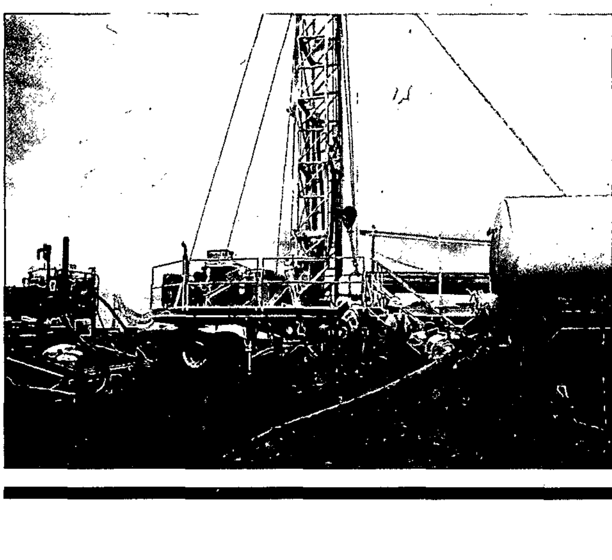
LOST CREEK ISR, LLC

Lost Creek Project

South-Central Wyoming

Environmental Report

ISR



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Application for

US NRC Source Material License

(Docket No. 40-9068)

October, 2007

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LIST OF ABBREVIATIONS AND ACRONYMS

$[UO_2(CO_3)^3]^{-4}$	uranyl tricarbonate ion
$[UO_2(CO_3)^2]^{-2}$	uranyl dicarbonate ion
°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
μR/hr	microRoentgens per hour
ACE	Army Corps of Engineers
ACEC	Area of Critical Environmental Concern
AD	anno domini
AM	Ante Meridiem
AUM	animal unit months
Basin	Great Divide Basin
BLM	Bureau of Land Management
BMP	Best Management Practice
BP	before present
$CaCO_3$	calcium carbonate
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
Conoco	Conoco, Inc.
Cs-137	cesium-137
CSU	Colorado State University
CV	curriculum vitaes
CWA	Clean Water Act
dBA	A-weighted decibels
DOE	Department of Energy
DOT	Department of Transportation
EIS	Environmental Impact Statement
ELI	Energy Laboratories Incorporated
EMT	emergency medical technician
EPA	Environmental Protection Agency
ER	Environmental Report
ERMA	Extensive Resource Management Area
ESD	Emergency Shut Down
Fault	Lost Creek Fault
FLPMA	Federal Land Policy and Management Act
ft^2/d	square feet per day
ft amsl	feet above mean sea level
ft bgs	feet below ground surface
ft/d	feet per day
ft/ft	feet per foot
ft/mi	feet per mile
ft/s	feet per second
FTE	full-time equivalent
FWS	Fish and Wildlife Service

g	gravity
g/L	grams per liter
g/m^2	grams per square meter
GIS	Geographic Information System
gpd/ft	gallons per day per foot
gpm	gallons per minute
GPS	Global Positioning System
GSP	Gross State Product
HDPE	high-density polyethylene
HMA	Herd Management Area
HPGe	High-Purity Germaniun
HPIC	High-Pressure Ionization Chamber
HPRCC	High Plains Regional Climate Center
IR	Isolated Resource
ISR	In Situ Recovery
JCR	Job Completion Report
km	kilometers
lb/mi^3	pounds per cubic mile
lb/VMT	pounds per vehicle miles traveled
LC	Lost Creek
LC ISR, LLC	Lost Creek ISR, LLC
LQD	Land Quality Division
LS	Lost Soldier
m^2	square meters
m/s	meters per second
man-Sv	man-Sievert
MBHFI	Migratory Birds of High Federal Interest
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MiniVol	Mini Volumetric
MIT	mechanical integrity test
mph	miles per hour
mrem	millirem
MSHA	Mine Safety and Health Administration
NAAQS	National Ambient Air Quality Standards
NaI	sodium iodide
NEPA	National Environmental Protection Act
NFU	New Frontiers Uranium Wyoming, LLC
NH_3	ammonia
NIST	National Institute of Standards and Technology
NMSS	Nuclear Material Safety and Safeguards
NO_2	nitrogen dioxide
NRC	Nuclear Regulatory Commission

NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWIS	National Water Information System
NWS	National Weather Service
O_3	ozone
OHV	off-highway vehicle
Pb-210	lead-210
PC	personal computer
pCi/L	picoCuries per liter
Permit Area	Lost Creek Permit Area
PFN	Prompt Fission Neutron
PLC	Programmable Logic Controllers
PM_{10}	particulate matter less than ten micrometers in diameter
PM	Post Meridiem
PPE	personal protective equipment
ppm	parts per million
Project	Lost Creek Project
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pound-force per square inch gauge
PVC	polyvinyl chloride
PWMTF	Permanent Wyoming Mineral Trust Fund
QA	quality assurance
QC	quality control
Ra-226	radium-226
rem	röntgen (roentgen) equivalent in man
RMP	Resource Management Plan
RMPPA	Resource Management Plan Planning Area
Rn-222	radon-222
RO	reverse osmosis
ROW	right of way
RV	recreational vehicle
RWP	Radiation Work Permit
SAR	sodium adsorption ratio
SDR	standard dimension ratio
SDWS	Secondary Drinking Water Standard
SEM	scanning electron microprobe
SHPO	State Historic Preservation Office
SMRA	Special Recreation Management Area
SMU	soil mapping unit
SO_2	sulfur dioxide
SOP	standard operating procedure
SPCC	Spill Prevention, Control, and Countermeasure

SWEDA	Sweetwater Economic Development Association
T&E	threatened and endangered
TAC	Technical Assignment Control
TDS	total dissolved solids
TEDE	Total EffectiveDose Equivalent
Texasgulf	Texasgulf, Inc.
Th-230	thorium-230
U_3O_8	uranium oxide
UBC	Uniform Building Code
UIC	Underground Injection Control
U-nat	natural uranium
Ur-E	Ur-Energy USA Inc.
URPA	Ur-Energy Passive Air
US	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standard
WCDA	Wyoming Community Development Authority
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WHDP	Wyoming Housing Database Partnership
WOS	Wildlife Observation System
WQD	Water Quality Division
WRDS	Water Resources Data System
WS	Wyoming Statute
WSA	Wilderness Study Area
WSEO	Wyoming State Engineer's Office
WW	World War
WYDOT	Wyoming Department of Transportation
WYPDES	Wyoming Pollution Discharge Elimination System

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1.0 INTRODUCTION

Lost Creek ISR, LLC (LC ISR, LLC) is submitting this Environmental Report (ER) to the United States (US) Nuclear Regulatory Commission (NRC) in support of a source and byproduct material license to operate the Lost Creek Project (Project) in accordance with the Atomic Energy Act of 1954, as amended, 10 Code of Federal Regulations (CFR) Parts 20, 40, 51, and 70, and other applicable laws, regulations and NRC guidelines. Issuance of this license would authorize LC ISR, LLC to conduct in situ recovery (ISR) uranium mining in Sweetwater County, Wyoming.

Per the National Environmental Protection Act (NEPA) of 1969, federal agencies are obligated to evaluate the effects of major federal actions on the health and safety of the public and assess impacts to the environment. NRC and the Bureau of Land Management (BLM) are the federal agencies with jurisdiction over the Project and the Lost Creek Permit Area (Permit Area), respectively. NRC has jurisdiction under 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions. NRC is required to perform an environmental evaluation of the proposed licensing actions. As the land manager, the BLM has jurisdiction over leases related to the use of the Permit Area. After consultations with both federal agencies, it was agreed that NRC will take the lead on implementing the NEPA process for the Project. Consequently, NRC will prepare an Environmental Impact Statement (EIS) related to the Lost Creek Project. LC ISR, LLC has held regular pre-licensing meetings with NRC and BLM to discuss baseline survey work plans, proposed hydrogeological programs, permitting schedules and application preparation. NRC and BLM staff members were also invited to the Project site during the baseline surveys. NRC issued a Docket Number (40-9068) and a Technical Assignment Control (TAC) Number (LU0142) for the Project in September 8, 2006.

This ER is organized in accordance with the guidance contained in NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with Nuclear Material Safety and Safeguards (NMSS) Programs, dated August 2003. **Section 1** provides an introduction of the Project, discusses why LC ISR, LLC is requesting a license to operate a uranium ISR facility, and presents a detailed Project description. **Section 2** discusses the proposed action versus alternatives, including the no-action alternative and alternatives considered but eliminated. **Section 3** describes the existing environmental conditions in the Permit Area; and **Section 4** discusses how those conditions could be impacted, if at all, by the proposed action, and the mitigation and monitoring measures that will be implemented during the Project. **Section 5** presents the Cost-Benefit Analysis. **Section 6** provides the summary of the environmental consequences from the Project. **Sections** 7 and **8** contain a list of references and preparers, respectively.

1.1 Purpose and Need for the Proposed Action

The Lost Creek Project will contribute to the advancement of the energy security goal of maintaining a reliable, economical, and domestic source of uranium. Exploratory drilling and testing have provided the delineation of the uranium ore trend and a reliable estimate on the uranium reserve, ore grade and percent recovery.

The Project will support energy-independent and environment-friendly policies. The uranium production will assist to supply a viable domestic uranium recovery industry by applying new technologies that minimize environmental disturbance and potential adverse effects to public health and safety. This Project will also help to offset the deficit in annual domestic uranium production and help to meet increasing energy demands. Between 1989 and 2003, annual domestic uranium production decreased by 75 percent. The United States produces about two percent of world uranium production, while consuming over 25 percent of that production. As of 2006, the world produced just over 50 percent of the annual consumption of U_3O_8. The gap between demand and supply has been filled by stockpiles and uranium from non-traditional sources (e.g., dilution of weapon-grade uranium). There are concerns about the long-term availability of uranium from non-traditional sources. The Project, once in full scale production, will add 1,000,000 pounds of U_3O_8 per year to the market. With appropriate regulatory approval, the processing facilities could also process ore from other ISR sites in the region even after the ore recovery is complete in the Permit Area.

Mining and other industrial activities have potential impacts. However, ISR operations will minimize surface and underground disturbance and significantly reduce potential adverse impacts to workers and the general public.

Nuclear energy production is an important strategy for curbing global climate change over the long-run. Unlike coal-fired power plants, nuclear power plants produce virtually no greenhouse gas emissions.

1.2 Proposed Action

LC ISR, LLC is applying for a source and byproduct material license for the Project in order to facilitate the production of U_3O_8 "yellowcake" slurry from the Permit Area.

1.2.1 Overview

The Permit Area is located in the northeast portion of Sweetwater County, south central Wyoming. **Figure 1.2-1** shows the regional location of the Permit Area and the general geographic features of the region. The approximate 4,220-acre Permit Area is remotely located on public land administered by the BLM and the State of Wyoming. The Permit Area is within Township 25 North and Ranges 92 and 93 West of the Sixth Principal Meridian and approximately centered at 42 degrees, eight minutes North latitude and 107 degrees, 51 minutes West longitude. Rawlins is 38 miles southeast; Rock Springs is 80 miles southwest; Casper is 90 miles northeast; and Jeffrey City is 25 miles north. The nearest population center, located 15 miles northeast of the Permit Area, is Bairoil, a small town with less than 100 people.

The Permit Area is characterized by low-relief, sagebrush-dominated plains, dissected by small, ephemeral drainages. Due to little variation in topography, severe winter conditions, and less than ten inches of annual precipitation, the ecological diversity in the Permit Area is limited.

The discovery of uranium deposits in the Permit Area and consequential exploratory drilling and studies have occurred over the course of four decades.

In 1968, American Metals Climax Inc. acquired the property and discovered low-grade mineralization. Exploration drilling, carried out by Texasgulf, Inc. (Texasgulf) from 1976 through 1982, identified the main mineral trend.

In 1969, Conoco Inc. (Conoco) acquired the adjacent property to the east and conducted a major exploratory drilling program, including the installation of groundwater monitor wells. In 1978, Texasgulf optioned a 50 percent interest in Conoco's property and continued the exploratory drilling of the main mineral trend at Lost Creek to the east. In 1981, Texasgulf carried out laboratory column leach testing of core samples with carbonate lixiviant which resulted in extraction in excess of 89 percent. In 1982, Texasgulf conducted pump tests on the mineralized sandstones at Lost Creek. The hydrological characteristics of the mineralized sandstones indicated that uranium extraction could be conducted with ISR methods (Poole, 1984). In 1983, Texasgulf and Conoco discontinued their exploration activities and studies due to economic reasons.

In 1986, the Japanese-owned, PNC Exploration, USA acquired the lode claims in the Lost Creek area and carried out additional delineation drilling, geologic and resource studies of the deposit through 1992 (Fruchey and Groth, 2004). New Frontiers Uranium, LLC, purchased the property from PNC Exploration, USA in 2000. New Frontiers

Uranium, LLC subsequently transferred the Lost Creek property along with its other Wyoming properties into NFU Wyoming, LLC (NFU).

From June 2005 through June 2007, Ur-Energy USA, Inc. (Ur-E), a Colorado corporation, purchased 100 percent ownership of NFU. During that time, NFU conducted engineering feasibility studies, core drilling for metallurgical studies and delineation drilling to outline and define the uranium resources at Lost Creek. In addition, NFU conducted comprehensive baseline studies, including the installation of additional monitor wells for hydrological testing and water quality sampling and a meteorological station within the Permit Area.

In July 2007, NFU transferred its Lost Creek property to Lost Creek ISR, LLC a wholly owned subsidiary of Ur-E formed for the specific purpose of owning and developing the Lost Creek property.

1.2.2 Project Description

LC ISR, LLC is proposing the construction, operation, and reclamation of facilities for ISR operations within the Permit Area. ISR involves the use of a recovery solution, otherwise known as a lixiviant, to extract the mineral from the geologic formation in which it occurs without physically removing the ore-bearing strata.

1.2.2.1 Design and Construction of Mine Units and Facilities

LC ISR, LLC will design and construct mine units and a processing facility in order to recover the uranium resources at Lost Creek.

Mine Units

A typical uranium ISR mine unit, usually 30 to 40 acres in area, will consist of:

- a production field with injection and production well patterns,
- a monitor well ring, and
- header houses and pipelines.

Production and injection well patterns will primarily be conventional five-spot patterns, unless modified to fit the shape of the ore body. A five-spot pattern, otherwise known as a cell, is a square with four injection wells at the corners and a centrally located production well. **Figure 1.2-2** shows a typical layout of an ISR mine unit and solution flow patterns. The injection wells will be spaced 75 to 150 feet apart. All the production and injection wells will be completed so they can be used as either production wells or injection wells. This design allows changes in the solution flow patterns to improve uranium recovery and to restore the groundwater in the most efficient manner.

There are four types of monitor wells, those completed in a 'monitor ring' around the production zone, those completed in the overlying and underlying aquifers, if any, and those completed within the pattern areas. The wells in the monitor ring will be spaced about 500 feet apart, depending on the hydrogeology of the production zone, and will be located approximately 500 feet outside the pattern area. Monitor wells will also be completed in the aquifers directly overlying and underlying the production zone. These wells will uniformly be distributed across the mine unit area, with approximately one overlying, one underlying, and one production zone monitor well in each four acres of the production field.

Injection wells and production wells will be connected to their respective injection or production manifold in a building commonly called a header house. The manifolds route solutions in pipelines to and from the ion exchange circuit in the Plant. Flow meters, control valves, and pressure gauges will be installed in the individual well lines to monitor and control the individual well flow rates.

Each mine unit will have its own construction, operation, and reclamation schedule. One or more mine units may be in production at any one time with additional mine units in various stages of construction and/or reclamation. A mine unit will be dedicated to only one production zone and will typically have a flow rate of about 6,000 gallons per minute (gpm). The size and location of the mining units will be defined based on the final delineation of the ore deposits, performance of the area and development requirements. **Figures 1.2-3a** shows the Lost Creek ore trend within the Permit Area. Based on current geological and hydrogeological data, approximately six mine units will be developed in the Permit Area during the life of the Project (**Figure 1.2-3b**).

Mine unit piping will be high-density polyethylene (HDPE), polyvinyl chloride (PVC), and/or steel. The individual well lines and the trunk lines to the Plant will be installed below ground to prevent freezing. Ancillary equipment needed will include truck mounted pulling units, trailer mounted hose reels, electrical generators, backhoes, mechanical integrity test (MIT) trucks, motor graders, all terrain forklifts, cementing trailers and light duty 4-wheel drive vehicles. The wells will be installed by contract well drillers who will use truck mounted rotary drilling rigs and water trucks.

Well Construction

The injection, production, and monitor wells will be drilled to the base of the target completion interval with a truck-mounted rotary drilling unit using native mud and a small amount of commercial drilling-fluid additive for viscosity and filtrate control. Following geophysical logging (spontaneous potential, single point resistivity, gamma ray, and Prompt Fission Neutron (PFN)), the upper portion of the hole will be reamed to accommodate casing. Casing will be set and cemented to isolate the completion interval from overlying aquifers. The cement will be placed by pumping it down the casing and forcing it out the bottom of the casing and back up the casing drill hole annulus.

The PVC well casing will have a standard dimension ratio (SDR) of 17, available in 20-foot joints. The typical casing will be a nominal 4.5 inch diameter with a minimum wall thickness of 0.291 inches and an internal pressure rating of 160 pound-force per square inch gauge (psig).

One casing centralizer will be located at each 40-foot interval to ensure the casing is centered in the drill hole and to ensure an effective cement seal.

The volume of cement used is the calculated volume required to fill the annulus and return cement to the surface. In most cases, the cement returns to the surface, at least initially. However, in some cases, the drilling may result in a larger annulus volume than anticipated and cement may not return to the surface. In these cases, the upper portion of the annulus will be cemented from the surface. In the majority of cases, where the cement fails to return to surface, the reason will be a washout or a casing failure. In the event of a casing problem, the well will not pass the MIT. In all cases, wells are required to pass an MIT test before operations approval. This will ensure that there is sufficient integrity to allow the use of the well in handling lixiviant.

After the cement has set, the cement plug within the casing will be drilled out and the well will be flushed with water to remove any cement fines from the target zone. An under reaming tool is then used to cut a larger diameter hole across the completion zone. The well is then air lifted for a period of time adequate to remove any remaining drilling mud and/or cuttings. If sand production or hole stability problems are expected, a wire-wrapped screen or similar equipment may be installed across the completion interval. The typical injection well and production well completions are illustrated in **Figure 1.2-4** and **Figure 1.2-5**, respectively. Further well development may be achieved by swabbing the well, additional airlifting or pumping.

Well Casing Integrity

Prior to operating a well, the well casing will undergo an MIT. During the MIT, the well casing is plugged, pressurized, and the pressure monitored for a set period of time. The bottom of the casing adjacent to or below the confining layer above the injection zone is sealed with a plug, down-hole packer, or other suitable device. The top of the casing is then sealed in a similar manner or with a threaded cap. A pressure gauge is installed to monitor the pressure inside of the casing. Once the well casing is plugged and a pressure gauge is installed, the pressure inside of the well casing is increased to a specified test pressure and will maintain 95 percent of that pressure for ten minutes to pass the test.

If a well casing does not pass an MIT, the casing will be repaired and retested. If a repaired well casing meets an MIT, the well will be used for its intended service. Also, if the well defect occurs at depth, the well may be plugged back and re-completed for use in a shallower zone provided it passes a subsequent MIT. If an acceptable MIT cannot be obtained after repairs, the well will be plugged. A new well casing integrity test will also be conducted after any well repair using a down hole drill bit or under reaming tool.

Monitor wells will be drilled and constructed in the same manner as production and injection wells and all three types of wells must pass MIT. All methods for demonstrating casing integrity must be approved by the Wyoming Department of Environmental Quality (WDEQ) prior to use on the Project.

Process Plant

The Plant will house three distinct process circuits: the ion exchange circuit (also called the resin-loading circuit), the elution circuit, and the precipitation/filtration circuit. The ion exchange circuit will be located adjacent to the other two circuits. The design of the Plant is presented in **Plate 1.2-1**.

The facility will be capable of processing 6,000 pounds U_3O_8 per day (2.2 million pounds per year) with normal operations at 90 percent of the design. The uranium concentration of the lixiviant solution is anticipated to range between 30 and 100 milligrams per liter (mg/L) of uranium oxide (U_3O_8), averaging 40 to 50 mg/L. Standard commercially available ion exchange resins function well under these conditions.

The Plant will be constructed by qualified contractors with direct supervision by LC ISR, LLC engineers.

1.2.2.2 ISR Operations

The Project will use ISR technology to extract uranium from permeable, uranium-bearing sandstones located at depths ranging from 300 to 700 feet below the surface. The processes used for uranium ISR are well understood and well-established industrial practices. **Figures 1.2-6a, b** and **c** are schematics of a typical uranium ISR operation.

Mine Units

The uranium ISR process starts at the mine units by first introducing lixiviant into the ore zone through the injection wells. The lixiviant is composed of native groundwater, carbon dioxide and oxygen or an equivalent oxidizing agent. Carbon dioxide is to be added either at the Plant and/or at the header houses. Oxygen will be added to the barren lixiviant at the mine unit header houses. The combined carbonate/bicarbonate concentration in the injected solution will be maintained at less than five grams per liter (g/L), and the hydrogen peroxide and/or oxygen concentration will be less than one g/L. These limits help reduce the possibility of "gas lock" in the formation, which reduces mining efficiency.

When the lixiviant is injected into the ore zone, the dissolved oxidant reacts with the uranium mineral and brings the uranium to the U^{+6} oxidation state. The uranium then complexes with some of the carbonates in the lixiviant to form an uranyl dicarbonate ion $[UO_2(CO_3)_2]^{-2}$ and/or an uranyl tricarbonate ion $[UO_2(CO_3)_3]^{-4}$, both of which are soluble and stable in solution. A small portion of the radium content will also be mobilized along with the uranium. Depending on site conditions, other metals such as arsenic, molybdenum, selenium, and/or vanadium, may also be mobilized. The resultant uranium-bearing solution will be recovered from the production wells to the surface. The injection and production rates will be balanced to control the movement of fluids in the aquifer.

In each mine unit, more uranium-bearing solution will be extracted than lixiviant injected which creates a localized hydrological cone of depression or pressure sink. The anticipated overproduction or bleed will be a nominal 0.5 percent to one percent of the production rate. Under this pressure gradient, the groundwater in the surrounding area will move toward the mine unit, minimizing any chance of excursion.

Small groups of injection and production wells will be connected by buried pipelines to a header house. The uranium-bearing solution will be conveyed between the mine unit and the ion exchange facility through buried pipelines with controlled flows.

Plant

The ion exchange circuit at the Plant receives the uranium-bearing solution from the mine unit(s) through buried pipelines. The following operations will occur at the Plant:

Resin Loading

The ion exchange circuit in the Plant will consist of ten pressurized vessels, each containing 500 cubic feet of anionic ion exchange resin. These vessels will be configured as five parallel trains for two-stage down-flow loading. Booster pumps will be located upstream and downstream of the trains.

As the pregnant (uranium rich) lixiviant enters the ion exchange circuit from the mine unit, the upstream booster pumps will pressurize the fluid to approximately 100 psig. The dissolved uranium in the pregnant lixiviant will chemically adsorb onto the ion exchange resin as the lixiviant passes through the resin beds. Any sand or silt entrained in the pregnant lixiviant will be trapped by the resin bed like a traditional sand filter. The barren lixiviant exiting the second stage will normally contain less than five mg/L uranium. A slip stream of the barren lixiviant will be treated with reverse osmosis (RO) prior to sending it back to the field for re-injection. The injection fluid will be pressurized by booster pumps prior to returning to the mine unit for re-injection. The bleed portion of the fluid will be treated and disposed of via a UIC Class I well.

Resin Elution

When resin in an ion exchange vessel is loaded and removing very little additional uranium from the incoming solution, the vessel will be isolated from the normal process flow. The resin will then be transferred to the Elution Circuit. At the Plant, the resin will be passed over vibrating screens with wash water to remove entrained sand particles and other fine debris. The resin will be gravity fed into pressurized down-flow elution vessels for uranium recovery and resin regeneration.

Once placed in the elution vessel, the resin will be contacted with an eluate composed of approximately 90 g/L sodium chloride and 20 g/L sodium carbonate (soda ash). The eluted resin will be rinsed with fresh water and returned to the bulk tank trailer or an empty ion exchange vessel. The resin will then be transported back to the ion exchange facility and placed in an ion exchange vessel for additional uranium recovery.

Using a three-staged elution circuit, 45,000 gallons of eluate will contact 500 cubic feet of resin, generating approximately 15,000 gallons of rich eluate containing ten to 20 g/L U_3O_8. Likewise, 15,000 gallons of fresh eluate will be required per elution. The fresh eluate will be prepared by mixing the proper quantities of a saturated sodium chloride (salt) solution, a saturated soda ash solution and water. The saturated salt solution will be generated in commercially available salt saturators (brine generators). The saturated soda ash solution will be prepared by passing warm water (greater than 105 degrees Fahrenheit [°F]) through a bed of soda ash. Both types of saturators are commercially available and represent standard, proven design and construction techniques.

Precipitation

In the elution circuit, the uranyl dicarbonate ions will be removed from the loaded resin and converted to uranyl tricarbonate by a relatively small volume of strong sodium chloride/soda ash solution. The resultant rich eluate will contain sufficient uranium for economic precipitation.

From the elution circuit, the uranium-rich eluate will be sent to an agitator tank for batch precipitation. To initiate the precipitation cycle, hydrochloric or sulfuric acid will be added to the eluate to breakdown the uranyl carbonate present in the solution. Hydrogen peroxide will then be added to the eluate to effect precipitation of the uranium as uranyl peroxide. Caustic soda solution will then be added to elevate the pH, which promotes growth of uranyl peroxide crystals and makes the slurry safer to handle in the subsequent process steps.

Product Filtering

After precipitation, the precipitated uranium will be washed, to remove excess chlorides and other soluble contaminants, and then de-watered and filtered to form the yellowcake slurry. This slurry will then be stored in holding tanks or in transport tanks parked in a secure area in the Plant. The holding and transport tanks will be used solely for yellowcake slurry. On-site inventory of U_3O_8 in the slurry form will typically be less than 100,000 pounds. However, in periods of inclement weather or other interruptions to product shipments, there will be capacity for up to 200,000 pounds of slurry within the Plant. The yellowcake slurry will be shipped by exclusive-use, authorized transport to a facility licensed by NRC for processing the slurry into dry yellowcake.

1.2.2.3 Instrumentation and Control

For control and monitoring purposes, two separate control systems will be provided during ISR operations. Each system will be designed and instrumented to accommodate the steady state or batch flow that is characteristic of particular process flow streams or unit operations. In particular, this distinction is highlighted as follows.

1. Steady State:
    a. Mine Unit/Resin Loading Circuit
    b. Mine Unit Process Water Disposal
2. Batch:
    a. Bleed Treatment
    b. Resin Elution
    c. Precipitation
    d. Product Filtering
    e. Process Water Disposal

Since the mine unit resin loading circuit operates at a steady state, modest deviations from the normal operating flow rates and pressure profiles (plus or minus ten percent or greater) will be indicative of major operating upsets. An automatic Emergency Shut Down (ESD) system, consisting of pressure and flow rate switches, will be provided for this circuit.

In the event of an automatic shut down, an alarm will notify the operator of the situation. Once the major upset (broken piping, leaking vessels, etc.) is identified and corrective action taken, only then can the circuit be manually restarted. This type of control system provides the best protection against fluid spills to the environment and product losses. The back-up for the automatic ESD system is provided by local displays of the same flow rates and pressures that the ESD system monitors.

The Elution, Precipitation, and Product Filtering Circuits will operate in a batch nature. These circuits are controlled by Programmable Logic Controllers (PLCs), which sequence the opening and closing of appropriate valves once the processes are manually initiated. In addition, the PLC will provide closed-loop feedback control for the elution and precipitation circuits. All automatic valves will be equipped with manual control override. Local indication of pressures, levels, flow rates, and pH will be provided for the complete manual control of these circuits if required.

Process water treatment and disposal circuits will operate under semi-continuous, steady-state conditions, which require control systems that integrate components of both steady-state and batch operations.

The control systems will employ state-of-the-art hardware with proven as well as demonstrated process logic. Like all elements of the designs, instrumentation and control designs are based on modern practices with proven techniques.

1.2.2.4 Restoration, Decommissioning, and Reclamation

Technical, economic, and operational criteria can be reviewed to determine if uranium recovery is complete in a given header house and/or mine unit. When the mineral is sufficiently recovered, the lixiviant injection ceases and groundwater restoration commences. If a mined unit is adjacent to another unit being produced, restoration of a portion of the unit may be deferred to minimize interference with the operating unit. However, LC ISR, LLC intends that concurrent restoration and mining will be conducted (e.g., each mine unit will be restored following mining).

The goal of groundwater restoration will be to return the water quality parameters to the pre-operational class of use as defined by WDEQ. After completion of groundwater restoration, which will be approved by WDEQ and NRC, all cased wells will be permanently plugged and capped. The well casing will be cut off below plow depth and the site revegetated.

Byproduct material, as defined and amended in the Atomic Energy Act of 1954, will be disposed of at an off-site NRC-licensed disposal facility or in a UIC Class I well.

Prior to the commencement of surface reclamation, affected areas and buildings will be decontaminated, and facilities and ancillary equipment will be decommissioned and removed. Vegetation will be reestablished with the approved seed mixtures.

1.2.3 Schedule

Prior to Project start up, the WDEQ Permit to Mine, NRC Source Material License, and other federal, state and local permits and approvals must be received. **Figure 1.2-7** presents the pre-operational development schedule. The critical tasks in this phase will be the approval of the Permit to Mine application and Mine Unit 1 permit by WDEQ, the NRC Source Materials License approval, approval of the Project by BLM, and approval of the Class III (deep injection) and Class I (ISR solution injection) Underground Injection Control (UIC) permits with aquifer exemptions from WDEQ/Environmental Protection Agency (EPA).

The projected mining schedule is based on an initial production rate of 45,000 pounds of U_3O_8 for the first year and increased to the maximum production rate sustainable from the ore-bearing sandstones, currently estimated at 1,000,000 pounds per year. The actual development schedule and production rates will be adjusted in response to actual mine unit conditions (e.g., flows, recovery rates, etc.) and the market demand for uranium.

Figure 1.2-8 provides a current estimated schedule of operational activities at Lost Creek for the first nine years of operation. Additional ore reserve and resources areas are known to exist within the Permit Area, but are not currently drilled adequately to evaluate for ISR planning. These reserve areas have the potential to extend the ultimate Project life beyond this initial period.

1.3 Applicable Regulatory Requirements, Permits, and Required Consultations

Prior to commencing ISR operations, LC ISR, LLC must obtain a License to Mine and a Permit to Mine from WDEQ. Since Wyoming is not an NRC Agreement State, a Source and Byproduct Material License must be obtained from NRC. Other permits that must be obtained prior to the commencement of operations include, but not limited to, two UIC Permits with aquifer exemptions (one for injection into the aquifer to be produced and the other for injection into a deeper formation for waste water disposal), an Air Quality Permit, a Wyoming Pollution Discharge Elimination System (WYPDES) discharge permit, and a Storm Water Discharge Permit. A list of the necessary permits and licenses are provided in **Table 1.3-1.**

Federal statutes (including authority delegated to states) that pertain to the Project include the:

- Atomic Energy Act,
- Clean Air Act,
- Clean Water Act,
- Resource Conservation and Recovery Act,
- Low-Level Radioactive Waste Policy Act,
- Emergency Planning and Community Right-to-Know Act,
- Safe Drinking Water Act,
- Noise Control Act,
- National Historic Preservation Act, and related statutes
- Endangered Species Act,
- Occupational Safety and Health Act, and
- Hazardous Material Transportation Act.

Under Sections 101 and 102 of NEPA, federal agencies are required to interpret and administer the policies, regulations, and public laws of the Act in order to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans. As such, federal agencies must address environmental issues and allow public input in the decision-making processes of major projects under their jurisdiction. NRC's regulations are contained in 10 CFR Part 51.

BLM administers the federal land on which the Permit Area is located, and NRC is the ISR licensing agency. After consultations with NRC and BLM, it was agreed that NRC will take the lead on implementing the NEPA process for the Project.

In order to perform a NEPA assessment of an ISR project, the applicant must provide the necessary information to the federal agencies. In October of 2006, NRC reorganized the review process to facilitate the application review process of proposed ISR facilities. As a result, a Technical Report must be prepared following the guidelines of NUREG-1569. In addition, all new ISR project applicants must prepare an Environmental Report in accord with NUREG-1748.

LC ISR, LLC has maintained consistent contact with federal and state agencies. Since the beginning of the Project, quarterly meetings have been conducted with NRC, BLM, and WDEQ. LC ISR, LLC has held regular pre-licensing meetings with NRC to discuss baseline survey work plans, proposed hydrogeological programs, permitting schedules, and application outlines and preparation. NRC staff members have also been invited to the Permit Area at the beginning and during the baseline surveys. NRC issued a Docket Number (40-9068) and a TAC Number (LU0142) for the Project on September 8, 2006.

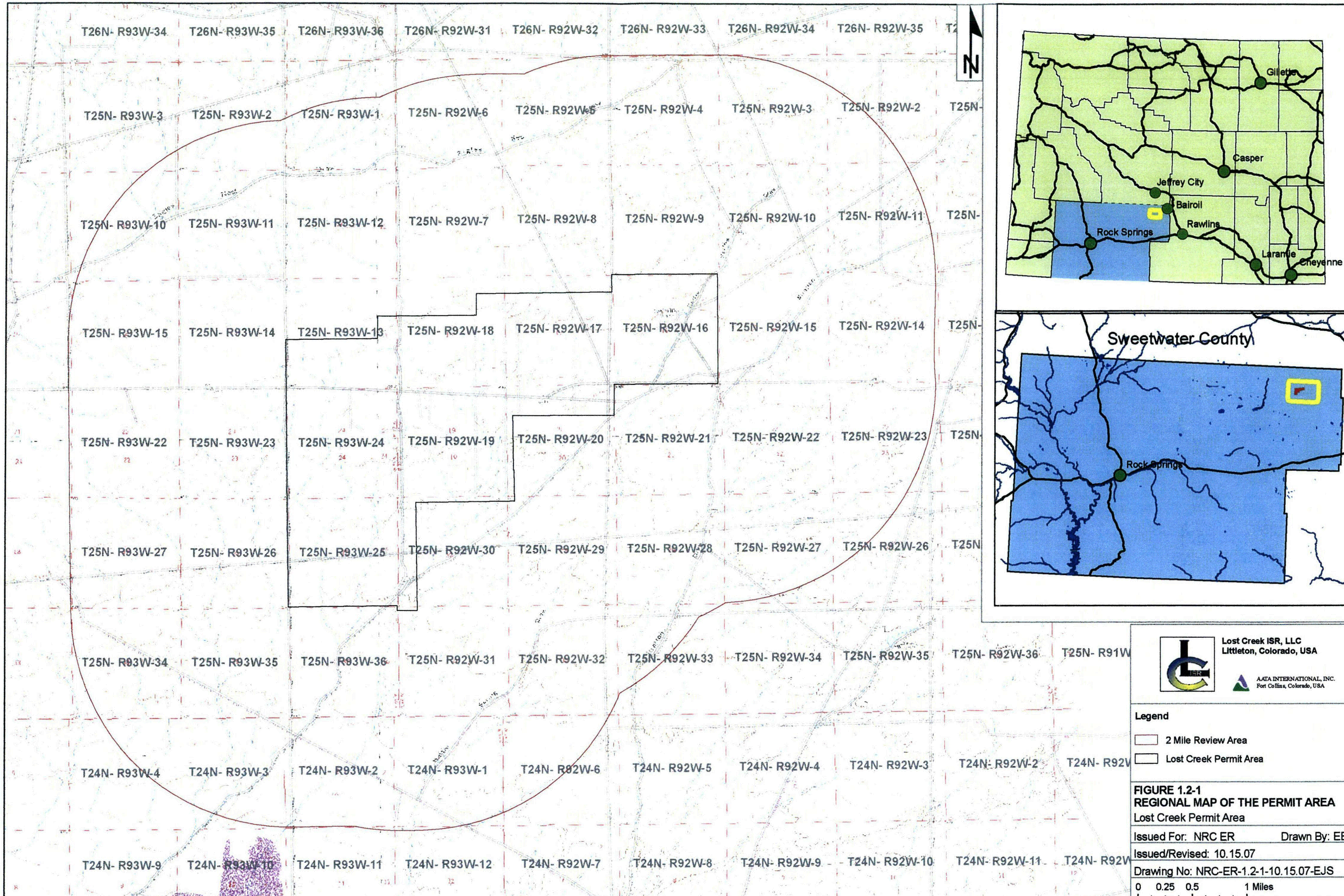
Other state and federal agencies involved in the permitting and licensing process include the EPA and the Wyoming State Engineer's Office (WSEO).

Representatives from LC ISR, LLC met with the Sweetwater County commissioners on October 16, 2007. LC ISR, LLC described the operations and schedule of the Project to the commissioners and answered related questions. Additional public consultation is planned for the near future.

Following WDEQ Rules and Regulations, a separate application packet will be prepared and submitted to WDEQ. During this review process, two different public-comment periods will allow individuals to contribute to the Project.

Applicable state and federal agencies were consulted in accordance with the requirements of the Endangered Species Act and the Fish and Wildlife Coordination Act. Personnel were contacted from the Wyoming Game and Fish Department (WGFD) in 2006 and 2007. The US Fish and Wildlife Service (FWS), was also contacted. Wildlife surveys were completed according to a work plan developed in consultation with the WGFD, WDEQ, and BLM. The scope of field work was finalized in consultation with BLM during February through March of 2006, and field survey protocols were consistent with recommendations from both BLM and WGFD.

A Class I file search was conducted through the Wyoming State Historic Preservation Office (SHPO) Cultural Records Office prior to the Class III archaeological survey with follow-up research at the BLM Rawlins Field Office. A fieldwork authorization was obtained from BLM prior to the onset of field investigations in 2006. Consultation with Native American groups will be conducted by BLM after the archaeological technical report has been received.



Lost Creek ISR, LLC
Littleton, Colorado, USA

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Fort Collins, Colorado, USA

Legend

2 Mile Review Area

Lost Creek Permit Area

FIGURE 1.2-1
REGIONAL MAP OF THE PERMIT AREA
Lost Creek Permit Area

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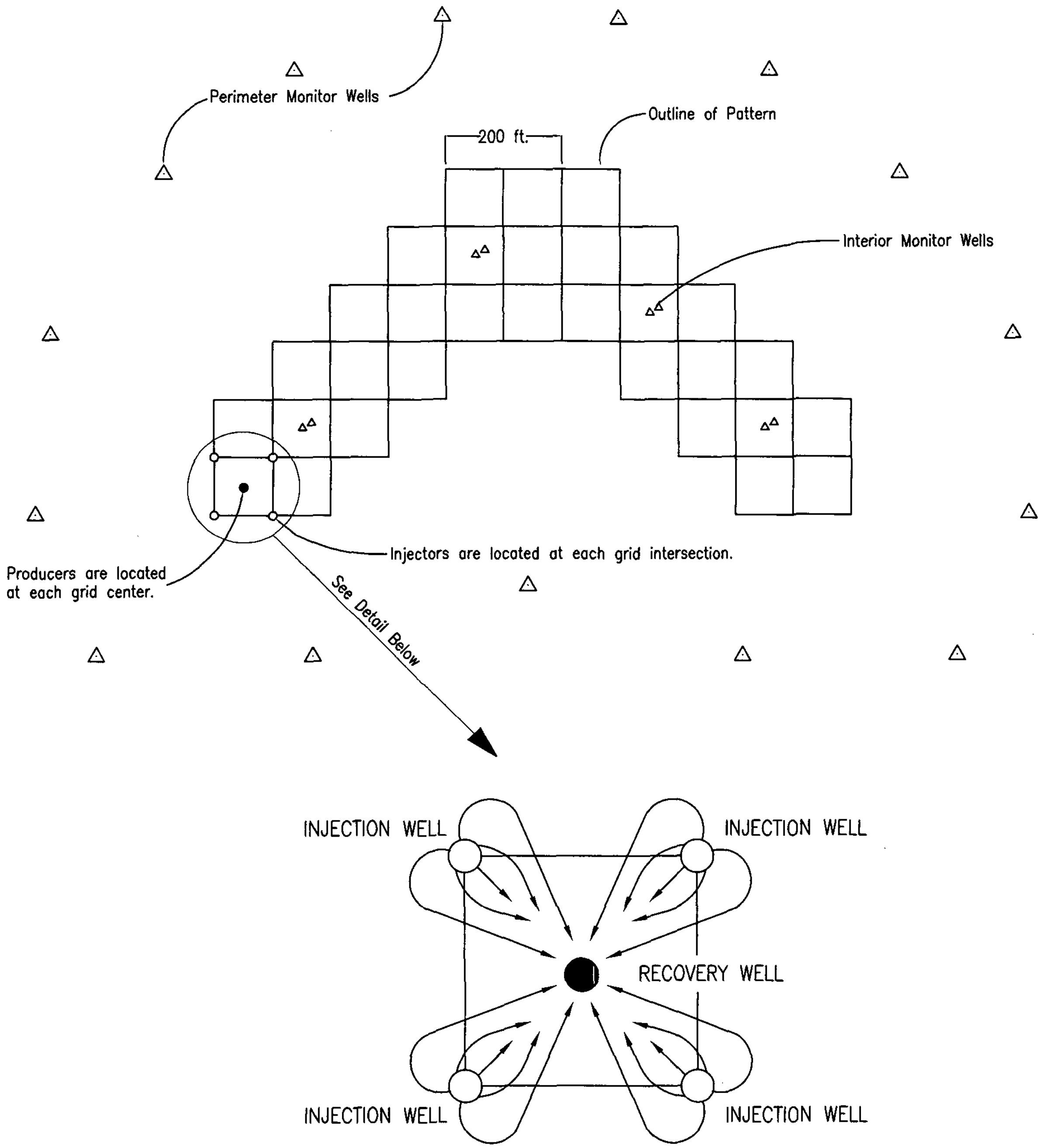
Issued/Revised: 10.15.07

Drawing No: NRC-ER-1.2-1-10.15.07-EJS

0 0.25 0.5 1 Miles



TYPICAL WELLFIELD PATTERN

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Fort Collins, Colorado, USA

FIGURE 1.2-2
Solution Flow Patterns
Lost Creek Permit Area

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Issued / Revised: 10.2.2007
Drawing No. NRCER 1.0 FIG 1.2-2 10.2.2007 SMH

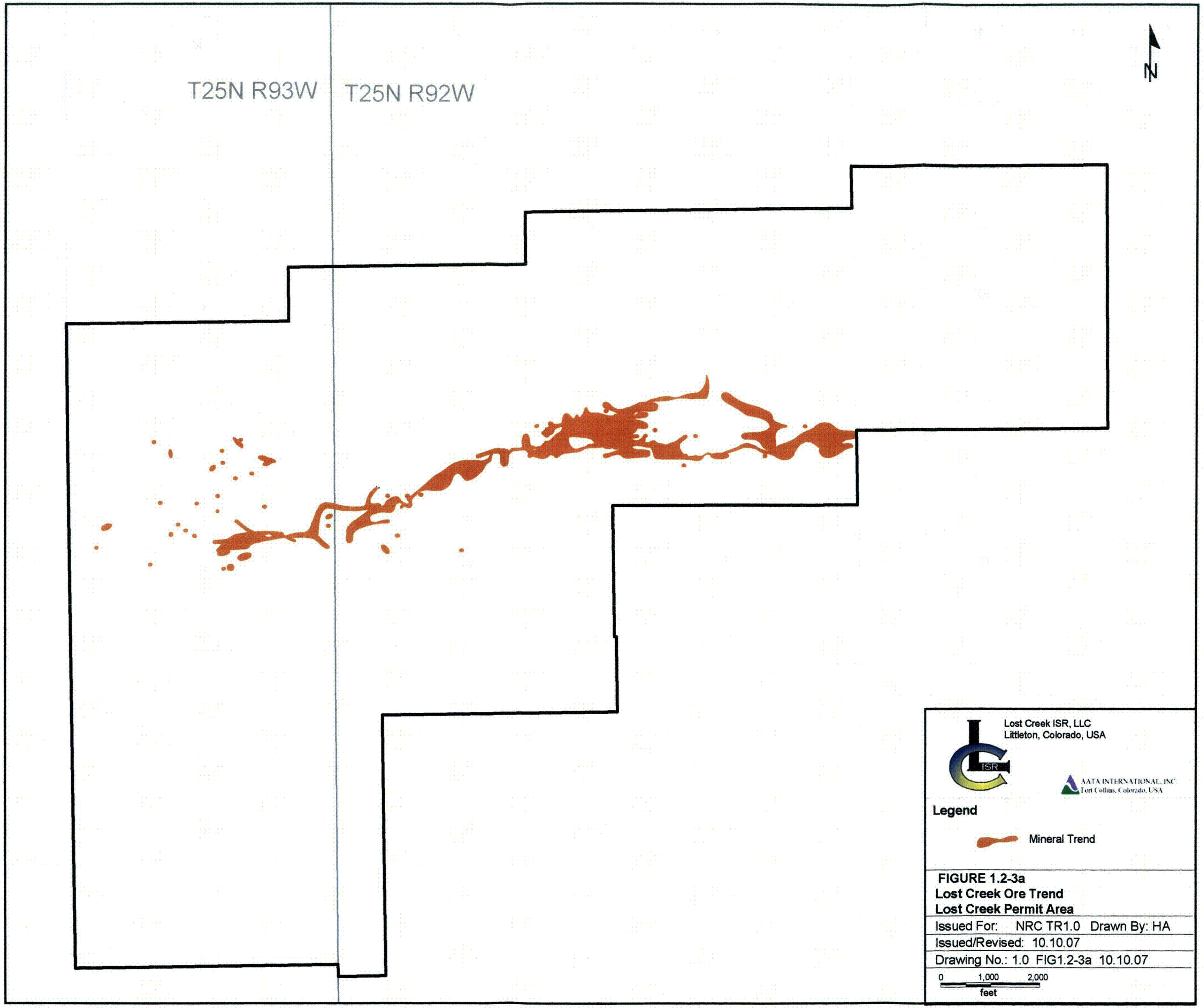

FIGURE 1.2-3a
Lost Creek Ore Trend
Lost Creek Permit Area

Issued For: NRC TR1.0 Drawn By: HA
Issued/Revised: 10.10.07
Drawing No.: 1.0 FIG1.2-3a 10.10.07

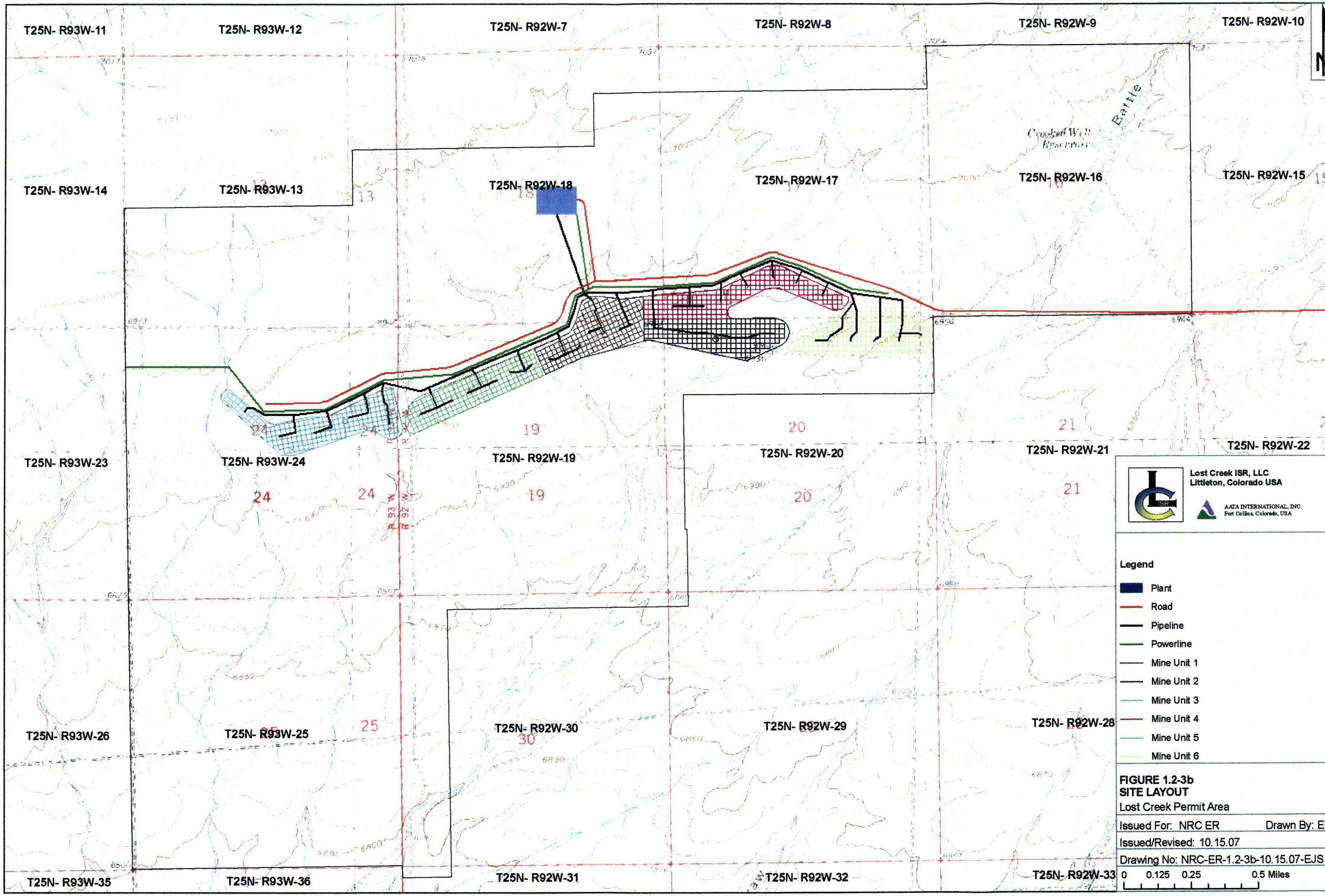

FIGURE 1.2-3b
SITE LAYOUT
Lost Creek Permit Area

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Issued/Revised: 10.15.07
Drawing No: NRC-ER-1.2-3b-10.15.07-EJS

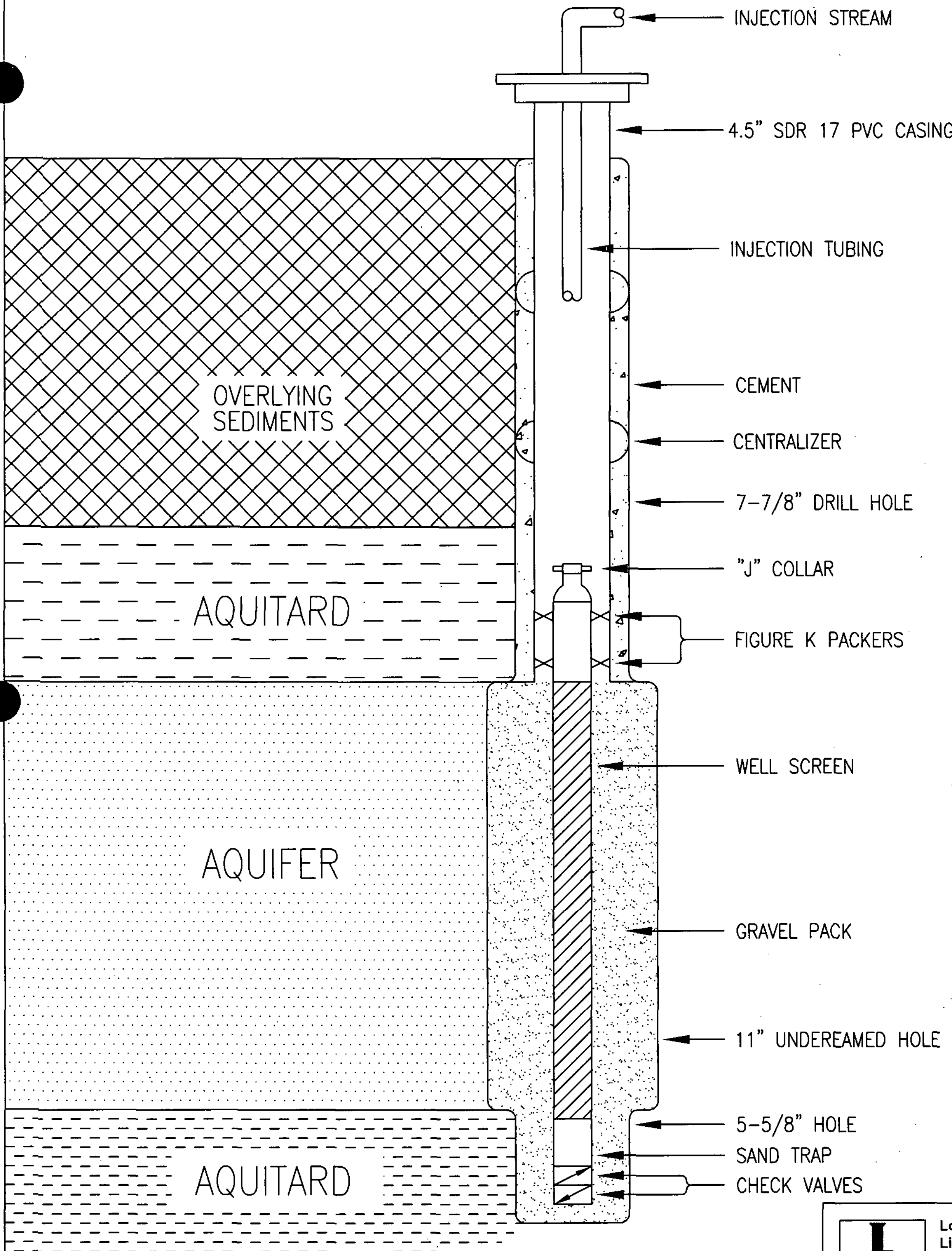

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FIGURE 1.2-4
Injection Well Construction
Lost Creek Permit Area

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Issued / Revised: 10.2.2007
Drawing No. NRCER 1.0 FIG 1.2-4 10.2.2007 SMH

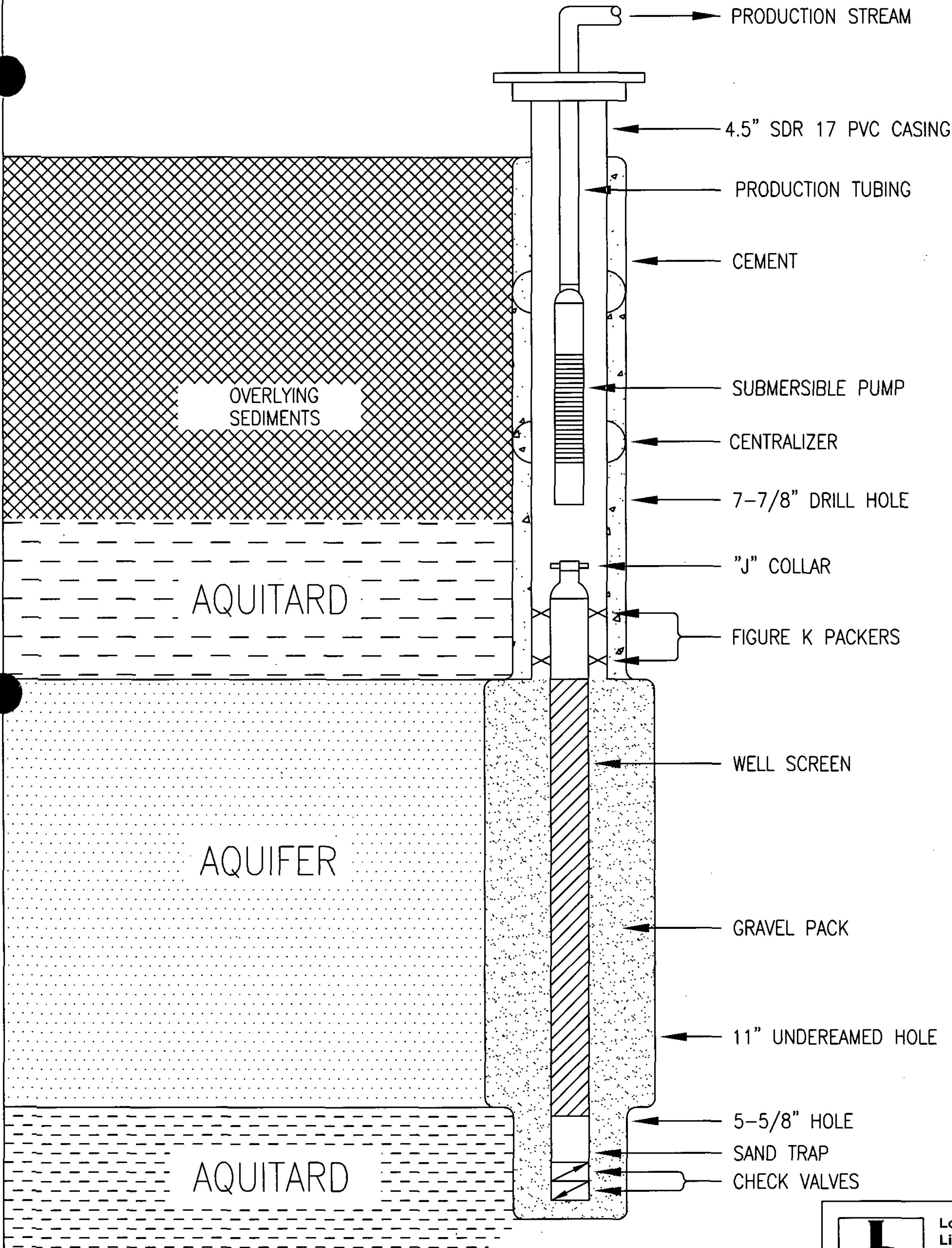

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FIGURE 1.2-5
Production Well Construction
Lost Creek Permit Area

Issued For: NRC ER 1.0 Drawn By: SMH
Issued / Revised: 10.2.2007
Drawing No. NRCER 1.0 FIG 1.2-5 10.2.2007 SMH

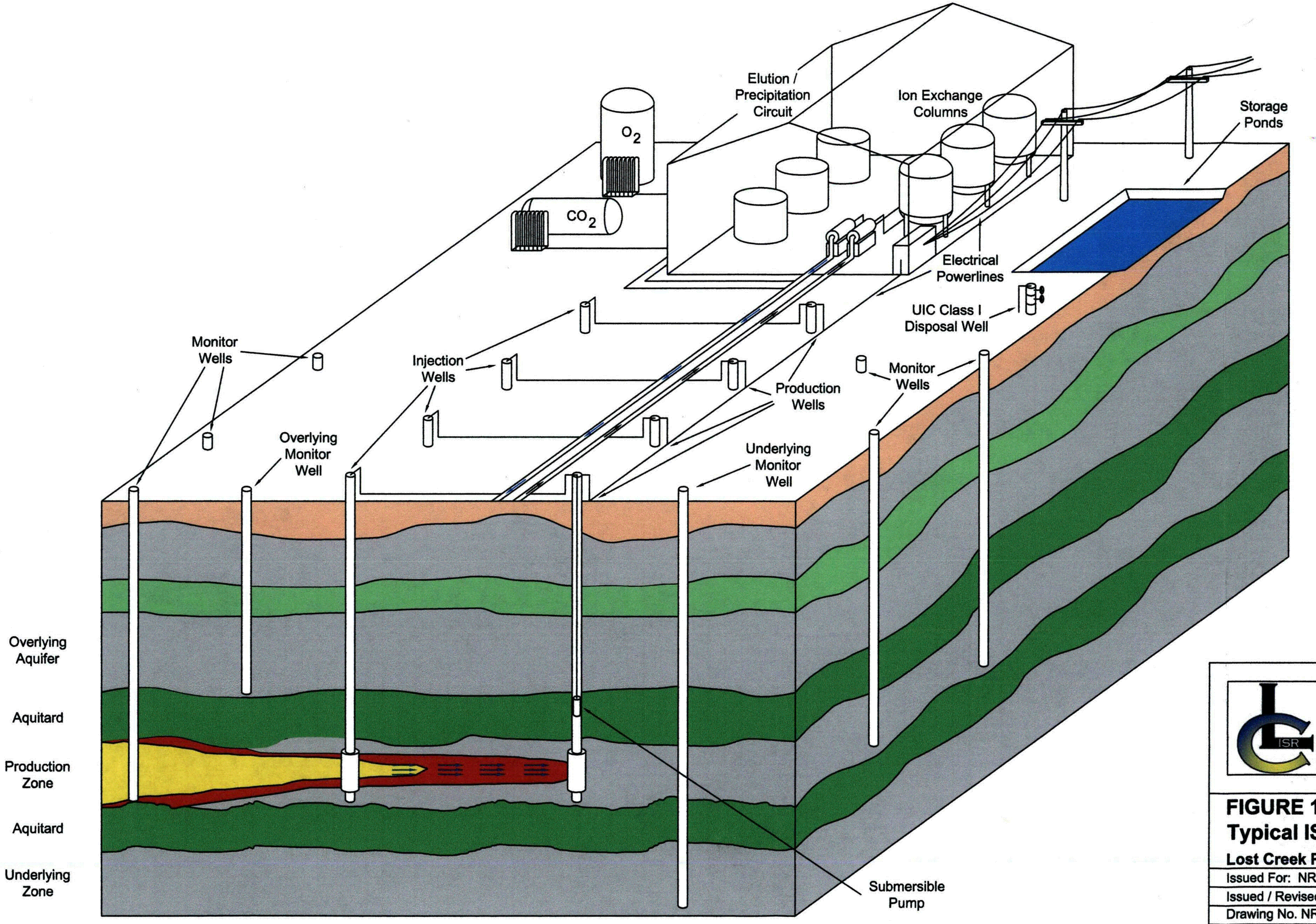

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FIGURE 1.2-6a
Typical ISR Operation
Lost Creek Permit Area

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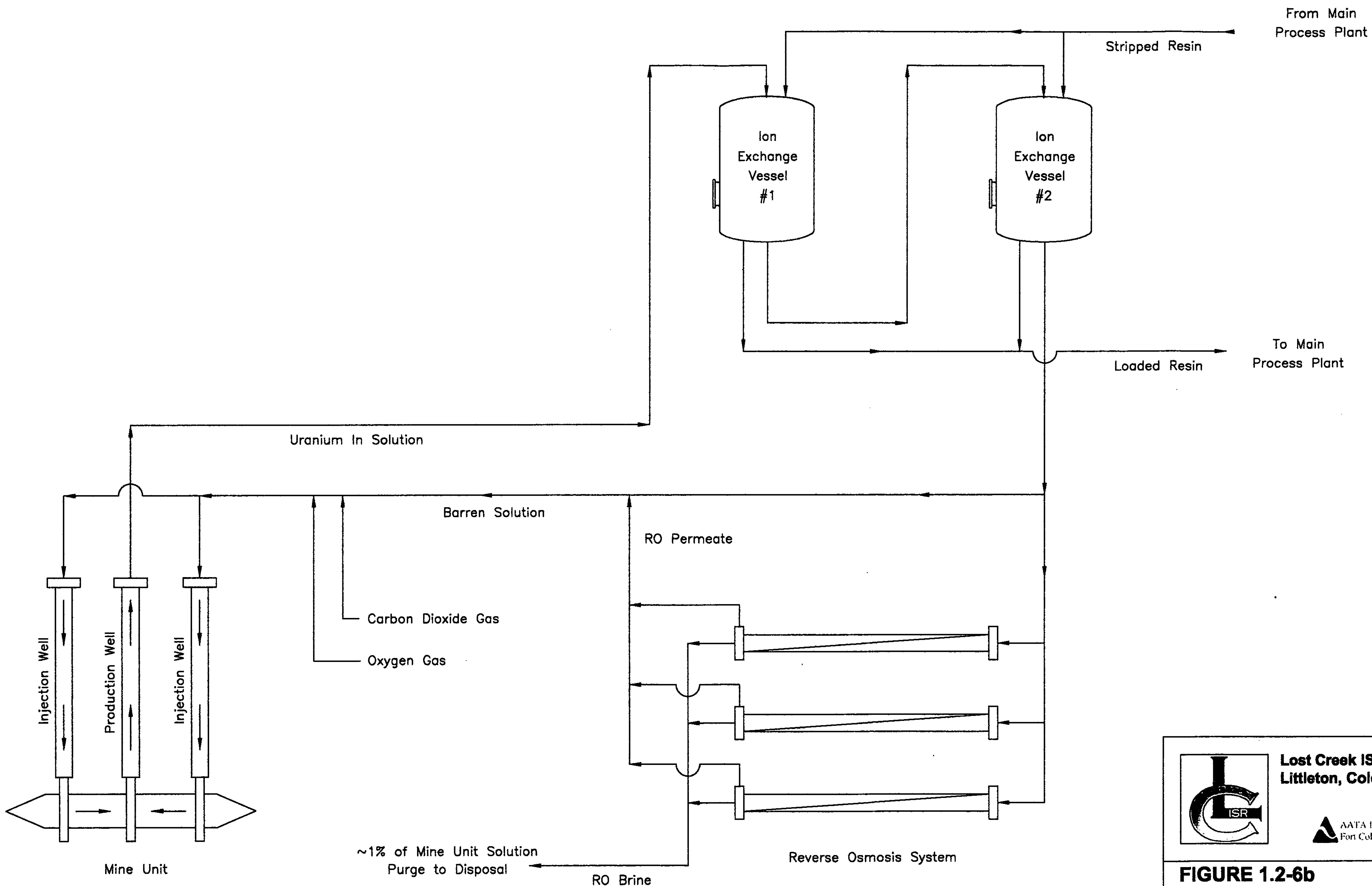
Issued / Revised: 10.18.2007	
Drawing No. NRCER 1.0 FIG 1.2-6a 10.18.07 SMH	



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Littleton, Colorado USA

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FIGURE 1.2-6b
Ion Exchange Process Flow
Lost Creek Permit Area

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Issued / Revised: 10.2.2007
Drawing No. NRCER 1.0 FIG 1.2-6b 10.2.2007 SMH

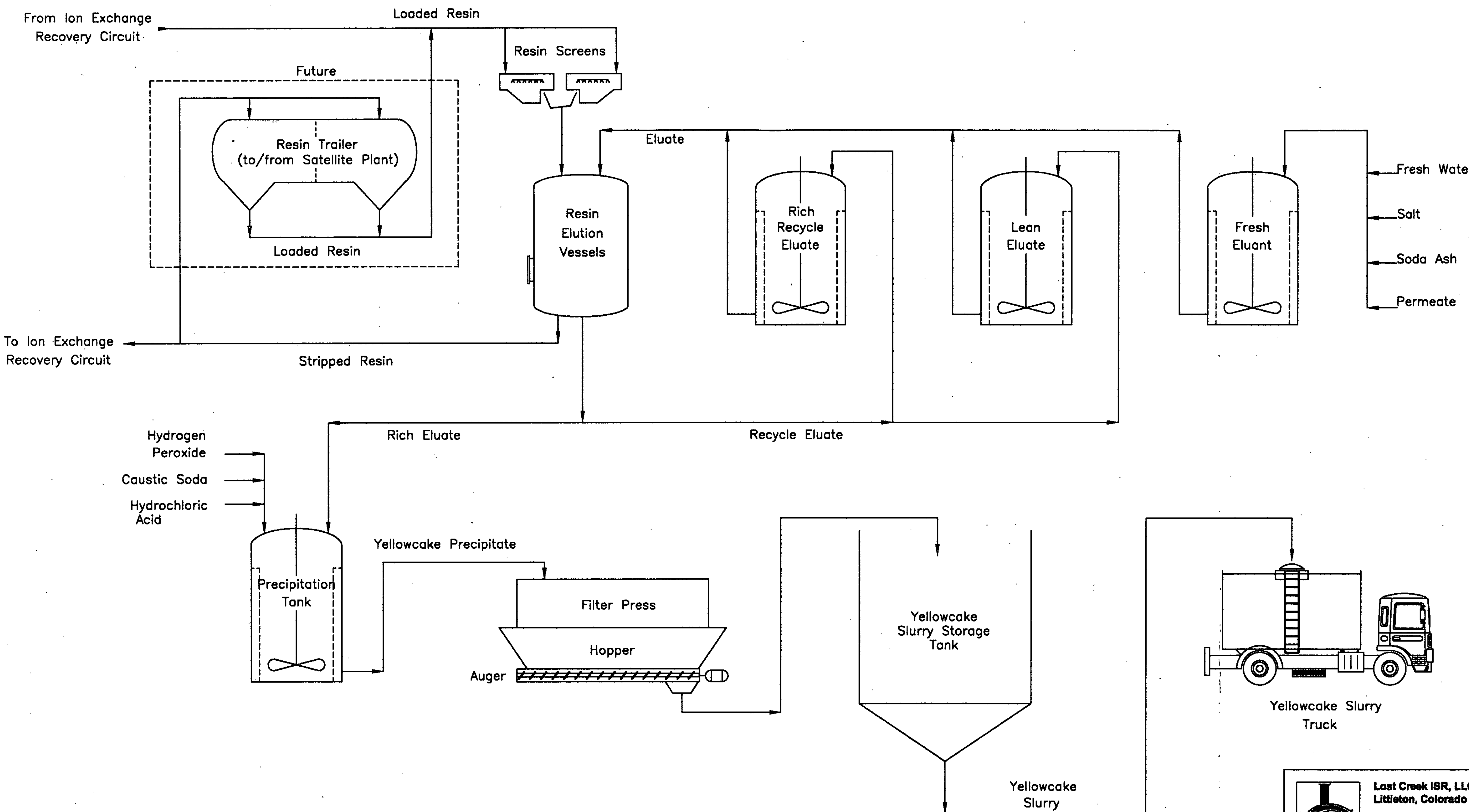

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FIGURE 1.2-6c
Plant Process Flow
Lost Creek Permit Area

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Issued / Revised: 10.2.2007
Drawing No. NRCER 1.0 FIG 1.2-6c 10.2.2007 SMH

Figure 1.2-7 Pre-operation Schedule of the Lost Creek Project

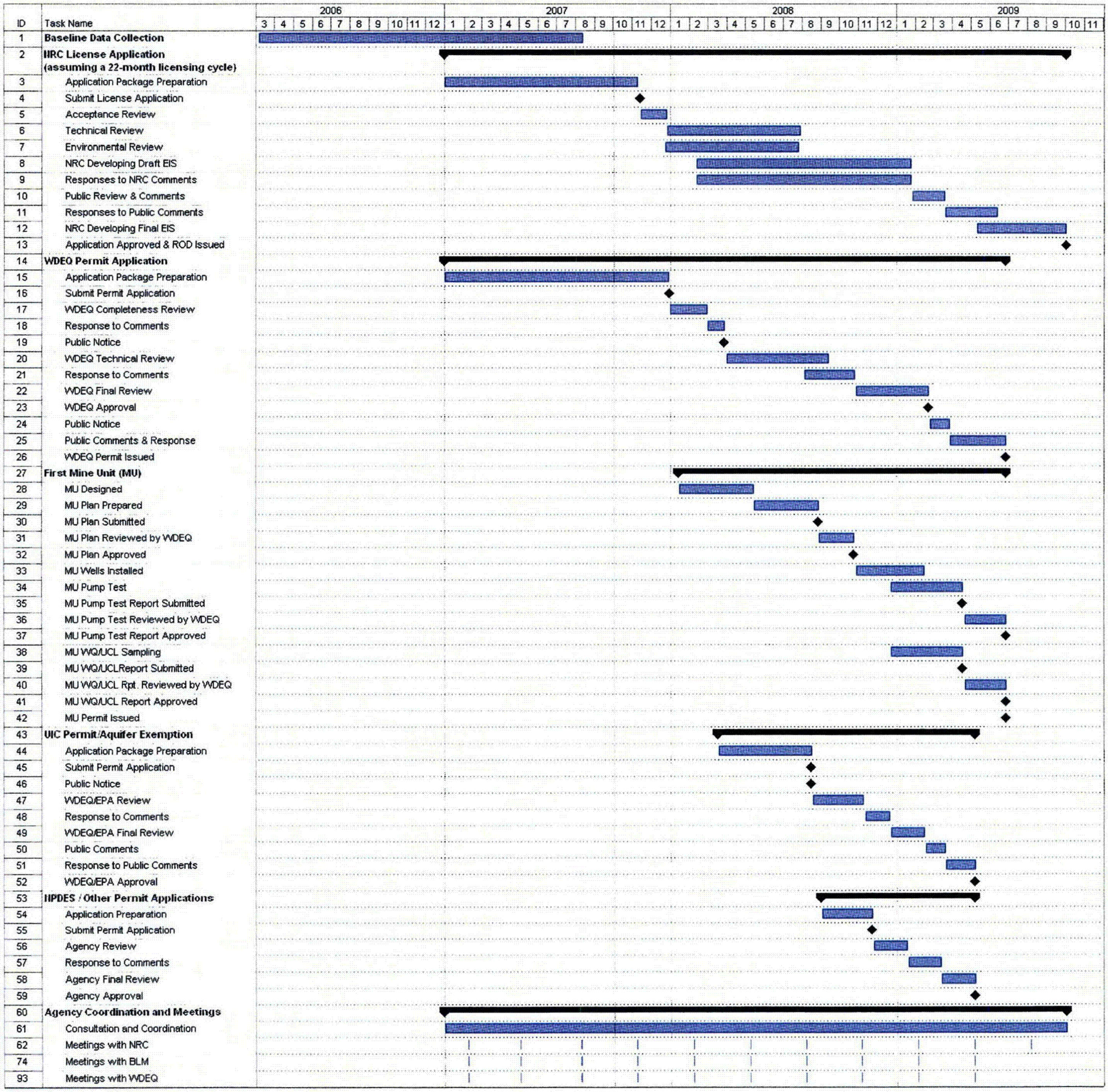

FIGURE-1.2-8

Lost Creek Project Development, Production and Restoration Schedule

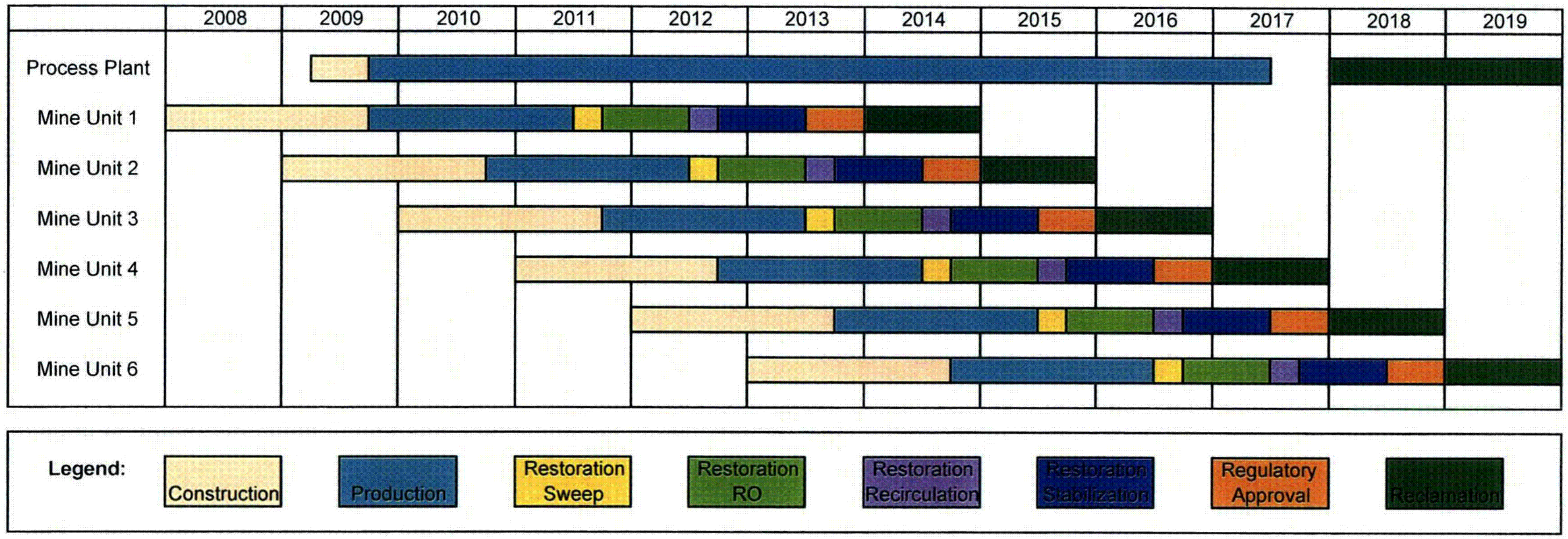

Table 1.3-1 List of Regulatory Requirements

PERMIT OR LICENSE	REGULATORY AUTHORITY	STATUS
Source and Byproduct Material License	NRC	Application Submitted
Permit to Mine	WDEQ & BLM	Being Prepared
Mineral Exploration Permit	WDEQ	Obtained
License to Mine	WDEQ	Being Prepared
Underground Injection Control Permit Class I (deep disposal wells)	WDEQ	Being Prepared
Aquifer Exemption Permit for Class I injection wells	WDEQ & EPA	Being Prepared
Underground Injection Control Permit Class III (ISR wells)	WDEQ	Being Prepared
Aquifer Exemption Permit for Class III injection wells	WDEQ & EPA	Being Prepared
Permit to Construct Additional Ponds	WDEQ & WSEO	Future Application As Needed
Permit to Appropriate Groundwater for Mine Units	WSEO	Being Prepared
Permit To Construct Sanitary Leach Field	WDEQ	Being Prepared
Air Quality Permit (Fugitive Dust)	WDEQ	Being Prepared
Stormwater Discharge Permit	WDEQ	Being Prepared
County Development Permits	Sweetwater County Planning Commission	Being Prepared

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
"PLATE 1.2-1
PLANT SITE PLAN
Lost Creek Permit Area"
DRAWING NO. NRCER 1.0 PLT 1.2-1
10.2.2007 SMH

WITHIN THIS PACKAGE... OR BY SEARCHING USING THE DOCUMENT/REPORT NO.

D-01

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2.0 ALTERNATIVES

2.1 No-Action Alternative

Under this alternative, no ISR operations would be conducted within the Permit Area. There would be no uranium produced from the Permit Area and no favorable or unfavorable impacts from this alternative.

2.2 Alternatives Considered but Eliminated

Underground and open pit mining represent the two currently available alternatives to ISR of the uranium resources in the Permit Area. Use of evaporation ponds for process water disposal was considered as an alternative to the UIC Class I wells. Shipping of loaded ion exchange resin, rather than yellowcake slurry, was also considered.

2.2.1 Open Pit Mining

Open pit mining requires the removal of all material covering the orebody (overburden) and then the ore itself. The ore would then be transported to a conventional mill for further processing and extraction through grinding, leaching, purifying, concentrating, and drying.

From an economic point of view, open pit mining of the relatively low grade and moderate depth of the Lost Creek orebodies would require a much larger investment than ISR, especially in the early phase, when a significant investment would be required for acquisition of heavy equipment to perform the earthwork to expose the orebody. The overall size of the operation facilities would be larger because of greater manpower and material handling requirements.

Waste rock piles from excavation of the overburden and the mine pit would make permanent changes to the topography, with a disturbed area approximately three times the area of the orebody mined, in order to maintain slope stability. Potential personnel injury rates and potential radiological exposures at the mining site would also be higher with open pit mining than what would be experienced with ISR.

A mill tailings pond would be required to contain the millions of tons of waste produced from the uranium mill. This tonnage would represent a large volume of radioactive tailings slurry covering a large area of ground surface. Conventional mill operation would involve higher risks of spillage and radiological exposure to both personnel and the environment than those associated with the proposed ISR operations.

Open pit mining at the Permit Area would also require substantial dewatering of the pit to depress the potentiometric surface of all aquifers. Large quantities of groundwater would be discharged to the surface. Some of this groundwater contains naturally elevated radium-226 (Ra-226), radon and uranium, which would have to be treated before discharge and the residue disposed of as radioactive solid waste.

2.2.2 Underground Mining

Underground mining of the uranium resources at the Permit Area would involve sinking of shafts to the vicinity of the orebodies, horizontally driving crosscuts and drifts to the orebodies at different levels, physically removing the ore and transporting the mined ore to the conventional mill for further processing. Processes for milling and uranium extraction from underground mined ores would be the same as those for ores mined from the open pit.

When one considers the alternative of underground mining, the economic and environmental disadvantage closely parallel those of an open pit mine. These, as stated above, include large amounts of initial investment, permanent changes to the topography (though in a smaller scale than open pit mining because less amounts of waste rock are being generated), generation of a significant amount of mine tailings, increased risks of injury and potential exposure to radioactive materials during mining and milling, and surface discharge of groundwater from mine dewatering with elevated radionuclide concentrations.

One major concern for underground uranium mining is the potential exposure of miners to radon gas if the gas is not continuously vented to the atmosphere. Subsequent land surface subsidence could also occur after the completion of underground mining.

Economic costs and environmental impacts associated with open pit and underground mining clearly show that ISR is the more viable uranium extraction technique to use. The initial investment is lower; the tailings problem is completely eliminated; radiation exposure and environmental impacts are minimized; and the groundwater resource is preserved. In addition, because of the reduced costs, lower grade ores can be recovered through ISR than can be recovered from open pit and underground mines.

2.2.3 Evaporation Ponds for Process Water Disposal

Using evaporation pond(s) and/or UIC Class I well(s) for process water disposal are the most common practices for uranium ISR operations. The evaporation pond alternative was considered for the Project but eliminated for the following reasons.

- Productivity and efficiency: Due to the severe winter weather conditions at the Permit Area, evaporation ponds would be frozen and covered with snow for several months, making any evaporation close to impossible.
- Area of land surface disturbance: The size of the evaporation pond(s) would have to be large enough to accommodate the extremely low evaporation rate during the winter and to support the constant year-round production rate of the Project. A preliminary feasibility study indicates that the evaporation ponds would be approximately 21 acres in total area to sustain the proposed production rate.
- Clean-up and reclamation: The solid wastes that precipitate from the process water are radioactive and extensive efforts are needed during the reclamation phase to clean up and dispose of these solid wastes.

UIC Class I wells will be drilled and used (together with Storage Ponds) for process water disposal at the Permit Area instead, as described in the sections that follow.

2.2.4 Shipping Loaded Resin

Shipping uranium-laden resin is a standard industry practice for satellite processing plants in conjunction with processing facilities. However, the option of shipping resin for processing and drying versus shipping slurry was eliminated for the following reasons.

- Productivity and efficiency: LC ISR, LLC's Project anticipates a production rate of one million pounds U_3O_8 per year. The average load of resin would be 500 cubic feet at a loading rate of eight pounds per cubic foot, or 4,000 pounds U_3O_8 per transfer (load). This would require a shipment of loaded resin to a separate facility approximately every 1.5 days. The Project will process slurry and require the transport of approximately 15,000 pounds U_3O_8 to a drying facility at a time. This will require a shipment every 5.5 days.
- Environmental health and safety: The transport of resin over slurry would increase the time an equipment operator would spend in transit by more than 350 percent.
- Operating cost: Processing the uranium at the Permit Area into slurry will reduce not only the transportation cost, but will reduce the number of trucks, trailers and equipment operators. Standby materials, such as resin and transport equipment, will also not be required. In addition, the cost for toll processing of resin will be

recovered against the Plant investment over the life of the Project, yielding a more valuable asset to be used in processing for other projects or toll processing of resin.

2.3 Proposed Action

The Project will use ISR technology to extract uranium from permeable, uranium-bearing sandstones located at depths ranging from 300 to 700 feet. Once extracted, the uranium will be recovered by means of ion exchange, which uses commercially available anionic resin. Periodically, the ion exchange resin will become saturated with uranium. Uranium will be removed from the ion exchange resin by conventional elution processing. The ion exchange resin, now stripped of uranium, will be returned to recover additional uranium. The uranium removed during the elution processing step will be precipitated, washed to remove impurities and filtered for shipment as slurry. The detailed operation plan is presented in **Section 1.2** of this report.

2.4 Reasonable Alternatives

2.4.1 Alternate Plant/Facility Locations

Two locations were considered for the Plant (**Figure 2.4-1**). The primary areas of concern were: 1) proximity to the ore, 2) surface geology, and 3) environmental issues, including sage grouse and raptor nests. Plant Site One, which is located in the Northwest Quarter of the Southeast Quarter of Section 18, Township 25 North, Range 92 West, was selected as the preferred alternative. Plant Site Two (located in the Northeast Quarter of the Southeast Quarter of Section 19, Township 25 North, Range 92 West) was considered, but not chosen based on the following.

- Proximity to ore: This location is reasonably close to the known ore trends, and has potential for future operations. This alone precludes it from being the first choice for the Plant site.
- Surface geology: No issues were noted.
- Environmental issues: No primary drainage concerns were noted. While this location does not encroach upon a two-mile lek (sage grouse mating area) buffer area, it is closer than the proposed Plant Site One.

2.4.2 Scale of Monitor Rings

A mine unit consists of ISR amenable production zones within a sandstone bounded by an upper and lower hydrologic barrier. In the simplest scenario, there is a single production zone; and a monitor well ring radially bounds that production zone, as one of the primary means of ensuring control of mining solutions within a mine unit. In more complex systems, there may be more than one production zone stacked vertically within a sandstone, and there may be more than one sandstone, with multiple production zones stacked vertically.

Depending on the location within the Permit Area, there may be only a single production zone underlying the Permit Area, or there may be multiple production zones in more than one sandstone. For this permit application, the term "sand" is applied to a specific production zone, and the term "horizon" is applied to the sandstone that contains one or more production zones. Specifically, LC ISR, LLC is proposing to recover uranium from the HJ Horizon, which has up to three production zones, the Upper, Middle, and Lower HJ Sands (UHJ, MHJ, and LHJ Sands, respectively). There are also shallower and deeper horizons within the Permit Area, in particular, the KM Horizon. LC ISR, LLC is not proposing to recover uranium from those horizons at this time, but may request a license amendment to recover uranium those horizons in the future.

Because of the different ore depths, several scenarios are possible for well completions. The Project proposes relatively small monitor rings, each containing approximately 1.2 million pounds of reserves, within the HJ Horizon. In the simplest scenario, where only one sand is present in a horizon, the production, injection, and monitor wells will be installed in that sand. Where more than one sand is present in the horizon, e.g., the MHJ and LHJ Sands, uranium will be recovered from one sand at a time. The production and injection wells will be installed with the lowest sand in the horizon and ore from that sand recovered. The lowest sand will then be sealed off, and the well completed in the next sand up. This process continues until ore has been recovered from all the targeted sands within the horizon. Restoration occurs in the reverse, with the uppermost sand being restored then sealed off and the next sand below opened up for restoration, in progression until all the sands are restored. The wells in the monitor ring will be designed so the open intervals correspond to the depths of the sands adjacent to each well. This is the Preferred Alternative. Other Alternatives include the following.

- Multiple Completions

  An alternate scenario to the one above is the completion of wells across multiples sands within the same horizon, using the same wells and the same monitor ring. However, this is not considered an appropriate alternative because of the difficulties of ensuring the injection and production fluids are being efficiently distributed to the various sands in the horizon and of monitoring the performance of the mine unit.

- Larger Rings Encompassing More Reserves

  Another option is the installation of a ring that contains production of several million pounds of reserves from one sand within a horizon. This option requires the installation of pattern areas within a monitor ring covering a much larger area. The wells are completed in the same manner as the preferred option. Because of the increase in scale, the construction time, evaluation of pump tests, and all other activities associated with installing and producing the mine unit would increase dramatically. Final restoration/reclamation of the mine unit would be delayed until all operations for the area were complete. Therefore, this option is not considered the most efficient approach.

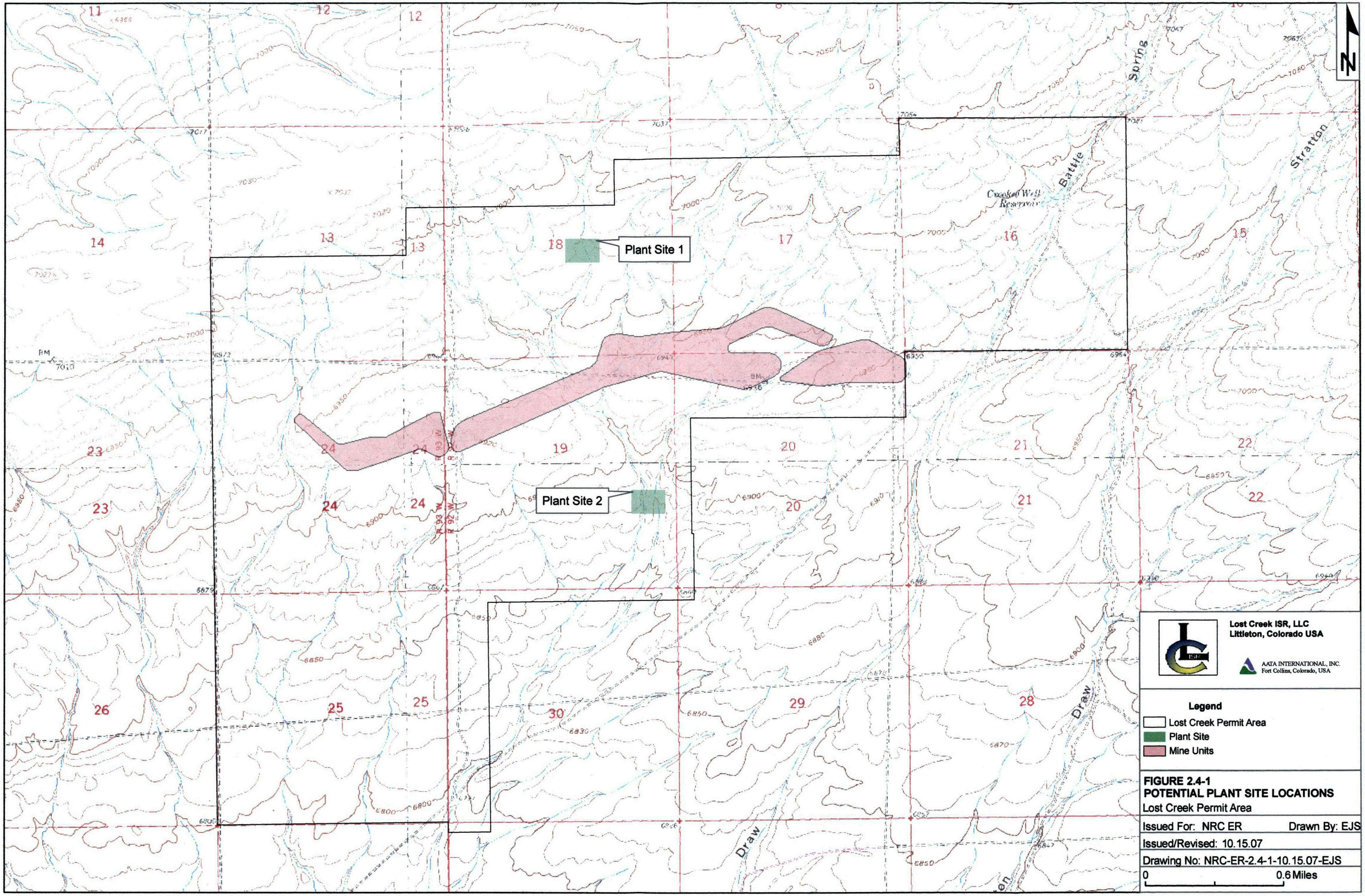

FIGURE 2.4-1
POTENTIAL PLANT SITE LOCATIONS
Lost Creek Permit Area

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FIGURES

TABLES

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The Permit Area is located in the northeastern corner of Sweetwater County, Wyoming near Carbon County, Wyoming. The Permit Area is about 15 miles southwest of the Bairoil, Wyoming, about 38 miles northwest of Rawlins, and about 90 miles southwest of Casper. The Permit Area consists of 199 unpatented federal lode claims and one state lease totaling 4,220 acres. The general location of the Permit Area is shown in **Figure 1.3-1**.

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 15 miles from the Permit Area boundary. The weather is dry and windy, with short, hot summers and cold winters. There is no perennial surface water, although there are a few ephemeral drainages that can convey surface water during spring snowmelt and following intense rainstorms.

3.1 Land Use

The land within the Permit Area is entirely publicly owned. Eighty-five percent is federal land, managed by BLM through the Rawlins and Lander Field Offices. Fifteen percent is owned by the State of Wyoming. The primary study area for land use includes a two-mile radius from the Permit Area boundary. Within the study area, 96 percent of the land is federally owned, three percent is state owned, and one percent is privately owned **(Figure 3.1-1)**. The primary land use in the study area is rangeland for cattle, but the area is also used for dispersed recreation such as hunting, off-highway vehicle (OHV) use, and antler collecting. There are no maintained roads within the study area, but a power line is present. Regional land uses include grazing, industry, wildlife habitat, hunting, dispersed recreation, OHV use, oil and gas extraction, gas and carbon dioxide (CO_2) pipelines, and transmission lines.

3.1.1 Existing Land Uses

3.1.1.1 Rangeland and Agriculture

There is no crop production within the Permit Area or within two miles of the Permit Area; the only agricultural production is related to grazing. The study area includes portions of three BLM grazing allotments: Stewart Creek, Cyclone Rim, and Green

Mountain (**Figure 3.1-2**). These allotments provide forage for cattle that are generally sold as food sources, as well as a small number of horses and sheep. Grazing rights are assigned by section, so all sections that are at least partly within two miles of the Permit Area are included in the grazing allotment study area. Water sources that support this grazing are discussed in **Section 3.5**.

The Stewart Creek and Cyclone Rim allotments are managed by the BLM Rawlins Field Office, and cover 22,101 acres within the study area. Together, these two allotments provide 3,027 animal unit months (AUMs) of summer and winter grazing (Calton, M. Range Specialist. BLM Rawlins Field Office. Personal communication. July, 2007.) The Green Mountain allotment is managed by the BLM Lander Field Office, and includes 9,339 acres within the study area. This acreage provides 635 AUMs of summer grazing. An AUM is an animal unit month, the common unit of measure defined as "the amount of forage to sustain one mature cow or the equivalent, based on an average daily forage consumption of 26 pounds of dry matter per day" (BLM, 2004a). The total AUMs for the study area is 3,662, which would provide year-round forage for the equivalent of 305 cattle. For a 1,000-pound cow, the average meat yield is 550 pounds (National Sustainable Agriculture Information Service, 2007). Therefore, the annual potential total meat production associated with the Permit Area is roughly 168,000 pounds if all the cattle are slaughtered. However, some animals are generally kept for breeding, so the actual meat production is probably somewhat smaller.

In 2000, one AUM for cattle was worth $33.27. At these values, the BLM calculated that cattle production would produce $65.07 per AUM of total economic impact, which includes both direct and secondary returns (BLM, 2004a). Using these figures, livestock production on rangeland within the grazing allotments of the Permit Area has a potential value of about $238,000 per year based on the current AUMs of the study area.

3.1.1.2 Wildlife Hunting and Viewing

WGFD hunting areas for antelope, deer, elk, and mountain lion include the Permit Area. Hunting seasons run from September through December, but hunting occurs primarily in October and November. Hunter days for the hunt areas that include the Project are shown in **Table 3.1-1**. There are no designated wildlife viewing locations in the study area.

3.1.1.3 Recreation and Special Use Areas

Considerable dispersed recreational activity takes place in the Green Mountains and Ferris Mountains, eight miles to the north and 25 miles northeast of the Permit Area, respectively. The Green Mountain Area has one developed campground with 17 campsites, water, and toilets (Rau, P. Recreation Specialist, BLM Rawlins Field Office. Personal communication. 2007.). This campground is under-used and is closed during elk calving season. There are also additional primitive camping areas available for campers with recreational vehicles (RVs) and tents. The general area is designated as an Extensive Resource Management Area (ERMA), which does not have restrictive use compared to a Special Recreation Management Area (SMRA) or Wilderness Study Area (WSA).

According to BLM's Natural Resource Recreation Settings, which are the criteria used for classification and prescriptions for BLM lands, the area is managed for Middle Country Designation. This designation does not restrict natural resource development and allows motorized and mechanized uses in most areas with some restrictions (BLM, 1987 and 2004c). A Middle Country designation falls between a Primitive classification and an Urban classification. The physical characteristics of the land area appear natural, except for primitive roads and within 0.5 miles of all improved roads, although improved roads may be visible.

3.1.1.4 Minerals and Energy

Bairoil is the residential area closest to the Permit Area, and is economically dependent on energy development in the area. Bairoil has an airport landing strip and residential and industrial units, a school, and town offices, including a police department.

Wyoming is a state with active mineral development. The types of minerals developed include oil and gas, coal and other minerals. About half the oil produced in the Resource Management Plan Planning Area (RMPPA) during 2000 and 2001 was from the Lost Soldier-Wertz Fields near Bairoil. This field complex is in a tertiary phase of oil recovery via CO_2 injection; it is expected that no future oil production enhancement can be accomplished.

There are no nuclear fuel cycle facilities within 50 miles of the Lost Creek Permit Area (NRC, 2007). However, there are several conventional uranium mills and mines and ISR projects within 50 miles of the Permit Area; the locations are shown on **Figure 3.1-3**. Other than Kennecott Uranium Company's Sweetwater Mill (NRC License No. SUA-1350; WDEQ Permit No. 481), which is currently on stand-by, and the PRI Gas Hills Project (NRC License No. SUA-1511-Amendment; WDEQ Permit No. 603), which is a new ISR project not yet in operation, all of the operations shown in **Figure 3.1-3** are in decommissioning or reclamation or have been reclaimed by the operator or the WDEQ Abandoned Mine Lands Division. The closest facility to the Project is the Sweetwater Mill, which is located about five miles south-southwest of the center of the Project, with about two miles separating the permit boundaries.

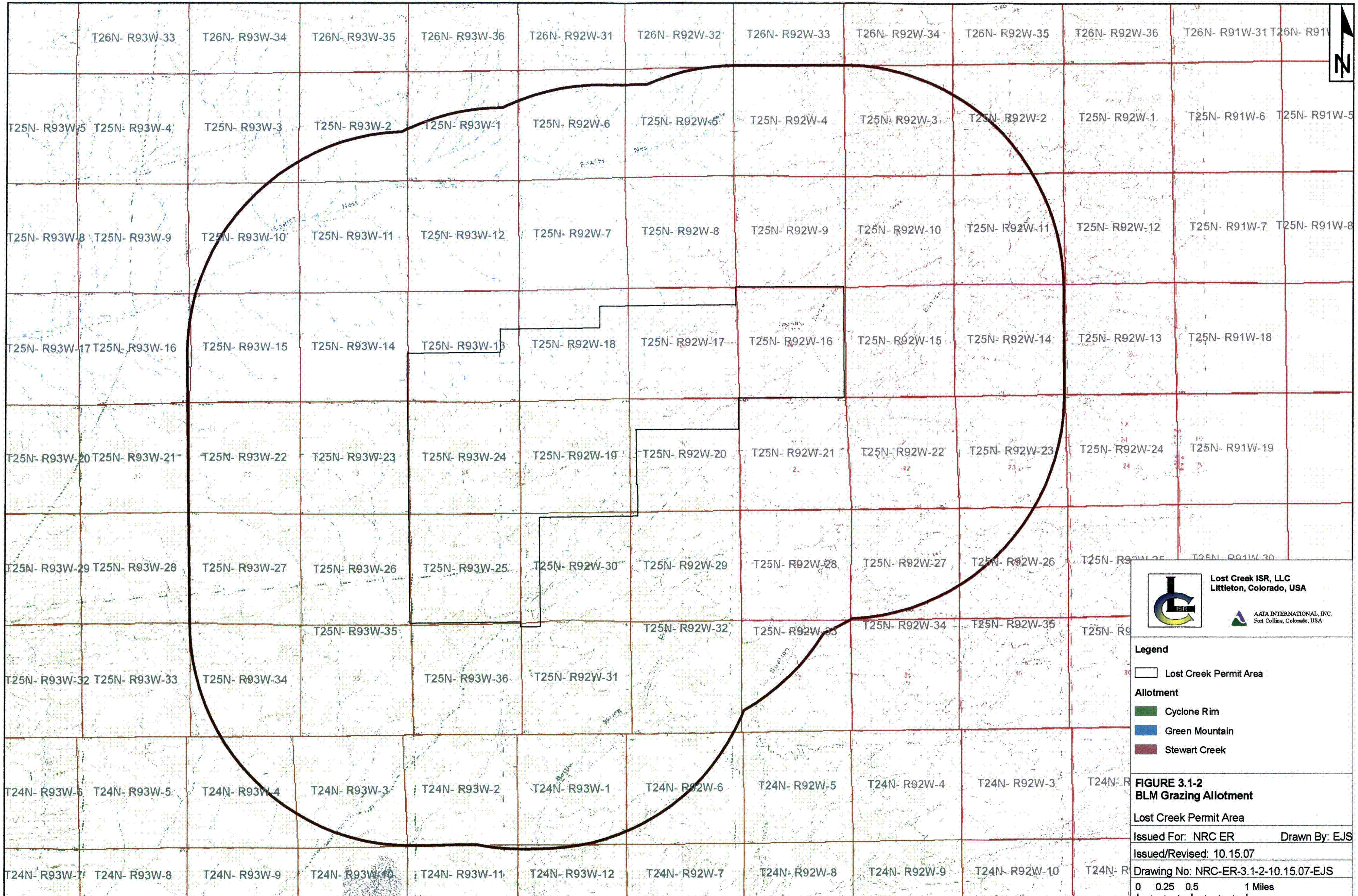
3.1.1.5 Infrastructure

Regional transportation corridors are discussed in **Section 3.2** of this report. A power line runs in a north-south direction along the western boundary of the Permit Area. The right-of-way easement for this power line is 25 feet wide.

3.1.2 Planned Land Uses and Developments

Both Carbon and Sweetwater Counties are experiencing considerable natural resource development, much of which is related to oil and gas exploration and production. Based on publicly available information, no projects are currently planned within the study area (Simons, D. Planning and Environmental Coordinator, BLM Rawlins Field Office. Personal communication. 2007; Murray, C. Planning and Environmental Coordinator, BLM Lander Field Office. Personal communication. 2007). Although specific locations and plans have generally not been publicly disclosed, uranium exploration in the general vicinity has recently increased in response to the current uranium market.

FIGURE 3.1-1
Land Ownership
Lost Creek Permit Area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T26N- R93W-34
T26N- R93W-35
T26N- R93W-36
T26N- R92W-31
T26N- R92W-32
T26N- R92W-33
T26N- R92W-34
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T26N- R92W-36
T26N- R91W-31
N
T25N- R93W-5
T25N- R93W-4
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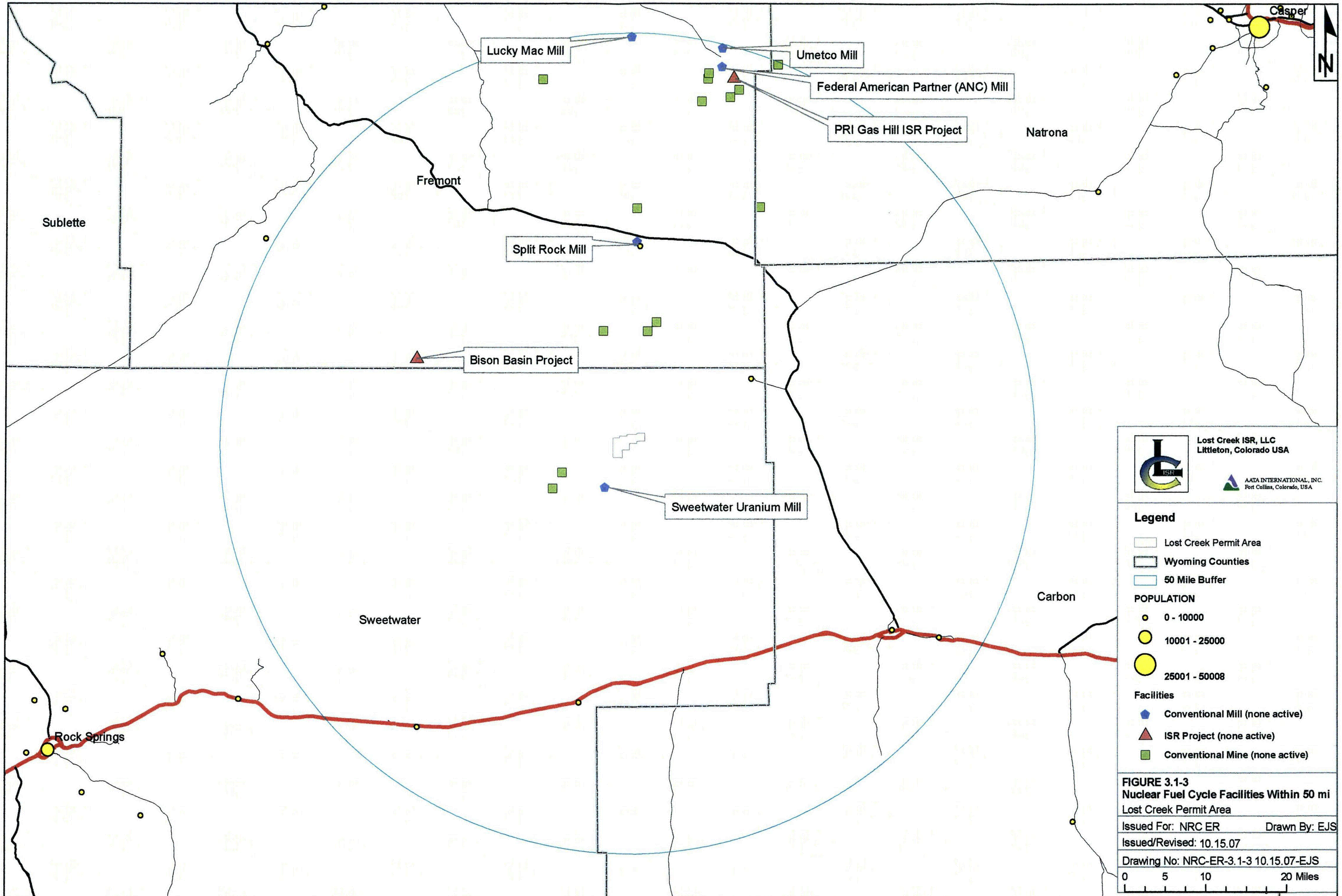
T24N- R93W-12
T24N- R92W-7
T24N- R92W-8
T24N- R92W-9
T24N- R92W-10
Lost Creek ISR, LLC
Littleton, Colorado, USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Lost Creek Permit Area
Allotment
Cyclone Rim
Green Mountain
Stewart Creek
FIGURE 3.1-2
BLM Grazing Allotment
Lost Creek Permit Area
Issued For: NRC ER
Drawn By: EJS
Issued/Revised: 10.15.07
Drawing No: NRC-ER-3.1-2-10.15.07-EJS
0 0.25 0.5 1 Miles



Casper
N
Lucky Mac Mill
Umetco Mill
Federal American Partner (ANC) Mill
PRI Gas Hill ISR Project
Natrona
Fremont
Sublette
Split Rock Mill
Bison Basin Project
Sweetwater Uranium Mill
Carbon
Sweetwater
Rock Springs
Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Lost Creek Permit Area
Wyoming Counties
50 Mile Buffer
POPULATION
0 - 10000
10001 - 25000
25001 - 50008
Facilities
Conventional Mill (none active)
ISR Project (none active)
Conventional Mine (none active)
FIGURE 3.1-3
Nuclear Fuel Cycle Facilities Within 50 mi
Lost Creek Permit Area
Issued For: NRC ER
Drawn By: EJS
Issued/Revised: 10.15.07
Drawing No: NRC-ER-3.1-3 10.15.07-EJS
0 5 10 20 Miles

Table 3.1-1 **Hunting Statistics for Hunt Areas that Include the Permit 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 [1]	NA	1	NA	5	Red Desert

[1] NA = No Data

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3.2 Transportation

This section provides a description of the regional and on-site transportation network that is relevant to the Project. Most transportation will use the public road network; but goods may be transported by rail to and from Wamsutter. The road network will be used for: 1) shipments of construction materials, process chemicals, office supplies, and related materials from suppliers to the Plant; 2) shipment of yellowcake slurry to an off-site drying facility; 3) shipments of waste material to be disposed of off-site; and 4) movement of personnel to and from the site and within the Permit Area.

3.2.1 Regional Transportation Corridors

The transportation system serving the Project relies almost exclusively on public roads and highways. Automobiles and trucks are the primary mode of transportation. The regional transportation network relevant to the Project consists of primary, secondary, and local roads (**Figures 1.2-1** and 3.2-1). The Permit Area is served by an Interstate Highway (I-80); a US Highway (US 287); Wyoming State routes (SR 220 and 73 to Bairoil); local Carbon, Sweetwater, and Fremont County roads; and BLM roads. Transportation to the Permit Area will be predominantly from I-80 at Rawlins, Wyoming, north about 15 miles on US 287, west approximately 32 miles on Mineral Exploration Road (Sweetwater County Road 63) then six miles north on Sooner Road (BLM Road 3215) to the Permit Area access road. These roads are paved with the exception of Sooner Road and the site access road. Some of the heavier transports of materials and equipment may use the unpaved Wamsutter-Crooks Gap Road (CR 23N) to the west of the Permit Area, that connects Wamsutter and Jeffrey City. In addition to the designated routes, there are a number of four-wheel-drive routes that traverse the area for recreation and grazing access, as well as various other uses, including oil, gas, and mineral exploration.

The primary interstate and US highways are well maintained. The other county and BLM roads providing access to the Permit Area are generally maintained biannually and in fair condition, depending on the season and how recently maintenance occurred. These roads are infrequently plowed in the winter. Ranchers, agency personnel and some hunters, fishermen, and other recreationists use these roads (Rau, P. Recreation Specialist, BLM Rawlins Field Office. Personal communication. 2007).

Table 3.2-1 describes these roads, with daily and peak traffic counts for the roads that are regularly monitored. Traffic counts are not available for the county roads. These roads receive little traffic for most of the year, but use peaks in the summer and fall, when hunting and dispersed recreation is greatest.

Traffic safety data are summarized in **Table 3.2-2**. An Operator's or Owner's Traffic Accident Report is required by the Wyoming Department of Transportation (WYDOT) if any party is injured or if there is property damage of $1,000 or more (Carpenter, T. Senior Data Analyst, WYDOT. Personal communication. March, 1997). The accident rate was calculated by dividing the mean number of truck accidents per year (2002 to 2006) by the product of the road segment length, the average number of trucks per day, and the number of days per year (365). From 2002 to 2006, no accidents involving large trucks occurred on the segment of interest of WY-73, so the accident rate was calculated using all traffic. During this period, there were an average of 230 cars per day, and a total of three accidents. Traffic counts were not available for the county and BLM roads listed in **Table 3.2-2**, so the accident rate for these segments could not be calculated directly. Where no data were available, the truck accident rate was estimated as 2.2×10^{-6} accidents per mile (Harwood and Russell, 1990), a widely cited value for two-lane rural roads. Most traffic accidents do not cause injuries or fatalities. From 2002 to 2005, an average of 15,867 accidents occurred in Wyoming, annually. Of these accidents, 0.9 percent was fatal, 25 percent caused injuries, and 74 percent caused property damage only (WYDOT, 2007a).

3.2.2 On-site Transportation Corridors

Currently, the only on-site transportation corridors are two-track roads that are accessible year-round by four-wheel-drive vehicles (**Figure 3.2-2**). Most are indistinct, difficult to delineate, or do not have obvious end points. These tracks are not maintained, have no drainage, and are sometimes impassable during the winter months. County Road 23 North (Wamsutter-Crooks Gap Road) is about five miles west of the Permit Area; and the BLM 3215 (Sooner Road) is about five miles east.

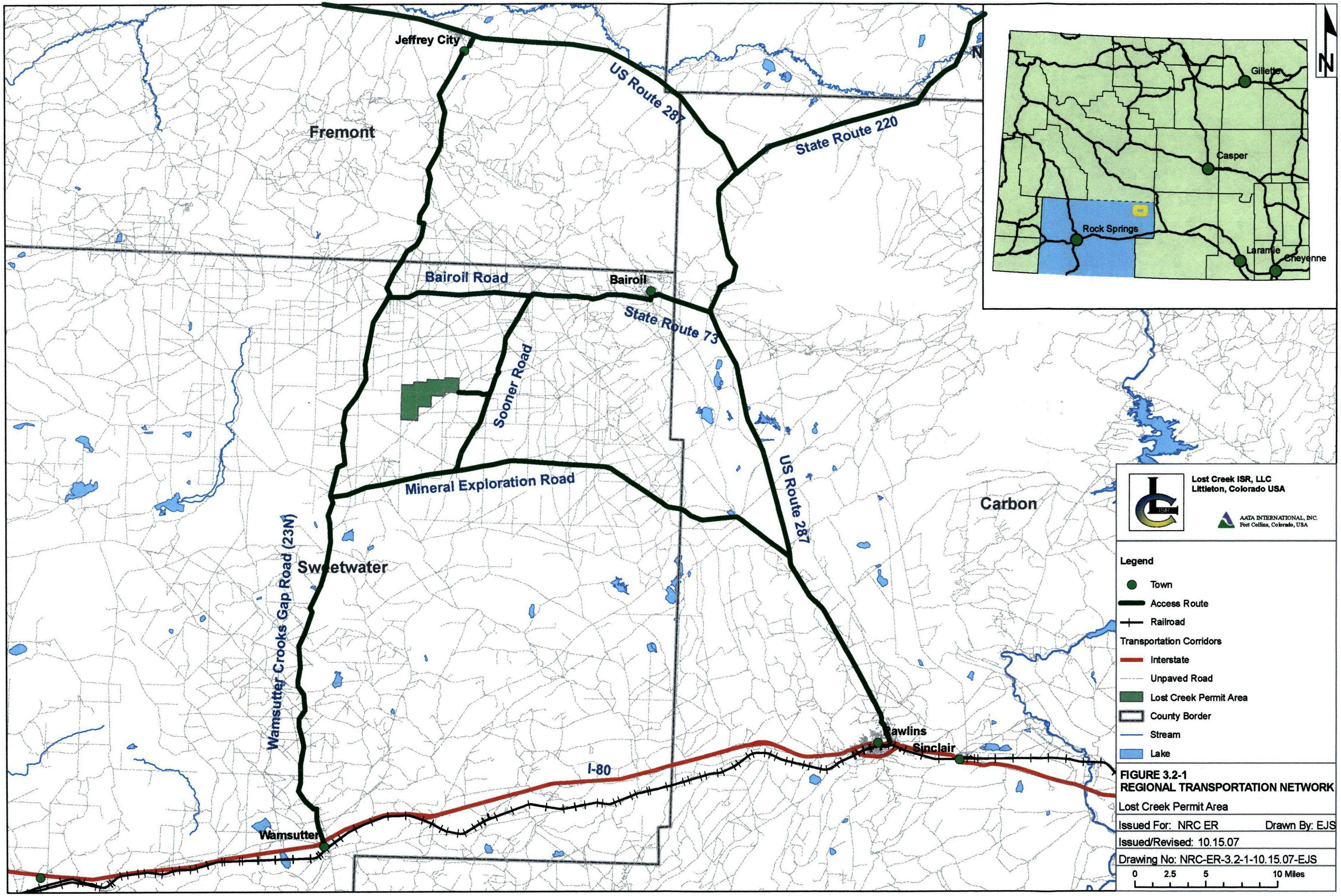

FIGURE 3.2-1
REGIONAL TRANSPORTATION NETWORK

Lost Creek Permit Area

Issued For: NRC ER Drawn By: EJS

Issued/Revised: 10.15.07

Drawing No: NRC-ER-3.2-1-10.15.07-EJS

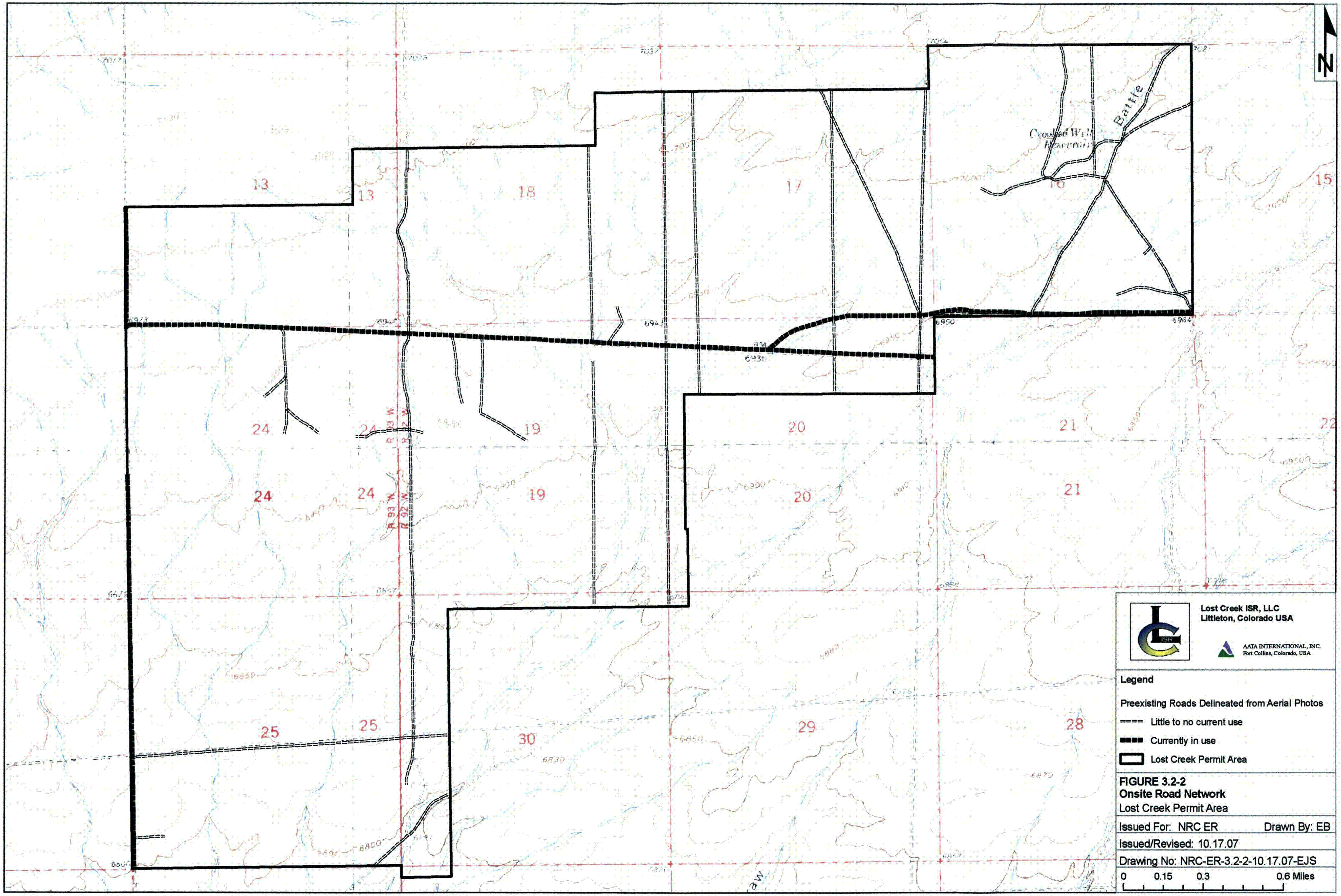
N
13
13
18
17
16
15
Battle
Crooked Well Reservoir
24
24
19
20
21
22
R 93 W
R 92 W
25
25
30
29
28
Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Preexisting Roads Delineated from Aerial Photos
Little to no current use
Currently in use
Lost Creek Permit Area
FIGURE 3.2-2
Onsite Road Network
Lost Creek Permit Area
Issued For: NRC ER
Drawn By: EB
Issued/Revised: 10.17.07
Drawing No: NRC-ER-3.2-2-10.17.07-EJS
0 0.15 0.3 0.6 Miles

Table 3.2-1 **Local and Regional Roads ***

Road/Counties	Road Surface	Lanes	Speed Limit	Average Daily Traffic	Peak Hourly Traffic	Peak Time
I-80 Carbon Sweetwater	paved	4	75	12,430 13,840	549 644	4 to 5 p.m. – Aug. 4 to 5 p.m. – Aug
US-287 Carbon Fremont	paved	2	65	1,820 1,870	460 259 North 308 South	2 to 3 p.m. – Aug 3 to 4 p.m. – July 3 to 4 p.m. – July
WY-73 Carbon	paved	2	65	230	NA	NA
County Rd 22 (Bairoil Rd)	native surface	2	Not posted	NA[1]	NA	NA
County Rd 23N (Wamsutter-Crooks Gap Rd)	native surface	2	Not posted	NA	NA	NA
County Rd 63 (Mineral Exploration Rd)	paved/ native surface	2	Not posted	NA	NA	NA
BLM Rd 2315 (Sooner Rd)	native surface	2	Not posted	NA	NA	NA

* (Sandidge. M. Transportation Technician 3, WYDOT Planning Traffic Surveys. Personal communication. March, 2007)

[1] NA = No Data

Table 3.2-2 Traffic Safety Data *

Road	Length (mi)	Trucks/Day	Annual Truck Accidents	Period of Record	Accident Rate (accidents/mile)
I80 (Carbon and SW County) milepost 57.04 to 280.9	223.9	6627	408.8	2002 to 2006	7.5E-07
US 287 (Rawlins to Muddy Gap)	43.1	490	6	2002 to 2006	7.8E-07
WY 73 (287 to Bairoil) milepost 0 to 4.65 [1]	4.7	30	0	2002 to 2006	1.5E-06
County Road 22, Bairoil Rd [2]	NA [3]	NA	0.6	2002 to 2006	2.2 E-06
County Road 23 Wamsutter-Crooks Gap Rd [2]	NA	NA	0.8	2002 to 2006	2.2 E-06
County Road 63/BLM 3206, Mineral Exploration Rd [2]	NA	NA	0.6	2002 to 2006	2.2 E-06
BLM Road 3215, Sooner Rd [2]	NA	NA	NA	2002 to 2006	2.2 E-06

* (WYDOT, 2007a)

[1] No Truck Accidents; Accident rate calculated from all vehicles

[2] Generic Accident Rate (Harwood and Russell, 1990)

[3] NA = No Data

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3.3 Soils

NUREG-1748 suggests a single section in the Environmental Report to include information on both soils and geology. However, for ISR operations, the data requirements and environmental concerns for soils and geology differ significantly. In particular, specific soil data are needed to support the proposed topsoil protection practices, surface reclamation, and vegetation reestablishment, while geology data is needed to understand the distribution of the ore reserve. Therefore, the topics of soil and geology are separated in this Environmental Report.

3.3.1 Soil Characteristics

The soils within the Permit Area are typical of the semiarid areas of the western US. Most of the soil has developed from the sedimentary bedrock of the Permit 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. The soils in the Permit Area tend to have low organic matter.

3.3.1.1 Soil Mapping Unit (SMU) Interpretation

The vertical relief of the Permit Area is approximately 260 feet with an average gradient of 1.5 percent. Due to the relative lack of relief and uniform surficial geology, there are only three exposed soil types within the Permit 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, the soil texture is the only difference in the three SMU names.

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

Plate 3.3-1 shows the distribution of the three soil units identified in the Permit Area and their characteristics are described below.

Thirty-four percent of the Permit Area (1,435 acres) is Typic Torriorthent, loamy, mixed, mesic. The soil is brown to yellowish-brown, and is typically five to 15 inches thick. It generally occurs on the lower foot-slopes, where slopes are less than ten percent but 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 30 inches.

Forty-six percent of the Permit Area (1,941 acres) is Typic Torriorthent, fine loamy, mixed, mesic. This soil is abundant in the down-slope areas of the Permit Area, where slopes are very gradual. The dominant vegetation is sagebrush, with scattered grasses and cactuses. The geomorphic surface consists of bare, fine sandy loam. The upper profile contains a dark grayish-brown silt loam to loam that is about nine inches thick. The subsoil is dark yellowish-brown to light yellowish-brown, and extends to a depth of at least 27 inches.

Twenty percent of the Permit Area (844 acres) is Typic Torriorthent, fine loamy over sandy, mixed, mesic. 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 15 inches thick. The subsoil is a brown to a light yellowish-brown sandy loam that extends to a depth greater than 20 inches.

3.3.1.2 Topsoil Suitability

Based on WDEQ-LQD Guideline No. 1, Topsoil Suitability, Table I-2 (1994), all of the Lost Creek samples were within the range for suitable plant growth media for pH, conductivity, sodium adsorption ratio (SAR), texture, selenium, and boron.

Of the 28 Permit Area samples, 11 were classified as marginally suitable for topsoil because of low saturation percentages. The measured saturation percentages of these marginally suitable soils ranged from 16 to 24 percent. These 11 samples were from seven different profiles, and represented all SMUs present in the Permit Area.

One sample from the Permit Area was considered unsuitable for topsoil; because the percentage of coarse fragment was 39 percent compared to a 35-percent threshold for unsuitable soil. This sample represented the B horizon of a soil profile in SMU #3. Therefore, only the top 11 inches of this SMU should be used as reclamation topsoil. One sample is considered marginally suitable due to an over 8.5 pH value. During reclamation, the use of marginal soils as topsoil will be avoided where possible, except in areas where the undisturbed topsoil is marginally suitable.

3.3.2 Geotechnical Investigations

A preliminary geotechnical evaluation of the Permit Area was completed in September 2007. The evaluation found that the subsurface conditions consist of unconsolidated sand with clay lenses from ground surface to depths of up to 20 feet below ground surface (ft bgs), transitioning to weathered to competent sandstone bedrock of the Battle Spring Formation through at least 600 ft bgs. It is unlikely that expansive, soft, or otherwise unsuitable soils will be encountered within the depth of anticipated shallow foundation excavations.

A full geotechnical engineering report will be performed prior to construction. This report will include engineering analyses on the representative site soils to determine the bearing capacity and potential settlement. The report will be used to determine the foundation type, depth, and allowable bearing capacity as well as provide guidance on preparation, earthwork, and cement type.

3.3.3 Historical Surface Disturbances

There was surface disturbance prior to LC ISR, LLC operations within the Permit Area. Most of this disturbance was due to historical exploration activities for oil and gas, as well as for uranium, and to support livestock and wildlife grazing. The primary activities included vehicle traffic, drilling activities, and stock tank usage. Approximately 26 miles of existing roads were delineated from the 2002 aerial photo of the Permit Area (**Figure 3.3-1**). Field measurements in 2007 indicate that the roads range from 6.9 to 9.4 feet wide. A few of these roads may still be used by grazing lessees, hunters, and for on-going exploration activities. Evidence of abandoned drill sites and stock tanks is more difficult to delineate; but numerous small areas are evident on the aerial photograph.

The roads caused compaction to the soil, which limits infiltration rates and decreases the vegetation regrowth (**Figure 3.3-2**). Active road surfaces have little to no organic matter, and most of the topsoil has been eroded from the road surface.

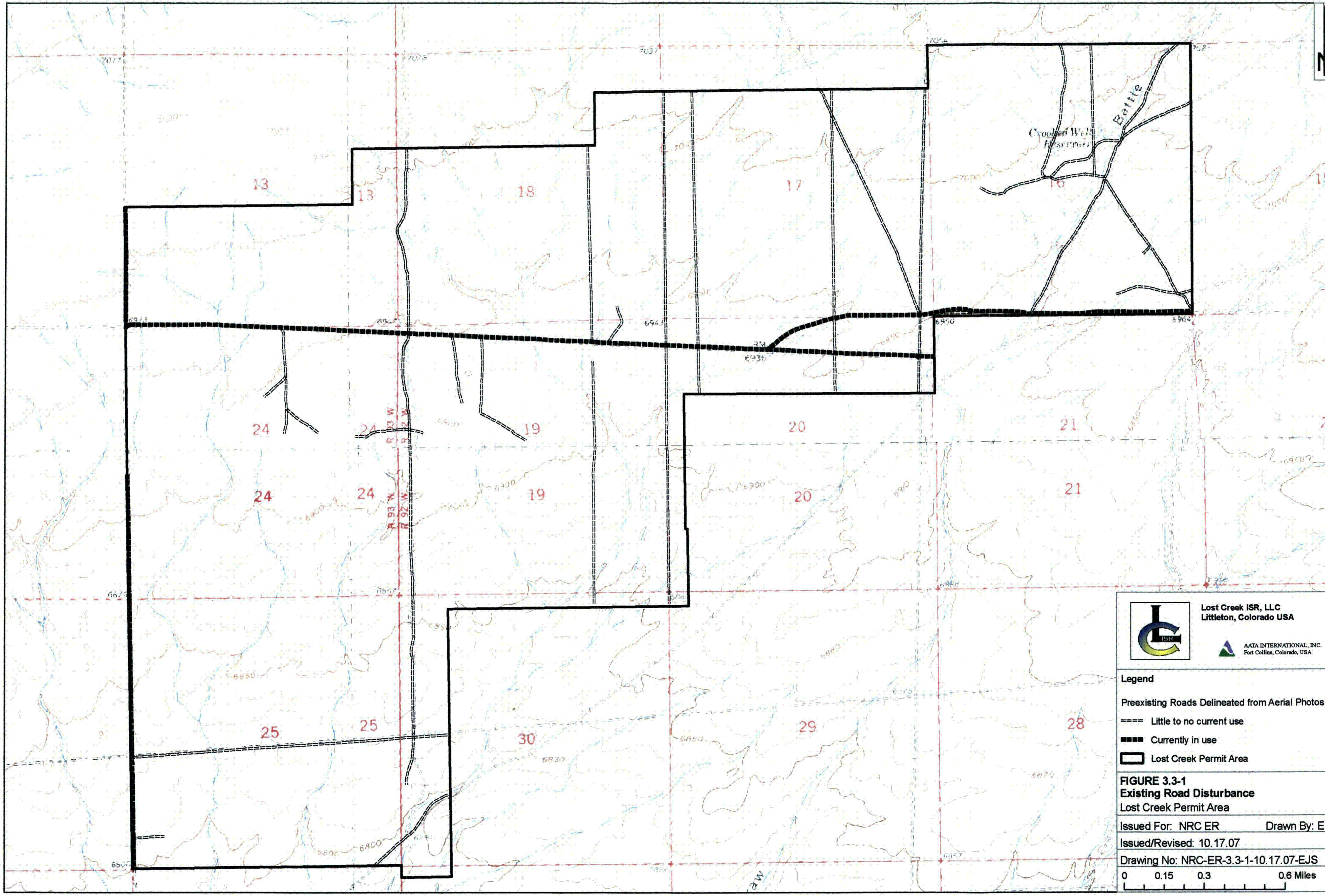
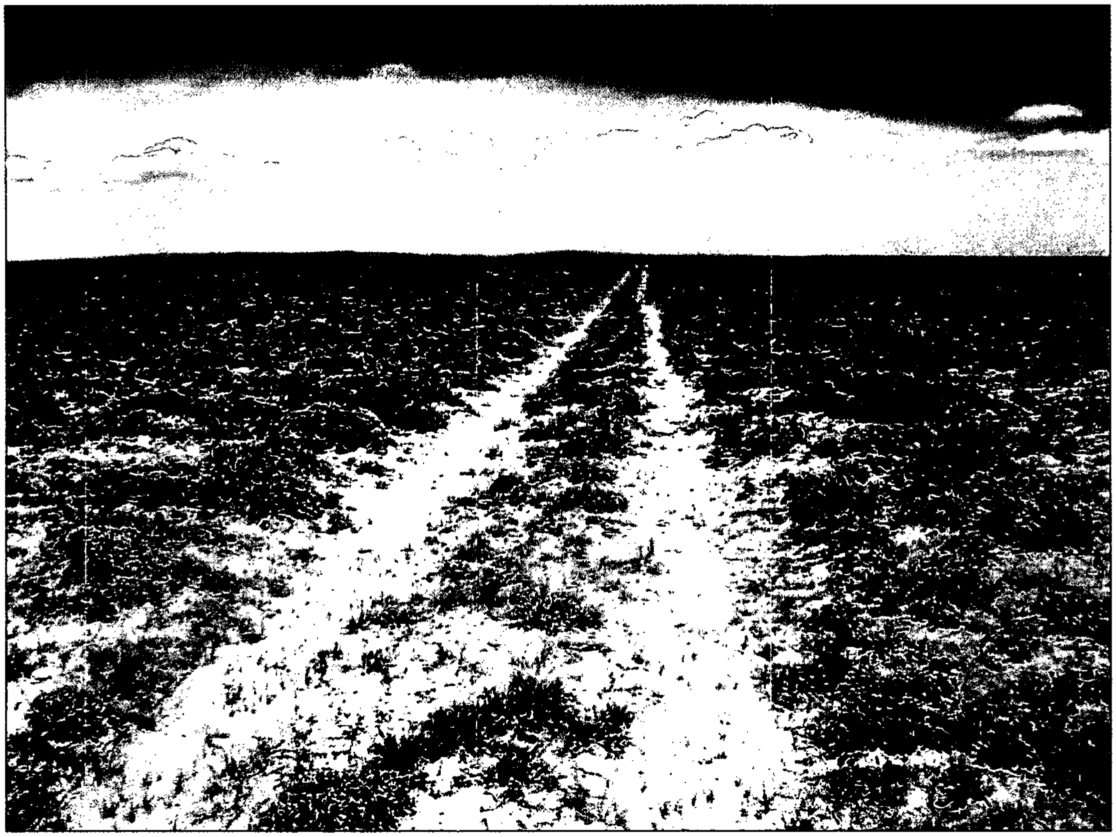


FIGURE 3.3-1
Existing Road Disturbance
Lost Creek Permit Area

FIGURE 3.3-2 Typical Two-Track Road within the Permit Area



July 2007

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
"PLATE 3.3-1
SOIL SURVEY MAPPING UNITS
Lost Creek Permit Area"
DRAWING NO. NRC-ER-3.3-1-10. 16.07-EJS

WITHIN THIS PACKAGE... OR BY SEARCHING USING THE DOCUMENT/REPORT NO.

D-02

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3.4 Geology

3.4.1 Regional Geology

The Great Divide Basin (Basin) is an oval-shaped structural depression, encompassing some 3,500 square miles in south-central Wyoming. The Basin is bounded on the north by the Wind River Range 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. The regional geologic map is shown in **Figure 3.4-1**. Geologic development of the Basin began in the Late Cretaceous and continued through much of the Early Eocene.

3.4.1.1 Stratigraphy

The earliest sedimentation in the Basin was the Paleocene (Early Tertiary) Fort Union Formation, which was unconformably deposited on the Lance Formation of Late Cretaceous age. The Fort Union Formation consists mostly of lacustrine shales, siltstones, and thin sandstones, which locally contain lignite beds. The thickness of the Fort Union Formation varies from place to place in the Basin, and it is approximately 4,650 feet thick in the Permit Area.

The Fort Union Formation is unconformably overlain by sediments of Eocene age, making up about 6,200 feet of basin fill. The western and southern portions of the Basin are covered by the Wasatch Group, which consists of sandstone, siltstone, limestone, conglomerate and lignite beds. The rocks in the Wasatch Group are believed to be of fluvial-lacustrine origin. Towards the north and northeast, the Wasatch Group rapidly grades into and inter-tongues with the equally thick, fine- to coarse-grained arkosic sandstones and conglomerates of the Battle Spring Formation, a typical alluvial fan complex. The source of the Battle Spring sediments is believed to be the ancestral Granite Mountains to the north. Pliocene pediment deposits and recent alluvium cover large areas of the surface in the Basin. **Table 3.4-1** and **Figure 3.4-2a** show the general stratigraphy of the Basin.

The upper portion of the Battle Spring Formation is the host to the uranium mineralization in the Permit Area. In the Permit Area, the top 700 feet of the Battle Spring Formation is divided into at least five horizons marked from top to bottom as BC, DE, FG, HJ, and KM. These horizons are separated from one another by various thicknesses of shale, mudstone and siltstone **(Figure 3.4-2b)**.

3.4.1.2 Structure

The present physiographic feature of the Basin was generated by the Laramide Orogeny. During the Late Cretaceous and Early Tertiary, the structures surrounding the Basin were either rejuvenated or were formed, transforming the area into a bowl-shaped geological structure, the Basin. During this upheaval, the Wind River Mountains and Granite Mountains were uplifted on the north side of the Basin. The Rawlins Uplift formed to the east; the Wamsutter Arch formed to the south; and the Rock Spring Uplift formed to the west. All of these highs formed a ring around the Basin, turning the Basin into a bowl-like structure with drainage being inward. The Continental Divide, extending from the south, splits into two and forms half circles on the east and west sides of the Basin, joining again as one topographic high on the north side of the Basin.

The Basin is asymmetrical with its major axis trending west-northwest. Several anticlines and synclines have been mapped within the Basin, and some of these features are oil-bearing (at much deeper levels than the uranium-bearing formations). Noteworthy among these structures is the Lost Soldier anticline in the northeastern part of the Basin, approximately 15 miles northeast of the Permit Area. The Battle Spring and Fort Union Formations, as well as older rocks crop out in the anticline; and the formations on the southwestern flank of the anticline dip 20 to 25 degrees to the southwest. The dip gradually becomes gentler, and, at the Permit Area, it is merely three degrees to the west.

Contemporaneous with the uplift of the mountains surrounding the Basin, there were episodes of normal and thrust faulting within and around the Basin. Most of the major faults are located in the northern part of the Basin, with displacement ranging from a few feet to over 3,000 feet. But, toward the center of the Basin near the Permit Area, faulting seems to be only on a minor scale. For example the displacement at the Lost Creek Fault (Fault) which traverses the mineralized area from west-southwest to east-northeast is zero to about 80 feet. More details about the Fault are given in **Section 3.4.2.2**.

3.4.2 Site Geology

The Permit Area is located near the north-central part of the Basin, where the Basin fills are predominantly the Eocene Battle Spring Formation and the Paleocene Fort Union Formation. Geological cross sections throughout the Permit Area are presented in **Plates 3.4-1a, b, c, d,** and **e**. **Attachment 3.4-1** contains copies of typical geophysical logs from the Permit Area.

3.4.2.1 Stratigraphy

The entire Permit Area is covered by the upper part of the Battle Spring Formation, which is the host to uranium mineralization. Generally, in the Basin, Battle Spring and Wasatch Formations, which are time equivalent, interfinger with one another. In the Permit Area, the upper half of the lithologic units consists of Battle Spring Formation and the lower half is made up of Wasatch Formation. The total thickness of the Battle Spring and Wasatch Formations under the Permit Area is about 6,200 feet. The Fort Union Formation, is 4,650 feet thick beneath the Permit 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 (**Table 3.4-1**). A schematic geologic cross section across the Permit Area is shown in **Figure 3.4-2a**, depicting all lithologic units present under the Permit Area.

The Battle Spring Formation in the Permit 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. At least five horizons with various amounts of mineralization have been identified. From the surface down, they have been named: BC, DE, FG, HJ, and KM. The two horizons with the most mineralization are HJ and KM, which have been further divided into upper, middle and lower sub-units of sandstones (UHJ Sand, MHJ Sand, and LHJ Sand; and UKM Sand, MKM Sand, and LKM Sand). Geological cross sections through the mineralized zones in the Permit Area are presented in **Plates 3.4-1a, b, c, d,** and **e**. 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 3.4-2a, b, c,** and **d**.

The HJ Horizon is 110 to 130 feet thick, averaging about 120 feet. The thinner part of HJ is generally south of the Fault. A thicker part of the HJ Horizon runs parallel to the Fault, trending in a west-southwest to east-northeasterly direction. 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 mudstones.

The UKM Sand lies under the Sage Brush Shale and is 20 to more than 60 feet thick, averaging about 40 feet. In the eastern part of the Permit Area, the unit is 20 to 50 feet thick; whereas the sand unit in the western portion of the permit area is 40 to more than 60 feet thick, indicating the development of a major paleo-channel. The mineralization occurs as both roll front and tabular deposits.

3.4.2.2 Structure

The geologic structure in the Permit Area is rather simple, as shown in **Plates 3.4-1a**, **b**, **c**, **d**, and **e**. The Battle Spring Formation dips gently to the west at three degrees and only one fault (i.e., the Fault) was recognized in the mineralized area. The Fault is a "scissor fault" that extends the length of the Permit Area from the west-southwest to the east-northeast. The maximum displacement at the west end of the Permit Area is around 45 feet, dropping down to the north; whereas the displacement on the east side of the Permit Area is about 80 feet with the down-dropped side to the south, creating the scissor fault. Near the middle of the Permit Area, the displacement is practically zero.

3.4.2.3 Ore Mineralogy and Geochemistry

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 surface 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.

Tabular deposits may form at the interface between oxidizing and reducing conditions (the redox front), where oxidation, for all practical purposes, stops. Localized tabular deposits may also form up-dip from the redox front in an entirely oxidized zone, where carbonaceous materials have gathered and formed locally reducing conditions.

The C-shaped roll-front deposits normally form just at the redox front, where the water loses its oxidizing potential. The uranium precipitates and accumulates in a "C"-shaped deposit, with the concave side facing up-dip toward the oxidized sand. Uranium usually accumulates in finer-grained sandstones that carry various amounts of organic matter, which provides a reducing condition.

The alteration process not only changes the color, but also alters the mineralogy of the host sandstones. The color of unaltered, reduced sandstone is light to dark grey, with carbon trash, dark accessories, and traces of pyrite. Altered, oxidized, sandstone contains iron oxide staining (where former carbonaceous matter and pyrite were present), kaolinized feldspar, and has a pink to tan-buff, greenish-grey to bleached appearance. 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.

The main uranium minerals are uraninite, a uranium oxide, and coffinite, a uranium silicate. Russell Honea (1979) and John V. Heyse (1979) studied several core samples by scanning electron microprobe (SEM), polished section and thin section. Their conclusions were that the host sands are fine- to coarse-grained, poorly sorted arkose. The uranium mineralization is of sub-microscopic size and can be seen only in SEM magnification. They are associated and at times intergrown with round pyrite particles. The uranium minerals identified are mostly uraninite and, possibly, coffinite. The uranium, besides occurring with pyrite, also occurs as a coating around sand grains and as filling of voids between grains. It also occurs as minute particles within larger clay particles.

The most recent study of the lithology and mineralogy was conducted by Hazen Research under the guidance of Dr. Nick Ferris, Ur-E geologist (Ferris, 2007, company report). He concluded that the rocks, represented by a core sample from a depth of 506 to 507 feet of Hole Number LC-64C, are medium- to coarse-grained with interstitial clay and silt. Uranium occurrences are very fine-grained and micron-sized, and are mainly dispersed throughout some of the interstitial clays, and occur similarly in some of the interstitial pyrite as well. Because of the size of uranium mineral particles, it was not certain whether the uranium mineral was coffinite or uraninite. The sample tested, comes from the Upper KM Sand unit and may or may not be representative of the majority of the mineralization in the overlying HJ Horizon within the Permit Area.

Known mineralized intervals are found at depths ranging from near surface down to 1,150 feet below the surface in the Permit Area. It is possible that deeper mineralization may exist as well. The main mineralization horizons trend in an east-northeast direction for at least three miles, and are up to 2,000 feet wide. The thickness of individual mineralized beds at the Permit Area ranges from five to 28 feet and averages about 16 feet. The mineralization grade ranges from 0.03 percent to more than 0.20 percent equivalent uranium oxide (eU_3O_8). Four main mineralized horizons, from depths of 300 to 700 feet, have been identified. The richest mineralized zone occurs in the middle part of the HJ Horizon (MHJ Sand) and it is about 30 feet thick, 400 to 450 feet deep, and is believed to contain more than 50 percent of the total resource under the Permit Area.

3.4.2.4 Historic Uranium Exploration Activities

Historic exploration activities in the Permit Area can be summarized as follows:

- Pre-1976: Numerous companies held the property; uranium mineralization was discovered by Climax Uranium and Conoco.
- 1976: Texasgulf optioned property from Valley Development Inc.

- 1977 through 1979: Texasgulf optioned property from Valley Development Inc., delineated the main trend of the mineralization, obtained a 50-percent interest in the Conoco claims on the trend to the east, and exercised its option with Valley Development Inc.
- 1986: Power Nuclear Corporation acquired the properties.
- 2000: Power Nuclear Corporation sold its Lost Creek properties to New Frontiers Uranium, LLC.
- 2005: New Frontiers Uranium, LLC transferred its Wyoming properties and data including its Lost Creek property to NFU Wyoming, LLC. (NFU).
- 2005: Ur-Energy USA, Inc. purchased NFU from New Frontiers Uranium, LLC on terms.
- 2007: Ur-Energy USA, Inc. completes the acquisition of NFU from NFU, LLC, and maintains NFU as a wholly owned subsidiary.
- 2007: Ur-Energy USA, Inc. forms LC ISR, LLC to develop the Lost Creek property into an ISR facility and transfers the Lost Creek property from NFU to LC ISR, LLC.

At least 560 uranium exploration holes had been drilled in Permit Area prior to 2000. The plates and table in **Attachment 3.4-2** present the locations and total depths of all the known historic exploration holes drilled in the Permit Area.

Historic and current uranium explorations exist in other areas of the Basin. Historic and current oil and gas exploration drilling are also in the region. There are no current oil and gas activities within the Basin that are completed in the same horizons as those discussed for ISR production in this application. The nearest significant gas fields are approximately ten miles to the southwest; therefore, no interference is anticipated between oil and gas production activities and ISR activities. There is no exploration of coal bed methane or other mineral resources within the Permit Area and the nearby region.

3.4.3 Seismology

The discussion of the seismology of the Permit Area and surrounding areas includes: an analysis of historic seismicity; an analysis of the Uniform Building Code (UBC); a deterministic analysis of nearby faults; an analysis of the maximum credible "floating earthquake;" and a discussion of the existing short- and long-term probabilistic seismic hazard analysis. The materials presented here are mainly based on the seismologic characterization of Sweetwater, Carbon, Fremont, and Natrona Counties by James C. Case and others from the Wyoming State Geological Survey (Case, et. al., 2002a, 2002b, 2002c and 2003).

3.4.3.1 Historic Seismicity

The Permit Area is located in the north-eastern portion of the Basin, in south-central Wyoming. Historically, south-central Wyoming has had a low to moderate level of seismicity compared to the rest of the State of Wyoming. As shown in **Figure 3.4-3**, most of the historical earthquakes occurred in the west-northwest portion of Wyoming. Significant historical earthquakes adjacent to the Permit Area are described below, and are organized by areas in which they occurred.

Town of Bairoil Area

Bairoil is located about 15 miles northeast of the Permit Area. Historically, there have been only a few earthquakes that have occurred within 20 miles of Bairoil. On August 11, 1916, a non-damaging intensity III earthquake occurred approximately 17 miles northwest of Bairoil. On June 1, 1993, a non-damaging magnitude 3.8, intensity III earthquake occurred four miles north of Bairoil, and was felt by some residents. On December 10, 1996, a non-damaging magnitude 2.6 earthquake occurred approximately ten miles northwest of Bairoil. A few residents also felt that event.

Two recent earthquakes were recorded near Bairoil in 2000. On May 26, 2000, a magnitude 4.0 earthquake occurred, followed by another (magnitude 2.8) four days later, on May 30, 2000. Both earthquakes were located about 3.5 miles southwest of Bairoil. Most residents in Bairoil felt the first earthquake. No significant damage was associated with either seismic event (Cook, 2000).

City of Rawlins Area

Rawlins is approximately 38 miles southeast of the Permit Area. The first recorded earthquake that was felt and reported immediately southwest of Rawlins occurred on March 28, 1896. The intensity IV earthquake shook for about two seconds. On March 10, 1917, an earthquake (intensity IV) was recorded approximately one mile northeast of Rawlins. The earthquake was felt as a distinct shock that caused wooden buildings to noticeably vibrate. Stone buildings were not affected by the event (Rawlins Republican, 1917).

On September 10, 1964, a magnitude 4.1 earthquake occurred approximately thirty miles west of Rawlins. One Rawlins resident reported that the earthquake caused a crack in the basement of his home in Happy Hollow. No other damage was reported (Daily Times, 1964).

Small earthquakes were detected, on April 13, 1973, May 30, 1973, and June 1, 1973, approximately six miles west of Hanna. No one reported feeling this event. On July 11, 1975, Rawlins residents felt an earthquake (intensity II) event. On January 27, 1976, an earthquake (magnitude 2.3, intensity V) occurred approximately 12 miles north of Rawlins. Several people reported that they were thrown out of bed (Daily Times, 1976). On March 3, 1977, an earthquake (intensity V) was reported approximately 18.5 miles west-northwest of Encampment. Doors and dishes were rattled in southern Carbon County homes; but no significant damage was reported (Laramie Daily Boomerang, 1977).

On April 13, 1991 and April 19, 1991, magnitude 3.2 and magnitude 2.9 earthquakes, respectively, occurred near the center of the Seminoe Reservoir. A magnitude 3.1 earthquake occurred, on December 18, 1991, southwest of the Seminoe Reservoir, approximately 15 miles northeast of Sinclair. No one reported feeling these Seminoe-Reservoir-area earthquakes. On August 6, 1998, a magnitude 3.6 earthquake occurred approximately 13 miles north of Rawlins. Residents in Rawlins reported hearing a sound and then feeling a jolt. On April, 1999, a magnitude 4.3 earthquake occurred approximately 29 miles north-northwest of Baggs. It was felt in Rawlins; and residents reported that pictures fell off the walls.

City of Rock Springs Area

Rock Springs is located approximately 80 miles southwest of the Permit Area. The first recorded earthquake that was felt in Sweetwater County occurred on April 28, 1888. This intensity IV earthquake, which originated near Rock Springs, did not cause any appreciable damage. On July 25, 1910, an intensity V earthquake occurred at the same time that the Union Pacific Number One Mine in Rock Springs partially collapsed. On July 28, 1930, an intensity IV earthquake, with an epicenter near Rock Springs, was felt in Rock Springs and Reliance (Casper Daily Tribune, 1930). The earthquake awakened many residents; and some merchandise fell off of store shelves.

On March 21, 1942, a non-damaging, intensity III earthquake was felt in Rock Springs area. This event was followed, on September 14, 1946, by an intensity IV earthquake. On October 25, 1947, a small earthquake with no assigned intensity or magnitude occurred southeast of Rock Springs. Two intensity IV earthquakes occurred in the Rock Springs area on September 24, 1948. The events rattled dishes in parts of Rock Springs.

A magnitude 3.9 event was recorded on January 5, 1964, approximately 23 miles south of Rock Springs. The University of Utah Seismograph Stations detected a non-damaging, magnitude 2.4 earthquake on March 19, 1968. This event was centered approximately 17 miles southeast of Rock Springs. A magnitude 3.2 event occurred on May 29, 1975, approximately 13 miles northeast of Superior. A week later, on June 6, 1975, a magnitude 3.7 earthquake was recorded in the same area. No damage was associated with any of the 1975 events.

The University of Utah Seismograph Stations recorded a non-damaging magnitude 2.7 earthquake on June 5, 1986. This event was located approximately 14 miles southwest of Green River, Wyoming.

On February 1, 1992, the University of Utah Seismograph Stations recorded a non-damaging magnitude 2.3 earthquake, approximately seven miles north of Rock Springs.

City of Lander Area

Lander is about 70 miles northwest of the Permit Area. A number of earthquakes have occurred in the Lander area. The first reported earthquake occurred on January 22, 1889, and had an intensity of III to IV. This was followed by an intensity IV event on November 21, 1895, during which houses were jarred and dishes rattled. On November 23, 1934, an intensity V earthquake was centered approximately 20 miles northwest of Lander. For a radius of ten miles around Lander, residents reported that dishes were thrown from cupboards, and that pictures fell down from the walls. Cracks were found in buildings along two business blocks; and the brick chimney of the Fremont County Courthouse was separated by two inches from the building. The earthquake was felt at Rock Springs and Green River, Wyoming (Casper Tribune-Herald, 1934).

There were a series of earthquakes in the Lander area in the 1950s that caused little damage. On August 17, 1950, there was an intensity IV earthquake that caused loose objects to rattle and buildings to creak. On January 12, 1954, there was an intensity II event; and on December 13, 1955, there was an intensity IV event near Lander, with no damage reported.

On June 14, 1973, a small earthquake was reported about eight miles east-northeast of Lander. The earthquake has been recently interpreted as a probable explosion. On January 31, 1992, a non-damaging magnitude 2.8 earthquake occurred approximately 20 miles northwest of Lander. This event was followed, on October 10, 1992, by a magnitude 4.0, intensity III earthquake centered approximately 22 miles east Lander.

City of Casper Area

Casper is located about 90 miles northeast of the Permit Area. Two of the earliest recorded earthquakes in Wyoming occurred near Casper. The first was on June 25, 1894, and had an estimated intensity of V. In residences on Casper Mountain, dishes rattled and fell on the floor and people were thrown from their beds. Water in the Platte River changed from fairly clear to reddish, and became thick with mud, due to the river banks slumping into the river during the earthquake. On November 14, 1897, an even larger event was felt. An intensity VI to VII earthquake, one of the largest recorded in central and eastern Wyoming, caused considerable damage to a few buildings. As a result of the earthquake, a portion of the Grand Central Hotel was cracked from the first to the third story. Some of the ceilings in the Grand Central Hotel were also severely damaged.

On October 25, 1922, an intensity IV earthquake was reported in the Casper area. The event was felt in Casper; at Salt Creek, 50 miles north of Casper; and at Bucknum, 22 miles west of Casper. Dishes were rattled and hanging pictures were tilted near Salt Creek. No significant damage was reported in Casper (Casper Daily Tribune, 1922). On December 11, 1942, an intensity IV earthquake was recorded north of Casper. Although no damage was reported, the event was felt in Casper, Salt Creek, and Glenrock (Casper Tribune-Herald, 1941). On August 2, 1948, another intensity IV earthquake was reported in the Casper area. No damage was reported (Casper Tribune-Herald, 1948). In the 1950s, two earthquakes caused some concern among Casper residents. On January 24, 1954, an intensity IV earthquake near Alcova did not result in any reported damage (Casper Tribune-Herald, 1954). On August 19, 1959, an intensity IV earthquake was felt in Casper. Most recently, on October 19, 1996, a magnitude 4.2 earthquake was recorded approximately 15 miles north-northeast of Casper. No damage was reported.

3.4.3.2 Uniform Building Code

With safety in mind, the UBC provides Seismic Zone Maps to help identify which building design factors are critical to specific areas of the country. Five UBC seismic zones are recognized, ranging from Zone 0 to Zone 4. These seismic zones are, in part, defined by the probability of having a certain level of ground shaking (horizontal acceleration) in 50 years. The criteria used for defining boundaries on the Seismic Zone Map were established by the Seismology Committee of the Structural Engineers Association of California (SEAOC, 1986). The criteria they developed are as follows:

- Zone 4: ≥ 30 percent gravity (g) effective peak acceleration;
- Zone 3: 20 to ≤ 30 percent g effective peak acceleration;
- Zone 2: 10 to ≤ 20 percent g effective peak acceleration;
- Zone 1: 5 to ≤ 10 percent g effective peak acceleration; and
- Zone 0: ≤ 5 percent g effective peak acceleration.

The Seismology Committee of the Structural Engineers Association of California assumed that there was a 90 percent probability that the above values would not be exceeded in 50 years, or a 100 percent probability that the values would be exceeded in 475 years.

Figure 3.4-4 shows the delineation of UBC seismic zones in Wyoming. The Permit Area is located in Seismic Zone 1. Since effective peak accelerations (90 percent chance of and eastern Wyoming, caused considerable damage to a few buildings. As a result of the earthquake, a portion of the Grand Central Hotel was cracked from the first to the third story. Some of the ceilings in the Grand Central Hotel were also severely damaged.

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3.4.3.2 UBC

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- Zone 4: ≥ 30 percent gravity (g) effective peak acceleration;
- Zone 3: 20 to ≤ 30 percent g effective peak acceleration;
- Zone 2: 10 to ≤ 20 percent g effective peak acceleration;
- Zone 1: 5 to ≤ 10 percent g effective peak acceleration; and
- Zone 0: ≤ 5 percent g effective peak acceleration.

The Seismology Committee of the Structural Engineers Association of California assumed that there was a 90 percent probability that the above values would not be exceeded in 50 years, or a 100 percent probability that the values would be exceeded in 475 years.

Figure 3.4-4 shows the delineation of UBC seismic zones in Wyoming. The Permit Area is located in Seismic Zone 1. Since effective peak accelerations (90 percent chance of non-exceedance in 50 years) can range from five to ten percent g in Zone 1, it may be reasonable to assume that an average peak acceleration of 7.5 percent g could be applied to the design of a non-critical facility located near the center of Zone 1.

3.4.3.3 Deterministic Analysis of Active Fault Systems

There are two active fault systems in the vicinity of the Permit Area, the Chicken Springs Fault System and the South Granite Mountain Fault System (**Figure 3.4-5**).

The Chicken Springs Fault System, located six miles east of the Permit Area, is composed of a series of east-west trending segments. In 1996, the Wyoming State Geological Survey investigated this fault system, and determined that the most recent activity on the system appears to be Holocene in age. Reconnaissance-level studies indicated that the fault system is capable of generating a magnitude 6.5 earthquake (Case, et al., 2002a). A magnitude 6.5 earthquake on the Chicken Springs Fault System would generate peak horizontal accelerations of approximately 4.8 percent g at Rawlins (Case, et al., 2002a). These accelerations would be roughly equivalent to an intensity V earthquake, which may cause some light damage. Bairoil, however, would be subjected to a peak horizontal acceleration of approximately 23 percent g, or an intensity VII earthquake (Case, et al., 2002a). Intensity VII events have the potential to cause moderate damage.

The South Granite Mountain Fault System is located about 14 miles northeast of the Permit Area. This fault system is composed of several northwest-southeast trending normal and thrust faults in southeastern Fremont County and northwestern Carbon County. The active segments of the system have been assigned a maximum magnitude of 6.75, which could generate peak horizontal accelerations of approximately 20 percent g at Bairoil and 6.1 percent g at the Rawlins (Case, et al., 2002a). These accelerations would be roughly equivalent to an intensity VII earthquake at the Bairoil and an intensity V earthquake at Rawlins. Bairoil could sustain moderate damage; whereas minor or no damage could occur at Rawlins.

3.4.3.4 Maximum Tectonic Province Earthquake "Floating Earthquake" Seismogenic Source

Tectonic provinces are regions with a uniform potential for the occurrence of earthquakes that are tied to buried faults with no surface expression. Within a tectonic province, earthquakes associated with buried faults are assumed to occur randomly, and, as a result, can theoretically occur anywhere within that area of uniform earthquake potential. In reality, that random distribution may not be the case, as most earthquakes are associated with specific faults. If all buried faults have not been identified, however, the distribution has to be considered random. "Floating earthquakes" are earthquakes that are considered to occur randomly in a tectonic province.

The USGS identified tectonic provinces in a report titled "Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States" (Algermissen et al., 1982). In that report, Sweetwater County was classified as being in a tectonic province with a "floating earthquake" maximum magnitude of 6.1. Geomatrix (1988) suggested using a more extensive regional tectonic province, called the "Wyoming Foreland Structural Province," which is approximately defined by the Idaho-Wyoming Thrust Belt on the west, 104 degrees West longitude on the east, 40 degrees North latitude on the south, and 45 degrees North latitude on the north. Geomatrix (1988) estimated that the largest "floating earthquake" in the "Wyoming Foreland Structural Province" would have a magnitude in the 6.0 to 6.5 range, with an average value of magnitude 6.25.

3.4.3.5 Short-Term Probabilistic Seismic Hazard Analysis

The USGS publishes probabilistic acceleration maps for 500-; 1,000-; and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a ten percent probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100 percent probability of exceedance in 500 years.

The 500-year map provides accelerations that are comparable to those derived from the UBC and from the deterministic analysis on the Green Mountain Segment of the South Granite Mountain Fault System. It was often used for planning purposes for average structures. Based on the 500-year map (ten percent probability of exceedance in 50 years), the estimated peak horizontal acceleration in the Permit Area is approximately 6.5 percent g, which is comparable to the acceleration expected in Seismic Zone 1 of the UBC (**Figure 3.4-6**). The estimated acceleration in the Permit Area is 20 percent g on the 2,500 year map.

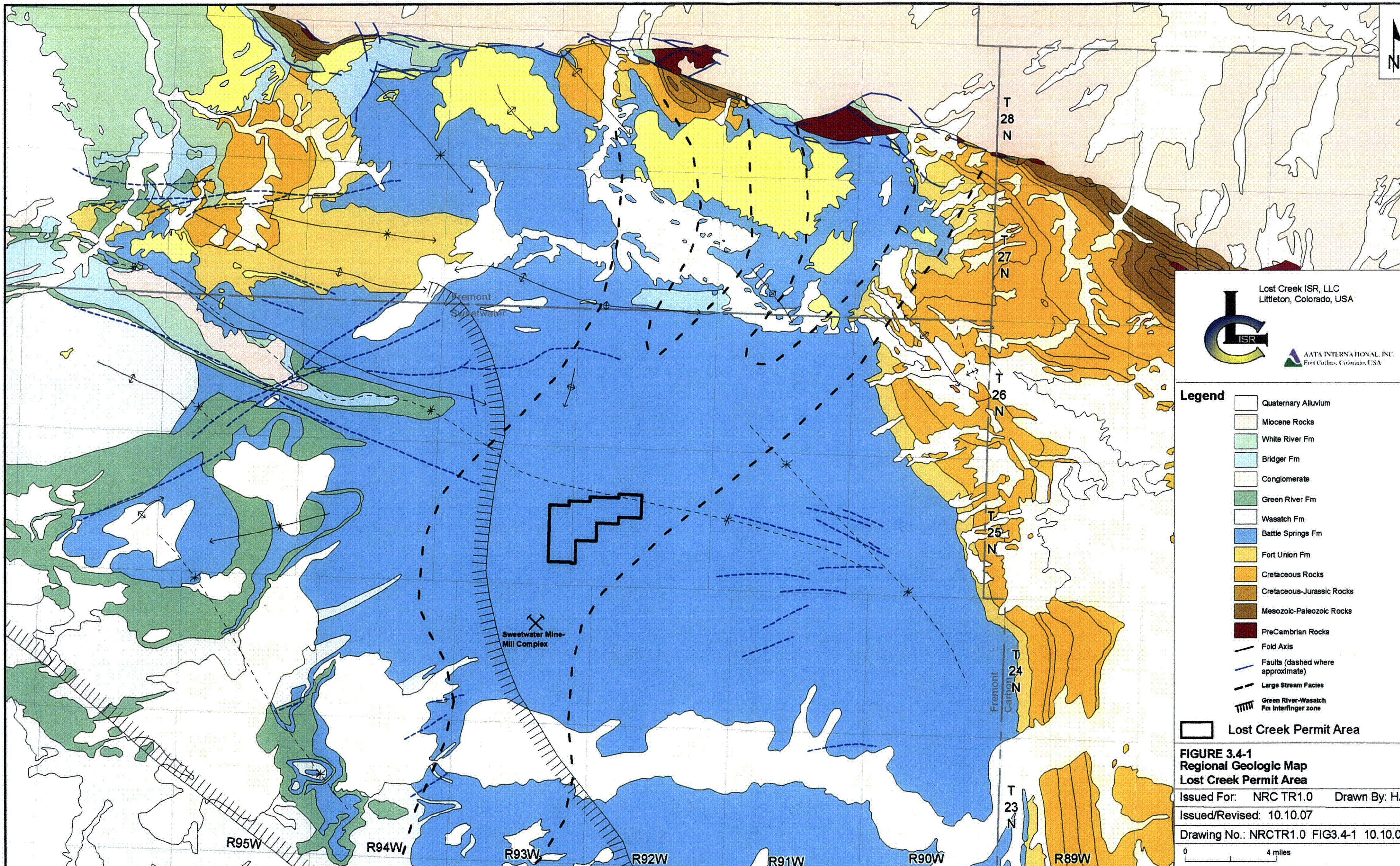
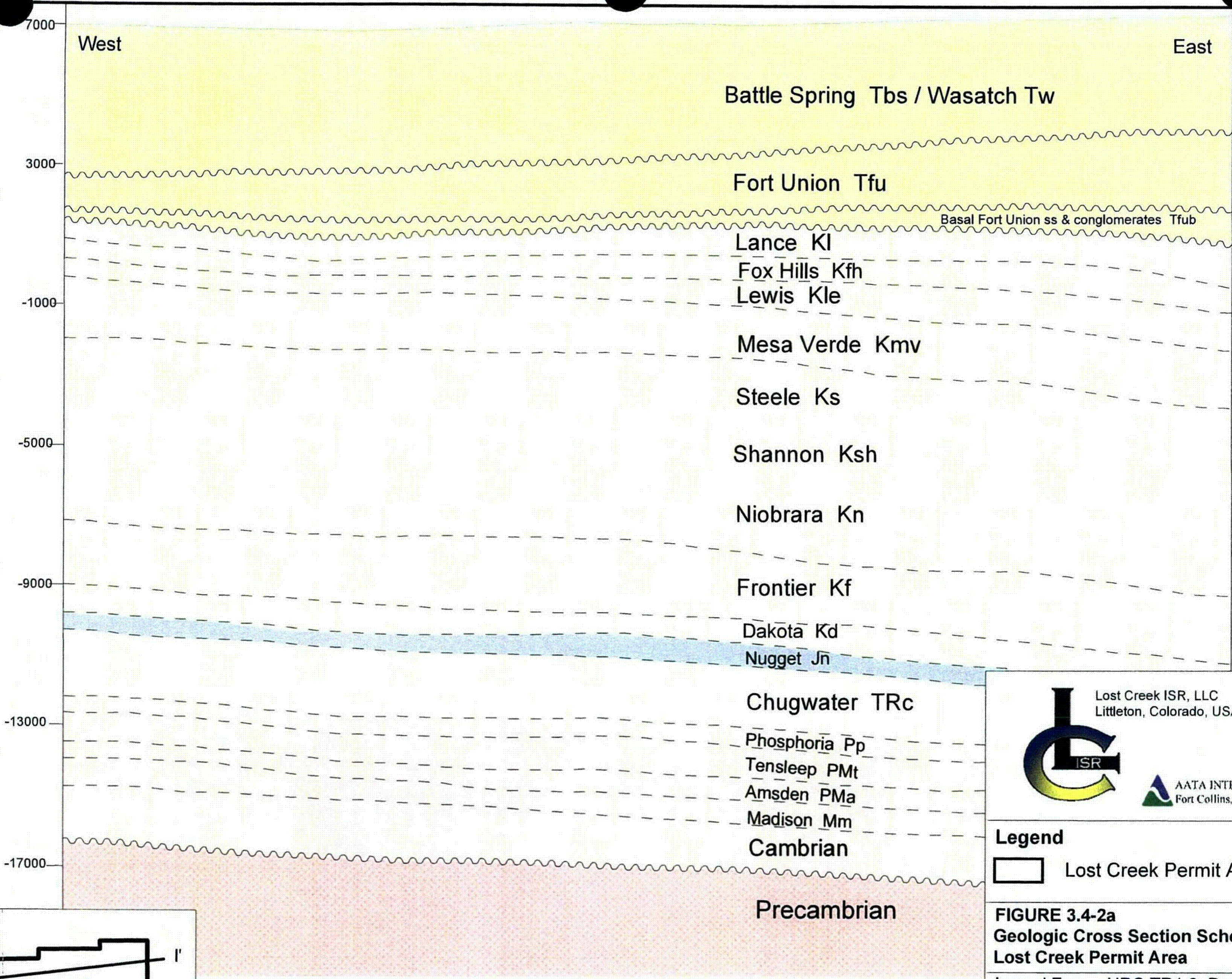
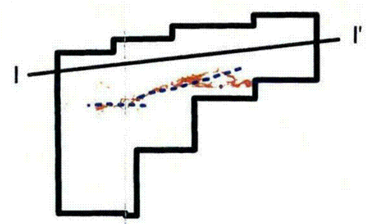


FIGURE 3.4-1
Regional Geologic Map
Lost Creek Permit Area

Issued For: NRC TR1.0 Drawn By: HA
Issued/Revised: 10.10.07
Drawing No.: NRCTR1.0 FIG3.4-1 10.10.07





Based on Cross-Section by R. E. Wellborn, January, 1973.

Lost Creek ISR, LLC
Littleton, Colorado, USA

AATA INTERNATIONAL, INC
Fort Collins, Colorado, USA

Legend

Lost Creek Permit Area

FIGURE 3.4-2a
Geologic Cross Section Schematic
Lost Creek Permit Area

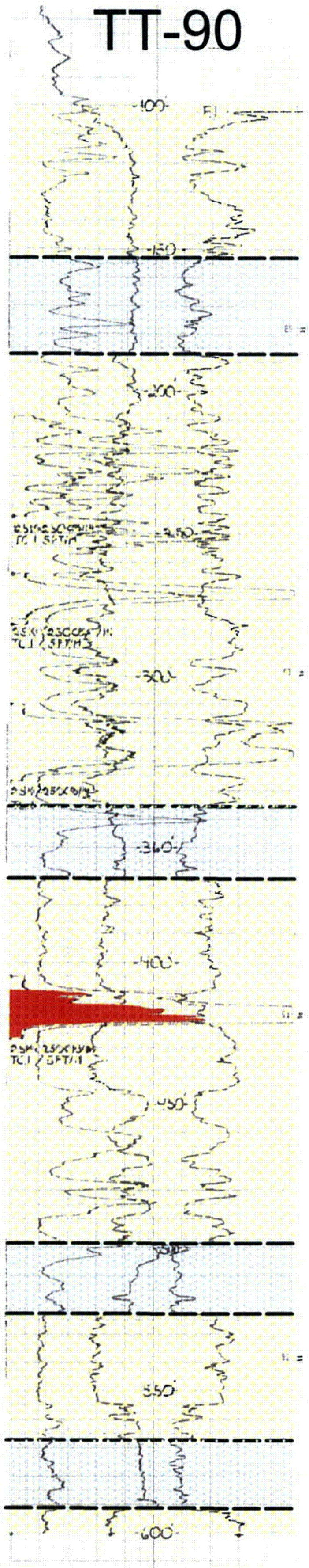
Issued For: NRC TR1.0 Drawn By: HA

Issued/Revised: 10.10.07

Drawing No.: NRCTR1.0 FIG3.4-2a 10.10.07

0 4000 feet

* see Table 2.6-1 for lithologic description of the stratigraphic units



DE Horizon

DE - Alternating very fine-course grain sandstone, mudstone and siltstone. Minor host for uranium mineralization.

Shale

FG Horizon

FG - Lenticular arkosic sandstones with intervals of mudstone and siltstone. Categorized as suspended load facies. Cut and fill channels not as prominent as in HJ Horizon. Minor host for uranium mineralization.

LCS - Lost Creek Shale separating FG Horizon from HJ Horizon; a virtually continuous aquiclude in the Lost Creek Permit Area.

Mineralization

HJ Horizon

HJ - Coarse-grained arkoses with minor matrix. Very thin lenticular intervals of fine sands. Cut and fill channels are prominent. Mixed load facies. Major host to uranium mineralization, especially in middle parts.

SBS - Sagebrush Shale/Mudstone separating HJ Horizon from KM Horizon. Continuous through-out Permit Area.

KM Horizon

KM - Generally massive, coarse-grained sandstone with lenticular fine sand intervals. Mixed load facies. Host to significant uranium mineralization.

NNS - No Name Shale separating KM Horizon

KM Horizon

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Littleton, Colorado, USA

AATA INTERNATIONAL, INC

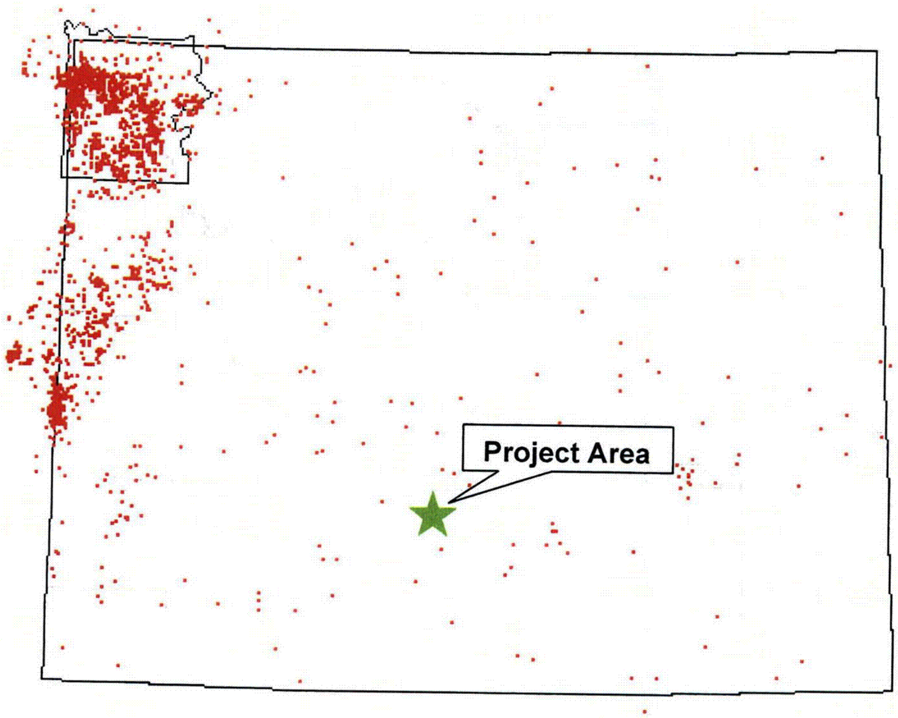
FIGURE 3.4-2b

Stratigraphic Column, Upper Battle Spring Formation

Lost Creek Permit Area

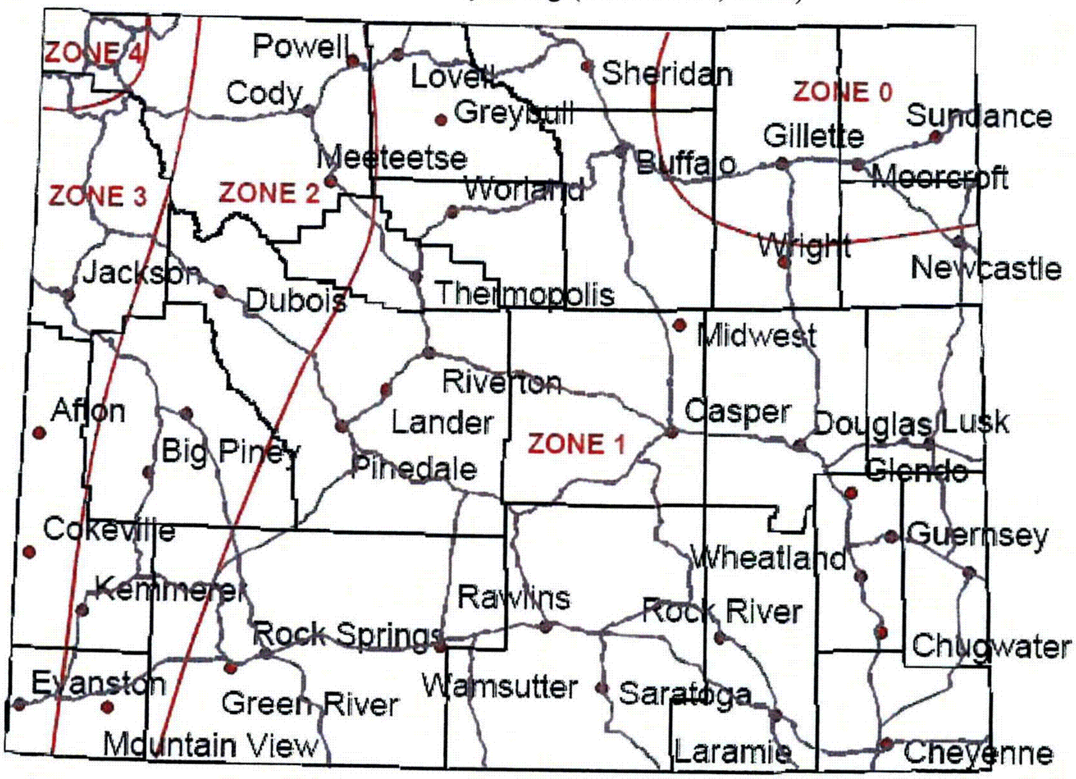
Issued For: NRC ER1.0	Drawn By: HA
Issued/Revised: 10.10.07	
Drawing No.: NRCER1.0 FIG3.4-2b 10.10.07	

Figure 3.4-3 Historical seismic activities in Wyoming*



* Red dots are locations of epicenters for those magnitude = 2.5 or intensity = III earthquakes recorded from 1871 to present. (Bergantion et al., 2007)

Figure 3.4-4 UBC Seismic Zones in Wyoming (Case et. al., 2002)



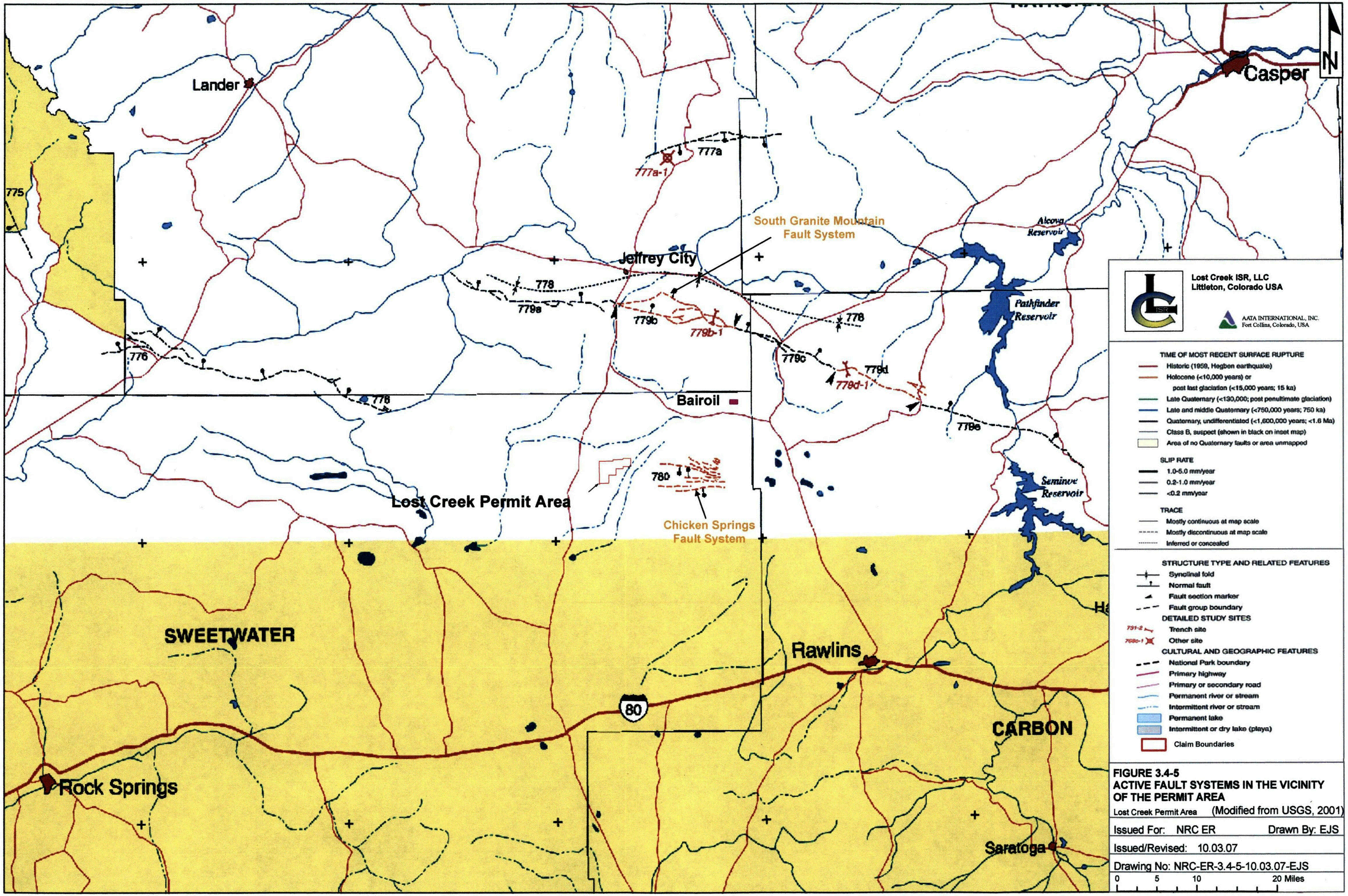


FIGURE 3.4-5
ACTIVE FAULT SYSTEMS IN THE VICINITY OF THE PERMIT AREA

Lost Creek Permit Area (Modified from USGS, 2001)

Issued For: NRC ER Drawn By: EJS

Issued/Revised: 10.03.07

Drawing No: NRC-ER-3.4-5-10.03.07-EJS

Figure 3.4-6. 500-YEAR PROBABLISTIC ACCELERATION MAP OF WYOMING (Case et. al., 2002)

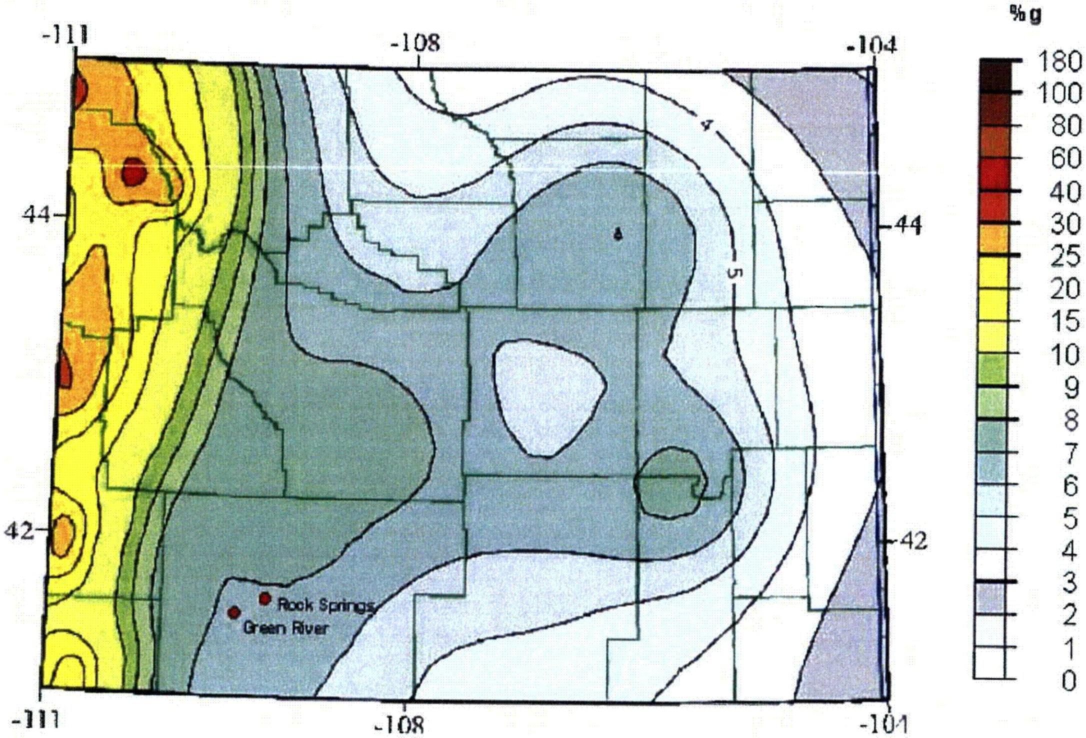


Table 3.4-1 Permit Area Stratigraphy (Page 1 of 3) *

Age	Formation	Thickness [1] (feet)	Aquifer [2]	Lithology
Quaternary	Alluvium (Qa)	0 to 20	Yes	Sands and clays derived chiefly from the Tertiary formations in the area.
Early Eocene	Battle Spring/ Wasatch Formation	6,200	Yes	Battle Spring Formation is a major fluvial system, consisting of alternating fine to coarse-grained sandstone, minor conglomerate, siltstones and mudstones. Host to mineralization. Minor carbonaceous matter. Color buff to tan in the oxidized areas and gray to dark-gray in unoxidized zones. Dips average of 3 degrees to the west. Mineralization in top portion in at least seven sand units separated by various siltstone and mudstones. Wasatch Formation interfingers with the Battle Spring Formation. It's source is to the south and southwest and consists of fine sandstones, mudstones, siltstones and lignites.
Unconformity [3]				
Paleocene	Fort Union Formation	4,650	Yes	Consists of alternating fine to coarse grained sandstone siltstone and mudstone. Contains various layers of lignitic coal beds.
Unconformity				

Table 3.4-1 Permit Area Stratigraphy (Page 2 of 3)

Age	Formation	Thickness (feet)	Aquifer	Lithology
Cretaceous	Lance Formation	2,950	Yes	Interbedded sandstone, siltstone and mudstone. Gray to brownish gray. Locally carbonaceous. Sandstone is white to grayish orange.
	Fox Hills Formation	550	No	Consists of coarsening upward shale and fine-grained sand with thin coal beds near the top. Represents a transition from marine to non-marine environment. Grades into Lewis Shale at the base.
	Lewis Shale	1,200	No	Interbedded dark-gray and olive-gray shale and olive-gray sandstone.
Unconformity				
Cretaceous	Mesa Verde Group	800	No	Gray to dark gray shales with interbedded buff to tan fine to medium grained sandstones.
	Steele and Niobrara Shales	2,000 to 2,500	No	Steele shale is soft gray marine, Niobrara shale is dark gray and contains calcareous zones.
	Frontier Formation	500 to 1,000	Yes	Gray sandstone and sandy shale.
	Dakota Formation	300 to 400	Yes	Marine sandstone, tan to buff, fine to medium grained may contain carbonaceous shale layer.
Jurassic	Nugget Sandstone	500	Yes	Grayish to dull red coarse grained cross-bedded quartz sandstone.
Triassic	Chugwater	1500	No	Red shale and siltstone contains gypsum partings near the base.

Table 3.4-1 Permit Area Stratigraphy (Page 3 of 3)

Age	Formation	Thickness (feet)	Aquifer	Lithology
Permian	Phosphoria	300	No	Black to dark gray shale, chert and phosphorite.
Permian-Pennsylvanian	Tensleep	500	No	White to gray sandstone containing thin limestone and dolomite partings.
Pennsylvanian-Mississippian	Amsden and Madison	250	No	Red and green shale and dolomite, sandstone near base.
Cambrian	Undifferentiated	1,000	No	Siltstone and quartzite, including Flathead sandstone.
Unconformity				
Precambrian	Basement		No	Granites and associated metamorphic and igneous rocks.

* (Love and Christiansen,1985; Wellborn and Wold, 1993)
[1] Thicknesses shown are approximate and apply only to the Permit Area and vicinity.
[2] Aquifer designation only applicable to the vicinity of the Permit Area.
[3] Only major unconformities are shown.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"ATTACHMENT 3.4-1
Typical Geophysical logs
Lost Creek Permit Area"
DRAWING NO. NRCTR 1.0
ATTACHMENT 3.4-1
10.10.07.

WITHIN THIS PACKAGE... OR BY SEARCHING USING THE DOCUMENT/REPORT NO.

D-03

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
1-13	13	25	93	534951	733076	6970	1000	1971	001-132593
1D-17	17	25	92	536222	745837	6965	502	1982	001D-172592
1D-18	18	25	92	535517	742596	6943	590	1982	001D-182592
1D-20	20	25	92	534519	745048	6933	530	1982	001D-202592
1M-17	17	25	92	536223	745813	6964	467	1982	001M-172592
1M-18	18	25	92	535515	742623	6943	450	1982	001M-182592
1M-19	19	25	92	534474	742623	6922	450	1982	001M-192592
1M-20	20	25	92	534520	745023	6933	440	1982	001M-202592
1S-17	17	25	92	536224	745785	6964	200	1982	001S-172592
1S-18	18	25	92	535513	742648	6943	357	1982	001S-182592
1S-20	20	25	92	534521	744998	6932	300	1982	001S-202592
2M	19	25	92	534500	742623	6923	680	1982	002M-192592
3M	19	25	92	534524	742622	6924	461	1982	003M-192592
4-1	13	25	93	534980	734943	6964	800	1972	004-01-132593
13-1	13	25	93	536446	734357	7003	800	1974	013-01-132593
13-2	13	25	93	536421	734954	7002	800	1974	013-02-132593
13-3	13	25	93	536449	735541	7002	800	1974	013-03-132593
13-4	13	25	93	536405	736285	6993	800	1974	013-04-132593
19-1	19	25	92	533679	738419	6925	800	1974	019-01-192592
24-1	24	25	93	534247	735799	6966	800	1974	024-01-242593
24-2	24	25	93	534253	736245	6949	800	1974	024-02-242593
24-3	24	25	93	534245	736669	6945	800	1974	024-03-242593
24-4	24	25	93	533467	734432	6941	800	1974	024-04-242593
24-5	24	25	93	533468	735004	6952	802	1974	024-05-242593
24-6	24	25	93	533452	735561	6943	800	1974	024-06-242593
24-7	24	25	93	533684	737018	6929	805	1974	024-07-242593
24-8	24	25	93	533689	737759	6929	802	1974	024-08-242593
24-9	24	25	93	534256	736148	6952	640	1974	024-09-242593
24-10	24	25	93	534252	736341	6947	671	1974	024-10-242593
50-1	23	25	93	533461	732899	6938	500	1968	050-01-232593
59-1	18	25	92	538215	740618	6969	300	1969	059-01-182592
72-1	19	25	92	534585	740732	6930	800	1972	072-01-192592
77-1	19	25	92	532792	740694	6918	790	1969	077-01-192592
81-1	24	25	93	534808	736051	6969	800	1973	081-01-242593
81-2	24	25	93	533491	735981	6936	795	1973	081-02-242593
82-1	24	25	93	532333	736092	6916	731	1969	082-01-242593
82-2	24	25	93	532327	736037	6916	795	1969	082-02-242593
82-3	24	25	93	532538	736088	6918	1214	1969	082-03-242593
83-1	24	25	93	533493	736182	6932	800	1969	083-01-242593
83-2	24	25	93	533615	736231	6934	600	1969	083-02-242593
83-3	24	25	93	534581	736243	6961	650	1969	083-03-242593
83-4	24	25	93	534816	736250	6968	1200	1969	083-04-242593
83-5	24	25	93	533805	736176	6940	800	1969	083-05-242593
84-1	24	25	93	533293	736188	6929	800	1969	084-01-242593
85-1	13	25	93	537469	736144	7020	600	1969	085-01-132593
86-1	13	25	93	534906	736097	6970	703	1969	086-01-132593
86-2	13	25	93	534907	736146	6970	800	1969	086-02-132593
86-3	13	25	93	534908	736051	6968	800	1969	086-03-132593
86-4	13	25	93	536382	735849	6997	800	1969	086-04-132593
86-5	13	25	93	535014	736045	6971	960	1969	086-05-132593
88-1	13	25	93	535024	736449	6967	600	1969	088-01-132593
88-2	13	25	93	535020	736245	6969	800	1969	088-02-132593
120-1	13	25	93	538676	737835	7028	440	1971	120-01-132593
131-1	13	25	93	535187	737668	6960	800	1972	131-01-132593
131-2	13	25	93	534915	736348	6970	760	1972	131-02-132593
131-3	13	25	93	534914	736438	6968	600	1972	131-03-132593
131-4	13	25	93	535025	736449	6969	1200	1973	131-04-132593
131-5	24	25	93	534819	736450	6965	800	1973	131-05-242593
135-1	24	25	93	533499	736381	6932	1200	1973	135-01-242593
139-1	24	25	93	532766	736917	6920	780	1973	139-01-242593

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
139-2	24	24	93	532788	737205	6920	1200	1973	139-02-242593
139-3	24	24	93	532788	737457	6916	800	1973	139-03-242593
140-1	19	25	92	532787	737743	6910	760	1969	140-01-192592
140-2	19	25	92	532786	739205	6915	800	1972	140-02-192592
140-3	19	25	92	532780	738903	6914	1200	1973	140-03-192592
557	17	25	92	537802	743507	6985	650	1969	557-172592
558	18	25	92	535102	743484	6944	650	1969	558-182592
844	20	25	92	531016	743890	6864	560	1969	844-202592
A13	36	25	93	524354	738350	6790	600	1970	A013-362593
A23	17	25	92	536149	745000	6955	700	1970	A023-172592
A39	36	25	93	524338	733142	6800	650	1970	A039-362593
A66	18	25	92	536785	742315	6945	360	1970	A066-182592
A67	18	25	92	539193	742196	7010	740	1970	A067-182592
A176	18	25	92	537740	742658	6975	500	1970	A176-182592
A177	17	25	92	537759	744371	6980	500	1970	A177-172592
A178	17	25	92	535346	745007	6950	500	1970	A178-172592
A179	17	25	92	535746	745004	6960	500	1970	A179-172592
A180	16	25	92	537777	749575	6995	620	1970	A180-162592
A181	17	25	92	535545	745008	6955	520	1970	A181-172592
A185	20	25	92	534555	745028	6939	500	1970	A185-202592
A186	16	25	92	537619	748849	6995	620	1970	A186-162592
A187	20	25	92	534155	745030	6935	500	1970	A187-202592
A188	20	25	92	534356	745030	6935	500	1970	A188-202592
A189	17	25	92	537703	748058	6995	620	1970	A189-172592
A190	20	25	92	534740	745025	6935	500	1970	A190-202592
A191	17	25	92	537647	747276	6985	690	1970	A191-172592
A196	17	25	92	537694	746475	6980	640	1970	A196-172592
A228	17	25	92	537790	745519	6983	700	1970	A228-172592
A399	17	25	92	537664	746839	6990	520	1970	A399-172592
A400	17	25	92	537801	743889	6980	580	1970	A400-172592
A426	18	25	92	537766	743062	6980	600	1970	A426-182592
A442	17	25	92	537704	744721	6985	600	1970	A442-172592
A443	17	25	92	537659	746654	6990	520	1970	A443-172592
B33	36	25	93	524383	735795	6800	700	1972	B033-362593
CG2-1	16	25	92	539699	749994	7034	660	1992	CG2-1-162592
D19	17	25	92	539152	748419	7015	600	1973	D019-172592
D21	17	25	92	536780	746085	6960	700	1973	D021-172592
D22	18	25	92	535655	742118	6942	640	1973	D022-182592
D23	19	25	92	533160	742140	6910	560	1973	D023-192592
D49	20	25	92	534410	744485	6920	660	1970	D049-202592
D50	19	25	92	534355	742139	6921	600	1973	D050-192592
D51	19	25	92	532182	742148	6895	780	1973	D051-192592
D52	19	25	92	533146	743295	6905	540	1973	D052-192592
D53	17	25	92	539180	744778	7010	600	1973	D053-172592
D54	17	25	92	539180	747227	7010	600	1973	D054-172592
D55	17	25	92	536780	747259	6980	780	1973	D055-172592
D75	17	25	92	536780	744862	6960	600	1977	D075-172592
D76	20	25	92	534378	746885	6950	600	1977	D076-202592
D96	20	25	92	534408	745690	6935	540	1970	D096-202592
D131	20	25	92	534395	746078	6942	520	1973	D131-202592
D132	18	25	92	535850	742138	6940	640	1973	D132-182592
D144	18	25	92	535750	742129	6943	540	1973	D144-182592
D149	20	25	92	534412	745368	6935	540	1973	D149-202592
D150	20	25	92	534400	745875	6937	540	1973	D150-202592
D156	20	25	92	534420	745266	6935	540	1973	D156-202592
LC1W	24	25	93	534754	735284	6963	380	2005	LC001W
LC2	19	25	92	534705	741758	6930	800	2005	LC002
LC3	19	25	92	534630	742090	6923	800	2005	LC003
LC4	20	25	92	534908	743606	6940	800	2005	LC004
LC5C	19	25	92	534824	743398	6942	800	2005	LC005C

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
LC6C	19	25	92	534800	742606	6930	800	2005	LC006C
LC7C	19	25	92	534756	741947	6932	800	2005	LC007C
LC8C	18	25	92	535399	743396	6943	800	2005	LC008C
LC9C	18	25	92	535206	743001	6934	800	2005	LC009C
LC10A	18	25	92	535299	743396	6950	240	2005	LC010A
LC10C	18	25	92	535304	743400	6950	800	2005	LC010C
LC11C	20	25	92	534805	745000	6933	800	2005	LC011C
LC12C	20	25	92	534813	744601	6935	800	2005	LC012C
LC13C	17	25	92	535400	743710	6948	800	2006	LC013C
LC14A	20	25	92	534805	744100	6933	200	2006	LC014A
LC15M	20	25	92	534823	744547	6935	350	2006	LC015M
LC16M	20	25	92	534821	744563	6935	472	2006	LC016M
LC17M	20	25	92	534840	744562	6935	575	2006	LC017M
LC18M	18	25	92	535319	743362	6949	350	2006	LC018M
LC19M	18	25	92	535318	743378	6949	463	2006	LC019M
LC20M	18	25	92	535332	743377	6949	543	2006	LC020M
LC21M	24	25	93	532851	736277	6925	410	2006	LC021M
LC22M	24	25	93	532851	736292	6925	592	2006	LC022M
LC23M	24	25	93	532835	736293	6924	634	2006	LC023M
LC24M	17	25	92	535203	744579	6943	542	2006	LC024M
LC25M	19	25	92	534620	743406	6935	380	2006	LC025M
LC26M	20	25	92	534833	748204	6953	436	2006	LC026M
LC27M	16	25	92	539018	753260	7010	477	2006	LC027M
LC28M	25	25	92	524437	733364	6804	563	2006	LC028M
LC29M	20	25	92	534837	744548	6935	171	2006	LC029M
LC30M	24	25	92	532836	736277	6925	236	2006	LC030M
LC31M	25	25	92	524434	733380	6803	191	2006	LC031M
LC32W	17	25	92	536806	747065	6987	900	2007	LC032W
LC33W	20	25	92	534313	748167	6944	1000	2007	LC033W
LC34	17	25	92	535700	744400	6954	866	2007	LC034
LC35	17	25	92	535700	744600	6953	650	2007	LC035
LC36	17	25	92	535600	744900	6959	866	2007	LC036
LC37	17	25	92	535550	745020	6957	750	2007	LC037
LC38	17	25	92	535500	744800	6954	750	2007	LC038
LC39	17	25	92	535500	744400	6948	752	2007	LC039
LC40	17	25	92	535550	744300	6951	760	2007	LC040
LC41	17	25	92	535400	744300	6944	850	2007	LC041
LC42	17	25	92	535500	744100	6951	862	2007	LC042
LC43	17	25	92	535400	744100	6947	860	2007	LC043
LC44	17	25	92	535300	744000	6944	706	2007	LC044
LC45	17	25	92	535300	743900	6946	867	2007	LC045
LC46	17	25	92	535200	743900	6942	867	2007	LC046
LC47	20	25	92	535100	743800	6941	866	2007	LC047
LC48	20	25	92	535025	743716	6943	765	2007	LC048
LC49	20	25	92	535002	743888	6942	766	2007	LC049
LC50	20	25	92	535100	743993	6942	784	2007	LC050
LC51	20	25	92	534900	744000	6938	604	2007	LC051
LC52	20	25	92	534800	743900	6990	604	2007	LC052
LC53	20	25	92	534746	743986	6988	804	2007	LC053
LC54	20	25	92	534831	744084	6935	604	2007	LC054
LC55	20	25	92	534900	744200	6938	604	2007	LC055
LC56	20	25	92	535000	744300	6991	604	2007	LC056
LC57	20	25	92	535100	744300	6940	764	2007	LC057
LC58	20	25	92	535200	744300	6941	750	2007	LC058
LC59	20	25	92	535300	744400	6941	750	2007	LC059
LC60	20	25	92	535160	744500	6941	704	2007	LC060
LC60C	20	25	92	534833	743909	6990	764	2007	LC060C
LC61	20	25	92	535100	744600	6993	764	2007	LC061
LC62	20	25	92	535130	744800	6942	750	2007	LC062
LC63	20	25	92	535700	745400	6959	750	2007	LC063

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
LC64	20	25	92	535700	745800	6959	804	2007	LC064
LC67	17	25	92	536060	747093	6967	865	2007	LC067
LC69	17	25	92	536420	747079	6979	840	2007	LC069
LC70	20	25	92	534534	748147	6948	850	2007	LC070
LC71	20	25	92	534422	748158	6945	860	2007	LC071
LC72	20	25	92	534202	748180	6943	860	2007	LC072
LC73	20	25	92	534524	748353	6946	860	2007	LC073
LC75	19	25	92	531498	742486	6932	850	2007	LC075
LC76	19	25	92	531683	742367	6934	850	2007	LC076
LC80	18	25	92	537597	739884	7034	920	2007	LC080
LC81	18	25	92	537602	740036	7034	1000	2007	LC081
LC82	18	25	92	537466	739726	7032	850	2007	LC082
LC85	20	25	92	534600	745000	6993	840	2007	LC085
LC86	20	25	92	534400	745000	6990	840	2007	LC086
LC87	20	25	92	534300	745000	6990	840	2007	LC087
LC88	20	25	92	534700	745700	6994	600	2007	LC088
LC89	20	25	92	534600	745700	6993	600	2007	LC089
LC90	20	25	92	534500	745700	6992	605	2007	LC090
LC91	20	25	92	534700	745600	6995	605	2007	LC091
LC92	20	25	92	534500	745600	6991	605	2007	LC092
LC93	20	25	92	534400	745600	6991	605	2007	LC093
LC94	20	25	92	534700	745500	6994	605	2007	LC094
LC95	20	25	92	534600	745500	6993	605	2007	LC095
LC96	20	25	92	534500	745500	6992	605	2007	LC096
LC97	20	25	92	534400	745500	6991	605	2007	LC097
LC98	20	25	92	534300	745500	6990	605	2007	LC098
LC99	20	25	92	534700	745400	6994	605	2007	LC099
LC100	20	25	92	534500	745400	6992	850	2007	LC100
LC101	20	25	92	534300	745400	6989	850	2007	LC101
LC102	20	25	92	534800	745300	6996	850	2007	LC102
LC103	20	25	92	534700	745300	6995	850	2007	LC103
LC104	20	25	92	534600	745300	6992	850	2007	LC104
LC105	20	25	92	534500	745300	6992	850	2007	LC105
LC106	20	25	92	534400	745300	6991	850	2007	LC106
LC107	20	25	92	534300	745300	6990	850	2007	LC107
LC108	20	25	92	534900	745200	6994	850	2007	LC108
LC109	20	25	92	534700	745200	6996	850	2007	LC109
LC110	20	25	92	534500	745199	6992	850	2007	LC110
LC111	20	25	92	534400	745200	6991	850	2007	LC111
LC112	20	25	92	534300	745200	6991	850	2007	LC112
LC113	20	25	92	534900	745100	6991	850	2007	LC113
LC114	20	25	92	534800	745100	6993	850	2007	LC114
LC115	20	25	92	534700	745100	6994	850	2007	LC115
LC116	20	25	92	534600	745100	6995	850	2007	LC116
LC117	20	25	92	534500	745100	6992	850	2007	LC117
LC118	20	25	92	534400	745100	6991	850	2007	LC118
LC119	20	25	92	534300	745100	6989	850	2007	LC119
LC120	20	25	92	534900	745000	6991	850	2007	LC120
LC121	20	25	92	534900	744900	6991	850	2007	LC121
LC122	20	25	92	534800	744900	6989	850	2007	LC122
LC123	20	25	92	534700	744900	6988	850	2007	LC123
LC124	20	25	92	534600	744900	6990	850	2007	LC124
LC125	20	25	92	534500	744900	6990	850	2007	LC125
LC126	20	25	92	534400	744900	6991	850	2007	LC126
LC127	20	25	92	534300	744900	6989	850	2007	LC127
LC128	20	25	92	534900	744800	6990	850	2007	LC128
LC129	20	25	92	534700	744800	6987	850	2007	LC129
LC131	20	25	92	534200	745400	6989	850	2007	LC131
LC132	20	25	92	534200	745200	6990	850	2007	LC132
LC133	20	25	92	534627	744696	6984	850	2007	LC133

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
LC137	20	25	92	534900	743800	6991	850	2007	LC137
LC139	20	25	92	534900	743900	6991	850	2007	LC139
LC143	20	25	92	534700	744100	6987	850	2007	LC143
LC144	20	25	92	534600	744100	6985	850	2007	LC144
LC145	20	25	92	534700	743700	6988	850	2007	LC145
LC146	20	25	92	534600	743700	6986	850	2007	LC146
LC147	20	25	92	534900	744300	6989	850	2007	LC147
LC148	20	25	92	534700	744300	6987	850	2007	LC148
LC149	20	25	92	534600	744300	6985	850	2007	LC149
LC150	20	25	92	534500	744300	6984	850	2007	LC150
LC151	19	25	92	534710	743479	6986	850	2007	LC151
LC152	20	25	92	534900	744400	6988	850	2007	LC152
LC153	20	25	92	534500	744400	6982	850	2007	LC153
LC155	20	25	92	535000	744500	6990	850	2007	LC155
LC156	20	25	92	534900	744500	6988	850	2007	LC156
LC157	20	25	92	534800	744500	6987	850	2007	LC157
LC158	20	25	92	534699	744486	6984	850	2007	LC158
LC159	20	25	92	534601	744498	6983	850	2007	LC159
LC160	20	25	92	534495	744501	6982	850	2007	LC160
LC161	20	25	92	534506	744601	6983	850	2007	LC161
LC162	20	25	92	535000	744700	6990	850	2007	LC162
LC163	20	25	92	534900	744700	6989	850	2007	LC163
LC164	20	25	92	534800	744700	6988	850	2007	LC164
LC165	20	25	92	534700	744700	6986	850	2007	LC165
LC167	20	25	92	534500	744700	6987	850	2007	LC167
LC168	20	25	92	535000	744900	6992	850	2007	LC168
LC169	17	25	92	535200	745000	6997	850	2007	LC169
LC170	20	25	92	535100	745000	6994	850	2007	LC170
LC171	17	25	92	535200	745200	6995	850	2007	LC171
LC172	20	25	92	535100	745200	6994	850	2007	LC172
LC173	17	25	92	535200	745400	6997	850	2007	LC173
LC174	20	25	92	535100	745400	6997	850	2007	LC174
LC175	20	25	92	535000	745600	6998	850	2007	LC175
LC176	20	25	92	535000	745700	6999	850	2007	LC176
LC177	20	25	92	535100	745800	7001	850	2007	LC177
LC178	20	25	92	534700	745800	6994	850	2007	LC178
LC179	20	25	92	534500	745800	6992	850	2007	LC179
LC180	20	25	92	534400	745800	6994	850	2007	LC180
LC-HJMO101	19	25	92	534988	743281	6952	326	2007	LC-HJMO-101
LC-HJMO102	19	25	92	534762	742550	6987	330	2007	LC-HJMO-102
LC-HJMO103	18	25	92	535101	742646	6939	330	2007	LC-HJMO-103
LC-HJMO104	19	25	92	534899	742898	6946	328	2007	LC-HJMO-104
LC-HJMO105	19	25	92	535074	742953	6944	328	2007	LC-HJMO-105
LC-HJMO106	18	25	92	535258	743169	6995	328	2007	LC-HJMO-106
LC-HJMO107	20	25	92	534790	743697	6990	370	2007	LC-HJMO-107
LC-HJMO108	18	25	92	535298	743461	6954	333	2007	LC-HJMO-108
LC-HJMO109	20	25	92	534825	743904	6991	379	2007	LC-HJMO-109
LC-HJMO110	17	25	92	535194	743674	6950	330	2007	LC-HJMO-110
LC-HJMO111	17	25	92	535371	743825	6953	330	2007	LC-HJMO-111
LC-HJMO112	20	25	92	534674	744375	6931	350	2007	LC-HJMO-112
LC-HJMO113	20	25	92	534805	744265	6934	362	2007	LC-HJMO-113
LC-HJMO114	20	25	92	534676	744979	6938	360	2007	LC-HJMO-114
LC-HJMP101	19	25	92	534998	743287	6951	490	2007	LC-HJMP-101
LC-HJMP102	19	25	92	534755	742559	6939	440	2007	LC-HJMP-102
LC-HJMP103	18	25	92	535109	742652	6939	432	2007	LC-HJMP-103
LC-HJMP104	19	25	92	534897	742885	6943	430	2007	LC-HJMP-104
LC-HJMP106	18	25	92	535258	743168	6945	480	2007	LC-HJMP-106
LC-HJMP107	20	25	92	534802	743684	6941	464	2007	LC-HJMP-107
LC-HJMP108	18	25	92	535311	743466	6955	436	2007	LC-HJMP-108
LC-HJMP109	20	25	92	534830	743895	6991	512	2007	LC-HJMP-109

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
LC-HJMP110	17	25	92	535184	743682	6950	476	2007	LC-HJMP-110
LC-HJMP111	17	25	92	535366	743835	6952	440	2007	LC-HJMP-111
LC-HJMP112	20	25	92	534668	744385	6931	400	2007	LC-HJMP-112
LC-HJMP113	20	25	92	534797	744273	6934	462	2007	LC-HJMP-113
LC-HJMP114	20	25	92	534687	744976	6938	460	2007	LC-HJMP-114
LC-HJMU101	19	25	92	534997	743277	6951	535	2007	LC-HJMU-101
LC-HJMU102	19	25	92	534748	742547	6987	600	2007	LC-HJMU-102
LC-HJMU103	18	25	92	535098	742657	6938	850	2007	LC-HJMU-103
LC-HJMU104	19	25	92	534907	742891	6946	550	2007	LC-HJMU-104
LC-HJMU105	19	25	92	535076	742942	6944	548	2007	LC-HJMU-105
LC-HJMU106	18	25	92	535258	743159	6944	547	2007	LC-HJMU-106
LC-HJMU107	20	25	92	534788	743686	6990	855	2007	LC-HJMU-107
LC-HJMU108	18	25	92	535299	743476	6954	850	2007	LC-HJMU-108
LC-HJMU109	20	25	92	534835	743904	6992	850	2007	LC-HJMU-109
LC-HJMU110	17	25	92	535195	743685	6954	850	2007	LC-HJMU-110
LC-HJMU111	17	25	92	535375	743841	6952	853	2007	LC-HJMU-111
LC-HJMU112	20	25	92	534675	744386	6931	802	2007	LC-HJMU-112
LC-HJMU113	20	25	92	534807	744277	6934	800	2007	LC-HJMU-113
LC-HJMU114	20	25	92	534678	744966	6937	557	2007	LC-HJMU-114
LC-HJT101	19	25	92	534610	742561	6993	478	2007	LC-HJT-101
LC-HJT102	19	25	92	534696	742886	6942	430	2007	LC-HJT-102
LC-HJT103	19	25	92	534670	743180	6944	430	2007	LC-HJT103
LC-HJT104	20	25	92	534892	743653	6942	460	2007	LC-HJT-104
LC-HJT105	20	25	92	535027	744437	6941	850	2007	LC-HJT-105
LC-HJT106	20	25	92	534493	743890	6934	850	2007	LC-HJT-106
LC-HJT107	20	25	92	534830	745230	6995	850	2007	LC-HJT-107
LC-UKMO101	20	25	92	534943	744085	6939	487	2007	LC-UKMO-101
LC-UKMO102	17	25	92	535134	744206	6947	420	2007	LC-UKMO-102
LC-UKMO103	17	25	92	535556	744501	6953	438	2007	LC-UKMO-103
LC-UKMP101	20	25	92	534929	744090	6939	575	2007	LC-UKMP-101
LC-UKMP102	17	25	92	535145	744204	6947	498	2007	LC-UKMP-102
LC-UKMP103	17	25	92	535558	744487	6953	537	2007	LC-UKMP-103
LC-UKMU101	20	25	92	534931	744101	6939	850	2007	LC-UKMU-101
LC-UKMU102	17	25	92	535143	744191	6945	580	2007	LC-UKMU-102
LC-UKMU103	17	25	92	535546	744487	6953	850	2007	LC-UKMU-103
OH1	16	25	92	537410	750061	6991	323	1968	OH-1-162592
P1-16	16	25	92	535240	749380	6945	680	1988	P01-162592
P1-17	17	25	92	535964	745571	6961	500	1987	P01-172592
P1-18	18	25	92	535288	743252	6939	560	1987	P01-182592
P1-19	19	25	92	533745	738394	6934	560	1987	P01-192592
P1-20	20	25	92	534558	744585	6927	560	1987	P01-202592
P1-24	24	25	93	533000	737450	6917	600	1987	P01-242593
P2-16	16	25	92	535655	749388	6942	600	1988	P02-162592
P2-17	17	25	92	535730	744805	6949	660	1988	P02-172592
P2-18	18	25	92	535253	743395	6949	500	1990	P02-182592
P2-19	19	25	92	533240	738578	6920	720	1988	P02-192592
P2-20	20	25	92	534620	745600	6935	560	1987	P02-202592
P2-24	24	25	93	532873	735930	6925	560	1987	P02-242593
P3-17	17	25	92	535198	746590	6946	640	1988	P03-172592
P3-18	18	25	92	535337	743382	6944	500	1990	P03-182592
P3-19	19	25	92	535052	742605	6931	500	1992	P03-192592
P3-20	20	25	92	534713	744606	6934	520	1990	P03-202592
P3-24	24	25	93	532378	734386	6920	730	1988	P03-242593
P4-17	17	25	92	536000	746000	6964	633	1988	P04-172592
P4-18	18	25	92	535436	743373	6942	500	1990	P04-182592
P4-19	19	25	92	534927	742602	6929	500	1992	P04-192592
P4-20	20	25	92	534762	744606	6934	520	1990	P04-202592
P5-17	17	25	92	535550	744644	6945	650	1988	P05-172592
P5-18	18	25	92	535487	743369	6940	500	1990	P05-182592
P5-19	19	25	92	534751	742593	6933	500	1992	P05-192592

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
P5-20	20	25	92	534862	744608	6936	520	1990	P05-202592
P6-17	17	25	92	535304	743799	6946	500	1990	P06-172592
P6-18	18	25	92	535151	742602	6935	500	1992	P06-182592
P6-19	19	25	92	534654	742596	6933	500	1992	P06-192592
P6-20	20	25	92	534913	744610	6937	520	1990	P06-202592
P7-17	17	25	92	535354	743798	6948	500	1990	P07-172592
P7-19	19	25	92	535096	742805	6933	500	1990	P07-192592
P7-20	20	25	92	534947	744605	6935	520	1990	P07-202592
P8-17	17	25	92	535503	743795	6953	500	1990	P08-172592
P8-19	19	25	92	534897	742798	6936	500	1992	P08-192592
P9-17	17	25	92	535300	743592	6947	500	1990	P09-172592
P10-17	17	25	92	535502	743603	6950	500	1968	P10-172592
RD34	16	25	92	537786	751305	6972	840	1968	RD034-162592
RD106	9	25	92	540450	748750	7050	1200	1967	RD106-092592
RD107	9	25	92	540437	751330	7040	800	1967	RD107-092592
RD108	10	25	92	540450	753950	7020	800	1967	RD108-102592
RD125	21	25	92	535200	751500	6955	480	1967	RD125-212592
RD130	16	25	92	540450	751700	7035	850	1967	RD130-162592
RD131	16	25	92	539200	751500	7005	900	1968	RD131-162592
RD150	9	25	92	540450	751150	7040	800	1968	RD150-092592
RD187	20	25	92	533437	744882	6931	774	1968	RD187-202592
RD188	17	25	92	535332	747248	6950	800	1968	RD188-172592
RD189	16	25	92	536725	749225	6975	800	1968	RD189-162592
RD210	16	25	92	535697	753550	6980	600	1968	RD210-162592
RD211	15	25	92	535191	753949	6964	570	1968	RD211-152592
RD301	16	25	92	535780	750500	6945	600	1968	RD301-162592
RD310	20	25	92	533520	748578	6929	550	1968	RD310-202592
RD343	20	25	92	533941	746072	6947	650	1968	RD343-202592
RD345	17	25	92	535299	745779	6950	791	1968	RD345-172592
RD392	16	25	92	535172	750066	6940	600	1968	RD392-162592
RD393	16	25	92	535810	753180	6963	200	1968	RD393-162592
RD396	20	25	92	532266	744003	6899	640	1968	RD396-202592
RD404	16	25	92	537535	750145	6985	550	1968	RD404-162592
RD412	17	25	92	538050	746040	6997	700	1968	RD412-172592
RD436	19	25	92	534436	742838	6925	670	1968	RD436-192592
RD445	16	25	92	537751	753179	6987	600	1968	RD445-162592
RD446	16	25	92	539024	748856	7015	800	1968	RD446-162592
S19	26	25	93	526745	733058	6940	515	1968	S19-262593
TE1	24	25	93	532611	736015	6920	680	1977	TE001-242593
TE2	24	25	93	532464	736159	6918	700	1977	TE002-242593
TE3	24	25	93	534251	736293	6946	680	1977	TE003-242593
TE4	24	25	93	534348	736356	6950	680	1977	TE004-242593
TE5	24	25	93	534148	736340	6945	680	1977	TE005-242593
TE6	24	25	93	534853	736198	6969	700	1977	TE006-242593
TE7	24	25	93	534704	736071	6943	700	1977	TE007-242593
TE8	24	25	93	534806	735850	6967	720	1977	TE008-242593
TE9	24	25	93	533428	734213	6939	820	1977	TE009-242593
TE10	24	25	93	533347	734409	6940	820	1977	TE010-242593
TE11	24	25	93	533535	734932	6948	720	1977	TE011-242593
TE12	24	25	93	533392	735080	6949	720	1977	TE012-242593
TE17	24	25	93	534463	736085	6961	1200	1977	TE017-242593
TE18	24	25	93	532773	735925	6923	775	1977	TE018-242593
TE19	24	25	93	532368	736251	6917	700	1977	TE019-242593
TE20	24	25	93	532346	735895	6917	800	1977	TE020-242593
TE21	24	25	93	533264	734028	6936	1200	1977	TE021-242593
TE22	24	25	93	533555	735137	6949	800	1977	TE022-242593
TE23	24	25	93	533224	735180	6945	800	1977	TE023-242593
TE26	24	25	93	534877	734690	6963	600	1977	TE026-242593
TE27	24	25	93	534654	735023	6961	600	1977	TE027-242593
TE28	24	25	93	534441	735444	6963	640	1977	TE028-242593

Attachment 3.4-2 . Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TE29	24	25	93	533952	735799	6952	620	1977	TE029-242593
TE30	24	25	93	534391	735912	6962	620	1977	TE030-242593
TE31	24	25	93	534858	735315	6962	620	1977	TE031-242593
TE32	13	25	93	535264	735117	6972	700	1977	TE032-132593
TE33	13	25	93	535324	735649	6977	800	1977	TE033-132593
TE34	24	25	93	534803	737380	6964	620	1977	TE034-242593
TE35	24	25	93	534839	734652	6963	620	1977	TE035-242593
TE36	24	25	93	534693	735103	6962	620	1977	TE036-242593
TE37	24	25	93	534622	735031	6957	620	1977	TE037-242593
TE38	24	25	93	534757	735323	6961	380	1977	TE038-242593
TE39	24	25	93	534418	735953	6962	620	1977	TE039-242593
TE40	24	25	93	534349	735882	6961	620	1977	TE040-242593
TE41	31	25	93	535016	734539	6970	620	1977	TE041-312593
TE42	24	25	93	534728	734857	6957	620	1977	TE042-242593
TE43	24	25	93	534496	735217	6956	620	1977	TE043-242593
TE44	24	25	93	534529	735751	6963	620	1977	TE044-242593
TE45	24	25	93	534286	736037	6954	620	1977	TE045-242593
TE46	24	25	93	533794	735984	6943	1200	1977	TE046-242593
TE47	24	25	93	533504	735874	6940	760	1977	TE047-242593
TE48	24	25	93	533644	735563	6947	600	1977	TE048-242593
TE49	24	25	93	533656	734818	6938	600	1977	TE049-242593
TE50	24	25	93	533606	734575	6940	800	1977	TE050-242593
TE51	24	25	93	533577	734220	6941	700	1977	TE051-242593
TE52	24	25	93	533363	733504	6936	1200	1977	TE052-242593
TE53	24	25	93	533122	733504	6935	800	1977	TE053-242593
TE54	22	25	93	533165	732894	6931	1200	1977	TE054-222593
TE56	24	25	93	532836	733821	6930	700	1977	TE056-242593
TE57	24	25	93	533203	734299	6938	1200	1977	TE057-242593
TE58	24	25	93	532478	733875	6921	1200	1977	TE058-242593
TE59	24	25	93	532517	734237	6927	700	1977	TE059-242593
TE60	24	25	93	532821	734692	6923	700	1977	TE060-242593
TE61	24	25	93	533017	735043	6941	1200	1977	TE061-242593
TE62	24	25	93	532421	734616	6917	700	1977	TE062-242593
TE63	24	25	93	533099	735337	6936	700	1977	TE063-242593
TE64	24	25	93	532993	735516	6931	680	1977	TE064-242593
TE65	24	25	93	532933	735377	6931	1203	1977	TE065-242593
TE66	24	25	93	532914	735683	6927	700	1977	TE066-242593
TE67	24	25	93	532607	735805	6921	719	1977	TE067-242593
TE68	24	25	93	533128	736061	6928	1202	1977	TE068-242593
TE69	24	25	93	532781	736195	6922	793	1977	TE069-242593
TE70	24	25	93	532541	735889	6919	1202	1977	TE070-242593
TE71	24	25	93	532691	736211	6923	700	1977	TE071-242593
TE72	24	25	93	532792	736105	6924	700	1977	TE072-242593
TE73	24	25	93	532902	736216	6926	700	1977	TE073-242593
TE74	24	25	93	534927	734450	6969	600	1977	TE074-242593
TE75	24	25	93	534827	734335	6968	600	1977	TE075-242593
TE77	24	25	93	533078	733539	6934	640	1977	TE077-242593
TE78	23	25	93	533128	732950	6931	640	1977	TE078-232593
TE79	23	25	93	533601	733396	6939	700	1977	TE079-232593
TE80	24	25	93	533464	733539	6937	680	1977	TE080-242593
TE81	24	25	93	534606	734395	6958	700	1977	TE081-242593
TE83	23	25	93	532752	733541	6928	640	1977	TE083-232593
TE84	24	25	93	533831	734645	6944	600	1977	TE084-242593
TE87	23	25	93	534825	733945	6969	700	1977	TE087-242593
TE88	23	25	93	534011	734536	6948	700	1977	TE088-242593
TE89	24	25	93	532895	736202	6927	660	1977	TE089-242593
TE90	24	25	93	533200	733800	6936	700	1977	TE090-242593
TE91	24	25	93	532599	734797	6916	700	1977	TE091-242593
TE92	24	25	93	532600	734399	6927	700	1977	TE092-242593
TE93	24	25	93	532802	734196	6933	600	1977	TE093-242593

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TE94	24	25	93	532999	733800	6931	700	1977	TE094-242593
TE96	24	25	93	532800	735000	6928	700	1977	TE096-242593
TE97	24	25	93	532800	734800	6925	700	1977	TE097-242593
TE101	24	25	93	532600	734600	6919	720	1977	TE101-242593
TG1-17	17	25	92	535200	743600	6944	500	1978	TG01-172592
TG1-18	18	25	92	535000	742400	6929	600	1992	TG01-182592
TG1-19	19	25	92	532400	742400	6908	600	1992	TG01-192592
TG1-20	20	25	92	534800	743600	6936	500	1978	TG01-202592
TG1-21	21	25	92	535000	749000	6947	600	1978	TG01-212592
TG1A-19(60deg)	19	25	92	534724	743405	6940	200	1978	TG01A-192592(60deg)
TG1A-19(75deg)	19	25	92	534720	743405	6940	380	1978	TG01A-192592(75deg)
TG1A-20(60deg)	20	25	92	534902	744200	6933	200	1978	TG01A-202592(60deg)
TG1A-20(75deg)	20	25	92	534900	744200	6933	380	1978	TG01A-202592(75deg)
TG2-18	18	25	92	535200	742400	6933	600	1978	TG02-182592
TG2-19	19	25	92	532800	742400	6912	600	1978	TG02-192592
TG2-20	20	25	92	535000	743600	6940	500	1978	TG02-202592
TG2-21	21	25	92	534800	749000	6942	540	1978	TG02-212592
TG3-17	17	25	92	535400	745400	6945	600	1978	TG03-172592
TG3-18	18	25	92	535400	742400	6939	600	1978	TG03-182592
TG3-19	19	25	92	533200	742400	6912	600	1978	TG03-192592
TG3-20	20	25	92	535000	744000	6937	500	1978	TG03-202592
TG3-21	21	25	92	534600	749000	6940	540	1978	TG03-212592
TG4-18	18	25	92	535600	742400	6940	600	1978	TG04-182592
TG4-19	19	25	92	533600	742400	6923	600	1978	TG04-192592
TG4-20	20	25	92	534800	744000	6934	600	1978	TG04-202592
TG4-21	21	25	92	535000	750600	6931	500	1978	TG04-212592
TG5-17	17	25	92	535200	744000	6939	500	1978	TG05-172592
TG5-18	18	25	92	535800	742400	6944	660	1978	TG05-182592
TG5-19	19	25	92	534000	742400	6934	600	1978	TG05-192592
TG5-20	20	25	92	535000	744400	6934	600	1978	TG05-202592
TG5-21	21	25	92	535000	749400	6946	600	1978	TG05-212592
TG6-17	17	25	92	535400	743600	6950	600	1978	TG06-172592
TG6-18	18	25	92	536000	742400	6947	600	1978	TG06-182592
TG6-19	19	25	92	534400	742400	6927	600	1978	TG06-192592
TG6-20	20	25	92	534800	744400	6931	600	1978	TG06-202592
TG6-21	21	25	92	535000	749800	6939	540	1978	TG06-212592
TG7-17	17	25	92	535400	744000	6945	540	1978	TG07-172592
TG7-18	18	25	92	536200	742400	6949	660	1978	TG07-182592
TG7-19	19	25	92	534600	742400	6929	600	1978	TG07-192592
TG7-20	20	25	92	534400	744800	6932	520	1978	TG07-202592
TG8-17	17	25	92	535600	744000	6953	560	1978	TG08-172592
TG8-18	18	25	92	535212	743201	6944	600	1978	TG08-182592
TG8-19	19	25	92	534800	742400	6926	600	1978	TG08-192592
TG8-20	20	25	92	534800	744800	6934	600	1978	TG08-202592
TG9-17	17	25	92	535123	744387	6936	560	1978	TG09-172592
TG9-18	18	25	92	535200	742800	6935	600	1978	TG09-182592
TG9-19	19	25	92	534800	742800	6935	600	1978	TG09-192592
TG9-20	20	25	92	534600	744800	6932	600	1978	TG09-202592
TG10-17	17	25	92	535400	744400	6941	600	1977	TG10-172592
TG10-18	18	25	92	535600	742800	6946	600	1977	TG10-182592
TG10-19	19	25	92	534600	742800	6932	500	1977	TG10-192592
TG10-20	20	25	92	534600	744400	6930	600	1977	TG10-202592
TG11-17	17	25	92	535600	744400	6949	600	1978	TG11-172592
TG11-18	18	25	92	536006	742800	6951	660	1978	TG11-182592
TG11-19	19	25	92	535000	742800	6932	500	1978	TG11-192592
TG11-20	20	25	92	534600	744000	6931	600	1978	TG11-202592
TG12-17	17	25	92	535121	744788	6939	560	1978	TG12-172592
TG12-18	18	25	92	536400	742800	6959	660	1978	TG12-182592
TG12-19	19	25	92	535000	743200	6942	500	1978	TG12-192592
TG12-20	20	25	92	535000	745000	6938	600	1978	TG12-202592

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TG12-21	21	25	92	535000	751000	6948	500	1978	TG12-212592
TG13-17	17	25	92	535400	744800	6949	600	1978	TG13-172592
TG13-18	18	25	92	535200	742900	6936	500	1978	TG13-182592
TG13-19	19	25	92	534600	743200	6932	540	1978	TG13-192592
TG13-20	20	25	92	535000	745400	6942	600	1978	TG13-202592
TG13-21	21	25	92	535000	750200	6935	540	1978	TG13-212592
TG14-18	18	25	92	536400	743200	6949	600	1978	TG14-182592
TG14-19	19	25	92	534800	743200	6941	500	1978	TG14-192592
TG14-20	20	25	92	534800	745400	6941	540	1978	TG14-202592
TG15-17	17	25	92	535800	745400	6961	600	1978	TG15-172592
TG15-18	18	25	92	535414	743205	6943	500	1978	TG15-182592
TG15-19	19	25	92	534600	742600	6930	580	1980	TG15-192592
TG15-20	20	25	92	534600	745400	6938	540	1978	TG15-202592
TG16-17	17	25	92	535800	745800	6961	600	1978	TG16-172592
TG16-19	19	25	92	534800	742600	6930	580	1980	TG16-192592
TG16-20	20	25	92	534600	745800	6938	600	1978	TG16-202592
TG17-17	17	25	92	535400	746200	6949	600	1978	TG17-172592
TG17-19	19	25	92	535000	742600	6929	580	1980	TG17-192592
TG17-20	20	25	92	534800	745800	6940	540	1978	TG17-202592
TG18-17	17	25	92	535800	746200	6961	600	1978	TG18-172592
TG18-19	19	25	92	534600	743000	6931	580	1980	TG18-192592
TG18-20	20	25	92	535000	745800	6943	600	1978	TG18-202592
TG19-17	17	25	92	535400	746600	6948	600	1978	TG19-172592
TG19-19	19	25	92	534800	743000	6940	580	1980	TG19-192592
TG19-20	20	25	92	535013	746209	6948	600	1978	TG19-202592
TG20-17	17	25	92	535800	746600	6956	600	1978	TG20-172592
TG20-18	18	25	92	535200	742600	6935	580	1980	TG20-182592
TG20-19	19	25	92	535000	743000	6935	580	1980	TG20-192592
TG20-20	20	25	92	534800	746200	6941	540	1978	TG20-202592
TG21-17	17	25	92	535600	745800	6954	600	1978	TG21-172592
TG21-18	18	25	92	535200	743000	6933	580	1980	TG21-182592
TG21-19	19	25	92	534800	743400	6936	580	1980	TG21-192592
TG21-20	20	25	92	534600	746200	6949	516	1978	TG21-202592
TG22-17	17	25	92	536000	745800	6966	600	1978	TG22-172592
TG22-18	18	25	92	535400	743000	6938	580	1980	TG22-182592
TG22-19	19	25	92	535000	743400	6942	580	1980	TG22-192592
TG22-20	20	25	92	534600	746600	6947	540	1978	TG22-202592
TG23-17	17	25	92	535200	747000	6948	600	1978	TG23-172592
TG23-18	18	25	92	535200	743400	6942	580	1980	TG23-182592
TG23-19	19	25	92	535000	742200	6936	580	1980	TG23-192592
TG23-20	20	25	92	534800	746600	6944	540	1978	TG23-202592
TG24-17	20	25	92	535400	747000	6944	600	1978	TG24-172592
TG24-18	18	25	92	535417	743401	6948	580	1980	TG24-182592
TG24-19	19	25	92	534800	742200	6931	580	1980	TG24-192592
TG24-20	17	25	92	535000	746600	6951	600	1978	TG24-202592
TG25-17	17	25	92	535200	747400	6954	600	1978	TG25-172592
TG25-18	18	25	92	535600	743400	6942	580	1980	TG25-182592
TG25-19	19	25	92	534600	742200	6931	580	1980	TG25-192592
TG25-20	20	25	92	535000	747000	6949	600	1978	TG25-202592
TG26-17	17	25	92	535400	747400	6953	600	1978	TG26-172592
TG26-20	20	25	92	534800	747000	6950	540	1978	TG26-202592
TG27-17	17	25	92	535800	747400	6960	600	1978	TG27-172592
TG27-18	18	25	92	535302	743392	6951	580	1980	TG27-182592
TG27-20	20	25	92	534600	747000	6951	540	1978	TG27-202592
TG28-17	17	25	92	535800	747000	6956	600	1978	TG28-172592
TG28-20	20	25	92	534600	747400	6956	600	1978	TG28-202592
TG29-17	17	25	92	535600	745400	6946	600	1978	TG29-172592
TG29-20	20	25	92	534800	747400	6953	540	1978	TG29-202592
TG30-17	17	25	92	536000	746200	6964	600	1978	TG30-172592
TG30-20	20	25	92	535000	747400	6952	600	1978	TG30-202592

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TG31-20	20	25	92	535000	747800	6957	600	1978	TG31-202592
TG32-17	17	25	92	535200	747800	6956	600	1978	TG32-172592
TG32-20	20	25	92	534800	747800	6953	540	1978	TG32-202592
TG33-17	17	25	92	535400	747800	6957	600	1978	TG33-172592
TG33-20	20	25	92	534600	747800	6949	540	1978	TG33-202592
TG34-17	17	25	92	535200	748200	6958	600	1978	TG34-172592
TG34-20	20	25	92	535000	748200	6955	600	1978	TG34-202592
TG35-17	17	25	92	535200	748600	6954	600	1978	TG35-172592
TG35-20	20	25	92	534800	748200	6949	540	1978	TG35-202592
TG36-17	17	25	92	535200	743800	6940	580	1980	TG36-172592
TG36-20	20	25	92	534600	748200	6943	540	1978	TG36-202592
TG37-17	17	25	92	535400	743800	6947	580	1980	TG37-172592
TG38-17	17	25	92	535200	744200	6937	580	1980	TG38-172592
TG39-17	17	25	92	535400	744200	6941	580	1978	TG39-172592
TG39-20	20	25	92	535000	748600	6950	600	1978	TG39-202592
TG40-17	17	25	92	535600	744200	6949	580	1980	TG40-172592
TG41-17	17	25	92	535200	744600	6938	580	1980	TG41-172592
TG41-20	20	25	92	534800	748600	6946	540	1978	TG41-202592
TG42-17	17	25	92	535440	744600	6942	580	1980	TG42-172592
TG42-20	20	25	92	534600	748600	6941	540	1978	TG42-202592
TG43-17	17	25	92	535600	744800	6950	580	1980	TG43-172592
TG43-20	20	25	92	534400	748600	6939	540	1978	TG43-202592
TG44-17	17	25	92	535800	745200	6958	580	1980	TG44-172592
TG44-20	20	25	92	531400	743800	6879	460	1979	TG44-202592
TG45-17	17	25	92	535800	745600	6958	580	1980	TG45-172592
TG46-17	17	25	92	536000	745600	6962	580	1980	TG46-172592
TG47-17	17	25	92	535800	746000	6958	580	1980	TG47-172592
TG48-17	17	25	92	535600	743800	6951	580	1980	TG48-172592
TG49-17	17	25	92	535300	744200	6938	580	1980	TG49-172592
TG50-17	17	25	92	535500	744200	6945	580	1980	TG50-172592
TG51-17	17	25	92	536400	746400	6972	600	1981	TG51-172592
TG52-17	17	25	92	538400	747200	7001	600	1981	TG52-172592
TG52-20	20	25	92	534600	743800	6929	580	1980	TG52-202592
TG53-20	20	25	92	534800	743800	6933	580	1980	TG53-202592
TG54-20	20	25	92	535000	743800	6936	580	1980	TG54-202592
TG55-20	20	25	92	534400	744200	6926	580	1980	TG55-202592
TG56-20	20	25	92	534600	744200	6928	580	1980	TG56-202592
TG57-20	20	25	92	534800	744200	6932	580	1980	TG57-202592
TG58-20	20	25	92	535000	744200	6936	580	1980	TG58-202592
TG59-20	20	25	92	534600	744600	6928	580	1980	TG59-202592
TG60-20	20	25	92	534800	744600	6930	580	1980	TG60-202592
TG61-20	20	25	92	535014	744604	6939	580	1980	TG61-202592
TG62-20	20	25	92	534800	745000	6933	580	1980	TG62-202592
TG63-20	20	25	92	534600	745200	6938	580	1980	TG63-202592
TG64-20	20	25	92	534800	745200	6938	580	1980	TG64-202592
TG65-20	20	25	92	535000	745200	6936	580	1980	TG65-202592
TG66-20	20	25	92	534600	745600	6935	580	1980	TG66-202592
TG67-20	20	25	92	534800	745600	6939	580	1980	TG67-202592
TG68-20	20	25	92	535000	745600	6941	580	1980	TG68-202592
TG69-20	20	25	92	534600	746000	6937	580	1980	TG69-202592
TG70-20	20	25	92	534800	746000	6941	580	1980	TG70-202592
TG71-20	20	25	92	535000	744800	6935	580	1980	TG71-202592
TG72-20	20	25	92	534700	744200	6930	580	1980	TG72-202592
TG73-20	20	25	92	535100	744200	6935	580	1980	TG73-202592
TGC1-19	19	25	92	534700	742600	6932	500	1980	TGC01-192592
TGC1A(45deg)	19	25	92	534502	742600	6927	300	1980	TGC01A-192592(45deg)
TGC1A(60deg)	19	25	92	534500	742600	6927	300	1980	TGC01A-192592(60deg)
TGC2-19	19	25	92	534860	742600	6935	480	1980	TGC02-192592
TGC16	18	25	92	535200	742850	6936	475	1979	TGC16-182592
TGC17	18	25	92	535200	742840	6935	423	1979	TGC17-182592

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TGC18	18	25	92	535200	742830	6935	442	1979	TGC18-182592
TGC19	18	25	92	535200	742810	6935	475	1979	TGC19-182592
TGC20	18	25	92	535300	742600	6939	460	1980	TGC20-182592
TGC21	18	25	92	535100	742600	6933	480	1980	TGC21-182592
TT1	24	25	93	534248	736505	6945	680	1977	TT001-242593
TT2	24	25	93	534770	736632	6959	700	1977	TT002-242593
TT3	24	25	93	534715	736460	6962	720	1977	TT003-242593
TT4	24	25	93	532712	737140	6919	600	1977	TT004-242593
TT5	19	25	92	532690	739388	6913	580	1977	TT005-192592
TT6	19	25	92	532707	740881	6914	600	1977	TT006-192592
TT7	24	25	93	533583	736925	6928	820	1978	TT007-242593
TT8	19	25	92	533626	738587	6923	740	1978	TT008-192592
TT9	19	25	92	534510	740816	6928	600	1978	TT009-192592
TT10	18	25	92	538540	740748	6973	740	1977	TT010-182592
TT13	24	25	92	532565	737144	6914	500	1977	TT013-242593
TT14	19	25	92	532763	739313	6914	500	1977	TT014-192592
TT15	19	25	92	532611	739476	6912	540	1977	TT015-192592
TT16	19	25	92	532570	741037	6907	600	1977	TT016-192592
TT17	24	25	93	533334	736646	6927	1140	1977	TT017-242593
TT18	19	25	92	533201	739915	6923	1000	1977	TT018-192592
TT19	19	25	92	534410	740974	6921	600	1977	TT019-192592
TT20	18	25	92	538428	740962	6972	1160	1977	TT020-182592
TT22	13	25	93	535378	736361	6975	700	1977	TT022-132593
TT23	13	25	93	535338	736755	6974	600	1977	TT023-132593
TT24	13	25	93	535303	737181	6972	600	1977	TT024-132593
TT25	13	25	93	533003	736823	6923	700	1977	TT025-242593
TT26	24	25	93	532765	736551	6922	700	1977	TT026-242593
TT27	24	25	93	532993	736379	6929	700	1977	TT027-242593
TT28	24	25	93	533139	736549	6926	700	1977	TT028-242593
TT29	24	25	93	532972	737964	6913	700	1977	TT029-242593
TT30	19	25	92	534804	737380	6919	780	1977	TT030-192592
TT31	19	25	92	533454	739102	6923	600	1977	TT031-192592
TT32	19	25	92	533734	739826	6930	600	1977	TT032-192592
TT33	23	25	93	532975	740698	6911	600	1977	TT033-232593
TT34	19	25	92	534200	740986	6921	600	1977	TT034-192592
TT35	19	25	92	532657	741212	6909	600	1977	TT035-192592
TT36	19	25	92	532838	741601	6910	600	1977	TT036-192592
TT37	19	25	92	535203	741350	6936	800	1977	TT037-182592
TT38	19	25	92	533221	741874	6911	600	1977	TT038-192592
TT39	19	25	92	534597	741211	6930	600	1977	TT039-192592
TT40	19	25	92	534099	740600	6924	800	1977	TT040-192592
TT41	19	25	92	533990	741087	6916	600	1977	TT041-192592
TT42	19	25	92	534423	741109	6925	600	1977	TT042-192592
TT43	19	25	92	533475	741581	6913	1000	1977	TT043-192592
TT44	19	25	92	532722	741402	6912	600	1977	TT044-192592
TT45	19	25	92	532906	740333	6918	1000	1977	TT045-192592
TT46	19	25	92	533009	739997	6920	1000	1977	TT046-192592
TT47	19	25	92	533382	739831	6921	700	1977	TT047-192592
TT48	19	25	92	533279	739352	6920	1000	1977	TT048-192592
TT49	19	25	92	533263	738999	6919	1000	1977	TT049-192592
TT50	19	25	92	533364	738575	6919	900	1977	TT050-192592
TT51	19	25	92	533043	738499	6913	1000	1977	TT051-192592
TT52	24	25	93	533120	737742	6919	1000	1977	TT052-242593
TT53	24	25	93	532575	737943	6907	1000	1977	TT053-242593
TT54	24	25	93	532929	737462	6916	700	1977	TT054-242593
TT55	24	25	93	532657	737323	6915	700	1977	TT055-242593
TT56	24	25	93	532783	736716	6921	700	1977	TT056-242593
TT57	24	25	93	532360	736674	6916	700	1977	TT057-242593
TT58	24	25	93	532547	736445	6919	700	1977	TT058-242593
TT59	24	25	93	533264	736402	6928	1060	1977	TT059-242593

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TT60	24	25	93	533701	736666	6933	900	1977	TT060-242593
TT61	24	25	93	532780	736311	6921	700	1977	TT061-242593
TT62	24	25	93	534541	736958	6948	820	1977	TT062-242593
TT63	19	25	92	534730	741361	6933	600	1977	TT063-192592
TT64	19	25	92	534205	740788	6923	600	1977	TT064-192592
TT65	19	25	92	533720	740218	6928	600	1977	TT065-192592
TT66	19	25	92	534320	740648	6927	600	1978	TT066-192592
TT67	19	25	92	533390	739541	6922	700	1978	TT067-192592
TT68	19	25	92	533163	738795	6915	700	1978	TT068-192592
TT69	24	25	93	532971	736555	6924	700	1978	TT069-242593
TT70	24	25	93	534439	736943	6947	760	1978	TT070-242593
TT71	24	25	93	534563	736857	6951	760	1978	TT071-242593
TT72	24	25	93	534652	736971	6951	760	1978	TT072-242593
TT73	24	25	93	534513	737060	6947	760	1978	TT073-242593
TT74	19	25	92	534519	741445	6928	600	1978	TT074-192592
TT75	19	25	92	534637	741746	6927	600	1978	TT075-192592
TT76	19	25	92	532907	741106	6921	600	1978	TT076-192592
TT77	19	25	92	532638	740672	6909	600	1978	TT077-192592
TT78	19	25	92	534367	740835	6925	600	1978	TT078-192592
TT79	19	25	92	534052	740388	6931	600	1978	TT079-192592
TT80	19	25	92	533823	740077	6933	600	1978	TT080-192592
TT81	19	25	92	533587	739699	6926	700	1978	TT081-192592
TT82	19	25	92	533435	739490	6923	700	1978	TT082-192592
TT83	19	25	92	532922	738626	6911	700	1978	TT083-192592
TT84	24	25	93	532787	738163	6908	700	1978	TT084-242593
TT85	19	25	92	534292	741243	6921	600	1978	TT085-192592
TT86	19	25	92	534431	741740	6921	600	1978	TT086-192592
TT87	19	25	92	534699	741544	6932	600	1978	TT087-192592
TT88	19	25	92	534732	741952	6926	600	1978	TT088-192592
TT89	19	25	92	533893	741807	6909	600	1978	TT089-192592
TT90	19	25	92	535196	741864	6937	600	1978	TT090-182592
TT94	18	25	92	535900	742100	6948	660	1978	TT094-182592
TT95	18	25	92	535500	742100	6938	660	1978	TT095-182592
TT96	18	25	92	535100	742100	6934	660	1978	TT096-182592
TT97	19	25	93	534723	742106	6927	600	1978	TT097-192592
TT98	19	25	92	534400	740400	6912	700	1978	TT098-192592
TT99	19	25	92	534100	740100	6916	700	1978	TT099-192592
TT100	19	25	92	533900	739500	6918	700	1977	TT100-192592
TT101	19	25	92	533700	739100	6912	700	1977	TT101-192592
TT102	19	25	92	533000	738800	6914	660	1977	TT102-192592
TT103	19	25	92	533000	739200	6918	700	1977	TT103-192592
TT104	19	25	92	533000	739600	6919	600	1977	TT104-192592
TT105	24	25	93	533600	738200	6926	660	1977	TT105-192592
TT106	24	25	93	533385	738216	6924	700	1977	TT106-242593
TT107	24	25	93	532919	737215	6920	700	1977	TT107-242593
TT108	24	25	93	533613	737270	6924	700	1977	TT108-242593
TT109	19	25	92	533400	738400	6923	700	1977	TT109-192592
TT110	19	25	92	534063	740395	6932	560	1977	TT110-192592
TT111	19	25	92	534741	741947	6928	500	1977	TT111-192592
TT112	24	25	93	533200	738200	6919	660	1977	TT112-242593
TT113	24	25	93	533400	738000	6921	660	1977	TT113-242593
TT114	24	25	93	533000	737200	6920	660	1977	TT114-242593
TT120	19	25	92	533200	739800	6920	600	1977	TT120-192592
TT121	19	25	92	533200	739600	6919	600	1977	TT121-192592
TT122	19	25	92	533200	739400	6919	600	1977	TT122-192592
TT123	19	25	92	533200	739200	6919	600	1977	TT123-192592
TT124	19	25	92	533600	739200	6927	620	1977	TT124-192592
TT125	19	25	92	533000	739400	6917	600	1977	TT125-192592
TT126	19	25	92	533600	739400	6927	600	1977	TT126-192592
TT127	19	25	92	533600	739600	6926	600	1977	TT127-192592

Attachment 3.4-2 Locations, Total Depths, and Completion Dates of Historic Exploration Holes

HOLE ID	S	T	R	N	E	ELEV	TD	Year Drilled	HOLE ID_S
TT128	19	25	92	532800	739400	6916	600	1977	TT128-192592
TT129	19	25	92	533600	739800	6926	600	1977	TT129-192592
TT130	24	25	93	533200	736800	6927	700	1977	TT130-242593
TT131	24	25	93	533200	737000	6924	700	1977	TT131-242593
TT132	24	25	93	533000	737000	6920	700	1977	TT132-242593
TT133	24	25	93	533200	736600	6927	700	1977	TT133-242593
TT134	24	25	93	533200	737200	6921	700	1977	TT134-242593
TT135	24	25	93	532800	737000	6922	700	1977	TT135-242593
TT136	24	25	93	532800	736800	6920	700	1977	TT136-242593
TT137	24	25	93	532600	737000	6919	700	1977	TT137-242593
TT138	24	25	93	532600	736800	6922	700	1977	TT138-242593
TT139	24	25	93	532600	736600	6922	630	1977	TT139-242593
TT140	19	25	92	533800	739800	6923	600	1977	TT140-192592
TT141	19	25	92	533800	739600	6924	600	1977	TT141-192592
TT142	19	25	92	533800	739400	6922	620	1977	TT142-192592
TT143	19	25	92	533800	739200	6924	620	1977	TT143-192592
TT144	19	25	92	533400	739400	6922	620	1977	TT144-192592
TT145	19	25	92	533200	739200	6923	620	1977	TT145-192592
TT146	24	25	93	532967	736309	6929	700	1977	TT146-242593
TT147	24	25	93	532918	736308	6927	560	1977	TT147-242593
TT148	24	25	93	532918	736298	6927	560	1977	TT148-242593
TT149	24	25	93	532866	736307	6925	700	1977	TT149-242593
TT150	19	25	92	533400	739100	6925	650	1977	TT150-192592
TT151	19	25	92	533700	739700	6927	660	1977	TT151-192592
TT152	19	25	92	533695	739801	6910	520	1977	TT152-192592
TT153	19	25	92	533300	739100	6923	650	1977	TT153-192592
TT154	19	25	92	533300	739200	6924	700	1977	TT154-192592
TT155	19	25	92	533700	739790	6924	490	1977	TT155-192592
TT156	24	25	93	532918	736288	6927	600	1977	TT156-242593

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Location Map of Historical Wells-Central Lost Creek Permit Area"
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PLATE A3.4-2b 10.11.07

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"PLATE 3.4-1e
Cross Section F-F', G-G', H-H'
Lost Creek Permit Area"
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PLATE 3.4-1e 10.11.07

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"PLATE 3.4-2a
Isopach Map of the Lost Creek Shale
Lost Creek Permit Area"
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"PLATE 3.4-2b
Isopach Map of the HJ Horizon
Lost Creek Permit Area"
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"PLATE 3.4-2c
Isopach Map of the Sagebrush Shale
Lost Creek Permit Area"
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"PLATE 3.4-2d
Isopach Map of the UKM Sand
Lost Creek Permit Area"
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