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Long-Term Management Plan for the Riverton, Wyoming, Processing Site

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U.S. DEPARTMENT OF ENERGY | Legacy Management

This document has been designed for online viewing.

Contents

Figures

Tables

Appendixes

Abbreviations

AWSS	alternate water supply system
bgs	below ground surface
CFR	*Code of Federal Regulations*
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
GCAP	Groundwater Compliance Action Plan
GEMS	Geospatial Environmental Mapping System
IC	institutional control
LM	Office of Legacy Management
LTMP	Long-Term Management Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
NANRO	Northern Arapaho Natural Resources Office
NRC	U.S. Nuclear Regulatory Commission
RRM	residual radioactive material
SAP	Sampling and Analysis Plan
VMR	Verification Monitoring Report

1.0 Introduction

1.1 Purpose

The purpose of this Long-Term Management Plan (LTMP) is for the U.S. Department of Energy (DOE) Office of Legacy Management (LM) to institute long-term management of the Riverton, Wyoming, Processing Site to ensure protection of human health and the environment. This LTMP is a stand-alone document used to specify management of the long-term activities at the Riverton site. It provides additional detail required to implement the groundwater monitoring program for the current natural flushing compliance strategy stipulated in the Riverton Groundwater Compliance Action Plan (GCAP) (DOE 1998a) (Appendix A). It also includes information about the monitoring of institutional controls (ICs), inspection and maintenance of monitoring wells at the site, and continuation of access agreements for sampling and maintenance of the monitoring wells.

Routine monitoring (DOE 2022a) and scientific studies (DOE 2022b) have been conducted at the Riverton site to assess geochemical conditions, distribution and mobility of contaminants, groundwater-unsaturated zone interaction, persistent secondary sources, and groundwater-surface water interaction to refine the conceptual site model, assess the natural flushing compliance strategy, and assess risk to human health and the environment. The routine monitoring and scientific studies have concluded that the natural flushing compliance is not on track to meet the clean up goals within the 100-year regulatory time frame. Although the natural flushing compliance strategy is not viable, recent studies have determined that there is no unacceptable risk to human health and the environment from current conditions at the site with the current ICs in place.

1.2 Background

A uranium and vanadium ore processing mill operated from 1958 to 1963 at the Riverton site. A tailings pile covered about 72 acres of the 140-acre site. The tailings and associated slurry water were the primary, original source of groundwater contamination of the surficial aquifer. In 1988 and 1989, the tailings pile was excavated down to an average depth of 4 feet (ft) below ground surface (bgs) based on a radium-226 soil standard in Title 40 *Code of Federal Regulations* Section 192 (40 CFR 192). Surface remediation activities resulted in removal of about 1.8 million cubic yards of tailings and associated materials, which were encapsulated at the Gas Hills East, Wyoming, Disposal Site (DOE 1998b). Soils at and below the water table with elevated thorium-230 concentrations were left in place (DOE 1991) on portions of the former mill site as permitted by the supplemental standards provision of 40 CFR 192. Additional details about the Riverton site, along with links to site documents and data, can be found at https://lmpublicsearch.lm.doe.gov/SitePages/default.aspx?sitename=Riverton.

All water quality data for the Riverton site are archived in the LM environmental database at the LM Field Support Center at Grand Junction, Colorado. Water quality data also are available for viewing with dynamic mapping via the Geospatial Environmental Mapping System (GEMS) website at https://gems.lm.doe.gov/#.

LM conducted initial groundwater characterization of the Riverton site in the 1990s. The characterization culminated in the *Final Site Observational Work Plan for the UMTRA Project Site at Riverton Wyoming* (DOE 1998b), also called the Site Observational Work Plan, which recommended a natural flushing compliance strategy that was presented in the GCAP (DOE 1998a). The U.S. Nuclear Regulatory Commission (NRC) had "no technical objection" to the natural flushing compliance strategy in the GCAP (DOE 1998a). LM has conducted verification monitoring since 1998 to document site conditions and assess the progress of natural flushing; data collected during verification monitoring are reported annually in a Verification Monitoring Report (VMR). In addition, the Northern Arapaho Natural Resources Office (NANRO) and a previous environmental oversight agency, the Wind River Environmental Quality Commission have conducted studies and provided verification monitoring support during the verification monitoring period.

Results of the verification monitoring indicated that natural flushing was generally progressing as expected until June 2010, when significant increases in contaminant concentrations were measured in several wells downgradient of the site after the area flooded. In response to the unexpected results following the flood, LM initiated additional characterization efforts in 2012 (DOE 2013) and 2015 (DOE 2016) to investigate the increases in contaminant concentrations and secondary sources of contamination, update the conceptual site model, and assess the viability of the natural flushing compliance strategy.

1.3 Regulatory Requirements

Most of the contaminated materials and residual radioactive material (RRM) were removed to an offsite, privately owned disposal cell (Gas Hills East, Wyoming, Disposal Site) during surface remedial action at the Riverton site in 1988 and 1989. Several isolated areas of RRM were left onsite in accordance with the application of supplemental standards (DOE 1991). When DOE relocated the RRM, the former processing site was cleaned up to meet 40 CFR 192 standards.

The GCAP (Appendix A) is the concurrence document for compliance with Subpart B of 40 CFR 192 for the Riverton site and provides an overview of the natural flushing compliance strategy (DOE 1998a). The natural flushing compliance strategy allows contaminants of concern to naturally flush from the groundwater; however, contaminants must flush below target levels within 100 years, and ICs must be in place to limit exposure for the compliance strategy to be viable. For compliance purposes (in accordance with 40 CFR 192), the surficial aquifer and semiconfined aquifer compose the uppermost aquifer, where compliance with groundwater standards is assessed. In its letter on September 3, 1998 (Appendix B), NRC had no technical objection with the compliance strategy specified in the GCAP. Subsequent monitoring and scientific studies have determined that the natural flushing strategy is not viable; therefore, a new compliance strategy will be needed, which will be documented in a revised GCAP.

2.0 Site Summary

2.1 Site Description

The Riverton site is in Fremont County, 2 miles southwest of the city of Riverton (Figure 1) and within the boundaries of the Wind River Indian Reservation (Northern Arapaho and Eastern Shoshone Tribes). The site is on alluvial deposits between the Wind River, 1 mile north, and the Little Wind River, about 4000 ft southeast. A privately owned sulfuric acid plant operates in the northwest corner of the former processing site. Effluent from the plant is contained in unlined ponds and discharged via an unlined ditch that eventually flows into the Little Wind River. Land near the Riverton site is primarily used for ranching and agriculture.

2.2 Site Ownership and Access

The Riverton site was purchased from the State of Wyoming by the current owner, Chemtrade Refinery Services, Inc., which operates a sulfuric acid plant on the former mill site property. Access to the site is granted through a perpetual easement and covenant.

LM has numerous monitoring wells around the former processing site on private land. Access to these monitoring wells will be maintained through access agreements with the individual owner. All wells are accessible by vehicle most of the year.

2.3 Hydrology

Three aquifers underlie the site. They include, in descending stratigraphic order, an unconfined surficial alluvial aquifer (surficial aquifer), a semiconfined sandstone aquifer (semiconfined aquifer), and a confined sandstone aquifer (confined aquifer). The surficial aquifer consists of approximately 11 to 20 ft of unconsolidated alluvial material; the semiconfined aquifer is a 15–30 ft thick sandstone unit of the Eocene Wind River Formation separated from the unconsolidated alluvial material by a 5–10 ft thick semiconfining layer (finer-grained Wind River Formation). The deeper confined aquifer is composed of shales and sandstones of the upper units of the Wind River Formation, which is more than 500 ft thick near the site and is used as a source of potable water near the Riverton site. The confining unit between the semiconfined aquifer and the confined aquifer is a 10–25 ft thick shale unit. Depth to groundwater in the surficial aquifer is generally less than 10 ft bgs. Groundwater in the uppermost aquifer flows to the southeast.

Because the Riverton site is on an alluvial terrace between the Wind River and the Little Wind River, site conditions have been influenced by periodic flooding of these rivers. Influence of river flooding on site conditions includes the following: formation of an oxbow lake from an abandoned Little Wind River meander in 1995; formation of a new surface water feature formed by high river flow that scoured out a side channel of the Little Wind River in 2016; post-flooding spikes in groundwater contaminant concentrations in 2010, 2016, and 2017; high groundwater levels leaving contaminants in the unsaturated zone; high groundwater levels that leached contaminants from the former tailings pile (White et al. 1984); and destruction of three monitoring wells and two stilling wells.

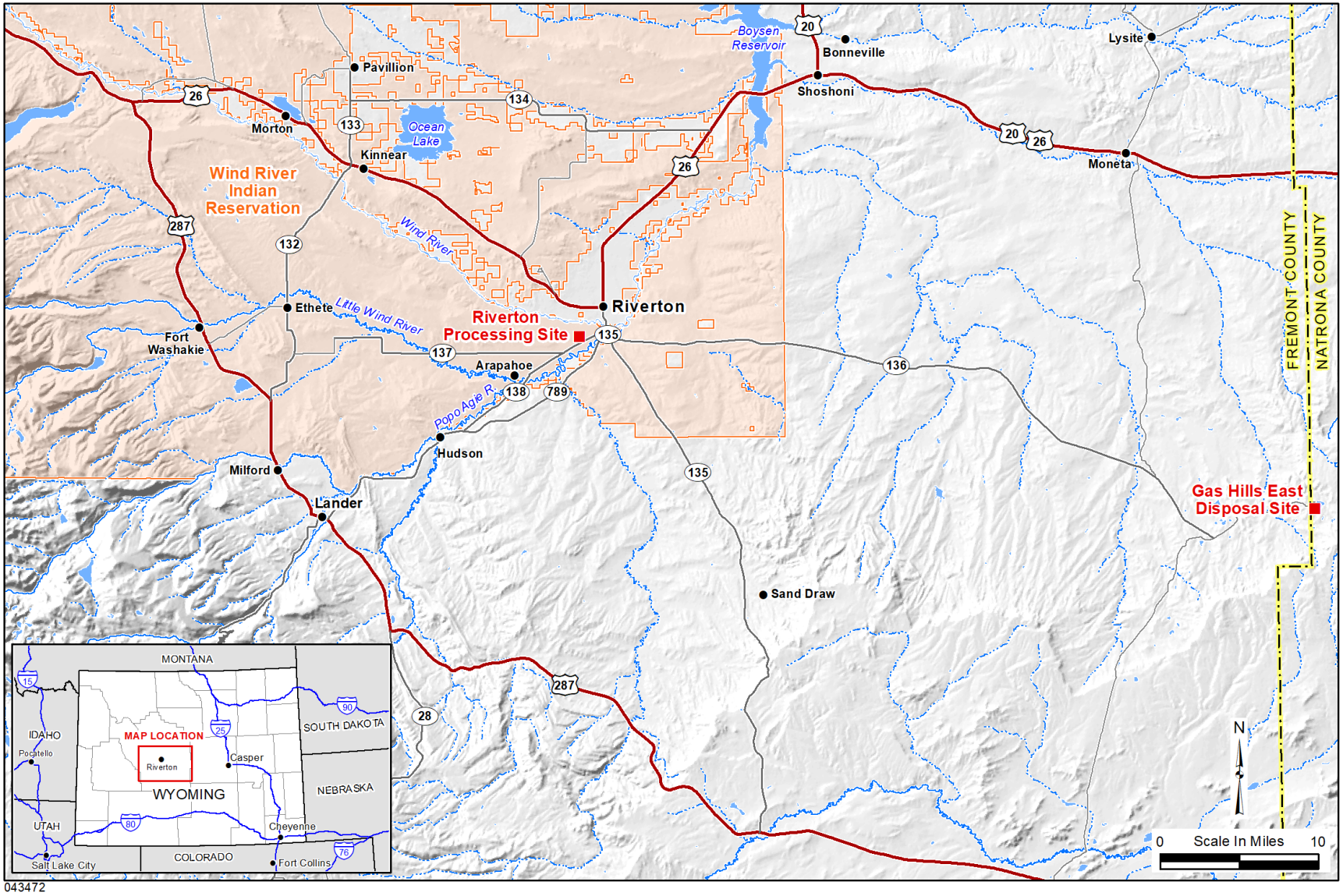

Figure 1. Riverton Site Location Map

2.4 Water Quality

Shallow groundwater beneath and downgradient from the site was contaminated by uranium-processing activities from 1958 through 1963 (DOE 1998b). Contaminants of potential concern (COPCs) in the groundwater beneath the Riverton site are manganese, molybdenum, sulfate, and uranium. COPCs were selected using a screening process that compared contaminant concentrations with the maximum concentration limits (MCLs) in 40 CFR 192, as appropriate, and evaluated potential human health and ecological risks. The COPC selection process is detailed in the *Environmental Assessment of Ground Water Compliance at the Riverton, Wyoming, Uranium Mill Tailings Site* (DOE 1998c). Molybdenum and uranium were selected as indicator contaminants for compliance monitoring in the *Final Ground Water Compliance Action Plan for the Riverton, Wyoming, Title I UMTRA Project Site* (DOE 1998a). These contaminants were selected as indicator contaminants because they are the most widely distributed and form significant aqueous plumes in the uppermost aquifer near the site. The MCLs for molybdenum and uranium concentrations in groundwater are 0.10 milligram per liter (mg/L) and 0.044 mg/L, respectively (40 CFR 192). The State of Wyoming surface water standard for uranium is 0.03 mg/L (WDEQ 2018), which has not been exceeded in samples collected from the Little Wind River.

2.5 Groundwater Compliance Strategy

The current groundwater compliance strategy specified in the GCAP is natural flushing in conjunction with ICs and compliance monitoring. Original groundwater modeling predicted that natural flushing of the surficial aquifer will be completed within the 100-year time frame specified in Subpart B of 40 CFR 192. However, it has been determined that natural flushing is not on track to achieve clean up goals within the 100-year regulatory time frame.

2.6 ICs

To protect human health and the environment during the natural flushing period, ICs are required to control exposure to contaminated groundwater. An IC boundary established at the Riverton site (Figure 2) delineates the area that requires protection. The boundary was set to encompass the area of current groundwater contamination and a surrounding buffer zone to account for potential future plume migration. The ICs listed below will be tracked, verified, and documented.

ICs at the Riverton site include the following components:

- An alternate water supply system (AWSS) (Figure 3), cofunded by DOE and operated by the Northern Arapaho Water and Sewer Department, supplies potable water to residents within the IC boundary to minimize use of groundwater.
- Warning signs installed around the oxbow lake (Figure 4) explain that the contaminated water is not safe for human consumption and instruct people not to drink from, fish in, or swim in the lake.

- A tribal ordinance (Appendix C) restricts well installation, prohibits surface impoundments, authorizes access to inspect and sample new wells, and notifies drilling contractors of the groundwater contamination within the IC boundary. Restrictions on well installation include a minimum depth of 150 ft bgs (approximately 50 ft below the top of the confined aquifer) and installation of surface casing through the contaminated upper aquifer.
- A State of Wyoming Department of Environmental Quality notification of existing groundwater contamination will be provided to private landowners who apply for a gravel pit permit within the IC boundary.
- The Wyoming State Engineer's Office will inform LM when permit applications are received for wells or surface impoundments within or adjacent to the IC boundary, provide LM with a copy of the application (so LM can comment on it), and incorporate LM's comments on the permit, if approved.
- An easement and covenant to restrict land use and well drilling on the former mill site property was finalized on June 29, 2009, when the former mill site was purchased by Chemtrade Refinery Services, Inc. from the State of Wyoming. Details of the easement and covenant are specified in the Quitclaim Deed (Appendix D).

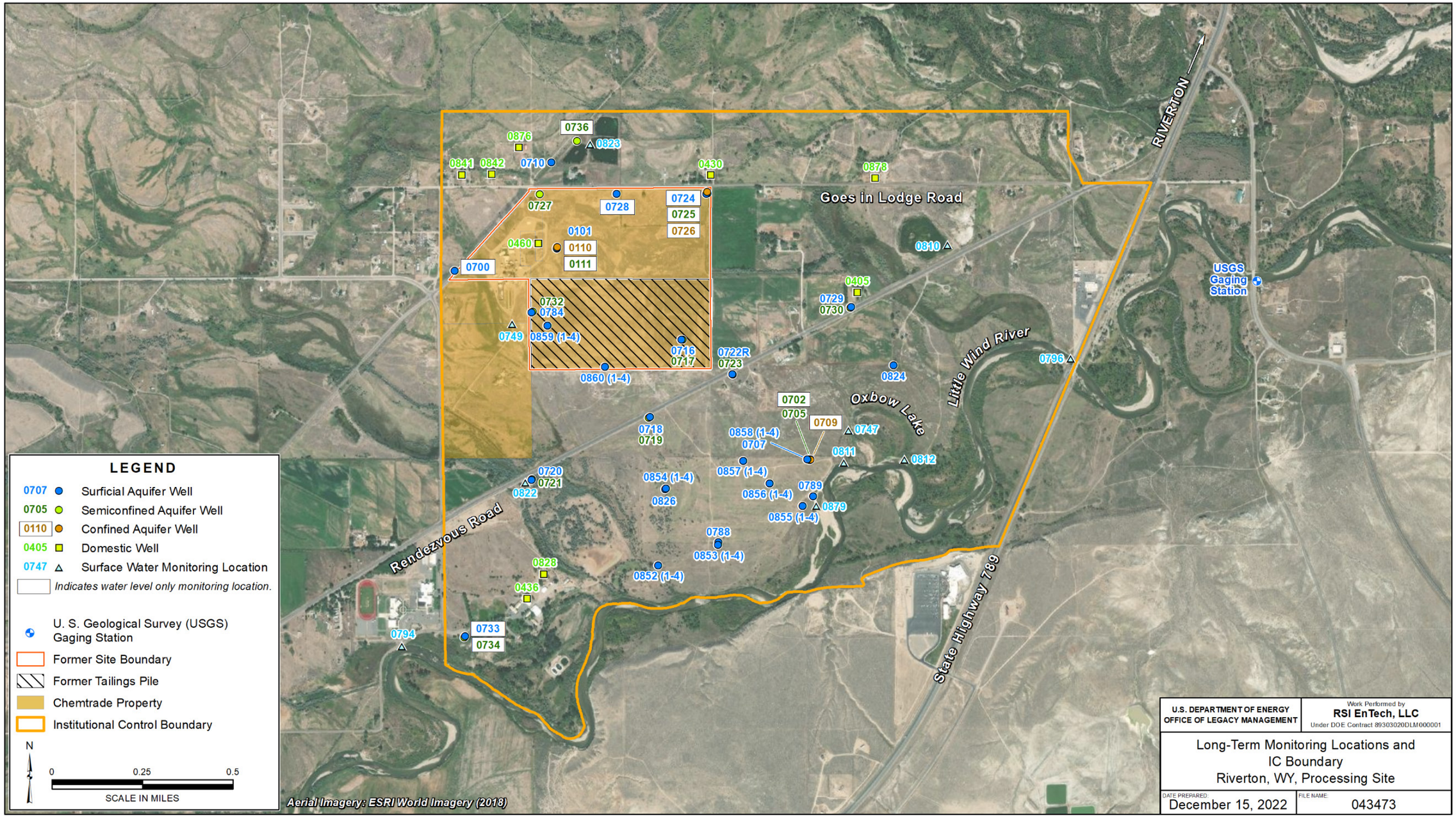

Figure 2. IC Boundary and Long-Term Monitoring Locations, Riverton Site

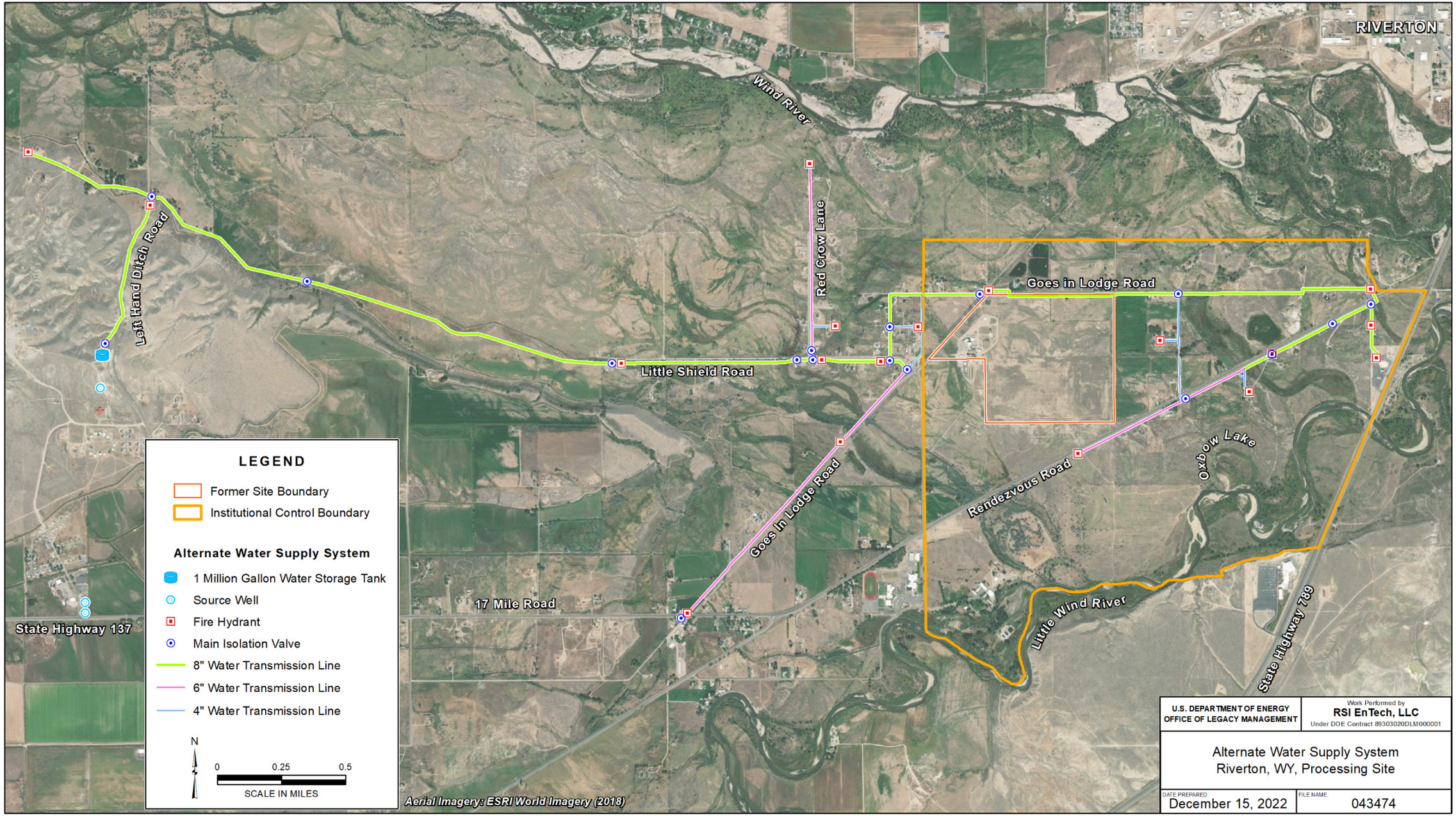

Figure 3. AWSS for the Riverton Site

Figure 4. Warning Sign at the Riverton Site Oxbow Lake

3.0 Long-Term Management Program

3.1 Monitoring

The long-term monitoring program will include groundwater monitoring (Section 3.1.1), surface water monitoring (Section 3.1.2), and IC monitoring (Section 3.1.3).

3.1.1 Groundwater Monitoring

The interim groundwater monitoring program will include water quality monitoring (Section 3.1.1.1) and water level monitoring (Section 3.1.1.2). This groundwater monitoring program will be implemented until a new program is specified in the revised GCAP.

3.1.1.1 Water Quality

Groundwater quality will be monitored to evaluate contaminant plume movement, provide data toward the development of a new compliance strategy, and refine the conceptual site model. Groundwater will be sampled annually in late summer (August or September) during low water conditions. The long-term groundwater monitoring network is summarized in Table 1 and shown in Figure 2. Multilevel monitoring wells 0852 through 0860 were installed in 2015. These wells were constructed as multilevel monitoring wells with four ports to monitor the vertical distribution of groundwater constituents. The top port (port 1) was designed to contain water only during flood conditions and will likely be dry most of the year.

All groundwater sampling will be conducted using procedures specified in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351), also called the SAP, and associated program directives. The SAP also specifies quality assurance measures, sample filtration and preservation, field measurements and calibration, equipment decontamination, sample identification and handling procedures, and documentation associated with groundwater sampling.

Water samples will be analyzed by a DOE Consolidated Audit Program-accredited laboratory for COPCs manganese, molybdenum, sulfate, and uranium (DOE 1998c). In addition, measurements of pH, specific conductance, temperature, total alkalinity, and turbidity will be made in the field. Manganese, molybdenum, and uranium will be analyzed using U.S. Environmental Protection Agency (EPA) SW-846 Method 6010B and EPA SW-846 Method 6020, and sulfate will be analyzed using EPA SW-846 Method 9056 (EPA 2015).

3.1.1.2 Water Levels

Water levels will be measured to monitor horizontal groundwater flow direction in the surficial aquifer, assess and monitor vertical gradients between aquifers, and characterize groundwater and surface water interaction. Surficial aquifer wells were selected to provide an extensive areal network that will allow construction of groundwater elevation contour maps with minimal interpolation between data points. To determine vertical gradients, wells completed in the semiconfined aquifer and confined aquifer are included in the water level network where they are clustered with surficial aquifer wells. Water levels will be measured at all wells in the monitoring network during each water sampling event using an electric sounder in accordance with procedures specified in the SAP. The long-term water level monitoring network is summarized in Table 1 and shown in Figure 2.

Continuous groundwater elevation monitoring will be conducted using datalogging pressure transducers. Pressure transducers will be installed, maintained, and downloaded at 12 monitoring wells (0101, 0700, 0707, 0710, 0716, 0718, 0722R, 0724, 0784, 0789, 0859-4, and 0860-4) at the Riverton site. Data will be used to evaluate water level fluctuations, flow direction, and gradient changes throughout the year and also may be used as input into a future groundwater flow model. The number and location of pressure transducers may be changed depending on project needs. Changes in the transducer network will be documented in a trip report.

Table 1. Long-Term Groundwater Monitoring Network at the Riverton Site

Well ID	Description	Water Quality	Water Level	Rationale
0101	Surficial aquifer	✓	✓	Monitor groundwater flow direction
0110	Confined aquifer		✓	Assess vertical gradient
0111	Semiconfined aquifer		✓	Assess vertical gradient
0700	Surficial aquifer		✓	Monitor groundwater flow direction
0702	Semiconfined aquifer		✓	Monitor groundwater flow direction
0705	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0707	Surficial aquifer	✓	✓	Monitor centroid of plume
0709	Confined aquifer		✓	Assess vertical gradient
0710	Surficial aquifer	✓	✓	Background location
0716	Surficial aquifer	✓	✓	Monitor upgradient portion of plume
0717	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0718	Surficial aquifer	✓	✓	Monitor lateral portion of the plume
0719	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0720	Surficial aquifer	✓	✓	Monitor lateral plume movement
0721	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0722R	Surficial aquifer	✓	✓	Monitor centroid of plume
0723	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0724	Surficial aquifer		✓	Monitor groundwater flow direction
0725	Semiconfined aquifer		✓	Assess vertical gradient
0726	Confined aquifer		✓	Assess vertical gradient
0727	Semiconfined aquifer	✓	✓	Geochemical evidence of connection with surficial aquifer
0728	Surficial aquifer		✓	Monitor groundwater flow direction
0729	Surficial aquifer	✓	✓	Monitor lateral plume movement
0730	Semiconfined aquifer	✓	✓	Monitor semiconfined aquifer
0732	Semiconfined aquifer	✓	✓	Geochemical evidence of connection with surficial aquifer
0733	Surficial aquifer		✓	Monitor groundwater flow direction
0734	Semiconfined aquifer		✓	Assess vertical gradient
0736	Semiconfined aquifer		✓	Monitor groundwater flow direction
0784	Surficial aquifer	✓	✓	Monitor lateral plume movement
0788	Surficial aquifer	✓	✓	Monitor lateral plume movement
0789	Surficial aquifer	✓	✓	Monitor centroid of plume
0824	Surficial aquifer	✓	✓	Monitor lateral plume movement
0826	Surficial aquifer	✓	✓	Monitor lateral plume movement
852 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
853 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
854 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
855 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
856 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
857 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
858 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
859 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer
860 (1-4)	Surficial aquifer	✓	✓	Monitor vertical variation in the surficial aquifer

3.1.2 Surface Water Monitoring

Surface water features near the site include gravel pit ponds, ditches, an oxbow lake, a seep in the side channel of the Little Wind River, and the Little Wind River. Because these surface water features likely receive discharge of shallow groundwater from the surficial aquifer, they will be included in the long-term monitoring program and will be sampled on the same schedule as groundwater (see Section 3.1.1.1). The surface water monitoring network is summarized in Table 2 and shown in Figure 2. All surface water locations will be sampled in accordance with procedures specified in the SAP. Samples collected from all surface water locations will be analyzed for the same constituents as groundwater, and field measurements will be made the same as for groundwater.

Table 2. Summary of the Long-Term Surface Water Monitoring Network

Location ID	Description	Rationale
0747	Oxbow lake	Impacted by discharge from the groundwater plumes; monitor COPC concentrations over time
0749	Sulfur acid plant ditch	Monitor effluent from the sulfuric acid plant
0794	Little Wind River	Upstream of IC boundary; use for comparison to locations adjacent and downstream of plume discharge
0796	Little Wind River	Downstream of predicted plume discharge to the river; verify no site-related impact to river water quality
0810	Pond—former gravel pit	Within IC boundary and cross gradient of groundwater plumes; verify background concentrations of COPCs
0811	Little Wind River	Within an area of predicted plume discharge to the river; verify no site-related impacts to river water quality
0812	Little Wind River	Downstream of the area of predicted plume discharge to the river; verify no site-related impacts to river water quality
0822	West side irrigation ditch	Within IC boundary and cross gradient of groundwater plumes; verify background concentrations of COPCs
0823	Pond—former gravel pit	Within IC boundary and upgradient of groundwater plumes; verify background concentrations of COPCs
0879	Seep in the side channel of the Little Wind River	Impacted by discharge from the groundwater plumes in the centroid of the plume; monitor COPC concentrations over time

3.1.3 IC Monitoring

The natural flushing compliance strategy depends upon ICs to protect human health and the environment during the flushing period. To verify ICs are in place and functioning as intended, an IC monitoring program will be conducted. The IC monitoring will have three components: sampling, verification and documentation of water use, and verification of land use.

3.1.3.1 Sampling

Domestic Wells

Domestic wells within the IC boundary that are used as potable water sources will be sampled annually to verify that they have not been impacted by site contaminants. Nine domestic wells identified for long-term sampling are wells 0405, 0430, 0436, 0460, 0828, 0841, 0842, 0876, and

0878 (Figure 2). All domestic well samples will be collected in accordance with the SAP and will not be filtered to represent potable water use. Samples from domestic wells will be collected annually during the groundwater and surface water sampling event and will be analyzed for the same constituents and field measurements as groundwater and surface water. If any additional domestic wells used as potable water sources within the IC boundary are discovered in the future, those wells will be added to the long-term monitoring network. In addition, if a homeowner gets connected to the AWSS and no longer uses their well for potable water, monitoring of their well will be discontinued.

AWSS

Elevated concentrations of radionuclides were identified in the AWSS in 2002 by the Wind River Environmental Quality Commission, and results were confirmed in 2004 by LM. In response to these findings, a 2-year flushing and monitoring program completed in 2007 concluded that a unidirectional flushing program was effective in reducing radionuclide concentrations in the system. Results of the flushing study are presented in the *Alternate Water Supply System Flushing Report, Riverton, Wyoming, Processing Site* (DOE 2008). In 2016, elevated concentrations of radionuclides were identified again (DOE 2017), which prompted a condition assessment of the system by an independent engineering firm (WWC 2018). The condition assessment identified a broken valve in the system that caused reduced flow rates and pipe velocities downstream of the valve, which diminished the effectiveness of the flushing. In addition, the condition assessment specified a new flushing plan along with system upgrades required to conduct an effective flush and ensure system longevity.

In addition to the radionuclide issue, other issues with the AWSS have arisen over the years that have required LM to partner with the Northern Arapaho Tribe (the owner of AWSS). These partnerships included engineering assessments, scientific investigations, sampling support, and funding. Issues with the AWSS have included the following:

- Materials used during initial construction not having enough margin for system pressures and not accounting for soil corrosivity
- Aging system components (e.g., hydrants, valves, and pumps)
- Demands on the system with the addition of large commercial customers
- Connection and integration of the AWSS with an area-wide water system

To be a viable IC, the AWSS will require management, maintenance, and upgrades to provide safe drinking water during the current natural flushing period and into the future when a new compliance strategy is selected. Current work involves updating the condition assessment report and conducting engineering design work to upgrade the system based on the updated report. The engineering design will be used to replace aging components, add additional components to optimize system pressures and flushing, and upgrade operational control of the system. Engineering design work is scheduled to be completed in 2023 with construction in 2024.

3.1.3.2 Land and Water Use Verification

Annual inspection of the land and water use within the IC boundary will be conducted to verify and document that there are no additional land or water uses that expose or use shallow groundwater. Inspections will occur in conjunction with annual water sampling events, and results will be documented in the trip report and reported in the VMR. Unauthorized land uses may include new wells, gravel pits, and recreational ponds. If unauthorized land use is observed, it will be documented in the trip report, and a letter will be sent to the appropriate regulatory agency (State Engineer's Office or Wyoming Department of Natural Resources) to initiate corrective action. Additional support for land and water use verification will be provided by NANRO through a cooperative agreement with LM.

To date, the oxbow lake (location 0747) and seep in the side channel of the Little Wind River (location 0879) have been impacted by site-related contamination; therefore, these surface water features will be inspected annually to verify that water from these locations is not being used as a potable water source and that warning signs placed around the oxbow lake are intact. If future monitoring indicates site-related impacts to water quality in the gravel pit ponds, irrigation ditches, or wetland areas, these areas will be included in the inspection process.

3.2 Risk Assessment

A comprehensive risk assessment at the Riverton site was completed in 2020. This risk assessment was a coordinated effort among LM, Argonne National Laboratory, and the Northern Arapaho Tribe to address any human health and environmental risk posed by contaminated groundwater, including discharge to surface water bodies, uptake by plants, and potential impacts to the ecosystem. The assessment focused on the risk from cultural use of plants, which had never been assessed in the past. Fieldwork to support the assessment of the use of cultural plants included collection of 157 vegetation samples from 12 species of plants in July and August 2018. A risk assessment report titled *Riverton, Wyoming, Processing Site: An Environmental Risk Assessment Update* (ANL 2021) was issued, and the report concluded that the current conditions at the Riverton site are protective of human health and the environment given the continuous monitoring, oversight, and ICs that are in place with collaborative efforts between LM and the Northern Arapaho Tribe (ANL 2021).

3.3 Maintenance, Access, and Reports

All monitoring wells remaining at the Riverton site are part of the long-term monitoring program, so they must be inspected and maintained. Monitoring wells will be inspected during each sampling event. The condition and integrity of the monitoring wells will be documented, and maintenance will be performed as necessary. Access agreements will be maintained for monitoring wells outside the boundary of the former mill site. On the former mill site, a perpetual easement and covenant is in place to access these monitoring wells. Inspection, maintenance, and redevelopment of all monitoring wells sampled in the long-term network will be conducted as needed according to the *Inspection and Maintenance of Groundwater Monitoring and Extraction Wells* (LMS/PRO/S18459).

An annual VMR will be required until a new compliance strategy is selected and documented in an updated and NRC-approved GCAP. The VMR will include water quality data, water level data, and IC status. An evaluation of these data summarizing site conditions and contaminant trends related to natural flushing will also be included. This report may include results of other scientific studies that are ongoing at the site and supplemental to the long-term monitoring program, along with updates to the conceptual site model. A revised monitoring program to assess the new compliance strategy will be specified in the updated GCAP.

After each sampling event, a written report will be sent to each homeowner with a domestic well that was sampled. The letter will provide the sampling results from the homeowner's well and compare the results to applicable standards.

3.4 Quality Assurance and Safety and Health

Quality assurance measures for implementation of the long-term monitoring program include using trained and qualified personnel and following established procedures. Water quality data collection activities will be conducted in accordance with procedures specified in the SAP for sample collection, quality control samples, analytical methods and reporting limits, field instrument calibration, and data validation procedures.

Safety and health considerations and controls for sampling and maintenance activities are addressed in a job safety analysis document appended to the SAP.

3.5 Review and Revision

The monitoring program specified in this LTMP is dynamic and subject to change as studies are conducted and concluded, the conceptual site model is revised, and the compliance strategy is reevaluated. Changes in monitoring locations, analyses conducted, and frequency of sampling may be necessary. Proposed changes to this LTMP will be reviewed by NANRO, and concurrence will be attained before changes become final. LM will hold working group meetings for specific topics and regular periodic general meetings to facilitate concurrence with the long-term monitoring program and this LTMP.

In lieu of revising this LTMP for each change, changes will be authorized via email from the LM site manager along with a concurrence email from NANRO. These email messages will be retained as project records, and the LTMP will be revised every 5 years to incorporate the interim changes that have been authorized and concurred via email, if necessary.

3.6 Groundwater Compliance

Scientific studies and groundwater modeling have determined that the natural flushing is not on track to achieve clean up goals within the 100-year regulatory time frame; therefore a new compliance strategy is needed that will be documented in a revised GCAP and submitted to NRC for concurrence with the new compliance strategy. Work is in progress to address data gaps that will facilitate selection of a new compliance strategy. Fieldwork and laboratory testing required to fill the data gaps are specified in the *2022 Work Plan for Continued Site Investigation of the Riverton, Wyoming, Processing Site* (DOE 2022c).

3.7 Tribal Collaboration

Collaboration with the Northern Arapaho tribe is essential to long-term management of the Riverton site. NANRO has partnered with LM in the past through cooperative agreements to provide oversight of the long-term monitoring program, review of site reports and plans, institutional control monitoring, public outreach, logistical support, and coordination with tribal entities. Collaboration and support will be required to manage the site and ensure protection of human health and the environment in the future. This support will be specified in ongoing cooperative agreements with LM.

4.0 References

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

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DOE (U.S. Department of Energy), 2022a. *2021 Verification Monitoring Report, Riverton, Wyoming, Processing Site*, LMS/RVT/S38307, Office of Legacy Management.

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Inspection and Maintenance of Groundwater Monitoring and Extraction Wells LMS/PRO/S18459*,* continually updated, prepared by the LMS contractor for the U.S. Department of Energy Office of Legacy Management.

Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites, LMS/PRO/S04351, continually updated, prepared by the LMS contractor for the U.S. Department of Energy Office of Legacy Management.

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WWC (WWC Engineering), 2018. *Condition Assessment of the Alternate Water Supply System Riverton, Wyoming, UMTRA Site*, prepared for the LMS contractor to the U.S. Department of Energy Office of Legacy Management, Sheridan, Wyoming, June.

Appendix A

1998 Ground Water Compliance Action Plan

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503

SEP 22 1998

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
Mail Stop T7J9
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Final Ground Water Compliance Action Plan for the Riverton, Wyoming, Title I UMTRA Site

Dear Mr. Holonich:

Please find enclosed two copies of the *Final Ground Water Compliance Action Plan (GCAP) for the UMTRA Project Site at Riverton, Wyoming, February 1998* for your review and concurrence.

The final GCAP text-language is submitted as the 40 CFR 192, Subpart B, Ground Water Modification to the Remedial Action Plan (RAP) and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Riverton, Wyoming. The GCAP will serve as a replacement of the current text identified in the RAP: Section 4.3.4 Hydrogeology; *Aquifer Restoration*, (DOE, 1987).

The DOE Ground Water Project has completed an Environmental Assessment (EA) of ground water compliance activities at the Uranium Mill Tailings Site, Riverton, Wyoming. A public scoping meeting was held at the St. Stephen's Mission School, near the Riverton Site, on January 27, 1998. The proposed action discussed at the scoping meeting suggested "natural flushing with monitoring and institutional controls" to comply with the U.S. Environmental Protection Agency Standards, 40 CFR 192, Subpart B. The EA is enclosed for your information.

Future monitoring and a performance assessment is required with the selection of the natural flushing strategy, and verification monitoring will be conducted to gain further confidence in the predicted flushing performance. At the end of verification monitoring (~5 years) and prior to transferring the site to the Long-Term Surveillance and Monitoring Project (LTSM) for out-year compliance monitoring, the DOE will develop and submit a confirmation report. This report will document the ground water and surface water monitoring data collected after NRC's concurrence with the GCAP and will compare actual data results to the predicted concentrations plots

included in Section 4.3.7 of the final SOWP. DOE's UMTRA Ground Water Project Management Action Process schedule for out-year activities at Riverton shows the site would be transferred to LTSM in 2002. Long-term compliance monitoring will be conducted under LTSM according to the proposed locations, frequencies, analyte list, and duration identified in Section 5.3 of the final SOWP. If predicted flushing results do not reasonably coincide with actual compliance monitoring data, DOE will involve the NRC, tribes, and state and will reevaluate the situation. A corrective action could be implemented if determined necessary.

An alternate water supply, funded by DOE and under construction management by Indian Health Service (IHS), is nearly completed. Residents living over or near the contaminated ground water will now have potable water supplied to their homes, which negates further reliance on their privates wells for domestic water use. Further, one of the requirements for installing the alternate water supply is an IHS moratorium on future well drilling for the purpose of eliminating private well water as a source of domestic water use. This will serve as a viable and effective institutional control to ensure the shallow contaminated ground water is not used inappropriately, such as a drinking water source.

If you have questions or need further clarification, please call me at (970) 248-7612.

Sincerely,

Donald R. Metzler, P.Hg.
Technical/Project Manager

Enclosures:
Final GCAP

cc w/enclosure:
D. Aragon, WREQC
J. Erickson, Wyoming DEQ

cc w/~~8~~ 9 enclosure:
File #GWRIV1.~~4~~ 9 (P. Taylor)

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Final Groundwater Compliance Action Plan (GCAP)

September 5, 1998

40 CFR 192 (Subpart B) Ground Water Compliance Modification to the Remedial Action Plan (RAP) and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Riverton, Wyoming (DOE,1987)

4.3 DESIGN DETAILS (from 1987 RAP)

4.3.4 Hydrogeology

Aquifer Restoration

To achieve compliance with Subpart B of 40 CFR 192 (aquifer restoration) at the Riverton, Wyoming, UMTRA Site, the DOE proposes implementation of the natural flushing strategy, in conjunction with institutional controls and compliance monitoring. This determination utilizes a consistent and objective strategy selection framework developed in the Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project (October, 1996).

In summary, the natural flushing strategy is based on observed ground water field data coupled with computer modeling predictions that natural ground water movement and geochemical attenuation processes will reduce the detected contamination to Maximum Concentration Limits (MCL) or background levels within 100 years. The uppermost aquifer is not currently and is not projected to be a drinking water source in the vicinity of the site.

In applying the decision framework developed in the Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project as the strategy selection process in the final Site Observational Work Plan (SOWP) for the UMTRA Project Site, at Riverton, Wyoming (February, 1998), the DOE has determined that the ground water in the uppermost aquifer was contaminated by uranium processing activities at the Riverton Site, but the uppermost qualifies for natural flushing based on: (1) water quality results from approximately 15 years of data collection at the site; (2) probabilistic flow and solute transport modeling depicting contaminant concentrations to the year 2072; (3) viability of an enforceable institutional control that will prevent inappropriate uses of the contaminated ground water during the flushing period; and (4) compliance monitoring framework and details that will ensure the contaminant concentrations decrease as predicted.

The framework as applied to the Riverton Site consists of five evaluative steps that are discussed below.

The first step of the decision framework was an assessment of both older and more recently collected environmental data. The uppermost aquifer consists of the surficial unconfined alluvial aquifer and the semiconfined sandstones with the upper geologic rock units of the Eocene-aged Wind River Formation. Ground water contaminants are a result of uranium processing activities that occurred from 1958 until mid-1963. Section 4.0 of the final SOWP provides a conceptual site model that includes the hydrogeologic setting, nature and extent of ground water contamination, and contaminant fate and transport. Evaluation of existing site data coupled with the Riverton Site conceptual model and predictive flow and solute transport modeling indicate that sufficient hydrological and ground water contamination characterization data exists to make an appropriate compliance strategy selection. In technical correspondence from the Nuclear Regulatory Commission (NRC) to DOE, dated April 29, 1996, NRC recommended that "DOE consider designing the proposed aquifer tests to measure the full range of properties an aquifer test is capable of measuring." This recommendation was aggressively addressed in Section 3.1.3 of the final

SOWP. NRC also recommended that "DOE provide data points on all maps presented in future reports." This recommendation has been addressed in the final SOWP.

The second step compares the list of ground water contaminants with MCLs or background ground water quality. Ground water contaminants from the uranium milling operation have seeped into the subsurface and migrated into the uppermost aquifer, forming a plume that continues to attenuate and discharge to the Little Wind River. The contaminant list includes arsenic, lead-210, molybdenum, nickel, polonium-210, thorium-230, uranium, and vanadium. Additional constituents that are indicators of process-related contaminated ground water, when detected in elevated concentrations include: sulfate and manganese (BLRA, 1995). Of these constituents, only uranium, molybdenum, and sulfate are sufficiently distributed to form volumetric aqueous plumes. Because interpretation of data collection has indicated that sulfate continues to emanate from a different and continued source other than past uranium mill processing and tailings seepage, sulfate has not been selected as an indicator constituent for predicting natural flushing. Only uranium and molybdenum were selected as indicator constituents for compliance monitoring.

The third step determines whether the contaminated ground water qualifies for natural flushing based on the criterion identified in the EPA ground water standards, 40 CFR 192.12 (60 FR 2854-2872). As shown in Figures 4-17, 4-18, 4-19, and 4-20, of the final SOWP, the numerical probabilistic computer model predicted that concentrations of uranium and molybdenum in the surficial aquifer are reduced to concentrations below MCLs within approximately 100 years from 1997. The probability that the concentrations are less than MCLs in 75 years for each constituent is on the order of 90 percent. By 100 years, all simulations showed uranium and molybdenum concentrations at background levels.

The fourth step determines whether institutional controls can be maintained during the flushing period and is natural flushing protective of human health and environmental. A viable and enforceable institutional control is in place through a Memorandum of Agreement among the Indian Health Service, the Northern Arapaho Tribe, and the Northern Arapaho Utility Organization (Public Law 86-121, Project No. BI 97-837). The institutional control is governed by these government entities because the contaminated ground water resides beneath tribal lands. There is no current risk to human health because there are no known exposure pathways for ground water from the uppermost aquifer to reach a domestic user (i.e., private wells). Further, an alternate water supply is in construction that will provide potable water to existing and future residents and will create a moratorium on domestic wells in the affected area (Section 4.3.4, final SOWP, 1998). Environmental risk has been evaluated, and the known ecological pathways are considered acceptable (BLRA, 1995). Contaminated ground water discharge to the Little Wind River is diluted nearly instantaneously, and statistical analysis on upstream, adjacent, downstream water sampling show no appreciable difference. One area the DOE will monitor closely is a cut-off meander (Oxbow Lake) on the north side of the Little Wind River. This cut-off was formed naturally a few years ago, and is characterized as contaminated ground water discharging and surface water mixing zone. Most of the year this area is dry or frozen. During periods of high water stage this area becomes flooded with river water. From an ecological risk, this exposure pathway does not create unacceptable risks; however, it will be monitored as part of compliance.

The fifth and final step in the framework selects an appropriate compliance strategy to meet the EPA ground water standards. The selection is to allow natural flushing to meet the EPA ground water standards within a performance period of 100 years, starting in 1998, and coupled with institutional controls and compliance monitoring. The uppermost aquifer is not currently and is not projected to be a drinking water source in the vicinity of the site (40 CFR 192.12, Subpart B).

Subpart C, *Implementation*, requires compliance monitoring to verify anticipated plume movement and the associated reduction in plume concentrations. The monitoring compliance plan, that will be used to verify that the elevated concentrations for the indicator constituents are being naturally reduced in general accordance to the out-year predictions, is detailed in the final SOWP. After five years of verification monitoring, the Riverton UMTRA Site will be transferred to the DOE Long-Term Surveillance and

Monitoring Program for continued compliance monitoring. In the unlikely event that the compliance monitoring indicates that observed concentration decreases are not in general accordance with the out-year predictions, then the process of applying the decision framework developed in the Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project (October, 1996) to the site conceptual model would be implemented as formal corrective action.

Details supporting the (1) regulatory framework requirements, (2) summary of site conditions and risk consequences, (3) ground water compliance strategy selection with coupled predictive modeling, and (4) the compliance monitoring plan can be found in the Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Riverton, Wyoming (September, 1995) and the final Site Observational Work Plan for the UMTRA Project Site at Riverton, Wyoming (February, 1998).

An Environmental Assessment of Ground Water Compliance Activities at the Uranium Mill Tailings Site, Riverton, Wyoming, has been completed with a Finding Of No Significant Impact. The EA will be distributed to key stakeholders and public reading rooms in September 1998. This National Environmental Policy Act document will tier from the Programmatic Environmental Impact Statement and has included public involvement.

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Appendix B

NRC GCAP Letter

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 3, 1998

Mr. Ray Plieness
U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

SUBJECT: REVIEW OF THE FINAL SITE OBSERVATIONAL WORK PLAN AND DRAFT GROUND WATER COMPLIANCE ACTION PLAN FOR THE RIVERTON, WYOMING, TITLE I UMTRA SITE

Dear Mr. Plieness:

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the U.S. Department of Energy's (DOE's) Site Observational Work Plan (SOWP), which included the Draft Ground Water Compliance Action Plan, submitted by cover letter dated February 25, 1998, for the Uranium Mill Tailings Remedial Action (UMTRA) Project site at Riverton, Wyoming. The review focused on the proposed ground-water remediation strategy for compliance with 40 CFR Part 192, and the technical information presented in support of this strategy. This review does not imply a concurrence in the ground-water cleanup activities at the Riverton site, but is provided as a "fatal flaw" review of the proposed compliance strategy based on collected data and analyses presented in the final SOWP.

The final SOWP summarizes the results from a probabilistic ground water flow and transport model that is used to reduce the uncertainties associated with the proposed ground-water compliance strategy. The model results show that the uncertainty associated with the proposed ground water compliance strategy is acceptable. Therefore, the next step in the UMTRA process, the preparation of site specific ground-water National Environmental Policy Act (NEPA) document, can begin.

The ground-water compliance strategy recommended for the Riverton site is natural attenuation with institutional controls to limit exposure to the contaminated ground water during the recovery period, and verification monitoring to ensure the model predictions are accurate. Hydrogeologic and geochemical data collected from the Riverton site and the results of the ground-water modeling indicates that the natural ground-water movement and geochemical processes will decrease contaminant concentrations to background levels or maximum concentration limits (MCLs) within 100 years. During that period of time, effective monitoring, institutional controls, and an alternative water supply will be maintained to prevent the use of ground water in the affected aquifer for domestic consumption, stock watering, or crop irrigation.

The NRC staff has no technical objection to utilizing this compliance strategy at the Riverton site. If you have any questions concerning this letter, please contact the NRC Project Manager, Jim Park, at (301) 415-6699.

Sincerely,

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

cc: D. Metzler

Appendix C

Tribal Ordinance

Susquehanna Uranium Mill Groundwater Control Ordinance

I. Findings

(A) The Joint Business Council of the Northern Arapaho and Eastern Shoshone Tribes ("JBC") finds that groundwater in the vicinity of the former Susquehanna Uranium Mill has been contaminated with uranium and other constituents that are harmful to human health.

(B) The JBC finds that the United States Department of Energy (DOE) is the entity with the legal responsibility for clean up of contaminated groundwater related to the Susquehanna Uranium Mill site. The DOE has chosen a natural flushing strategy for clean up of contaminated groundwater related to the Susquehanna Uranium Mill site

(C) The JBC finds that where the natural flushing strategy is chosen, federal law requires the DOE to maintain institutional controls that will prevent human contact with contaminated groundwater until levels of contamination fall below the maximum concentration limits established in Ground Water Standards adopted by the United States Environmental Protection Agency (EPA), 40 C.F.R. Pt. 192.

(D) The JBC finds under the natural flushing strategy chosen by the DOE, levels of contamination in the groundwater in the vicinity of the Susquehanna Uranium Mill site may exceed the maximum concentration limits established in EPA's Ground Water Standards for as many as 100 years.

(E) The JBC finds that the Eastern Shoshone and Northern Arapaho Tribes have a vital interest in preventing all residents of and visitors to the Wind River Indian Reservation from coming in contact with contaminated groundwater until natural flushing brings the level of contamination in the groundwater below the maximum concentration limits established in EPA's Ground Water Standards.

II. Restrictions Applicable to "Susquehanna Uranium Mill Groundwater Control Area"

(A) The JBC hereby establishes the "Susquehanna Uranium Mill Groundwater Control Area." The boundaries of the Susquehanna Uranium Mill Groundwater Control Area are set forth in Appendix A to this Ordinance. The boundaries are subject to modification if the JBC, in consultation with the DOE, determines that different boundaries would better protect public health.

(B) Within the Susquehanna Uranium Mill Groundwater Control Area, the Water Resource Control Board of the Wind River Reservation (the "Board") shall adhere to the

following restrictions when issuing permits and licenses under the Wind River Water Code of 1991.

(1) Well Construction Licenses – The Board shall insert the following terms and conditions in every new well construction license issued under the Wind River Water Code for any well proposed to be drilled within the Susquehanna Uranium Mill Groundwater Control Area:

a. Wells shall be drilled to a minimum depth of 150 ft. The top of the screened interval shall start at 150 feet and the blank casing above the screen shall be grouted to the surface.

b. Well construction shall include grouting a larger diameter steel surface casing through the contaminated upper aquifer (i.e., the first 25 ft. of depth). Once the surface casing is set and grouted in place, the well can be drilled to an approved depth of at least 150 feet.

c. The licensee will allow the federal government (U. S. Department of Energy) and authorized agents of the Wind River Environmental Quality Commission and the Tribal Water Engineer's Office to have access to the well and to inspect and sample the well (or a tap/hydrant from the well) as part of its monitoring program for the Riverton site.

(2) Drilling Licenses – The Board shall notify each existing well drilling licensee and shall include with every new well drilling license issued under the Wind River Water Code an advisory notifying the licensee of the existence and location of the Susquehanna Uranium Mill Groundwater Control Area and the restrictions imposed on drilling within this area by this Ordinance.

(3) Storage Permit – The Board shall not issue a storage permit under the Wind River Water Code for any surface water impoundment located or proposed to be located within the Susquehanna Uranium Mill Groundwater Control Area.

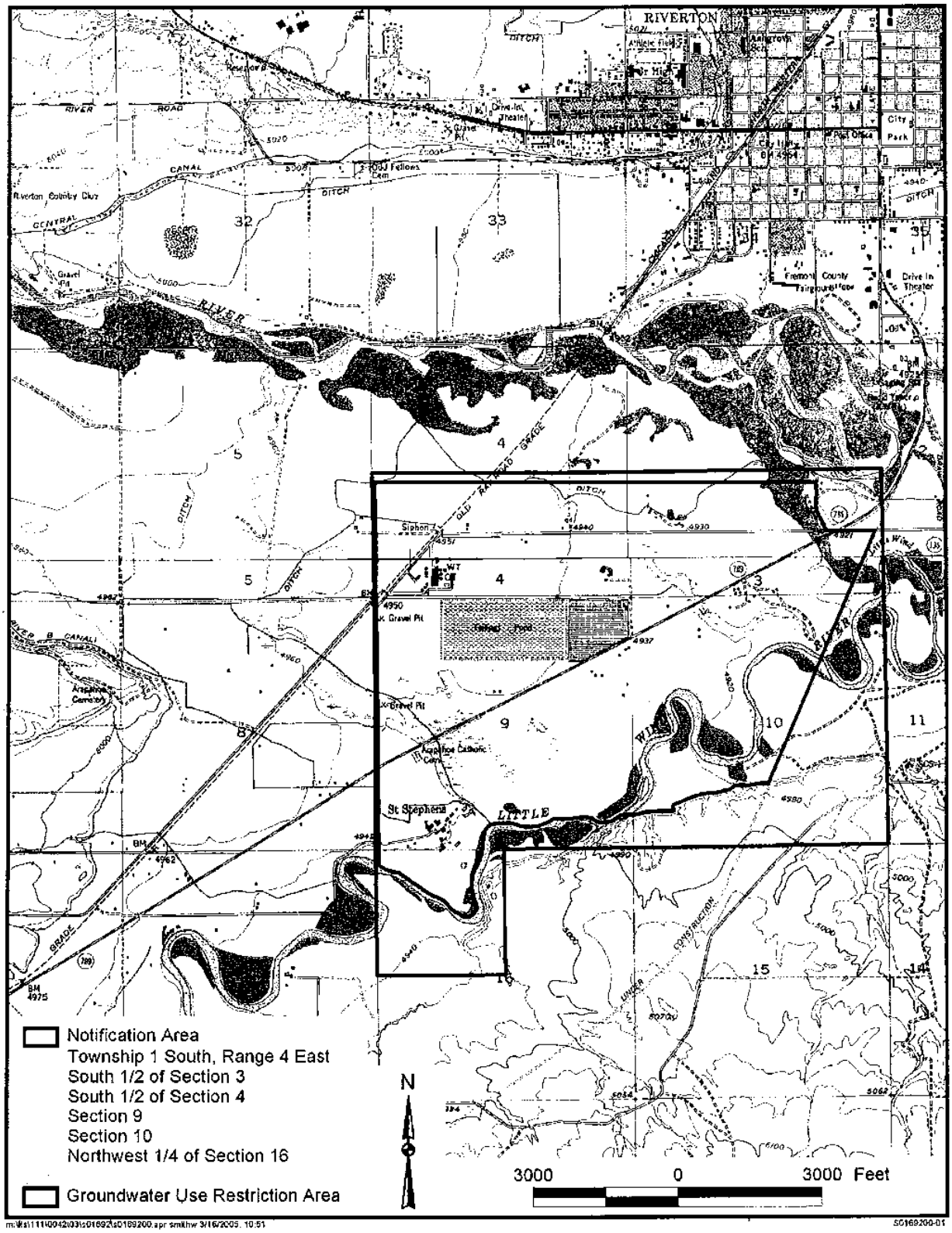
(4) Other Permits – The Board shall not issue any other permit under the Wind River Water Code for an activity located or proposed to be located within the Susquehanna Uranium Mill Groundwater Control Area where the issuance of the permit could expose persons to contact with contaminated groundwater.

(C) Upon receiving any application for a permit or license for an activity proposed to occur within the Susquehanna Uranium Mill Groundwater Control Area, the Board shall provide written notice to the DOE which shall include a legible copy of the permit or license application. If the DOE provides written comments within 30 days of such notification, the Board shall consider these comments when acting on the application, in addition to adhering to all other requirements of this Ordinance

(D) This ordinance shall remain effective until the Nuclear Regulatory Commission has concurred with DOE's determination that groundwater remediation at the Susquehanna Uranium Mill site is complete and groundwater contaminant levels have fallen below the maximum concentration levels established in EPA's Ground Water Standards, 40 C.F.R. Pt. 192.

(E) The Tribal Water Engineer shall mail a copy of this Ordinance to the Wyoming State Engineer's Office, the Wyoming Department of Environmental Quality, the Bureau of Indian Affairs (Wind River Agency and Regional Office), the U.S. Environmental Protection Agency, the Army Corps of Engineers, the Indian Health Service and Fremont County and request the cooperation of these agencies in maintaining the effectiveness of this Ordinance.

(F) This Ordinance is adopted in the spirit of cooperation to protect public health on the Wind River Indian Reservation. Adoption of this Ordinance shall not be construed as a concession on the part of the JBC, the Northern Arapaho Tribe, or the Eastern Shoshone Tribe that DOE has met its obligations under federal law to clean up contaminated groundwater related to the Susquehanna Uranium Mill site.


RIVERTON
Notification Area
Township 1 South, Range 4 East
South 1/2 of Section 3
South 1/2 of Section 4
Section 9
Section 10
Northwest 1/4 of Section 16
Groundwater Use Restriction Area
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3000
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3000 Feet
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Appendix D

Quitclaim Deed

STATE OF WYOMING

QUITCLAIM DEED NO. 212 - QC

THE STATE OF WYOMING, DEPARTMENT OF ENVIRONMENTAL QUALITY, ACTING BY AND THROUGH THE WYOMING BOARD OF LAND COMMISSIONERS, 122 West 25th Street, Herschler Building, Cheyenne, Wyoming, 82002-0600, GRANTOR, for Ninety-Five Thousand and No/100 Dollars ($95,000.00) and in consideration of the mutual promises stated in the Remedial Action Agreement and Agreement for Purchase of Land made between the United States of America, the State of Wyoming and Chemical Marketing Services, Inc. (predecessor in interest to Chemtrade Refinery Services Inc.), on the Eleventh day of June 1987, recorded in the Fremont County Clerks Records at Book 296, Page 501, hereby conveys and quitclaims to Chemtrade Refinery Services Inc., a Delaware corporation, GRANTEE, all interest in the following described real property (the "Real Property"), situate in the county of Fremont, in the State of Wyoming; to wit:

The S1/2SW1/4, SW1/4SE1/4 of Section 4, and the W1/2NW1/4, NE1/4NW1/4, NW1/4NE1/4 of Section 9, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming.

EXCEPTING, however, from the above described land the following five parcels of land:

1) All that portion of the SW1/4SW1/4, Section 4, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming, lying North and West of the Northwesterly boundary of the Chicago and Northwestern Railway Company right of way.

2) Beginning at a point which is located 19.3 feet North and 2819.5 feet West of the East 1/16 corner between Sections 4 and 9, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming; said point being further located 3.5 feet West of the West rail of the Chicago and Northwestern Railway spur; thence South 24.3 feet; thence West 212.0 feet; thence North 280.0 feet; thence East 212.0 feet; thence South 255.7 feet to the point of beginning.

3) Beginning at a point which is located 28.7 feet South and 2808.5 feet West of the East 1/16 corner between Sections 4 and 9, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming; said point being further located 3.5 feet East of the East rail of the Chicago and Northwestern Railway spur; thence South 62.0 feet; thence East 50.0 feet; thence North 62.0 feet; thence West 50.0 feet to the point of beginning.

4) A tract of land in the SW1/4SW1/4 of Section 4, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming, more particularly described as follows:

Beginning at a point, designated as the Main Laboratory Building NW corner, lying approximately North 412.00 feet and East 1032.00 feet from B.M. 4950.00 located in the NE corner of Section 8, Township 1 South, Range 4 East, Wind River Meridian; thence Easterly 74 feet to the Main Laboratory NE corner; thence Southerly 118 feet; thence Westerly 84 feet along the property line; thence Northerly 118 feet; thence Easterly 10 feet to the point of beginning.

5) A part of the SW1/4 of Section 4 and a part of the NW1/4 of Section 9, Township 1 South, Range 4 East, Wind River Meridian, Fremont County, Wyoming, more particularly described as follows:

Commencing at the NW corner of said Section 9; thence East along the North line of said Section 9, a distance of 163.56 feet to the point of beginning, said point of beginning also being on the Southeasterly right-of-way line of the Chicago and Northwestern Railroad. (now abandoned); thence on a deflection angle to the left of the 47°22'52", along said right-of-way line, a distance of 1541.48 feet; thence on a deflection angle to the right of 148°38'06", a distance of 173.23 feet; thence on a deflection angle to the left of 11°04'40", a distance of 775.75 feet; thence on a deflection angle to the left of 89°47'10", a distance of 168.15 feet to a point on the East line extended of the NW1/4NW1/4 of said Section 9; thence on a deflection angle to the right of 89°36'14", along said East line extended and along the east line of said NW1/4NW1/4, a distance of 849.21 feet to the SE corner of the N1/2NW1/4NW1/4 of said Section 9; thence on a deflection angle to the right of 90°00'08", along the South line of said N1/2NW1/4NW1/4, a distance of 1339.38 feet to the SW corner of said N1/2NW1/4NW1/4; thence on a deflection angle to the right of 90°00'18", along the West line of said Section 9, a distance of 484.00 feet to a point on said Southeasterly right-of-way line; thence on a deflection angle to the right of 42°37'04", along said right-of-way line, a distance of 241.56 feet to the point of beginning.

Together with all water and water rights benefiting the Real Property and subject to all valid and subsisting restrictions, easement and rights of way of record affecting the Real Property.

The Real Property is conveyed subject to all valid and subsisting rights of way, easements, and restrictions of record previously granted under the laws of the State of Wyoming or reserved to the United States upon or across the Real Property specifically including, but not limited to, the Easement and Covenant to Restrict Use made between the United States of America, acting through the Department of Energy (DOE) and the State of Wyoming on the 29th day of June 2009, and recorded in the Fremont County Clerk's Office, document number 2009-1326272 (the "Restrictive Covenant").

GRANTEE covenants to hold harmless GRANTOR and DOE from any liability associated with disruption

of any public purpose on the Real Property, the disruption of any improvement on said Real Property made by the Grantee, its successors and assigns, and any temporary or permanent limitations to use the property, should DOE be required to perform additional remedial activities on the Real Property conveyed by this deed. This covenant is made in favor and to the Benefit of GRANTOR and DOE, shall run with the land and be binding upon Grantee and its successors and assigns, and shall be enforceable by DOE and Grantor, but shall terminate in the event the Restrictive Covenant is terminated in accordance with the terms thereof.

GRANTEE acknowledges that the Real Property was once used as a uranium milling site, and that the GRANTOR makes no representations or warranties that the Real Property is suitable for GRANTEE's purposes.

NOW, THEREFORE, the State of Wyoming, Board of Land Commissioners, through its duly elected, qualified and authorized officers has caused these presents to be executed at Cheyenne, Wyoming, this 26th day of October, 2009.

SEAL

Dave Freudenthal, President
Board of Land Commissioners

Countersigned:

Lynne Boomgaarden, Secretary
Board of Land Commissioners

John Corra, Director
Department of Environmental Quality

ACCEPTANCE OF DEED AND COVENANTS:

GRANTEE:
Chemtrade Refinery Services Inc.

By: _____
Mark Davis, President

Country of Canada)
) ss.
Province of Ontario)

The foregoing instrument was acknowledged before me by Mark Davis, this 26th day of October, 2009.

Witness my hand and official seal.

Susan M. Paré

Title: NOTARY PUBLIC
My Commission does not expire.

Attorney General's Office Approval as to Form:

Bridget Hill
Bridget Hill, Senior Assistant Attorney General

BH Examined