation impacts include new road construction, elevated traffic counts on existing road networks and associated surface wear, and the potential for accidents involving the commuting workforce and/or the release of low-level radioactive materials. The principal access roads linking the existing Wamsutter-Crooks Gap and Sooner Roads with the central processing plant (CPP) represent long-term impacts, as they would be present throughout the project lifespan. Secondary roads from the CPP to the well fields and any tertiary, two-track roads are also long-term impacts. However, no road construction impacts to the project area can be considered permanent, since the land would ultimately be returned to its natural condition after approximately ten years, when production and decommissioning are complete. Transportation related impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

Like the Lost Creek ISR Project area, land use in much of the surrounding area is diversified and cooperative, with coal and oil and gas extraction activities sharing land with livestock grazing and herd management. Many unimproved, two-track dirt roads and gravel roads are present in the region, installed primarily for livestock grazing and herd management, but also facilitating access for natural resource exploration and extraction and hunting and off-road vehicle use. Oil and gas production facilities and coal mines have been, and continue to be, developed on both public and private lands throughout the Great divide Basin. All of these roads have low traffic volumes, and therefore cumulative effects on their capacity would be SMALL. The two existing mineral extraction facilities, Lost Soldier-Wertz Field oil and gas operation, to the east, and the Sweetwater Uranium Mill , to the south-southwest, are not expected to affect, or be affected by, the Lost Creek project with respect to transportation.

Because the preferred means of transporting the products of ISR operations is by road, future projects like the Lost Creek ISR Project would require the construction of new road surfaces or the improvement of existing roads within the vicinity of the Lost Creek ISR Project site and access roads. The number of roads and road networks can be expected to grow concurrently with the natural resource exploration and extraction activities. Current and future oil and gas extraction projects would also require use of roadways, and traffic would likely increase as a result. There would also be an increase in vehicular traffic and risk of traffic accidents on existing roadways from daily travel by workers and their families. Demand for railroads, pipelines, and transmission lines would increase to meet the increased demand for capacity to move coal, oil and gas, and electricity from production locations in the area to markets outside the area.

Cumulatively, the roads at the Lost Creek ISR Project would be reclaimed and overall project-related transportation impacts are thus relatively minor. However, past and ongoing natural resource development and extraction activities in the vicinity of the Lost Creek ISR Project and access roads have resulted in an extensive network of roads. Future activities (ISR and otherwise) would require the construction of additional road surfaces and other transportation-related developments. The SMALL impacts to transportation from the Lost Creek ISR Project described in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to transportation in the area when added to past, present, and reasonably foreseeable future actions.

5.4 Geology and Soils

Cumulative impacts to geology and soils are assessed within the immediate vicinity of the Lost Creek ISR Project site and access roads.

The principal impacts on geology and soils from the Lost Creek ISR Project would result from earth-moving activities associated with constructing surface facilities, access roads, well fields, and pipelines. Earth-moving activities that might impact soils include the clearing of ground or top soil and preparing surfaces for the central processing plant, satellite facility, header houses, access roads, drilling sites, and associated structures. As described in Chapter 4, all phases of the Lost Creek ISR are anticipated to have a SMALL impact to geology and soils.

Development activities from ongoing and future activities in the vicinity of the Lost Creek ISR Project site would continue to impact geology and soils. Past, ongoing, and inevitable future drilling into the earth for locatable minerals disturb the geology of the region, and, if not properly abandoned, leave opportunity for long-term problems. Increased vehicle traffic, clearing of vegetated areas, soil salvage and redistribution of ISR- produced groundwater, and construction and maintenance of project-specific components (e.g., roads, well pads, industrial sites, and associated ancillary facilities) are all activities that could cause impacts (BLM 2008c). Of the past, present, and reasonably foreseeable future activities, coal mining would create the most concentrated cumulative impacts to soils, due to the extensive acreage involved and nature of the operation as well as the tendency for mining operations to occur in contiguous blocks.

While there are numerous activities occurring in the eastern Great Divide Basin (grazing, herd management, hunting, mineral extraction), the only activities that potentially would affect the geology and soil resources in the area around the proposed project would be grazing, recreation (hunting) and herd management. The only mineral extraction-related activities would be those of the applicant (LCI), as there would be no exploration taking place on the newly-constructed access roads. The cumulative effect of the LCI action at Lost Creek, in combination with grazing, herd management and hunting, is not expected to impact geology and soils. On-site soil disturbing impacts, described earlier would only amount to 115 ha (285 ac), or about 7 percent of the total project area. Access road development, to the east and to the west, would widen existing two-track roads to 30 feet (including drainage ditches on either side of the road. Overall, the cumulative effect of all activities in the defined geographic area, including the Lost Creek project, on geology and soils would be SMALL.

Long-term and short-term impacts to soil include accelerated wind or water erosion, declining soil quality factors, a decline in microbial populations, fertility, and organic matter, compaction, and the permanent removal of soil (BLM, 2005c). Some degree of soil reclamation is possible, although not all overburden materials can be used to reestablish vegetation.

Road development from future activities in the site vicinity would also continue to impact geology and soils, though, as discussed in Section 5.3, the roads at the Lost Creek ISR Project would be reclaimed and would not contribute significantly to the cumulative impact from other road development.

Cumulatively, the SMALL impacts to geology and soils from the Lost Creek ISR Project described in Chapter 4 are not expected to contribute to a perceptible increase in the potentially MODERATE impacts to geology and soils in the immediate vicinity of the Lost Creek ISR Project site and access roads when added to past, present, and reasonably foreseeable future actions.

5.5 Water Resources

5.5.1 Surface Water

The Lost creek ISR Project is located in the Battle Springs Flat drainage areas, which consists mainly of ephemeral streams that flow after snow melt or heavy rains. Surface water related impacts from the Lost Creek ISR project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

Coal extraction, natural gas, uranium extraction, and cattle ranching in the area may cumulatively affect surface water resources. There are four ISR projects proposed in the vicinity of the Lost Creek ISR Project: Antelope and JAB, West Alkali Creek, Lost Soldier, and Sweetwater. These projects have the potential to degrade water quality in the area and cause erosion and subsequent siltation of streambeds by the construction of new roads, power lines, underground piping, and well drilling, all of which could have negative effects on surface waters. Cattle ranching is a source of nonpoint pollution to waterways in the Battle Springs Flat drainage area.

Operational practices to mitigate impacts and prevent erosion and water quality degradation on a regional basis would be an important component to the future of surface waters and wetlands. Compliance with applicable federal and state regulations, permit conditions, the use of best management practices, and required mitigation measures would reduce construction impacts to surface waters.

Cumulatively, the SMALL impacts to surface waters from the Lost Creek ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL to MODERATE potential impacts to the Battle Springs Flat drainage area when added to past, present, and reasonably foreseeable future actions.

5.5.2 Groundwater

Potential environmental impacts to groundwater resources in the Lost Creek ISR Project can occur during each phase of the ISR facility's lifecycle. ISR activities can impact aquifers at varying depths (separated by aquitards) above and below the uranium-bearing aquifer as well as adjacent surrounding aquifers in the vicinity of the uranium-bearing aquifer. Surface activities that can introduce contaminants into soils are more likely to impact shallow (near-surface) aquifers while ISR operations and aquifer restoration are more likely to impact the deeper uranium-bearing aquifer, any aquifers above and below, and adjacent surrounding aquifers. ISR facility impacts to groundwater resources can occur from surface spills and leaks, consumptive water use, horizontal and vertical excursions of leaching solutions from production aquifers, degradation of water quality from changes in the production aquifer's chemistry, and waste management practices involving evaporation ponds or deep well injection

The principal activities that have occurred in the past, that are currently taking place, and that are expected to continue in the future, include grazing, herd management, hunting and mineral extraction. The Rawlins RMP EIS evaluated the potential impacts of past, present, and reasonably foreseeable future actions in the Great Divide Basin on groundwater resources (BLM, 2008b). The primary impacts anticipated were consumptive use and degradation of water quality. Impacts to groundwater quality would depend in large part on the quality and maintenance of oil and gas wells as well as in-situ or other extractive use activities (mostly exploration). Existing levels of mineral extraction activities, combined with the reasonably foreseeable future development, would increase the potential for such impacts. Impacts of drawdown from past, present, and reasonably foreseeable future activities was noted as less of a concern due to the depths of many water formations in the region (305 to 3,050 m; 1,000 to 10,000 ft), and their resulting impracticality for use. Impacts to groundwater from past, present, and reasonably foreseeable future activities in the Lost Creek area of the Great Divide Basin are thus anticipated to be MODERATE. The cumulative effects of the Lost Creek ISR project, when added to these MODERATE impacts of current and future use, are expected to be MODERATE.

5.6 Ecological Resources

Land disturbance resulting from the construction of the Lost Creek ISR Project and accompanying roadways would be the primary source of impacts to ecological resources. Ecology-related impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

Land disturbance resulting from other development activities in the Great Divide Basin are likely to have similar ecological impacts as those described earlier for the Lost Creek ISR Project. However, the cumulative result of land disturbances and alterations has likely cause habitat fragmentation, reduced habitat ranges for certain species, and an increased susceptibility to invasive species in these areas. Past and continued reduction in natural brush and grass communities can change light, wind, and temperature conditions on a small scale. For species with specialized habitat requirements, future population viability would be strongly influenced by the quality and composition of the remaining habitat. Other activities occurring in the area of the Lost Creek project boundary include grazing and herd management, hunting, mineral exploration and the Sweetwater Uranium Mill. The added impact from the Lost Creek site upon vegetation would be SMALL as only 115 ha (285 ac) out of the approximate 40,000 ha (100,000 ac) area within a 8-km (5-mi) radius would be disturbed.

Land disturbance resulting from other development activities in the vicinity of the project area have similar ecological impacts described earlier for the Lost Creek ISR facility and may be SMALL individually. However, assuming that adjacent habitats for each disturbed parcels of land would be at, or near, carrying capacity, and considering the fact that there would be an unavoidable reduction or alteration of the habitats, development activities in this portion of the Great Divide Basin would create some unquantifiable reduction in wildlife populations including plant species and alteration of population structure cumulatively. For some species that may require specific conditions for their habitats, future use would be strongly influenced by the quality and composition of the remaining habitats. Additionally, since grasses and noxious weeds tend to replace sagebrush after disturbances, cumulative impacts to sagebrush habitat that occur in the area and wildlife species that occupy the habitat could be MODERATE.

Therefore, overall impacts to ecological resources from past, present, and reasonably foreseeable future actions are anticipated to be MODERATE.

However, the potential cumulative effect upon wildlife could be MODERATE, as new roads into the area would result in additional hunting opportunities, as well as the potential for additional road kills. The addition of the Lost Creek site would result in a decrease in habitat, particularly for smaller mammals and other less mobile wildlife, as well as reduce the amount of habitat for sage grouse.

Cumulatively, the SMALL impacts to ecology from the Lost Creek ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL to MODERATE potential impacts to habitats within the Great Divide Basin when added to past, present, and reasonably foreseeable future actions.

5.7 Meteorology, Climatology, and Air Quality

Air quality impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS. Regional air quality in Sweetwater County, in which the Lost Creek ISR Project is located is in attainment status for all National Ambient Air Quality Standards (NAAQS) criteria pollutants. Sweetwater County is not within an Air Quality Control Region, as designated by the U.S. Environmental Protection Agency (EPA). Generally, limited air pollution emissions sources and effective atmospheric dispersion conditions result in good air quality conditions throughout the Great Divide Basin. Individual surface coal mines within the Great Divide Basin, however, may show some exceedance of the 24-hour PM_{10} standard, but are usually the product of high wind conditions and low precipitation, which results in a short-term elevation in PM_{10} levels (WDEQ, 2006).

Air quality impacts from construction, typical operations, aquifer restoration, and decommissioning activities at the project area were analyzed as part of this SEIS, and are anticipated to be SMALL (Chapter 4). During all phases of the project transportation-related would be the primary air pollution sources that would affect off-site receptor locations. This incremental increase is not expected to be noticeable on the well-traveled, paved roadways in the area, such as I-80, SR 287, and SR 73, but would be especially noticeable on the less-traveled, unpaved roads (LCI, 2008a). Air pollution sources from on-site equipment used during all phases of the proposed project are expected to be unnoticeable to the nearest residential receptors. Due to the rural and remote location of the project area, nearest residential receptor would be expected to experience no change in pollution levels equivalent to existing background levels with the on-site activities in operation.

The GEIS (NRC, 2009) did not address human-induced climate change given the imprecise state of the science for making human-induced climate predictions and the relatively short timeframe of the ISR facility lifecycle. Public comments during scoping for the GEIS addressed the potential for ISR facilities to release carbon dioxide (CO_2) and other greenhouse gas emissions, methane (CH_4), water vapor, ozone (O_3), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The following discussion discusses this potential relative to other industries that could produce these greenhouse gas emissions.

Section 3.6 of the GEIS provides a discussion of the meteorology and climatology within the Wyoming West Uranium Milling Region, where the Lost Creek Project is located. Further discussion is provided in Section 3.7 of this SEIS. The entire Wyoming West Uranium Milling Region (including Lost Creek), is classified as in attainment for all primary pollutants under the National Ambient Air Quality Standards (NAAQS) (NRC, 2009). Other past, present, and reasonably foreseeable activities that may contribute to pollutant emissions and greenhouse gas emissions are identified in Section 5.1 of this SEIS.

As discussed in Section 4.7 of this SEIS, air-quality impacts throughout the lifecycle of the proposed Lost Creek Project would come primarily from fugitive dust and engine exhaust emissions. Fugitive dust would be generated by vehicular traffic, earth-moving activities during construction, and wind erosion of disturbed areas. As discussed, these types of emissions are not expected to be significant as they would be intermittent (temporary), quickly dispersed and would not cause any exceedance of any applicable air quality standards. Additionally, LCI may use best management practices (e.g., wetting of dirt roads and cleared land areas) to reduce fugitive dust and emissions.

Additionally, gaseous emissions during ISR operations may come from the release of pressurized vapor from well field pipelines, and during resin transfer or elution. These gases come from two sources: (1) the liquefied gases such as oxygen and carbon dioxide used in the lixiviant that come out of solution and (2) gases in the underground environment that are mobilized. Venting the well pipeline system allows the release of naturally occurring radon gas. Gaseous emission levels from the proposed Lost Creek facility are expected to comply with applicable regulatory limits and restrictions, and would not be expected to reach levels that result in the Lost Creek facility being classified as a major source under the operating (Title V) permit process.

Other actions causing a potential cumulative impact in the region that may generate pollutants and emissions are surface coal mining activities. Surface coal mining activities generate fugitive dust particulates, and gaseous emissions from large mining equipment. Activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are also emitted from small boilers and off-road vehicles (BLM, 2009a). Overburden and coal blasting can produce gaseous clouds that contain nitrogen dioxide (NO_2).

Other air pollutant emission sources potentially having a cumulative impact within the region include carbon monoxide (CO) and nitrogen oxides (NO_X) from internal combustion engines used at natural gas and CBNG pipeline compressor stations; CO, NO_X, particulates (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions; particulate matter (dust) generated by vehicle travel traffic on unpaved roads, agricultural activities, and application of sand to paved roads in winter; NO_2 and PM_{10} emissions from railroad locomotives; SO_2 and NO_X from other power plants; and air pollutants transported from emission sources located outside the basin (BLM, 2009a).

The Center for Climate Strategies (CCS) estimates that activities in Wyoming will account for approximately 60.3 million metric tons (tonnes) of gross CO_2 equivalent emissions in Year 2010 and 69.4 million tons in Year 2020 (CCS, 2007). Using those projections, the Year 2007 emissions from the three applicant coal mines reviewed by the staff total represents 2.22 percent of the Year 2010 statewide emissions. With the addition of the expected six new coal mines, the estimated total emissions at the three applicant mines would represent 3.61 percent of the projected Year 2020 state-wide emissions (BLM, 2009a).

The proposed Lost Creek ISR facility is not expected to be a major contributor of greenhouse gases due to the size of the facility, small construction and decommissioning workforce, and relative short term of operation. Additionally, it is expected that greenhouse gas emissions associated with the proposed Lost Creek Project would be much lower than other actions in the

Great Divide Basin region associated with natural resource-based extraction facilities (i.e., surface coal mining) and would represent a small fraction of the greenhouse gas emissions in the State of Wyoming.

A Wyoming Statewide Emission Inventory cited in the Rawlins Resource Management Plan EIS (BLM, 2008c) indicated that levels of NO_x, SO_2, PM_{10}, and $PM_{2.5}$ in the Rawlins RMP area and the State of Wyoming are anticipated to increase. Increases in concentrations, however, were not anticipated to exceed any federal or state ambient air quality standards. The area surrounding the Lost Creek ISR project area (northeastern Sweetwater County, northwestern Carbon County and southeastern Fremont County) is a rural setting with air quality classified as an attainment (clean air) area for all the primary pollutants. The hilly terrain with sparse sagebrush vegetation and windy conditions lends itself to good conditions for dispersion of air pollutants (Section 3.7). Air quality monitoring stations in Wamsutter, Casper, Lander, and Murphy Ridge were analyzed to get an idea of the regional air quality. The analysis found that all ambient data was consistent with the area's attainment status with one exception Section 3.7). Air quality impacts in the region from past, present, and future activities are thus considered to be SMALL.

Uranium exploration in the project vicinity has recently increased in response to the current uranium market. Additional ore reserves and resources areas are known to exist within the project area, but they have not yet been evaluated for ISR purposes. At present, Carbon, Fremont and Sweetwater Counties are experiencing considerable natural resource development, much of which is related to uranium, oil and gas exploration and production. For a comparative analysis, available information regarding oil and gas installations in the Powder River Basin (about 240 km (150 mi) to the northeast) indicates that maximum fugitive dust concentrations generated during construction (24-hour PM_{10}) are estimated to be 55 $\mu g/m^3$ (DOI, 2003), or approximately one third of the NAAQS (DOI, 2003). Maximum potential near-field CO emissions (8-hour concentration) are estimated to be 156 $\mu g/m^3$, which is also less than the NAAQS of 10,000 μg/m3 (DOI, 2003).

Cumulatively, the SMALL impacts to air quality from the Lost Creek ISR Project described in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to air quality in Sweetwater County when added to past, present, and reasonably foreseeable future actions.

5.8 Noise

Noise impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

Noise associated with construction of the Lost Creek ISR Project is anticipated to be greater than other phases. However, because some noise can be detected beyond the project boundary, a radius of 8 km (5 mi) was considered as a conservative radius for the assessment of cumulative noise impacts. (The nearest receptor [residence] is 24 km (15 mi) northeast of the Lost Creek site in Bairoil.) Past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the Lost Creek ISR Project are primarily traffic noise, oil and gas operation, and mineral exploration. At present, both Carbon County and Sweetwater County (where the Lost Creek ISR Project is located) are experiencing considerable natural resource development, much of which is related to oil and gas exploration and production Oil and gas operations would generate noise during well drilling and operation of compressor stations. However, noise levels at these activities attenuate to ambient levels at distances of 488 m (1,600 ft) and beyond (BLM, 2003). Noise related impacts are generally limited to the 610 m (2,000 ft) immediately surrounding each discrete source (e.g., drill rig, compressor station).

However, within the 8-km (5-mi) radius considered for this analysis, additional energy-related operations are not likely to increase significantly in density.

Cumulatively, the SMALL impacts to noise from the Lost Creek ISR Project described in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL potential impacts to noise in the 8 km (5 mi) vicinity when added to past, present, and reasonably foreseeable future actions. Additionally, noise levels would be mitigated by administrative and engineering controls in order to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits.

The Lost Creek ISR Project is located in a remote and rural area of northeastern Sweetwater County.

5.9 Historical and Cultural Resources

Historical and cultural impacts from the Lost Creek ISR Project are anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are described in detail in Chapter 4 of this SEIS.

The GEIS considers cumulative impacts to four regions including the Wyoming East Uranium Milling Region which encompasses Campbell and Johnson counties. Fourteen projects, mostly related to minerals extraction, are considered in the analysis. The impact of these current or proposed projects on cultural resources would be similar. The GEIS also considers the cumulative effects of traditional land uses, wildlife/fisheries/forest management, recreation, government lands and land management, mineral extraction and energy development (including coal), and cultural resources preservation. Despite the fact that the many of the actions require inventory, evaluation, mitigation, avoidance, or protection of the cultural resources, it is acknowledged that adverse impacts to cultural resources would occur (NRC, 2009). These impacts are anticipated to be MODERATE.

Ninety-three archaeological resource sites were identified in the Lost Creek ISR Project area. Three were determined eligible to include in the National Register of Historic Places (NRHP). The analysis of cumulative impacts on historic and cultural resources would be focused on these identified cultural resources, which are described in more detail in Chapter 3 of this SEIS. An EIS for the Great Divide Basin, Resource Management Area (BLM, 2009b) lists various actions which have the greatest potential for cumulative effects on cultural resources in the Great Divide Basin region. These actions include: coal extraction actions, oil and gas operations, utility transmission and distribution actions, other mining/milling actions including uranium, wind power activities, reservoir development, various non-energy related developments including transportation, and county-level economic development actions. Of these actions, coal extraction, oil and gas operations, other mining actions, reservoir development, and wind power activities most closely resemble the actions that are likely to take place in the vicinity of the Lost Creek ISR Project, and which have the potential to affect the identified cultural resources. Impacts to cultural resources are likely to be minimized for projects that are on federal or state lands or are funded in part by a government entity because they would be subject to the National Historic Preservation Act (NHPA), Section 106 consultation process, and other applicable statutes, whereas actions that are on private land pose the threat of irrevocable loss of cultural resources. The Rawlins Resource Management Plan Amendment/Environmental Assessment (BLM, 2004) describes and analyzes alternatives for managing public lands that cumulatively, may indirectly affect cultural resources by activities such as erosion, destabilization of land surfaces, increased area access, and increased vibration from truck traffic. Such activities can degrade cultural resources.

Cumulatively, the SMALL to MODERATE impacts to historic and cultural resources from the Lost Creek ISR Project described in Chapter 4 may contribute to a perceptible increase in the MODERATE potential impacts to nearby historic and cultural resources when added to past, present, and reasonably foreseeable future actions. However, mitigation would likely take place for the three cultural resources in the Lost Creek ISR Project area that are recommended as eligible to be included in the NRHP, as described in Chapter 4 of this SEIS. Additionally, any past, present, or future actions that occur on federal lands or require a federal permit would require a Section 106 Consultation, which would ensure that historic and cultural resources are adequately considered.

5.10 Visual and Scenic Resources

Visual and scenic impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

The Wyoming West Uranium Milling region, in which the Lost Creek ISR Project is situated, is extensively developed with oil and gas, coal mining, uranium mining, and related development. Developments within the Great Divide Basin region, in which the Lost Creek ISR Project is situated, are expected to continue over the next 15 to 20 years and would involve construction of railroads, coal-fired power plants, major (230kV) transmission lines, coal technology projects, and oil and gas transportation pipelines and refineries. Expectations are that this area would see additional ISR, coal mining, and and oil and gas activities as the nationwide need for energy sources continues to swell. New roads, power lines, underground piping, and well drilling would have adverse effects on visual and scenic resources. Additionally, increased vehicle traffic, clearing of vegetated areas, soil salvage and reclamation, and construction of these facilities are all activities that could cause impacts. The impact of these developments on the visual resources of the region could be MODERATE, if not mitigated.

Cumulatively, the SMALL impacts to visual resources from the Lost Creek ISR Project described in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE potential impacts to the Lost Creek ISR Project viewshed when added to past, present, and reasonably foreseeable future actions.

5.11 Socioeconomics

Socioeconomic impacts from the Lost Creek ISR Project are anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are described in detail in Chapter 4 of this SEIS.

Wyoming's population is projected to grow modestly from 2010 to 2020 (from 519,886 to 530,948 respectively) then decrease to 522,979 by 2030 (USCB, 2009). These relatively flat population projections do not take into account the current recession, climate change legislation (including cap and trade components) and future technological changes (e.g., clean coal innovations). Projected increases in employment in the Great Divide Basin from increases in the coal mining operations, oil and gas development, and other mineral extraction activities, however, are expected to be modest. While Sweetwater County and the entire Great Divide Basin region 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 (BLM, 2005a, 2005b, 2005c). 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 be high overall. School capacity shortages may result from the increase in the mineral extraction industry, as well as could limitations in public services.

Ad valorem taxes are anticipated to provide a beneficial impact, and beneficial social effects are also anticipated to follow the expanding economy and employment opportunities associated with project energy development increases.

Cumulative impacts to socioeconomics could be more severe, however, if extractive industries and power production were to increase above average historic levels of growth. These impacts would be both adverse and beneficial. Cumulative adverse impacts to the local housing inventory and real estate market could occur if demand for labor in the extractive industries were to increase during the economic life of the proposed project. There could be long-term adverse impacts to local schools, health care facilities, fire and police services, and infrastructure, including waste management facilities, if large industrial projects create a demand for labor in the Great Divide Basin. However these impacts would be met by over 40 years of experience in dealing with rapid population changes, a more sophisticated planning system and a taxing system that helps capture tax revenue during construction, operation and decommissioning of most all industrial facilities.

Casper, the largest city in the state, has the greatest and most diverse services to offer the potential new workforce. Casper, and its surrounding communities, would likely be where most of the construction workforce would live, if only temporarily. The cumulative effect on the real estate market and on schools would be SMALL, as construction activities are generally short-termed, and workers, even if from out-of-state, would not likely bring their families. The cumulative effect on retail and personal services would be beneficial, and could be MODERATE. The economic benefit to the city would also be beneficial, but SMALL, as much of the monies spent by construction workers would be used for increased public services (infrastructure upgrades, police, fire and emergency services, and health services).

If the population remains stable or grows within an annual rate of growth that area has managed well in the past (approximately 2 percent/year), the local economy could be positively affected by multiple mining operations that would bring in local and state economic revenue.

As potential extractive industries come on-line and begin to operate, the workforce would become more stable and commute back and forth to their long-term workplace. It is likely, then, that an operational workforce may live closer to their place on work and become active in their community. The City of Rawlins, and the Towns of Bairoil and Wamsutter may see an increase in population. The City of Rawlins would be a more likely place for a family to settle than Bairoil or Wamsutter, because of its greater amount of services it has to offer (schools, retail establishments, places of worship, leisure time activities, etc.). Rawlins is a much smaller city than Casper, so the impacts on real estate, schools, infrastructure, and the service industries would be potentially MODERATE, particularly if other extractive industries become active in the area.

Cumulatively, the SMALL to MODERATE impacts to socioeconomics from the Lost Creek ISR Project described in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE potential impacts to local socioeconomics when added to past, present, and reasonably foreseeable future actions.

5.12 Environmental Justice

There are no concentrations of people living below the poverty level near the project area, and no concentrated minority populations are located near the project area. there are no disproportionately high or adverse impacts arising from the proposed action. Impacts relating to environmental justice for the Lost Creek ISR Project are described in more detail in Section 4.12 of this SEIS.

The GEIS identified no minority populations in the Wyoming West Uranium Million Region, but did identify the Wind River Indian Reservation in northern Fremont County as a low-income population (NRC, 2009). However, the Wind River Indian Reservation is more than 100 (road) miles from the Lost Creek site, and for this reason, it was determined that there were no environmental considerations expected for the area around the Lost Creek site.

The relative homogeneity of Wyoming, despite 40 years of energy/natural resource development, indicates that environmental justice issues would not be a problem. Because the economic base of the study area is largely ranching and resource extraction, low-income areas are not only dispersed within the study area, but are small in size. Families with incomes below the poverty level may reside within the study area, but not are disproportionately represented. At the present time, there is no significant concentration of people living below the poverty level and no significant concentration minority populations located near the project.

5.13 Public and Occupational Health and Safety

Public and occupational health and safety impacts from the Lost Creek ISR Project are anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are discussed in detail in Chapter 4 of this SEIS. During all phases of normal operation, health and safety impacts are expected to be SMALL. Annual doses to the population within 80 km (50 mi) of the project are expected to be far below applicable NRC regulations. For accidents, impacts are expected to range from SMALL to MODERATE. Impacts could be MODERATE in the unlikely event that mitigation measures and other procedures intended to ensure worker safety are not followed.

The proposed project would make a minor contribution to cumulative impacts in terms of radiation doses in the environment to both the public and workers. There is no impact during the construction phase of the project, and a negligible increase during the operation and decommissioning phases. Annual doses to the population outside the boundaries of the project are far below any applicable limits, for both occupationally exposed workers and members of the public.

As stated in the GEIS (NRC, 2009) the Lost Creek site is located in the Wyoming West Uranium Milling Region, which contains 16 previous, current or potential uranium mining or milling sites. None of the 16 identified sites are currently involved in uranium processing, although four are in the decommissioning phase. One, the Kennecott Sweetwater Mine and Mill, is located within 8 km (5 mi) of the perimeter of the Lost Creek site. Although this facility is not currently operating, it is currently licensed and could resume operations in the future. The GEIS (NRC, 2009a) identified 10 draft or final EIS' submitted from January 2005 to February 2008 whose proposed actions could contribute to a cumulative impact on public and occupational health and safety and were specific to the Wyoming West Uranium Milling Region. In addition, the GEIS identified ten large scale, programmatic EIS' whose proposed actions could that have an impact over the entire state of Wyoming. Given the proposed activities of the submitted EIS', the addition of the Lost Creek ISR facility will have a negligible impact on public and occupational health and safety. A follow-up review for any proposed "new" projects (since February 2008 as addressed in the GEIS) did not identify any projects that would likely increase cumulative impacts on radiological public health and safety for the study area.

Studies of the existing radioactivity levels in the environment have been conducted and presented in Section 3.12 of this SEIS. The identified radioactivity concentrations in the soil, air and water are consistent with other background concentrations in the region. This indicates that currently, prior to activities at the proposed Lost Creek facility, there is not a public and occupational health and safety impact concern. The past, present, and reasonably foreseeable future activities mentioned above are anticipated to have a SMALL impact on radiological public health and safety for the study area.

The maximum expected exposure to any member of the public from the Lost Creek facility, as with other operating ISR facilities in the U.S., is expected to be on the order of less than 10 mrem per year, at the site boundary. This exposure, combined with exposures from other facilities, is expected to remain far below the public limit of 100 mrem/year and have a negligible contribution to the 620 mrem average yearly dose received by a member of the public from exposure to natural background radiation. Cumulatively, the public health and safety impacts from the Lost Creek ISR Project combined with the past, present and reasonably foreseeable future activities of the Powder River Basin are anticipated to be SMALL.

When considering the contribution of the Lost Creek project to the overall cumulative impacts to public and occupational health and safety in the Wyoming West Uranium Milling Region, the Lost Creek ISR occupational health and safety impacts are SMALL in scale.

When considering the contribution of the Lost Creek project to the overall cumulative impacts to public and occupational health and safety in the Wyoming West Uranium Milling Region, the Lost Creek ISR occupational health and safety impacts would be SMALL in scale.

5.14 Waste Management

Waste management impacts from the Lost Creek ISR Project are anticipated to be SMALL and are described in detail in Chapter 4 of this SEIS.

Past, present, and reasonably foreseeable future activities in the area around the Lost Creek ISR Project site that could generate hazardous or radioactive wastes include uranium mining/milling activities and oil and gas exploration. Each of these facilities would be responsible for complying with regulations and site-specific license agreements that manage any wastes generated. Because hazardous and radioactive wastes are so closely monitored throughout the United States, the impact from these activities is anticipated to be SMALL.

Some current activities within the project area, such as grazing and herd management, would not use any of the proposed waste disposal facilities because they produce no waste that needs to be disposed. Others, such as mineral exploration, generally produce non-radiological waste that would be disposed at a solid waste landfill such as SWCSWD #1. The same would be true of the Lost Soldier-Wertz Oil Field – no radiological wastes, only solid wastes.

Proposed new ISR facilities (Antelope and JAB, Lost Soldier, West Alkali Creek, and Sweetwater) would produce the same types of radiological waste (i.e., 11e.(2) byproduct material), and about the same quantities, as the Lost Creek ISR facility. It is likely that these ISR facilities would use the same waste disposal facilities.

Because of the small amounts of wastes generated by the types of activities that occur and would occur in the geographic scope area, the cumulative impact on the waste disposal facilities would be SMALL. For deep-well injected radiological liquid wastes, the receiving aquifer would be located below the lowest aquifer used for drinking water. Therefore, the cumulative effect on groundwater from the Lost Creek facility is expected to be SMALL.

Cumulatively, the SMALL impacts to waste management from the Lost Creek ISR Project described in Chapter 4 are not likely to contribute to a perceptible increase in the SMALL potential impacts to waste management in the vicinity of the Lost Creek ISR Project site when added to past, present, and reasonably foreseeable future actions.

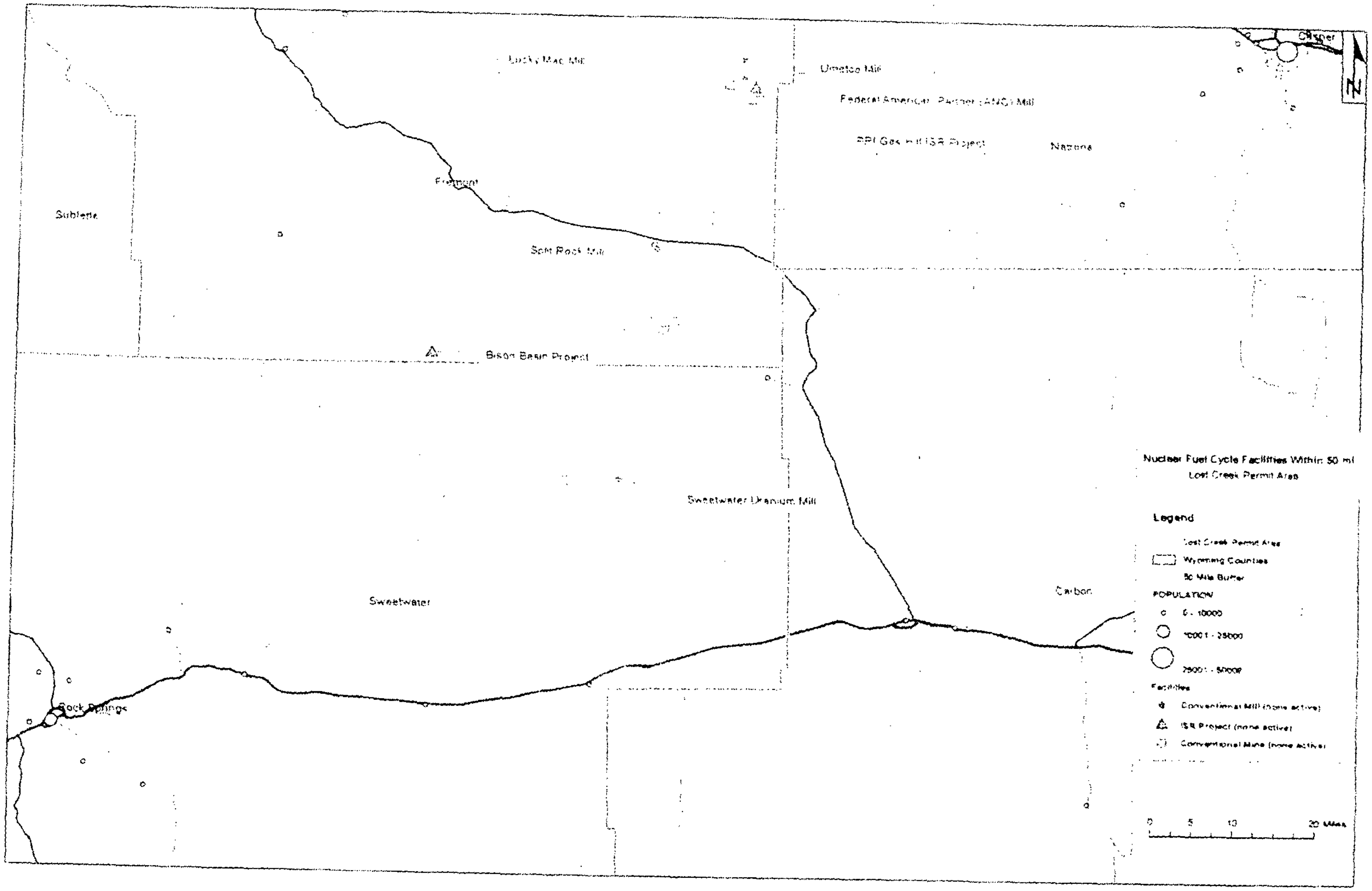

Figure 5-1. Nuclear Fuel Cycle Facilities within a 50-mile Radius of the Lost Creek Site

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 Introduction

As described in the GEIS (Section 8.0), monitoring programs, in general, are developed for *in-situ* uranium recovery (ISR) facilities 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 (NRC, 2009). Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. In this regard, these programs help to limit potential environmental impacts at ISR facilities.

Monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions resulting from the conclusions of the NRC's safety and environmental reviews.

The description of monitoring programs for the Lost Creek project is organized in the following manner:

- Radiological monitoring (Section 6.2)
- Physiochemical monitoring (Section 6.3)
- Ecological monitoring (Section 6.4)

6.2 Radiological Monitoring

This section describes Lost Creek ISR, LLC's (LCI) proposed radiological monitoring program as described in its license application (LCI, 2008a and 2008b). The purpose of this 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, 2003).

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a pre-operational monitoring program is required for establishing facility baseline conditions. Following this baseline program, operators of ISR facilities are required to conduct an operational monitoring program to measure or evaluate compliance with standards and to evaluate environmental impact of operations. Although not a requirement, NRC Regulatory Guide 4.14 " Radiological Effluent and Environmental Monitoring at Uranium Mills" (NRC, 1980) provides a monitoring program that is acceptable to the NRC staff for establishing a radioactive effluent and environmental monitoring program for uranium mills, which includes ISR facilities.

The results of LCI's baseline monitoring (sampling) program are presented in Chapter 3. The following provides a brief description of the applicant's proposed operational monitoring program a more detailed description is presented in NRC's Safety Evaluation Report [SER] for the Lost Creek ISR Application).

6.2.1 Airborne Radiation Monitoring

LCI proposes to implement an airborne radiation monitoring program that includes routine and non-routine operations, maintenance, and cleanup. The results from the program would be used to calculate personnel exposure and to ensure radioactive releases and exposures due to airborne radiation are as low as reasonably achievable (ALARA). LCI would implement this program in conjunction with the respiratory protection program. Figure 6-1shows the routine airborne radioactivity sampling locations within the central processing plant (CPP) proposed by LCI. Figures 6-2 and 6-3 show the radon, gamma, and air particulate monitoring locations in the project area. Air sampling would be conducted in accordance with, or equivalent to, NRC Regulatory Guide 8.25, *Air Sampling in the Workplace* (NRC, 1992), and would be consistent with NRC Regulatory Guide 8.30, *Health Physics in Uranium Recovery Facilities* (NRC, 2002).

Airborne uranium particulate monitoring would include both breathing zone (lapel air sampler worn by worker) and area sampling (portable air sampler or fixed location sampler). The breathing zone air samplers would measure the worker's intake of uranium. Area samplers would be placed in areas where there is the potential for generation of airborne radioactive materials. These samplers would verify the effectiveness of confinement, or containment, and provide warning of elevated concentrations for planning or response actions. Area sampling frequency would be conducted in accordance with NRC Regulatory Guide 8.30 (NRC, 2002). Breathing zone air and area samples would be used for both routine (drying and packaging activities, maintenance, cleanup) and non-routine operations as required by operating procedure and/or Radiation Work Permit.

LCI has established a program to perform continuous environmental monitoring for radon gas at seven separate locations within and on the border of the site (Figure 6-2). The monitoring would be conducted with alpha track etch detectors and the samplers would be analyzed quarterly. This methodology is expected to detect radon at levels at, or above, 0.33 pCi/L, based on a 90-day sample. Direct gamma radiation measurements would also be sampled quarterly at specific passive locations (Figure 6-4).

Besides radon, airborne release of radioactive material could occur from a spill of yellowcake slurry or pregnant lixiviant under the proposed action. A spill of yellowcake slurry would most likely occur in the operating areas of the facility, so that installed workplace air sampling equipment would quickly monitor the airborne hazards. A spill of pregnant lixiviant, however, is a credible hazard, and is described by NUREG/CR-6377 (NRC, 2001).

6.2.2 Soils and Sediment Monitoring

LCI is not proposing either soil or sediment monitoring.

6.2.3 Vegetation, Food, and Fish Monitoring

Because the only vegetation in the study area is sagebrush, which is not considered forgeable for cattle and is not expected to rapidly absorb surface contamination, LCI does not plan to monitor vegetation or food supply. The only nearby source of food is grazing cattle. While cattle may approach the site up to the fenced areas, such as the CPP, header houses and drill rigs, they are not expected to spend significant time in these areas. In addition, cattle are only in the area for approximately 6 months out of the year, and graze over large areas due to the limited food supply. Food (beef) would be sampled to perform a baseline assessment of radiological conditions.

Fish monitoring would also not be performed, because there are no surface waters in the Battle Springs Flat drainage area.

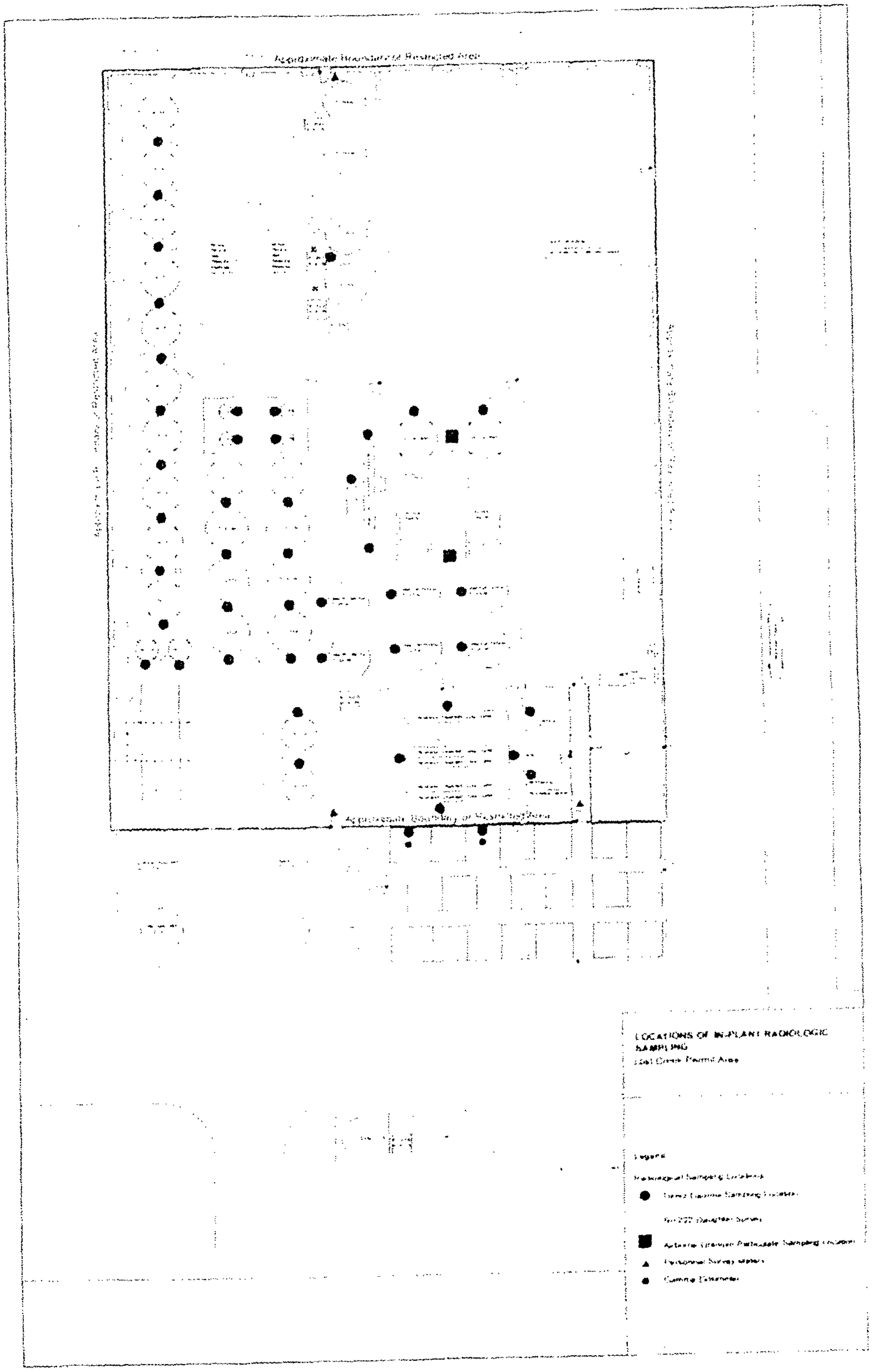

Figure 6-1. In-Plant Radiological Monitoring Locations

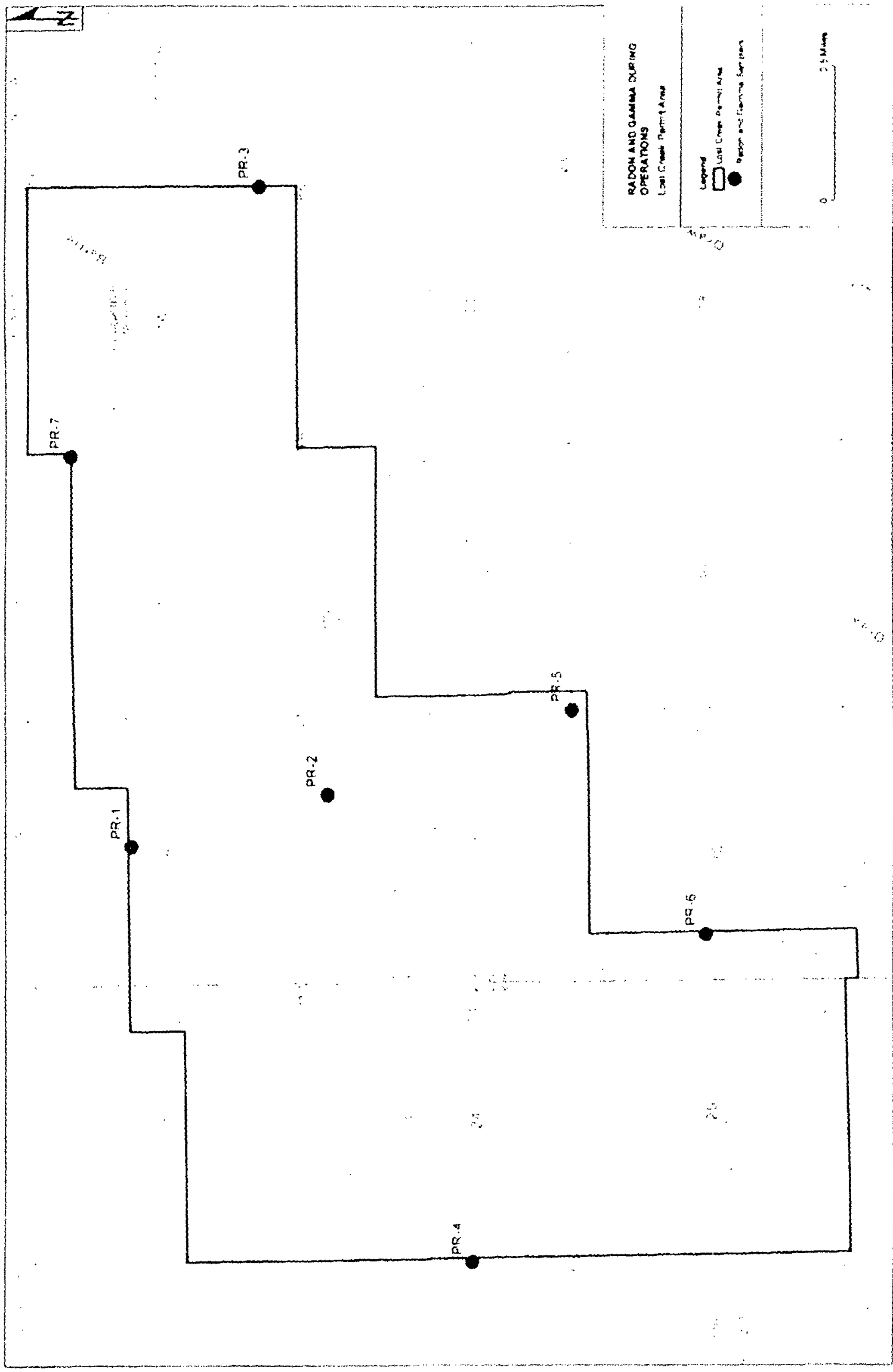

Figure 6-2. Radon and Gamma Monitoring Locations

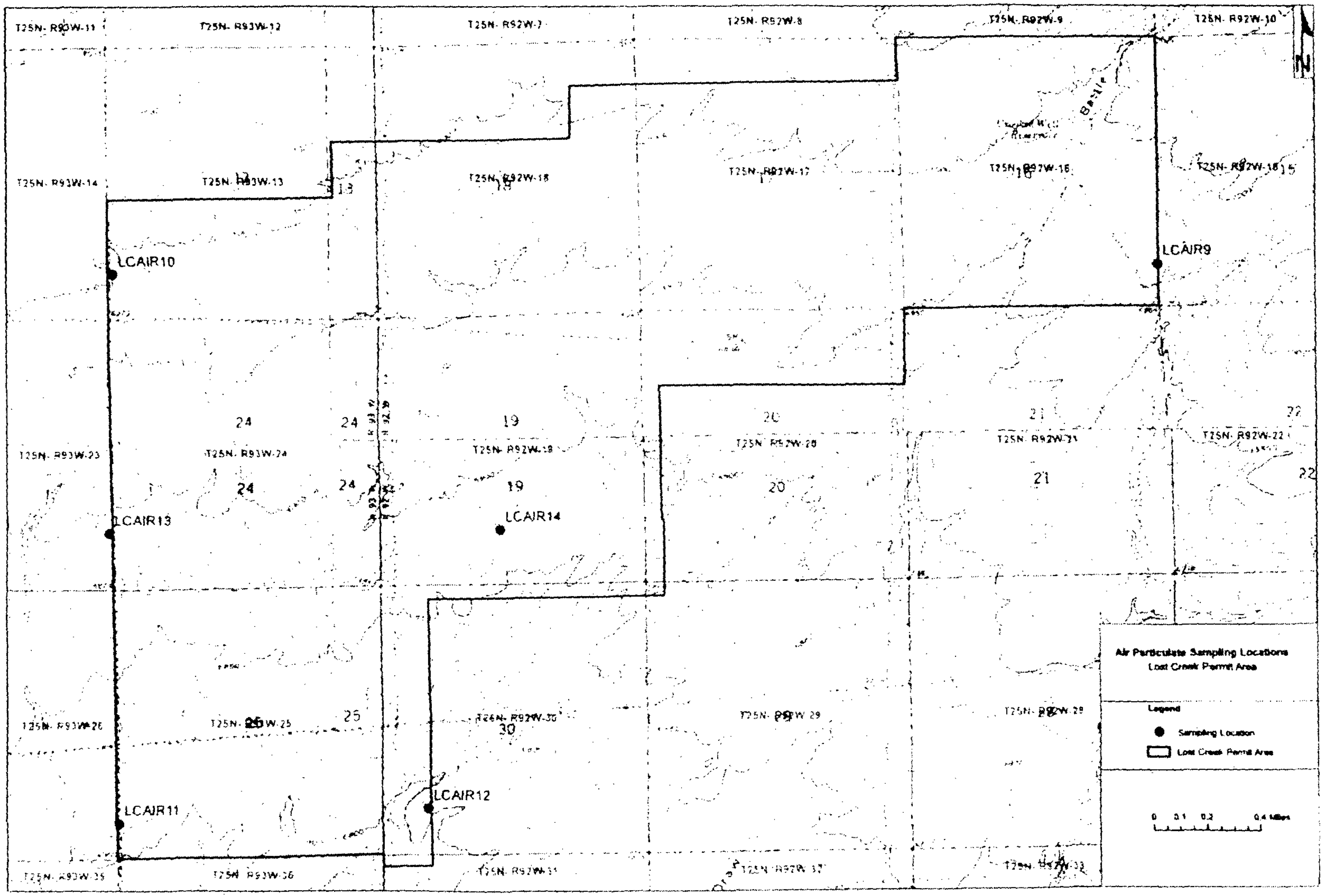

Figure 6-3. Air (Particulate) Monitoring Locations

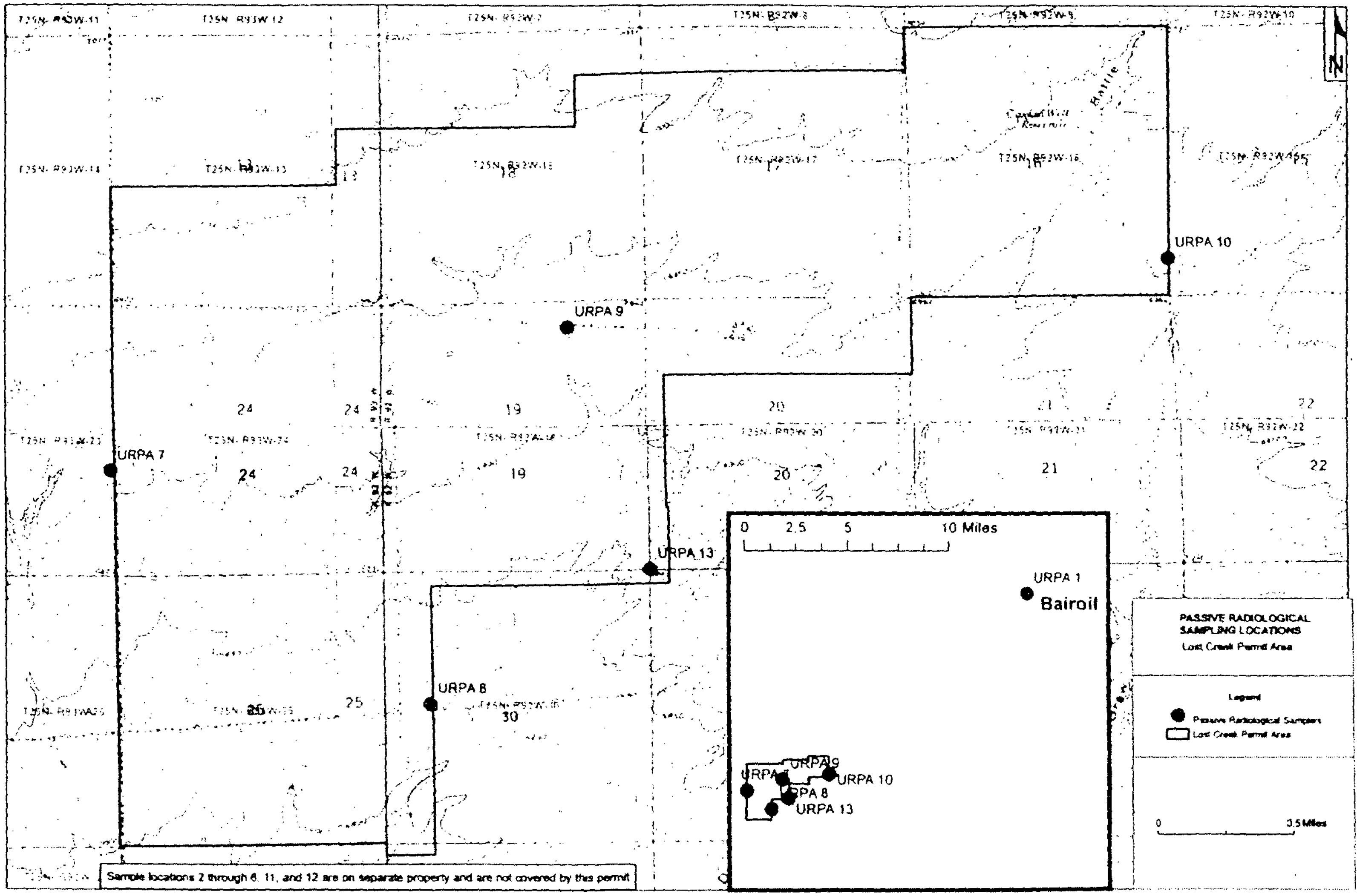

Figure 6-4. Passive Radiological Monitoring Locations

The north-central portion of the Great Divide Basin lacks any perennial, or even intermittent surface waters, and as such, no surface water monitoring program is proposed. Samples, however, would be collected in the event of spill or accidental release of contaminants. If no surface water is present at the time of a spill that could potentially impact an ephemeral drainage, only the soil would be sampled. However, sampling of the surface water would occur the next time that surface water is present.

6.2.5 Groundwater Monitoring

Groundwater environmental monitoring would be conducted at private and BLM-owned wells within 2 km (1.2 mi). of the permit area on a quarterly basis, with the owners' consent. Samples would be analyzed for uranium and Ra-226. Of the 17 monitoring wells already drilled, and the one private well sampled, more than two-thirds show elevated radionuclide concentrations (Table 3-3). None of these wells, however, are used for drinking or agricultural purposes, and the elevated radionuclide concentrations are consistent with uranium ore within the aquifer.

6.3 Physiochemical Monitoring

This section describes the proposed monitoring program to characterize and evaluate the chemical and physical environment. The purpose is to provide a basis for evaluating changes in the environment resulting from the proposed action. Two aspects must be considered: 1) baseline monitoring, used to support a pre-operational description of the environment; and 2) operational monitoring, used to support potential changes (impacts) to the environment as a result of uranium milling.

6.3.1 Well Field Groundwater Monitoring

As described in Section 8.3 of the GEIS (NRC, 2009), ISR production processes directly affect groundwater in the operating well field. For this reason, groundwater conditions are extensively monitored before, during and after operations. The pre-operational groundwater monitoring that occured at Lost Creek is described below in Section 6.3.1.1. The groundwater quality monitoring that would occur during and after operation is described in Section 6.3.1.2.

6.3.1.1 *Pre-Operational Groundwater Sampling*

A licensee must establish baseline groundwater quality before beginning uranium production in a well field (NRC, 2009). This is done to characterize the water quality in monitoring wells that would be used to detect lixiviant excursions from the production zone, to recover excursions, and to establish standards for aquifer restoration after uranium recovery is complete. The requirements and details of sampling programs to establish pre-operational groundwater quality are described in Section 8.3.1.1 of the GEIS (NRC, 2009).

LCI installed a monitor well network to provide an evaluation of pre-mining (baseline) conditions within the Lost Creek project area. The baseline groundwater monitoring program is described, in detail, in Section 5.7.8.1 of the applicant's Technical Report (TR), and the results of that monitoring program are described, in detail, in Section 2.7.3 of the TR. To establish baseline groundwater quality, quarterly groundwater samples were collected from 17 monitoring wells and one water supply well. These wells were completed in the production aquifer (designated as the HJ Horizon), the underlying aquifer (designated as the UKM horizon), and in the overlying aquifer (designated as the DE and LFG horizons). Sampling of all the wells began in September 2006, with the exception of four well in which sampling was begun in 2007. This sampling program provided a preliminary baseline analysis of groundwater quality and is intended to describe the overall quality of groundwater that now exists beneath the project area.

It should be noted that this does not, necessarily, provide the final basis for establishing restoration criteria for the individual well fields in which uranium milling would be conducted.

6.3.1.2 *Groundwater Quality Monitoring*

A baseline water quality assessment and restoration goal for each well field would be provided prior to beginning uranium recovery. This assessment would be provided to the WDEQ after being reviewed and approved by the LCI's Safety and Environmental Review Panel (SERP) and the NRC. A detailed description of the monitoring program that would be used to establish baseline water quality is provided in Section 5.7.8.2 of the LCI's TR. Production zone wells (injection and production pattern area) would be sampled four times with a minimum of two weeks between samplings during baseline characterization. The production wells would be selected based on a density of one well per three acres of well fields. During the first two sampling events, each well would be sampled for the full set of constituents required by the WDEQ (Table 6-1). The constituent list may be reduced during subsequent sampling events based on the result of the first two sampling events.

As described in the GEIS (NRC, 2009), monitoring wells would be placed around the perimeter of well fields, in the aquifers both overlying and underlying the ore-bearing (production) aquifers, as well as within the production aquifer for the early detection of potential horizontal and vertical excursions of lixiviants (Figure 2-7). Monitoring well placement is based on what is known about the nature and extent of the confining layer and the presence of drill holes, hydraulic gradient and aquifer transmissivity, and well abandonment procedures used in the region. The ability for a monitoring well to detect groundwater excursions is influenced by several factors, such as the thickness of the aquifer monitored, the distance between the monitoring wells and the well field, the distance between the adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in chemical indicator parameters that are monitored to determine whether and excursion has occurred. As a result, the spacing, distribution, and number of monitoring wells at a given ISR facility are site-specific and established by license conditions. The factors that control the spacing, distribution and number of monitoring wells are described in greater detail in Section 8.3.1.2 of the GEIS (NRC, 2009).

LCI has documented the groundwater monitoring program that would be implemented at the Lost Creek ISR project in Section 5.7.8 of its TR. Monitoring well locations and spacing are described in Section 3.2.2.2 of LCI's TR. Monitoring wells would be located in a perimeter ring around the well field, with the completion interval of each well targeted to the mineralized zones adjacent to the well. Distances from the perimeter monitor wells to the injection/production patterns in each well field are anticipated to be on the order of 152 m (500 ft). The distance between each of the monitoring wells in the ring is also anticipated to be on the order of 152 m (500 ft). The results of pumping tests indicate that the radius of influence of a single pumping well is much greater than 152 m (500 ft). Consequently, the proposed monitoring well rings should be in hydraulic connection with the production well fields and the proposed monitoring should allow adequate detection so that production fluids could be controlled within 60 days, as required by the NRC. LCI must further demonstrate the hydraulic interconnection between the monitoring wells and production pattern at each well field. The distances between the monitoring ring and the production wells and between each well within the ring would be based on the aquifer characteristics of that well field, and actual distances would be refined at a later time when more data becomes available for that well field.

Monitoring wells would also be completed in the aquifers immediately above and below the uppermost and lowermost mineralized zone, in the UKM and FG horizons, respectively. As previously described in Section 3.5.3 and 4.5.3, aquifer testing conducted in the project area have indicated a potential for hydraulic connection between the production zone (HJ Horizon) and the overlying FG and underlying UKM aquifers. LCI anticipates that the overlying and underlying monitoring wells would be installed at a density of approximately one well for each four acres of mine area. However, they further indicate that the actual density would be based on the aquifer characteristics of the mineralized zone and the overlying or underlying aquifer. Specific locations would be targeted depending on the thickness and continuity of the shale separating the mineralized zone and the underlying and overlying aquifer. LCI is required to demonstrate the adequacy of the monitoring program for the overlying and underlying aquifers at each mine unit.

A fault passing through the project area also complicates the design of an effective monitoring program. As previously described in Section 3.5.3 and 4.5.3, while the fault acts as an impediment to groundwater flow, it does not appear to act as an impermeable barrier. In addition, the strata are displaced across the fault. Monitoring well locations and depths must be specified that adequately represent the existing conditions and ensure adequate operational monitoring in the vicinity of the fault. The location and depth of monitoring wells intended to characterize flow across the fault, but would be determine based on individual mine unit testing.

The constituents chosen for indicators of lixiviant migration and for which UCLs would be set, are chloride, conductivity, and total alkalinity. Chloride was chosen due to its low natural levels in the native groundwater and because chloride is introduced into the lixiviant from the ion exchange process. Chloride is also a very mobile constituent in groundwater. Conductivity was chosen because it is an indicator of overall groundwater quality. Total alkalinity concentrations should be affected during an excursion as bicarbonate is the major constituent added to the lixiviant during mining.

Operational monitoring would consist of sampling the excursion monitoring wells at least twice monthly and at least ten days apart and analyzing the samples for the excursion indicators chloride, conductivity and total alkalinity. If two of the three UCL values are exceeded in a well during a monitoring event, the well is re-sampled within 24 hours of that determination. If results of the confirmatory sampling are not completed within 30 days of the initial sampling event, the excursion is considered confirmed. If the second sample does not exceed the UCLs, a third sample is taken. If neither second nor third round sample results exceed the UCLs, the first sample is considered in error. If the second or third round samples verify the exceedence, the well in question is place on excursion status. The NRC Project Manager and the WDEQ-LQD are notified by telephone or email within 24 hours and notified in writing within thirty days of a confirmed excursion. Corrective actions are undertaken at this point. A written report describing the excursion event, corrective actions, and corrective action results are to be submitted to the NRC within 60 days of the excursion confirmation.

Following the installation of each production pattern and monitor well network, the Well Field Hydrologic Data Package is assembled and submitted to the WDEQ for review. The contents of the data package would meet the extensive requirements established by the WDEQ. SERP would review the data package to ensure that the results of the hydrologic testing and planned mining activities are consistent with technical requirements and do not conflict with any requirement stated in NRC regulations. The Well Field Hydrologic Data Package would also be reviewed and approved by the NRC to ensure that the specific monitoring program establish for each well field would be adequate to provide a timely indication of any horizontal or vertical excursion that may occur.

Table 6-1. Baseline Water Quality Monitoring Parameters	
Parameters Major Ions	**Trace Constituents**
Calcium	Aluminum
Magnesium	Ammonia
Potassium	Arsenic
Sodium	Barium
Bicarbonate	Boron
Chloride	Cadmium
Carbonate	Chromium
Sulfate	Copper
Nitrate (Total)	Iron
Fluoride	
General Water Chemistry	Manganese
Alkalinity 1	Mercury
Total Dissolved Solids	Molybdenum
pH (field measured)	Nickel
pH (lab measured)	Selenium
Specific Conductance (field measured)	Silica
Temperature (field measured)	Vanadium
Zinc	
Radionuclides	
Gross Alpha 1	
Gross Beta 1	
Radium-226	
Radium-228 1	
Uranium	

[1] *The 1982 sampling did not include these parameters Lost Creek October 2007*

6.3.2 Well Field and Pipeline Flow and Pressure Monitoring

Section 8.3.2 of the GEIS (NRC, 2009), indicates the facility operator typically would monitor both injection and production well flow rates to manage water balance for the entire well field. Additionally, the pressure of each production well and the production trunk line in each well field header house would also be monitored. Unexpected losses of pressure may indicate equipment failure, a leak, or a problem with well integrity.

The program planned for the well field and pipeline flow and pressure monitoring is described in detail, in Section 3.2.7.1 of the LCI's TR. Injection well and production well flow rates and pressures would be monitored at each header house in order that injection and production can be balanced for each pattern and the entire well field. The flow rate of each production and injection well is continuously monitored by monitoring individual electronic flow meters in each well field header house. The pressure of each production and injection trunk line would be monitored at the header house with electronic pressure gauges. The flow meters and pressure gauges would be tied into the header house control panel, which would be in communication with the CPP control room.

High and low pressure, as well as flow alarms would be installed to alert well field and plant operators if specified ranges are exceeded in conjunction with automatic shutoff valves to stop flow if significant changes in flow or pressure occur.

6.3.3 Surface Water Monitoring

LCI is not proposing any operational surface water monitoring for the project area because it concluded all of the drainages are ephemeral. In their application, LCI stated that runoff to the drainages only occurs during major precipitation events, and only a portion of it infiltrates to the surficial aquifer. NRC staff notes, however, it is possible that spills from wellheads or piping in the project area may be captured by runoff, be carried to drainages, infiltrate into the subsurface, and potentially affect the water quality in the surficial aquifer. For this reason, LCI has established several surface water sampling points within, and at, the borders of the project area with storm water samplers which were effective at measuring surface water quality during major precipitation events (Figure 6-5). NRC staff concludes these samplers would be adequate evaluate surface water runoff during precipitation events.

6.3.4 Meteorological Monitoring

The only air quality parameter proposed for monitoring at the Lost Creek site is particulate matter (PM_{10}). Monitoring would be conducted by continuous visual inspection within the project boundary.

6.4 Ecological Monitoring

Site-specific monitoring programs need to be implemented in accordance with WDEQ, USFWS, WGFD, and BLM guidelines. Regular inspections on the status of mitigation installments also need to be incorporated into the ecological monitoring plan.

6.4.1 Vegetation Monitoring

Vegetation at the Lost Creek project area would be monitored by observing disturbed areas for the presence of undesirable (noxious) weedy species. If noxious weed species are noted, they would be controlled either by manual removal, mowing, or by herbicide applications.

Disturbed areas that have been reclaimed, and where indigenous (native) vegetation is developing, the areas would be monitored according to BLM and WDEQ guidance. These areas would continue to be monitored until the vegetation cover values (exclusive of noxious weeds) become comparable to the surrounding native shrub land areas.

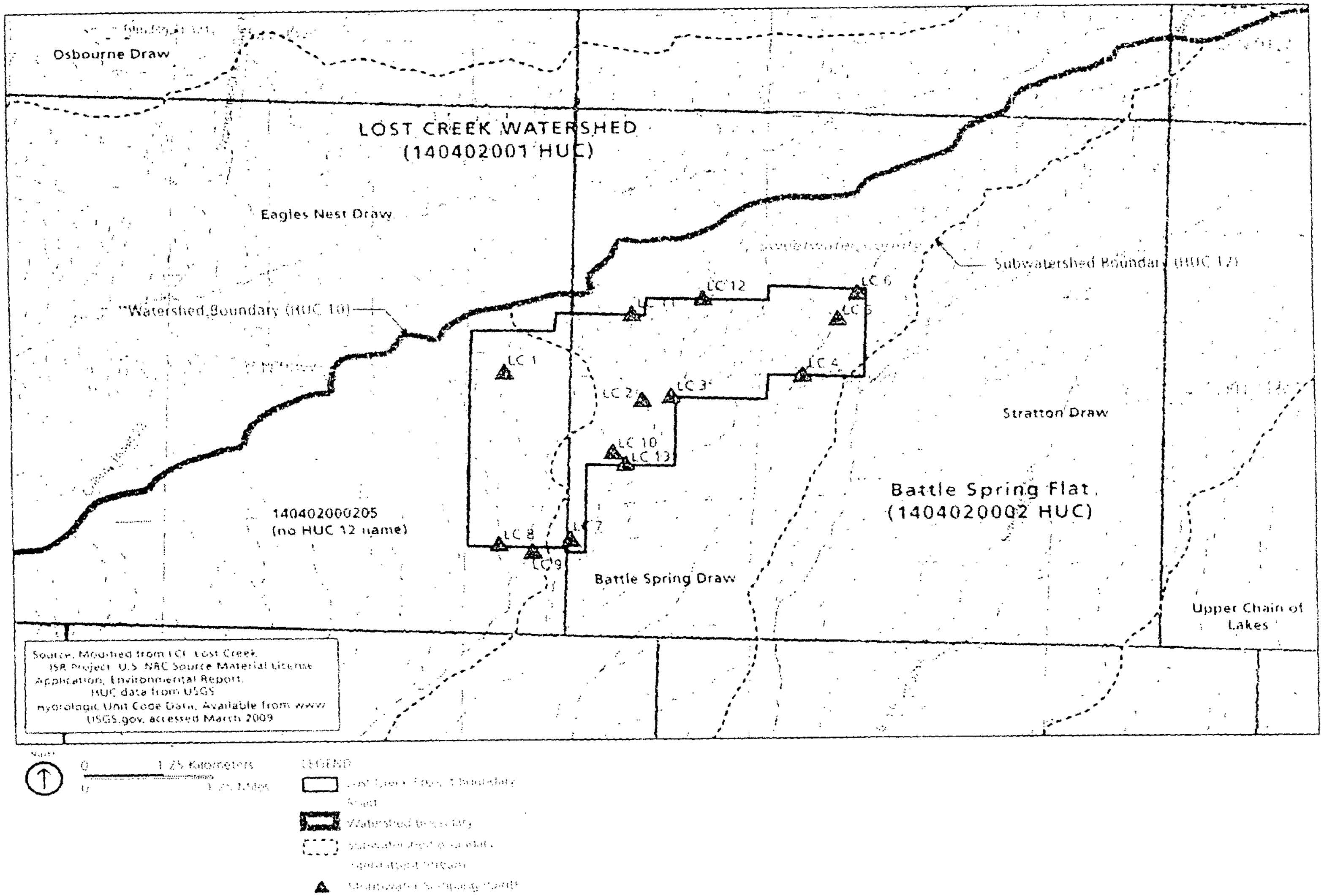

Figure 6-5. Surface Water Sampling Locations

6.4.2 Wildlife Monitoring

Wildlife resources in, and near, the project area would be monitored on an annual basis throughout the life of the project, and would document key wildlife species, population trends, and habitats.

6.4.2.1 *Annual Report and Meetings*

The monitoring program would be coordinated with the Rawlins BLM Field Office, and the Wyoming Game & Fish Department (WGFD). Consultation with the BLM and WGFD would be conducted prior to initiating monitoring, and would be documented in a work plan, with concurrence by the BLM and WGFD.

An annual monitoring report would be prepared by LCI and submitted to the BLM, WGFD, and other interested parties by November 15 of each year, and would include: 1) survey methods, results, any trends, an assessment of protection measures implemented during the past year; 2) recommendations for changes in protection measures for the coming year; 3) recommended modifications to monitoring or surveying; and 4) recommendations for additional species to be monitored (*e.g.*, a newly listed species). Data and mapping would be formatted to meet BLM requirements (i.e., geographic information systems [GIS] data and maps).

6.4.2.2 *Annual Inventory and Monitoring*

Wildlife inventory and monitoring would be completed by the BLM or WGFD biologists, or a third-party contractor paid for by LCI (approved by BLM prior to completing any work).

6.4.2.3 *Raptors*

Monitoring of known raptor nests would be completed each year between April and July to determine nest status. Surveys can be completed by helicopter or from the ground, and would be conducted using WGFD protocol to minimize adverse effects to nesting raptors. Observations would be scheduled for as late in the nesting season as possible to avoid disturbance during the incubation and early brood rearing periods.

Surveys for new nests would also be conducted within the project area, but would extend to a 1.6-km (1 mi) radius outside of the project area at least once every five years. For areas of new disturbance, a survey for new raptor nests would be completed prior to the disturbance.

6.4.2.4 *Sage-grouse*

A survey for new (undocumented) leks would be completed within the project area and within a surrounding 3.2-km (2 mi) radius outward from the project area boundary once every five years, or as deemed appropriate by BLM and WGFD. Just as with raptors, surveys may be completed by aerial or by ground methods, following standard WGFD protocol.

All documented and known leks would be monitored on an annual basis to determine its attendance and trends in activity. Monitoring would occur three times during the appropriate season (late March to early May), and following WGFD standard protocol.

6.4.2.5 *Big Game*

No monitoring of big game is proposed LCI. Only the number of road kills for each of the major species would be recorded. To determine the extent of big game road kills all wildlife/vehicle collisions on project access roads would be recorded and reported in the annual monitoring report. Other big game mortality resulting from project activities would also be recorded and reported.

6.4.2.6 *General Wildlife*

No monitoring of other wildlife species is being proposed. Known mortality of wildlife species resulting from project activities would be recorded and reported. Large die-offs, or evidence of possible wildlife exposure to toxic chemicals, would be reported immediately to the BLM, WGFD, and USFWS.

6.4.2.7 *Sensitive Species*

Specific monitoring of sensitive species (except as noted above for raptors and sage-grouse) is not proposed.

Known mortality of sensitive wildlife species due to project activities would be recorded and reported. Significant die-offs or other evidence of possible wildlife exposure to toxic chemicals would be reported immediately to the BLM, WGFD, and USFWS.

6.4.3 Noise

Noise is not being proposed for monitoring because the nearest receptor is more than 15 miles away.

6.4.4 Historic and Cultural Resources Monitoring

No specific on-going monitoring plan is required for this project. A treatment (mitigation) plan, however, was prepared for a pre-historic site identified in the project area that is potentially eligible for inclusion on the *National Register of Historic Places*. In addition, should unanticipated cultural resources be uncovered during the construction, operation, aquifer restoration, or decommissioning phases, an Unanticipated Discovery Plan would be implemented by the Site Supervisor. The plan would be prepared prior to license approval, and would outline the process of notification, evaluation, and actions to be taken should unanticipated cultural resources be found during the development of the facility.

6.5 References

10 CFR Part 40 Appendix A. *Code of Federal Regulations*, Title 10, Energy, Part 40 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content.

36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 60, "National Register of Historic Places."

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7 COST-BENEFIT ANALYSIS

This chapter summarizes benefits and costs associated with the proposed action and the No-Action alternative. Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek Project by Lost Creek ISR, LLC (LCI).

The implementation of the proposed action primarily would generate regional and local benefits and costs. The regional benefits of constructing and operating the proposed Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Sweetwater County, Wyoming, where the proposed ISR facility would be located, and the towns of Bairoil and Wamsutter, and the cities of Rock Springs and Green River. Other benefits may extend to the neighboring Carbon County, Wyoming, and to the Town of Rawlins. Costs associated with the proposed Lost Creek Project are, for the most part, limited to the area surrounding the site. Examples of these environmental impacts would include changes to current land use, wildlife habitat, and increased road traffic.

7.1 No-Action Alternative

Under the No-Action alternative, the NRC would not approve the license application for the proposed Lost Creek Project. The No-Action alternative would result in LCI not constructing, operating, restoring the aquifer, or decommissioning the proposed Lost Creek Project. No facilities, road, or well fields would be built; no pipeline would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface orebody; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface and no buildings would be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. As a result, the proposed site would not be disturbed by the proposed project activities, and ecological, natural, and socioeconomic resources would remain unaffected. All potential environmental impacts from the proposed action would be avoided. Similarly, all project-specific socioeconomic impacts (e.g., related to employment, economic activity, population, housing, local finance) would be avoided.

7.2 Benefits from the Proposed Action

Under the proposed action, LCI would construct, operate, and decommission and conduct aquifer restoration at the proposed Lost Creek Project site in Sweetwater County, Wyoming. Construction of the central processing plant, access roads, and initial development of the well fields for the proposed Lost Creek Project would take place over a 21-month period, with the CPP and supporting structures expected to take approximately 6 months to construct. Operation of the central plant for uranium recovery and processing would be expected to occur over 8 years, with aquifer restoration activities and associated stability monitoring following restoration is expected to occur over a 3.5-year period. LCI expects to conduct final well field and site decommissioning within one year.

The principal socioeconomic impact or benefit from the proposed Lost Creek Project would be an increase in the jobs in Sweetwater County, Wyoming and the surrounding counties. LCI expects that from 70 to 90 workers (including both full-time employees and subcontractors) would be employed during the life of the proposed project. LCI anticipates that most would commute from larger communities in Wyoming, such as Casper, Rawlins and Rock Springs, but some (if they are specialized in a particular trade) could come from out-of-state.

If it is assumed that the majority of the employment requirements is filled by a workforce from outside the region, assuming a multiplier of about 0.7 (see text box) there could be an influx of a minimum of 49 jobs (i.e., 70x0.7) and a maximum of 63 jobs (i.e., 90 x 0.7). In the region of influence the nearest towns to the proposed project site are the Towns of Bairoil (population of 96), Wamsutter (population of 269), and Rawlins (population of 8,740) (U.S. Census Bureau, 2008). Given their relative size and proximity to the proposed site, Bairoil (24 km [15 mi] from the proposed project site) and Wamsutter (43 km [27 miles]), the new jobs could have a LARGE positive impact in the unemployment of the Towns of Bairoil and Wamsutter, but only a SMALL to MODERATE impact in the Town of Rawlins (61 km [38 mi] from the proposed site). The influx of these jobs along with the reduction of unemployment should have a MODERATE benefit to the businesses of the Towns of Bairoil and Wamsutter, but only a SMALL to MODERATE impact to the businesses in the Town of Rawlins.

In addition to job creation, the project's operations and its employees would contribute to local, regional, and state revenues through the purchase of goods and services and through the taxes levied on such goods and services. Additionally, severance taxes associated with uranium mining in Sweetwater County are levied by the State of Wyoming, Mineral Tax Division of the Department of Revenue has a 4% uranium severance tax of taxable market value coming from mining operations (Wyoming Department of Revenue, 2009). LCI estimates that the proposed project will produce 454,500 kg (1,000,000 lb) of U_3O_8 per year for 8 years. If these were sold at nominal market price for U_3O_8 of $45, the severance tax would yield approximately $1,800,000 in net economic benefits per year and $14,400,000 over the life of the operation. This figure excludes potential reserve resources and does not include potential benefits derived from taxes on royalties or lease payments to local landowners stemming from the operation of the proposed Project. LCI also expects to pay $1,600,000 in county property taxes.

7.2.1 Benefits from Potential Production

Both the employment generated and the taxes paid by LCI would depend on the production of yellowcake. The amount of yellowcake produced would depend on the market price for yellowcake (as U_3O_8) and the cost of production. Since 2007, the spot-market price for U_3O_8 has fluctuated significantly, from a high of over $130 in 2007 to as low as $40 in 2009. As of September 8, 2009, the price was $46 per pound.

The project's potential benefits to the local community depend on LCI's operating costs being lower than the future price of U_3O_8. If the price of U_3O_8 is less than the costs of operation, then operations may be suspended and/or discontinued.

7.2.2 Costs to the Local Communities Associated with the Proposed Lost Creek Project Activities

Table 7-1 identifies the towns within 40 km [25 mi] and towns within commuting distance from the proposed project site. The table also presents the towns' population and distance from the project site.

Table 7-1. Communities Closest to the Proposed Project

Communities	Population *	Distance from Project Site - km (mi)
Within 25 miles from the project site		
Bairoil (T)	96	24 (15)
Between 25 and 50 miles from the project site		
Wamsutter (T)	269	43 (27)
Rawlins (T)	8,740	61 (38)
Beyond 50 miles of the project site		
Rock Springs (C)	20,200	134 (84)
Casper (C)	54,047	145 (91)

*U.S. Census Bureau, 2008

As stated in Section 7.2, the proposed project is expected to employ from 70 to 90 workers, and, if the majority of operational requirements are filled by a workforce from outside the region, there could be an influx of 49 to 63 jobs. These new jobs would have an influx of 122 to 156 people, based on 2.48 persons per household for the State of Wyoming (U.S. Census Bureau, 2000). As discussed previously, it is expected that a large fraction of these new workers and their households would prefer to reside in larger communities, such as the Town of Rawlins. If it were assumed that all new households resided in the Town of Rawlins, then that would lead to a population increase of 1.4 percent (i.e., 122 ÷ 8,740) to 1.8 percent (i.e., 156 ÷ 8,740) for the town. However, it is expected that not all the new households would reside in the Town of Rawlins and may prefer other large communities. Therefore, the impact to housing demand and health and social services is estimated to be SMALL to MODERATE.

The local communities would require minimal increase in emergency response and medical treatment capabilities because of the small risk of industrial accident due the proposed project.

Table 7-2. Estimated Project Costs to the Local Communities

Summary of Costs and Benefits of the Proposed Lost Creek Project	
Cost-Benefit Category	**Proposed Action**
BENEFITS	
Capacity Produced	1.0 million pounds of U3O8 for 8 years
Other Monetary	$14.4 million (estimated for severance tax)
Non-Monetary (50% of jobs will be from Campbell County)	70-90 jobs—during construction, operation aquifer restoration, and decommissioning 49-63 jobs—local jobs from economic multiplier during operation and aquifer restoration
COSTS	
Education Infrastructure	SMALL to MODERATE
Health and Social Services	SMALL to MODERATE
Housing Demand	SMALL to MODERATE
Emergency Response	SMALL

7.3 Evaluation of Findings for the Proposed Lost Creek ISR Project

Implementation of the proposed action would have a SMALL to MODERATE overall economic impact on the region of influence. The implementation of the proposed action would generate primarily regional and local benefits and costs. The regional benefits of building the proposed Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in the region around the site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Sweetwater County. Other benefits may extend to neighboring counties in the State of Wyoming. Costs associated with the proposed Lost Creek ISR Project are, for the most part, limited to the area surrounding the site and the communities within commuting distance. Table 7-2 summarizes the costs and benefits.

7.4 References

Economic Policy Institute, 2003, "Updated Employment Multipliers for the U.S. Economy," Washington, DC: Economic Policy Institute. 2003.

NRC, 2009, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities," Washington, DC: NUREG-1910. May 2009.

NRC, 1996, U.S. Nuclear Regulatory Commission, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Washington, DC: NUREG-1437, Office of Nuclear Reactor Regulation. May 1996.

U.S. Census Bureau, 2008, U.S. Census Bureau, 2008 Population Estimates, http://factfinder.census.gov

U.S. Census Bureau, 2000, State and County Quick Facts, http://quickfacts.census.gov/qfd/states/56000.html

Wyoming Department of Revenue. 2009. State of Wyoming Department of Revenue 2009 Annual Report. < http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20 Revenue%20%2010.29.2009.pdf> (11 November 2009).

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the No-Action alternative. In doing so, the potential impacts and consequences are discussed in terms of: 1) the unavoidable adverse environmental impacts; 2) the relationship between local short-term uses of the environment and the maintenance of long-term productivity; and 3) the irreversible and irretrievable commitment of resources. The information is presented for the proposed action and each alternative for the 13 resource areas and discussed by stage of the proposed facility's lifecycle (i.e., construction, operation, aquifer restoration and decommissioning). These conclusions are provided in the tables below.

NRC's NUREG-1748 (NRC, 2003) defines the following terms:

- **Unavoidable adverse environmental impacts**: impacts that cannot be avoided and for which no practical means of mitigation are available
- **Irreversible**: commitments of environmental resources that cannot be restored
- **Irretrievable**: applies to material resources and would involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means
- **Short-term**: represents the period from pre-construction to the end of the decommissioning activities, and therefore generally affect the present quality of life for the public.
- **Long-term**: represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations.

As described in Chapter 4, the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeable alter any important attribute of the resource.

MODERATE: The environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

8.1 Proposed Action (Alternative 1)

NRC would issue Lost Creek ISR, LLC (CLI) a license for the construction, operation, aquifer restoration, and decommissioning of facilities for in-situ recovery (ISR) uranium milling and processing at the Lost Creek ISR Project site as proposed in the license application and related submittals.

One identified archaeological site, eligible for inclusion on the National Register of Historic Places may be potentially affected. A Memorandum of Agreement (MOA) has been developed, and is currently in the process of being executed. The potential environmental impacts of this alternative are summarized in Table 8-1.

8.2 No-Action (Alternative 2)

LCI would not be issued a license for the construction and operation of ISR facilities related to the Lost Creek ISR Project. As a result, no uranium ore would be recovered from this site under the LCI license application.

Alternative 2 would result in no impacts to any of the 13 resources areas. Therefore, no unavoidable adverse environmental impacts would occur, no relationship between local short-term uses of the environment and the maintenance of long-term productivity irreversible or irretrievable commitments would result, and there would be no irreversible and irretrievable commitment of resources.

8.3 Dry Yellowcake (Alternative 3)

NRC would issue LCI a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing as proposed by LCI, and would include a vacuum dryer to produce a dry yellowcake as the final product.

The potential environmental impacts for Alternative 3 on each of the 13 resource areas are similar to, or nearly the same as, the impacts from the proposed action (summarized in Table 8-1). The same area of land would be disturbed, which would not result in any additional impacts to geology and soils or ecological resources. Additional equipment, and potentially additional workers, may be needed, which could affect transportation and air quality.

1

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Land Use **4.2.1**	During construction, there would be a SMALL impact from use of earth-moving equipment, removal of topsoil, grading and clearing of land to create access roads, and creation of wells. Impacts during other phases would be similar.	During all phases, there would be a SMALL commitment of energy resources and water resources to project activities. In addition, a small amount of grazing and herd management land would be affected, irretrievably, for a period of about 10 years.	During all phases, there would be a SMALL impact from temporary alteration of rangeland leases, and short-term restricted access to neighboring lands. During decommissioning, there would be a SMALL impact from land disturbances from earth-moving equipment, regarding, and reseeding of land.	During all phases of the project there would be a SMALL long-term impact from vegetation removal, affecting grazing and herd management. During decommissioning, wells, though abandoned, would remain on the site.
Transportation **4.3.1**	During all phases, there would be a SMALL increase in local traffic counts and dust and noise associated with project-related traffic	During the life of the project, fuel, necessary for vehicle and equipment operation, as well as heating, would be irreversibly committed. In addition, labor, from on-site and service personnel, would be irreversibly committed.	During all phases, there would be a SMALL increased risk of chemical spills on roadways. During periods of intense project development, such as construction and decommissioning, there would be a noticeable increase in traffic on local roads	Because no project-related transportation impacts would persist after the life of the project, no long term impacts would result.

Table 8-1. Summary of Environmental Consequences of the Proposed Action				
Impact Category	**Unavoidable Adverse Environmental Impacts**	**Irreversible and Irretrievable Commitment of Resources**	**Short-term impacts and uses of the environment**	**Long-term impacts and the maintenance and enhancement of productivity**
Geology and Soils **4.4.1**	During construction, and again, during decommissioning, disturbance of soil would cause SMALL impacts. Spills causing contamination, and alteration of soil horizons would result in MODERATE impacts, unless mitigated.	During all phases, disturbance to the soil layers would be irreversible, though SMALL. 'Reseeding and re-contouring would mitigate this impact.	During construction, disturbance of soil would cause SMALL impacts. Spills causing contamination, and alteration of soil horizons would result in MODERATE impacts, unless mitigated.	Because project area would be returned to its original condition during decommissioning, no long-term impacts to geology and soils are expected.
Surface Waters and Wetlands 4.5.1.1	Not applicable	Not applicable	Not applicable	Not applicable
Groundwater **4.5.2.1**	Impacts could occur throughout the life cycle of the project. There is the potential to affect drawdown in wells outside the project boundaries that are drilled into the ore-bearing aquifer. There is the potential to alter groundwater chemistry from spills, leaks and excursions	Stock wells in the area may be irretrievably affected by drawdown from the aquifer, particularly during operation and restoration. Change in aquifer chemistry may be an irreversible impact.	Consumptive use – drawdown of the aquifer would be most noticeable during aquifer restoration. Impacts to surrounding wells would be affected for a short-term. There is the potential for contamination to surficial aquifers from spills and leaks, and to lower aquifers from excursions.	There is the potential to alter the chemistry of an aquifer due to operation.

Table 8-1. Summary of Environmental Consequences of the Proposed Action				
Impact Category	**Unavoidable Adverse Environmental Impacts**	**Irreversible and Irretrievable Commitment of Resources**	**Short-term impacts and uses of the environment**	**Long-term impacts and the maintenance and enhancement of productivity**
Ecological Resources **4.6.1**	During construction, removal of vegetation and clearing of land, possible introduction of invasive species, and displacement of wildlife species would result in SMALL impacts. During all other phases, limited access of wildlife to wintering habitat would result in SMALL impacts.	During the life of the project, a small amount of vegetation would be lost to buildings, storage areas, roads and well pads. Habitat removed for project development constitutes an irretrievable commitment of resources, as would be the displacement of some wildlife species	Impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL. Reseeding after decommissioning would restore native vegetation.	During all phases, altered wildlife patterns and changes to the vegetative community would result in SMALL impacts.
Air Resources **4.7.1**	During all phases, fugitive dust, and vehicle and equipment emissions would result in SMALL impacts.	During all phases of the project, for short periods of time, the quality of the air would be degraded, mostly by dust, but would not be irreversible.	During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.	Because emissions are expected to be SMALL, no long-term impacts are expected.
Noise **4.8.1**	During construction, noise levels would be elevated on, and in the vicinity of, the site, but would result in SMALL impacts. During other phases, noise levels would be elevated, but to a lesser extent than during construction.	Not applicable	During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.	Because noise impacts would not persist past the life of the project, no long-term impacts would result.

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Historical, Cultural, and Paleontological Resources **4.9.1**	During construction, potential disturbance of archaeological sites could result in MODERATE impacts unless mitigated.	If archaeological sites are not avoided during construction, this would result in an irreversible commitment of resources and could result in MODERATE to LARGE impacts, if not mitigated.	During all phases, restricted access to identified historical and cultural sites would be short-term and would result in a SMALL impact.	If potential impacts from construction activities are not mitigated, then long-term MODERATE to LARGE impacts to archaeological sites would likely result.
Visual and Scenic Resources **4.10.1**	During construction, minor visual impacts from equipment and dust/diesel emissions would result in a SMALL impact. During all phases, impacts from buildings, structures and activities would be SMALL.	During the life cycle of the project, impact upon the landscape would be irretrievable, but not irreversible.	During all phases, all impacts associated with visual/scenic resources would be short-term.	Because project area would be returned to its original condition after during decommissioning, no long-term impacts would result.
Socioeconomic **4.11.1**	During operation, increased demand for housing may increase housing costs in the local area and could result in a MODERATE impact. During all phases, increased demand for education and health and social services could put a strain on these resources and result in a MODERATE impact, particularly if it is a small community.	The operation phase of the ISR project may cause an irretrievable commitment of housing and education resources, and health and social services, depending on the community affected.	During all phases, increased demand for housing, educational services, and health and social services would result in a short-term and SMALL impact.	No long-term socioeconomic impacts are expected.

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Environmental Justice **4.12.1**	Not applicable[(1)]	Not applicable[(1)]	Not applicable[(1)]	Not applicable[(1)]
Public and Occupational Health and Safety **4.13.1**	During operation, the potential radiological impacts from accidents would be SMALL to MODERATE for workers, but SMALL to the public, but only from accidents related to the transportation of yellowcake. During other phases, the impacts would be SMALL.	Not applicable	During all phases, all impacts associated with public and occupational health would represent a short-term and SMALL impact.	No long-term public and occupational health impacts are expected.
Waste Management **4.13.1**	During all phases, generation of low volumes of wastes would result in a SMALL impact. Construction wastes would be mostly solids, operations wastes would include solids and liquids (brine, plant wash-down water, and others), and decommissioning wastes would include some radioactive wastes.	During all phases, energy and space used to properly handle and dispose of all types of waste would represent an irreversible commitment of resources resulting in a SMALL impact. On-site, temporary storage of wastes would result in an irretrievable commitment of space resources.	During all phases, hazards associated with handling and transport of wastes would represent a short-term and SMALL impact.	During all phases, permanent disposal or storage of wastes would represent a long-term, but SMALL, impact to facilities licensed to handle such wastes.

[(1)] Section 4.12.1 of this SEIS concluded that there are no disproportionately high and adverse impacts to minority or low-income populations from the Lost Creek Project.

8.4 References

NRC (U.S. Nuclear Regulatory Commission). NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003.

9 LIST OF PREPARERS

This section documents all individuals who were involved with the preparation of this draft Supplemental Environmental Impact Statement (SEIS). Contributors include staff from the U.S. Nuclear Regulatory Commission (NRC) and consultants. Each individual's role, education, and experience are outlined below.

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10 DISTRIBUTION LIST

The U.S. Nuclear Regulatory Commission (NRC) is providing copies of this draft Supplemental Environmental Impact Statement (SEIS) to the organizations and individuals listed below. The NRC will provide copies to other interested organizations and individuals upon request.

10.1 Federal Agency Officials

Bureau of Land Management
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Cheyenne, WY

Bureau of Land Management
Rawlins Field Office
Rawlins, WY

Environmental Protection Agency
Region * Office
Denver, CO

Fish & Wildlife Service
Wyoming Ecological Services
Cheyenne, WY

Bureau of Indian Affairs
Wind River Agency
Fort Washakie, WY

10.2 Tribal Government Officials

Eastern Shoshone
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10.3 State Agency Officials

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State Historic Preservation Office
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Game & Fish Department
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10.4 Local Agency Officials

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Green River, WY

Sweetwater County
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Green River, WY

City of Rock Springs
City Clerk
Rock Springs, WY

City of Rawlins
City Clerk
Rawlins, WY

City of Lander
City Clerk
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10.5 Other Organizations and Individuals

Wyoming Outdoor Council
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Sierra Club – Glen Canyon Group
Salt Lake City, UT

Biodiversity Conservation Alliance
Laramie, WY

APPENDIX A

CONSULTATION CORRESPONDENCE

A.1. Consultation Correspondence

The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966 require that Federal agencies consult with applicable state and federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historic and archaeological resources, respectively. This appendix contains consultation documentation related to these federal acts.

Table A-1. Chronology of Consultation Correspondence

Author	Recipient	Date of Letter
Wyoming State Parks and Cultural Resources (J. Daniele)	U.S. Department of Interior, Bureau of Land Management (P. Madigan)	July 24, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	October 3, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	October 3, 2008
U.S. Department of Interior, Bureau of Land Management (W. Hill)	Centennial Archaeology. Inc. (C. Zier)	October 16, 2008
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	November 12, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming Game and Fish Department (T. Christiansen)	October 29, 2008
U.S. Nuclear Regulatory Commission (A. Kock)	Shoshone Business Council (I. Posey)	January 28, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	U.S. Department of Interior, Bureau of Indian Affairs (R. Nation)	January 28, 2009
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009

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Phone: (307) 777-7697
Fax: (307) 777-6421
http://wyoshpo.state.wy.us

Jul 24, 2008

Patrick Madigan
Bureau of Land Management PM 8-11-08
Rawlins Field Office
P.O. Box 2407
1300 North Third
Rawlins, WY 82301-2407

Re: Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming (SHPO File # 0708JRD021)

Dear Mr. Madigan:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that site 48SW16604 is eligible for listing in the National Register of Historic Places.

We agree that site 48SW16604 will be adversely impacted. We recommend the BLM/SHPO Protocol be followed:

1. Data Recovery Plan: If the historic property is eligible for inclusion in the National Register under Criterion D only, and the adverse effect will be minimized by data recovery, then the BLM will prepare a data recovery plan and follow the procedures in Section VII.A of this Protocol. A Memorandum of Agreement is not required to implement the data recovery plan.

Please refer to SHPO project #0708JRD021 on any future correspondence regarding this project. If you have any questions, please contact Joseph Daniele, Archaeologist/Review and Federal Consultation at 307-777-8793.

Sincerely,

Joseph Daniele
Wyoming State Historic Preservation Office

RECEIVED

AUG 11 2008

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October 3, 2008

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic Preservation Office
Department of State Parks
& Cultural Resources
2301 Central Avenue, Barrett Building
3rd Floor
Cheyenne, Wyoming 82002

SUBJECT: INITIATION OF SECTION 106 PROCESS FOR LOST CREEK ISR, LLC'S LOST CREEK URANIUM RECOVERY PROJECT LICENSE REQUEST (Docket 040-09068)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations*, Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 106 of the National Historic Preservation Act, the EA would include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML073190550.

M. Hopkins 2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at alan.bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials and
Environmental Management Programs

Docket No.: 040-09068

Enclosure:
Lost Creek ISR, LLC Proposed Area

October 3, 2008

Brian T. Kelly, Field Supervisor
U.S. Fish and Wildlife Service
Mountain-Prairie Region
Wyoming Field Office
5353 Yellowstone Road
Cheyenne, WY 82009

SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED LICENSE APPLICATION FOR LOST CREEK ISR, LLC'S LOST CREEK URANIUM RECOVERY PROJECT (Docket 040-09068)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations*, Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 7 of the Endangered Species Act, the EA would include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 50 CFR 402. After reviewing all the information collected, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc .gov/reading-rm/adams.html. The accession number for the application is ML073190550.

B. Kelly 2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at alan.bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
Environmental Review Branch
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09068

Enclosure:
Lost Creek ISR, LLC Proposed Area

Rawlins

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

TAKE PRIDE IN AMERICA

In Reply Refer To:
8151 (930)
568-WY-AR09
RCapron

OCT 16 2008

Dr. Christian J. Zier
Centennial Archaeology, Inc.
300 East Boardwalk, Building 4-C
Fort Collins, CO 80525

Dear Dr. Zier:

We are pleased to provide you with a Wyoming Bureau of Land Management (BLM) Cultural Resource Use Permit No. 568-WY-AR09. This permit authorizes data recovery at 48SW16604, associated with the Lost Creek IR project. The specific location is identified on the permit. This archaeological site is on land administered by the Wyoming Bureau of Land Management, Rawlins Field Office. All activities should be coordinated with Tim Marshall. Work is authorized from October 20, 2008, through October 19, 2009.

All work and reporting requirements must follow the approved data recovery plan unless prior approval for modification is made with BLM RFO. Mr. Christopher C. Kinneer is required to carry a copy of the permit with him while in the field.

If you have any questions about this permit, please contact Ranel S. Capron at (307) 775-6108 or via e-mail at Ranel_Capron@blm.gov.

Sincerely,

Ranel Stephenson Capron

for William M. Hill
Deputy State Director,
Resources Policy and Management

Attachment

1

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road – Suite 308
Cheyenne, Wyoming 82009

In Reply Refer To:

ES/61411/W.26 /WY09SL0021

NOV 1 2 2008

Mr. Gregory F. Suber
U.S. Nuclear Regulatory Commission
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials and
Environmental Programs
Washington, D.C. 20555-0001

Dear Mr. Suber:

Thank you for your letter of October 3, 2008 requesting information on endangered or threatened species and critical habitat for the proposed Lost Creek uranium in-situ recovery facility (docket 040-09068) in Sweetwater County, Wyoming.

In response to your letter, the Service is providing you with information on (1) federally listed species, (2) migratory birds, (3) wetland and riparian areas, and (4) sensitive species. The Service provides recommendations for protective measures for federally listed species in accordance with the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

Threatened and Endangered Species

The following threatened and endangered species may occur in Sweetwater County, and could also occur on or near this project site. If you determine that the proposed project may affect any of the following listed species, please contact our office to discuss consultation requirements under the Act.

1

SPECIES	STATUS	HABITAT
Black-footed ferret (*Mustela nigripes*)	Endangered	Prairie dog towns
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Seasonally moist soils and wet meadows of drainages below 7000 feet

Black-footed ferret: Black-footed ferrets may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. However, we encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the myriad of species that rely on them.

If a field check indicates that prairie dog towns may be affected, you should contact this office for guidance on ferret surveys.

Ute ladies'-tresses: Ute ladies'-tresses is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically include fine silt/sand, gravels and cobbles, and highly organic, peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens.

Migratory Birds

Please recognize that consultation on listed species may not remove your obligation to protect the many species of migratory birds, including eagles and other raptors, protected under the MBTA and BGEPA. Of particular focus are the species identified in the Service's *Birds of Conservation Concern 2002.* In accordance with the Fish and Wildlife Coordination Act (16 USC 2912 (a)(3)), this report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Act. This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners and is available at http://www.fws.gov/migratorybirds/reports/bcc2002.pdf.

The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

In order to promote the conservation of migratory bird populations and their habitats, the Service recommends that your agency implement those strategies outlined within the Memorandum of Understanding directed by the President of the U.S. under the Executive Order 13186, where possible. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

***In situ* Uranium Mining**

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994) which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 μg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 μg/L.

Wetlands/Riparian Areas

Wetlands perform significant ecological functions, which include: (1) providing habitat for aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. The Service recommends measures be taken to avoid and minimize wetland losses in accordance with Section 404 of the Clean Water Act, and Executive Order 11988 (floodplain management) as well as the goal of "no net loss of wetlands." If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and stream banks.

Sensitive Species

Mountain Plover: Although the Service has withdrawn the proposal to list the mountain plover (*Charadrius montanus*) and we will no longer be reviewing project impacts to this species under the Act, we continue to encourage conservation of this species as it remains protected under the MBTA. Measures to protect the mountain plover from further decline may include (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. We strongly encourage the development of protective measures with an assurance of implementation should mountain plovers be found within the project area.

Greater Sage-grouse: The Service has determined that the greater sage-grouse (*Centrocercus urophasianus*) does not warrant listing at this time. However, the Service continues to have concerns regarding sage-grouse population status. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations range-wide (Braun 1998, Wisdom *et al.* 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage-grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no project-related disturbance from November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigation to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act, MBTA or BGEPA, please contact Pedro 'Pete' Ramirez at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

Scott Hicks

for Brian T. Kelly
Field Supervisor
Wyoming Field Office

Enclosure (1)

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (V. Stelter)

Literature Cited

Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. In L.W. Jacobs, ed. Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI. pp: 107-121.

Braun, C.E. 1998. Sage grouse declines in western North America: What are the problems? Proceedings of the Western Association of Fish and Wildlife Agencies 78:139-156

Fairbrother, A.F., M. Fix, T. O'Hara, and C.A. Ribic. 1994. Impairment of growth and immune function of avocet chicks from sites with elevated selenium, arsenic, and boron. Journal of Wildlife Diseases. 30(2):222-233.

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1

Ramirez, P. Jr. and B.P. Rogers. 2002. Selenium in a Wyoming grassland community receiving wastewater from an *in situ* uranium mine. Arch. Environ. Contam. Toxicol. 42:431-436.

See, R.B., D.L. Naftz, D.A. Peterson, J.G. Crock, J.A. Erdman, R.C. Severson, P. Ramirez, Jr., and J.A. Armstrong. 1992. Detailed study of selenium in soil, representative plants, water, bottom sediment, and biota in the Kendrick Reclamation Project Area, Wyoming, 1988-90. U.S. Geological Survey Water Resources Investigations Report 91-4131. 142 pp.

Skorupa, J.P., and H.M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds. Pages 345-368 *in* A. Dinar and D. Zilberman (eds.). The economics and management of water and drainage in agriculture. Kluwer Academic Publishers, Boston, MA.

U.S. Fish and Wildlife Service. 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act, April 1989. U. S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico. 15pp.

Wisdom, M.J., B.C. Wales, M.M. Rowland, M.G. Raphael, R.S. Holthausen, T.D. Rich, and V.A. Saab. 2002. Performance of Greater Sage-Grouse models for conservation assessment in the Interior Columbia Basin, USA. Conservation Biology16: 1232-1242.

January 28, 2009

Mr. Ivan Posey
Chairman
Shoshone Business Council
P. O. Box 538
Fort Washakie, WY 82514

SUBJECT: REQUEST FOR INFORMATION REGARDING TRIBAL HISTORIC AND CULTURAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED LICENSE APPLICATION FOR UR-ENERGY USA's LOST CREEK URANIUM RECOVERY PROJECT IN SWEETWATER COUNTY, WYOMING (DOCKET NO. 040-09068)

Dear Mr. Posey:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from UR-Energy USA for a new radioactive source materials license to construct and operate the Lost Creek Uranium Recovery Project (an *in-situ* recovery operation) located in Sweetwater County, Wyoming. The Lost Creek Project consists of one large unit, with the central processing plant located in the north-central portion of the permit area. Additional facilities associated with the proposed project include well fields, header houses, waste storage ponds, deep disposal wells, ancillary buildings, and materials storage.

Lost Creek site is located approximately 70 miles southeast of the City of Lander, and approximately 40 miles northwest of the City of Rawlins. The project site covers approximately 4,220 acres, of which approximately 3,580 acres are federally owned Bureau of Land Management land, and the State of Wyoming, Office of State Lands and Investment own 640 acres. Access to the Lost Creek site would either be via Wamsutter Crooks Gap and Bairoil Roads, south from Jeffrey City, off US Highway 287, or from Bairoil, off State Route 73, via Bairoil and Sooner Roads. The Lost Creek site is located in Township 25N, Range 92 West, Sections 16-19, and Range 93W, Sections 13, 14 & 25, and is situated in the Battle Spring Draw, which drains to Battle Spring Flat, approximately nine miles southwest of the site. A map showing the site location of the Lost Creek Project is shown in Figure 1 (enclosed).

As established in Title 10 Code of Federal Regulations Part 51 (10 CFR Part 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the NRC is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. The NRC's EA process includes an opportunity for public and inter-governmental participation in the development of the EA. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural properties. To support the environmental review, the NRC is requesting information to facilitate the identification of Tribal historic sites or cultural resources that may be affected by the proposed Lost Creek Uranium Recovery Project. Specifically, the NRC is interested in learning of any sites that you believe have traditional religious or cultural significance. Any input you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR Part 51 and 36 CFR 800.

I. Posey 2

After reviewing all of the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

The UR-Energy USA's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency-wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The docket number for the application is 040-09068. Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission ATTN: Mrs. Andrea L. Kock, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan B. Bjornsen of my staff by telephone at 301-415-1195 or by email at Alan.Bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Andrea L. Kock, Branch Chief
Environmental Review Branch
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09068

Cc: Mr. Reed Tidzump
Tribal Historical Preservation Officer
Shoshone Oil & Gas Commission
P.O. Box 538
Fort Washakie, WY 82514

Mr. Richard Brannan, Chairman
Arapaho Tribal Business Council
P.O. Box 396
Fort Washakie, WY 82514

Ms. Amanda White
Arapaho Tribal Preservation Officer
533 Ethete Road
Fort Ethete, WY 82520

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 28, 2009

Mr. Ramon A. Nation
Deputy Superintendent
BIA - Wind River agency
P.O. Box 158
Fort Washakie, WY 82514

SUBJECT: DRAFT GENERIC ENVIRONMENTAL IMAPCT STATEMENT FOR *IN-SITU* LEACH URANIUM MILLING FACILITIES

Dear Mr. Nation:

In response to your request for the Draft Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities at our meeting on Thursday, January 15, 2009, I am enclosing, on behalf of the U.S. Nuclear Regulatory Commission (NRC), a compact disk containing the GEIS. You should know that the comment period for this document closed on November 7, 2008, and that the comments that were received are currently being addressed by the NRC staff and its consultant. Should you have any questions about what the document contains, I or Mr. James Park, Project Manager for the document, would be happy to respond.

Sincerely,

Alan B. Bjornsen

Alan B. Bjornsen, Project Manager
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure: Compact Disk (Document)

June 30, 2009

Mr. Richard L. Currit
Senior Archaeologist and NEPA Coordinator
Wyoming State Historic Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: TREATMENT PLAN FOR MITIGATIVE EXCAVATION OF PREHISTORIC SITE 48SW16604 FOR THE PROPOSED LOST CREEK ISR PROJECT IN SWEETWATER COUNTY, WYOMING (SHPO FILE # 0708JRD021)

Dear Mr. Currit:

Lost Creek ISR, LLC (LCI), a subsidiary of UR-Energy, Inc. of Denver, Colorado, is proposing to develop a 4,220-acre site about 15 miles southwest of Bairoil in northeastern Sweetwater County, Wyoming, for *in-situ* uranium recovery. In March 2008, LCI resubmitted an application for license to the U.S. Nuclear Regulatory Commission (NRC) to construct, operate, and decommission a source and by-product materials facility at the Lost Creek site. The submittal was made in accordance with the Atomic Energy Act of 1954, as amended, and Title 10 of the Code of Federal Regulations (CFR) (Parts 20, 40, 51, and 70), as well as other applicable laws and regulations, and NRC guidelines. The purpose of this letter is to inform you of NRC's review and concurrence of the treatment plan for the referenced site. A Memorandum of Agreement (MOA) will be executed between the NRC, Bureau of Land Management (BLM) – Rawlins Field Office, Lost Creek ISR, LLC and the Wyoming State Historic Preservation Office regarding the mitigation of the adverse effect, in accordance with 36 CFR Part 800.6(b)(1)(iv) and NUREG-1569, Section 2.4.2. The MOA will be structured in accordance with the guidance outlined in the Advisory Council on Historic Preservation's *Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites* published in the *Federal Register* on May 18, 1999 (Vol. 64, No. 95, p. 27085).

The NRC, as the federal agency that issues licenses to facilities authorizing the possession and use of regulated radioactive materials is currently reviewing the license application for the proposed Lost Creek ISR Project. The NRC has reviewed both the subject treatment plan (Kinneer 2008, *Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming),* and the original Class III inventory report for the project area (Kinneer et al. 2007, *A Cultural Resource Inventory of the Lost Creek Property for the Proposed Lost Creek ISR, LLC Project in Sweetwater County, Wyoming*), and the passed data recovery method approved by BLM, prepared by LCI and its consultant. The NRC concurs with the BLM's determinations of site eligibility and project effect regarding archaeological site 48SW16604, and support BLM's acceptance of the "Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Lost Creek ISR Project in Sweetwater County, Wyoming" and the phased data recovery method proposed. The mitigation document was submitted by the BLM Rawlins Field Office on May 27, 2008, and reviewed by your office on July 24, 2008, stating that a data recovery plan be prepared, and that specific procedures be followed (according to protocol).

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R. Currit - 2 -

The NRC can require as a condition of any license issued to LCI, that LCI comply with the MOA and treatment plan. The NRC will reference the treatment plan and MOA in the draft supplemental environmental impact statement to provide an opportunity for public comment. However, the treatment plan will not be available to the public because disclosure of site locations is prohibited under 43 CFR 7.18.

The Lost Creek Prehistoric (48SW16604) site was visited on September 19, 2008, by Reed Tidzump, a member of the Wind River Agency and Tribal Historic Preservation Officer (THPO) for the Eastern Shoshone Tribe. Three other tribes were invited (Northern Cheyenne, Northern Arapaho, and Ute Tribal), but did not attend. The Eastern Shoshone found the proposed treatment plan adequate, meeting the approval of tribal elders. The NRC has maintained communication with Arlen Shoyo, the new THPO for the Eastern Shoshone Tribe.

If you have any questions, or require additional information, please contact Alan Bjornsen at (301) 415-1195, or at alan.bjornsen@nrc.gov.

Sincerely,

/RA By Patrice Bubar, Acting For/.

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

cc: P. Walker, BLM, Rawlins
J. Cash, LCI, Casper
D. McKenzie, DEQ, Cheyenne

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(9-2004)
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U.S. NUCLEAR REGULATORY COMMISSION

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(See instructions on the reverse)

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(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1910
Supplement 3

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Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming
Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities
Draft Report for Comment

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Division of Waste Management and Environmental Protection
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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

By letter dated March 20, 2008, Lost Creek ISR, LLC (LCI), submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Lost Creek in-situ uranium recovery (ISR) project. LCI is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Lost Creek project site, to be located in Sweetwater County, Wyoming. In this draft Supplemental EIS (Draft SEIS), the NRC staff evaluated the potential environmental impacts of the proposed action and its reasonable alternatives, described the environment potentially affected by LCI's proposed site activities, and described LCI's environmental monitoring program and proposed mitigation measures.

In preparing this Draft SEIS, the NRC staff evaluated site-specific data and information to determine whether the LCI's proposed activities and existing site characteristics were consistent with those evaluated in NUREG-1910, "Generic Environmental Impact statement for In-Situ Leach Uranium Milling Facilities" (GEIS). The NRC staff, then determined findings and conclusions in the GEIS and relevant sections of the GEIS that could be incorporated by reference in the Draft SEIS, and areas that needed additional analysis.

This Draft SEIS was prepared in compliance with the National Environmental Policy Act of 1969 and NRC regulations for implementing the Act found at Tile 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" (10 CFR Part 51).

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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