RESPONSES TO WDEQ/LQD COMMENTS
on the
MINE UNIT 1 PACKAGE

and

NEW INFORMATON

for the
LOST CREEK PROJECT
Wyoming

March 2010

RESPONSES TO WDEQ_LQD FEBRUARY 2010 COMMENTS

1) LQD (2/10) - No map has been provided (in the Permit Application or the MU1 Package) depicting the following three items on the same map:
All known historic drill holes within the mine unit and 500' beyond the monitor ring,
the proposed first mine unit pattern area, and
the proposed monitor well ring.
A map depicting the above three features must be included with the Mine Unit Package.[4] **(MLB, BRW)**

LC ISR, LLC (3/10) - Plate MU1 5-1 (Historic Drill Holes in Area of Mine Unit 1) has been added to the MU1 Application, and this plate provides the requested information on one map. Table MU1 5-1, which originally included information on the borings shown on Figure MU1 5-3, has been updated to also include information for the borings shown on Plate MU1 5-1.

2) LQD (2/10) - WDEQ/LQD NonCoal R&R, Chapter 11, Sec 3(a)(xiv) clearly requires that aquifer characteristics of all "aquifers which may be affected by the mining process" be provided. To date the only source of aquifer characteristics provided for the overlying and underlying aquifers comes from relatively short duration single well pump tests conducted by Hydro Engineering at the site in 2006 (see Volume 3A of the Main Permit, Table D6-8). The MU package provides no additional information about the characteristics of the overlying and underlying aquifers. In light of this omission and because the 2006 pump tests were single well tests, the current assessment of the overlying and underlying aquifers remains incomplete. Please provide a complete assessment of the over and underlying aquifer characteristics.[9] **(BRW)**

LC ISR, LLC (3/10) - LC ISR, LLC understands that LQD has performed an initial review of the drawdown analysis presented in Sections OP 3.6.3.3 and OP 3.6.3.4. Based on that initial review, a subsequent letter from LQD dated March 11, 2010, and a meeting held with LQD on March 18, LC ISR, LLC understands that LQD wishes to see an explanation as to how the analysis provide in the aforementioned sections of the Operations Plan are consistent with the aquifer properties measured by the single well pumping tests. That analysis in incomplete at this time but will be submitted in the near future.

3) LQD (2/10) - The following comment was part of the permit application review, and the response from LC indicated that it would be addressed through the Mine Unit Package submittal. *Section OP 3.2 Mine Unit Design. The details for the Hydrologic Test Report for the first wellfield package should include a refined water balance based on the hydrologic information for the wellfield. Minimum, maximum and average pumping rates, as well as the* *capacity of the ion exchange units, injection well(s) and evaporation pond(s) should be included. (AB)* A refined water balance based on the MU1 specifications needs to be included in the Mine Unit package.[23] **(AB)**

LC ISR, LLC (3/10) - Per the discussion during the February 25, 2010 meeting between WDEQ-LQD and LC ISR, LLC, a statement was added to MU1 Section 5.1.1 (Operating Parameters and Procedures) indicating that hydrologic information obtained from the MU1 pump tests did not alter the assumptions used to develop the Lost Creek Project water balance.

4) LQD (2/10) - The following comment was part of the permit application review, and the response from LC indicated that it would be addressed through the Mine Unit Package submittal. *Figure OP-2a Site Layout: A much more detailed Mine Plan map will need to be included in the permit. It should indicate all roads, fencing, topsoil pile locations, stormwater diversion structures, chemical storage areas, lay down yards, easements, utilities, pipelines, monitor well locations, air and weather monitoring stations, etc. There should be one comprehensive map that indicates where any surface disturbance or feature is planned. (AB)* Figure MU1 1-3 Surface Facilities provides details for the Mine Unit, but greater detail is required as listed below:

A larger scale map (e.g. 1" = 100')
All pipelines, powerline, roads, fencelines, staging areas, culverts and topsoil stockpiles (some of these are already included)
The proposed layout of the wellfield production and monitoring wells (The Division is interested in how the proposed wellfield layout will address the fault zone)
The wellfield layout should indicate which sand (UHJ, MHJ, or LHJ) is being mined or monitored based on screened interval)
The temporary vs. long term disturbances associated with the wellfield should be distinguished (well pad, header houses, pipelines, utilities)
The primary, secondary, and 2-track roads should be mapped out. (The Division is interested in how the proposed layout will minimize surface disturbances and travel ways) **(AB)**

LC ISR, LLC (3/10) - As outlined below, LC ISR, LLC believes that the information requested in this comment has been provided to WDEQ-LQD in: the main permit document; the original MU1 application; or the updates to MU1 per these responses. As outlined below, the rest of the information has been provided in as much detail as possible prior to installation of the production and injection wells. Therefore the requested map has not been included with this submittal.

Figure MU1 1-3 provided in the MU1 application shows the locations of the following items:

- The main wellfield trunkline (pipeline);
- Powerlines;
- The fence surrounding the wellfield;
- The main access road, roads located within the wellfield and existing two track roads inside the monitor well ring;
- Staging area;
- Culverts; and
- Topsoil stockpile locations.

There will not be a chemical storage area, weather station, or air monitoring station within MU1.

Figures MU1 5-1 through MU1 5-4, which replace Figures MU1 5-1 and MU1 5-2, provide additional information on the proposed layout of the pattern areas and monitor wells, along with information on which sands are being mined and how the perimeter monitor wells are screened to monitor the those sands. Additionally, a discussion of the proposed pattern layout, which addresses monitoring across the Lost Creek Fault through the use of overlying and underlying monitor wells, has been added to Section 5.2.1 of the MU1 Application.

The information that has not and cannot be provided prior to the actual installation of the production and injection wells is the layout of travel ways within the pattern areas. The travel ways used for the construction and operation of the mine unit will be developed in accordance with the guidance provided in Section OP 2.6 (Roads) of the main permit document. This type of detailed information has never been presented in a mine unit package, before the wells are installed, simply because it is not possible to determine this amount of detail until the work begins. At that time, the engineers and geologists, actually walk the pattern area and stake well locations based on the most up-to-date surface and subsurface information. Even as the wells are installed, the information obtained from the early wells may influence the locations of the later wells. For this reason, LC ISR, LLC presented a generic wellfield layout on Figure OP-6b of the main permit document.

A discussion of topsoil management, which includes long-term and short-term topsoil protection, is provided in Section OP 2.5 (Topsoil Management) of the main permit document. Also, a discussion of vegetation protection during wellfield construction is provided in Section OP 2.7 (Vegetation Protection and Weed Control) of the main permit document. The amount of topsoil disturbance for the facilities shown on Figure MU1 1-3 is provided in Table MU1 3-1 of the Mine Unit 1 Application and is allocated by short-term and long-term stockpiles. Also provided in Table MU1 3-2 of the Mine Unit 1 Application is the amount of vegetation disturbance for the facilities shown on Figure MU1 1-3.

LC ISR, LLC will not construct a sedimentation pond or other permanent structures as sediment control measures for MU1. LL ISR, LLC will use alternate sediment control measures in accordance with WDEQ-LQD Guideline #15. Since the area surrounding the mine site is relatively flat-lying, LC ISR, LLC will use sediment control features such as silt fences and hay bales appropriately placed for erosion control. The locations of these sediment control units will be determined during construction.

5) LQD (2/10) - WDEQ/LQD Non Coal R&R's Chapter 11 Sec 4(a)(x)(A-E) and (xi) requires a description of the proposed injection rates and pressures, fracture pressure, stimulation program, type of lixiviant, physical and chemical characteristics of the receiving strata fluids. There is no description in the submitted text for Mine Unit 1 or the initial permit application concerning the proposed injection pressure to be utilized, only that it will not exceed testing pressure. The only discussion concerning fracture pressure of the formation occurs in the Class 1 disposal well application. Furthermore, in the Class 1 disposal well application a literature value of fracture pressure for the Lance Formation is specified, rather than a site-specific value for the Battle Spring Formation. Please provide a discussion concerning the Fluid Pressure to be utilized during operations and the Fracture Pressure associated with the production as required by WDEQ/LQD Non Coal R&R's Chapter 11, Section 4 (a)(x).[17] **(BRW)**

LC ISR, LLC (3/10) - Section OP 3.4 discusses a mechanical integrity testing or (MIT). A typical MIT will begin at 150 psi for injection and production wells. The well will be required to maintain 95% of the pressure for 10 minutes. Section OP 3.6.1 discusses maximum injection pressure and has been revised to address WDEQ's comment.

6) LQD (2/10) - Neither the mine permit application nor this first mine unit package provide a thorough assessment of the projected impact of the operation on regional water resources or plans to mitigate such impacts. Please reference comment no. OP-105 from the 11/20/09 review (W.S. §35-11-428(a)(ii)(B) and W.S. §35-11-428(a)(iii)(E)). Additionally, WDEQ/LQD Non Coal R&R's Chapter 11 Sec 4(a)(x)(F) requires the following to be provided in the Mine Unit Package: Expected changes in pressure, native groundwater displacement, direction of movement of injection fluid and a drawdown projection, including a map, which describes the extent of groundwater drawdown in the ore zone aquifer for the life of the first wellfield, through restoration. And the MU 1 package must address the ROI in overlying and underlying aquifers. Several comments in this review have addressed portions of these requirements. However, LQD expects the entire suite of requirements in Chapter 11, Sec 4(a)(x)(F) and W.S. §35-11-428(a)(ii)(B) and W.S. §35-11-428(a)(iii)(E)to be addressed in the MU1 Package.[18] **(MM, BRW)**

LC ISR, LLC (3/10) - Per the discussion during the February 25, 2010 meeting between WDEQ-LQD and LC ISR, LLC, LC ISR, LLC believes the Response to Comment V5, RP#5 and the associated changes to Section OP 3.6.3.3, submitted in February 2010, address this comment as well. LQD will review that information in relation to this comment.

7) LQD (2/10) - Please provide a detailed Mine and Reclamation Plan schedule for Mine Unit 1.[26, 28] **(BRW)**

LC ISR, LLC (3/10) - Per the discussion during the February 25, 2010 meeting between WDEQ-LQD and LC ISR, LLC, a statement was added to MU1 Section 5.1.1 (Operating Parameters and Procedures) indicating that hydrologic information obtained from the MU1 pump tests did not alter the Lost Creek Project mine and reclamation schedule.

8) LQD (2/10) - Please provide a site development plan that demonstrates how impacts to soil and vegetation will be minimized per section OP 2.5 of the Main Permit and includes:

Stream crossing design criteria
Avoid placing wells in drainage bottoms
Sediment control measures to be implemented, designs, and locations **(BRW, MM)**

LC ISR, LLC (3/10) - Please see Response to Comment MU1 #4.

9) LQD (2/10) Contrary to normal protocol, Lost Creek never submitted a hydrologic testing proposal to LQD prior to the installation of the monitor well ring. To be consistent with what has been required of other operators in Districts II and III that have followed normal protocol, the following comment is made. Proper selection of well construction materials along with proper completion and development techniques are crucial aspects of a successful ISL operation. Accordingly, I respectfully request that LC provide very detailed well completion procedures (ref: WDEQ/LQD Non Coal R&R's, Chapter 11, Section. 6(a)(i) and NUREG-1569, Sec. 3.1.2, pg. 3-1) as formal permit commitments in the permit document. These procedures at a minimum should specifically address the following:

a) Type of drilling rig and specifications
b) Drilling mud composition (trade names, additives, loss of circulation material, etc.) and weight
c) Hole geophysical logging procedure
d) Casing (include type, manufacture name, manufactures specification, I.D., O.H, wall thickness, burst pressure, collapse pressure)
e) Cement slurry (composition, mix water quality and slurry weight and yield)
f) Cements thickening time @ 70-degrees at 4hrs., 48hrs., 72hrs.

g) Casing cementing hardware (centralizers, float shoe, wiper plug)
h) Hole conditioning practice prior to cementing in the casing
i) Cement slurry mix procedures and equipment.
j) Procedure used to displace cement from casing to annulus.
k) Time waiting for cement to cure before re-entering casing
l) Casing/well under-reaming (equipment, tools, procedure)
m) Screens (include type, manufacture name, manufactures specifications, I.D., O.H, slot opening, burst pressure, collapse pressure)
n) Gravel packing procedure (sand specifications)
o) Packer assemblies (include type, manufacture name, manufactures specifications)

[19]**(BRW)**

LC ISR, LLC (3/10) - Installation of the monitor well ring was discussed with LQD staff during a meeting on June 25, 2008. The discussion included details of how the perimeter monitor wells would be screened to monitor specific mining zones within the HJ Horizon, the appropriate distances from the mining patterns, and the distances between the perimeter monitor wells. LQD staff indicated that the monitor well plan would suffice as a hydrologic testing proposal. The requested information in this comment was presented to LQD staff in the Lost Creek ISR, LLC Mine Unit 1 Monitor Well Plan, which was submitted for approval on August 4, 2008. The approval of the Plan was included with the approval of the Revision to Update 4 for Drilling Notification No. 334DN which was received on October 23, 2008. The cover letter including the submittal of the Mine Unit 1 Monitor Well Plan and the plan are included in the Mine Unit 1 Application as Attachment MU1 1-1.

10) LQD (2/10) - Please provide geologic cross sections and maps to illustrate the lateral and vertical extent of the ore horizons to be developed in the first mine unit. In particular, the location and extent of those portions of the mine unit containing multiple ore horizons should be clearly identified.[1,2] **(MM)**

LC ISR, LLC (3/10) - Two new maps have been added to Section 5.0 of the MU1 application, and the text has been revised to provide additional information about the lateral and vertical extent of the ore horizons (see Response to Comment MU1 #23). In addition, the original cross sections submitted with Attachment MU1 2-1 have been revised to provide a clearer picture of the ore zones.

11) LQD (2/10) Section OP 3.2.2.2 in the main permit discusses the use of observation wells in situations where multiple ore horizons will be produced. No observation wells are described in this mine unit package, even though there are several locations where multiple ore horizons are being developed. Please address. **(MM)**

LC ISR, LLC (3/10) - LC ISR, LLC will incorporate existing wells HJMU-101 and HJMU-110 into the MU1 monitor well system as observation wells. These wells will be used as observation wells by taking water level measurements at a frequency as discussed in Attachment OP-8 of the main permit document. The data will be reported to the WDEQ-LQD. The locations of these wells are shown on Figure MU1 4-1, and initial water levels are shown on Table MU1 4-3. A discussion of the use of these wells has been included in Section 5.2.1 of the MU1 Application (see Response to Comment MU1 #23).

12) LQD (2/10) - Sections 2.2.1 and 2.2.3.1: The role of the fault with regard to its effects on transmissivity and its role in hydraulic connectivity among the various horizons within the Mine Unit must be more consistently described. There are several places within the text of the Mine Unit Package as well as Attachment MU1 2-1 that provide contradicting assessments of the fault. For example, the last sentence of the second to last paragraph in Section 2.2.1 (on Page MU 1-9) states "The fault does not appear to impede groundwater flow within the UKM Sand, as there is little or no displacement in the potentiometric surface across the fault." However, the last sentence in the second paragraph of Section 2.2.3.1 (Page MU1-10) reads "...it appears that the fault is a significant barrier to groundwater flow within MU1, although there does appear to be some leakage." The fault is interpreted as a non-barrier and then a barrier. Please explain the variable interpretations of the fault.[9] **(MLB)**

LC ISR, LLC (3/10) - Based on the water level and hydrologic test data collected to date, the hydrologic nature of the Lost Creek Fault is variable between the HJ Horizon and the UKM Sand. As stated in the Mine Unit 1 Application, there is structural offset throughout all of the geologic zones of interest (the FG, HJ and KM Horizons). The potentiometric data clearly show several feet of offset across the Fault in the LFG and HJ Horizons (Attachment MU1 2-1, Figures 4-2 and 4-1, respectively). However, potentiometric surface data from the UKM Sand show little, if any displacement across the Lost Creek Fault or the fault splay (Attachment MU1 2-1, Figure 4-3).

Hydrologic tests conducted on the north and south sides of the Lost Creek Fault have shown that the Fault impedes groundwater flow within the HJ Horizon. Under large hydraulic stresses, some leakage does occur across the Fault within the HJ Horizon. The Lost Creek Fault acts as a partial barrier to groundwater flow within the HJ Horizon. Hydrologic testing within the UKM Sand has shown that the Fault does impede groundwater flow within that unit when large hydraulic stresses are applied. The explanation for the different behavior of the Fault under natural and stressed conditions within the UKM Sand is not clear.

Cross sections constructed across the Fault (Attachment MU1 2-1, Figures 2-7 through 2-9 and 2-12) indicate that sands within the HJ Horizon are directly juxtaposed across the Fault. The maximum throw on the Fault is on the order of 80 feet and the thickness of the HJ

Horizon is approximately 120 feet. The displacement across the Fault is not great enough to disconnect the HJ Horizon along its entire thickness. Therefore, the sealing properties of the Fault with respect to groundwater flow within the HJ Horizon are not directly related to offset and displacement of the HJ Horizon. The sealing nature of the fault is more likely related to smearing or shearing of horizontal bedding planes that were the primary flowpaths for groundwater movement.

The Fault impedes groundwater flow within the HJ Horizon, however, it is not impermeable to flow. To clarify this concept, the text of Attachment MU1 2-1 has been revised to replace the term "significant" with "partial" when describing the hydraulic barrier properties of the Lost Creek Fault (Executive Summary, 3rd bullet; the last paragraphs in Sections 6.3.1 and 6.3.2; and Section 8.0, 1st bullet).

13) LQD (2/10) - Sections 2.2. The section states that the pump tests were conducted to determine the hydrologic characteristics of the Production Zone Aquifer. In addition, WDEQ/LQD NonCoal R&R, Chapter 11, Section 3(a)(xiv) requires that all aquifers that may be affected by the mining process be characterized. Aquifer characteristics are presented in Appendix D-6, Table D6-11 of the Permit Application. Has the additional information provided by the 2008 pump tests refined these values? Please reference Table D6-11 within the discussion in this section and update Table D6-11 as appropriate. [9] **(AB)**

LC ISR, LLC (3/10) - A discussion comparing data results from the MU1 pump tests versus the information presented in Appendix D-6 of the main permit document has been added to MU1 Section 2.2 (Summary of Hydrogeologic Pump Tests).

14) LQD (2/10) - Section 2.2.1, Paragraph 3. The statement is made that "The hydraulic gradient on the north side of the fault was approximately 0.006 ft/ft and 0.0054 ft/ft." Please correct the sentence to indicate which number represents the gradient on the south side of the fault. [9] **(AB)**

LC ISR, LLC (3/10) - The typographic error has been corrected.

15) LQD (2/10) - Section 2.2.2 Paragraph 3 states that there were 98 monitoring wells for the north pump test and paragraph 5 states that there were 100 monitoring wells for the south pump test, yet Figures 6-1 through 6-16 in Attachment MU1 2-1 only present the drawdowns for those wells that were monitored with a LevelTROLL device. Please add a statement that distinguishes the number of wells that were monitored 'continuously' with LevelTROLL monitors versus the number of wells that were monitored once every 24 hours with electronic water level meters. In addition, please also differentiate in the discussion how the information from each type of monitoring well was utilized to determine drawdown, ROI, and aquifer characteristics.[9] **(AB)**

LC ISR, LLC (3/10) - Attachment MU1 2-1 provides the details of the hydrologic testing that was performed on the north and south sides of the Lost Creek Fault. The following statements found in Section 4.2.1 and 4.2.2 of Attachment MU1 2-1 have also been added to the MU1 Section 2.2.2 for clarity:

> "Water levels in 53 wells (including the pumping well, 28 HJ Horizon observation wells, and 24 wells in the overlying and underlying aquifers) were measured and recorded with In-Situ Level TROLL® pressure transducer dataloggers for the north test." and
> "Water levels in 52 wells (including the pumping well, 31 HJ Horizon observation wells, and 20 wells in the overlying and underlying aquifers) were measured and recorded with In-Situ Level TROLLs® for the south test."

Section 4.2.1 of Attachment MU1 2-1 also states that "In addition to the wells continuously monitored using the Level TROLLS®, numerous other wells were periodically measured for depth to water using a manual electronic water level meter. This allowed for a more extensive assessment of the potentiometric surface before, during, and after the pump test." Only wells that were monitored continuously using the LevelTROLL devices were used to develop aquifer characteristics and calculate drawdown and ROI. These statements have also been added to the MU1 Application under Section 2.2.2.

16) LQD (2/10) - Section 2.2.4 HJ Horizon Aquifer Properties. The north and south pump tests were of 48 hour and 70 hour duration respectively, and did not achieve steady state conditions. The radius of influence (ROI) presented based on the north pump test was 3,000 to 3,500 feet, and for the south pump test 3,200 to 3,700 feet. Please provide the rationale and calculations for how these radii were determined. [8] **(AB)**

LC ISR, LLC (3/10) - It is unlikely that steady state could be achieved under the conditions observed at the Lost Creek site (including heterogeneity, potential leakage from underlying and overlying units, termination of the fault with distance), or at any ISR project. In general, most pump tests do not reach steady state, and the reference to non-steady state conditions was included as an indication of the aquifer analyses that were appropriate (see e.g., Page 36 in R. Heath, "Basic Ground-Water Hydrology," USGS Water Supply Paper 2220, 1983 [available on line at http://pubs.er.usgs.gov/djvu/WSP/wsp_2220.pdf] or Section 11.8 in M. Kasenow, Applied Ground-Water Hydrology and Well Hydraulics, Water Resources Publications, LLC, 2001).

The hydrologic testing was run long enough to achieve all of the stated objectives:

- Determine hydrologic characteristics of the Production Zone aquifer,
- Demonstrate hydrologic communication between the Production Zone pumping well and the surrounding Production Zone monitor wells;
- Assess the presence of hydrologic boundaries within the Production Zone aquifer over the area evaluated by the pump test; and
- Evaluate the degree of hydrologic communication between the Production Zone and the overlying and underlying aquifers in the vicinity of the pumping well.

There was no technical advantage to continuing to run the test beyond the achievement of the stated objectives.

The ROIs for the north and south tests were based on distance-drawdown plots for the tests. These plots were not originally included in Attachment MU1 2-1 but have been included in the revised version under Appendix F.

17) LQD (2/10) - Section 3.2 and 3.4.1 Soil Conditions and Soils. Twenty-four inches of topsoil stripping was used as a conservative estimate in order to determine the volume of topsoil to be stockpiled, yet is inaccurate. Attachment MU1 3-1 Section 4.0 indicates a topsoil depth of 19 to 24 inches for the Poposhia Loam (10% of the Study Area), six to 12 inches for the Teagulf Sandy Loam (15% of the Study Area), and 14 to 18 inches for the Pepal Sandy Loam (75% of the Study Area). Please definitively identify a recommended salvage depth for each soil series and revise Section 3.4.1, topsoil depths, topsoil stockpile volumes as appropriate. In addition, please provide a map showing topsoil suitability/stripping depths and revise table MU1 3-1 to include the depth and volume of soils to be salvaged from each of the various areas. Also, include a description of how the disturbed areas were calculated for roads and header houses.[16 6] **(BW, MM)**

LC ISR, LLC (3/10) - Table MU1 3-1 and Figure MU1 3-1 have been updated to include more site-specific information. The topsoil stockpile locations shown on Figure MU1 1-3 were not updated because those locations represent the most conservative case, i.e., the most disturbance that could be associated with topsoil stockpiles. The dimensions used for the calculations are discussed in the first paragraph in Section 3.4.

18) LQD (2/10) - Section 4.0: LC has provided the water quality analysis results for four sampling periods, but has not provided any water level data. The only water level data presented is associated with the various pump tests. Water level monitoring is essential to proper operation of an ISL operation. This critical piece of the monitoring program seems to have been overlooked in this mine unit package. Water levels are to be recorded as part of every well sampling event. The results should be reported and tracked as the operation moves forward. Please provide the data collected to date.[5,13] **(BRW, MM)**

LC ISR, LLC (3/10) - Table MU1 4-3 has been added to the MU1 Application, and this table provides the requested water level information.

19) LQD (2/10) - Section 4.1: The second paragraph (p. MU1-16), states that each monitor well is subject to a mechanical integrity test (MIT). Please provide the results of mechanical integrity testing for the wells that have been installed to date.[19] **(MM)**

LC ISR, LLC (3/10) - Table MU1 4-1b has been added to the MU1 Application, and this table provides the requested MIT information.

20) LQD (2/10) - Please describe how water level monitoring data will be collected and evaluated in the various operational situations. For example:

a. Section 5.1.2, Process Instrumentation (p. MU1-24) makes reference to Section OP 3.6 in the main permit document. There is no specific description in Section OP 3.6 of the use of any instrumentation for monitoring water levels. How will water level data be collected?

   LC ISR, LLC (3/10) - Water level data will be collected as described in Section V(A) of Attachment OP-8 of the main permit document. This information has been included in Section 4.2 of the MU1 Application.

b. Section OP 3.6.3 in the main permit document states: "The water level changes, including both the drawdown and mounding from production and injection, respectively, will be evaluated to minimize interference among the mine units and to determine cumulative drawdown." How will the data be evaluated?

   LC ISR, LLC (3/10) - Water level data will be evaluated using a "rose" diagram as discussed in Section 1.2.3 of Attachment OP-2 to evaluate interference among mine units.

c. Section 5.1.1 (p. MU1-23) states: "As part of the start-up procedure, LC will monitor the water levels in the overlying and underlying monitor wells nearest to the header house as the house is brought on line." How will this data be collected and evaluated?

LC ISR, LLC (3/10) - The water level data will be collected as described in Section V(A) of Attachment OP-8 of the main permit document. Please see Section 1.2.3 of Attachment OP-2 for further discussion on how the data will be evaluated.

d. Section 5.1.3 (page MU1-24) describes excursion monitoring and states: "The prevention of horizontal excursions in the perimeter monitor well ring is possible by reviewing the water quality data in concert with the water level data." Specifically, how will the water level data be evaluated?

   LC ISR, LLC (3/10) - Please see Section 1.2.3 of Attachment OP-2.

e. Section 5.1.3 (page MU1-25) states: "Sudden increase is water levels in overlying and underlying aquifers may be an indication of casing failure in a production, injection or monitor well." Are there other possible explanations, such as improperly plugged drill holes? Please describe the likely scenarios and how these will be addressed if increases in water levels are detected.[5,13,21] **(MM, BRW)**

   LC ISR, LLC (3/10) - LC ISR, LLC does not believe that a sudden increase in water levels in overlying and underlying monitor wells would generally be caused by an improperly plugged drill hole. It is more likely that steady increases in water levels would occur due to an improperly plugged borehole. Therefore, LC ISR, LLC believes that the only credible scenario that would result in a sudden increase in water levels is a casing failure in a production, injection or monitor well. Increased water levels in overlying and underlying monitor wells, regardless of perceived cause or how suddenly it occurred, would result in an investigation to determine the cause. Please see Section 1.2.3 of Attachment OP-2 for a response to changes in water levels in overlying and underlying monitor wells.

21) LQD (2/10) - Section 5.1.4: The second to the last paragraph in Section 5.1.4 states that the "relatively uniform drawdown pattern in the perimeter monitor wells...indicates that significant channeling with the HJ horizon does not occur..." It appears that the sole basis for concluding the absence of channeling within the HJ is based upon two pump tests (the North and South pump tests of late 2008). This reviewer's observations of the nature of the Battle Spring Formation in the Great Divide Basin (from the walls of open pits at various sites) has revealed that paleochannels pervade the formation. To summarily dismiss the potential presence of paleochannels based on the radius of influence (ROI) pattern of two pump tests, that did not reach steady-state, seems a little premature. Additionally, a more detailed discussion of the existence of anisotropies such as paleochannels in the Mine Unit must be provided.[8,9,10] **(MLB)**

LC ISR, LLC (3/10) - The statement in question has been revised to address paleochannels. (The results of the earlier pump tests [Appendix D-6 of the main permit document] support a similar conclusion.) Additional discussion of the duration of the pump tests (i.e., whether they reached steady state or not) and anisotropy is included in the Responses to Comments MU1 #16. and #30, respectively.

22) LQD (2/10) - Section 5.1.4: This section explains that the monitoring well ring distance was chosen to be 500' in the fall of 2008 because it was considered industry standard. Subsequent to the construction of the monitor well ring, the November and December 2008 pump tests were conducted. The results of the pump tests showed a minimum ROI after two days of pumping of approximately 2,600 feet (North Pump Test). The conclusion was essentially that any ROI greater than 500 feet would render the 500' monitor well ring viable. However, Guideline 4 asks that the location of the monitoring wells be based on gradient considerations, dispersivity of recovery fluids, the initial excursion recovery measures employed by the operator, the normal mining operational flare, and the recoverability with the allowable regulatory time frame. Monitor well locations should be based on a groundwater flow model or other technically justified methods. Please provide a scientific, site specific justification for the monitor well spacing.[10] **(MLB, AB)**

LC ISR, LLC (3/10) - As discussed in Response to Comment MU1 #9, installation of the monitor well ring, including well spacing, was discussed with LQD staff during a meeting on June 25, 2008. The approval to install the monitor wells was received and bond posted prior to installation (see Update 3 of DN334 which was approved on May 14, 2008 in a letter from Don McKenzie). Approval of the plan was included with the approval of the Revision to Update 4 for Drilling Notification No. 334DN which was received on October 23, 2008. Therefore, based on this approval, the perimeter monitor wells were installed. At that time, two regional pump tests had been conducted; therefore, information on aquifer characteristics and anticipated well responses was available.

The MU1 pump tests confirm that the well spacing is appropriate in that all of the wells responded to pumping, as discussed in Response to Comment MU1 #16. (In some cases, the response was greater than required for other ISR operations.) Based on the discussion in Section 5.1.4 of the Mine Unit 1 Application concerning the radius of influence and the lack of the influence on groundwater flow due to paleochannels within the HJ Horizon LC ISR, LLC believes that the spacing of the monitor wells is appropriate for MU1.

23) LQD (2/10) - Section 5.2.1: This section addresses monitoring of the LFG and UKM sands across the fault. Figures MU1 5-1 and MU1 5-2 depicts pattern areas in the UHJ and LHJ respectively that are juxtaposed with either the LFG or UKM sands on the opposite side of the fault. Those figures also depict monitoring wells in the LFG or UKM sands to demonstrate that LC will be able to readily detect cross-fault excursions of lixiviant during solution mining. The depiction of the UHJ and LHJ pattern areas in Figures MU1 5-1 and 5-2 implies that there are also middle HJ (MHJ) pattern areas in the Mine Unit. Assuming there are MHJ pattern areas, they should be discussed in this section and they should be depicted on an additional figure to demonstrate that they, too, will be adequately monitored across the fault.

Lastly, to more clearly depict pattern areas near the fault, please provide a localized cross section at each of the pattern areas near the fault to indicate the known displacement and juxtaposition of the sands across the fault. Along cross section A-A' on Attachment MU1 2-1, Figure 2-7, there is connection of the HJ horizon north of the fault with the FG Horizon south of the fault, and connection with the HJ horizon south of the fault with the KM horizon north of the fault. Regardless of whether the production zone is in the upper, middle or lower HJ with the entire aquifer under production and under pressure the possibility of an excursion either direction outside the production zone exists and needs to be presented and discussed. Please review all possible connections between upper and lower aquifers and the production zone, and present the engineering controls for avoiding an excursion, and the additional monitoring wells to be used to ensure that a cross formation excursion does not occur.[11] **(MLB, AB)**

LC ISR, LLC (3/10) - The requested review has been completed by LC ISR, LLC and Section 5.2.1 has been revised to include a discussion of the MHJ Sands. Additional maps showing the possible cross fault connections have been provided in the Mine Unit 1 Application, and an additional cross section has been included in the Attachment MU1 2-1. LC ISR, LLC staff also met with LQD staff in the WDEQ Lander office on March 18, 2010 and presented a detailed discussion on these issues. Please see Response to Comment MU1 #33 regarding engineering controls.

24) LQD (2/10) - Section 5.3 The role of historic drill holes needs to be addressed in far greater detail than is currently provided. The late 2008 pump test results show that the upper KM (UKM) and the lower FG (LFG) sands are hydraulically connected to the HJ horizon. The drawdown observed in the UKM and LFG monitoring wells during the north and south pump tests was noted in Attachment MU1 2-1 as being an order of magnitude less than what was observed in the observation wells completed in the HJ horizon (ore zone) monitoring wells. The implication was that an order of magnitude less (in the vertical versus the horizontal) is somehow not a concern. It would seem that, during a pump test, one should expect the drawdown observed in an overlying or underlying unit to be substantially lower than the drawdown observed within the formation being pumped. Therefore, simply dismissing the significance of the observed drawdown as an "order of magnitude" less is not acceptable.

The reality at the LC site is that the overlying and underlying aquifers are in communication with the HJ. This is a considerable concern because it implies that protection of the overlying and underlying aquifers is untenable. It is unclear to this reviewer whether the cause of communication between the HJ and its overlying and underlying aquifers is due to:

1) cross fault communication,
2) void space in historic drill holes functioning as vertical conduits,
3) gaps in the Sagebrush or Lost Creek Shales, or
4) a combination of all three above factors.

Given the above doubts about the possibility of protecting the overlying and underlying aquifers during the proposed solution mining at the LC project, LC must take greater steps to address the above listed three concerns in the Mine Unit Package. The most glaring concern (of the three listed above) is the role of historic drill holes functioning as vertical conduits. The attached table (Table 1) provides a comparison of overlying and underlying wells (that had one foot or greater drawdown during the pump tests) with their proximity to 1) the fault and 2) historic drill holes. Table 1 indicates that there are at least 30 instances in which historic drill holes have the potential to be affecting the drawdown observed (I.e. where the historic drill hole may be functioning as a conduit for vertical communication between the HJ horizon and the LFG and UKM horizons).
Moreover, Table 1 indicates two instances, involving monitoring well MO-106, where 1 foot of drawdown was observed but the fault is a significant distance away (480') from the well. There are two historic drill holes that are 50 feet (TG8-18) and 160 feet (TG15-18) from the MO-106. Both historic drill holes (TG8-18 and TG15-18) are open holes in the same depth where MO-106 is screened. No discussion of the potential for TG8-18 and TG15-18 functioning as conduits for vertical communication was provided in Attachment MU1 2-1. It is expected that the role of historic drill holes be more thoroughly addressed in the context of the drawdown observed during the late 2008 pump tests.[11] (MLB, BRW)

LC ISR, LLC (3/10) - There are select locations where responses greater than one foot of drawdown have been observed at overlying or underlying monitor wells during the north and south hydrologic tests. LC ISR, LLC is continuing to investigate each of those locations to determine if the cause of hydraulic communication is likely to be a historic borehole or local thinning of a confining unit. To date, there is no direct evidence that an abandoned borehole has created an artificial pathway at the Lost Creek site. Two wells installed by LC ISR, LLC that were determined to have been damaged may have resulted in temporarily establishing hydraulic communication between the Production Zone and overlying or underlying units (e.g. Well MU-108). Those wells have been abandoned. LC ISR, LLC has also committed to attempt to locate and abandon all historic boreholes within MU1 (as well as the entire Permit Area). Many historic boreholes have already been abandoned.

Regardless of the cause of the hydraulic communication, LC ISR, LLC will conduct adequate monitoring during ISR operations to ensure that a vertical excursion into the overlying or underlying aquifers is promptly detected and that appropriate corrective actions are applied to prevent loss of fluids and impacts to overlying and underlying aquifers. Should an excursion be detected, LC ISR, LLC will engage in recovery and restoration operations, as required to return water quality in the affected aquifer to pre-mining conditions.

The 6th bullet under the Executive Summary of Attachment MU1 2-1 was revised to read:

> "Responses in the overlying and underlying aquifers were minor and an order of magnitude lower than responses observed in the HJ Horizon. Additional evaluation as to the cause of the responses is being conducted. LC ISR is pursuing the proper plugging and abandonment of historic wells to mitigate the potential for communication through improperly abandoned wells."

The following statement was also added as the 4th bullet in Section 8.0 of Attachment MU1 2-1:

> "LC ISR is conducting a program of locating, plugging and abandonment of historic wells within MU1 to mitigate the potential for hydraulic communication through improperly abandoned wells."

25) LQD (2/10) - Section 6.1.1: Please provide an updated pore volume calculation specific to Mine Unit #1, including an evaluation of all of the inputs and assumptions used in the calculation, based on currently available information. Particular attention should be focused on the thickness and spatial distribution of the ore horizons and calculation of an appropriate flare factor. The MU1 PV calculation in section 6.1.1 assumes an average ore zone thickness of 12 feet. This does not appear to be an appropriate value given that the average screened interval in the 13 ore zone monitor wells (MP wells, which will be utilized as injection and production wells) is 17 feet. It is also noted that section OP 1.2 in the mine permit document (bottom of page OP-3) states that the MHJ mineralized zone is about 30 ft. thick. Data should be provided to define the ore zone thickness in mine unit #1. Additionally, it should be noted that the mine-unit-specific water balance and mining/restoration schedule may be affected by a change in pore volume.[22,28] **(MM)**

LC ISR, LLC (3/10) -The surety estimate submitted to WDEQ-LQD in February 2010 (Table RP-4) totaled $7,532,329 and included the most current estimate of the number of MU1 patterns and size of that pattern area at that time. It was also based on complete installation of MU1 within the first year. Table RP-4 of the main permit document and Section OP 6.1.1 have been updated to reflect the most recent information. As outlined below under the discussion of 'Area', the number of patterns has changed, and the approach to determining the size of the pattern area has also been changed to better account for stacked ore zones. In addition, it has been determined that only half of MU1 could be installed within the first year.

Area: is the area of the patterns projected to the ground surface. It is used in the pore volume calculations, but because of the presence of 'stacked' ore, it must be adjusted in those calculations to account for pattern overlap. The surety estimate was originally based on 180 patterns at 9,000 sq. ft. per pattern or 1,620,000 sq. ft. total. However, the pattern overlap within the HJ Sand was not taken into account in this approach. The updated estimate includes 241 patterns, and the actual surface area is 1,611,720 sq. ft. However, to account for pattern overlap in the pore volume calculations, it is has been assumed that the area is larger, i.e., the area of each pattern is taken into account in the pore volume calculation, even if it is stacked with another pattern. With this approach, the total MU1 total area has been revised to 2,115,594 sq. ft.. The surety estimate and schedule will be modified on an annual basis, and the estimated areal extent will be updated as necessary.

Thickness: is estimated to be 12 feet based on preliminary estimates for pattern completions. The average completion thickness for the MP monitor wells in MU1 is 17 feet. The MP monitor wells completions are considered 'gross' completions and are designed to capture all the ore in the immediate production horizon. The MP monitor wells also tend to be in the thickest part of the ore to insure water quality samples indicative of the ore zone. Therefore, these monitor well completion intervals are expected to be thicker than many of the actual production and injection well completions because many of the production and injection wells are located on the 'fringes' of the ore where the ore thickness is less. Because of the range of ore thicknesses, LC ISR, LLC maintains that the original estimate of 12 feet 'average' completion thickness is valid. Further, the surety estimate will be modified on an annual basis and the estimated ore thickness will be replaced with actual ore thickness as the production and injection wells are installed.

'Stacked Ore' in MU1: The HJ Sand is the production zone of interest in MU1. Production is planned from four horizons (UHJ, MHJ1, MHJ2 and LHJ) within the Sand. Production patterns will be completed with separate wells in each of these horizons and produced simultaneously regardless of whether they overlie each other or not. The surety estimate accounts for horizontal flare equal to 20% of each pattern's area and vertical flare equal to 20% of each pattern's thickness. This is regardless of continuity with other patterns either vertically or horizontally. Therefore, every pattern is fully accounted for in the surety estimate.

26) <u>LQD (2/10)</u> - Figure MU1 4-1 Mine Unit 1 Monitor Well Locations Attachment MU1 2-1, Appendix A, Well Completion reports. Given the MU1 Proposed Pattern Area for the various sands the spacing of the monitoring well ring needs to be justified, and each of the sands should be monitored individually. The current M wells are sometimes only screened in the Middle HJ, and would not identify an excursion in the Upper or Lower HJ. [eg the west (down gradient) end of the monitoring well ring (M-114, M-115, and M-116) are screened in the MHJ sand only, yet the pattern area to the east contains proposed production zones in the

Upper, Middle and Lower HJ sands]. In addition there are M wells that have screened intervals within each of the sands which would dilute any excursion within one of the zones. The footprints of the Upper and Lower HJ ore bearing zones are significantly smaller than the footprint of the Middle HJ, and therefore the distance from the edge of the ore zone to the current monitoring well ring is substantially more than the proposed 500 ft. distance. The monitor well ring wells were installed in the summer of 2008, under a drilling notification, prior to any discussion with or approval by the Division. A revised monitoring network should be proposed and discussed with the Division prior to installation. [20] **(AB)**

LC ISR, LLC (3/10) - Please see Response to Comment MU1 #22.

27) LQD (2/10) - Figure MU1 1-2 Location of MU1 within Permit Areas. The footprint of Mine Unit 1 does not coincide with the footprint of Mine Unit 1 in the Operations Plan (Figure OP-2a) or Plate OP-1 Site Layout. It appears to now be part of what was originally described as Mine Units 1, 2, and 4. Figure OP-2a and Plate OP-1 (and any other effected Figure) will need to be updated accordingly. **(MM)**

LC ISR, LLC (3/10) - Pursuant to the discussions held during the February 25, 2010 meeting, a summary of the Project Development has been provided in the Adjudication volume. This summary explains how the project has evolved from discovery through permitting and how knowledge has changed through that process. The summary also describes how the areal extent of MU1 has moved from conceptual in the original Permit Application to a refined area in the MU1 Data Package. Both Plate OP-1 and Figure OP-2a have been revised to show how the refined MU1 area overlays the conceptual mine unit area.

28) LQD (2/10) - Attachment MU 1 2-1, Section 4.3: The data analysis presented concerning vertical gradients in the Mine Unit 1 suggests that there is no communication between the overlying, production, and underlying aquifers. While outside of the proposed mine unit, analysis of water levels in the southwest corner of the permit area would suggest otherwise (reference Volume 3A of the main permit, Table D6-7b). The reviewer concedes that the data being analyzed for the Mine Unit 1 submittal does not infer communication; however, data are available to the contrary. Please revise statements in the text appropriately. [8] **(BRW)**

LC ISR, LLC (3/10) - The discussion in Section 4.3 of Attachment MU1 2-1 is specific to MU1. All of the figures and tables referenced in the discussion are specific to MU1. Additional references to MU1 have been placed throughout the discussion in Section 4.3 to ensure that the reader understands that the interpretation of the data applies to MU1 and not other portions of the Permit Area. Data indicating that there may be hydraulic communication in areas other than MU1 is provided in the appropriate place within

Appendix D6 of the Permit to Mine Application. A statement has also been added to the second to last paragraph in Section 4.3 that reads:

> "There is at least one location in the southwest corner of the permit area (approximately 12,000 feet from MU1) where the potentiometric head in the HJ Horizon is slightly greater than the potentiometric head in the overlying LFG Sand, indicating an upward vertical gradient at that location."

29) LQD (2/10) - Attachment MU 1 2-1, Section 7.1, Analytical Methods: On page 25 in the third to the last paragraph of this section, it states "The criterion for terminating the MU1 pump tests was observation of measurable drawdown at each of the perimeter "ring" monitor wells. This case was met before steady state was reached..." The termination of the pump test prior to achieving steady state brings into question the thoroughness of the pump tests. Specifically, in the absence of achieving steady state, what are the implications for 1) the regional radius of influence (ROI) of the proposed mining operation and 2) the preferred pathways due to variable transmissivity values (anisotropies) within the production zone.

Specifically, one of the purposes of the pump test is to enable a simulation of "mine-induced drawdown of the regional potentiometric surface using an appropriate groundwater flow model" (Guideline 4, Attachment II). It is unclear to this reviewer how such a simulation can be deduced from a pump test that did not reach steady state. Additionally, the MU package does not provide analysis of a regional potentiometric surface using pump-test-specific data.

Speaking to the second point above (about preferred pathways), in the absence of steady state, it is questionable whether the system was adequately stressed during the late 2008 pump test. The MU1 Package must more accurately identify the boundary conditions and aquifer characteristics and all preferred pathways (due to variable transmissivites).[8,9,10]
(MLB)

LC ISR, LLC (3/10) - As previously described under the Response to Comment #16, it is unlikely that true steady state conditions could be achieved during a pump test at the Lost Creek site. The objectives of the hydrologic tests are stated in LQD Guideline 4 and were all achieved. Running the test for a longer period of time would have served no useful purpose. All of the wells within the monitor ring had adequate response to indicate hydraulic connection to the pumping well. There were no observation wells located beyond the monitor ring; therefore continuing the pump test would not have provided additional data with respect to the ROI or regional impacts.

Preferred pathways within MU1 would not have become more apparent from conducting a longer test. The distribution of drawdown would remain similar to that shown in Attachment

MU1 2-1 Figures 6-17 (north) and 6-18 (south), only the amount of drawdown would increase with continued pumping.

Prior to conducting the MU1 hydrologic tests, hydrologic tests were conducted on the north (July 2007) and south (November 2007) sides of the fault within the HJ Horizon. Both tests were run for over 5½ days. Aquifer properties determined from those earlier tests were very comparable to the results calculated from the MU1 tests. The aquifer properties estimated from the four HJ Horizon hydrologic tests are representative of site conditions and have been used in analytical models to project long-term impacts to groundwater resources under the Operations Plan and Reclamation Plan of the Lost Creek Permit to Mine Application.

The reference to steady state has been removed from Attachment MU1 2-1 to avoid additional confusion over this issue.

30) LQD (2/10) - Attachment MU 1 2-1, Section 7.3, Transmissivity Distribution: This section states that "A quantitative analysis of directional transmissivity was not conducted..." Qualitatively, two main preferred pathways were described in this section of Attachment MU1 2-1: one trending west-southwest and another trending east-southeast. This reviewer is concerned that the monitor well ring may be insufficient to detect excursions following either 1) one of the two preferred pathways identified in Section 7.3 or 2) a preferred pathway not yet defined because the quantitative analysis was not done. A quantitative analysis of directional transmissivity is essential in order to fulfill requirements of WDEQ/LQD NonCoal R&R, Ch. 11, Sec 3 (a)(xiv).[9] **(MLB)**

LC ISR, LLC (3/10) - First it should be noted that Attachment MU1 2-1, Section 7.3 did not describe "preferred pathways" but indicated "preferred orientation of T" implied from the drawdown data. The description of the text in Attachment MU1 2-1, Section 7.3 has been revised to more clearly state the observed conditions as follows:

"The distribution of transmissivity calculated from the MU1 north and south pump tests are presented on Figures 7-2 and 7-3, respectively. For consistency, only transmissivity values determined from the Theis drawdown method are posted. The overall range of transmissivity determined from the north and south tests is relatively small (51 to 129 ft^2/d) relative to typical fluvial depositional systems.

The presentation of the distribution of transmissivity (provided in Attachment MU1 2-1, Figures 7-2 and 7-3), indicates a slight directional bias in transmissivity. A southwest decrease in transmissivity observed on the north side of the Fault appears to be correlative with a slight reduction in the thickness of the HJ Horizon. The HJ Horizon thins west of the pumping well PW-102 (Figure 2-3), which generally corresponds to the decreasing trend observed in T values (Figure 7-2). On the south side of the Fault there is an area of slightly lower transmissivity that trends along wells M-106, M105 and M104 to the southeast. This southeast trend of low transmissivity correlates with the elliptical shape of the drawdown observed on the south side of the Fault during hydrologic testing. Transmissivity appears to increase closer to the Fault in the area of the fault splay (wells UKMO-101, HJT 105 and M-127). This increase in transmissivity may be partially the result of impacts of the fault splay during the south hydrologic test in reducing the drawdown in wells located in the downthrown fault block. This would not be considered a "preferred pathway."

As further described in Attachment MU1 2-1, the Lost Creek Fault strongly affects the analysis of the drawdown data. Analytical results only provide an "effective" transmissivity because of the hydraulic barrier created by the Fault. During the hydrologic tests, the Fault reduces the available aquifer by almost half. This is demonstrated in Appendix OP1 of the Operations Plan. One of the key assumptions in using the Papadopulos method for directional transmissivity (or any other analytical method) is that the aquifer is infinite acting, that is there are no significant hydraulic boundaries. Because of the impact of the fault, a quantitative analysis of directional transmissivity could provide misleading and incorrect results.

One of the two "preferred pathways" referenced in the comment is actually a reflection of the orientation of the fault. Regardless of transmissivity, because of the hydraulic barrier effect of the Lost Creek Fault, groundwater within the HJ Horizon on the north side of the fault will generally move parallel to subparallel to the Fault (toward the southwest). This is demonstrated by the potentiometric surface maps presented in Attachment MU1 2-1, Figures 4-1, 4-2 and 4-3. The exception to this might occur if large hydraulic stress (pumping) is applied to the south side of the Fault, which may, at least temporarily induce flow more toward the south.

The other "preferred pathway" the elliptical shape of the drawdown contours on the south side of the fault, is manifested by a slight decrease in transmissivity. A zone of lower transmissivity would obviously not be a preferred pathway for groundwater migration.

As described in response to comment 21, results of the north and south hydrologic tests indicate hydraulic communication between the entire HJ Horizon across MU1. The monitor ring circumscribes the entire Mine Unit. Additional information regarding directional axis of transmissivity would only identify a possible orientation to groundwater flow, not the exact location. Furthermore, operational rates proposed for the Lost Creek ISR will be sufficient to overcome any directional component of transmissivity.

31) LQD (2/10) - Attachment MU 1 2-1, Section 7.5 This section references a Table which is on Page 29. This is a duplicate page no. and within the Table, PW-101 for the South Test is mislabeled as PW-102. **(AB)**

LC ISR, LLC (3/10) - The duplicate page number has been corrected and Well PW-101 has been properly labeled in the table.

32) LQD (2/10) - Attachment MU1 2-1, Section 8.0, Summary and Conclusions, Bullet 1: In the first bullet in the list in this section, the report concludes that the late 2008 pump test revealed "minor communication" across the fault but that communication was an "order of magnitude" smaller than the communication observed within the HJ pumping and observation wells. The conclusion was that the minor communication rendered the fault a "significant barrier to groundwater flow". If this is true, then LC ISR must explain the 3.8' of drawdown observed in MU-109 during the South Pump test.
Monitoring well MU-109, completed in the UKM sand, is located 40 feet from the fault and 80 feet from the nearest historic drill hole (see attached Table 1) on the opposite side of the fault. If the fault is functioning as a significant barrier to (horizontal) ground water flow, why were 3.8 feet of drawdown observed in MU-109? Was the drawdown due to historic drill hole TG15-19 80 feet away? Was the drawdown due to a discontinuity in the Sagebrush Shale? The reviewers have similar questions for MO-114 and MW-106 which saw 2 and 1.4 feet of drawdown, respectively, during the North Pump Test. The role of the fault and/or historic drill holes in these locations must be addressed in far greater detail than provided. [9,11]
(MLB, BRW)

LC ISR, LLC (3/10) - The drawdown at Well MU-109 of 3.8 feet cited by the reviewer actually occurred during the South Test. The MU-109 drawdown during the North Test was 0.8 ft. Attachment MU1 2-1 Figures 6-20 and 6-21 and Tables 4-3 and 4-4 show and list the drawdown data. Nevertheless, it is acknowledged that there are select locations where responses greater than one foot of drawdown have been observed at overlying or underlying monitor wells during the north and south hydrologic tests. LC ISR, LLC is investigating each of those areas to determine if the cause of hydraulic communication is likely to be an historic borehole or thinning of a confining unit. To date, there is no direct evidence that abandoned boreholes have created an artificial pathway at Lost Creek. Two recent wells that were determined to have been damaged may have resulted in establishing hydraulic communication between the Production Zone and overlying or underlying units. Those wells have been abandoned. LC ISR has also committed to attempt to locate and abandon all historic boreholes within the MU1 area. Many such boreholes have already been abandoned.

As described under the Response to Comment MU1 #24, the Lost Creek Fault appears to act as a partial hydraulic barrier to groundwater flow in the HJ Horizon and LFG Sand but not in the UKM Sand, based on potentiometric and hydrologic test data. The cause of this variable behavior is not fully understood. Recognition of this phenomenon will assist in the design and performance of adequate monitoring to ensure that a vertical excursion into the overlying or underlying aquifers is promptly detected and that appropriate corrective actions are applied to prevent loss of fluids.

33) LQD (2/10) - Attachment MU1 2-1, Section 8.0, Summary and Conclusions, Bullet 3: In the third bullet in the list in this section, it is concluded that despite the hydraulic connectivity revealed during the North and South Pump tests conducted in late 2008, that engineering practices have been used at other ISR operations with similar subsurface conditions to prevent lixiviant from entering overlying and underlying aquifers.
Merely stating that "engineering practices" will be employed to protect the overlying and underlying aquifer from lixiviant is not sufficient to demonstrate that the overlying and underlying zones will be protected. W.S. §35-11-406(m)(v) states that a permit shall not be denied except for...(one or more of)...the following reason(s):

If the proposed mining operation will cause pollution of any waters in violation of the laws of this state or of the federal government;

To achieve the end of demonstrating that the overlying and underlying aquifers at the Lost Creek project will be protected from pollution in the form of lixiviant during ISR mining operations, LC ISR must provide a detailed groundwater model showing exactly how lixiviant will be controlled by engineering practices. This discussion must be very specific and should include volumes anticipated to be lost to the upper and lower aquifers (based on the pump tests) and pumping rate calculations projected through the life of the operation including unexpected down time from pumping. That is, this discussion must include more than merely a commitment to maintain a "bleed" on the operation. [11,18] **(MLB)**

LC ISR, LLC (3/10) - Per the discussion during the February 25, 2010 meeting between WDEQ-LQD and LC ISR, LLC, Attachment OP-2 (Summary of Engineering Controls) has been added to the main permit document. The focus is to identify: the specific practices (e.g., water level measurements); the operational limits (e.g., whether the rate of change in a parameter is of concern or an upper or lower limit); and the responses.

34) LQD (2/10) - Attachment MU1 2-1, Figure 2-5 Structure Map, HJ Horizon. Please indicate on the map that this represents the top of the HJ horizon. **(AB)**

LC ISR, LLC (3/10) - The typographic error has been corrected.

35) LQD (2/10) - Attachment MU1 2-1, Figures 6-17 and 6-18: These figures depict observed drawdown in the HJ horizon during the North and South Pump Test, respectively. The contour lines of the drawdown are truncated at the fault due to the significantly smaller drawdowns observed on the opposite side of the fault during the tests. This graphic is misleading because there was some drawdown observed across the fault during both pump tests. The contour interval chosen for Figures 6-17 and 6-18 (five feet) precludes the depiction of any influence across the fault. Additional figures should be provided for each pump test with a contour interval of one half a foot (0.5') which was done on Figures 6-19 through 6-22. Additionally, there appears to be an error on Figure 6-17. Monitoring well M-114 indicates a drawdown of 2.8 feet but it appears between the 5 and 10 foot contour lines.[9,11] **(MLB, AB)**

LC ISR, LLC (3/10) - During both the North and South Tests, there was a large range of drawdown on the side of the Fault where the pumping well was located, Therefore, a one-half foot drawdown contour interval would result in a very high density of contours on the side of the Fault where the pumping well was located, making the contour maps unreadable. All drawdown data for the HJ Horizon at the end of the tests are posted on the maps. As discussed during the February 25. 2010, the following statement has been placed on Figure 6-17:

"Maximum Drawdown South of the Lost Creek Fault In The HJ Horizon At The End of The Hydrologic Test Was Less Than 3 Feet".

For Figure 6-18, the statement reads:

"Maximum Drawdown North of the Lost Creek Fault In The HJ Horizon At The End of The Hydrologic Test Was Less Than 3 Feet".

The contour on Figure 6-17 has been corrected to properly address the drawdown at Well M-114.

36) LQD (2/10) - Attachment MU1 2-1, Section 6.5. Although MIT testing is required on all Class III wells, Section OP 3.4 indicates that MIT testing would be conducted on monitoring wells as well. Was an MIT conducted on MU-108 or was the North pump test the first indication that there was something wrong with this well? The drill notes indicated that the reaming bit was not fully retracted when retrieved. Did this information indicate immediately that there was an integrity problem with this well? Please provide further explanation regarding when the integrity of this well was first questioned, and future procedures to prevent a problem like this during production. [19] **(AB)**

LC ISR, LLC (3/10) - Well MU-108 (HJMU-102) was piloted on July 25, 2007 to 600'. On July 27, 2007 the hole was reamed with a 7-7/8" bit to 495', cased and pressure cemented to 495'. On August 21, 2007, the excess cement was drilled out of the casing with a 4-¼" rock bit, then under-reamed from 495'-525', and then screened over the same interval with the J-collar set at 482'. The well was not mechanical integrity tested prior to the regional pump test in 2007. (The monitor wells had not been mechanical integrity tested as of the pump test because the MIT unit was still under construction.) In November 2008, some of the well clusters installed in 2007 were included in the MU1 pump test to monitor the overlying and underlying sands. The test on the north side of the fault revealed that well MU-108 had communication between the underlying horizon and the HJ horizon. Well MU-108 was then abandoned with a pressure cementer from the bottom up. The MU1 pump test on the south side of the fault was completed after the well had been abandoned. In early 2009, all the wells that were used in the MU1 pump test were mechanical integrity tested. In July 2009, a short term pump test was completed around MU-108 to demonstrate that abandonment was successful.

LC ISR, LLC has since taken steps to eliminate the possibility of using wells that have not passed an MIT. Every well that is installed on site is required to pass an MIT before that well can be used for testing, monitoring or operations. All wells that fail mechanical integrity testing will be abandoned unless they can be repaired and successfully MIT tested.

37) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion Reports. . Currently some of the wells are only in Attachment D6-3, some are only in MU1 Appendix A, and some appear in both locations. Please add a Table to this Appendix that indicates the wells that make up the first Mine Unit package and whether the completion log is located in Attachment D6-3 or MU1 Appendix A. **(AB)**

LC ISR, LLC (3/10) - The requested table has been included in Appendix A of Attachment MU1 2-1. Also, the table in Attachment D6-3 of Appendix D6 has been revised to indicate which wells have been recompleted and which wells have been renamed.

38) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion Reports There are eight wells with two designations. Well UKMU-101 and UKMU-102 in Appendix D6-3 do not include MO-114, and MO-115 in their designation on their well completion report. Please correct these. **(AB)**

LC ISR, LLC (3/10) - The completion logs for UKMU-101 and UKMU-102 submitted in Attachment D6-3 were revised as requested. See also the Response to Comment MU1 #39 below for additional discussion regarding the completion logs and their organization.

39) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion Reports The completion on the following eight wells was changed following the submittal of Attachment D6-3 and need to be revised to indicate the revised screen interval, back plug elevations or well deepening elevation and the date that the work was conducted and why. [UKMU-101, UKMU-102, HJMP-102, HJMP-103, HJMP-106, HJMP-107, HJMP-111, HJMP-112, HJMP-114] The well completion reports should be consistent at either location. **(AB)**

LC ISR, LLC (3/10) - Recompletion logs for each of the following wells UKMU-101, UKMU-102, HJMP-102, HJMP-103, HJMP-106, HJMP-107, HJMP-111, HJMP-112, HJMP-114 were submitted in Appendix A of Attachment MU1 2-1 of the MU1 Application. These completion logs have been revised to include the date of recompletion and why.

During the February 25, 2010 meeting between LQD and LC ISR, LLC staff, LC ISR, LLC stated that the original completion logs submitted in Appendix D6-3 of the main permit document would be removed rather than be revised to match the completion logs submitted in Appendix A of Attachment MU1 2-1 of the MU1 Application. However, LC ISR, LLC decided not to remove the original completion logs for the following reason. The original completion logs of the wells in question (UKMU-101, UKMU-102, HJMP-102, HJMP-103, HJMP-106, HJMP-107, HJMP-111, HJMP-112, HJMP-114) were submitted in Appendix D6-3 since they had been used to collect groundwater level data during the regional pump tests conducted in July and November of 2007. These wells were completed to monitor specific horizons at that time. These wells were then recompleted to monitor groundwater levels in specific horizons for the MU1 pump tests conducted in November and December of 2008. As an example, UKMU-101 was originally completed to monitor the KM Horizon during the regional pump tests. UKMU-101 was later recompleted to monitor the LFG Horizon for the MU1 pump tests and was re-designated as MO-114. If the completion log for well UKMU-101 submitted in Appendix D6-3 were revised to match the completion log for well MO-114 submitted in Appendix A of Attachment MU1 2-1, then the data reported in the regional pump test reports will not make sense. Therefore, the original completion logs presented in Appendix D6-3 have not been revised since these wells were used during the collection of data that is submitted with the main permit document. The table at the beginning of Appendix D6-3 titled "List of Well Completion Logs in Appendix D6-3" was revised to indicate which wells were recompleted. Also, the table at the beginning of Appendix A of Attachment MU1 2-1 titled "List of Completion Logs for Wells Monitored during the MU1 Pump Tests" was revised to indicate which wells were recompleted.

40) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion Reports. Well M-120A was installed to replace well M-120. Please indicate in a footnote on the Completion Report for Well M-120 why it needed to be replaced, and when it was abandoned. Please revise Table 3-1 in Attachment MU1 2-1 by replacing well M-120 with Well M-120A. **(AB)**

LC ISR, LLC (3/10) - The Completion Report for Well M-120 has been revised as requested. Table 3-1 in Attachment MU1 2-1 was not revised since M-120 was the well used during the Mine Unit 1 pump tests to monitor the water level data. Well M-102A was included in the Mine Unit 1 report since it replaced Well M-120 after the pump tests and was used to collect baseline groundwater quality samples, therefore a Completion Report for Well M-120A has been included in Appendix A of Attachment MU1 2-1. A description of the activities associated with Well M-120 and Well M-120A is provided in Section 4.1.1 of the Mine Unit 1 Application.

41) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion Reports. Well MP -109 states that the well is screened from 422-438 feet, yet the diagram shows the screen extended to 450 feet. Similarly, Well MP 110 is reportedly screened from 419 – 438 Feet, yet the diagram shows the screen extended to 445 feet. Please correct the Well Completion reports for these wells. **(AB)**

LC ISR, LLC (3/10) - The completion logs for Well MP -109 and Well MP-110 submitted in Appendix A of Attachment MU1 2-1 were revised as requested.

42) LQD (2/10) - Attachment MU1 2-1, Appendix A, Well Completion reports. LQD ISL Regulation, Chapter 11, Section 6(c)(i) states that the wells should be constructed with a "*drill hole of sufficient diameter for adequate sealing and, at any given depth, at least three inches greater in nominal diameter than the diameter of the outer casing at that depth*". The Outer diameter of the SDR17 pipe used is 5 inches and the drill hole diameter is 7 7/8 Inches – giving a 2 7/8 inch gap, yet with the joints that gap would be smaller. There is a possibility that the State Engineer may propose that the spacing be 4 inches. [7] **(AB)**

LC ISR, LLC (3/10) - LC ISR, LLC is aware of the current SEO proposal of 4 inches, which was also under consideration in the mid-2000s. The difference between the outer casing and joint diameters was part of the discussion of the Chapter 11 rule changes in the mid-2000s. It is LC ISR, LLC's intent to ensure that the purpose of the sealing is met, i.e., each well is adequately sealed and tested to prevent movement of fluids into areas which should not be impacted. LC ISR, LLC will stay informed about well construction requirements and adjust construction techniques if the requirements change.

43) LQD (2/10) - Attachment MU1 4-2 Groundwater Quality Laboratory Results. The CD provided contains scanned *.pdf copies of the Energy Laboratory reports. An electronic spreadsheet of the data was provided via email. Please also provide a CD of the monitoring data in the required spreadsheet format provided on the following DEQ website link: http://deq.state.wy.us/lqd/Uranium_Data.htm. **(AB)**

LC ISR, LLC (3/10) - An electronic copy of the groundwater quality lab results is being submitted under separate cover to the WDEQ-LQD Lander Office in the requested format. This copy has been updated with sample results collected subsequent to the initial submittal with the Mine Unit 1 Application.

NEW INFORMATION

The water quality data for Wells MO-111, MO-114, M-120A, and MP-109, which was not available at the time of the original MU1 submittal, has been incorporated into Attachment MU1 4-1. The associated tables and UCL calculations have also been updated.

INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

Date: 3/26/2010
TFN: 4 6/268

MINE COMPANY NAME: Lost Creek ISR, LLC MINE NAME: Lost Creek ISR Project PERMIT NO.: N/A

Statement: I, John W. Cash, an authorized representative of Lost Creek ISR, LLC declare that only the items listed on this and all consecutively numbered Index Sheets are intended as revisions to the current permit document. In the event that other changes inadvertently occurred due to this revision, those unintentional alterations will not be considered approved. Please initial and date. JWC 3/26/10

NOTES: 1) Include all revision or change elements and a brief description of or reason for each revision element.
2) List all revision or change elements in sequence by volume number; number index sheets sequentially as needed.

VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
Main Permit Document			
1 of 5 Adj File	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.
	–	Tab & Text "Project Development"	Added in response to LQD comments. Please put this tab & contents before the tab for Table ADJ-1.
	–	Attachment ADJ-1	Added in response to LQD comments. Please put Attachments ADJ-1 through ADJ-4 after Table ADJ-1 & before List of Preparers.
	–	Attachment ADJ-2	Please move the contents of Attachment OP-2 (which is just a CD) to Attachment ADJ-2.
	–	Attachment ADJ-3	Please move the contents of Attachment OP-3 (which is several page of text) to Attachment ADJ-3.
	–	Attachment ADJ-4	Added in response to LQD comments.
2 of 5 Apps D1-D5	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
3a of 5 App D6 through Attach D6-2b	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.
3b of 5 Attach D6-3 & D6-4	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.
	List of Well Logs at beginning of Attachment D6-3	List of Well Logs at beginning of Attachment D6-3	Updated.
	In Attachment D6-3, completion logs for Wells UKMU-101 & UKMU-102.	In Attachment D6-3, completion logs for Wells UKMU-101 & UKMU-102.	See list at beginning of Attachment D6-3 for location of these 2 logs within the attachment - they are almost at the end. Logs updated in response to LQD comments.
4 of 5 Apps D7-D11; App D References; & App D E&W Roads	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
5 of 5 Ops Plan & Rec Plan	Pages i, ii, iii, xxvi, & xxviii	Pages i, ii, iii, xxvi, & xxviii	Updated General and Detailed Table of Contents.
	Pages 45 & 46	Pages 45, 46, & 46a	Added additional information in response to LQD comments.
	Figure OP-2a	Figure OP-2a	Revised in response to LQD comments.
	Plate OP-1	Plate OP-1	Updated in response to LQD comments.
	Attachment OP-1 cover sheet	Attachment OP-1 cover sheet	Please leave tab in place; remove old cover sheet; and insert new cover sheet.
	Attachment OP-2 cover sheet & CD	Attachment OP-2	Please leave tab in place; remove existing Attachment OP-2 cover sheet; & move existing contents of Attachment OP-2 (just a CD) to new Attachment ADJ-2. New contents of Attachment OP-2 includes new cover sheet, text, & figures. Rearranged in response to LQD comments.
	Attachment OP-3 cover sheet & text	Attachment OP-3 cover sheet	Please leave tab in place; remove existing Attachment OP-3 cover sheet; & move existing contents to new Attachment ADJ-3. New content of Attachment OP-3 is just a cover sheet. Rearranged in response to LQD comments.
	Attachment OP-10	–	Please remove tab & cover sheet. No replacement.
	Table RP-4	Table RP-4	Updated in response to LQD comments.

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
Mine Unit 1 Document			
1 of 2	Pages MU-i through MU-iv & MU-1 through MU-34	Pages MU-i through MU-iv & MU-1 through MU-37	Revised in response to LQD comments. While all pages of the text were resubmitted due to pagination changes, the only changes to the text are those outlined in the responses.
	Figure MU1 1-2	Figure MU1 1-2	Revised in response to LQD comments.
	Figure MU1 3-1	Figure MU1 3-1	Revised in response to LQD comments.
	Figures MU1 4-1 through MU1 5-3	Figures MU1 4-1 through MU1 5-5	Revised in response to LQD comments.
	Table MU1 3-1	Table MU1 3-1	Revised in response to LQD comments.
	Table MU1 4-1	Table MU1 4-1a	Updated in response to LQD comments & renumbered for addition of new tables.
	–	Table MU1 4-1b	Added in response to LQD comments.
	Table MU1 4-2	Table MU1 4-2a	Renumbered from Table MU1 4-2 for addition of new tables.
	–	Table MU1 4-2b	Renumbered from Table MU1 4-4 for addition of new tables.
	Table MU1 4-3	Table MU1 4-3	Added in response to LQD comments.
	Table MU1 4-4	Table MU1 4-4	Renumbered from Table MU1 4-3 for addition of new tables.
	Tables MU1 4-6 through MU1 5-2	Tables MU1 4-6 through MU1 5-2	Updated.

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
1 of 2	–	Plate Tab & Plate MU1 5-1	Added in response to LQD comments.
	–	Attachment MU1 1-1	Added in response to LQD comments.
	In Attachment MU4 1-1, individual water quality tables for Wells M-120A, MO-111, MO-114, & last 2 pages of attachment (combined water quality table for Wells MP-110 through MP-113 & outlier analysis)	In Attachment MU4 1-1, list of wells, individual water quality tables for Wells M-120A, MO-111, MO-114, & last 2 pages of attachment (combined water quality table for Wells MP-109 through MP-113 & outlier analysis)	Updated. Please add list at beginning of Attachment MU1 4-1, and see list for location of the individual water quality tables for Wells M-120A, MO-111, and MO-114 logs within the attachment.
	Attachment MU1 1-2	Attachment MU1 1-2	Please replace CD. Updated with new information.
2 of 2 (MU1 North & South Tests)	Binder Cover & Spine	Binder Cover & Spine	Updated with revision date.
	Cover Page	Cover Page	Updated with revision date.
	Pages i through v and 1 through 30	Pages i through v and 1 through 31	Revised in response to LQD comments. While all pages of the text were resubmitted due to pagination changes, the only changes to the text are those outlined in the responses.
	Figures 2-5 through 2-11	Figures 2-5 through 2-11	Revised in response to LQD comments.
	–	Figure 2-12	Added in response to LQD comments.
	Figures 6-17 & 6-18	Figures 6-17 & 6-18	Revised in response to LQD comments.
	Table 3-1	Table 3-1	Updated with Well M-120 note.
	At beginning of Appendix A, list of completion logs.	At beginning of Appendix A, list of completion logs.	Updated. Note: This list may have been inadvertently omitted from some copies of the MU1 application. If there is no list at the beginning of Appendix A, please insert the updated list. If there is a list at the beginning of Appendix A, please replace it with the updated list.

INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
2 of 2 (MU1 North & South Tests) - cont'd	In Appendix A, completion logs for Wells MO-114 (UKMU-101), MO-115 (UKMU-102), M-120, M-120A, MP-109, MP-110, MP-102 (HJMP-114), MP-103 (HJMP-112), MP-104 (HJMP-107), MP-105 (HJMP-111), MP-106 (HJMP-106), MP-107 (HJMP-103), & MP-108 (HJMP-102)	In Appendix A, completion logs for Wells MO-114 (UKMU-101), MO-115 (UKMU-102), M-120, M-120A MP-109, MP-110, MP-102 (HJMP-114), MP-103 (HJMP-112), MP-104 (HJMP-107), MP-105 (HJMP-111), MP-106 (HJMP-106), MP-107 (HJMP-103), & MP-108 (HJMP-102)	See list at beginning of Appendix A for location of these logs within the appendix. Logs for Wells MO-114 and MO-115 are under *FG Horizon* (Recompletes); logs for Wells MP-109 & MP-110 are under *HJ Horizon* (New Completions); logs for Wells MP-104 through MP-108 are under *HJ Horizon* (Recompletes). Logs updated in response to LQD comments.
	Appendix A-1 Well List & CD	Appendix A-1 Well List & CD	Note: List may have been inadvertently omitted from some copies of the MU1 application. If there is no list, please insert the updated list. Logs updated in response to LQD comments.
	--	Appendix F	Added in response to LQD comments.

Main Permit Document
Volume 1 of 5
Replacement Pages

TABLE OF CONTENTS - General

TABLE OF CONTENTS - Detailed

MINE PERMIT VOLUME 1 of 5: Adjudication Files

MINE PERMIT VOLUME 2 of 5: Appendix D - Main Permit Area (D1 to D5)

ATTACHMENTS

TABLE OF CONTENTS – Detailed (continued)

ATTACHMENTS (continued)

OVERVIEW OF
IN SITU RECOVERY (ISR) PROJECT DEVELOPMENT

The exploration, development, mining of a uranium ore body, and subsequent restoration/reclamation, by in situ recovery (ISR) is generally a lengthy, iterative process. During initial exploration, very little surface and subsurface information may be known about an area, so the area can only be described in very generic terms. However, as additional knowledge is gained through drilling, testing, and collection of baseline data, the descriptions can be more specific and the economic and environmental feasibility of a project can be evaluated. The permitting generally follows a similar trend. Permitting of (and reclamation bonds for) exploration work generally allows for limited work, and it generally involves only one or two agencies. If the exploration work indicates the potential for viable project, then the data gathering and project design expand to provide sufficient information to support permit-to-mine documents and project construction and operation. Even after permit approval and project start-up, monitoring continues to provide information as to whether projections are met, and the monitoring information must be reported periodically (e.g. annual reports) and permit revisions obtained (if necessary). This monitoring, reporting, and permit updating continues until the project is reclaimed, with agency approval, and the reclamation bond released.

Exploration

Initial exploration for a uranium ore body is based on a geologist's model of what he or she believes is required for an ore body. For example, most models address: a host rock; a source of ore: and a geochemical mechanism to concentrate the metal-bearing fluid in the host rock. [*In the area of the Lost Creek Project, the sandstones of the Battle Spring Formation held promise as a host rock; the Granite Mountains were considered a source for the ore; and the change from oxidizing to reducing conditions as groundwater moved into the Great Divide Basin could result in ore deposition.*] Once a model is established, the geologist will begin 'desk top' exploration to look for a region that may fit the model. If the geologist can locate such a region, and funding and a land position (e.g., claims and/or leases) are obtained, a field exploration program may be started.

Exploration programs for other resources, such as oil and gas, often involve seismic testing or other procedures that can provide relatively detailed subsurface information on reservoirs before drilling begins. However, to delineate uranium deposits, very few tools are available other than drilling to obtain cores and geophysical data. For ISR, the first step in the field is typically to drill a series of holes on wide-spaced 'fences' to characterize the local geology. These holes are generally hundreds to thousands of feet apart. [*In the area of the Lost Creek Project, these fences were drilled in the late 1970s/early 1980s by TexasGulf.*] As the understanding of the regional geology improves, the geologist will begin to reduce the spacing of the fences to focus efforts on areas of greater potential. With years of hard work, good analysis and some luck a mineralized zone may eventually be discovered. In Wyoming, exploration drilling (after the early 1970s) was generally permitted through a Drilling Notification (DNs) with the Wyoming Department of Environmental Quality - Land Quality Division (WDEQ-LQD). [*The Texas Gulf exploration was done under DN #47.*] Similar to exploration permits for other resources, these DNs are held confidential because the information on ore location and grade could be used by other potential operators to adversely affect the land position of the DN holder or other aspects of project development.

Development

After the discovery of a mineralized zone, the geologist will recommend more closely-spaced drilling (e.g., drilling with spacing of fifty to a few hundred of feet apart) to characterize the extent, grade, and amenability of the mineralized zone in situ mining. Bench-scale testing of lixiviants and ore recovery rates may also occur. At some point during the developmental drilling and testing, the geologist will have enough data, and therefore confidence, to calculate resources. If the resource is sufficient and the economics are desirable, the zone will be classified as an ore body. Development drilling may occur immediately after exploration drilling, or a significant period of time may elapse between exploration and development drilling, depending on economic conditions, developer resources, and changes in land positions. [*In the Lost Creek area, over 20 years elapsed between the Texas Gulf exploration and the development drilling by Lost Creek ISR, LLC (LC ISR, LLC).*]

Because the project design is still being formulated and the impacts are still limited to those associated with drilling, only one or two agencies are generally involved at this stage of permitting. However, if the results of the development drilling continue to indicate the potential for a viable ISR project, then the operator may begin discussions with primary agencies to keep them informed, determine permitting requirements, and give agencies a heads-up on potential work load. [*LC ISR, LLC began meeting with agencies in 2005.*]

Depending on the site conditions and regulatory changes over the years, more specific surface information (e.g., archeological surveys) may also need to be collected to allow for the more closely spaced drilling. At this stage, because of the dependence of the ISR process on ground water pumping and re-injection, collection of the hydrologic information necessary for project development is also generally started. The operator also considers selection of an appropriate area for the permit application. In addition, because data for some disciplines must be collected over the course of a year to determine seasonal impacts (e.g., meteorological data), this data collection may also start. [*The development drilling by LC ISR, LLC is being done under WDEQ-LQD DN #334* *and BLM Notice # WYW-166224. Although wells were installed by Texas Gulf, and pump testing and water quality sampling occurred, this information was not considered sufficient for project design and development. Therefore, additional drilling and pump testing was started. One of the main subsurface features at the Lost Creek site is a subsurface fault. Multi-day pump testing was conducted on both sides of the fault to determine overall aquifer characteristics and the influence of the fault on ground water movement.]*

Mining and Reclamation

Once sufficient information is available and resources are determined to be viable for production, an application for a permit to mine is prepared. The initial stage in the permitting process is to collect even more data to support the permit document which will ultimately be used by regulators to determine if mining can be performed without undue degradation of the environment. After collection and compilation of the baseline data, the permit application is submitted to the respective agencies for consideration. Even at this stage, drilling continues to further define the resource and locate additional mineralization. In fact, drilling will continue throughout the project as the focus changes from regional information (on the scale of thousands of feet) to well pattern installation (on the scale of tens to hundreds of feet).

In Wyoming, the uranium resources of interest for ISR occur usually occur in long, narrow, sinuous deposits called 'roll fronts'. These roll fronts are within sandstones interlayer with shales, and there may be economic quantities of ore in a single sandstone layer or multiple layers. Because of the geometry of the ore deposits, the permit defines the general shape of the ore body(ies) of interest, the layer(s) in which the ore body(ies) is (are) located and the overlying and underlying shales and sandstones. [*For the Lost Creek Project, the ore body is in the HJ Horizon. Although mineralization occurs in almost all of the sandstone in the Permit Area, only mining of the HJ is considered economic at present.*]

When the permit is initially submitted, the focus shifts from regional to more localized information. At this time, a series of mine units (or wellfields) is defined within the Permit Area. Because the permit documents represent the state of knowledge at the time they are submitted, additional documentation (Mine Unit Package) is submitted for each mine unit as the specifics become known and the operator wants to begin production from that mine unit. [*LC ISR, LLC submitted the permit to WDEQ-LQD in December 2007, and the locations of six mine units were identified. Plate OP-1 and Figure OP-2a originally showed a conceptual location of Mine Unit 1 as well as subsequent Mine Units 2 through 6. However, additional information has been collected during the permit review, resulting in the outline of Mine Unit 1 being revised. The conceptual and actual locations of Mine Unit 1 are shown as an overlay in Plate OP-1 and Figure OP-2a. The* *details of the Mine Unit 1 layout are shown on the figures and plates in the mine unit package.]*

After the requisite permits are acquired, the mining process may begin. During the installation of the production and injection wells, the geologists will gain even more information and may make minor adjustments to the area to be mined. Even during mining, more will be learned about the ore body's geology and hydrologic characteristics. The operation of the mine will test the hypothesis forwarded by the scientists involved from exploration through permitting. Therefore, the permit includes information on monitoring and responses that may be taken based on the monitoring information. In addition, if the monitoring information indicates conditions substantially different from what was anticipated, then a permit revision may also be necessary. *[The Lost Creek permit application includes the required provisions for excursion monitoring and also outlines the engineering controls that will be used to ensure equipment is operating within specified parameters.]*

For ISR, reclamation involves both ground water restoration and reclamation of surface impacts. Even during this process, additional knowledge may be gained about subsurface conditions. For example, use of bioremediation during ground water restoration is a relatively new technology and is apparently amenable for some constituents but not others. [*The possibility of bioremediation has been considered for the Lost Creek Project; however, the decision to use this technology will depend on the state of knowledge about both the technology and the subsurface conditions after groundwater restoration by more conventional methods.*] Therefore, the process of monitoring and permit revision continues. Once restoration is completed and the wells are abandoned, surface reclamation, including a minimum of 2 years for vegetation re-establishment, is necessary. Even after restoration and reclamation are approved, and the reclamation bond is released, there is a requirement of a deed notice to indicate the project location, primarily because of the potential for future drilling to encounter the plugged wells.

The permitting process goes through many iterations with numerous agencies. In the future, the approved permit will be revised as required to ensure it contains the current state of knowledge. Revisions will be made through annual reports, bond calculations, mine unit data packages and minor or significant permit revision requests as required. [*Table ADJ-1 shows the Lost Creek permitting requirements that must be completed prior to mining. WDEQ-LQD has requested that copies of four of these permits be included in the WDEQ-LQD permit to mine application. These are the WDEQ-AQD Permit (Attachment ADJ-1); UIC Class 1 Well Permit (Attachment ADJ-2); Storm Water Pollution Prevention Plan (Attachment ADJ-3); and Septic System Permits (Attachment ADJ-4).*]

ATTACHMENT ADJ-1

WDEQ-AQD Permit
(to be provided when approved)

ATTACHMENT AJD-2

UIC Class 1 Well Permit Application
(electronic submittal only;
permit will be provided when approved)

ATTACHMENT ADJ-3

Storm Water Pollution Prevention Plan

ATTACHMENT ADJ-4

Septic System Permits
(to be provided when approved)

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List of Well Completion Logs in Attachment D6-3

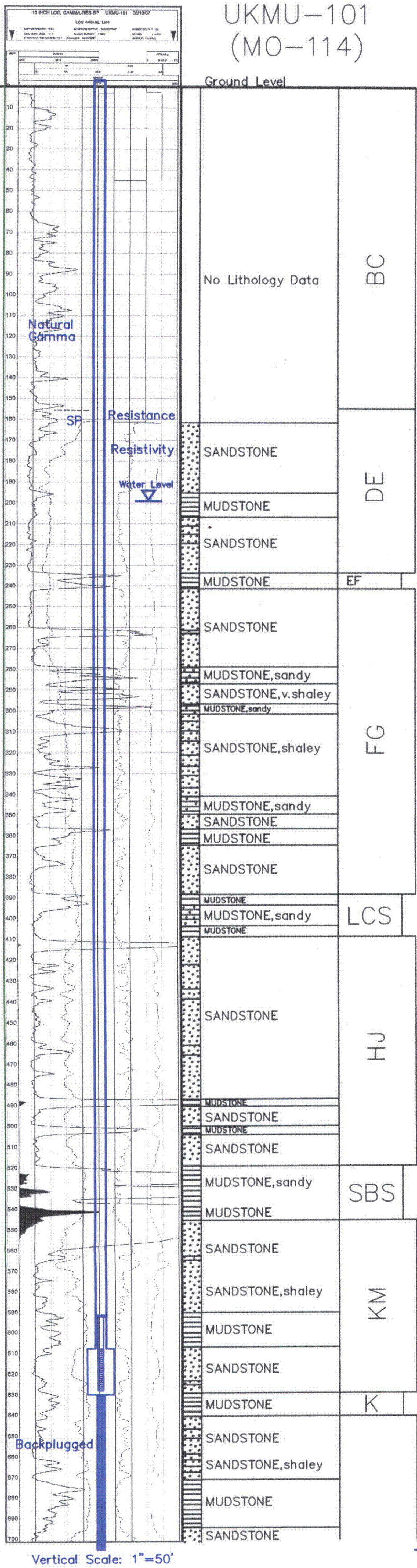
(see Table D6-5 for summary of well information)

DE Horizon	*HJ Horizon*	*KM Horizon*
HJT-106	HJMP-101	HJMU-101
HJT-107	*HJMP-102 (MP-108)	**HJMU-102 (MU-108)
LC-29M	*HJMP-103 (MP-107)	**HJMU-103 (MU-107)
LC-30M	HJMP-104	HJMU-104
LC-31M	HJMP-105	HJMU-105
MB-1	*HJMP-106 (MP-106)	**HJMU-106 (MU-106)
MB-7	*HJMP-107 (MP-104)	**HJMU-107 (MU-104)
MB-10	HJMP-108	HJMU-108
FG Horizon	HJMP-109	HJMU-109
HJMO-101	HJMP-110	HJMU-110
**HJMO-102 (MO-108)	*HJMP-111 (MP-105)	**HJMU-111 (MU-105)
**HJMO-103 (MO-107)	*HJMP-112 (MP-103)	**HJMU-112 (MU-103)
HJMO-104	HJMP-113	HJMU-113
HJMO-105	*HJMP-114 (MP-102)	**HJMU-114 (MU-102)
**HJMO-106 (MO-106)	HJT-101	LC-17M
**HJMO-107 (MO-104)	HJT-102	LC-20M
HJMO-108	HJT-103	LC-23M
HJMO-109	HJT-104	LC-24M
HJMO-110	HJT-105	LC-27M
**HJMO-111 (MO-105)	LC-16M	LC-28M
**HJMO-112 (MO-103)	LC-19M	UKMP-101
HJMO-113	LC-22M	UKMP-102
**HJMO-114 (MO-102)	LC-26M	UKMP-103
LC-15M	UKMO-101	MB-4
LC-18M	UKMO-102	*UKMU-101 (MO-114)
LC-21M	UKMO-103	*UKMU-102 (MO-115)
LC-25M	MB-3B	UKMU-103
MB-2	MB-6	
MB-5	MB-9	
MB-8		

*These completion reports represent the original configuration of these wells. Following the submission of these completion reports, these wells were recompleted to be used as monitor wells for Mine Unit 1. The completion logs detailing recompletion of these wells are included in Attachment MU1 2-1 of the MU1 Application. The original completion reports presented here have been preserved since these wells were used in this configuration during the collection of data that is submitted with the main permit document.

**These wells were renamed. The new name of the well is listed in parentheses.

UKMU-101
(MO-114)



Lost Creek ISR, LLC

WELL COMPLETION REPORT

WELL # UKMU-101 SEO # 179905 Date Drilled: 5-10-07

Location: E 744,101 / N 534,931 (NAD 27)

Ground Elev: 6939.87 Measure Point Elev: 6941.87

TD: 850 ft. Hole Dia.: 7-7/8"

CASED to: 608' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: MKM Sand

Static Water Level: Depth 198' Elev: 6743' (avg.)

UNDERREAM: Blade Dia: 10-1/2"
Intervals: from 608' to 630' /length 22'
from ______ to ______ /length ______

SCREEN LINER ASSEMBLY

Description	Depth From	Depth To	Elev. From	Elev. To	Length
K-packer		592'		6350'	
Screen	608'	628'	6334'	6314'	20'

SCREEN SPECIFICATIONS:
Slot: 0.030" Composition 3" PVC

FILTER PACKING:
Volume: ______ (bags)(ft^3) Sand Specs. ______
Method: N/A

WELL STIMULATION: Method Airlift
Yield: Good / Moderate / Poor

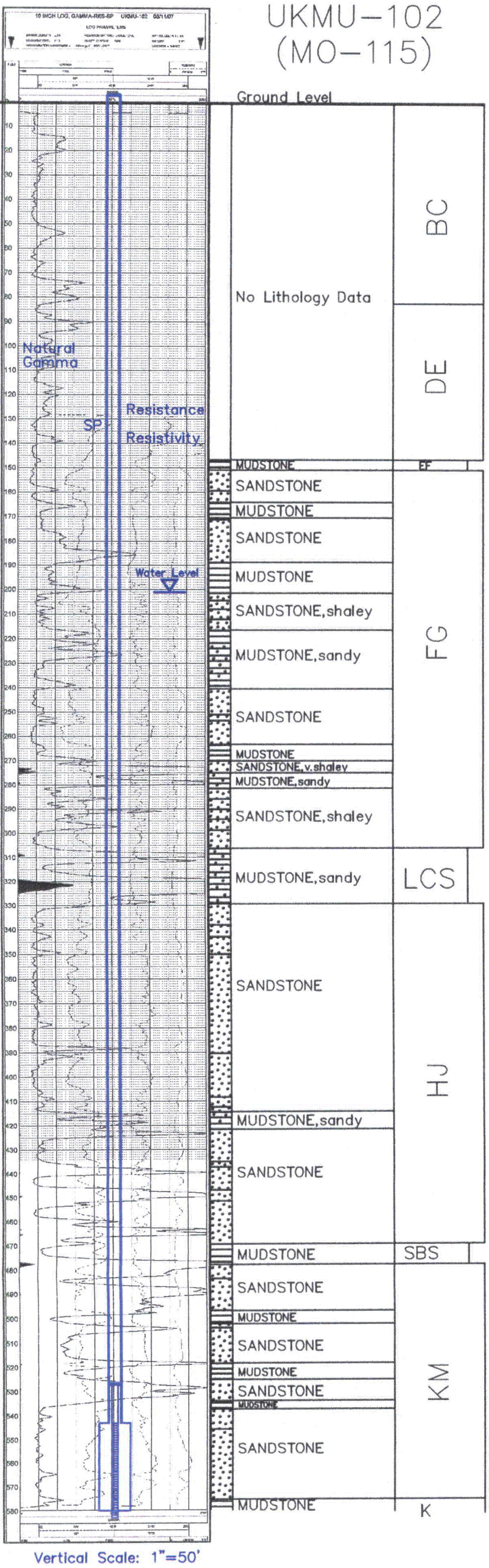
Pilot Hole BACKPLUGGED: 630'-850'
w/ BH Ultragrout slurry – 25% solids

(Note: UKMU-101 recompleted 11-3-08 to monitor LFG)
Renamed as MO-114
See Completion Log for MO-114

PROFESSIONAL GEOLOGIST
CALVIN E. VANHOLLAND
PG-2184
WYOMING

UKMU-101
(MO-114)

UKMU-102
(MO-115)



Lost Creek ISR, LLC

WELL COMPLETION REPORT

WELL # UKMU-102 SEO # 179908 Date Drilled: 5-11-07

Location: E 744,191 / N 535,143 (NAD 27)

Ground Elev: 6941.62' Measure Point Elev: 6942.62'

TD: 583' Hole Dia.: 7-7/8"

CASED to: 543' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: MKM Sand

Static Water Level: Depth 201' Elev: 6742' (avg.)

UNDERREAM: Blade Dia: 10.5"

Intervals: from 545' to 570' /length 25'

from ______ to ______ /length ______

SCREEN LINER ASSEMBLY

Description	Depth From	Depth To	Elev. From	Elev. To	Length
K-packer		527'		6416'	
Screen	543'	583'	6400'	6360'	40'

SCREEN SPECIFICATIONS:

Slot: 0.030" Composition 3" PVC

FILTER PACKING:

Volume: ______ (bags)(ft^3) Sand Specs. ______

Method: N/A

WELL STIMULATION: Method Airlift

Yield: Good / Moderate / Poor

(Note: UKMU-102 recompleted 11-3-08 to monitor LFG)
Renamed as MO-115
See Completion Log for MO-115

PROFESSIONAL GEOLOGIST CALVIN E. VANHOLLAND PG-2184 WYOMING

UKMU-102
(MO-115)

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MINE PERMIT VOLUME 3b of 5: Appendix D - Main Permit Area (D6)

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OP 3.6.1 Header House Control

Within each mine unit, injection and production balance will be monitored in well groupings related to header houses. The production and injection wells within each header house will be monitored individually or by production or injection headers, which are groups of production or injection wells piped together, depending on the monitoring parameter. The instrumentation will allow: monitoring of the header house solution balance; monitoring manifold pressures; and shutdown of flows in the event of a piping failure. Other instrumentation in the header house will include automatic oxygen shut-off and leak detection.

The hydrologic balance is determined by summing the flow rates of the injection and production wells separately and controlling the rates such that each header house is receiving the same injection volume per unit time as is being produced, minus the bleed volume. In a stable operating mine unit, the well flows observed will only fluctuate minimally from day to day. Appropriately designed flow meters will be used to measure the individual flow rates of each well. As a redundant control measure, flow meters will also be installed on the main pipelines entering and exiting each header house. The individual well flows will be monitored and adjusted daily and the pipeline meter will be monitored continuously with the instrumentation system.

All production and injection headers will have pressure gauges; and the pressures will be recorded daily. Pressure switches will be installed on the production wells and injection header in each header house. These switches will be designed to detect a piping failure and to shut down power to the production wells. In normal operation, when one header house has an event that trips the power to that house, the pressure change is noticeable throughout the system and other header houses will alarm the operator and subsequently shutdown.

The pressure information on the injection well headers is necessary to help ensure that the injection pressures do not exceed the formation fracture pressure or the rated pressure for the well casing. Regional information and historical operational practices indicate that the minimum pressure that could initiate hydraulic fracturing is 0.70 psi per foot of well depth. Further, injection pressures also will be limited to the pressure at which the well was integrity tested. During mine unit operations, injection pressures shall not exceed the MIT pressures at the injection wellheads (**Section OP 3.4**). Not withstanding this restriction, the maximum injection operating wellhead pressures shall not exceed 90% of the production zone fracture pressure or 95% of the American Society for Testing and

Materials (ASTM) maximum recommended operating pressure at 75°F for the well casing at the surface, whichever is less.

An example of the determination of the maximum injection pressure would be as follows:

Maximum injection pressure will be the lesser of the following:

Minimum MIT Pressure = 95% of the Manufacturer's Maximum Internal Pressure;
95% of the ASTM and/or Manufacturer Maximum Operating Casing Pressure; or
90% of the Production Zone Facture Pressure.

Using the following values:

Well Casing Depth = D in feet;
Maximum Casing Pressure from Manufacturer and/or ASTM = $P_{max;}$
Fracture Gradient = G_f = 0.7 psi/ft;
Water Gradient = G_w = 0.433 psi/ft; and
Lixiviant Gradient = G_w = 0.437 psi/ft;

the maximum injection pressure would be the less of:

P_{mit} = Maximum Injection Pressure based on Passing MIT Pressure = 0.95 x P_{max};
P_{csg} = Maximum Injection Pressure based on ASTM and/or Manufacturer = 0.95 x P_{max}; or
P_{Frac} = Maximum Injection Pressure based on Fracture Gradient = 0.9 x D x ($G_f - G_w$)

The oxygen system in each header house will have solenoid operated valves that will close in the event of a power loss or injection flow shutdown. This will prevent the continued delivery of oxygen to the pipeline when the field is not operating. Other operational safety features include, but are not limited to, a set of wet contacts or a conductivity probe installed in the sump in each header house to detect fluids on the floor of the house. If fluids are detected, the shunt will be tripped and electrical power to the production wells will be turned off. An audible and visual alarm system will be activated. Remote shutoff of the well pump power supply will also be available at each of the header houses.

OP 3.6.1.1 Plant Control Room

The Plant Control Room will house the main computer system that will monitor wellfield operating systems. Data from the wellfield instrumentation will be transmitted to the plant control room either by hardwire or wireless means. A Plant Operator will be on-site 24 hours a day to monitor the data being sent from the wellfield and a Wellfield Operator will be on-site 24 hours a day to respond to upset conditions.

The wellfield instrumentation will monitor the flows and pressures of production and injection systems. If the set tolerance limits for a monitored parameter is exceeded, then an alarm located within the plant facility will alert the Plant Operator of an upset condition in the wellfield and to its location. Radio communications between the Plant and Wellfield Operators will allow for timely response to alarms regardless of location. A record of each alarm will be noted in the plant control room log book, indicting the date, time and who responded in the wellfield. Also, each alarm event will be captured and stored electronically on the plant control room computer system.

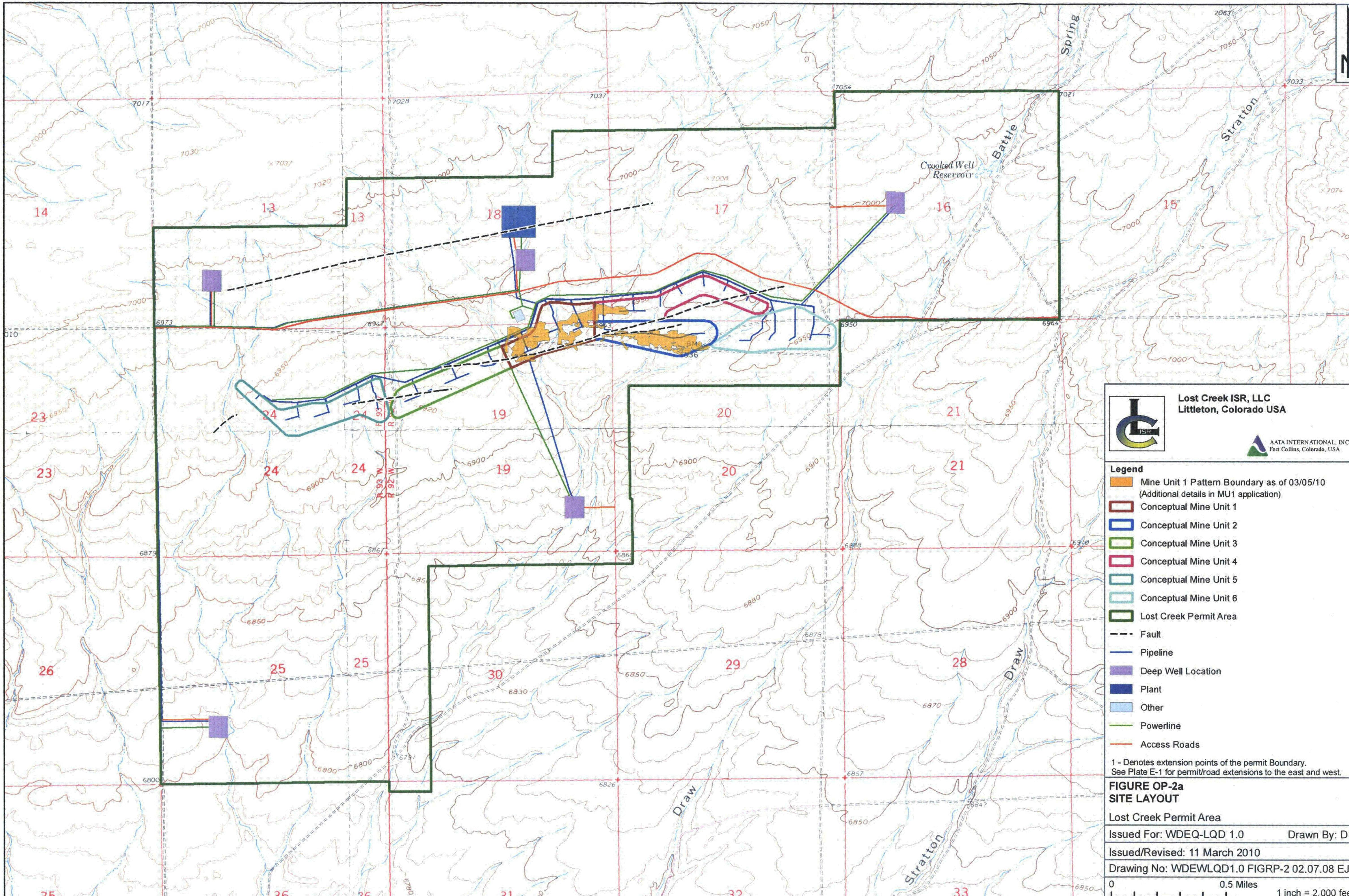
All Operators will be task trained in the proper operation of systems within their department. Maintenance on systems deemed faulty will be the responsibility of the Wellfield Operators or the Maintenance department depending on the nature of the fault. Employees will be task trained on the appropriate installation and testing of monitoring systems and all systems will be tested prior to initial operation.

The wellfield instrumentation system is comprised of the following components: Leak Detection; System Integrity; Tolerance Limits; Oversight; and Redundancy.

Leak Detection

The basis for monitoring flow and pressure in pipelines is the prevention of leaks. There will be three layers of protection associated with the wellfield instrumentation:

1) Monitoring and Data Output;
2) Alarm and Notification; and
3) Control and Shutdown.


Lost Creek ISR, LLC
Littleton, Colorado USA
AATA INTERNATIONAL, INC.
Fort Collins, Colorado, USA
Legend
Mine Unit 1 Pattern Boundary as of 03/05/10
(Additional details in MU1 application)
Conceptual Mine Unit 1
Conceptual Mine Unit 2
Conceptual Mine Unit 3
Conceptual Mine Unit 4
Conceptual Mine Unit 5
Conceptual Mine Unit 6
Lost Creek Permit Area
Fault
Pipeline
Deep Well Location
Plant
Other
Powerline
Access Roads
1 - Denotes extension points of the permit Boundary.
See Plate E-1 for permit/road extensions to the east and west.
FIGURE OP-2a
SITE LAYOUT
Lost Creek Permit Area
Issued For: WDEQ-LQD 1.0
Drawn By: DS
Issued/Revised: 11 March 2010
Drawing No: WDEWLQD1.0 FIGRP-2 02.07.08 EJS
0
0.5 Miles
1 inch = 2,000 feet
N
Crooked Well Reservoir
Battle
Spring
Draw
Stratton
Stratton
Draw
R 93 W
R 92 W

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:
Drawing Number: WDEQ-LQD 1.1 PLT OP-1
09.11.09 SMH
"PLATE OP-1
SITE LAYOUT
Lost Creek Permit Area"

WITHIN THIS PACKAGE...OR BY SEARCHING USING THE

D-01

ATTACHMENT OP-1

(RESERVED)

ATTACHMENT OP-2

SUMMARY OF ENGINEERING CONTROLS

Attachment OP-2
Summary of Engineering Controls

FIGURES

Attachment OP-2
Summary of Engineering Controls

Note: This material is also part of the NRC NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities", 2009 (GEIS). Engineering controls are discussed in general in Section 7.4 of the GEIS, and cross-references to specific GEIS sections are also included. Cross-references to specific sections of the WDEQ-LQD Operations Plan are also included.

1.0 Mine Unit

Each mine unit consists of a monitor well ring, production patterns, and the associated infrastructure to allow for transfer of lixiviant to and from the Plant. The mine unit boundaries are based on the geometry of the specific uranium mineralization and will have sufficient size and lateral continuity to enable economic uranium extraction. The well pattern installation for a given mine unit is based on the subsurface geometry of the ore deposit. Various pattern shapes are used including five-spot, line drives and various alternate configurations. Because roll-front uranium deposits normally have irregular shapes, some of the well patterns in a given well field are also irregular, and the well patterns may be altered to fit the size, shape, and boundaries of individual ore bodies. Depending on ore body geometry and surface topography, a typical pattern will be from 6,000 to 10,000 sq. ft. Ore body size and geometry will also influence the number of wells in a mine unit.

1.1 Pipelines

Pipelines are used to transport lixiviant to and from the Plant, the mine units, the header houses and eventually the injection and production wells. Pipelines are also used to transport waste water to the disposal wells. The lines are generally buried, minimizing the possibility of freezing in adverse weather and of being damaged by surface traffic (Section OP 2.9.1). In general, piping to and from the Plant and the mine units and within the mine units are constructed of high density polyethylene (HDPE) with butt-welded joints or the equivalent. In addition to the electronic engineering controls described below, Plant and Mine Unit operators augment the systems by performing routine visual checks and comparisons of the operating parameters. Access routes are installed (where possible) to track pipelines and powerlines to allow operators to perform visual inspections during travel.

1.1.1 Flow

Flow is measured at entrance and exit points of the Plant and the header houses. Flow data from the header house is transmitted to the Plant and compared to the Plant outflow through the Plant Programmable Logic Controller (PLC) to determine if a leak is present. If the change in flow is beyond the set point (allowing for accuracy in the measurement devices), then an alarm occurs.

1.1.2 Pressure

Pressure is measured at entrance and exit points of the Plant and the header houses. Pressure data from the header house headers is transmitted to the Plant and compared to the Plant outflow through the Plant PLC to determine if a leak is present. If the change in pressure is beyond the set point (allowing for friction and elevation), then an alarm occurs.

1.1.3 Leak Detection

As previously indicated in Sections 1.1.1 and 1.1.2 above, leak detection occurs in the form of pressure and flow measurement and comparison. If changes occur in the measured variables, then an alarm occurs. Additionally, more conventional methods of leak detection occur continually during production operations. Standard operating procedures (SOPs) require routine inspection of pipeline ROWs and valve station inspections. Operators are trained to look for leak indicators in their visual inspections of pattern areas, header houses and pipeline (ROWs).

1.2 Monitor Wells

There are three types of wells: injection wells for injecting lixiviant; production wells for uranium production; and monitoring wells for assessing ongoing operations. (Deep disposal wells are discussed in Section 2.5.3 of this attachment).

1.2.1 Installation

Design, location and installation are based on data gathered during exploration and delineation drilling. That previous drilling allows for the geologists to correlate the sands and confining units associated with the mine unit. The geologist also generally defines the ore completion horizons and their relationship to the monitor well ring. From this combined information, the geologist specifies the locations of the exterior, overlying, underlying and production zone monitor wells including their proposed completion intervals.

The monitor well locations are surveyed, drill locations are constructed and pilot holes are drilled and a geophysical log of the hole is made. The geologist checks the actual geophysical log versus the estimate and revises the casing and completion interval accordingly. The well casing is then installed, cemented in place and the cement allowed to cure. The well is then completed by under-reaming the desired monitor interval and possibly installing a well screen, if necessary. The final step for the drilling rig is to develop the completion interval by "airlifting" the well. After the rig moves off the location, a mechanical integrity test (MIT) is performed on the well. Following the MIT, a swabbing unit is typically used to develop the well again to insure an adequate completion. The final step is the installation of a pump, water level measurement, and sampling for water quality.

1.2.2 Water Quality (OP 3.6.4.1)

The water quality data provides the baseline assessment for the monitor well ring as well as the excursion detection procedure. Baseline water quality in the monitor ring is determined from four sampling events prior to production operations. Subsequent operational sampling is compared to the upper control limits (UCLs) for chloride, conductivity and total alkalinity. As the monitor samples are collected, they are evaluated in the on-site laboratory for the excursion parameters. The analytical results are put in the monitor well database and compared against previous results and the UCLs for significant changes or trends. This analysis indicates whether the mine unit is operating as planned or whether an excursion or a trend toward an excursion is occurring. Section OP 3.6.4.3 details the measures in excursion detection and verification.

Any adverse trend in water quality is reported to the site Operations Manager who will work with his staff to reverse the affects. Methods for trend reversal include modifying pattern balance in the region and increasing localized bleed (OP 3.6.4.4). Also included in this process is the review of well completion records, area geology and well history to insure no issues exist with any of the well placements or completions.

1.2.3 Water Levels

Sudden changes in water levels may indicate that the mine unit flow is out of balance. Increases in water levels in the overlying or underlying aquifers may be an indication of fluid migration from the production zone. Flow rates would be adjusted to correct this situation (OP 3.6.4.4). Adjustments to well flow rates or complete shutdown of individual wells may be required to correct this situation. Increases in water levels in the overlying or underlying aquifers may also be an indication of casing failure in a production, injection or monitor well. Isolation and shutdown of individual wells can be used to determine the well causing the water level increases.

Baseline water levels in the monitor ring are determined during four sampling events prior to production operations. Subsequent operational sampling water levels are put in the monitor well database and compared against previous results and the baseline data for significant changes or trends. This trend analysis may indicate an unbalanced group of patterns and may be the precursor to an increase in water quality parameters. Analysis may be in the form of numerical, graphical or both. **Figure OP-A2-1** depicts one form of this review method. In this example, a significant change is highlighted after the May 15 sample. However, this method does not provide the entire water balance picture.

An additional review method that will be used in conjunction with the individual water levels is a "rose" or "radar" plot. The water level data for all the monitor wells of the same horizon are plotted radially and anomalies are graphically noted. In these charts, it is easily seen that a "mounding" of water is occurring at M-101 (**Figure OP-A2-2**).

Any adverse trend in water levels will typically be reported to the site Operations Manager who will work with his staff to reverse the affects. Methods for trend reversal include modifying pattern balance in the region and increasing localized bleed. In particular, a trial and error system involving modifying injection and bleed patterns will be used to determine the exact location of the problem, i.e., the injection wells near the mounding would be turned off one at a time and the effects on the water level noted until the appropriate well or combination of wells was found. These wells and their associated patterns would then be re-balanced to properly affect the balance in the monitor wells. Also included in this process is the review of well completion records, area geology and well history to insure no issues exist with any of the well placements or completions.

Additional controls may include detailed monitoring of water levels adjacent to new production areas during the first two weeks of start-up, installation of observation wells as deemed hydrologically pertinent and/or installation and full-time monitoring of permanent piezometers in wells of concern.

1.3 Header Houses (GEIS 6.3.2; OP 3.6)

Header houses are the interface and measurement point between the Plant, pipelines and the well patterns. Each header house will consist of an injection and production header where the lixiviant will go to/come from the wells. The houses will also be the point where power control, instrumentation and oxygen distribution will occur. The attached **Figure OP-A2-3** depicts the header house instrumentation systems in general form.

1.3.1 Pattern Balance

This balance is the key component to maintaining hydrologic control within header houses and the mine units. The main tool used in pattern balance is the individual well flow rates. These flow rates are gathered when the fluid from/to each well travels through its "meter run" and the flow rate is measured. The engineering control aspects of pattern balance are: flow design, flow control; and flow measurement, as outlined in the following subsections.

1.3.1.1 Flow Design

Once the well patterns are installed, the designing engineer and operations staff will designate "balanced" flow values for each injection well based on the associated production flow rate. **Figure OP-A2-4** details the process for flow determination.

1.3.1.2 Flow Control

Wellfield operators will inspect each house daily to physically monitor and adjust the flow in the wells. They will review the pattern balance based on production well performance and adjust the injection wells accordingly. If special balance conditions exist such as excursion control or monitor well water level "mounding", the operator may be required to operate a group of patterns in an underbalanced mode. In other words, the injection well flow rates will be set below the balance level to increase the localized bleed. The operator will use a control valve and the flow meter reading on the injection meter run to set each individual injection well rate.

1.3.1.3 Flow Measurement

This measurement will occur via a flow meter installed on each injection and production meter run. Wellfield operators will inspect each house daily to physically monitor the flow in the wells. In addition, the flow data will be transmitted to the Plant computer for review, analysis, and alarm. Additional bulk measurement (See Section 1.1.1) will occur on the injection and production header to facilitate comparison against Plant flow for pipeline leak detection.

1.3.1.4 Data Comparison and Review

Data analysis will occur after the flow data has been transmitted to the Plant computer system for the following:

Individual Wells

Comparative analysis will be used to monitor for significant changes in individual well flow rates. A significant change could be an indicator of an upset condition either inside the header house or in the piping between the header house and the well head. Changes of this nature will cause an alarm and the wellfield operator will be notified for visual inspection of the well and/or to reset the well to the appropriate flow rate for proper balance.

Pattern Balance

The transmitted data will be used by operations staff to review pattern balance. As noted above, this may result in routine daily adjustments or modifications in pattern balance to deal with an upset condition such as elevating water levels in the monitor ring.

1.3.2 Pressure Control

Controls exist within the header house to insure that operational pressure requirements are not exceeded for: lixiviant injection and production and for oxygen injection, as outlined in the following subsections.

1.3.2.1 Lixiviant Injection

Pressure on the injection header will be measured and transmitted to the Plant control room for comparison with the Plant pipeline exit pressure. If the difference, less losses for elevation and friction, are significant then an alarm will be generated. This may be an indication of a pipeline leak or non-functioning equipment.

Low Pressure

A low pressure switch will be installed on the injection header. It is designed to alarm (locally and at the Plant) for a leak on the injection system as well as interlock with the oxygen system to insure oxygen injection occurs only in conjunction with lixiviant injection. This switch will also interlock with the injection control valve and shut flow off (in operational mode) to the injection header to minimize the volume in case of a spill. OP 3.4 and OP 3.6.1 discuss the pressure levels partially established by MIT and pressure monitoring at the header.

High Pressure

A high pressure switch will also be installed on the injection header. It is designed to shut down injection via the control valve to insure all regulatory pressure requirements are met. Those requirements are detailed in OP 3.4 and OP 3.6.1. High pressure alarms will be generated locally and at the Plant.

1.3.2.2 Lixiviant Production

Pressure on the production header will be measured and transmitted to the Plant control room for comparison with the Plant pipeline entrance pressure. If the difference, less losses for elevation and friction, are significant then an alarm will be generated. This may be an indication of a pipeline leak or non-functioning equipment.

Low Pressure

A low pressure switch will be installed on the production header. It is designed to alarm (locally and at the Plant) for a leak on the production system or to indicate an electrical problem causing the production pumps to not operate properly.

High Pressure

A high pressure switch will also be installed on the production header. It is designed to shut down production via the motor control center to insure piping pressure ratings are not exceeded. High pressure alarms will be generated locally and at the Plant.

1.3.2.3 Oxygen Injection

The oxygen system in each header house will have solenoid operated valves that will close in the event of a power loss or injection flow shutdown. This will prevent the continued delivery of oxygen to the pipeline when the field is not operating. High and low data points will be set for oxygen injection piping within the header houses. If pressures are outside the set points, operators will be notified via alarm and will address the upset condition.

1.3.3 Leak Detection (OP 3.5)

Mine unit leak detection is focused in three main areas: pipelines feeding the mine unit and Plant, header houses and pattern areas. The engineering controls associated with each area are:

1.3.3.1 Pipelines

Leak detection will occur in the form of flow and pressure measurement and comparison. If changes occur in the measured variables, then an alarm will occur. Additionally, more conventional methods of leak detection occur continually during production operations. Standard operating procedures (SOP's) will require routine inspection of pipeline right-of-ways (ROWs) and valve station inspections. Operators will be trained to look for leak indicators in their visual inspections of pipeline ROWs.

Flow

Flow will be measured at pipeline entrance and exit points at the Plant and the header houses. Flow data from the header house will be transferred to the Plant and compared through the Plant PLC to determine if a leak is present. If the change in flow is beyond the set point (allowing for accuracy in the measurement devices), then an alarm will occur.

Pressure

Pressure will be measured at pipeline entrance and exit points at the Plant and the header houses. Pressure data from the header house headers will be transferred wirelessly to the Plant and compared through the Plant PLC to determine if a leak is present. If the change in pressure is beyond the set point (allowing for friction and elevation), then an alarm will occur.

1.3.3.2 Header Houses

Leak detection will occur in the form of pressure and flow measurement and comparison as well level indication in the sump. If changes occur in the measured variables, then an alarm will occur. Additionally, more conventional methods of leak detection occur continually during production operations. Standard operating procedures (SOP's) will require inspection of each header house each shift. Operators will be trained to look for leak indicators in their visual inspections.

Flow

Flow is measured at each well meter run and on the injection and production headers. As discussed above, comparative analysis is used to determine if significant changes exist and alarms will occur. Wellfield operators are notified upon alarm and a visual inspection is required to determine the nature of the upset condition.

Pressure

Pressure is measured on the injection and production headers and is transmitted to the Plant. Pressure switches are used to detect upset conditions in the headers. If the injection header appears to have a failure, the injection control valve will close and stop lixiviant flow to the header house. If the production header pressure is above or below the pressure switch set points, then the motor control center will be shutdown which will, in turn, shut all production well flow to the header house. Wellfield operators will be notified upon alarm and a visual inspection will be required to determine the nature of the upset condition.

Sump

The sumps should be dry; therefore, water levels and the operating status of the sump pumps in the header house basements will be monitored and transmitted to the Plant for review and alarm. A low level indication in the sump will initiate an alarm as well as begin pumping sump fluid into the production header. A high sump level will continue to alarm but will also shut down flow into and out of the header house.

1.3.3.3 Pattern Areas

Leak detection will occur via flow and pressure measurements and via wellhead equipment at each well. SOP's will require inspection of each header house each shift. Operators will be trained to look for leak indicators in their visual inspections.

Flow

Flow will be measured at each well meter run. As discussed above, comparative analysis will be utilized to determine if significant changes exist and alarms will occur. Wellfield operators will be notified upon alarm and a visual inspection will be required to determine the nature of the upset condition.

Pressure

Pressure indication is available on each meter run and will also be used as an indicator of a potential leak. Pressure is not a good leak indicator on injection wells, as they may operate at different pressures depending upon recent workover status and reservoir loading. The same is true of production wells as a drop in pressure could be an indicator of a failed pump, a failure in the downhole tubing used to support the pump or a failure in the piping from the well. Any changes in pressure data will be noted by operators and visual inspections of lines and systems will be completed to insure system integrity.

Wellheads

Each wellhead (injection and production) includes leak detection into its construction. Each wellhead cover includes a catch -basin and an alarm contactor. The contactor's circuit will complete if fluid is present in the catch-basin and a local and Plant alarm will occur. A wellfield operator will be notified upon alarm and a visual inspection will be required to determine the nature of the upset condition.

2.0 Plant

2.1 Ion Exchange (GEIS 2.4.2.1)

2.1.1 Flow / Water Balance

As pregnant lixiviant (also called production concentrate [PC]) from the production wells enters the ion-exchange circuit, it is sent to the ion-exchange columns. The lixiviant exiting the ion-exchange columns normally contains less than 5 mgL of uranium. The PC flow rate is monitored entering the Plant and at each of the ion exchange columns. This is the total flow from the header houses, i.e. the production wells. The flow rates will be compared through the PLC and an alarm generated if the difference is outside the set point (based on meter accuracy). The purpose of this comparison is to look for pipeline leaks between the header houses and the Plant by comparing total well field production well output to total Plant input.

The barren lixiviant (also called injection concentrate [IC]), is recharged with oxidant and bicarbonate, and is returned to the well field for reinjection. The production bleed is removed downstream of the ion-exchange columns, before re-injecting the barren lixiviant into the well field. The total bleed is estimated to be between 0.5% and 1.5% of the total well field production flow. IC flow rate is monitored leaving the Plant and, similar to the PC, is compared to the IC flow rates at the header houses through the Plant PLC. An alarm will be generated if the difference is outside the set point (based on meter accuracy). The purpose of this comparison is to look for pipeline leaks between the Plant and the header houses.

2.1.2 Pressure

Pressure readings will be utilized in a comparative manner to determine if an upset condition exists (leaking pipeline, fitting or valve) in the well field piping similar to the flow comparison. Entry and exit pressures for IC and PC lines at the header houses will be monitored and compared to the Plant IC and PC pressures through the PLC with allowances for friction and elevation changes. An alarm will be generated if the difference is outside the head loss allowances.

2.2 Elution (GEIS 2.4.2.2)

After the resin is loaded with uranium, it enters the elution circuit where the uranium is washed (eluted) from the resin, and the resin is made available for further cycles of uranium absorption. The resin will be transferred to a separate elution tank where the uranium is removed from the resin by flushing with a concentrated brine solution (eluant). After the uranium has been stripped from the resin, the resin may be rinsed with a sodium carbonate or bicarbonate solution. This rinse removes the high chloride eluant physically entrained in the resin and partially converts the resin to bicarbonate form. The resulting uranium-rich solution is termed pregnant or rich eluant. After enough pregnant eluant is obtained, it is moved to the precipitation, drying, and packaging circuit. All facets of the elution system are monitored to optimize chemical usage and minimize water usage. Monitored parameters include, but are not limited to: flow rates, fluid volume/level, pH and pressure. These types of engineering controls are designed to reduce waste disposal water and thus overall water consumption.

2.3 Precipitation (GEIS 2.4.2.3)

In the precipitation circuit, the pregnant eluant will be acidified to destroy the uranyl carbonate complex. Hydrogen peroxide (H_2O_2) is then added to precipitate the uranium as uranyl peroxide. Caustic soda (NaOH) is also added at this stage to neutralize the acid remaining in the eluate. The (now barren) eluant is recycled. Water left over from these processes will be reused in the eluant circuit or added to the waste stream to be included in deep disposal. All facets of the precipitation system are monitored to optimize chemical usage and minimize water usage. Monitored parameters include, but are not limited to: flow rates; fluid volume/level; pH; and slurry density. These types of engineering controls are designed to reduce waste disposal water and thus overall water consumption.

2.4 Slurry Storage (GEIS 2.4.2.3)

After the precipitation process, the resulting slurry is washed, filtered, and dewatered. At this point, the slurry is 30 to 50% solids. This thickened slurry will be stored in tanks in preparation for transport offsite to a uranium processing facility to produce yellowcake. Process water will be reused as possible in the elution and precipitation circuits. Filter press wash times will be minimized through monitoring of fluid flow rates and pressures as well as routine conductivity measurement on the filter press wash water discharge. Conductivity is a direct indication of chloride and thus the slurry cleanliness.

2.5 Waste Water Disposal (GEIS 2.4.3)

Uranium mobilization and processing produce excess water that must be properly managed. The production wells extract slightly more water than is re-injected into the host aquifer, which creates a net inward flow of groundwater in the well field. This production bleed is about 0.5 to 1.5% of the circulation rate. The production bleed is diverted after the uranium is removed in the ion-exchange resin system, but before the lixiviant is recharged. This water still contains lixiviant and minerals leached from the aquifer. The excess water will go through secondary ion exchange for further uranium capture prior to being stored for deep well disposal or to be treated further through reverse osmosis. Permeate from reverse osmosis may be used for Plant makeup water or restoration purposes. Other liquid waste streams produced during ISL operation can include spent eluant from the ion-exchange system and liquids from process drains. These are handled in the same manner as the production bleed.

Specifically, the Lost Creek Project waste water disposal system will consist of two storage tanks inside the Plant, two lined storage ponds adjacent to the Plant and a network of up to five deep disposal wells located around the Permit Area as well as the transfer and injection pumps. Engineering controls for each aspect will function as follows:

2.5.1 Plant Storage Tanks

Each of the tanks will be equipped with high and low fluid level indication that will interlock with feed and transfer pumps to either limit water coming into the tanks and/or transfer water going out of the tanks to the storage ponds and/or the deep disposal wells. A low level will shut down the pumps that transfer fluid to the storage ponds or feed the deep disposal injection pumps. A high level will shut down the waste water feed pumps. High and low fluid levels will alarm to the Plant Operator and pump status will also display on the Operator's screen.

2.5.2 Lined Storage Ponds

The lined storage ponds, Section OP 5.2.3.1, will be installed as additional waste fluid storage in the event deep disposal capacity is disrupted. The primary reasons for use will be falloff testing of disposal wells or well failure(s). The Storage Ponds will be lined and equipped with a leak detection system. During operations, the leak detection standpipes will be checked for evidence of leakage. Visual inspection of the pond embankments, fences and liners and the measurement of pond freeboard will also be performed during normal operations. The criteria for determining if a leak has been detected include both water level and water quality criteria. If there is an abrupt increase in the water level in one of the leak detection standpipes or if six or more inches of water are present in one of the standpipes, the water in that standpipe will be analyzed for specific conductance. If the specific conductance is more than half the specific conductance of the water in the pond, the water will be further sampled for chloride, alkalinity, sodium, and sulfate. In addition, the liner will be immediately inspected for damage and the appropriate agencies will be notified. Upon verification of a liner leak in one of the ponds, the water level in that pond will be lowered by transferring the contents to the other pond and/or to the UIC Class I wells.

With respect to pond overflow, SOPs will be such that neither pond is allowed to fill to a point where overflow is considered a realistic possibility. Flow rates to and from the storage ponds will be monitored and pump status will also display on the Operator's screen. Since the primary disposal method will be the UIC Class I wells, the flow rates to the pond are expected to be minimal; and there will be sufficient time to reroute the flow to another pond, or to modify Plant operations to reduce flow for the critical period. If precipitation is excessive, the freeboard allowance of the ponds will be designed to contain significant quantities of precipitation before an overflow occurs. The freeboard allowance will also reduce the possibility of water blowing over the pond walls during high winds.

2.5.3 Deep Disposal Well System

Up to five total deep disposal wells are planned for the Lost Creek Project. The wells are monitored in accordance with the requirements of the UIC Class I permit; and an evaluation of the well performance is included in the Annual Report submitted to NRC and WDEQ. Each well installation consists of a deep disposal well, an injection pipeline, pump house with injection pump and a feeder pipeline from the Plant.

2.5.3.1 Deep Disposal Wells

Each well consists of steel casing with perforations into the receiver formation, with injection tubing and a packer to deliver the waste fluid to the receiver and to form a casing annulus. The annulus will be filled with corrosion inhibited fluid. The wellhead (injection) and annulus pressure will be transmitted to the Plant wirelessly where it will be monitored and trended and where alarms will occur if either exceeds limits. The injection pressure limit is detailed in the Class 1 UIC permit and is based on the fracture pressure and gradient. The annular pressure is monitored as a secondary means of maintaining mechanical integrity. If the pressure in the annulus equals the injection pressure then a failure in either the tubing or packer or both has occurred and repairs will be required.

2.5.3.2 Injection Pipeline

This pipeline consists of high pressure steel piping rated for the transfer of the waste fluid between the pump house and the well. This pipe will be buried approximately six feet below surface and will typically be less than 100 feet in length. Pressure readings at the pump house discharge and at the wellhead will be compared using the

Plant PLC to determine if there is a leak. A pressure drop greater than the allowance for friction and elevation head will generate an alarm and the injection pump will be shut down.

2.5.3.3 Pump House

The pump house consists of a skid type building, motor control center, high pressure injection pump, instrumentation, leak detection, and suction and discharge piping. The following parameters are monitored: suction pressure (pump inlet pressure); suction flow rate; discharge pressure;, sump level; and pump status. All data will be transmitted wirelessly to the Plant for monitoring, trending and alarming. Suction pressure and flow rate will be compared to pressure and flow data at the Plant to determine if there is a pipeline leak. If either parameter exceeds set points which allow for friction and head loss, then an alarm will be generated and the pump(s) will be shut down. Sump level will also be monitored to two stages: low and high. A low level in the sump will alarm the Plant operator of the condition. A high level will initiate shut down of the pump(s).

2.5.3.4 Feeder Pipeline

This pipeline consists of a buried pipeline, typically HDPE, from the Plant to each well. This line may feed more than one disposal well. Pressure and flow at the start and end of the pipelines will be compared through the Plant PLC to determine if a leak is present. If the change in pressure is beyond the set point (allowing for friction and elevation), then an alarm will occur and the pump(s) will be shut down.

2.6 Restoration (GEIS 2.5)

The objective of restoration is to return the affected groundwater to the uses for which it was suitable before commencement of Project operations. The Plant restoration systems (ion exchange, reverse osmosis filtration, storage tanks, and degassers) are used to achieve this goal, and the engineering controls for each are outlined in the following subsections.

2.6.1 Ion Exchange

This system consists of two ion exchange columns designed to remove the majority of any remaining uranium from the stream. The incoming fluid flow rate is monitored entering the Plant and at each of the ion exchange columns. This is the total flow from the restoration header houses. The flow rates will be compared through the PLC and an alarm generated if the difference is outside the set point (based on meter accuracy). Pressure is also monitored as a secondary means of leak detection. The purpose of this comparison is to look for pipeline leaks between the header houses and the Plant by comparing total well field production well output to total Plant input. The barren fluid is then pumped to the reverse osmosis system for filtration.

2.6.2 Reverse Osmosis (RO)

The RO system consists of pre-filtration, pumps, instrumentation and semi-permeable membranes. The RO process yields two fluids: clean water (permeate) that can be re-injected into the aquifer and water with concentrated ions (brine) that cannot be re-injected directly. The following instrumentation (pressure transmitters, pressure gauges, conductivity meters, and flow meters) will be part of the reverse osmosis system.

2.6.2.1 Pressure Transmitters

The transmitters on the system feed and discharge will be monitored, trended and alarmed through the PLC. Operation outside of set points will alarm the Plant operator and may cause an automatic shutdown of feed and discharge pumps depending on the severity of the reading.

2.6.2.2 Pressure Gauges

The gauges on the pumps, feed, interstage and discharge and on the required pre-filtration will support operation of the system.

2.6.2.3 Conductivity

Conductivity of permeate and feed will be monitored and alarmed through the PLC. Operation outside of set points will alarm the Plant operator and necessitate review of the RO performance. This may trigger additional cleaning of membranes.

2.6.2.4 Flow

Flows of permeate and concentrate will be monitored, trended and alarmed through the PLC. Operation outside of set points will alarm the Plant Operator and may cause an automatic shutdown of one or more of the pumps.

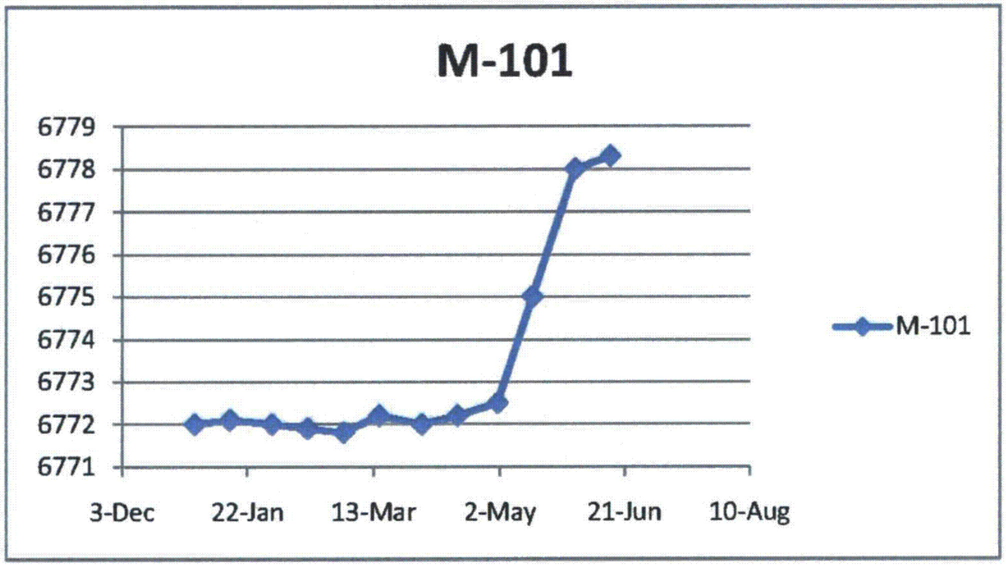
2.6.3 Storage Tanks

Permeate and brine streams will each be stored in tanks prior to shipment. The brine will be added to the waste water tanks previously discussed in Section 2.5 (Waste Water Disposal). The permeate tank will be equipped with high and low fluid level indication that will interlock with feed and transfer pumps to either limit water coming into the tanks and/or transfer water going out of the tanks to the wellfield. A low level will shut down the pumps that send fluid to the wellfield for reinjection as part of the restoration process. High and low fluid levels will alarm to the Plant Operator and pump status will also display on the Operator's screen.

2.6.4 Degasser

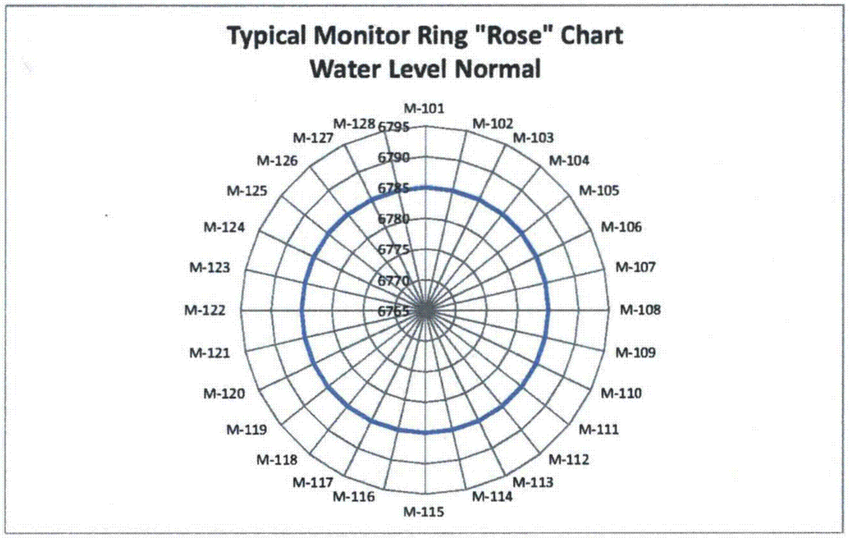
The purpose of the degassers is to liberate carbon dioxide and moderate pH prior to permeate reinjection. The units will monitor, trend and alarm pH and pressure through the Plant PLC.

Figure OP-A2-1 Example of Change in Water Level from Normal to 'Mounding' Conditions



M-101		
Date	Wtr Lvl	Change
1-Jan	6772	
15-Jan	6772.1	0.1
1-Feb	6772	-0.1
15-Feb	6771.9	-0.1
1-Mar	6771.8	-0.1
15-Mar	6772.2	0.4
1-Apr	6772	-0.2
15-Apr	6772.2	0.2
1-May	6772.5	0.3
15-May	6775	2.5
1-Jun	6778	3
15-Jun	6778.3	0.3

Figure OP-A2-2 Example of Rose Diagrams - Normal and 'Mounding" Conditions



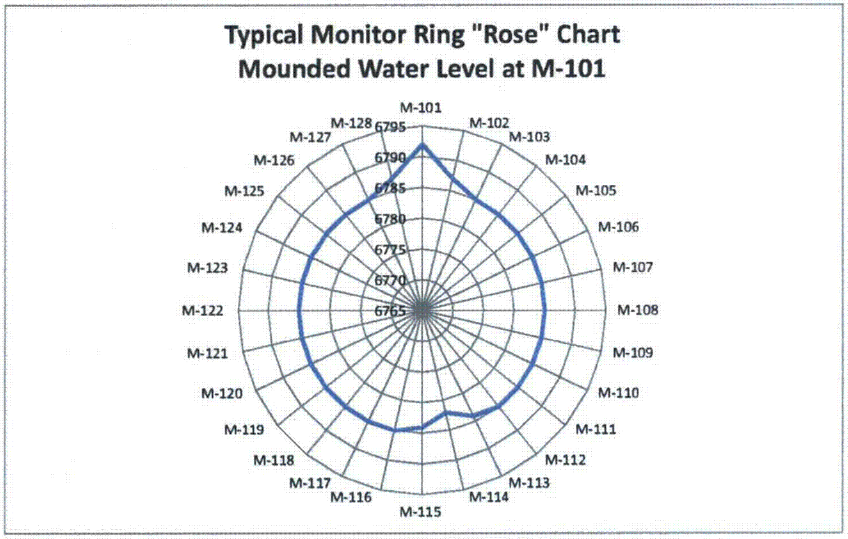


Figure OP-A2-3 Schematic of Header House Instrumentation

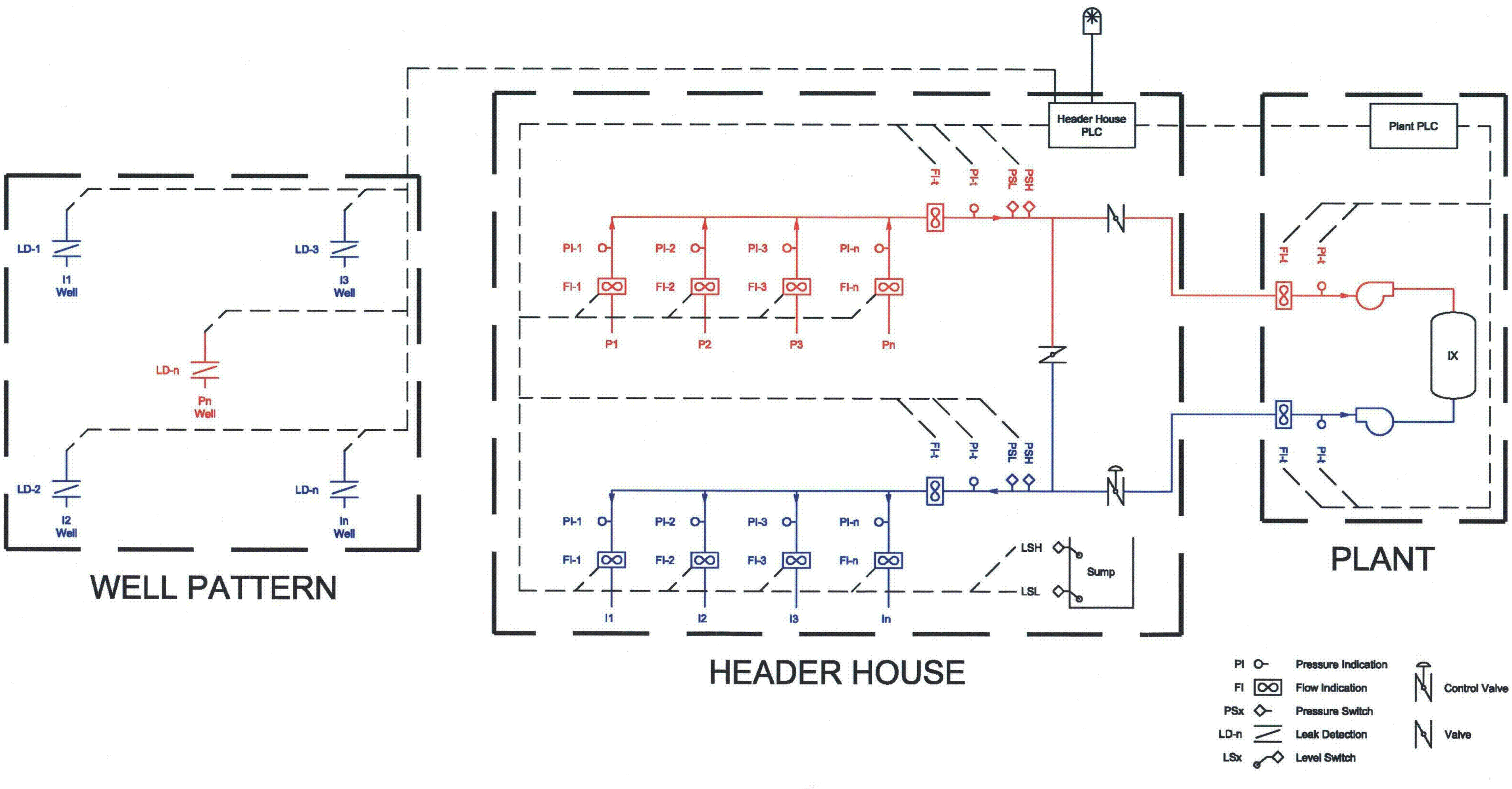
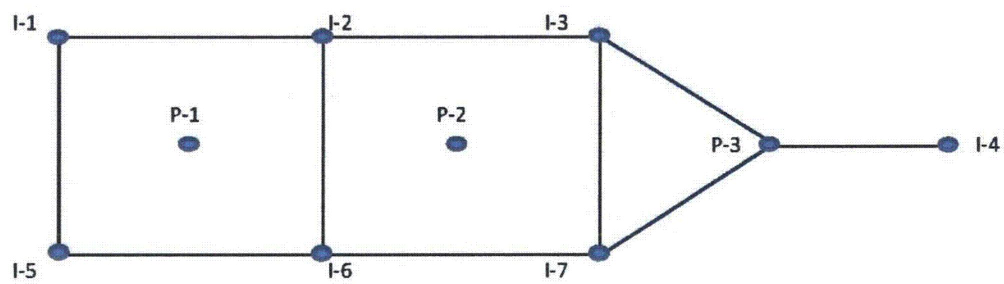


Figure OP-A2-4 Example of Pattern Balancing



P-1 Flowrate	30 gpm			
P-2 Flowrate	24 gpm			
P-3 Flowrate	36 gpm			
I-1 Flowrate =	25% of P-1 =	.25 * 30 =	7.5 gpm	
I-2 Flowrate =	25% of P-1 =	.25 * 30 =	7.5 gpm	plus
	25% of P-2 =	.25 * 24 =	6 gpm	
			13.5 gpm	
I-3 Flowrate =	25% of P-2 =	.25 * 30 =	6 gpm	plus
	33% of P-3 =	.33 * 36 =	12 gpm	
			18 gpm	
I-4 Flowrate =	33% of P-3 =	.33 * 36 =	12 gpm	
I-5 Flowrate =	25% of P-1 =	.25 * 30 =	7.5 gpm	
I-6 Flowrate =	25% of P-1 =	.25 * 30 =	7.5 gpm	plus
	25% of P-2 =	.25 * 24 =	6 gpm	
			13.5 gpm	
I-7 Flowrate =	25% of P-2 =	.25 * 30 =	6 gpm	plus
	33% of P-3 =	.33 * 36 =	12 gpm	
			18 gpm	

ATTACHMENT OP-3

(RESERVED)

Table RP-4 Reclamation/Restoration Bond Estimate (Page 1 of 37)

LOST CREEK ISR, LLC SUMMARY OF RECLAMATION/RESTORATION BOND ESTIMATE

I	GROUNDWATER RESTORATION - Worksheet 1	$3,719,492
II	DECOMMISSIONING AND SURFACE RECLAMATION	$1,385,856

A.	Plant Equipment Removal and Disposal - Worksheet 2	$73,724
B.	Plant Building Demolition and Disposal - Worksheet 3	$331,514
C.	Storage Pond Sludge and Liner Handling - Worksheet 4	$405,997
D.	Well Abandonment - Worksheet 5	$207,589
E.	Wellfield Equipment Removal and Disposal - Worksheet 6	$173,896
F.	Topsoil Replacement and Revegetation - Worksheet 7	$72,944
G.	Miscellaneous Reclamation Activities - Worksheet 8	$120,193

SUBTOTAL RESTORATION AND RECLAMATION	**$5,105,348**
III TOTAL CONTINGENCY	$1,761,345

Miscellaneous Costs Associated with Third Party Contractors			
Project Design	2%	=	$102,107
Contractor Profit & Mobilization	8%	=	$408,428
Pre-Construction Investigation	1%	=	$51,053
Project Management	5%	=	$255,267
On-Site Monitoring	0.5%	=	$25,527
Site Security & Liability Assurance	1%	=	$51,053
Longterm Administration	2%	=	$102,107
Contingency	15%	=	$765,802

TOTAL RESTORATION AND RECLAMATION	**$6,866,693**

Table RP-4 Reclamation/Restoration Bond Estimate (Page 2 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
Technical Assumptions:			
Wellfield Area (Square Feet)	1,057,797	Proposed area	Data
Wellfield Area (Acres)	24.28		Calculated
Affected Ore Zone Area (Square Feet)	1,057,797	Proposed area affected	Data
Average Completed Thickness (Feet)	12.0	Proposed thickness	Data
Affected Volume:			
Factor For Vertical Flare	20%	Vertical flare estimate	Estimated
Factor For Horizontal Flare	20%	Horizontal flare estimate	Estimated
Total Volume (Cubic Feet)	18,278,732	= Area * Thickness * Vertical flare * Horizontal flare	Calculated
Porosity	25.0%	Typical value for host sand	Data
Gallons Per Cubic Foot	7.48	Conversion factor	Constant
Gallons Per Pore Volume	34,181,229	= Volume * Porosity * gal/ft^3	Calculated
Number of Wells in Unit(s)			
Production Wells	120	Proposed well count	Data
Injection Wells	208	Proposed well count	Data
Monitor Wells	69	Proposed well count	Data
Average Well Spacing (Feet)	95	Proposed well spacing	Data
Average Well Depth (Feet)	410	Proposed well depth	Data

Table RP-4 Reclamation/Restoration Bond Estimate (Page 3 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
I GROUNDWATER SWEEP			
A. PLANT & OFFICE			
Operating Assumptions:			
Flow Rate (Gallons per Minute)	40	Planned flow	Data
Pore Volumes Required	0.3	Required value	Data
Total Gallons For Treatment	10,254,369	= Gallons per Pore Volume * Number of Pore Volumes	Calculated
Total Kilogallons for Treatment	10,254		Calculated
Cost Assumptions:			
Power			
Average Connected Horsepower	20	Proposed pump horsepower	Data
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	$0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	40	Planned rate	Data
Gallons per Hour	2400		Calculated
Cost per Hour	$0.90		Calculated
Cost per Gallon	$0.00037		Calculated
Cost per Kilogallon	$0.373		Calculated
Chemicals			
Antiscalent (Cost per Kilogallon)	$0.120	Based on required dosage/estimated cost	Unit Rate
Repair & Maintenance (Cost per Kilogallon)	$0.035	Estimate	Unit Rate
Analysis (Cost per Kilogallon)	$0.030	On-site laboratory analysis	Unit Rate

Table RP-4 Reclamation/Restoration Bond Estimate (Page 4 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
I GROUNDWATER SWEEP (continued)			
A. PLANT & OFFICE (continued)			
Total Cost per Kilogallon	$0.558		Calculated
Total Treatment Cost	$5,722		Calculated
Utilities			
Power (Cost per Month)	$225	Estimate	Unit Rate
Propane (Cost per Month)	$225	Estimate	Unit Rate
Time for Treatment			
Minutes for Treatment	256,359	=Total Gallons for Treatment Divided by Flow Rate (gpm)	Calculated
Hours for Treatment	4,273		Calculated
Days for Treatment	178		Calculated
Average Days per Month	30.4		Calculated
Months for Treatment	5.9		Calculated
Utilities Cost	$2,634		Calculated
TOTAL PLANT & OFFICE COST	$8,356		

Table RP-4 Reclamation/Restoration Bond Estimate (Page 5 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
I GROUNDWATER SWEEP (continued)			
B. WELLFIELD			
Cost Assumptions:			
Power			
Average Flow per Pump (Gallons per Minute)	32	Estimate from pumping	Data
Average Horsepower per Pump	7.50	Estimate from pumping	Data
Average Number of Pumps Required	1.3	Estimate from pumping	Data
Average Connected Horsepower	14.4	Pumps plus 5 horsepower for HH	Data
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	$0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	40	Planned flow	Data
Gallons per Hour	2400		Calculated
Cost per Hour	$0.64		Calculated
Cost per Gallon	$0.0003		Calculated
Cost per Kilogallon	0.268		Calculated
Repair & Maintenance (Cost per Kilogallon)	$0.115	Estimate	Unit Rate
Total Cost per Kilogallon	$0.383		Calculated
TOTAL WELLFIELD COST	$3,928		Calculated
TOTAL GROUNDWATER SWEEP COST	$12,284		Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 6 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
II REVERSE OSMOSIS			
A. PLANT & OFFICE			
Operating Assumptions:			
Flow Rate (Gallons per Minute)	760	Estimate from pumping	Data
Pore Volumes Required	6.0	Required value	Data
Total Gallons for Treatment	205,087,375	= Gallons per Pore Volume * Number of Pore Volumes	Calculated
Total Kilogallons for Treatment	205,087		Calculated
Feed to Reverse Osmosis Unit (Gallons per Minute)	760	Planned flow	Data
Permeate Flow (Gallons per Minute)	570	= Planned Flow * Average Reverse Osmosis Recovery	Calculated
Brine Flow (Gallons per Minute)	190	= Planned Flow - Permeate Flow	Calculated
Average Reverse Osmosis Recovery	75.0%	Reverse Osmosis Design	Data
Cost Assumptions:			
Power			
Average Connected Horsepower	300.00	Average value for each area	Data
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	$0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	760	Planned flow	Data
Gallons per Hour	45600		Calculated
Cost per Hour	$13.43		Calculated
Cost per Gallon	$0.00029		Calculated
Cost per Kilogallon	$0.294		Calculated
Chemicals			
Sulfuric Acid (Cost per Kilogallon)	$0.090	Estimate	Unit Rate
Caustic Soda (Cost per Kilogallon)	$0.023	Estimate	Unit Rate
Reductant (Cost per Kilogallon)	$0.113	Estimate	Unit Rate
Antiscalent (Cost per Kilogallon)	$0.124	Based on required dosage/estimated cost	Unit Rate
Repair & Maintenance (Cost per Kilogallon)	$0.068	Estimate	Unit Rate
Sampling & Analysis (Cost per Kilogallon)	$0.030	Estimate	Unit Rate

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
II REVERSE OSMOSIS (continued)			
A. PLANT & OFFICE (continued)			
Total Cost per Kilogallon	$0.742		Calculated
Total Pumping Cost	$152,169		Calculated
Utilities			
Power (Cost per Month)	$560	Estimate	Unit Rate
Propane (Cost per Month)	$225	Estimate	Unit Rate
Time for Treatment			
Minutes for Treatment	269,852		Calculated
Hours for Treatment	4,498		Calculated
Days for Treatment	187		Calculated
Average Days per Month	30.4		Calculated
Months for Treatment	6.2		Calculated
Utilities Cost	$4,867		Calculated
TOTAL PLANT & OFFICE COST	$157,036		Calculated

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
II REVERSE OSMOSIS (continued)			
B. WELLFIELD			
Cost Assumptions:			
Power			
Average Flow per Pump (Gallons per Minute	32.00	Average value for each area	Data
Average Horsepower per Pump	7.50	Average value for each area	Data
Average Number of Pumps Required	23.8	Average value for each area	Data
Average Connected Horsepower	188.1	Pump horsepower plus 10 horsepower	Calculated
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	$0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	760	Planned flow	Data
Gallons per Hour	45,600		Calculated
Cost per Hour	$8.42		Calculated
Cost per Gallon	$0.0002		Calculated
Cost per Kilogallon	$0.185		Calculated
Repair & Maintenance (Cost per Kilogallon)	$0.115	Estimate	Unit Rate
Total Cost per Kilogallon	$0.300		Calculated
TOTAL WELLFIELD COST	$61,456		Calculated
TOTAL REVERSE OSMOSIS COST	$218,493		Calculated

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
III RECIRCULATION			
A. WELLFIELD			
Cost Assumptions:			
Power			
Average Flow per Pump (Gallons per Minute)	32	Estimate from pumping	Data
Average Horsepower per Pump	7.50	Estimate from pumping	Data
Average Number of Pumps Required	120.0	Estimate from pumping	Data
Average Connected Horsepower	905.0	Pumps plus 5 horsepower for HH	Data
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	3840	Planned flow	Data
Gallons per Hour	230400		Calculated
Cost per Hour	$40.51		Calculated
Cost per Gallon	$0.0002		Calculated
Cost per Kilogallon	0.176		Calculated
Repair & Maintenance (Cost per Kilogallon)	$0.115	Estimate	Unit Rate
Total Cost per Kilogallon	$0.291		Calculated
TOTAL WELLFIELD RECIRCULATION COST	$9,940		Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 10 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
IV WASTE DISPOSAL WELL			
Operating Assumptions:			
Annual Evaporation Capacity (Gallons)	0		Data
Average Monthly Evaporation Capacity (Gallons)	0		Calculated
Total Disposal Requirement			
Reverse Osmosis Brine (Total Gallons)	51,271,844	=Treatment Gallons * (1- Reverse Osmosis Recovery)	Calculated
Reverse Osmosis Brine (Total Kilogallons)	51,272		Calculated
Brine Concentration Factor	50%	Reverse Osmosis Design	Data
Total Concentrated Brine (Gallons)	25,635,922	= Reverse Osmosis Brine Gallons * Brine Concentration Factor	Calculated
Months of RO Operation	6.2		Calculated
Average Monthly Requirement (Gallons)	4,134,826	=Total Concentrated Brine / Months of Reverse Osmosis Operation	Calculated
Monthly Balance for DDW (Gallons)	4,134,826	=Average Monthly Requirement - Average Monthly Evaporation	Calculated
Total WDW Disposal (Gallons)	25,635,922		Calculated
Total WDW Disposal (Kilogallons)	25,636		Calculated
Cost Assumptions:			
Power			
Average Connected Horsepower	100.0	Estimate	Data
WDW Average Connected Horsepower	300.0	Estimate	Data
Kilowatt-hours per Horsepower	0.746		Conversion Factor
Cost per Kilowatt-hour	$0.060	Estimate based on supplier	Unit Rate
Gallons per Minute	115.0	Planned flow	Data
Gallons per Hour	6900		Calculated
Cost per Hour	$17.90		Calculated
Cost per Gallon	$0.0026		Calculated
Cost per Kilogallon	$2.595		Calculated

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
IV WASTE DISPOSAL WELL (continued)			
Chemicals			
Reverse Osmosis Antiscalent (Cost per Kilogallon)	$0.225	Based on required dosage and cost	Unit Rate
WDW Antiscalent (Cost per Kilogallon)	$0.254	Based on required dosage and cost	Unit Rate
Sulfuric Acid (Cost per Kilogallon)	$0.315	Estimate	Unit Rate
Corrosion Inhibitor	$0.244	Estimate	Unit Rate
Repair & Maintenance (Cost per Kilogallon)	$0.130	Estimate	Unit Rate
Total Cost per Kilogallon	$3.762		Calculated
TOTAL WASTE DISPOSAL WELL COST	$96,450		Calculated

Assumptions/Items	Mine Unit No. 1	Explanation	Source
V STABILIZATION MONITORING			
Operating Assumptions:			
Time of Stabilization (Months)	9	Time frame required	Data
Frequency of Analysis (Months)	3	Required sampling	Data
Total Sets of Analysis	4	Required sampling	Data
Cost Assumptions:			
Power (Cost per Month)	$1,125	Estimate	Unit Rate
Total Power Cost	$10,125		Calculated
Sampling & Analysis (Cost per Set)	$4,050	Estimate	Unit Rate
Total Sampling & Analysis Cost	$16,200		Calculated
Utilities (Cost per Month)	$2,250	Estimate	Unit Rate
Total Utilities Cost	$20,250		Calculated
TOTAL STABILIZATION COST	$46,575		Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 12 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items					Mine Unit No. 1	Explanation	Source
VI LABOR							
Cost Assumptions							
	Crew Numbers	Cost per Hour	Hours per Year	Crew	Cost		
	1	$50.00	7280	Project Manager	$364,000	Anticipated operations crew	Data
	1	$40.00	7280	Supervisor/RSO	$291,200	Anticipated operations crew	Data
	1	$30.00	7280	EHS Tech	$218,400	Anticipated operations crew	Data
	1	$30.00	4160	Sampler	$124,800	Anticipated operations crew	Data
	8	$30.00	2600	Plant and Field Operators	$624,000	Anticipated operations crew	Data
	1	$30.00	4160	Chemist	$124,800	Anticipated operations crew	Data
	1	$30.00	7280	Maintenance	$218,400	Anticipated operations crew	Data
	1	$30.00	7280	Office Support	$218,400	Anticipated operations crew	Data
	1	$30.00	7280	Equipment Operator	$218,400	Anticipated operations crew	Data
	4	$30.00	2773	Reclamation Laborer	$332,760	Anticipated operations crew	Data
	1	$35.00	5200	Foreman	$182,000	Anticipated operations crew	Data
	4	$13.50	2080	Vehicles	$112,320	Anticipated operations crew	Data
TOTAL RESTORATION LABOR COST					$3,029,480		

VII RESTORATION CAPITAL REQUIREMENTS			
I Plug and Abandon DDW (3)	$306,270	$104,090 for well 1 and $101,090 for wells 2/3	Data
TOTAL	$306,270		

Table RP-4 Reclamation/Restoration Bond Estimate (Page 13 of 37)

LOST CREEK ISR, LLC GROUNDWATER RESTORATION - WORKSHEET 1

Assumptions/Items	Mine Unit No. 1	Explanation	Source
SUMMARY:			
I GROUNDWATER SWEEP	$12,284		
II REVERSE OSMOSIS	$218,493		
III RECIRCULATION	$9,940		
IV WASTE DISPOSAL WELL	$96,450		
V STABILIZATION	$46,575		
VI LABOR	$3,029,480		
VII CAPITAL	$306,270		
TOTAL GROUNDWATER RESTORATION COST	**$3,719,492**		

Table RP-4 Reclamation/Restoration Bond Estimate (Page 14 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: A. Plant Equipment Removal and Disposal - WORKSHEET 2

Assumptions/Items	Shop / Lab / Office	Precipitation Section	Chemical Section	Ion Exchange Section	Restoration Section	Total	Explanation	Source
Volume (Cubic Yards)	68	46	17	111	96	338	Estimate of equipment to be removed	Data
Volume per Truck Load (Cubic Yards)	20	20	20	20	20		Typical load for shipping	Data
Number of Truck Loads	3.4	2.3	0.8	5.6	4.8	16.9		Calculated
I DECONTAMINATION								
Decontamination Cost per Truck Load	$620	$620	$620	$620	$620		Estimated average decontaminate	Unit Rate
Percent Requiring Decontamination	50.0%	100.0%	0.0%	100.0%	100.0%		Percent expected	Data
TOTAL DECONTAMINATION COST	$1,060	$1,428	$0	$3,443	$2,963	$8,894		Calculated
II DISMANTLING & LOADING								
Cost per Truck Load	$805	$805	$805	$805	$805		Estimated average dismantle cost	Unit Rate
TOTAL DISMANTLING & LOADING COST	$2,753	$1,854	$676	$4,470	$3,847	$13,600		Calculated
III OVERSIZE								
Percent Requiring Permits	0.0%	10.0%	10.0%	10.0%	10.0%			Data
Cost per Truck Load	$367	$367	$367	$367	$367			Unit Rate
TOTAL OVERSIZE COST	$0	$85	$31	$204	$175	$495		Calculated
IV TRANSPORTATION & DISPOSAL								
A. Landfill								
Percent to be Shipped	90.0%	50.0%	100.0%	50.0%	50.0%		Percent acceptable at landfill	Data
Distance (Miles)	48	48	48	48	48		Distance to landfill	Data
Cost per Mile	$2.90	$2.90	$2.90	$2.90	$2.90		Current transport rate	Unit Rate
Transportation Cost	$429	$160	$117	$386	$333			Calculated
Disposal Fee per Cubic Yard	$13.50	$13.50	$13.50	$13.50	$13.50		Landfill fee	Unit Rate
Disposal Cost	$831	$311	$227	$750	$645			Calculated
Total Cost	$1,260	$471	$344	$1,136	$978			Calculated
B. Licensed Site								
Percent to be Shipped	10.0%	50.0%	0.0%	50.0%	50.0%		Percent requiring disposal at licensed site	Calculated
Distance (Miles)	105	105	105	105	105		Distance to Shirley Basin	Data
Cost per Mile	$2.90	$2.90	$2.90	$2.90	$2.90		Current transport rate	Unit Rate
Transportation Cost	$104	$351	$0	$845	$728			Calculated
Disposal Cost per Cubic Foot	$12.38	$12.38	$12.38	$12.38	$12.38		Licensed site fee	Unit Rate
Volume per Truck Load (Cubic Yards)	20.0	20.0	20.0	20.0	20.0		Typical load for shipping	Data
Volume per Truck Load (Cubic Feet)	540	540	540	540	540			Calculated
Disposal Cost	$2,287	$7,697	$0	$18,562	$15,975			Calculated
Total Cost Licensed Site	$2,391	$8,047	$0	$19,407	$16,702			Calculated
TOTAL TRANSPORTATION & DISPOSAL COST	$3,650	$8,518	$344	$20,544	$17,680	$50,736		Calculated
TOTAL PLANT EQUIPMENT REMOVAL AND DISPOSAL COST	**$7,464**	**$11,884**	**$1,050**	**$28,661**	**$24,666**	**$73,724**		Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: B. Plant Building Demolition and Disposal - WORKSHEET 3

Assumptions/Items	Plant	Header Houses	Drill Shed	Total	Explanation	Source
I STRUCTURE DEMOLITION & DISPOSAL						
Structural Character	2-Story Steel Frame	1-Story Pre Fab. (6)	1-Story Pole Barn			
Demolition Volume (Cubic Feet)	1,248,000	19,620	22,400		Estimated volume of structures	Data
Demolition Cost per Cubic Foot	$0.1474	$0.1474	$0.0737			Unit Rate
Demolition Cost	$183,955	$2,892	$1,651	$188,498		Calculation
Factor For Gutting	20.0%	10.0%	10.0%			Data
Gutting Cost	$36,791	$289	$165	$37,245		Calculation
Weight (Pounds)	196,750	99,000	15,000		Estimated weight of building components	Data

	Quantity	Height (Feet)	Length (Feet)	Area (Square Feet)	Density (Pounds per Square Foot)	Building Weight (Pounds)
Ends	2	1	4800	9600	2.5	24000
Roof	2	82.5	260	42900	2.5	107250
Sidewall	2	20	260	10400	2.5	26000
Internal Wall	1	20	460	9200	2.5	23000
Internal Wall	1	30	220	6600	2.5	16500
Total 2-Story Steel Frame Weight						**196750**

Assumptions/Items	Plant	Header Houses	Drill Shed	Total	Explanation	Source
Weight per Truck Load	40,000	40,000	40,000		Typical load for shipping	Data
Number of Truck Loads	4.9	2.5	0.4			Calculation
Distance to Landfill	48	48	48		Distance to landfill	Data
Cost per Mile	$2.90	$2.90	$2.90		Current transport rate	Unit Rate
Transportation Cost	$685	$345	$52	$1,081		
Disposal Cost per Ton	$40.20	$40.20	$40.20		Landfill fee	Unit Rate
Disposal Cost	$3,955	$1,990	$302	$6,246		Calculation
TOTAL STRUCTURE DEMOLITION & DISPOSAL COST	$225,386	$5,516	$2,170	$233,071		Calculation

Table RP-4 Reclamation/Restoration Bond Estimate (Page 16 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: B. Plant Building Demolition and Disposal - WORKSHEET 3

Assumptions/Items	Plant	Header Houses	Drill Shed	Total	Explanation	Source
II CONCRETE DECONTAMINATION, DEMOLITION & DISPOSAL						
Area (Square Feet)	30,050	283	565		Building concrete area	Data
Average Thickness (Feet)	1	1.0	0.3			Data
Volume (Cubic Feet)	30,050	283	141			Calculation
Percent Requiring Decontamination	75.0%	50.0%	0.0%			Data
Percent Decontaminated	75.0%	75.0%	0.0%			Data
Decontamination (Cost per Square Foot)	$0.191	$0.191	$0.191			Unit Rate
Decontamination Cost	$4,305	$41	$0	$4,345		Calculation
Demolition (Cost per Square Foot)	$2.124	$2.124	$0.100			Unit Rate
Demolition Cost	$63,826	$601	$57	$64,484		Calculation
Transportation & Disposal						
A. On-Site Disposal						
Percent to be Disposed On-Site	90%	90%	100%			Data
Transportation Cost	$0	$0	$0			Data
Disposal Cost per Cubic Foot	$0.055	$0.055	$0.055			Unit Rate
Disposal Cost	$1,487	$14	$8	$1,509		Calculation
B. Licensed Site						
Percent to be Shipped	10%	10%	0%			Calculation
Distance (Miles)	105	105	105			Data
Cost per Mile	$2.90	$2.90	$2.90		Current transport rate	Unit Rate
Transportation Cost	$1,694	$16	$0	$1,710		Calculation
Disposal Cost per Cubic Foot	$4.16	$4.16	$4.16			Unit Rate
Volume per Truck Load (Cubic Yards)	20	20	20			Data
Volume per Truck Load (Cubic Feet)	540	540	540			Calculation
Disposal Cost	$12,501	$118	$0	$12,619		Calculation
TOTAL CONCRETE DECONTAMINATION, DEMOLITION & DISPOSAL COST	$83,814	$789	$64	$84,667		Calculation

Table RP-4 Reclamation/Restoration Bond Estimate (Page 17 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: B. Plant Building Demolition and Disposal - WORKSHEET 3

Assumptions/Items	Plant	Header Houses	Drill Shed	Total	Explanation	Source
III SOIL REMOVAL & DISPOSAL						
Front End Loader Cost per Hour	$50	$50	$50	$50		
Time with Front End Loader (Hours)	16	6	1	23		
Cost of Front End Loader	$800	$300	$50	$1,150	Assume removal of 3" of Contaminated	Data
Volume to be Shipped (Cubic Feet)	2504	71	0		Soil Under Headers, 1" under Plant,	Data
Distance (Miles)	105	105	105		Disposal at a Licensed Facility	Data
Cost per Mile	$2.90	$2.90	$2.90			Unit Rate
Transportation Cost	$1,412	$40	$0	$1,452		Calculation
Disposal Fee per Cubic Foot	$4.16	$4.16	$4.16			Unit Rate
Quantity per Truck Load (Cubic Feet)	540	540	540			Data
Disposal Cost	$10,417	$294	$0	$10,712		Calculation
TOTAL SOIL REMOVAL & DISPOSAL COST	$12,629	$634	$50	$13,314		Calculation
IV RADIATION SURVEY						
Area Required (Acres)	0.69	0.01	0.01			Data
Survey Cost per Acre	$653.00	$653.00	$653.00			Unit Rate
TOTAL RADIATION SURVEY COST	$450	$4	$8	$462		Calculation
TOTAL PLANT BUILDING DEMOLITION AND DISPOSAL COST	**$322,279**	**$6,943**	**$2,292**	**$331,514**		Calculation

Table RP-4 Reclamation/Restoration Bond Estimate (Page 18 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: C. Storage Pond Sludge and Liner Handling - WORKSHEET 4

Assumptions/Items	Pond 1 Storage	Pond 2 Storage	Total	Explanation	Source
I POND SLUDGE					
Average Sludge Depth (Feet)	0.250	0.250			Data
Average Sludge Area (Square Feet)	40,300	40,300			Data
Sludge Volume (Cubic Feet)	10,075	10,075			Calculated
Sludge Volume (Cubic Yards)	373	373			Calculated
Sludge Volume per Truck Load (Cubic Yards)	20.0	20.0			Data
Number of Sludge Truck Loads	18.7	18.7			Calculated
Sludge Handling Cost Per Load	$268.00	$268.00			Unit Rate
Total Sludge Handling Cost	$5,012	$5,012	$10,023		Calculated
Transportation & Disposal					
Percent to be Shipped	100.0%	100.0%			Data
Distance (Miles)	105	105			Data
Cost per Mile	$2.90	$2.90			Unit Rate
Transportation Cost	$5,694	$5,694			Calculated
Disposal Cost per Cubic Foot	$12.38	$12.38			Unit Rate
Volume per Truck Load (Cubic Yards)	20.0	20.0			Data
Volume per Truck Load (Cubic Feet)	540	540			Calculated
Disposal Cost	$125,013	$125,013			Calculated
Total Transportation & Disposal Cost	$130,707	$130,707	$261,414		Calculated
TOTAL POND SLUDGE COST	$135,719	$135,719	$271,438		Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 19 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: C. Storage Pond Sludge and Liner Handling - WORKSHEET 4

Assumptions/Items	Pond 1 Storage	Pond 2 Storage	Total	Explanation	Source
II POND LINER					
Total Pond Area (Acres)	0.93	0.93			Data
Total Pond Area (Square Feet)	40,300	40,300			Calculated
Factor For Sloping Sides	20.0%	20.0%			Data
Total Liner Area (Square Feet)	48360	48360			Calculated
Liner Thickness (Mils)	30	30			Data
Liner Thickness (Inches)	0.0300	0.0300			Calculated
Liner Thickness (Feet)	0.0025	0.0025			Calculated
"Swell" Factor	25.0%	25.0%			Data
Liner Volume (Cubic Feet)	151	151			Calculated
Truck Loads of Liner	0.3	0.3			Calculated
Liner Handling Cost					
Labor Crew Cost per Hour	$135	$135			Unit Rate
Hours per Load	2.0	2.0			Unit Rate
Liner Handling Cost per Load	$270.00	$270.00			Calculated
Total Liner Handling Cost	$81	$81	$162		Calculated
Transportation & Disposal					
Percent to be Shipped	100.0%	100.0%			Data
Distance (Miles)	105	105			Data
Cost per Mile	$2.90	$2.90			Unit Rate
Transportation Cost	$91	$91			Calculated
Disposal Cost per Cubic Foot	$12.38	$12.38			Unit Rate
Volume per Truck Load (Cubic Feet)	540	540			Data
Disposal Cost	$2,006	$2,006			Calculated
Total Transportation & Disposal	$2,097	$2,097	$4,194		Calculated
TOTAL POND LINER COST	$2,178	$2,178	$4,356		Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 20 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: C. Storage Pond Sludge and Liner Handling - WORKSHEET 4

Assumptions/Items	Pond 1 Storage	Pond 2 Storage	Total	Explanation	Source
III POND BACKFILL					
Backfill Required (Cubic Yards)	10,448	10,448			Data
Backfill Cost per Cubic Yard	$1.13	$1.13			Unit Rate
TOTAL POND BACKFILL COST	$11,806	$11,806	$23,612		Calculated
IV RADIATION SURVEY					
Areal required (Acres)	1.02	1.02			Data
Survey Cost per Acre	$653.00	$653.00			Unit Rate
TOTAL RADIATION SURVEY COST	$665	$665	$1,330		Calculated
V LEAK DETECTION SYSTEM REMOVAL					
Gravel and Piping Volume (Cubic Feet)	10075	10075		Assume 3 inches	Data
Volume per Truck Load (Cubic Feet)	540	540			Data
Loads to be Shipped	18.7	18.7			Calculated
Distance (Miles)	105	105			Data
Cost per Mile	$2.90	$2.90			Unit Rate
Transportation Cost	$5,681	$5,681			Calculated
Handling Cost	$5,038	$5,038			Unit Rate (Imbedded)
Disposal Fee per Cubic Foot	$4.16	$4.16			Unit Rate
Disposal Cost	$41,912	$41,912			Calculated
TOTAL LEAK DETECTION SYSTEM REMOVAL COST	$52,631	$52,631	$105,261		Calculated
TOTAL POND RECLAMATION COST	**$202,998**	**$202,998**	**$405,997**		Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: D. Well Abandonment - WORKSHEET 5

Assumptions/Items	Mine Unit No. 1	Explanation	Source
Number of Wells	397		Data
Average Depth (Feet)	410		Data
Average Diameter (Inches)	4.328		Data

I MATERIALS			
Class G Neat Cement Required (Cubic Feet per Well)	41.9		Data
Cement Sacks Required per Well	32.7	15 ppg Class G cement requires 6 gallons water per sack cement and 1-1/2% bentonite by weight	Data
Cement Sack Cost	$14.43		Unit Rate
Cement Cost per Well	$472.22		Calculated
Bentonite Sacks Required per Well	0.9		Data
Bentonite Bag Cost	$2.90		Unit Rate
Bentonite Cost per Well	$2.68		Calculated
TOTAL MATERIALS COST PER WELL	$474.89		Calculated
II LABOR (INCLUDED IN WORKSHEET 1)			
Hours Required per Well	0.0		Data
Labor Cost per Hour	$0.00		Unit Rate
TOTAL LABOR COST PER WELL	$0.00		Calculated
III EQUIPMENT RENTAL			
Hours Required per Well	1.0		Data
Backhoe with Operator Cost per Hour	$48.00		Unit Rate
Total Equipment Cost per Well	$48.00		Calculated
TOTAL EQUIPMENT COST PER WELL	$522.89		Calculated

TOTAL WELL ABANDONMENT COST	**$207,589**		Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
I WELLFIELD PIPING		
A. Removal		
Surface Length per Well (Feet)	250	
Downhole Length per Well (Feet)	350	
Total Number of Wells	328	
Total Length (Feet)	196,800	Calculated
Cost of Removal per Foot	$0.109	Unit Rate
Cost of Removal	$21,353	Calculated
Average OD (Inches)	1.6	
Chipped Volume Reduction (Cubic Feet per Foot)	0.008	Unit Rate
Chipped Volume (Cubic Feet)	1,574	Calculated
Volume per Truck Load (Cubic Feet)	540	
Total Number of Truck Loads	2.9	Calculated
B. Survey & Decontamination		
Percent Requiring Decontamination	0%	
Number of Decontamination Loads	0.0	Calculated
Decontamination Cost per Load	$620.00	Unit Rate
Decontamination Cost	$0	Calculated
C. Transport & Disposal		
Landfill		
Transportation		
Percent to be Shipped	0.0%	
Loads to be Shipped	0.0	Calculated
Distance (Miles)	48	
Transportation Cost per Mile	$2.90	Unit Rate
Transportation Cost	$0	Calculated
Disposal		
Disposal Fee per Cubic Yard	$13.50	Unit Rate
Load Volume (Cubic Yards)	20	
Disposal Cost	$0	Calculated
Total Landfill Cost	$0	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 23 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
I WELLFIELD PIPING (continued)		
C. Transport & Disposal (continued)		
Licensed Site		
Transportation		
Percent to be Shipped	100.0%	Calculated
Loads to be Shipped	2.9	Calculated
Distance (Miles)	105	
Transportation Cost per Mile	$2.90	Unit Rate
Transportation Cost	$883	Calculated
Disposal		
Disposal Fee per Cubic Foot	$12.38	Unit Rate
Disposal Fee per Cubic Yard	$334.26	Calculated
Load Volume (Cubic Yards)	20	
Disposal Cost	$19,387	Calculated
Total Licensed Site Cost	$20,270	Calculated
Total Transport & Disposal Cost	$20,270	Calculated
TOTAL WELLFIELD PIPING REMOVAL & DISPOSAL COST	$41,623	Calculated
II PRODUCTION WELL PUMPS		
A. Pump and Tubing Removal		
Number of Production Wells	120	
Removal Cost per Well	$12.07	Unit Rate
Removal Cost	$1,448	Calculated
Number of Pumps per Truck Load	180	
Number of Truck Loads (Pumps)	0.7	Calculated
B. Survey & Decontamination (Pumps)		
Percent Requiring Decontamination	0.0%	
Number of Decontamination Truck Loads	0.0	Calculated
Decontamination Cost per Load	$0.00	Unit Rate
Decontamination Cost	$0	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 24 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
II PRODUCTION WELL PUMPS (continued)		
C. Tubing Volume Reduction & Loading		
Length per Well (Feet)	360	
Total Length (Feet)	43,200	Calculated
Removal Cost per Foot	$0.014	Unit Rate
Removal Cost	$583	Calculated
Average OD (Inches)	2.0	
Chipped Volume Reduction (Cubic Feet per Foot)	0.012	
Chipped Volume (Cubic Feet)	518	Calculated
Volume per Truck Load (Cubic Feet)	540	
Number of Truck Loads	1.0	Calculated
D. Transport & Disposal		
Landfill		
Transportation		
Percent to be Shipped (Pumps)	100.0%	
Loads to be Shipped	0.7	Calculated
Distance (Miles)	48	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$97	Calculated
Disposal		
Disposal Fee per Cubic Yard	$13.50	Unit Rate
Load Volume (Cubic Yards)	20	
Disposal Cost	$189	Calculated
Total Landfill Cost	$286	Calculated
Licensed Site		
Transportation		
Percent to be Shipped (Pumps)	0.0%	
Percent to be Shipped (Tubing)	100.0%	
Loads to be Shipped	1.0	Calculated
Distance (Miles)	105	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$292	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
II PRODUCTION WELL PUMPS (continued)		
D. Transport & Disposal (continued)		
Licensed Site (continued)		
Disposal		
Disposal Cost per Cubic Foot	$12.38	Unit Rate
Disposal Fee per Cubic Yard	$334.26	Calculated
Load Volume (Cubic Yards)	20	
Disposal Cost	$6,418	Calculated
Total Licensed Site Cost	$6,710	Calculated
Total Transport & Disposal Cost	$6,997	Calculated
TOTAL PRODUCTION WELL PUMP REMOVAL & DISPOSAL COST	$9,028	Calculated
III SURFACE TRUNKLINE PIPING		
A. Removal		
Total Length (Feet)	0	
Removal Cost per Foot	$0.081	Unit Rate
Removal Cost	$0	Calculated
Average OD (Inches)	8.750	
Chipped Volume Reduction (Cubic Feet per Foot)	0.088	Unit Rate
Chipped Volume (Cubic Feet)	0	Calculated
Volume per Truck Load (Cubic Feet)	540	
Total Number of Truck Loads	0.0	Calculated
B. Survey & Decontamination		
Percent Requiring Decontamination	0.0%	
Number of Decontamination Truck Loads	0.0	Calculated
Decontamination Cost per Load	$0.00	Unit Rate
Decontamination Cost	$0	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
III SURFACE TRUNKLINE PIPING (continued)		
C. Transport & Disposal		
Landfill		
Transportation		
Percent to be Shipped	0.0%	
Loads to be Shipped	0.0	Calculated
Distance (Miles)	48	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$0	Calculated
Disposal		
Disposal Fee per Cubic Yard	$13.50	Unit Rate
Load Volume (Cubic Yards)	20	
Disposal Cost	$0	Calculated
Total Landfill Cost	$0	Calculated
Licensed Site		
Transportation		
Percent to be Shipped	100.0%	Calculated
Loads to be Shipped	0.0	Calculated
Distance (Miles)	105	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$0	Calculated
Disposal		
Disposal Cost per Cubic Foot	$12.38	Unit Rate
Disposal Fee per Cubic Yard	$334.26	Calculated
Load Volume (Cubic Yards)	20	
Disposal Cost	$0	Calculated
Total Licensed Site Cost	$0	Calculated
Total Transport & Disposal Cost	$0	Calculated
TOTAL SURFACE TRUNKLINE PIPING REMOVAL & DISPOSAL COST	$0	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 27 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
IV BURIED TRUNKLINE		
A. Removal		
Total Length (Feet)	24,304	
Removal Cost per Buried Foot	$1.58	Unit Rate
Removal Cost	$19,139	Calculated
Average OD (Inches)	9.635	
Chipped Volume Reduction (Cubic Feet per Foot)	0.309	Unit Rate
Chipped Volume (Cubic Feet)	7,510	Calculated
Volume per Truck Load (Cubic Feet)	540	
Number of Truck Loads	13.9	Calculated
B. Survey & Decontamination		
Percent Requiring Decontamination	0.0%	
Number of Decontamination Truck Loads	0.0	Calculated
Decontamination Cost per Load	$0.00	Unit Rate
Decontamination Cost	$0	Calculated
C. Transport & Disposal		
Landfill		
Transportation		
Percent to be Shipped	0.0%	
Loads to be Shipped	0.0	Calculated
Distance (Miles)	48	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$0	Calculated
Disposal		
Disposal Fee per Cubic Yard	$13.50	Unit Rate
Load Volume (Cubic Yards)	20	
Disposal Cost	$0	Calculated
Total Landfill Cost	$0	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
IV BURIED TRUNKLINE (continued)		
C. Transport & Disposal (continued)		
Licensed Site		
Transportation		
Percent to be Shipped	100.0%	Calculated
Loads to be Shipped	13.9	Calculated
Distance (Miles)	105	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$4,233	Calculated
Disposal		
Disposal Cost per Cubic Foot	$12.38	Unit Rate
Disposal Fee per Cubic Yard	$334.26	Calculated
Load Volume (Cubic Yards)	20	
Disposal Cost	$92,924	Calculated
Total Licensed Site Cost	$97,157	Calculated
Total Transport & Disposal Cost	$97,157	Calculated
TOTAL BURIED TRUNKLINE REMOVAL & DISPOSAL COST	$116,296	Calculated
V MANHOLES		
A. Removal		
Total Quantity	9	
Removal Cost per Manhole	$73.16	Unit Rate
Removal Cost	$658	Calculated
Quantity per Truck Load	10	
Number of Truck Loads	0.9	Calculated
B. Survey & Decontamination		
Percent Requiring Decontamination	0.0%	
Number of Decontamination Truck Loads	0.0	Calculated
Decontamination Cost per Load	$0.00	Unit Rate
Decontamination Cost	$0	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: E. Wellfield Equipment Removal and Disposal - WORKSHEET 6

Assumptions/Items	Mine Unit No. 1	Source
V MANHOLES (continued)		
C. Transport & Disposal		
Landfill		
Transportation		
Percent to be Shipped	0.0%	
Loads to be Shipped	0.0	Calculated
Distance (Miles)	48	Unit Rate
Cost per Mile	$2.90	Calculated
Transportation Cost	$0	
Disposal		
Disposal Fee per Cubic Yard	$13.50	Unit Rate
Load Volume (Cubic Yards)	20	
Disposal Cost	$0	Calculated
Total Landfill Cost	$0	Calculated
Licensed Site		
Transportation		
Percent to be Shipped	100.0%	Calculated
Loads to be Shipped	0.9	Calculated
Distance (Miles)	105	
Cost per Mile	$2.90	Unit Rate
Transportation Cost	$274	Calculated
Disposal		
Disposal Cost per Cubic Foot	$12.38	Unit Rate
Disposal Fee per Cubic Yard	$334.26	Calculated
Load Volume (Cubic Yards)	20	
Disposal Cost	$6,017	Calculated
Total Licensed Site Cost	$6,291	Calculated
Total Transport & Disposal Cost	$6,291	Calculated
TOTAL MANHOLE REMOVAL & DISPOSAL COST	$6,949	Calculated

TOTAL WELLFIELD EQUIPMENT REMOVAL AND DISPOSAL COST	**$173,896**	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
I PLANT		
A. Topsoil Handling & Grading		
Affected Area (Acres)	5.0	
Average Affected Thickness (Inches)	12.0	
Topsoil Volume (Cubic Yards)	8,067	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$9,115	Calculated
Grading Cost per Acre	$56.28	Unit Cost
Grading Cost	$281	Calculated
Total Topsoil Handling & Grading Cost	$9,397	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$653.00	Unit Cost
Total Survey & Analysis Cost	$3,265	Calculated
C. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$2,767	Calculated
TOTAL PLANT COST	$15,429	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 31 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
II PONDS		
A. Topsoil Handling & Grading		
Affected Area (Acres)	5.0	
Average Affected Thickness (Inches)	12	
Topsoil Volume (Cubic Yards)	8,067	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$9,115	Calculated
Grading Cost per Acre	$56.28	Unit Cost
Grading Cost	$281	Calculated
Total Topsoil Handling & Grading Cost	$9,397	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$653.00	Unit Cost
Total Survey & Analysis Cost	$3,265	Calculated
C. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$2,767	Calculated
TOTAL POND COST	$15,429	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
III WELLFIELDS		
A. Topsoil Handling & Grading		
Affected Area (Acres)	0.0	
Average Affected Thickness (Inches)	3.5	
Topsoil Volume (Cubic Yards)	0	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$0	Calculated
Grading Cost per Acre	$56.28	Unit Cost
Grading Cost	$0	Calculated
Total Topsoil Handling & Grading Cost	$0	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$653.00	Unit Cost
Total Survey & Analysis Cost	$0	Calculated
C: Spill Cleanup		
Affected Area (Acres)	-	Calculated
Affected Area (Square Feet)	-	
Average Affected Thickness (Feet)	0.25	
Affected Volume (Cubic Feet)	-	Calculated
Volume per Truck Load (Cubic Feet)	540	
Number of Truck Loads	0.0	Calculated
Distance (Miles)	105	
Cost per Mile	$2.90	Unit Cost
Transportation Cost	$0	Calculated
Handling Cost per Truck Load	$238	Unit Cost
Handling Cost	$0	Calculated
Disposal Fee per Cubic Foot	$4.16	Unit Cost
Disposal Cost	$0	Calculated
Total Spill Cleanup Cost	$0	Calculated

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
III WELLFIELDS (continued)		
D. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$0	Calculated
TOTAL WELLFIELDS COST	$0	Calculated
IV ROADS		
A. Topsoil Handling & Grading		
Affected Area (Acres)	11.1	

Main Road Lengths (ft)	Secondary Road Lengths (ft)	
1,556		
594		
228		
356	966	
362	391	
211	276	
2,309	291	
1,260	311	
244	257	
1,029	330	
5,049	323	
13,198	3,145	Total Road Lengths (Feet)
20	12	Road Width (Feet)
12	8	Road Borrow (Feet)
32	20	Road Width and Borrow (Feet)
9.7	1.4	Road Area (Acres)
11.1		**Total Road Area (Acres)**

Table RP-4 Reclamation/Restoration Bond Estimate (Page 34 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
IV ROADS (continued)		
A. *Topsoil Handling & Grading (continued)*		
Average Affected Thickness (Inches)	12	
Topsoil Volume (Cubic Yards)	17,908	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$20,236	Calculated
Grading Cost per Acre	$56.28	Unit Cost
Grading Cost	$625	Calculated
Total Topsoil Handling & Grading Cost	$20,861	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$653.00	Unit Cost
Total Survey & Analysis Cost	$7,248	Calculated
C. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$6,143	Calculated
TOTAL ROADS COST	$34,252	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 35 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
V OTHER		
A. Topsoil Handling & Grading		
Affected Area (Acres)	1.0	
Average Affected Thickness (Inches)	3.0	
Topsoil Volume (Cubic Yards)	403.33	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$456	Calculated
Grading Cost per Acre	$56.28	Unit Cost
Grading Cost	$56	Calculated
Total Topsoil Handling & Grading Cost	$512	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$653.00	Unit Cost
Total Survey & Analysis Cost	$653	Calculated
C. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$553	Calculated
TOTAL OTHER COST	$1,718	Calculated

Table RP-4 Reclamation/Restoration Bond Estimate (Page 36 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: F. Topsoil Replacement and Revegetation - WORKSHEET 7

Assumptions/Items	Mine Unit No. 1	Source
VI REMEDIAL ACTION		
A. Topsoil Handling & Grading		
Affected Area (Acres)	11.1	
Average Affected Thickness (Inches)	0.0	
Topsoil Volume (Cubic Yards)	0	Calculated
Hauling/Placement Cost per Cubic Yard	$1.13	Unit Cost
Topsoil Handling Cost	$0	Calculated
Grading Cost per Acre	$0.00	Unit Cost
Grading Cost	$0	Calculated
Total Topsoil Handling & Grading Cost	$0	Calculated
B. Radiation Survey & Soil Analysis		
Survey & Analysis Cost per Acre	$0.00	Unit Cost
Total Survey & Analysis Cost	$0	Calculated
C. Revegetation		
Fertilizer Cost per Acre	$52.33	Unit Cost
Seeding Preparation & Seeding Cost per Acre	$189.85	Unit Cost
Mulching & Crimping Cost per Acre	$311.25	Unit Cost
Total Revegetation Cost per Acre	$553.43	Calculated
Total Revegetation Cost	$6,115	Calculated
TOTAL REMEDIAL ACTION COST	$6,115	Calculated

TOTAL TOPSOIL REPLACEMENT AND REVEGETATION COST	**$72,944**	

Table RP-4 Reclamation/Restoration Bond Estimate (Page 37 of 37)

LOST CREEK ISR, LLC DECOMMISSIONING AND SURFACE RECLAMATION: G. Miscellaneoues Reclamation Activities - WORKSHEET 8

Assumptions/Items	Quantity	Source
I FENCE REMOVAL & DISPOSAL		
Length (Feet)	9,500	
Removal & Disposal Cost per Foot	$0.34	*Unit Cost*
TOTAL FENCE REMOVAL AND DISPOSAL COST	$3,230	Calculated
II POWERLINE REMOVAL & DISPOSAL		
Length (Feet)	15,300	
Removal & Disposal Cost per Foot	$1.00	Unit Cost
TOTAL POWERLINE REMOVAL & DISPOSAL COST	$15,300	Calculated
III POWERPOLE REMOVAL & DISPOSAL		
Number of Powerpoles	51	
Removal & Disposal Cost per Powerpole	$100.00	Unit Cost
TOTAL POWERPOLE REMOVAL & DISPOSAL COST	$5,100	Calculated
IV TRANSFORMER REMOVAL & DISPOSAL		
Number of Transformers	12	
Removal & Disposal Cost per Transformer	$2,428	Unit Cost
TOTAL TRANSFORMER REMOVAL & DISPOSAL COST	$29,131	Calculated
V BOOSTER PUMP ASSEMBLY REMOVAL & DISPOSAL		
Number of Booster Pump Assemblies	0	
Removal & Disposal Cost per Booster Pump Assembly	$149	Unit Cost
TOTAL BOOSTER PUMP ASSEMBLY REMOVAL & DISPOSAL COST	$0	Calculated
VI CULVERT REMOVAL & DISPOSAL		
Length (Feet)	200	
Removal & Disposal Cost per Foot	$1.74	Unit Cost
TOTAL CULVERT REMOVAL & DISPOSAL COST	$348	Calculated
VII UTILITIES		
Number of Months	6	
Cost per Month	$2,380	Unit Cost
TOTAL UTILITIES COST	$14,280	Calculated
VIII DDW PIPELINE REMOVAL AND DISPOSAL		
Length (Feet)	21,730	
Removal & Disposal Cost per Foot	$2.43	Unit Cost
TOTAL DDW PIPELINE REMOVAL & DISPOSAL COST	$52,804	Calculated
TOTAL MISCELLANEOUS RECLAMATION ACTIVITIES COST	**$120,193**	Calculated

Mine Unit 1 Document
Volume 1 of 2
Replacement Pages

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PLATES

Plate MU1 5-1	Historic Drill Holes in Area of Mine Unit 1

ATTACHMENTS

Attachment MU1 1-1	Mine Unit 1 Monitor Well Plan
Attachment MU1 2-1	Hydrogeologic Pump Tests (separate volume)
Attachment MU1 3-1	Order 1 Soil Survey Results
Attachment MU1 4-1	Water Quality Results
Attachment MU1 4-2	Original Water Quality Laboratory Results (electronic data set)

ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
µmhos/cm	micromhos per centimeter
AATA	AATA International, Inc.
BPT	Best Practicable Technology
EPA	United States Environmental Protection Agency
ISR	In Situ Recovery
fault	Lost Creek Fault
ft/ft	foot per foot
ft/day	feet per day
ft^2/day	square feet per day
ft/year	feet per year
GIS	Geographic Information System
gpm	gallons per minute
LC ISR, LLC	Lost Creek ISR, LLC
LFG	Lower FG Sand
LHJ	Lower HJ Sand
MCC	motor control center
MCL	maximum contaminant level
mg/L	milligrams per liter
MHJ	Middle HJ Sand
MIT	mechanical integrity test
MO well	overlying aquifer monitor well
MP well	production zone monitor well
MU1	Mine Unit 1
MU well	underlying aquifer monitor well
M well	monitor ring well
NRC	Nuclear Regulatory Commission
NRCS	National Resource Conservation Service
pCi/L	picoCuries per liter
Permit Area	Lost Creek Permit Area
Petrotek	Petrotek Engineering Corporation
PLC	Programmable Logic Controller
Project	Lost Creek Project
PV	pore volume
QA/QC	quality assurance/quality control
ROI	radius of influence
SMU	soil mapping unit
SU	standard unit
TDS	total dissolved solids
UCL	Upper Control Limit

UHJ	Upper HJ Sand
UKM	Upper KM Sand
U_3O_8	uranium oxide
US	United States
WDEQ-LQD	Wyoming Department of Environmental Quality - Land Quality Division
WDEQ-WQD	Wyoming Department of Environmental Quality - Water Quality Division

1.0 Introduction

Lost Creek ISR, LLC (LC ISR, LLC) has prepared this Mine Unit 1 (MU1) Application for the Wyoming Department of Environmental Quality - Land Quality Division (WDEQ-LQD) in support of a permit to conduct In Situ Recovery (ISR) of uranium in Sweetwater County, Wyoming. The Lost Creek Project (Project) will use existing ISR technology and best industry practices to extract uranium from permeable, uranium-bearing sandstones, located at depths ranging from 300 to 700 feet below the surface, through a series of mine units. MU1, as well as the other mine units, will consist of a "pattern" of production and injection wells, ringed by monitor wells. Once extracted from a mine unit, the uranium will be recovered by means of ion exchange, using commercially available anionic resin, and prepared for shipment as uranium oxide (U_3O_8) "yellowcake" slurry to a facility licensed to process the slurry into dry yellowcake. When production from a mine unit is complete, the groundwater will be restored and the surface reclaimed.

The information for the Lost Creek Permit Area (Permit Area) as a whole is included in the main portion of the permit application, which includes the Adjudication File, the baseline Appendices D1 through D11, the Operations Plan, and the Groundwater Quality Restoration and Surface Reclamation Plan. This Mine Unit Application includes the detailed information specific to the surface and subsurface conditions and operation within the area of MU1.

1.1 Project Location

The Permit Area is located in the northeast portion of Sweetwater County, south-central Wyoming (**Figure MU1 1-1**). A series of paved and unpaved county and United States (US) Bureau of Land Management roads provide access to the Permit Area. 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. MU1 is located within the Permit Area in Sections 17, 18, 19 and 20 of Township 25 North and Range 92 West, and covers approximately 37 acres. **Figure MU1 1-2** shows the location of MU1 within the Permit Area, while **Figure MU1 1-3** shows the MU1 layout. The layout of MU1 is shown in both its original and revised forms on **Plate OP-1** and **Figure OP-2a**. The original form was based on limited historic drilling and was therefore conceptual in nature. The revised form is based on the results of both historic and recent drilling that have enabled the geologists to more precisely select the pattern areas. Additional minor revisions to the pattern area are likely as geologists learn more about the ore during the installation of recovery wells.

The Permit Area is geographically located in the northeastern portion of the Great Divide Basin. The Great Divide Basin is an oval-shaped structural and topographic depression, encompassing approximately 3,500 square miles in Sweetwater and Fremont Counties, in south-central Wyoming. The Great Divide Basin is broadly bounded by mountains and hills on all sides: the Wind River and Granite Mountains to the north, the Rawlins Uplift to the east, the Wamsutter Arch to the south, and the Rock Springs Uplift to the west. The Great Divide Basin occurs between two bifurcating branches of the North American Continental Divide, which separates south of and rejoins north of the Great Divide Basin.

The regional rolling landscape has draws, rock outcroppings, ridges, and bluffs. The Permit Area is characterized by low-relief, sagebrush-dominated plains, dissected by small, ephemeral drainage networks. Within the Permit Area, there are no drainages with perennial surface water flow or permanent water bodies.

1.2 Report Organization

For ISR, the subsurface hydrogeologic conditions are an integral part of the mining process. **Attachment MU1 1-1** describes the construction and monitoring of the well network for evaluating the MU1 subsurface conditions. **MU1 Section 2.0** summarizes the subsurface conditions, including the structural geology and the results of the hydrogeologic pump tests in MU1. **MU1 Section 3.0** provides a description of the surface conditions of MU1, including the mine unit layout, site-specific soil and vegetation conditions. **MU1 Section 4.0** discusses the results of the baseline water quality sampling results. **MU1 Section 5.0** discusses the mine unit operations, including UCL calculations, historic drill hole locations, and updated well permit information. **MU1 Section 6.0** discusses the restoration and reclamation information, and **MU1 Section 7.0** contains a list of references.

2.0 Subsurface Conditions

The hydrogeologic conditions for the Permit Area as a whole are discussed in **Appendix D5** (Geology) and **Appendix D6** (Hydrology) of the main permit document. The entire Permit Area is covered by the Battle Spring Formation of Eocene age. Generally, in the Great Divide Basin, the Battle Spring and Wasatch formations, which are time equivalent, interfinger with one another. In the Permit Area, the upper half of the Eocene lithologic units consists of the Battle Spring Formation and the lower half is made up of the Wasatch Formation. The total thickness of the Battle Spring and Wasatch formations under the Permit Area is about 6,200 feet, and the formations both consist of fine to coarse grained arkosic sandstones and conglomerates, typical of alluvial fan complexes.

The upper portion of the Battle Spring Formation is the host to the uranium mineralization within the Permit Area. In the Permit Area, the top 700 feet of the Battle Spring Formation are 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.

Within MU1, the production zone is the HJ Horizon. The HJ Horizon has been subdivided into the Upper HJ (UHJ), Middle HJ (MHJ), and the Lower HJ (LHJ) sands. The HJ Horizon is continuous throughout MU1 with an average thickness of 120 feet, ranging from 100 to 151 feet thick. The HJ Horizon is bounded above and below by laterally extensive confining units. The Lost Creek Shale overlies the HJ Horizon and the Sagebrush Shale occurs below the HJ Horizon.

The FG Horizon aquifer overlies the Lost Creek Shale and consists of upper, middle and lower sand sequences, with the deepest sand designated as the Lower FG (LFG) Sand. The KM Horizon aquifer occurs beneath the Sagebrush Shale and consists of an upper and lower sand sequence with the uppermost sand designated as the Upper KM (UKM) Sand. The DE Horizon overlies the FG Horizon and is the shallowest aquifer within the Permit Area.

2.1 Structural Geology

In MU1 (and the Permit Area as a whole), the Battle Spring Formation dips gently to the northwest at roughly three degrees. This pattern is broken locally by a fault referred to as the Lost Creek Fault. The geologic structure in the Permit Area is illustrated on the cross sections (**Plates D5-1a, b, c, d** and **e**) and isopach maps (**Plates D5-2a, b, c,** and **d**) in **Appendix D5** of the main permit document. The Lost Creek Fault was initially interpreted to be a scissor fault, with a reversal of displacement direction occurring in the western third of the Permit Area. Recent interpretation has revealed that it is, instead, a sequence of sub-parallel faults with opposite displacement occurring in an en echelon configuration (**Plate D5-3**, Geology of Lost Creek Permit Area, in the main permit document).

The 'main' Lost Creek Fault trends northeast-southwest and bisects MU1 almost in half (**Figure MU1 1-2**). Downward displacement occurs on the south block. Throw is approximately 70 to 80 feet in the eastern portion of MU1, decreasing to approximately 50 feet in the central portion of MU1, and further decreasing to approximately 40 feet in the western portion of MU1. A minor sub-parallel 'splinter' fault (or 'splay') splits to the south from the main Lost Creek Fault near the center of MU1 (**Figure MU1 1-2**). The splinter fault trends roughly east-west, and the greatest distance between the main Lost Creek Fault and the splinter fault is about 200 feet. Displacement along the splinter fault is about 14 feet along its western portion, increasing to about 28 feet farther to the east, before losing identity about 2,000 feet east of the split from the main Lost Creek Fault. The downthrown block is to the north, which creates a small, localized graben feature between the main Lost Creek fault and the splinter fault. Both the main Lost Creek Fault and the splinter fault extend vertically through all the horizons of interest.

2.2 Summary of Hydrogeologic Pump Tests

This section summarizes the hydrogeologic pump tests conducted by Petrotek Engineering Corporation (Petrotek) within MU1. The Lost Creek Hydrologic Testing – Mine Unit 1 North and South Tests Report prepared by Petrotek in October 2009 – is included as **Attachment MU1 2-1**. The pump tests were conducted in accordance with the regulatory objectives of WDEQ-LQD's Non-Coal Rules and Regulations, Chapter 11 (In-Situ Mining) and the US Nuclear Regulatory Commission's (NRC's) Section 2.7 (Hydrology) of NUREG-1569 (WDEQ-LQD, 2005a; NRC, 2003). The pump tests were conducted to achieve the following objectives:

1. Determine the hydrologic characteristics of the Production Zone Aquifer;
2. Demonstrate hydrologic communication between the Production Zone pump well and the surrounding Production Zone monitor wells;
3. Assess the presence of hydrologic boundaries, if any, within the Production Zone Aquifer over the area evaluated by the Pump Test; and,
4. Evaluate the degree of hydrologic communication, if any, between the Production Zone and the overlying and underlying aquifers in the vicinity of the pump well.

Two pump tests were conducted within MU1 due to the faulting that bisects the mine unit from west-southwest to east-northeast. The north pump test was conducted on the north side of the Lost Creek Fault (and associated splinter fault) in November 2008, and the south pump test was conducted on the south side of the Lost Creek Fault (and associated splinter fault) in December 2008. Both pump tests were conducted in the HJ Horizon, with monitoring of the overlying and underlying aquifers as well. In the following discussion, reference to the fault includes both the main Lost Creek Fault and the associated splinter fault, unless otherwise noted.

The additional information collected from the two pump tests did not significantly alter the information on the aquifer characteristics attained from previous pump tests. This conclusion is based on a comparison with aquifer characteristics presented in **Appendix D-6** of the main permit document with the information presented in **Attachment MU1 2-1**. A comparison of the hydraulic gradients presented in **Table D6-7a** and **Section 4.3** of **Attachment MU1 2-1** for the FG, HJ and KM Horizons indicated no significant differences. Also, a comparison of the vertical hydraulic gradients between the three horizons indicated no significant differences (**Table D6-7b** of the main permit document and **Table 4-5** of **Attachment MU1 2-1**). Finally, a comparison of the transmissivity and storativity values for the HJ Horizon, presented in **Table D6-11** of the main permit document and **Tables 7-1** and **7-2** of **Attachment MU1 2-1**, indicated no significant differences.

2.2.1 Potentiometric Surfaces

Water levels were measured at all of the MU1 monitor wells completed in the HJ Horizon, LFG Sand, and UKM Sand on December 8, 2008. The data represent static conditions because the water levels were measured after an extended period without drilling activities or pump tests in the immediate vicinity of MU1. Groundwater flow within MU1 in the HJ Horizon on both sides of the fault is to the west-southwest. The potentiometric elevation on the north side of the fault is approximately 5 to 17 feet higher than on the south side, resulting in a steep gradient of the potentiometric surface across the fault. The hydraulic gradient on the north side of the fault was approximately 0.0052 foot per foot (ft/ft) and 0.0087 ft/ft on the south side.

Groundwater flow within MU1 in the LFG Sand aquifer is to the west-southwest. The hydraulic gradient on the north side of the fault was approximately 0.006 ft/ft and 0.0046 ft/ft on the south side, with an observed steep gradient across the fault similar to the HJ Horizon.

Groundwater flow within MU1 in the UKM Sand aquifer is to the west-southwest. The hydraulic gradient on the north side of the fault is approximately 0.006 ft/ft and approximately 0.0054 ft/ft on the south side of the fault. The fault does not appear to impede groundwater flow within the UKM Sand, as there is little or no displacement in the potentiometric surface across the fault.

Potentiometric surface data is presented in **Figures 4-1** to **4-3** of **Attachment MU1 2-1**. This data indicates that the FG, HJ, and KM Horizons within MU1 are not in direct hydraulic communication as evidenced by the difference in elevations of the potentiometric surfaces for each horizon.

2.2.2 Pump Test Design and Procedures

The pump tests were performed by collecting data from the two pump test wells (PW-102 on the north side of the fault and PW-101 on the south side) completed in the Production Zone (HJ Horizon) and a number of monitor wells (completed in the Production Zone and the overlying and underlying aquifers). The pump and monitor well locations are shown on **Figure 1-2** and **Figure 1-3** of **Attachment MU1 2-1**. The pump tests were performed with electrical submersible pumps powered by a portable generator. Flow from the pumps was controlled with a manual gate valve. Surface flow was monitored with two 1.5-inch turbine meters that displayed total flow in gallons and instantaneous flow rates in gallons per minute (gpm). Water was discharged to the ground surface, approximately 350 feet downgradient from the pump wells.

Water levels were continuously measured and recorded in a majority of the wells by In-Situ Level TROLL data-logging pressure transducers. The pressure transducers were programmed to record water levels at five-minute intervals during the pump and recovery periods. In addition to the wells continuously monitored, water levels were measured periodically in other wells using a manual electronic water level meter. This allowed for a more extensive assessment of the potentiometric surface before, during, and after the pump test. Only wells that were monitored continuously with LevelTROLL devices were used to develop aquifer characteristics and calculated drawdown and radius of influence.

The north pump test wells consisted of well PW-102 (pump well) and 98 monitor wells, including 44 Production Zone monitor wells, 25 monitor wells completed in the LFG Sand (overlying aquifer), and 26 monitor wells completed in the UKM Sand (underlying aquifer), and 3 monitor wells completed in the DE Horizon (uppermost aquifer). Water levels in 53 wells (including the pumping well, 28 HJ Horizon observation wells, and 24 wells in the overlying and underlying aquifers) were measured and recorded with In-Situ Level TROLL® pressure transducer dataloggers for the north test. Prior to conducting the long-term pump test at well PW-102, a short-term constant rate test was conducted at a flow rate of 86.4 gpm for 5.8 hours to evaluate pumping rates for the long-term test. Water levels were allowed to recover for approximately seven days, equilibrating to within approximately one foot or less prior to starting the pump test.

The north pump test was conducted from November 10 through November 20, 2008, and water level recovery data were collected through December 2, 2008. The pumping lasted for 2,880 minutes, with an average pumping rate of 70.9 gpm.

The south pump test wells consisted of well PW-101 (pump well) and 100 monitor wells, including 48 Production Zone monitor wells, 25 monitor wells completed in the LFG Sand (overlying aquifer), and 25 monitor wells completed in the UKM Sand (underlying aquifer), and 2 monitor wells completed in the DE Horizon (uppermost aquifer). Water levels in 52 wells (including the pumping well, 31 HJ Horizon observation wells, and 20 wells in the overlying and underlying aquifers) were measured and recorded with In-Situ Level TROLLs® for the south test. Prior to the long-term pump test at pump well PW-101, a step-rate test was conducted with rates of 39, 54.4, 72.9, and 80.9 gpm to evaluate pumping rates for the long-term test.

The south pump test was conducted from December 9 through December 12, 2008, and the water level data were collected through December 22, 2008. The pumping lasted for 4,185 minutes, with an average pumping rate of 58.1 gpm.

2.2.3 Drawdown during the Pump Tests

2.2.3.1 North Pump Test

During the north pump test, drawdown was observed in all of the wells completed in the HJ Horizon located on the north side of the fault. The pump well, PW-102, had the most drawdown at 111.1 feet. Drawdown in the closest observation well (MP-107) to PW-102 was 48.6 feet. Drawdown ranged from 2.8 to 36.5 feet in the perimeter observation wells located on the north side of the fault (M-114 to M-126).

Drawdown ranged from 0.0 to 2.7 feet in 13 monitor wells located on the south side of the fault. The largest drawdown occurred in wells closest to the fault. Based on the minimal drawdown in the monitor wells located on the south side of the fault, it appears that the fault is a partial barrier to groundwater flow within MU1, although there does appear to be some leakage.

Drawdown responses were observed in the overlying and underlying observation wells located on the north and south sides of the fault during the north pump test. The drawdown ranged from 0.1 to 3.4 feet in the overlying aquifer, and 0.0 to 2.2 feet in the underlying aquifer. There does appear to be a limited degree of communication between the HJ Horizon and the overlying and underlying aquifers however the responses on both sides of the fault are generally an order of magnitude less than the observed responses within the HJ Horizon.

2.2.3.2 South Pump Test

During the south pump test, drawdown was observed in all of the wells completed in the HJ Horizon located on the south side of the fault. The pump well, PW-101, had the most drawdown at 63.5 feet. Drawdown in the closest observation wells (HJMP-109 and MP-104) to PW-101 was 41.7 and 48.1 feet, respectively. Drawdown ranged from 4.8 to 34.1 feet in the perimeter observation wells located on the south side of the fault (M-101 to M113, M-127 and M-128).

Drawdown ranged from 0.1 to 2.0 feet in 21 monitor wells located on the north side of the fault. The largest drawdown occurred in wells closest to the fault. Based on the minimal drawdown in the monitor wells located on the north side of the fault, it appears that the fault is a partial barrier to groundwater flow within MU1, although there does appear to be some leakage. Results of testing also indicate that the splinter fault south of the main Lost Creek fault acts as a minor barrier to flow compared to the main fault.

Drawdown responses were observed in the overlying and underlying observation wells located on the north and south sides of the fault during the south pump test. The drawdown ranged from 0.0 to 1.9 feet in the overlying aquifer, and 0.1 to 5.7 feet in the underlying aquifer. There does appear to be a limited degree of communication between the HJ Horizon and the overlying and underlying aquifers; however the responses on both sides of the fault are generally an order of magnitude less than the observed responses within the HJ Horizon.

2.2.4 HJ Horizon Aquifer Properties

Drawdown data collected from monitor wells equipped with In-Situ Level TROLL data-logging pressure transducers were analyzed to determine aquifer properties, including transmissivity and storativity, primarily using the Theis method (Theis, 1935).

2.2.4.1 North Pump Test

Transmissivity results from the drawdown data for the PW-102 pump test of the HJ Horizon ranged from 50.9 to 104.0 square feet per day (ft^2/day), with an average transmissivity value of 77.9 ft^2/day. Transmissivity values calculated from the recovery data ranged from 52.2 to 57.5 ft^2/day, with an average transmissivity value of 55.4 ft^2/day. The transmissivity values appear to increase slightly toward the east on the north side of the fault. Hydraulic conductivity ranged from 0.42 to 0.87 feet per day (ft/day), with an average of 0.65 ft/day. Storativity of the HJ Horizon aquifer ranged from 5.4×10^{-5} to 1.9×10^{-4}, with an average storativity of 9.3×10^{-5}. The groundwater velocities on the north side of the fault ranged from 2.9 to 5.6 feet per year (ft/year), with an average of 4.4 ft/year.

The radius of influence (ROI), based on the drawdown responses observed in the monitor ring wells during the north pump test, was estimated from a distance drawdown plot (**Appendix F** of **Attachment MU1 2-1**) to be between 3,100 and 3,300 feet. The ROI is not symmetrical with respect to the pump well due to the presence of the fault. The minimum ROI is greater than 2,600 feet.

2.2.4.2 South Pump Test

Transmissivity results from the drawdown data for the PW-101 pump test of the HJ Horizon ranged from 69.4 to 129.0 ft^2/day with an average transmissivity value of 92.6 ft^2/day. Transmissivity values calculated from the recovery data ranged from 58.3 to 108 ft^2/day, with an average transmissivity value of 70.5 ft^2/day. The transmissivity values on the south side of the fault appear to increase closer to the fault, in the northeast portion of the test area.. Hydraulic conductivity ranged from 0.58 to 1.08 ft/day, with an average of 0.77 ft/day. Storativity of the HJ Horizon aquifer ranged from 3.6×10^{-5} to 4.2×10^{-4}, with an average storativity of 1.1×10^{-4}. The groundwater velocities on the south side of the fault ranged from 6.6 to 12.1 ft/year, with an average of 8.8 ft/year.

The ROI, based on the observed drawdown in the monitor ring wells during the south pump test, was estimated to be between 3,200 and 3,500 feet calculated from distance drawdown plots (**Appendix F** of **Attachment MU1 2-1**). The ROI, as with the north pump test, is truncated by the fault. The minimum ROI is greater than 2,900 feet.

3.0 Surface Conditions

3.1 Mine Unit Layout

The layout of MU1, including roads, pipelines, and header houses, is shown on **Figure MU1 1-3**. The MU1 monitor well ring will encompass about 210 acres, and the pattern area will cover about 37 acres within that ring. The ring extends about 5,600 feet east to west and about 2,000 feet north to south. The topography within the ring is flat, with a maximum elevation change of about 30 feet across the mine unit. Minor ephemeral drainages cross the mine unit from northeast to southwest and northwest to southeast. The types of soil and vegetation within MU1 are discussed below, along with the areas of disturbance.

3.2 Soil Conditions

The results of the Order 3 soil survey for the entire Permit Area are in Appendix D7 (Soils) of the main permit document. In accordance with WDEQ-LQD Guideline No. 1 (WDEQ-LQD, 1994), a more detailed Order 1 soil survey is needed for the portions of the Permit Area, where mining-related surface disturbance is proposed. Order 1 soil surveys were conducted for the Plant site (2008), the deep well sites and associated roads (2009), and the results are included in **Attachment OP-5a** and **Attachment OP-5b** of the main permit document. An Order 1 soil survey was also conducted at MU1 in 2008. The following section summarizes the results of that survey, which is described in more detail in **Attachment MU1 3-1.** The Order 1 soil survey fieldwork was completed in September 2008, and the soil samples were analyzed by Energy Laboratories, Inc. in Casper, Wyoming, in September and October 2008.

A reconnaissance survey was conducted in early September 2008 to select locations for backhoe excavation of soil pits and profiles and for soil sampling. Soils were examined in more detail at 28 locations, where a 3-inch diameter hand-held soil auger and a 16-inch tile spade were used to excavate soil "pits". The pits were excavated to a depth of 60 inches, or to the C horizon In addition to the 28 pit locations, observations were also made at several of the mud pits excavated for project-related drilling in the Permit Area. Pits at the MU1 study area were also compared to pits at the Plant site, which were excavated during the same field session in September 2008 (**Attachment OP-5a** to the Operations Plan in the main permit document).

Some soil profile locations were selected to correspond with soil pit locations in order to ensure sampling was adequate to represent the spatial variability of the soils. The soil profiles were excavated by a backhoe, which allowed for more detailed observations. Each excavation was approximately 15 feet in length, five feet in depth, and four to five feet in width, oriented in an east-west direction to provide good lighting on the north soil face for descriptions and pictures.

The bottom of each profile was flat for a length of five feet, with a 45-degree slope at one end for access. The profiles were excavated and samples collected in mid-September 2008. Between three and seven horizons or sub-horizons were described and sampled at each soil profile.

Based on the soil pit and the mud pit observations, eight soil "profile" locations were selected to describe and sample. Three soil mapping units (SMUs) were identified, described and sampled in MU1: the Poposhia Loam, the Teagulf Sandy Loam, and the Pepal Sandy Loam.

> **Poposhia Loam**: This soil formed in calcareous loamy alluvium. This deep, well-drained soil occurs in narrow swales and comprises a small proportion of the study area. Typically, the surface layer is about a six-inch-thick dark brown sandy loam. The next layer is about an 18-inch-thick dark yellowish brown clay loam or sandy clay loam. The substratum is a brown or yellowish brown loam or coarse sandy loam to a depth of 60 inches or more. Its slopes range from zero to one percent.
>
> **Teagulf Sandy Loam**: This soil formed in calcareous loamy or sandy alluvium, and is influenced by sandstone, siltstone, and mudstone or shale bedrock. Comprising a small proportion of the study area, this shallow, well-drained soil occurs on side slopes and upland ridges of slightly dissected plains. Its slopes range from three to seven percent. Typically, the surface layer is about a three-inch-thick brown or dark yellowish brown loam. The next layer is about a seven-inch-thick dark yellowish brown sandy clay loam or heavy sandy loam. The substratum is a brown or yellowish brown loamy coarse sand or coarse sand to a depth of 60 inches or more. Substrata, consisting of silt loam or sandy clay loam, also occur but are less prevalent.
>
> **Pepal Sandy Loam**: This soil formed in calcareous loamy alluvium. This moderately deep, well-drained soil occurs on gently (one- to three-percent slopes) undulating uplands and comprises a large proportion of the study area. Typically, the surface layer is about a four-inch-thick dark brown or brown coarse sandy loam. The next layer is about a 15-inch-thick dark yellowish brown clay loam or sandy clay loam. The substratum is a dark yellowish brown loamy coarse sand or coarse sandy loam to a depth of 60 inches or more.

After examining the eight soil profile descriptions, samples from four of the eight soil profiles were selected for laboratory analysis Based on the laboratory results and the field observations, the topsoil of all three SMUs provides a favorable medium for plant growth, though the depth of topsoil varies between units. The Poposhia Loam provides about 19 to 24 inches of topsoil material favorable for plant growth. The Teagulf Sandy Loam provides about six to 12 inches of topsoil material favorable for plant growth. The Pepal Sandy Loam provides 14 to 18 inches of topsoil material favorable for plant growth.

3.3 Vegetation Conditions

The results of the vegetation studies conducted throughout the Permit Area are discussed in Appendix D8 (Vegetation) of the main permit document. Within MU1 (as well as the entire Permit Area) two vegetation types, dominated by big sagebrush, were identified and mapped (**Figure MU1 3-2**). The Upland Big Sagebrush Shrubland type dominates the flat upland areas and the gentle slopes, and covers about 80% of MU1. The Lowland Big Sagebrush Shrubland type occurs in deeper soils along the gently sloped, south-facing ephemeral dry washes, and covers about 20% of MU1.

During the vegetation studies, special consideration was given to the identified potential species of special concern and micro-environments capable of supporting these species; however, no species of special concern were observed within the Permit Area. Within the Permit Area, only one listed restricted noxious weed species, tansy mustard, was observed with scattered individuals observed in the Lowland Big Sagebrush Shrubland. No areas dominated by weedy species were observed within the Permit Area. Selenium indicator species were not observed on-site, and none of the soils of the Permit Area are considered seleniferous.

3.4 Disturbance Calculations

Figures MU1 3-1 and **3-2** show the MU1 layout overlain on the soil and vegetation maps, respectively. **Tables MU1 3-1** and **3-2** include the topsoil salvage and vegetation disturbance calculations, respectively. Standard areas in the calculations, e.g., the footprint of the header houses and road widths, were based on the dimensions in **Figures OP-3c**, **OP-6a**, and **OP-6b**. Road and pipeline lengths were measured from **Figure MU1 1-3**.

3.4.1 Soils

For **Table MU1 3-1**, the topsoil salvage was calculated on the basis of the areas from which the topsoil would be removed: (1) long term, i.e., for the life of the mine unit (e.g., from roadways and header house locations); and (2) short-term, i.e., for a few weeks or months (e.g., from pipeline routes). All three of the major soil units surveyed in the Permit Area occur within MU1. About 3 acres of the Pepal Sandy Loam, which covers the most area within MU1, will be stripped. Based on a topsoil stripping depth of 24 inches, about 13,300 cubic yards will be stockpiled long term (for the life of the mine unit), and about 9,500 cubic yards will be stockpiled short term (for a few days to a few months). About 0.4 acres of the Teagulf Sandy Loam will be stripped. Up to about 1,400 cubic yards will be stockpiled long term, and up to about 4,100 cubic yards will be stockpiled short term. About 0.4 acres of the Poposhia Loam will be stripped; resulting in about 1,200 cubic yards stockpiled long term and about 1,700 cubic yards stockpiled short term. The stripping depths for the Teagulf Sandy Loam and Poposhia Loam will generally be less than 24 inches (Section 3.2 above), but for a conservative estimate of the volume of topsoil to be stockpiled, a depth of 24 inches was used in the calculations.

3.4.2 Vegetation

For **Table MU1 3-2**, the vegetation disturbance was calculated on the basis of: (1) the areas from which vegetation will be removed, which essentially correspond to the areas from which topsoil will be removed; and (2) the areas in which vegetation will be trodden (e.g., driven over during facility installation), but not removed. As noted in the table, about 8 acres of vegetation in the Upland Big Sagebrush community will be removed, and up to about 25 acres may be trodden. Much less disturbance of the Lowland Big Sagebrush community is anticipated; about 1 acre will be removed, and up to about 6 acres may be trodden.

Table MU1 3-2 also includes estimates of the existing disturbance within MU1. This disturbance includes: two-track roads which pre-dated the LC ISR, LLC activities but which LC ISR, LLC is currently using; the LC ISR, LLC field trailer site; and the reclaimed areas around the MU1 monitor ring wells.

4.0 Baseline Ground Water Quality

This section presents the results of baseline ground water quality sampling for MU1 in the Permit Area. The baseline groundwater quality of MU1 is characterized to facilitate the detection of potential excursions during operations and to establish restoration goals.

4.1 Sampling Protocols

Chapter 11, Non-Coal In-Situ Mining, of the Non-Coal Rules and Regulations (2005a) and Guideline No. 4, In-Situ Mining, of WDEQ-LQD (2000) provide the recommended frequency, density, parameters, and quality assurance/quality control (QA/QC) for baseline monitoring. The baseline monitoring methodology applied to MU1 is discussed below.

Following well completion, each monitor well is subject to a mechanical integrity test (MIT). With a successful MIT, each well may be employed in its intended service. In contrast, when a monitor well fails an MIT, down-hole casing repairs with follow-up MIT generally suffice. However, when a monitor well fails an MIT and repair is infeasible, the well is properly abandoned. A replacement well may then be selected or drilled. (For example, wells M-120 and

MU-108 failed their MITs, were properly abandoned, and replaced by wells M-120A and KPW-2.)

Once a monitor well passes the MIT, water quality sampling may be conducted by following the procedures below.

- The static water level is measured to the nearest 0.1 foot below ground level.
- With this static water level and the known total well depth, the casing volume is calculated.
- The groundwater is pumped from the well, using a downhole submersible pump, to remove stagnant water that may chemically differ from the water in the formation. For sampling purposes, 220 volt single phase 1 to 3 horsepower pumps were used. The resulting flow rates, depending on the size of the pump and the yield of the well, ranged from 2 to 25 gpm.
- Field parameters are measured and recorded until three consecutive samples collected at least 0.5 casing volumes apart show less than 10% variability. A minimum of three casing volumes were pumped prior to sample collection during the baseline sampling of the MU1 monitor wells.
- The field parameters include:
  - pH to the nearest 0.2 standard units (SU);
  - temperature to the nearest 0.2 degrees Celsius (°C); and
  - specific conductance to within 20 micromhos per centimeter (μmhos/cm), corrected to 25 °C.
- Once the field parameters are stable, water samples are collected in a clean plastic or glass container, properly labeled and stored on ice in coolers.
- Upon returning from the field, the water samples may be kept in a refrigerator until transferred to coolers with ice and delivered to the laboratory with a completed chain-of-custody form within one day of collection or as soon as possible to meet required holding times.

At the Permit Area, baseline water quality data were collected at:

- the monitor ring wells outside the area of uranium recovery (M wells),
- the monitor wells completed in the aquifer overlying the production zone aquifer (MO wells),
- the monitor wells completed in the aquifer underlying the production zone aquifer (MU wells), and
- the monitor wells completed in the production zone aquifer within the planned area of uranium recovery, also known as the pattern monitor wells (MP wells),

Figure MU1 4-1 shows the locations of the monitor wells. **Table MU1 4-1a** lists the monitor wells in MU1. As noted on the table, two wells (M-120A and KPW-2) replace the wells originally installed at those locations due to problems with the original wells. The MIT results for the monitor wells are included in **Table MU1 4-1b**. The completion logs, geophysical logs and lithologic logs for all the MU1 monitor wells are included in **Appendix A** of **Attachment MU1 2-1**. Some of these logs were originally submitted in **Attachment D6-3** of the main permit document. For easier reference, those logs are also included in **Appendix A** of **Attachment MU1 2-1**. In addition, seven of the wells that were used previously as regional monitor wells were recompleted to be used as monitor wells in MU1. The procedure involved retrieving the screen and packer assembly from the well and then back plugging the well to the desired depth with neat cement. A new screen and packer assembly was installed to monitor the interval of interest. The recompletion details for these seven wells are included in **Appendix A** of **Attachment MU1 2-1**.

Each monitor well has been sampled four times with at least two weeks between each sampling event as shown in **Table MU1 4-2a**. The associated QA/QC sampling is listed in **Table MU1 4-2b**, and the water levels collected during these sampling events are shown in **Table MU1 4-3**. All of the wells were sampled in April, May, and June 2009, with the following exceptions. Due to an error, the fourth round of well MO-111 sampling was conducted after sampling of the other monitor wells. Well M-120 was piloted on July 24, 2008 and was intended to be used as a perimeter monitor well. After the well was completed, it was not immediately tested for integrity. The well was monitored during the MU1 pump tests for water levels and these results are reported in **Attachment MU1 2-1**. Following the pump tests and prior to baseline groundwater quality sampling, the well was tested for integrity and failed on February 6, 2009. Since Well M-120 failed integrity, Well M-120A was installed as a replacement well approximately 18 feet away on March 20, 2009. The original groundwater quality data collected from wells MP-109 and M-120A indicated these wells had not been fully developed and the water sampled from the wells did not represent formation groundwater. Therefore, the wells were redeveloped and resampled. Well MO-114 was added to the monitor program to ensure adequate monitoring near the Lost Creek Fault and associated splinter fault and was sampled the requisite four times.

Table MU1 4-4 presents the parameters analyzed at the laboratory, which include the water quality constituents, the uranium mine constituents, and the additional trace metals listed in WDEQ-LQD's Parts IV and V of Appendix 1, Guideline No. 8, Hydrology (2005b). To facilitate accurate and precise water quality data, QA/QC procedures were implemented for field measurements, sampling and laboratory analyses. Instruments for analyzing field parameters were calibrated in accordance with the manufacturer's specifications and were able to report pH to the nearest 0.2 SU, temperature to the nearest 0.2 °C, and specific conductance to the nearest 20 μmhos/cm, corrected to 25 °C.

As recommended in WDEQ-LQD's Part III of Appendix 1, Guideline No. 8, Hydrology (2005b), duplicate and field blank samples were prepared during each sampling event to identify potential data errors resultant from improper sampling or analytical methods, poor sample preservation, or collection of non-representative samples. At a randomly selected well, duplicate samples were collected by filling two separate bottle sets, preserved, stored and transported in an identical manner to verify precision. One duplicate sample was collected for each sampling event or every 20 samples. A field blank sample was prepared by filling a clean bottle set with distilled water in the field and preserving it in the same manner as other samples in order to verify the analytical recognition of zero values, any positive bias from contaminated sample bottles or preservatives, and any contamination from atmospheric sources (e.g., airborne dust). One field blank sample of distilled water was prepared for each sampling event or every 20 samples. **MU1 Table 4-2b** shows the MU1 QA/QC samples in relation to their respective sampling events.

All laboratory analysis methods are approved by the American Water Works Association, with methodologies provided by the US Environmental Protection Agency (EPA) and the American Public Health Association as shown in **Table MU1 4-4**. In addition, the laboratory conducted its own QA/QC procedures of laboratory samples.

4.2 Sampling Results

This section discusses the water level and water quality data. The water quality data is separated into QA/QC and groundwater samples.

The groundwater level data, collected during each sampling event in accordance with **Attachment OP-8** of the main permit document, is included as **Table MU1 4-3**. The anomalous water level readings for wells M-103, M-116, MO-112, MO-113 and MP-104 appear to be due to sampler error as opposed to significant changes in water levels. Also, samplers failed to take water level measurements for MP-109 on December 1, 2009 and December 16, 2009 and also for KPW2 on June 6, 2009.

4.2.1 QA/QC Results

Once the laboratory results were received, they were reviewed by the Environment, Health and Safety Manager, the Radiation Safety Officer or a trained designee. The review included analyzing cation-anion balances, comparing the measured and calculated total dissolved solids (TDS) values, analyzing the QA/QC samples, comparing and contrasting the results with state and federal water quality criteria, and identifying potential outliers.

Table MU1 4-5 shows the WDEQ Water Quality Division's (WDEQ-WQD's) class-of-use criteria (WDEQ-WQD, 2005) and the EPA's maximum contaminant level (MCL) drinking water criteria (EPA, 2009a). The three referenced WDEQ-WQD water use classes are domestic (Class I), agriculture (Class II), and livestock (Class III). The EPA MCL drinking water criteria are enforceable primary standards and the highest contaminant level allowed in drinking water.

Unless a matrix caused interference with the laboratory analyses, the laboratory detection limits are those listed in **Table MU1 4-4**.

As shown in **Table MU1 4-6**, the cation-anion balances are less than an absolute value of 5 (except 12 values less than an absolute value of 7), which is an acceptable balance (Eaton et al., 2005). **Table MU1 4-7** compares the measured TDS to the calculated TDS, which are reasonably comparable. **Table MU1 4-8** presents the laboratory results of the field blank analyses. The detected parameter concentrations/ radiation or abnormal values of the field blank samples are minimal, with the exception of gross alpha and dissolved radium-228 radiation. In many of the analyses, the precision of the gross alpha activity exceeds the WDEQ-WQD criterion; therefore, the precision of the laboratory analysis may alone account for many of the exceedances. However, the presence of these parameters in the field blank samples may suggest that potential data errors occurred from improper sampling or analytical methods. Certain gross alpha and dissolved radium-228 values may erroneously exceed WDEQ-WQD water quality criteria if the field blank samples are representative of the other samples. Overall, even when subtracting the detected radiation levels in blanks from those of the monitor well samples, the monitor well samples generally have elevated radiation levels that exceed the WDEQ-WQD water quality criteria.

Table MU1 4-9 shows the laboratory results of the duplicate samples. Some of the dissolved potassium, total sulfate, specific conductance, dissolved arsenic, and dissolved uranium concentrations as well as gross alpha, gross beta, and dissolved radium-226 radiation values differ, although none are considered anomalies.

4.2.2 Groundwater Quality Results

The groundwater quality analytical results are included in **MU1 Attachment 4-1**. The results are tabulated by well (one page per well) and grouped by well. The electronic water-quality results received from the laboratory are included as **MU1 Attachment 4-2**.

The table for each well includes: the water quality results from each of the four sampling events; the minimum, mean, maximum, and standard deviation for each parameter (without outliers); and exceedances of state and federal water quality criteria. The results that exceed WDEQ-WQD's and EPA's criteria are discussed in detail below.

4.2.2.1 Monitor Ring Wells (M-Wells)

The M-well laboratory results are discussed in the following and presented in **MU1 Attachment 4-1**.

General Parameters. The pH of the M-well samples ranges from 7.58 to 9.15 SU. The pH values meet the WDEQ-WQD agriculture criteria of 4.5 to 9.0 SU, except those of wells M-101, M-114, and M-115. TDS concentrations (502 to 629 milligrams per liter [mg/L]) from wells M-102 through M-106 exceed the WDEQ-WQD domestic use criterion of 500 mg/L. Samples from wells M-101 through M-107 have total sulfate concentrations exceeding the domestic criterion of 200 mg/L. The total sulfate concentrations of samples from wells M-102 through M-104 also exceed the domestic use criterion of 250 mg/L.

Metals. Wells M-117 and M-126 have samples with dissolved and total manganese concentrations exceeding the WDEQ-WQD domestic criterion (0.05 mg/L). Samples from wells M-103 and M-104 have concentrations exceeding the selenium WDEQ-WQD agriculture criterion (0.02 mg/L). The four samples collected from well M-106 have total iron concentrations (0.68 to 2.71 mg/L) exceeding the WDEQ-WQD domestic criterion (0.3 mg/L).

Uranium and Radionuclides. Twenty-two of the 28 M-wells have dissolved uranium concentrations (0.037 to 0.61 mg/L) exceeding the EPA MCL 0.03 mg/L criterion. All of the M-wells have gross alpha radiation exceeding the WDEQ-WQD criterion (15 picoCuries per liter [pCi/L]). Twenty of the 28 wells have Ra-226 plus Ra-228 values exceeding the WDEQ-WQD criterion (5 pCi/L).

4.2.2.2 'Overlying' Monitor Wells (MO-Wells)

The MO-well laboratory results are discussed in the following and presented in **MU1 Attachment 4-1**.

General Parameters. The pH of the MO-well samples ranges from slightly basic (7.65 SU) to basic (9.69 SU). Ten samples from wells MO-106, MO-110, MO-111, and MO-112 exceed the WDEQ-WQD livestock pH criteria of 6.5 to 8.5 SU. One sample from well MO-101 has a total sulfate concentration (204.0 mg/L) that exceeds the WDEQ-WQD agriculture criterion (200.0 mg/L).

Metals. One sample from well MO-111 has a dissolved arsenic concentration (0.011 mg/L) that exceeds the EPA MCL criterion (0.010 mg/L). The dissolved selenium concentrations range from 0.001 to 0.047 mg/L. Nearly half of the samples have dissolved selenium concentrations that exceed the WDEQ-WQD agriculture criterion of 0.020 mg/L.

Uranium and Radionuclides. The uranium concentrations (0.13 to 0.92 mg/L) of every MO-well sampled exceed the EPA MCL criterion of 0.03 mg/L. All of the gross alpha values (137 to 1,060 pCi/L) exceed the WDEQ-WQD criterion of 15 pCi/L. Forty-five of the 56 samples exceed the WDEQ-WQD Ra-226 plus Ra-228 criterion (5 pCi/L).

4.2.2.3 'Underlying' Monitor Wells (MU-Wells)

The MU-well laboratory results are discussed in the following and presented in **MU1 Attachment 4-1**.

General Parameters. The pH of the MU-well samples is basic, ranging from 7.89 to 10.20 SU. More than half of the sample values exceed the WDEQ-WQD livestock pH criteria of 6.5 to 8.5 SU.

Metals. Wells MU-109, MU-110, MU-112 and MU-113 have samples with dissolved arsenic concentrations (0.011 to 0.022 mg/L) exceeding the EPA MCL criterion (0.010 mg/L). Seven samples from wells MU-103 through MU-105 have total iron concentrations (0.45 to 3.91 mg/L) exceeding the WDEQ-WQD domestic criterion (0.3 mg/L).

Uranium and Radionuclides. Samples from wells MU-104, MU-105, MU-106, MU-110 and MU-111 have dissolved uranium concentrations (0.031 to 0.111 mg/L) that exceed the EPA MCL criterion of 0.03 mg/L. All of the MU well samples have gross alpha values (16.6 to 828 pCi/L) that exceed the WDEQ-WQD criterion of 15 pCi/L. Forty-eight (48) of the 52 samples exceed the WDEQ-WQD Ra-226 plus Ra-228 criterion of 5 pCi/L.

4.2.2.4 Pattern Monitor Wells (MP-Wells)

The MP-well laboratory results are discussed in the following and presented in **MU1 Attachment 4-1**.

General Parameters. The pH of the MP well samples ranges from slightly basic (7.69 SU) to basic (10.70 SU). With the exception of wells MP-109 and MP-112, the pH results meet the WDEQ-WQD agriculture criteria of 4.5 to 9.0 SU. One-third of the samples exceed the WDEQ-WQD pH livestock criteria of 6.5 to 8.5 SU.

Metals. The dissolved arsenic EPA MCL (0.010 mg/L) is exceeded in eight samples (0.016 to 0.027 mg/L) from wells MP-103, MP-105 and MP-112. The selenium concentration (0.023 mg/L) of one MP-111 well sample exceeds the WDEQ-WQD agriculture criterion of 0.02 mg/L. The total iron concentrations of the MP-107 well samples also exceed the WDEQ-WQD domestic or agriculture criteria of 0.3 mg/L and 5.0 mg/L, respectively. In addition, the total manganese concentrations of only the MP-107 well samples exceed the WDEQ-WQD domestic or agriculture of 0.05 mg/L and 0.2 mg/L, respectively.

Uranium and Radionuclides. With the exception of well MP-106 samples, all of the well samples have uranium concentrations above the EPA MCL of 0.03 mg/L. All of the samples have gross alpha activity that exceeds the WDEQ-WQD criterion of 15 pCi/L. All of the samples, with the exception of two samples from well MP-107, have radium isotopic activity above the WDEQ-WQD criterion of 5 pCi/L of Ra-226 plus Ra-228.

4.3 Outliers

The water quality data of the monitor wells were evaluated to identify and remove potential outliers (anomalously high or low values relative to other values) that might otherwise strongly influence the general characterization of the wells. The outliers were identified in accordance with the process described in Section OP 3.6.4.1 of the main permit document, which is based on Attachment I of the WDEQ-LQD Guideline No. 4 (2000).

Well outliers were identified from the combined quarterly water quality sampling results of each type of monitor well (M, MO, MU, and MP). As noted in WDEQ-LQD Guideline No. 4, "there are no hard and fast rules regarding the initial selection of potential outliers" (2000). The water quality data was visually screened for anomalous values or groups of values, which were then subjectively evaluated as especially high or low relative to other values. Each potential outlier was compared to its tolerance interval, which was calculated excluding the potential outlier from the dataset. Each potential outlier was considered an outlier if its value was not within the calculated tolerance limit, unless it only marginally differed from the tolerance interval, was one of only a few detected samples, or was similar to multiple samples. **Table MU1 4-10** presents an example of outlier calculations. After evaluating the well data, the outliers were determined and are shown in **Table MU1 4-11**.

4.4 Baseline

It is assumed that the baseline concentrations are normally distributed. The 95% confidence interval, which is approximated by the baseline mean plus or minus three standard deviations, will be used to establish that the actual population mean is represented by the baseline mean. For the M, MO, and MU wells, the baseline mean is established on a well-by-well basis. For the MP wells, the baseline mean is established for the wells as a group (WDEQ 2007).

5.0 Operations Plan

Section OP 3.0 of the main permit document describes the mine unit processes, instrumentation, and control for the Project as a whole. The following sections describe specific operational considerations for MU1.

5.1 Mine Unit Operations

5.1.1 Operating Parameters and Procedures

MU1 will be subdivided into 12 operational areas referred to as header houses. **Figure MU1 1-3** shows the proposed locations and associated infrastructure for the 12 header houses. Each header house will be designed to accommodate the meter runs and distribution manifolds for approximately 20 production and 40 injection wells. The MU1 production wells are expected to have an average flow rate between 30 to 35 gpm. The injection wells are expected to have an average flow rate between 15 to 20 gpm, depending on the production and bleed flow rates. With the Plant operating at a nominal flow rate of 6,000 gpm, approximately 180 production wells and 360 injection wells will be in operation at any given point in time. Also, the hydrologic information obtained from the MU1 pump tests did not alter the assumptions used to develop the Lost Creek Project water balance. (The water balance for the Project is discussed in Section OP 3.6.3 and illustrated on **Figures OP-5a** through **OP-5f** of the main permit document.)

During the initial start up of mine unit operations, a single header house will be brought on line with an approximate production flow rate of 640 gpm flowing to the Plant through the main production pipeline. The main production and injection pipelines will be designed to accommodate the nominal operating flow rate of 6,000 gpm. Additional header houses will be brought on line at an approximate schedule of one per month until the maximum flow capacity through the Plant is realized. By this time, there should be eight to ten partially or fully on line header houses, depending on the realized average flow rates from the production wells. Header house construction and well installations will continue even though the nominal flow rate to the Plant has been achieved.

The start of each header house will be done in accordance with a prescribed standard operating procedure. The procedure will include a set checklist to ensure that pre start up inspections have been performed and documented. As part of the start-up procedure, LC ISR, LLC will monitor the water levels in the overlying and underlying monitor wells nearest to the header house as the house is brought on line.

The nominal flow rate of 6,000 gpm for the Plant is determined by the anticipated flow rate capacity of the ion exchange columns. The ten ion exchange columns are designed for an average throughput of 1,200 gpm with a maximum of 1,500 gpm. The flow through the ion exchange columns will be in series with five columns in the lead position and five columns in the trail position. This means that five lead columns will receive the mine unit flow directly from the production pipeline and the five trail columns will receive the flow exiting the lead columns. The flow from the trail columns is returned to the mine unit by the main injection pipeline. Therefore, the nominal flow rate through the Plant is five times 1,200 gpm, or 6,000 gpm. A bleed stream of the production flow into the Plant will be sent to the waste water disposal system prior to the re-injection of the leaching solution. Also, the carbonate component of the injection fluid will be added to the leaching solution downstream of the ion exchange columns and prior to exiting the Plant. The oxidant will be added to the leaching solution in the header houses prior to injection. The chemical constituents will be added at concentrations as specified in **Section OP 3.0** of the main permit document. An antiscalant may be added if needed.

New production wells will be brought on line to replace production wells that are shut in when it is determined that the recovery of uranium from these wells is no longer technically or economically warranted. This process will ensure that the nominal flow rate to the Plant will be maintained for maximum production and will continue in MU1 until the twelfth header house is fully on line. Groundwater restoration and surface reclamation will commence directly following the determination of the completion of uranium recovery (mining) in MU1 in accordance with the Reclamation Plan of the main permit document.

The initial proposed project schedule for the Lost Creek Project was based on the results of the regional pump tests performed in 2007. Since the MU1 pump tests provided comparable results to these previous pump tests, the proposed project schedule has not changed. A detailed discussion of the mine and reclamation plans for each proposed wellfield is provided in **Section OP 2.1** and a timeline is presented in **Figure OP-4a** of the main permit document.

5.1.2 Process Instrumentation

Instrumentation systems will be an essential component to monitoring and maintaining the proper mine unit flow balance and provide notice to operators in the case of mine unit upset conditions. Mine Unit Operators will use the data and information provided by the instrumentation systems to maintain proper header house and pattern flow balances as specified in **Section OP 3.6** of the main permit document.

5.1.3 Operational Monitor Well Sampling and Data Review

The MU1 monitor wells listed in **Table MU1 4-1a** were installed as described in **Section OP 3.2** of the main permit document. **MU1 Section 4.0** describes the baseline sampling program for these wells and the UCL and baseline restoration criteria calculation methods. This section presents the operational well sampling procedure and the review of the monitor well sample data.

Excursion monitoring includes sampling of the monitor ring wells (M wells), which are completed in the same horizon as the pattern area (HJ Horizon) and monitor wells screened in the overlying (MO wells) and underlying (MU wells) aquifers on the schedule outlined in **Section OP 3.6.4.2** of the main permit document. Prior to the start of well sampling, water levels will be measured for each monitor well. The groundwater collected from the wells will be analyzed for the excursion parameters (chloride, specific conductance and alkalinity) and their concentrations will be compared to the calculated UCL concentrations for those parameters for each type of monitor well. Data retention times are also included in **Section OP 3.6.4.2**.

During mine unit operations, the primary purpose of the monitoring well sampling program is to prevent and detect excursions. Therefore, a thorough review of the monitor well sampling data will be performed by an LC ISR, LLC employee trained for this task as the results of the sample analyses become available. The prevention of horizontal excursions in the perimeter monitor well ring is possible by reviewing the water quality data in concert with the water level data. The data reviewer will have access to a monitor well data base that will allow that person to trend data over time for a specific monitor well or a series of wells to determine whether a potential excursion exists and alert the mine unit operations staff to make the necessary flow changes to prevent the excursion.

Sudden increases in water levels in the overlying or underlying aquifers, however, may be an indication of casing failure in a production, injection or monitor well. Isolation and shutdown of individual wells can be used to determine the well causing the water level increases. MIT's of production and injection wells in the area of a suspected failure may also be performed to locate the failed well.

In the event that an excursion is detected, then verified by confirmation samples, excursion control would be initiated in accordance with the procedures in **Section OP 3.6.4** of the main permit document.

5.1.4 Perimeter Monitor Well Location Design

The primary objective for an in situ recovery project groundwater monitoring program is the protection of existing groundwater supplies. Appendix D5 and Appendix D6 of the main permit document contain general baseline geologic and hydrologic information pertaining to the overall project area. Prior to mine unit development it is necessary to collect and assemble detailed information on geologic and hydrologic conditions to define the ore zones, plan the mine unit and develop the groundwater monitoring program.

As part of the groundwater monitoring program, perimeter monitor wells have been installed within the Production Zone, outside of the production pattern area in a "ring" around the mine area. These wells were used to obtain baseline water quality data and will be used to detect mining zone excursions during mine unit operations. The UCLs determined for these wells from the baseline water quality data (Section 4.5) are used to determine the presence of an excursion.

The MU1 perimeter monitor well ring was installed in the fall of 2008 with each well located approximately, but no greater than, 500 feet from the outside edge of the mine unit as defined by mapped individual pattern areas. Also, the distance between each of the monitor ring wells is approximately, but no greater than, 500 feet apart. These distances are based on the MU1 aquifer characteristics to ensure the monitor well ring is adequate to detect horizontal excursions. Also, the completion interval of each monitor well targets the production zone(s) adjacent to that well.

As discussed in LQD Guideline #4 the distance between the mine unit and the perimeter monitor wells should be such that the monitor wells are within the zone of control of the production wells which would be used to control excursions. Based on the MU1 aquifer pump tests results, it is apparent that the radius of influence of a single pumping well greatly exceeds 500 feet. In fact, the MU1 aquifer pump tests indicated a response in the HJ Horizon of a minimum distance of 2,600 feet (North Test) within 2 days. Therefore, an excursion detected at the perimeter monitor well ring placed within 500 feet of the mine unit will be readily controlled by adjusting extraction and injection rates in nearby well patterns as described in Section OP 3.6.4 of the main permit document.

The approximate 500 foot spacing between perimeter monitor wells is a standard practice within the ISR industry in Wyoming and has proven to be effective in detecting mining zone excursions. Also, **Figures 6-17** and **6-18 in Attachment MU1 2-1** indicate a relatively uniform drawdown pattern in the perimeter monitor wells in relation to the distance from the pumped well. This indicates that channeling within the HJ Horizon, if present within MU1, does not significantly control or influence groundwater movement during periods of pumping stress. Each of the monitor ring wells, with the exception of well M-114 (which straddles the fault) showed approximately five feet or more of drawdown by the end of the 2 to 3-day tests. Even if paleochannels are present at MU1 that traverse between two monitor wells, the uniform hydraulic response of the HJ Horizon to the pumping wells indicates that any paleochannel would also be hydraulically connected to the pumping wells. Otherwise, there would have been a 'shortcircuit' in the system that would have either prevented a response in wells separated from the pumping well by the paleochannel, or resulted in a drastic steepening of the drawdown contours between the paleochannel and the outer monitor wells. The north hydrologic test included monitoring of 32 HJ Horizon wells on the north side of the Fault and the south hydrologic test included monitoring of 29 HJ Horizon wells on the south side of the Fault. This density of monitoring should be sufficient to identify if areas of MU1 are hydraulically isolated within the HJ Horizon. The Hydrologic Tests did not indicate such an occurrence. Based on results of the hydrologic testing that has been performed, any paleochannels that exist within MU1, are in hydraulic communication with the Production Zone aquifer and will be adequately monitored.

Each perimeter monitor well has been screened to discretely monitor the mining zones closest to the monitor well ring as was previously discussed with the WDEQ-LQD in Lander on June 25, 2008 prior to design and installation of the wells. The results of the attached MU1 pump tests confirm that the various sand units within the HJ Horizon are hydraulically well connected. As a result, these sands respond as a single hydrostratigraphic unit. Therefore, monitor well completions across the entire HJ Horizon would most likely result in the collection of samples that are more diluted with respect to any mining fluids which could potentially decrease the likelihood of detecting an excursion.

5.2 UCL Calculations

With the characterization of the baseline MU1 groundwater quality, the UCL parameters and limits were selected and calculated to facilitate the detection of potential excursions during Project operations. Among other factors, UCL parameters were selected considering their potential to react through sorption, oxidation, reduction, and precipitation. Common, reliable UCL parameters of in-situ uranium mining are specific conductance, chloride, TDS, sulfate, bicarbonate or total alkalinity, sodium, and calcium.

Total alkalinity, chloride, and specific conductance were chosen as the primary lixiviant migration indicators for MU1. Since bicarbonate (a component of total alkalinity) is a major compound added to the lixiviant during mining, total alkalinity is a useful UCL parameter. Chloride is a common UCL parameter in Wyoming due to its low levels in the native groundwater and its mobility in groundwater. Chloride is elevated in the lixiviant in comparison to the native groundwater due largely to the chemistry of the ion exchange system. The lixiviant TDS concentration generally differs than that of the baseline groundwater quality and does not appreciably change with sediment interaction; therefore, specific conductance is an excellent indicator due to its direct correlation to TDS.

UCLs were established for each M, MO and MU well. As recommended in WDEQ-LQD's Guideline No. 4 (2000), the alkalinity and specific conductance UCLs were calculated by adding five standard deviations to each UCL parameter baseline mean. Each chloride UCL was calculated by adding five standard deviations to each mean chloride concentration or by adding 15 mg/L to each mean chloride concentration, whichever was larger. The outliers identified in **MU1 Section 4.3** were excluded from the UCL calculations. **Table MU1 4-12** shows the means, the standard deviations and UCLs for the M, MO, and MU wells.

5.2.1 Monitoring the LFG and UKM Sands across the fault

The Lost Creek Fault transects the MU1 pattern area. LC ISR, LLC recognizes that within some areas of MU1, the LFG and UKM Sands are positioned across from the HJ mining zone due to the structure of the fault. This fact is illustrated on **Plate D5-1d** of the main permit document. Therefore, LC ISR, LLC has examined these areas to ensure that a monitoring strategy to detect excursions into these juxtaposed sands is in place prior to the start of mining. Section 2.1 (Structural Geology) provides a more detailed discussion of the Lost Creek Fault.)

LC ISR, LLC has designed MU1 so none of the individual patterns cross the fault. However, there are patterns screened in the Upper HJ (UHJ) Sand that are positioned across from the LFG Sand on the down thrown side of the splinter fault of the Lost Creek Fault. **Figure MU1 5-1** shows the pattern locations, outlined in red, where this occurs. In order to monitor the LFG Sand at this location, LC ISR, LLC has recompleted well MO-114 in the LFG Sand and will use this well to monitor for mining solutions that may cross the Lost Creek Fault from the UHJ mining patterns. Well MO-114 was not included in the MU1 baseline sampling program conducted April through June 2009. However, a baseline sampling program for well MO-114 has been completed and the data has been incorporated into the database for MU1. Also indicated on **Figure MU1 5-1,** there is a set of patterns (outlined in red) north of the Lost Creek Fault screened in the UHJ Sand that are positioned across from the LFG Sand on the down thrown side of the Lost Creek Fault. Monitor well MO-113, which was sampled as part of the original baseline wells, is positioned to monitor the LFG Sand to detect potential excursions that may occur across the fault at this location.

Also indicated on **Figure MU1 5-2,** there is a set of patterns north of the Lost Creek Fault screened in the Middle HJ1 (MHJ1) Sand that are positioned across from the LFG Sand on the down thrown side of the Lost Creek Fault. Monitor wells MO-113 and MO-109 are positioned to monitor the LFG Sand to detect potential excursions that may occur across the fault at these locations.

The Middle HJ2 (MHJ2) Sand is the only sand unit that is positioned across from both the LFG and the UKM Sands. **Figure MU1 5-3** shows the pattern areas (outlined in red) where this occurs. The MHJ2 pattern areas north of the Lost Creek Fault are positioned across from the LFG Sand on the down thrown side of the Lost Creek Fault. Monitor well MO-114 is positioned to monitor the LFG Sand to detect potential excursions that may occur across the fault from these patterns. Also shown on **Figure MU1 5-3** are the MHJ2 pattern areas that are screened across from the UKM Sand. Monitor wells MU-106, MU-107 and KPW-2 are positioned to monitor for potential excursions that may occur north across the Lost Creek Fault from the patterns located within the splinter fault. Also, LC ISR, LLC will include wells HJMU-101 and HJMU-110 as observation wells to enhance the monitor well system. These wells are screened in the UKM Sand and will be responsive to potential excursions through changes in groundwater levels in this sand unit. LC ISR, LLC will take water level measurements from these wells at the same frequency as discussed in Attachment OP-8 of the main permit document. The results will be reported to WDEQ-LQD along with routine monitor well sampling data. Monitor well MU-111 is positioned to monitor the UKM Sand to detect potential excursions that may occur north across the Lost Creek Fault from the MHJ2 pattern areas located south of the fault in the western portion of the of the mine unit.

Finally, there are patterns screened in the LHJ Sand that are positioned across from the UKM Sand in two areas as shown on **Figure MU1 5-4**. LC ISR, LLC believes there are sufficient monitor wells positioned in the UKM Sand (MU wells) that leakage across the Lost Creek Fault into the UKM sand will be detected. Monitor well MU-104 is in position to detect leakage south of the splinter fault of the Lost Creek Fault, from pattern areas located within the splinter fault. Monitor wells MU-106, MU-107 and KPW-2 are in position to detect an excursion into the UKM Sand should leakage to the north of the Lost Creek Fault occur from this same pattern area. Also, LC ISR, LLC will be using wells HJMU-101 and HJMU-110 as observation wells for the UKM Sand. Monitor well MU-111 is positioned to monitor the UKM Sand to detect potential excursions that may occur north across the Lost Creek Fault from the LHJ pattern areas located south of the fault in the western portion of the of the mine unit.

LC ISR, LLC will be overproducing in these pattern areas as part of the bleed system as discussed in **Section OP 3.6** and **Attachment OP-2**, "Engineering Controls" of the main permit document. However, in the event that leakage is detected across the fault in these locations and verified by confirmation samples, then excursion control would be initiated in accordance with the procedures in **Section OP 3.6.4** of the main permit document.

LC ISR, LLC believes that, with the addition of monitor well MO-114 and observation wells HJMU-101 and HJMU-110, the monitoring system is sufficient to discover any leakage of mining solutions that may occur across the fault into the LFG and UKM sand units due to their juxtaposition to the HJ mining zone.

5.3 Historic Drill Hole Locations

Figure MU1 5-5 shows the historic drill holes located within the proposed MU1 pattern area. Also, **Plate MU1 5-1** shows the proposed MU1 pattern area, the proposed monitor well ring and historic drill holes out to a distance 500 feet beyond the proposed monitor well ring. **Table MU1 5-1** lists the abandonment information available for the historic drill holes shown on **Figure MU1 5-5** and **Plate MU1 5-1.**

A review of the historic records suggests these holes were properly abandoned by the original operator pursuant to regulations that were in place at that time. Additionally, the two MU1 pump tests included with this submittal do not identify any improperly abandoned drill holes within the

MU1 pattern areas. The pump tests do reveal minor communication between the overlying and underlying aquifers and the HJ Horizon, which is most likely caused through the displacement of the Lost Creek Fault.

However, to ensure compliance with the Safe Drinking Water Act and State Regulations, LC ISR, LLC will actively pursue a re-plugging program of historic drill holes within the MU1 pattern areas for holes which can be positively located and identified by LC ISR and/or WDEQ-LQD. Additionally, if a historic drill hole or well is later located during the mine unit installation testing, or operation, the drill hole or well will be abandoned in accordance with abandonment procedures currently in use by LC ISR, LLC.

5.4 Updated Water Rights Information

Table D6-13 of the main permit document lists the groundwater permits of the Project that had been obtained from the Wyoming State Engineer's Office as of December 2008. As requested in the WDEQ-LQD's August 2008 Comment #34 on Appendix D6, **Table MU1 5-2** lists the groundwater permit information updated for MU1.

6.0 Groundwater Quality Restoration and Surface Reclamation

The section on Groundwater Quality Restoration and Surface Reclamation in the main permit document describes the plans for the Project as a whole. The following sections describe specific restoration and reclamation considerations for MU1.

6.1 Groundwater Restoration

6.1.1 Calculated MU1 Pore Volume

The progress of groundwater restoration is often measured on the basis of the number of pore volumes (PVs) treated in each phase. Pore volume is a term used by the industry to define an indirect measurement of a unit volume of aquifer water affected by ISR operations. It represents the volume of water that fills the void space in a certain volume of rock or sediment. Pore volume provides a unit reference that an operator can use to describe the amount of treated water circulations needed to flow through a depleted ore body to achieve restoration standards. A more detailed discussion about pore volumes is included in **Section RP 2.3** of the main permit document.

One PV is equivalent to:

- PV = Area x Thickness x Horizontal Flare x Vertical Flare x Porosity x Conversion
- PV (in gallons) = A (ft^2) x T (ft) x 1.2 x 1.2 x 0.25 x 7.48 (gallons/ft^3)

The MU1 PV is based on the following data:

- Mine Unit Area = 2,115,594 ft^2
- Average Thickness = 12 ft

Therefore the mine unit area PV is:

- PV = 2,115,594 ft^2 x 12 feet x 1.2 x 1.2 x 0.25 x 7.48 (gallons/ft^3) = 68,362,458 gallons.

Additional data specific to MU1 is available in Worksheet 1 of **Table RP-4** of the main permit document.

6.1.2 Groundwater Restoration Methods

The number of PVs planned for each stage of groundwater restoration to meet the restoration objective and to demonstrate the application of BPT is as follows:

- Groundwater transfer: zero to two PVs (optional);
- Groundwater sweep: three-tenths (0.30) of a PV;
- RO permeate injection: six PVs; and
- Groundwater recirculation: one PV.

LC ISR, LLC will conduct an in-house water quality monitoring program throughout the progression of the groundwater restoration activities. Once the restoration requirements are believed to have been met, LC ISR, LLC will collect appropriate groundwater samples for verification, as outlined in the main permit document. If confirmed, LC ISR, LLC will initiate the stabilization monitoring phase and submit supporting documentation that the restoration parameters are at or below the restoration standards. If, at the end of restoration activities, the parameters are not at or below the primary standards, LC ISR will either re-initiate certain restoration phases or submit documentation to the agencies that BPT has been used in restoration and the aquifer has been restored to its original class of use. The documentation will include an evaluation of the water quality data and a narrative of the application of BPT.

Additional details, descriptions and discussion of the PV requirement determination of the various phases of groundwater restoration are presented in **Section RP 3.2** of the main permit document.

6.1.3 Evaluation of Groundwater Restoration Success

Upon completing groundwater restoration and notifying WDEQ, a groundwater stabilization monitoring program will begin in which the 13 MU1 pattern monitor wells will be sampled to evaluate restoration success will be sampled. Additional details of the stabilization monitoring program are discussed in **Section RP 2.4** and **Section RP 2.5** of the main permit document.

As described in **Section RP 2.2** (Restoration Requirements) of the main permit document, LC ISR, LLC will apply the Best Practicable Technology (BPT) to return the groundwater to the pre-operational class-of-use, and if possible, to approximate baseline conditions, in accordance with WDEQ statutes and regulations. Per **Section RP 2.5** of the main permit document, the criteria that will be used to evaluate restoration success are: the baseline and restoration means and associated statistics; the water treatment technology applied during restoration, and the EPA criteria. The criteria for the wells in the monitor ring (M) and the overlying (MO) and underlying (MU) aquifers are evaluated on a well-by-well basis. Additionally, **Section RP 2.5** of the main permit document outlines the procedure to follow if an M, MO or MU monitor well has been impacted by an excursion during mining. The criteria for the monitor wells in the pattern area (MP) are evaluated collectively (WDEQ-LQD & WQD, 1977).

Comparison of Baseline and Restoration Means. After the stability samples are analyzed, the minimum, mean, maximum, and standard deviation of each parameter will be calculated. For the MP wells, the calculations will be an average of the results for all the MP wells. For any M, MO, or MU well that went on excursion during mine unit operation, the calculations will be for that well.

Similar to the baseline samples, the 95% confidence interval will be used to establish that the actual population mean is represented by the restoration mean. The unpaired t-test, or similar parametric test, will be used to determine if the difference between the restoration and baseline means is statistically significant at the 95% confidence interval (see e.g., Part III of the EPA Unified Guidance [EPA 2009b]).

Application of Best Practicable Technology (BPT). If the restoration mean exceeds the baseline mean for a particular parameter, then LC ISR, LLC will provide detail on the technology applied per Section RP 2.5 of the main permit document. The WDEQ-LQD will evaluate whether the technology meets the definition of per Chapter 11, Section 5(a)(ii) of the WDEQ-LQD NonCoal Rules (2005).

EPA Criteria. Per Chapter 11, Section 5(a)(ii)(D) of the LQD NonCoal Rules and Regulations, the EPA Maximum Contaminant Limits must be taken into consideration if an MCL has been established for a particular parameter. If the baseline concentration exceeds the MCL, then the baseline becomes the criteria (see, e.g., Item 2 Fact Sheet #13 for WDEQ-VRP).

6.2 Surface Reclamation

6.2.1 Well Abandonment

Once NRC and WDEQ review and approve LC ISR, LLC's assessment that the groundwater restoration is complete in a given mine unit, all of the wells will be abandoned in accordance with applicable regulations, unless a well is needed for continued monitoring of another mine unit or retention of the well for future use has been requested and approved. A detailed description of LC ISR, LLC's well abandonment procedure has been submitted with the main permit application in **Section RP 3.1**.

6.2.2 Surface Reclamation

Once NRC and WDEQ review and approve LC ISR, LLC's assessment that the groundwater restoration is complete in a given mine unit, with the exception of any facilities, access roads, or utility corridors required for continued operation, all of the facilities associated with the 12 header houses in MU1 will be removed in accordance with **Section RP 3.2** of the main permit document. Soil replacement and reseeding will be performed in accordance with the methods described in **Section RP 4.5** of the main permit document.

7.0 References

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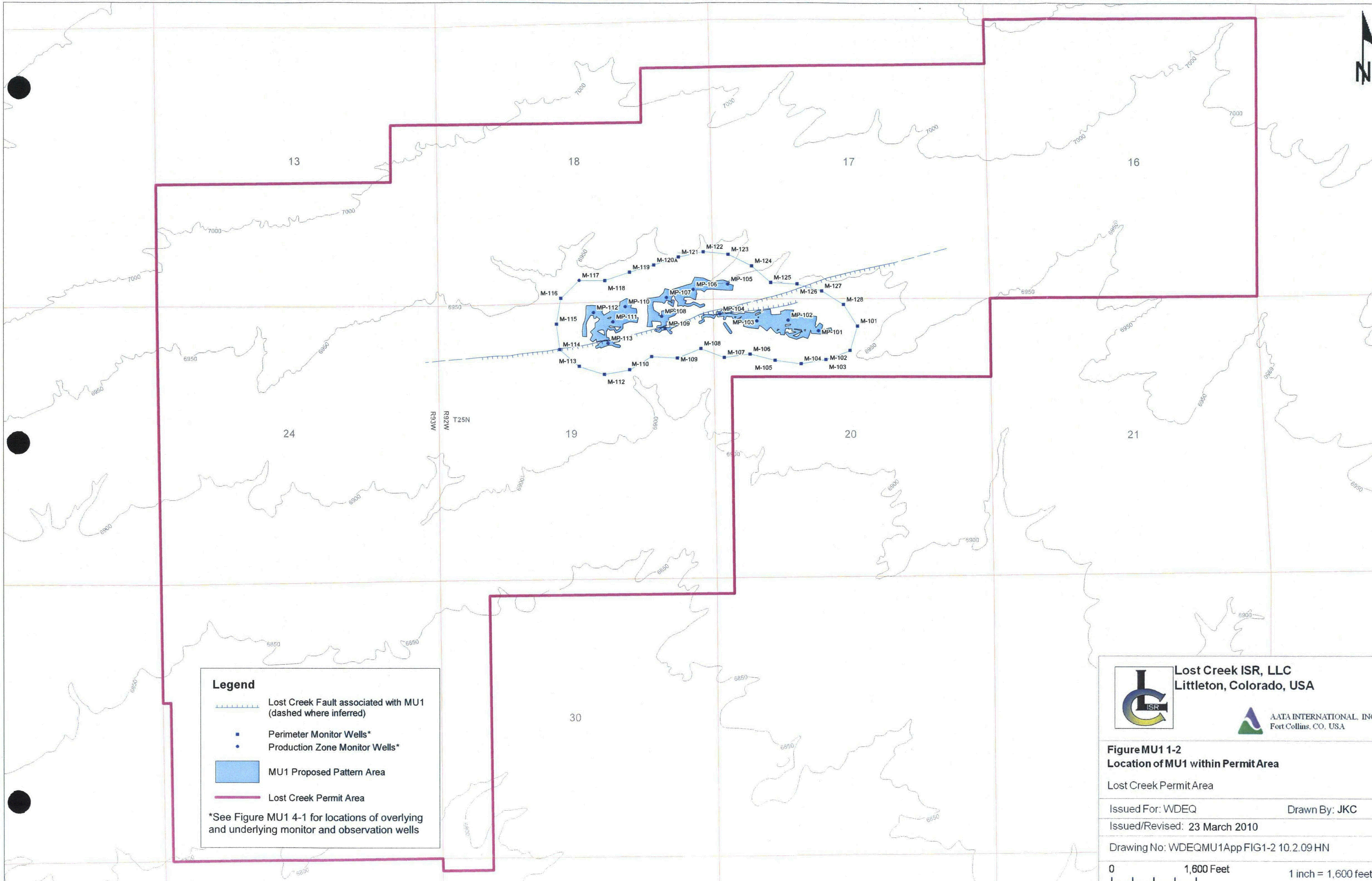

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M-102
M-103
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M-120A
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MP-110
MP-111
MP-112
MP-113
Legend
Lost Creek Fault associated with MU1 (dashed where inferred)
Perimeter Monitor Wells*
Production Zone Monitor Wells*
MU1 Proposed Pattern Area
Lost Creek Permit Area
*See Figure MU1 4-1 for locations of overlying and underlying monitor and observation wells
Lost Creek ISR, LLC
Littleton, Colorado, USA
ISR
AATA INTERNATIONAL, INC
Fort Collins, CO, USA
Figure MU1 1-2
Location of MU1 within Permit Area
Lost Creek Permit Area
Issued For: WDEQ
Drawn By: JKC
Issued/Revised: 23 March 2010
Drawing No: WDEQMU1App FIG1-2 10.2.09 HN
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1,600 Feet
1 inch = 1,600 feet

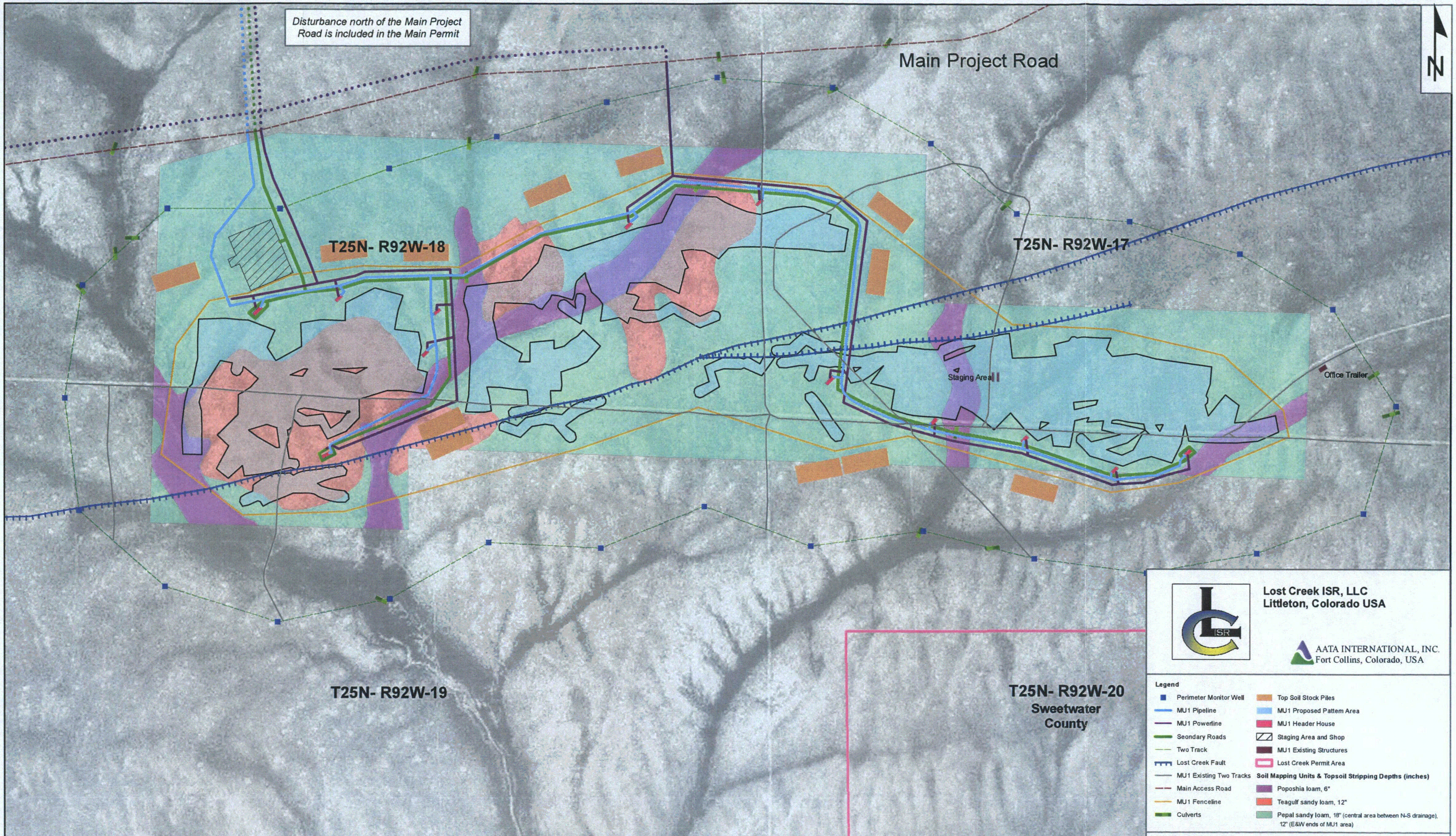
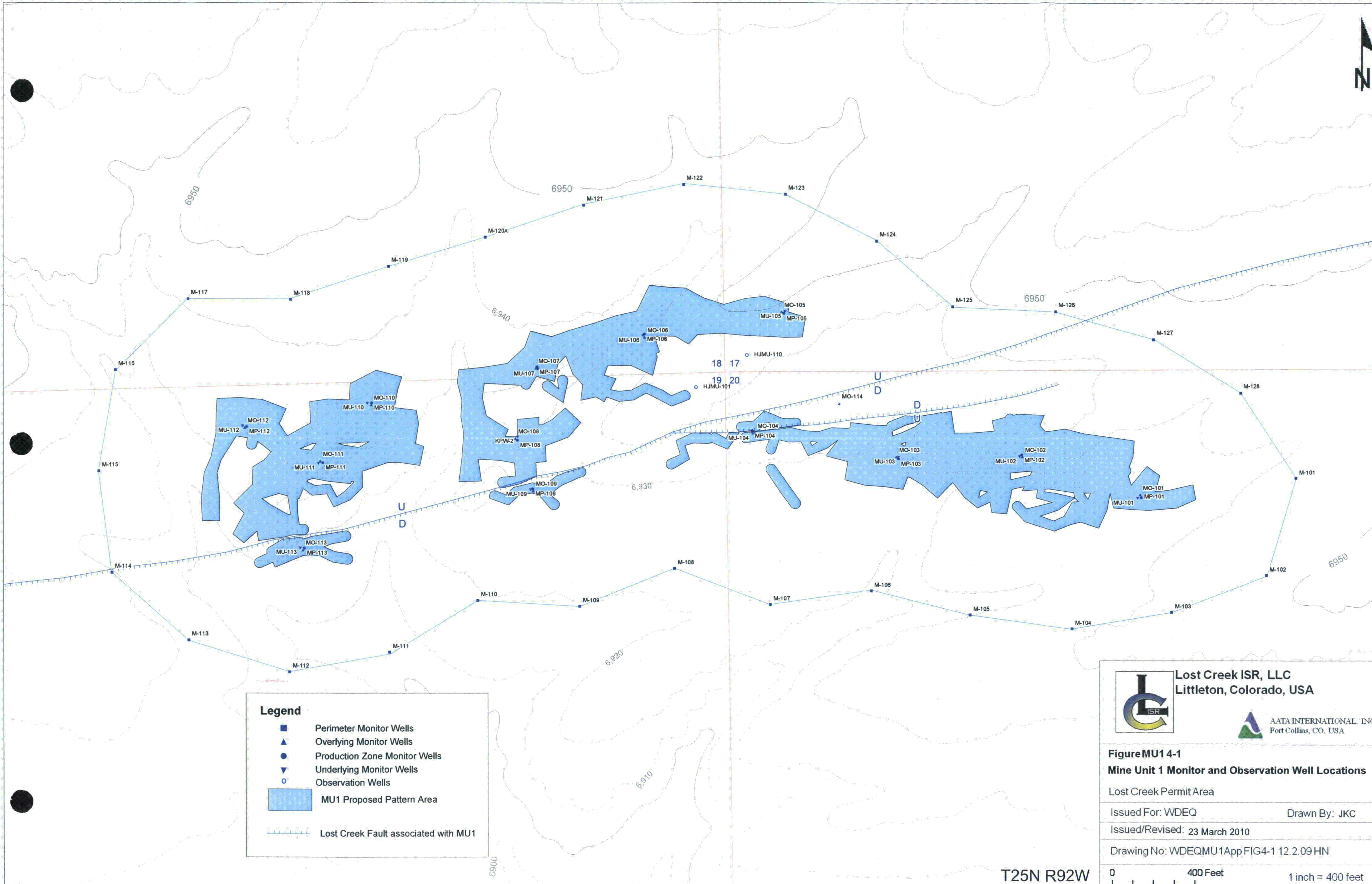


Figure MU1 3-1
Mine Unit 1 Soil Disturbance
Lost Creek Permit Area

Issued For: WDEQ — Drawn By: HN

Issued/Revised: 17 March 2010

Drawing No: WDEQMU1App FIG3-1 11.24.09 HN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HJMU-101
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Legend
Perimeter Monitor Wells
Overlying Monitor Wells
Production Zone Monitor Wells
Underlying Monitor Wells
Observation Wells
MU1 Proposed Pattern Area
Lost Creek Fault associated with MU1
T25N R92W
Lost Creek ISR, LLC
Littleton, Colorado, USA
ISR
AATA INTERNATIONAL, INC
Fort Collins, CO, USA
Figure MU1 4-1
Mine Unit 1 Monitor and Observation Well Locations
Lost Creek Permit Area
Issued For: WDEQ
Drawn By: JKC
Issued/Revised: 23 March 2010
Drawing No: WDEQMU1App FIG4-1 12.2.09 HN
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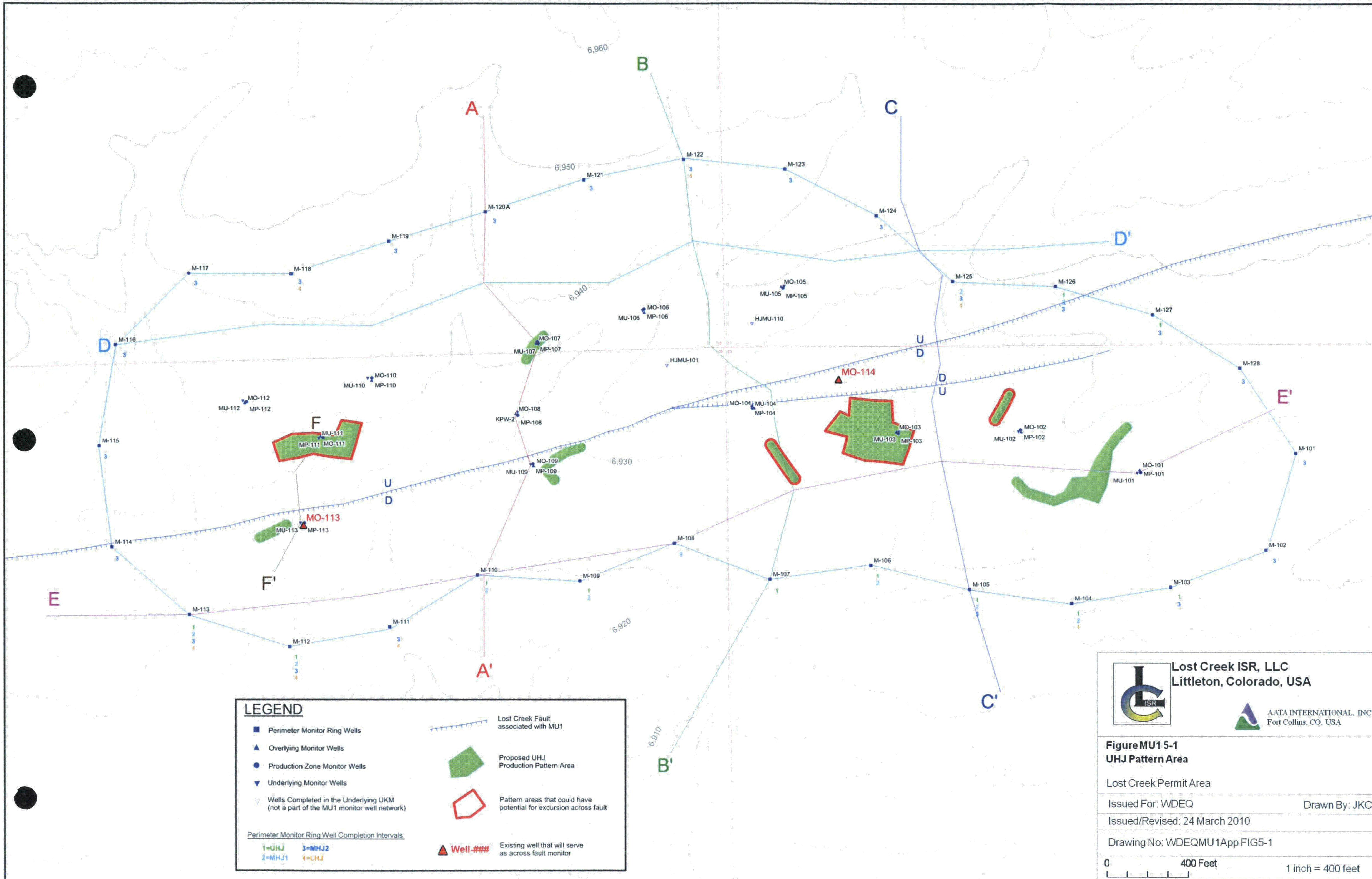
1 inch = 400 feet



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HJMU-110
LEGEND
Perimeter Monitor Ring Wells
Overlying Monitor Wells
Production Zone Monitor Wells
Underlying Monitor Wells
Wells Completed in the Underlying UKM
(not a part of the MU1 monitor well network)
Perimeter Monitor Ring Well Completion Intervals:
1=UHJ 3=MHJ2
2=MHJ1 4=LHJ
Lost Creek Fault
associated with MU1
Proposed UHJ
Production Pattern Area
Pattern areas that could have
potential for excursion across fault
Well-###
Existing well that will serve
as across fault monitor
Lost Creek ISR, LLC
Littleton, Colorado, USA
AATA INTERNATIONAL, INC
Fort Collins, CO, USA
Figure MU1 5-1
UHJ Pattern Area
Lost Creek Permit Area
Issued For: WDEQ
Drawn By: JKC
Issued/Revised: 24 March 2010
Drawing No: WDEQMU1App FIG5-1
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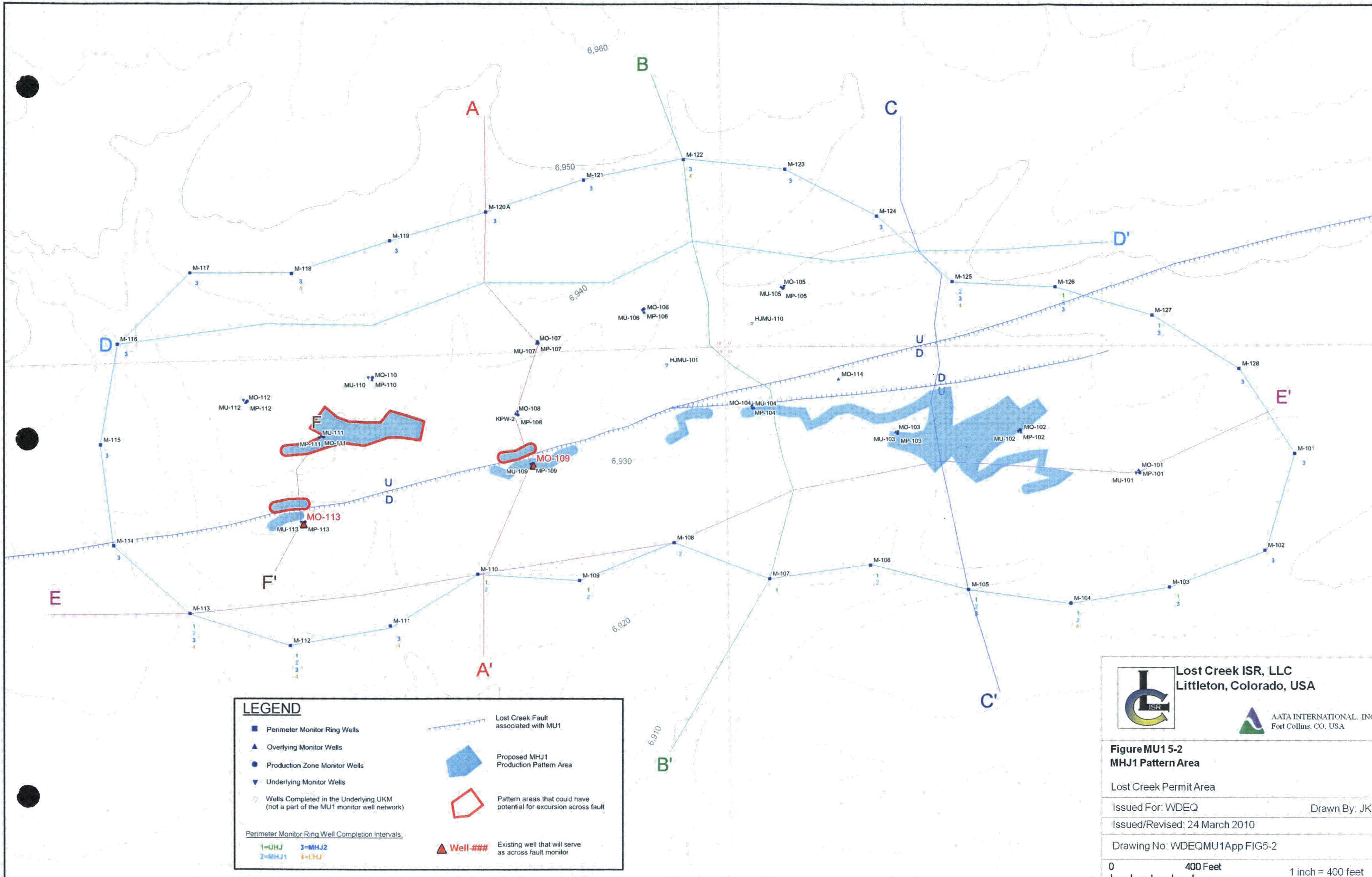
400 Feet
1 inch = 400 feet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MU-113
MP-113
MO-114
HJMU-101
HJMU-110
LEGEND
Perimeter Monitor Ring Wells
Overlying Monitor Wells
Production Zone Monitor Wells
Underlying Monitor Wells
Wells Completed in the Underlying UKM
(not a part of the MU1 monitor well network)
Perimeter Monitor Ring Well Completion Intervals
1=UHJ
2=MHJ1
3=MHJ2
4=LHJ
Lost Creek Fault
associated with MU1
Proposed MHJ1
Production Pattern Area
Pattern areas that could have
potential for excursion across fault
Well-###
Existing well that will serve
as across fault monitor
Lost Creek ISR, LLC
Littleton, Colorado, USA
ISR
AATA INTERNATIONAL, INC
Fort Collins, CO, USA
Figure MU1 5-2
MHJ1 Pattern Area
Lost Creek Permit Area
Issued For: WDEQ
Drawn By: JKC
Issued/Revised: 24 March 2010
Drawing No: WDEQMU1App FIG5-2
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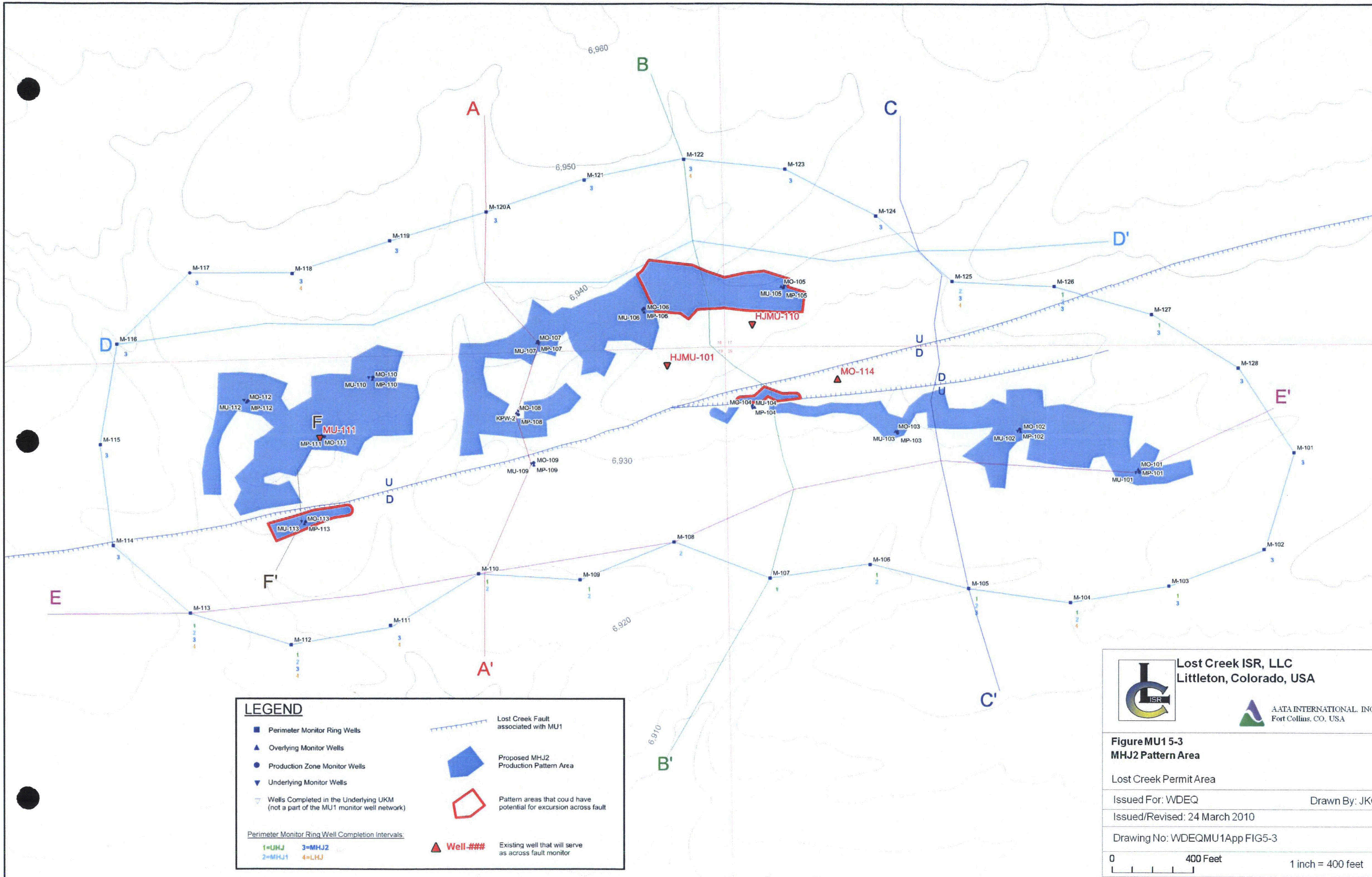
400 Feet
1 inch = 400 feet



Lost Creek ISR, LLC
Littleton, Colorado, USA

AATA INTERNATIONAL, INC
Fort Collins, CO, USA

Figure MU1 5-3
MHJ2 Pattern Area

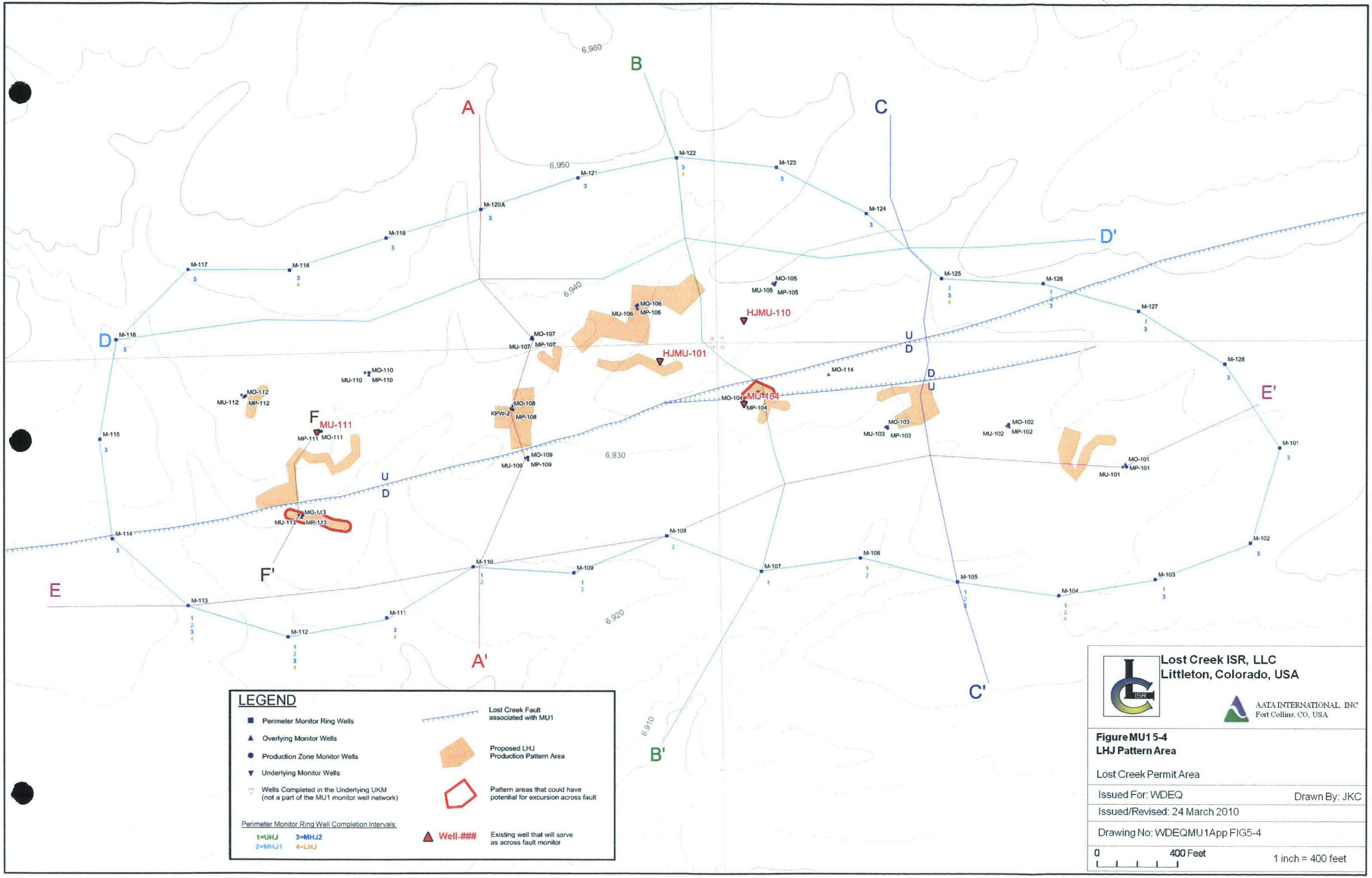
Lost Creek Permit Area

Issued For: WDEQ
Drawn By: JKC

Issued/Revised: 24 March 2010

Drawing No: WDEQMU1App FIG5-3

0 400 Feet
1 inch = 400 feet



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MP-111
MU-111
MO-112
MP-112
MU-112
MO-113
MP-113
MU-113
MO-114
HJMU-110
HJMU-101
LEGEND
Perimeter Monitor Ring Wells
Overlying Monitor Wells
Production Zone Monitor Wells
Underlying Monitor Wells
Wells Completed in the Underlying UKM (not a part of the MU1 monitor well network)
Perimeter Monitor Ring Well Completion Intervals:
1=UHJ
2=MHJ1
3=MHJ2
4=LHJ
Lost Creek Fault associated with MU1
Proposed LHJ Production Pattern Area
Pattern areas that could have potential for excursion across fault
Well-###
Existing well that will serve as across fault monitor
Lost Creek ISR, LLC
Littleton, Colorado, USA
AATA INTERNATIONAL, INC
Fort Collins, CO, USA
Figure MU1 5-4
LHJ Pattern Area
Lost Creek Permit Area
Issued For: WDEQ
Drawn By: JKC
Issued/Revised: 24 March 2010
Drawing No: WDEQMU1App FIG5-4
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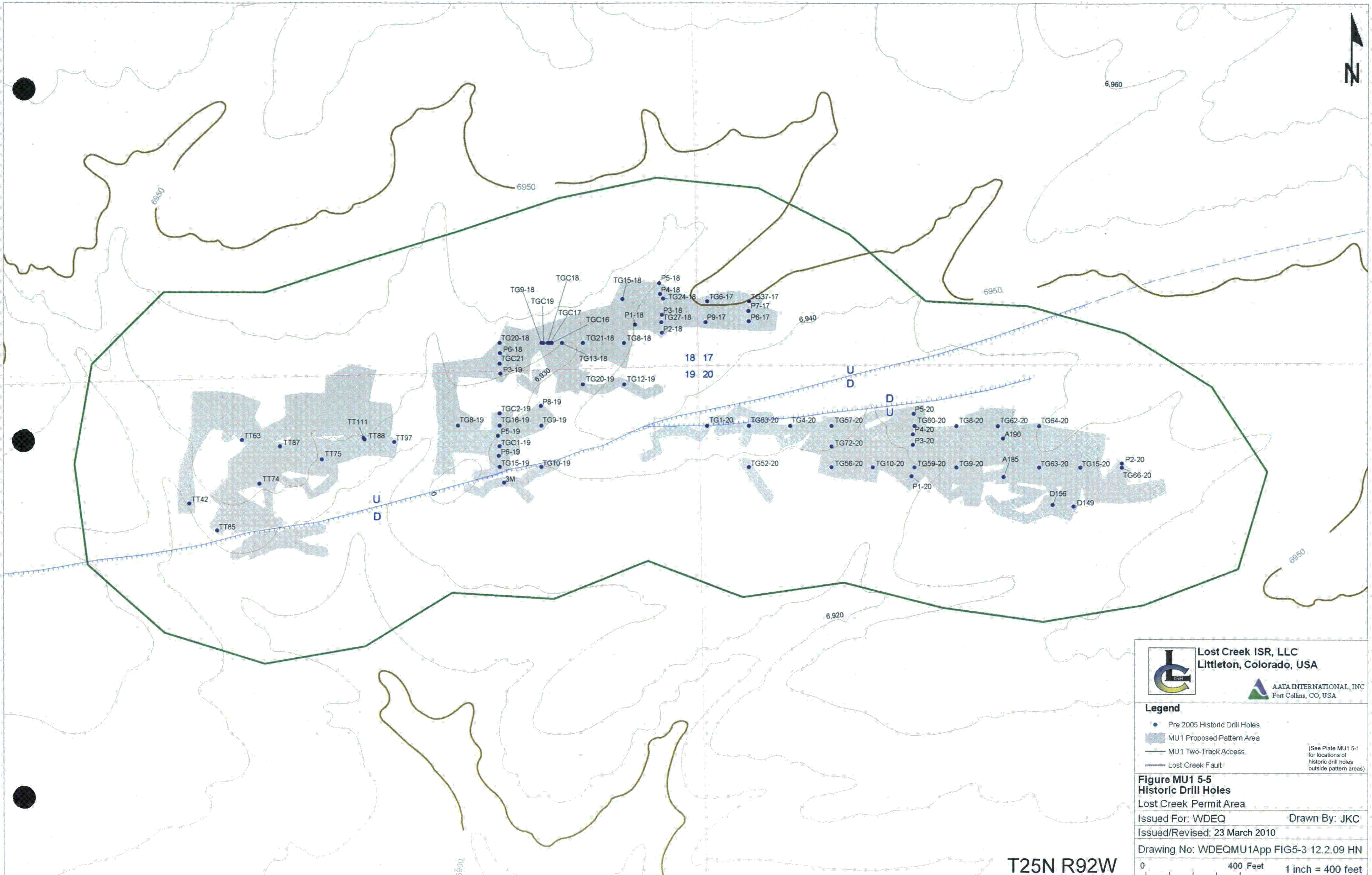
400 Feet
1 inch = 400 feet



Lost Creek ISR, LLC
Littleton, Colorado, USA

AATA INTERNATIONAL, INC
Fort Collins, CO, USA

Legend

- Pre 2005 Historic Drill Holes
- MU1 Proposed Pattern Area
- MU1 Two-Track Access
- Lost Creek Fault

(See Plate MU1 5-1 for locations of historic drill holes outside pattern areas)

Figure MU1 5-5
Historic Drill Holes
Lost Creek Permit Area

Issued For: WDEQ | Drawn By: JKC

Issued/Revised: 23 March 2010

Drawing No: WDEQMU1App FIG5-3 12.2.09 HN

0 400 Feet | 1 inch = 400 feet

Table MU1 3-1 Topsoil Salvage (Page 1 of 2)

Facility [1]	Type of Disturbance [2]	Soil Type (acres) and Topsoil Stripping Depths (inches) [3]				Topsoil Volumes	Comments
		Poposhia Loam	Teagulf Sandy Loam	Pepal Sandy Loam		Cubic Yards	
		6	12	12	18		
Support Facilities							
Staging Area & Shop	LT	--	--	--	1.18	1903.10	
Access Roads [3]	LT	0.37	0.40	1.72	0.81	6678.84	Secondary roads including 'main' road in MU1 and roads from Header Houses to that road.
Trunkline	ST	0.10	0.11	0.53	0.25	1462.83	Trench.
Transmission Line	--	--	--	--	--	--	No topsoil will be stripped for installation of the transmission line (see Table MU1 3-2, Vegetation Disturbance).
Fence	--	--	--	--	--	--	No topsoil will be stripped for installation of the fence (see Table MU1 3-2, Vegetation Disturbance).
Header Houses	LT	--	0.03	0.35	0.07	733.82	Area includes building footprint, perimeter access, and topsoil stockpile. Roads from Header Houses to 'main' MU1 road are included under Access Roads.
Pattern Area							
Drill Pits & Trenches	ST	0.43	1.16	1.29	0.86	6375.39	Based on 10% ST disturbance within pattern area (see Figure OP-6b in the main permit document). The LT disturbances for Header Houses and Access Roads are specified above.
Monitor Well Ring							
Mud Pits for Monitor Wells	--	--	--	--	--	--	Monitor ring wells were installed in Summer/Fall 2008 and associated disturbance reclaimed.
Monitor Wells	--	--	--	--	--	--	The above-ground casing for each well occupies a very small space (e.g., 1 ft by 1 ft). Topsoil removed during installation of the wells in Fall 2008 was replaced around the wells.
Two-Track Road (monitor well ring)	--	--	--	--	--	--	Topsoil will not be stripped from this road unless problems are encountered in maintaining portions of road (e.g., drainage crossing); therefore, no disturbance is planned at this time.

Table MU1 3-1 Topsoil Salvage (Page 2 of 2)

Facility [1]	Type of Disturbance [2]	Soil Type (acres) and Topsoil Stripping Depths (inches) [3]				Topsoil Volumes	Comments
		Poposhia Loam	Teagulf Sandy Loam	Pepal Sandy Loam		Cubic Yards	
Topsoil Salvage (acres)	LT	0.37	0.43	2.07	2.06	69.31	
	ST	0.53	1.27	1.82	1.11	58.32	
Topsoil Salvage (cubic yards) [4]	LT	49	58	279	276	9315.76	Recommended topsoil stripping depths were 24 inches or less (Attachment MU1 3-1). For a conservative estimate of the amount of topsoil to be removed and stockpiled, a depth of 24 inches was used for the disturbance calculations.
	ST	71	170	245	149	7838.22	

[1] Facility locations and distribution of vegetation types are shown on Figure MU1 3-2.

[2] LT = Long Term topsoil stockpile, i.e., duration of mine unit. ST = Short Term topsoil stockpile, i.e., a few days to a few months.

[3] Includes road through mine unit and roads connecting header houses to that road.

[4] Rounded to nearest five cubic yards.

Table MU1 4-1a Monitor and Observation Wells

Monitor Ring (M) Wells[1]		Overlying Aquifer Monitor (MO) Wells	Underlying Aquifer Monitor (MU) & Observation (HJMU) Wells	Production Zone Monitor (MP) Wells
M-101	M-115	MO-101	MU-101	MP-101
M-102	M-116	MO-102	MU-102	MP-102
M-103	M-117	MO-103	MU-103	MP-103
M-104	M-118	MO-104	MU-104	MP-104
M-105	M-119	MO-105	MU-105	MP-105
M-106	M-120A[2]	MO-106	MU-106	MP-106
M-107	M-121	MO-107	MU-107	MP-107
M-108	M-122	MO-108	KPW-2[4]	MP-108
M-109	M-123	MO-109	MU-109	MP-109
M-110	M-124	MO-110	MU-110	MP-110
M-111	M-125	MO-111	MU-111	MP-111
M-112	M-126	MO-112	MU-112	MP-112
M-113	M-127	MO-113	MU-113	MP-113
M-114	M-128	MO-114[3]	HJMU-101	---
---	---	---	HJMU-110	---

[1] Detailed monitor well information (e.g., well depths, screened intervals) provided in Attachment MU1 2-1.

[2] Well M-120 failed the MIT, was properly abandoned and was replaced with well M-120A.

[3] Well MO-114 was added to this list to ensure adequate monitoring near the Lost Creek Fault and associated splinter fault.

[4] Well MU-108 failed the MIT, was properly abandoned and replaced with well KPW-2, which was originally used as a pump test well within the same horizon as and 17 feet from well MU-108.

Table MU1 4-1b Results of MU1 MIT Tests on Monitor Wells (Page 1 of 2)

Well	Test Date	Pass	Fail	Depth of Packer (feet)	Initial Test Pressure (psi)	Pressure Loss After 10 min. (psi)	Comments
M-101	10/21/2008	X		400	110	4	
M-102	10/21/2008	X		398	110	5	
M-103	10/22/2008	X		340	110	3.5	
M-104	10/22/2008		X	340	100	9	Abandoned
M-104A	11/18/2008	X		345	100	2	
M-105	10/28/2008	X		335	100	3	
M-106	10/28/2008	X		330	100	4	
M-107	10/28/2008	X		345	100	1	
M-108	10/24/2008	X		380	100	2	
M-109	10/24/2008	X		355	100	3.75	
M-110	10/24/2008	X		360	100	3	
M-111	10/24/2008	X		390	100	3	
M-112	10/23/2008	X		360	100	2	
M-113	10/27/2008	X		375	100	4	
M-114	10/27/2008	X		445	100	5	
M-115	10/27/2008	X		411	100	5	
M-116	2/10/2009	X		400	100	2	
M-117	2/6/2009	X		408	100	1	
M-118	2/6/2009	X		400	100	1	
M-119	2/6/2009	X		400	100	4	
M-120	2/6/2009		X	385	50	12	Abandoned
M-120A	4/15/2009	X		385	100	1	
M-121	2/5/2009	X		404	100	4	
M-122	2/5/2009	X		400	100	5	
M-123	2/5/2009	X		400	100	5	
M-124	2/5/2009	X		300	100	0	
M-125	10/20/2008	X		340	100	2	
M-126	10/20/2008	X		300	100	3.75	
M-127	10/20/2008	X		375	104.5	3.5	
M-128	10/20/2008	X		400	100	1.5	
MO-101	2/10/2009	X		280	100	0	
MO-102	3/3/2009	X			100	4	
MO-103	3/18/2009	X		275	100	3	
MO-104	4/14/2009	X		300	100	2	
MO-105	3/18/2009	X		275	100	1	
MO-106	3/3/2009	X		260	100	2	
MO-107	2/19/2009	X		374	100	0	
MO-108	3/5/2009	X		270	100	3	

Table MU1 4-1b Results of MU1 MIT Tests on Monitor Wells (Page 2 of 2)

Well	Test Date	Pass	Fail	Depth of Packer (feet)	Initial Test Pressure (psi)	Pressure Loss After 10 min. (psi)	Comments
MO-109	4/14/2009	X		300	100	0	
MO-110	2/18/2009	X		285	100	0	
MO-111	3/6/2009	X		280	100	1	
MO-112	2/12/2009	X		280	100	1	
MO-113	2/18/2009	X		320	100	2	
MP-101	2/10/2009	X		390	100	3	
MP-102	3/3/2009	X		380	100	2	
MP-103	3/18/2009	X		335	100	2	
MP-104	4/14/2009	X		400	100	4	
MP-105	3/18/2009	X		370	100	2	
MP-106	4/16/2009	X		370	100	4	
MP-107	3/5/2009	X		370	100	1	
MP-108	3/5/2009	X		390	100	2	
MP-109	4/14/2009	X		400	100	0	
MP-110	2/18/2009	X		390	100	1	
MP-111	3/5/2009	X		360	100	4.5	
MP-112	2/11/2009	X		385	100	4	
MP-113	2/18/2009	X		420	100	4	
MU-101	2/10/2009	X		490	100	1	
MU-102	3/3/2009	X		490	100	3	
MU-103	3/18/2009	X		490	100	4	
MU-104	4/14/2009	X		523	100	3	
MU-105	3/18/2009	X		470	100	1.5	
MU-106	3/3/2009	X		460	100	5	
MU-107	2/19/2009	X		480	100	2	
MU-108	Problem with well construction found during pump test. Abandoned.						
MU-109	4/14/2009	X		300	100	0	
MU-110	2/13/2009	X		490	100	4	
MU-111	3/5/2009	X		485	110	5	
MU-112	2/11/2009	X		480	100	4	
MU-113	2/18/2009	X		500	90	1	
KPW-2	4/22/2009	X		473	100	2	

Table MU1 4-2a Monitor Well Sampling Events (Page 1 of 3)

Wells	Apr-09				May-09								Jun-09				Nov-09	Dec-09			Jan-10		Feb-10		Comments
	20th	21st	22nd	23rd	4th	5th	6th	7th	18th	19th	20th	21st	1st	2nd	3rd	4th	18th	1st	15th	16th	5th	14th	2nd	3rd	
Monitor Ring Wells																									
M-101	X				X				X				X												
M-102	X				X				X				X												
M-103	X				X				X				X												
M-104	X				X				X				X												
M-105	X				X				X				X												
M-106	X				X				X				X												
M-107	X				X				X				X												
M-108	X				X				X				X												
M-109	X				X				X				X												
M-110	X				X				X				X												
M-111	X				X				X				X												
M-112	X				X				X				X												
M-113	X				X				X				X												
M-114	X				X				X				X												
M-115	X				X				X				X												
M-116	X				X				X				X												
M-117	X				X				X				X												
M-118	X				X				X				X												
M-119		X				X				X				X											
M-120A	X				X				X				X				X	X	X			X			Underwent recompletion and then four samplings.
M-121	X				X				X				X												
M-122		X				X				X				X											
M-123		X				X				X				X											
M-124		X				X				X				X											
M-125		X				X				X				X											
M-126		X				X				X				X											
M-127		X				X				X				X											
M-128		X				X				X				X											

Table MU1 4-2a Monitor Well Sampling Events (Page 2 of 3)

Wells	Apr-09				May-09								Jun-09				Nov-09	Dec-09			Jan-10		Feb-10		Comments
	20th	21st	22nd	23rd	4th	5th	6th	7th	18th	19th	20th	21st	1st	2nd	3rd	4th	18th	1st	15th	16th	5th	14th	2nd	3rd	
Overlying Monitor Wells																									
MO-101				X				X				X				X									
MO-102				X				X				X				X									
MO-103				X				X				X				X									
MO-104			X				X				X				X										
MO-105				X				X				X				X									
MO-106			X				X				X				X										
MO-107			X				X				X				X										
MO-108			X				X				X				X										
MO-109			X				X				X				X										
MO-110		X				X				X				X											
MO-111						X				X				X			X								Fourth sample inadvertently not collected when originally scheduled.
MO-112		X				X				X				X											
MO-113		X				X				X				X											
MO-114																		X		X		X		X	Added to provide additional monitoring near Lost Creek Fault.
Underlying Monitor Wells																									
MU-101				X				X				X				X									
MU-102				X				X				X				X									
MU-103				X				X				X				X									
MU-104			X				X				X				X										
Underlying Monitor Wells (continued)																									
MU-105				X				X				X				X									
MU-106			X				X				X				X										
MU-107			X				X				X				X										
KPW-2				X				X				X				X									Sampled in place of well MU-108 (which was abandoned due to casing problems).
MU-109			X				X				X				X										
MU-110		X				X				X				X											
MU-111		X					X			X				X											
MU-112		X				X				X				X											
MU-113		X				X				X				X											

Table MU1 4-2a Monitor Well Sampling Events (Page 3 of 3)

Wells	Apr-09				May-09								Jun-09				Nov-09	Dec-09			Jan-10		Feb-10		Comments
	20th	21st	22nd	23rd	4th	5th	6th	7th	18th	19th	20th	21st	1st	2nd	3rd	4th	18th	1st	15th	16th	5th	14th	2nd	3rd	
Pattern Area Wells																									
MP-101				X				X				X				X									
MP-102				X				X				X				X									
MP-103				X				X				X				X									
MP-104			X				X				X				X										
MP-105				X				X				X				X									
MP-106			X				X				X				X										
MP-107			X				X				X				X										
MP-108			X				X				X				X										
MP-109																		X		X	X		X		Underwent recompletion and then four samplings.
MP-110		X				X				X				X											
MP-111		X						X				X				X									
MP-112		X				X				X				X											
MP-113			X				X				X				X										

Table MU1 4-2b QA/QC Monitor Well Sampling Events

Sampling	Duplicate	Field Blank	Comments
4/20/2009	M-129	M-130	Duplicate from well M-110
4/21/2009	M-131	M-132	Duplicate from well MP-110
4/22/2009	M-133	M-134	Duplicate from well MU-107
4/23/2009	M-135	M-136	Duplicate from well MP-105
5/4/2009	M-129	M-130	Duplicate from well M-110
5/5/2009	M-131	M-132	Duplicate from well MO-110
5/6/2009	M-133	M-134	Duplicate from well MU-107
5/7/2009	M-135	M-136	Duplicate from well MU-105
5/18/2009	M-129	M-130	Duplicate from well M-110
5/19/2009	M-131	M-132	Duplicate from well MO-110
5/20/2009	M-133	M-134	Duplicate from well MU-107
5/21/2009	M-135	M-136	Duplicate from well MU-105
6/1/2009	M-129	M-130	Duplicate from well M-110
6/2/2009	M-131	M-132	Duplicate from well MO-110
6/3/2009	M-133	M-134	Duplicate from well MU-107
6/4/2009	M-135	M-136	Duplicate from well MU-105
11/18/2009 [1]	--	--	
12/1/2009 [1] 12/15/2009	--	MO-115	
12/15/2009 [1]	MO-120A	--	Duplicate from well M-120A
12/16/2009 [1]	--	--	
1/5/2010 [1]	--	--	
1/14/2010 [1]	MO-120	--	Duplicate from well MO-114
2/2/2010 [1]	--	B-2	
2/3/2010 [1]	--	--	

[1] Few samples collected during the sampling event; therefore, one blank sample and one duplicate sample were collected at least every 20 samples in accordance with the Groundwater Monitoring Program (Attachment OP-8 of the Main Permit Application).

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 1 of 8)

Well	Date Measured	Groundwater Elevation (ft, msl)	Comments
M-101	04/20/09	6771.99	
M-101	05/04/09	6772.24	
M-101	05/18/09	6772.00	
M-101	06/01/09	6772.01	
M-102	04/20/09	6771.15	
M-102	05/04/09	6771.63	
M-102	05/18/09	6770.53	
M-102	06/01/09	6771.22	
M-103	04/20/09	6785.54	
M-103	05/04/09	6768.50	
M-103	05/18/09	6768.81	
M-103	06/01/09	6769.83	
M-104	04/20/09	6758.24	
M-104	05/04/09	6758.62	
M-104	05/18/09	6758.31	
M-104	06/01/09	6758.47	
M-105	04/20/09	6754.74	
M-105	05/04/09	6755.05	
M-105	05/18/09	6754.84	
M-105	06/01/09	6755.02	
M-106	04/20/09	6753.13	
M-106	05/04/09	6754.23	
M-106	05/18/09	6753.49	
M-106	06/01/09	6754.04	
M-107	04/20/09	6748.13	
M-107	05/04/09	6748.46	
M-107	05/18/09	6748.25	
M-107	06/01/09	6748.18	
M-108	04/20/09	6745.47	
M-108	05/04/09	6747.27	
M-108	05/18/09	6747.15	
M-108	06/01/09	6747.05	
M-109	04/20/09	6744.25	
M-109	05/04/09	6744.39	
M-109	05/18/09	6744.59	
M-109	06/01/09	6750.60	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 2 of 8)

M-110	04/20/09	6740.65	
M-110	05/04/09	6741.86	
M-110	05/18/09	6741.67	
M-110	06/01/09	6741.10	
M-111	04/20/09	6738.08	
M-111	05/04/09	6738.29	
M-111	05/18/09	6738.17	
M-111	06/01/09	6738.19	
M-112	04/20/09	6736.47	
M-112	05/04/09	6736.22	
M-112	05/18/09	6735.89	
M-112	06/01/09	6736.68	
M-113	04/20/09	6735.59	
M-113	05/04/09	6736.26	
M-113	05/18/09	6735.76	
M-113	06/01/09	6735.86	
M-114	04/20/09	6740.65	
M-114	05/04/09	6740.77	
M-114	05/18/09	6740.52	
M-114	06/01/09	6740.57	
M-115	04/20/09	6753.65	
M-115	05/04/09	6753.65	
M-115	05/18/09	6753.75	
M-115	06/01/09	6754.79	
M-116	04/20/09	6754.90	
M-116	05/04/09	6752.89	
M-116	05/18/09	6753.15	
M-116	06/01/09	6742.71	
M-117	04/20/09	6758.66	
M-117	05/04/09	6758.80	
M-117	05/18/09	6758.55	
M-117	06/01/09	6758.85	
M-118	04/20/09	6761.13	
M-118	05/04/09	6761.06	
M-118	05/18/09	6760.13	
M-118	06/01/09	6759.96	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 3 of 8)

M-119	04/21/09	6764.01	
M-119	05/05/09	6766.41	
M-119	05/19/09	6764.32	
M-119	06/02/09	6764.12	
M-120A	11/18/09	6767.80	
M-120A	12/01/09	6767.90	
M-120A	12/15/09	6767.88	
M-120A	01/14/10	6767.79	
M-121	04/20/09	6770.01	
M-121	05/04/09	6770.01	
M-121	05/18/09	6769.96	
M-121	06/01/09	6770.36	
M-122	04/21/09	6770.75	
M-122	05/05/09	6771.07	
M-122	05/19/09	6770.25	
M-122	06/02/09	6769.90	
M-123	04/21/09	6772.65	
M-123	05/05/09	6773.01	
M-123	05/19/09	6772.94	
M-123	06/02/09	6772.88	
M-124	04/21/09	6773.80	
M-124	05/05/09	6774.11	
M-124	05/19/09	6773.79	
M-124	06/02/09	6773.59	
M-125	04/21/09	6774.12	
M-125	05/05/09	6774.51	
M-125	05/19/09	6774.61	
M-125	06/02/09	6774.76	
M-126	04/21/09	6775.54	
M-126	05/05/09	6775.72	
M-126	05/19/09	6775.11	
M-126	06/02/09	6775.57	
M-127	04/21/09	6772.78	
M-127	05/05/09	6772.74	
M-127	05/19/09	6772.98	
M-127	06/02/09	6772.90	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 4 of 8)

M-128	04/21/09	6773.13	
M-128	05/05/09	6773.45	
M-128	05/19/09	6773.35	
M-128	06/02/09	6773.31	
MO-101	04/23/09	6782.04	
MO-101	05/07/09	6779.84	
MO-101	05/21/09	6781.88	
MO-101	06/04/09	6781.68	
MO-102	04/23/09	6778.56	
MO-102	05/07/09	6778.25	
MO-102	05/21/09	6778.00	
MO-102	06/04/09	6777.88	
MO-103	04/23/09	6776.82	
MO-103	05/07/09	6776.82	
MO-103	05/21/09	6776.76	
MO-103	06/04/09	6776.76	
MO-104	04/22/09	6771.53	
MO-104	05/06/09	6771.41	
MO-104	05/20/09	6771.36	
MO-104	06/03/09	6771.22	
MO-105	04/23/09	6782.16	
MO-105	05/07/09	6782.12	
MO-105	05/21/09	6782.05	
MO-105	06/04/09	6781.99	
MO-106	04/22/09	6776.56	
MO-106	05/06/09	6776.43	
MO-106	05/20/09	6776.44	
MO-106	06/03/09	6776.27	
MO-107	04/22/09	6775.99	
MO-107	05/06/09	6775.73	
MO-107	05/20/09	6775.79	
MO-107	06/03/09	6770.39	
MO-108	04/22/09	6775.26	
MO-108	05/06/09	6774.36	
MO-108	05/20/09	6774.11	
MO-108	06/03/09	6774.16	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 5 of 8)

MO-109	04/22/09	6765.59	
MO-109	05/06/09	6764.53	
MO-109	05/20/09	6764.38	
MO-109	06/03/09	6765.36	
MO-110	04/21/09	6765.39	
MO-110	05/05/09	6769.70	
MO-110	05/19/09	6769.63	
MO-110	06/02/09	6768.09	
MO-111	04/21/09	6768.40	
MO-111	05/05/09	6768.43	
MO-111	05/19/09	6768.83	
MO-111	11/18/09	6768.34	
MO-112	04/21/09	6767.46	
MO-112	05/05/09	6767.56	
MO-112	05/19/09	6737.15	
MO-112	06/02/09	6768.41	
MO-113	04/21/09	6743.39	
MO-113	05/05/09	6743.42	
MO-113	05/19/09	6760.31	
MO-113	06/02/09	6743.48	
MO-114	12/01/09	6773.89	
MO-114	12/16/09	6774.56	
MO-114	01/14/10	6774.51	
MO-114	02/03/10	6774.45	
MP-101	04/23/09	6769.95	
MP-101	05/07/09	6772.20	
MP-101	05/21/09	6770.10	
MP-101	06/04/09	6770.02	
MP-102	04/23/09	6761.27	
MP-102	05/07/09	6761.41	
MP-102	05/21/09	6761.02	
MP-102	06/04/09	6761.12	
MP-103	04/23/09	6755.83	
MP-103	05/07/09	6756.18	
MP-103	05/21/09	6754.53	
MP-103	06/04/09	6755.96	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 6 of 8)

MP-104	04/22/09	6752.90	
MP-104	05/06/09	6752.95	
MP-104	05/20/09	6774.46	
MP-104	06/03/09	6753.02	
MP-105	04/23/09	6769.58	
MP-105	05/07/09	6769.67	
MP-105	05/21/09	6769.94	
MP-105	06/04/09	6769.57	
MP-106	04/22/09	6744.49	
MP-106	05/06/09	6743.84	
MP-106	05/20/09	6744.41	
MP-106	06/03/09	6744.54	
MP-107	04/22/09	6766.29	
MP-107	05/06/09	6767.03	
MP-107	05/20/09	6767.28	
MP-107	06/03/09	6767.04	
MP-108	04/22/09	6764.85	
MP-108	05/06/09	6764.56	
MP-108	05/20/09	6764.75	
MP-108	06/03/09	6764.56	
MP-109	12/01/09	NA	Water level data not available.
MP-109	12/16/09	NA	Water level data not available.
MP-109	01/05/10	6747.09	
MP-109	02/02/10	6746.71	
MP-110	04/21/09	6759.95	
MP-110	05/05/09	6760.13	
MP-110	05/19/09	6759.98	
MP-110	06/02/09	6759.84	
MP-111	04/23/09	6759.41	
MP-111	05/07/09	6758.93	
MP-111	05/21/09	6758.73	
MP-111	06/04/09	6758.85	
MP-112	04/21/09	6758.25	
MP-112	05/05/09	6758.25	
MP-112	05/19/09	6758.58	
MP-112	06/02/09	6758.34	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 7 of 8)

MP-113	04/22/09	6737.54	
MP-113	05/06/09	6737.85	
MP-113	05/20/09	6737.60	
MP-113	06/03/09	6736.45	
MU-101	04/23/09	6751.97	
MU-101	05/07/09	6750.07	
MU-101	05/21/09	6751.69	
MU-101	06/04/09	6751.13	
MU-102	04/23/09	6748.84	
MU-102	05/07/09	6750.23	
MU-102	05/21/09	6749.83	
MU-102	06/04/09	6750.98	
MU-103	04/23/09	6750.55	
MU-103	05/07/09	6750.52	
MU-103	05/21/09	6750.12	
MU-103	06/04/09	6748.50	
MU-104	04/22/09	6745.58	
MU-104	05/06/09	6746.31	
MU-104	05/20/09	6745.62	
MU-104	06/03/09	6745.58	
MU-105	04/23/09	6747.08	
MU-105	05/07/09	6747.27	
MU-105	05/21/09	6746.96	
MU-105	06/04/09	6747.17	
MU-106	04/22/09	6767.60	
MU-106	05/06/09	6769.63	
MU-106	05/20/09	6767.75	
MU-106	06/03/09	6767.76	
MU-107	04/22/09	6742.07	
MU-107	05/06/09	6742.56	
MU-107	05/20/09	6741.26	
MU-107	06/03/09	6741.83	
MU-109	04/22/09	6739.73	
MU-109	05/06/09	6740.00	
MU-109	05/20/09	6739.79	
MU-109	06/03/09	6739.80	

Table MU1 4-3 Water Level Measurements in Monitor and Observation Wells (Page 8 of 8)

MU-110	04/21/09	6735.68	
MU-110	05/05/09	6738.23	
MU-110	05/19/09	6737.88	
MU-110	06/02/09	6736.69	
MU-111	04/21/09	6734.56	
MU-111	05/05/09	6737.20	
MU-111	05/19/09	6735.27	
MU-111	06/02/09	6735.23	
MU-112	04/21/09	6736.75	
MU-112	05/05/09	6735.95	
MU-112	05/19/09	6735.60	
MU-112	06/02/09	6736.75	
MU-113	04/21/09	6735.54	
MU-113	05/05/09	6736.20	
MU-113	05/19/09	6735.92	
MU-113	06/02/09	6735.00	
KPW-2	04/23/09	6740.20	
KPW-2	05/07/09	6740.07	
KPW-2	05/21/09	6739.97	
KPW-2	06/04/09	NA	Water level data not available.
HJMU-101	12/08/08	6748.86	
HJMU-110	12/08/08	6749.40	

Table MU1 4-4 General Laboratory Analyses

Parameter	Laboratory Analysis Method	Detection Limit[1]
Physical		
Specific Conductance at 25 °C	APHA SM A2510 B	1 µmhos/cm
Laboratory pH	APHA SM A4500-H B	0.01 SU
TDS at 180 °C	APHA SM A2540 C	10 mg/L
Major Ions		
Total Alkalinity as $CaCO_3$	APHA SM A2320 B	1 mg/L
Bicarbonate (HCO_3)	APHA SM A2320 B	1 mg/L
Carbonate (CO_3)	APHA SM A2320 B	1 mg/L
Dissolved Calcium (Ca)	EPA 200.7	1 mg/L
Total Chloride (Cl)	EPA 300.0	1 mg/L
Dissolved Fluoride (F)	APHA SM A4500-F C	0.1 mg/L
Dissolved Magnesium (Mg)	EPA 200.7	1 mg/L
Ammonia as Nitrogen (NH_3-N)	EPA 350.1/APHA SM A4500-NH3 G	0.05 mg/L
Dissolved Nitrate plus Nitrite as Nitrogen (NO_3+NO_2-N)	EPA 353.2	0.05 mg/L
Dissolved Potassium (K)	EPA 200.7	1 mg/L
Dissolved Silica (SiO_2)	EPA 200.7	0.2 mg/L
Dissolved Sodium (Na)	EPA 200.7	1 mg/L
Total Sulfate (SO_4)	EPA 300.0	1 mg/L
Dissolved Metals		
Dissolved Aluminum (Al)	EPA 200.7/EPA 200.8	0.1 mg/L
Dissolved Arsenic (As)	EPA 200.8	0.001 mg/L
Dissolved Barium (Ba)	EPA 200.7/EPA 200.8	0.1 mg/L
Dissolved Boron (B)	EPA 200.7/EPA 200.8	0.1 mg/L
Dissolved Cadmium (Cd)	EPA 200.8	0.005 mg/L
Dissolved Chromium (Cr)	EPA 200.7/EPA 200.8	0.05 mg/L
Dissolved Copper (Cu)	EPA 200.8	0.01 mg/L
Dissolved Iron (Fe)	EPA 200.7/EPA 200.8	0.03 mg/L
Dissolved Lead (Pb)	EPA 200.8	0.001 mg/L
Dissolved Manganese (Mn)	EPA 200.7/EPA 200.8	0.01 mg/L
Dissolved Mercury (Hg)	EPA 200.8	0.001 mg/L [2]
Dissolved Molybdenum (Mo)	EPA 200.7/EPA 200.8	0.1 mg/L
Dissolved Nickel (Ni)	EPA 200.7/EPA 200.8	0.05 mg/L
Dissolved Selenium (Se)	EPA 200.8	0.001 mg/L
Dissolved Uranium (U)	EPA 200.8	0.003 mg/L
Dissolved Vanadium (V)	EPA 200.8	0.1 mg/L
Dissolved Zinc (Zn)	EPA 200.7/EPA 200.8	0.01 mg/L
Total Metals		
Total Fe	EPA 200.7/EPA 200.8	0.03 mg/L
Total Mn	EPA 200.7/EPA 200.8	0.01 mg/L
Dissolved Radionuclides		
Gross Alpha	EPA 900.0	---
Gross Beta	EPA 900.0	---
Radium-226 (Ra-226)	EPA 903.0	---
Radium-228 (Ra-228)	EPA RA-05	---

[1] Detection level may be increased due to sample matrix interference.

[2] This exceeds the WDEQ Water Quality Division's Livestock Class-of-Use Criterion of 0.00005 mg/L.

Table MU1 4-6 Cation-Anion Balances (Page 1 of 2)

Wells	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
M-101	-2.96	-3.73	-3.07	-2.87
M-102	-3.57	-3.33	-5	-3.54
M-103	-3.66	-3.8	-1.93	-3.67
M-104	-1.89	-3.73	-0.459	-4.85
M-105	-1.91	-4.77	-1.24	-4.75
M-106	-2.47	-4.08	-1.74	-4.28
M-107	0.214	-3.1	0.183	-1.58
M-108	-0.936	-2.09	-3.21	-4.8
M-109	-1.79	-2.78	-2.9	-4.46
M-110	-1.84	-1.2	-2.99	-3.06
M-111	-2.72	-2.56	-4.8	-3.52
M-112	-2.35	-2.69	-2.73	-2.83
M-113	-2.75	-2.25	-1.3	-3.41
M-114	1.16	-1.95	-1.99	-4.56
M-115	-1.54	-2.63	-2.81	-0.46
M-116	-3.79	-1.96	-5.69	-4.34
M-117	-1.78	-2.76	-3.79	-2.84
M-118	-3.68	-2.68	-2.82	-3.52
M-119	-1.19	-3.78	-2.72	-2.95
M-120A	-2.58	-4.29	-5.22	1.25
M-121	-2.51	-4.75	-4.69	-0.674
M-122	0.711	-4.69	-1.99	-2.91
M-123	-4.08	-4.2	-2.38	-2.73
M-124	-1.55	-4.34	0.17	-3.92
M-125	-0.234	-5.89	0.708	-3.36
M-126	-2.98	-4.43	-2.57	-0.758
M-127	-2.92	-3.97	-0.166	-2.72
M-128	-0.0164	-3.09	-0.392	-2.81
MO-101	-5.23	-1.58	-2.14	-4.39
MO-102	-4.87	-4.4	-2.95	-4.53
MO-103	-5.86	-2.16	-1.33	-3.11
MO-104	-2.79	-4.19	0.166	0.234
MO-105	-3.92	-2.41	-4.76	-3.92
MO-106	-0.128	-3.52	-4.58	-3.36
MO-107	-3.74	-1.7	-1.15	-0.834
MO-108	-1.93	-1.07	-1.68	-2.93
MO-109	-2.04	-1.72	-4.02	-4.92
MO-110	-0.562	-2.36	-2.15	-4.6
MO-111	-5.01	-1.64	-3.93	-2.70
MO-112	0.678	-1.89	-2.09	2.48
MO-113	-1.27	-4.92	-3.94	-1.38
MO-114	-3.75	-5.02	-0.63	-4.43
MU-101	-3.78	-5.23	-3.82	-5.09
MU-102	-3.87	-2.87	-3.07	-4.86
MU-103	-3.74	-0.791	-3.57	-4.77
MU-104	-0.599	-1.95	-5.91	0.423

Table MU1 4-6 Cation-Anion Balances (Page 2 of 2)

Wells	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
MU-105	-1.53	-2.5	-3.74	-4.05
MU-106	2.22	-1.38	-1.57	-2.98
MU-107	0.723	-2.29	-2.5	-1.98
KPW-2	-3.16	-2.3	-4.37	-1.85
MU-109	0.0544	-1.01	-3.06	-4.37
MU-110	0.75	-0.743	-0.171	0.403
MU-111	-1.22	-4.62	-0.0922	-1.12
MU-112	0.718	1.4	1.42	3.22
MU-113	-2.17	-0.986	0.912	3.17
MP-101	-4.2	-3.34	-3.06	-2.5
MP-102	-4.32	-4.48	-3.16	-4.68
MP-103	-3.78	-2.06	-0.673	-0.863
MP-104	-0.0148	-2.82	-1.11	-0.694
MP-105	-3.68	1.1	-3.48	-1.5
MP-106	-1.13	0.77	-4.27	-2.92
MP-107	-2.87	-3.09	-4.93	-6.91
MP-108	-4.13	-1.33	-1.82	-4.58
MP-109	-3.15	-4.78	-1.51	-2.05
MP-110	-0.705	-4.1	-3.35	-5
MP-111	-2.01	-6.4	-2.33	-4.47
MP-112	0.0959	-1.45	-0.338	3.33
MP-113	-1.13	-1.14	-3.07	-4.46

Table MU1 4-7 Measured versus Calculated TDS (Page 1 of 3)

Wells	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Measured	Calculated	Measured	Calculated	Measured	Calculated	Measured	Calculated
M-101	405	396	471	409	439	435	491	433
M-102	520	509	553	514	522	510	548	514
M-103	609	577	629	561	608	579	627	554
M-104	578	562	602	561	544	557	603	534
M-105	507	492	527	466	472	497	495	463
M-106	491	473	505	478	489	487	502	483
M-107	424	418	481	417	437	452	475	440
M-108	423	420	439	417	394	411	425	389
M-109	322	315	335	318	292	318	334	302
M-110	356	343	368	348	317	342	371	347
M-111	371	353	377	353	320	349	378	333
M-112	356	344	376	350	322	348	373	353
M-113	306	294	321	302	300	302	315	303
M-114	334	313	354	332	325	336	340	315
M-115	326	298	319	288	298	301	322	302
M-116	293	284	310	295	312	291	304	282
M-117	300	285	316	312	307	301	309	307
M-118	340	332	347	339	350	337	353	342
M-119	329	323	325	318	331	318	338	301
M-120A	294	307	304	311	295	319	266	318
M-121	326	323	335	332	325	321	346	309
M-122	336	327	335	312	334	317	345	301
M-123	313	304	324	303	326	316	330	292
M-124	300	296	314	289	311	296	312	275
M-125	362	357	379	350	362	355	360	334
M-126	324	320	344	313	329	320	328	313

Table MU1 4-7 Measured versus Calculated TDS (Page 2 of 3)

Wells	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Measured	Calculated	Measured	Calculated	Measured	Calculated	Measured	Calculated
M-127	332	338	356	334	345	338	340	318
M-128	349	363	377	357	363	361	368	340
MO-101	428	409	442	429	442	425	451	421
MO-102	373	348	406	382	434	393	393	385
MO-103	389	375	396	389	322	310	426	367
MO-104	394	366	424	406	438	427	413	398
MO-105	312	304	324	306	402	382	336	283
MO-106	240	224	291	272	304	282	276	258
MO-107	298	273	297	290	316	298	300	278
MO-108	316	288	312	302	322	306	310	289
MO-109	310	286	324	312	335	310	318	289
MO-110	264	260	258	259	283	265	285	250
MO-111	310	303	265	253	261	243	246	270
MO-112	214	195	205	203	229	225	218	210
MO-113	292	282	292	273	299	255	273	268
MO-114	366	368	357	356	366	369	384	355
MU-101	340	322	365	341	391	348	365	315
MU-102	268	253	280	261	293	264	276	256
MU-103	244	228	273	242	277	267	290	242
MU-104	318	293	337	319	399	325	337	316
MU-105	263	252	265	259	279	248	297	261
MU-106	321	292	324	314	341	317	318	296
MU-107	276	261	287	282	312	289	286	274
KPW-2	281	276	307	300	301	287	337	279
MU-109	252	228	260	249	309	281	293	263
MU-110	238	231	237	230	242	222	225	216
MU-111	273	271	310	288	311	302	304	288

Table MU1 4-7 Measured versus Calculated TDS (Page 3 of 3)

Wells	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
	Measured	Calculated	Measured	Calculated	Measured	Calculated	Measured	Calculated
MU-112	259	255	278	255	278	269	271	267
MU-113	263	253	292	276	314	286	290	276
MP-101	391	379	410	388	425	388	394	360
MP-102	314	305	325	308	340	312	347	303
MP-103	375	365	376	364	312	309	404	355
MP-104	398	376	419	388	425	412	415	383
MP-105	309	291	306	306	385	367	343	288
MP-106	304	279	305	300	317	286	275	274
MP-107	361	344	372	354	388	348	355	328
MP-108	347	314	352	341	356	341	343	316
MP-109	313	305	294	277	290	299	236	300
MP-110	328	322	314	311	328	315	341	298
MP-111	259	261	340	327	348	322	340	295
MP-112	279	266	261	252	257	249	240	246
MP-113	375	340	366	348	370	350	371	323

Table MU1 4-8 Field Blank Data (Page 1 of 4)

Parameters	Units	M-130	M-132	M-134	M-136	M-130
		4/20/2009	4/21/2009	4/22/2009	4/23/2009	5/4/2009
Total Alkalinity as $CaCO_3$	mg/L	2	ND	2	2	2
CO_3	mg/L	ND	ND	ND	ND	ND
HCO_3	mg/L	2	ND	2	2	2
Dissolved Calcium	mg/L	ND	ND	ND	ND	ND
Total Chloride	mg/L	ND	ND	ND	ND	ND
Dissolved Fluoride	mg/L	ND	ND	ND	ND	ND
Dissolved Magnesium	mg/L	ND	ND	ND	ND	ND
Total NH_3-N	mg/L	ND	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND	ND	ND
Dissolved Potassium	mg/L	ND	ND	ND	ND	ND
Dissolved SiO_2	mg/L	ND	ND	ND	1.9	ND
Dissolved Sodium	mg/L	ND	ND	ND	ND	ND
Total $S0_4$	mg/L	ND	ND	ND	ND	ND
Specific Conductance at 25 °C	μmhos/cm	ND	ND	3	ND	1
Laboratory pH	SU	5.96	6.12	7.49	6	6.01
TDS Dried at 180 °C	mg/L	ND	ND	ND	ND	ND
Dissolved Aluminum	mg/L	ND	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	ND	ND	ND	ND
Dissolved Barium	mg/L	ND	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND	0.001	ND
Dissolved Manganese	mg/L	ND	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND	ND
Dissolved Selenium	mg/L	ND	ND	ND	ND	ND
Dissolved Uranium	mg/L	ND	ND	ND	ND	0.0004
Dissolved Vanadium	mg/L	ND	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	0.02	ND	0.02	0.02
Total Iron	mg/L	ND	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND	ND
Gross Alpha	pCi/L	1.7	0.1	2.2	1.4	ND
Gross Beta	pCi/L	ND	ND	ND	ND	0.04
Dissolved Ra-226	pCi/L	ND	ND	0.24	ND	ND
Dissolved Ra-228	pCi/L	ND	ND	ND	1.6	ND

Table MU1 4-8 Field Blank Data (Page 2 of 4)

Parameters	Units	M-132	M-134	M-136	M-130	M-132
		5/5/2009	5/6/2009	5/7/2009	5/18/2009	5/19/2009
Total Alkalinity as $CaCO_3$	mg/L	2	1	2	1	1
CO_3	mg/L	ND	ND	ND	ND	ND
HCO_3	mg/L	2	2	3	1	1
Dissolved Calcium	mg/L	ND	ND	ND	ND	ND
Total Chloride	mg/L	ND	ND	ND	ND	ND
Dissolved Fluoride	mg/L	ND	ND	ND	ND	ND
Dissolved Magnesium	mg/L	ND	ND	ND	ND	ND
Total NH_3-N	mg/L	ND	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND	ND	ND
Dissolved Potassium	mg/L	ND	ND	ND	ND	ND
Dissolved SiO_2	mg/L	ND	ND	ND	ND	ND
Dissolved Sodium	mg/L	ND	ND	ND	ND	ND
Total $S0_4$	mg/L	ND	ND	ND	ND	ND
Specific Conductance at 25 °C	µmhos/cm	8	1	1	1	1
Laboratory pH	SU	6.68	5.8	6.1	6.01	6
TDS Dried at 180 °C	mg/L	ND	ND	11	ND	ND
Dissolved Aluminum	mg/L	ND	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	ND	ND	ND	ND
Dissolved Barium	mg/L	ND	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND	ND	ND
Dissolved Manganese	mg/L	ND	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND	ND
Dissolved Selenium	mg/L	ND	ND	ND	ND	ND
Dissolved Uranium	mg/L	ND	ND	ND	ND	ND
Dissolved Vanadium	mg/L	ND	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	ND	ND	ND
Total Iron	mg/L	ND	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND	ND
Gross Alpha	pCi/L	0.02	ND	0.2	ND	0.7
Gross Beta	pCi/L	ND	ND	ND	ND	ND
Dissolved Ra-226	pCi/L	ND	0.05	ND	ND	ND
Dissolved Ra-228	pCi/L	ND	0.02	0.5	ND	0.2

Table MU1 4-8 Field Blank Data (Page 3 of 4)

Parameters	Units	M-134 5/20/2009	M-136 5/21/2009	M-130 6/1/2009	M-132 6/2/2009	M-134 6/3/2009
Total Alkalinity as $CaCO_3$	mg/L	2	2	2	2	2
CO_3	mg/L	ND	ND	ND	ND	ND
HCO_3	mg/L	2	3	2	2	3
Dissolved Calcium	mg/L	ND	ND	ND	ND	ND
Total Chloride	mg/L	ND	ND	ND	ND	ND
Dissolved Fluoride	mg/L	ND	ND	ND	ND	ND
Dissolved Magnesium	mg/L	ND	ND	ND	ND	ND
Total NH_3-N	mg/L	ND	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND	ND	ND
Dissolved Potassium	mg/L	ND	ND	ND	ND	ND
Dissolved SiO_2	mg/L	ND	ND	ND	ND	ND
Dissolved Sodium	mg/L	ND	ND	ND	ND	ND
Total $S0_4$	mg/L	ND	ND	ND	ND	ND
Specific Conductance at 25 °C	µmhos/cm	ND	ND	2	1	1
Laboratory pH	SU	4.62	5.98	5.96	6.16	6
TDS Dried at 180 °C	mg/L	ND	ND	ND	ND	ND
Dissolved Aluminum	mg/L	ND	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	ND	ND	ND	ND
Dissolved Barium	mg/L	ND	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND	ND	ND
Dissolved Manganese	mg/L	ND	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND	ND
Dissolved Selenium	mg/L	ND	ND	ND	ND	ND
Dissolved Uranium	mg/L	ND	ND	ND	ND	ND
Dissolved Vanadium	mg/L	ND	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	0.01	ND	ND
Total Iron	mg/L	ND	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND	ND
Gross Alpha	pCi/L	0.4	0.1	0.7	0.1	0.2
Gross Beta	pCi/L	ND	ND	ND	ND	ND
Dissolved Ra-226	pCi/L	ND	ND	0.006	ND	ND
Dissolved Ra-228	pCi/L	0.4	ND	ND	0.3	1.8

Table MU1 4-8 Field Blank Data (Page 4 of 4)

Parameters	Units	M-136	MO-115	B-2
		6/4/2009	12/1/2009	2/2/2010
Total Alkalinity as $CaCO_3$	mg/L	ND	ND	ND
CO_3	mg/L	ND	ND	ND
HCO_3	mg/L	ND	ND	ND
Dissolved Calcium	mg/L	ND	ND	ND
Total Chloride	mg/L	ND	ND	ND
Dissolved Fluoride	mg/L	ND	ND	ND
Dissolved Magnesium	mg/L	ND	ND	ND
Total NH_3-N	mg/L	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND
Dissolved Potassium	mg/L	ND	ND	ND
Dissolved SiO_2	mg/L	ND	ND	ND
Dissolved Sodium	mg/L	ND	ND	ND
Total $S0_4$	mg/L	ND	ND	ND
Specific Conductance at 25 °C	µmhos/cm	3	1	1
Laboratory pH	SU	6.02	5.95	5.87
TDS Dried at 180 °C	mg/L	19	ND	ND
Dissolved Aluminum	mg/L	ND	ND	ND
Dissolved Arsenic	mg/L	ND	ND	ND
Dissolved Barium	mg/L	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND
Dissolved Manganese	mg/L	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND
Dissolved Selenium	mg/L	ND	ND	ND
Dissolved Uranium	mg/L	ND	ND	ND
Dissolved Vanadium	mg/L	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	ND
Total Iron	mg/L	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND
Gross Alpha	pCi/L	ND	2.5	ND
Gross Beta	pCi/L	ND	ND	ND
Dissolved Ra-226	pCi/L	ND	ND	ND
Dissolved Ra-228	pCi/L	2.5	ND	ND

ND = below the detection limit

Table MU1 4-9 Duplicate Data (Page 1 of 3)

Parameters	Units	M-110	M-129	MP-110	M-131	MU-107	M-133	MP-105	M-135	M-110	M-129	MO-110	M-131	MU-107	M-133	MU-105	M-135
		4/20/2009		4/21/2009		4/22/2009		4/23/2009		5/4/2009		5/5/2009		5/6/2009		5/7/2009	
		C09040674-010	C09040674-021	C09040693-010	C09040693-011	C09040800-008	C09040800-017	C09040827-004	C09040827-008	C09050081-010	C09050081-011	C09050144-010	C09050144-011	C09050203-009	C09050203-010	C09050246-006	C09050246-008
Total Alkalinity as $CaCO_3$	mg/L	110	110	104	105	87	87	71	70	110	109	92	91	92	91	92	93
CO_3	mg/L	ND	ND	2	4	ND	ND	ND	1	ND	ND	6	6	ND	ND	4	4
HCO_3	mg/L	134	134	123	120	106	107	85	84	134	133	101	99	112	111	105	107
Dissolved Calcium	mg/L	72	72	51	52	52	44	48	49	74	72	45	42	51	50	45	45
Total Chloride	mg/L	5	5	5	5	4	4	5	5	5	5	7	8	4	4	4	4
Dissolved Fluoride	mg/L	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1
Dissolved Magnesium	mg/L	3	3	2	2	3	2	2	2	3	3	1	1	2	2	2	2
Total NH_3-N	mg/L	ND	ND	0.05	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	0.14	ND	ND	ND	ND
Dissolved Potassium	mg/L	2	2	16	16	2	3	8	8	2	2	4	4	3	3	3	3
Dissolved SiO_2	mg/L	11.9	11.9	15	15.2	13.3	14.3	13.7	13.4	16.2	15.9	12.6	12.1	15.6	15.3	14.2	14.1
Dissolved Sodium	mg/L	30	30	38	39	34	35	32	33	29	29	33	32	32	32	32	32
Total $S0_4$	mg/L	149	151	128	128	114	114	137	136	148	148	96	96	115	115	100	100
Specific Conductance at 25 °C	µmhos/cm	539	531	498	496	425	424	472	474	534	533	417	418	440	440	402	402
Laboratory pH	SU	7.94	7.82	8.41	8.37	8.25	8.28	8.97	8.97	7.73	7.98	8.78	8.72	8.22	8.23	8.6	8.59
TDS Dried at 180 °C	mg/L	356	353	328	324	276	282	309	314	368	369	258	265	287	293	265	273
Dissolved Aluminum	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	0.001	0.009	0.009	0.002	0.005	0.019	0.019	0.001	ND	0.002	0.002	0.004	0.004	0.004	0.003
Dissolved Barium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND	ND	ND	ND	0.001	0.001	ND	ND	0.002	0.003	ND	ND	ND	ND
Dissolved Manganese	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Selenium	mg/L	ND	ND	ND	ND	0.012	ND	0.009	0.009	ND	ND	0.021	0.021	ND	ND	ND	ND
Dissolved Uranium	mg/L	0.168	0.171	0.241	0.239	0.0184	0.0186	0.444	0.451	0.166	0.161	0.313	0.3	0.0175	0.0174	0.0275	0.0275
Dissolved Vanadium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	0.05	0.05	ND	0.02	0.03	0.06	0.02	ND	ND	ND	0.01	0.01	ND	0.01
Total Iron	mg/L	0.06	0.06	ND	ND	ND	ND	ND	ND	0.06	0.06	ND	ND	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gross Alpha	pCi/L	220	174	2040	2030	52.6	51	823	785	228	193	294	260	47.9	53.8	161	165
Gross Beta	pCi/L	71.9	59.2	816	820	19.6	18.2	303	283	88.1	79	89.2	88.5	19.9	21.2	57.6	57
Dissolved Ra-226	pCi/L	41	41	732	846	7.6	7.2	227	219	42	40	3.1	3.2	8.9	8.7	70	73
Dissolved Ra-228	pCi/L	4.8	4.8	5.6	4.8	4.4	5.6	2.6	3.1	3	3.4	7	4.2	4.7	4.9	3.3	3.8

Table MU1 4-9 Duplicate Data (Page 2 of 3)

Parameters	Units	M-110	M-129	MO-110	M-131	MU-107	M-133	MU-105	M-135	M-110	M-129	MO-110	M-131	MU-107	M-133	MU-105	M-135
		5/18/2009		5/19/2009		5/20/2009		5/21/2009		6/1/2009		6/2/2009		6/3/2009		6/4/2009	
		C09050548-010	C09050548-021	C09050629-010	C09050629-019	C09050645-009	C09050645-010	C09050746-006	C09050746-008	C09060055-010	C09060055-011	C09060141-009	C09060141-011	C09060201-009	C09060201-010	C09060266-006	C09060266-008
Total Alkalinity as $CaCO_3$	mg/L	108	109	95	96	94	92	90	80	109	110	96	95	97	94	97	100
CO_3	mg/L	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	1
HCO_3	mg/L	132	133	115	113	114	112	109	98	133	134	117	116	118	114	116	119
Dissolved Calcium	mg/L	70	68	47	50	52	51	46	58	72	72	47	48	53	52	46	47
Total Chloride	mg/L	5	5	7	7	4	4	4	5	5	5	8	8	5	5	4	4
Dissolved Fluoride	mg/L	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Dissolved Magnesium	mg/L	3	3	1	2	2	2	2	2	3	3	1	1	2	2	2	2
Total NH_3-N	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	0.13	0.13	ND	ND	ND	ND	ND	ND	0.13	0.14	ND	ND	ND	ND
Dissolved Potassium	mg/L	2	2	4	4	3	3	2	7	2	2	3	3	3	3	3	3
Dissolved SiO_2	mg/L	14.1	13.5	11.7	11.8	13.3	13.3	16.1	15.2	13	13	13.6	14	15.7	15.9	15.9	15.8
Dissolved Sodium	mg/L	30	29	33	31	34	34	25	30	29	29	31	33	33	33	30	30
Total $S0_4$	mg/L	149	148	99	98	120	121	94	139	151	151	101	100	119	118	98	97
Specific Conductance at 25 °C	µmhos/cm	506	507	398	399	426	425	359	447	518	516	421	419	447	448	412	417
Laboratory pH	SU	7.95	7.97	8.57	8.5	8.22	8.23	8.26	8.56	7.82	7.91	8.06	8.29	8.07	8.11	8.32	8.32
TDS Dried at 180 °C	mg/L	317	334	283	290	312	299	279	324	371	365	285	265	286	285	297	279
Dissolved Aluminum	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	0.054	0.002	0.001	0.003	0.003	0.001	0.017	ND	ND	0.001	0.001	0.003	0.003	0.003	0.002
Dissolved Barium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	0.049	0.002	0.002	ND	ND	ND	ND	ND	ND	0.001	0.001	ND	ND	ND	ND
Dissolved Manganese	mg/L	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Selenium	mg/L	ND	0.052	0.019	0.018	ND	ND	ND	0.005	ND	ND	0.019	0.018	ND	ND	ND	ND
Dissolved Uranium	mg/L	0.142	0.0908	0.302	0.292	0.0154	0.0153	0.0108	0.446	0.136	0.137	0.294	0.307	0.0157	0.0155	0.0231	0.022
Dissolved Vanadium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	0.04	ND	0.01	0.01	ND	ND	ND	0.01	ND	ND	ND	0.01	ND	ND
Total Iron	mg/L	0.06	0.06	ND	ND	ND	ND	0.45	ND	0.06	0.06	ND	ND	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Gross Alpha	pCi/L	184	186	319	306	48.8	43.3	60.7	859	187	202	385	388	47.1	45.1	150	189
Gross Beta	pCi/L	77.1	72.2	98.8	75.9	24.3	23.1	35.5	345	69.9	69.4	96.7	98.1	18.9	18.7	55.2	71.1
Dissolved Ra-226	pCi/L	33	26	2.5	2.7	8.7	8.3	4.6	228	41	43	2.6	3.3	9.6	8.4	58	77
Dissolved Ra-228	pCi/L	4.7	3.4	2.5	1.2	4.6	2.7	3.7	3.9	4.5	4.3	4.2	1.9	5	5.1	4.2	4.4

ND = below the detection limit

Table MU1 4-9 **Duplicate Data** (Page 3 of 3)

Parameters	Units	M-120A	MO-120A	MO-114	M-131
		12/15/2009		1/14/2010	
		C09120527-001	C09120527-002	C10010493-004	C10010493-005
Total Alkalinity as $CaCO_3$	mg/L	119	112	110	108
CO_3	mg/L	ND	ND	ND	ND
HCO_3	mg/L	146	137	134	132
Dissolved Calcium	mg/L	57	58	77	74
Total Chloride	mg/L	6	6	6	6
Dissolved Fluoride	mg/L	0.1	0.1	0.2	0.2
Dissolved Magnesium	mg/L	3	3	3	3
Total NH_3-N	mg/L	ND	ND	ND	ND
Dissolved NO_3+NO_2-N	mg/L	ND	ND	ND	ND
Dissolved Potassium	mg/L	2	2	3	3
Dissolved SiO_2	mg/L	16.9	17.3	16.2	15.6
Dissolved Sodium	mg/L	33	32	33	33
Total $S0_4$	mg/L	123	122	160	157
Specific Conductance at 25 °C	µmhos/cm	469	469	536	537
Laboratory pH	SU	7.97	8.00	7.95	7.94
TDS Dried at 180 °C	mg/L	295	298	366	362
Dissolved Aluminum	mg/L	ND	ND	ND	ND
Dissolved Arsenic	mg/L	ND	ND	ND	ND
Dissolved Barium	mg/L	ND	ND	ND	ND
Dissolved Boron	mg/L	ND	ND	ND	ND
Dissolved Cadmium	mg/L	ND	ND	ND	ND
Dissolved Chromium	mg/L	ND	ND	ND	ND
Dissolved Copper	mg/L	ND	ND	ND	ND
Dissolved Iron	mg/L	ND	ND	ND	ND
Dissolved Lead	mg/L	ND	ND	ND	ND
Dissolved Manganese	mg/L	ND	ND	ND	ND
Dissolved Mercury	mg/L	ND	ND	ND	ND
Dissolved Molybdenum	mg/L	ND	ND	ND	ND
Dissolved Nickel	mg/L	ND	ND	ND	ND
Dissolved Selenium	mg/L	0.003	0.003	0.018	0.018
Dissolved Uranium	mg/L	0.0847	0.0896	0.409	0.408
Dissolved Vanadium	mg/L	ND	ND	ND	ND
Dissolved Zinc	mg/L	ND	ND	0.02	0.01
Total Iron	mg/L	ND	ND	ND	ND
Total Manganese	mg/L	ND	ND	ND	ND
Gross Alpha	pCi/L	85.4	113	346	431
Gross Beta	pCi/L	25.0	33.7	112	121
Dissolved Ra-226	pCi/L	1.2	1.2	2.6	2.5
Dissolved Ra-228	pCi/L	1.5	1.7	3.6	4.1

Table MU1 4-10 **Example of Outlier Calculations** (Page 1 of 4)

Parameters	Units	Parameter Values [1]																			
		MO-101				MO-102				MO-103				MO-104				MO-105			
		4/23/09	5/7/09	5/21/09	6/4/09	4/23/09	5/7/09	5/21/09	6/4/09	4/23/09	5/7/09	5/21/09	6/4/09	4/22/09	5/6/09	5/20/09	6/3/09	4/23/09	5/7/09	5/21/09	6/4/09
Total Alkalinity as $CaCO_3$	mg/L	112	110	111	112	99	105	107	109	115	113	105	114	108	124	123	124	107	104	114	105
CO_3	mg/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
HCO_3	mg/L	137	135	136	137	121	128	130	132	141	138	129	139	132	151	150	151	130	127	139	129
Dissolved Calcium	mg/L	82	91	92	89	70	75	82	77	74	80	62	79	76	85	85	91	57	58	79	56
Total Chloride	mg/L	7	8	9	10	6	6	6	6	6	6	5	6	8	9	9	9	5	5	6	5
Dissolved Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dissolved Magnesium	mg/L	4	4	4	4	3	4	4	4	4	4	3	4	4	4	5	5	3	3	4	3
Total NH_3-N	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved NO_3+NO_2-N	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.09	0.07	0.15	0.1	0.72	0.84	0.87	0.84	0.12	0.12	0.1	0.15
Dissolved Potassium	mg/L	3	3	3	2	3	3	3	3	2	2	2	2	4	3	3	2	2	2	2	2
Dissolved SiO_2	mg/L	14.1	14.4	15.7	15.4	15.2	14.2	15.4	14.8	14.4	15.8	15.5	15.4	14.5	15.9	15.2	15.5	14.2	14.4	15.3	15.1
Dissolved Sodium	mg/L	31	34	31	29	32	32	30	29	30	33	30	32	35	30	42	35	31	32	29	31
Total SO_4	mg/L	196	204	200	199	174	181	184	180	177	175	124	174	171	177	183	177	124	125	174	122
Specific Conductance at 25 °C	µmhos/cm	652	624	612	638	567	577	566	588	593	577	448	580	596	616	615	616	481	469	557	469
Laboratory pH	SU	7.89	7.93	7.84	7.87	8.06	8	7.94	7.93	7.81	7.77	7.9	7.83	7.79	7.77	7.86	7.73	7.94	7.98	7.75	7.91
TDS Dried at 180 °C	mg/L	428	442	442	451	373	406	434	393	389	396	322	426	394	424	438	413	312	324	402	336
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Arsenic	mg/L	0.001	-0.001	-0.001	-0.001	0.004	0.003	0.003	0.002	-0.001	-0.001	0.001	0.001	-0.001	-0.001	-0.001	-0.001	0.002	0.001	-0.001	0.001
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	0.04	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Dissolved Lead	mg/L	0.003	-0.001	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.002	-0.001	-0.001	-0.001
Dissolved Manganese	mg/L	0.01	0.01	0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Selenium	mg/L	0.012	0.012	0.013	0.012	-0.001	-0.001	-0.001	-0.001	0.013	0.014	0.015	0.014	0.043	0.046	0.046	0.047	0.013	0.014	0.014	0.016
Dissolved Uranium	mg/L	0.385	0.384	0.378	0.368	0.332	0.339	0.341	0.339	0.469	0.481	0.326	0.464	0.718	0.916	0.883	0.899	0.327	0.320	0.473	0.313
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Zinc	mg/L	0.05	0.02	0.02	0.01	0.02	-0.01	0.01	-0.01	0.02	-0.01	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01
Total Iron	mg/L	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.07	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	0.06
Total Manganese	mg/L	0.01	-0.02	0.01	0.02	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	-0.01
Gross Alpha	pCi/L	424	445	552	440	312	387	402	388	505	500	267	458	682	834	837	717	249	334	463	372
Gross Beta	pCi/L	95.7	144	118	108	97.4	100	114	95.9	115	121	81.1	110	197	382	303	255	78.3	121	131	91.5
Dissolved Ra-226	pCi/L	4.3	4.1	5	5.2	6.9	7.7	7.9	8.6	4.1	3.3	2.1	3.4	3.1	2.7	3.2	2.4	2.5	2.4	2.5	2.7
Dissolved Ra-228	pCi/L	3.1	2.1	2.9	2.4	3.5	2.7	2.3	3.8	3	2.7	1.8	2.4	2.3	2.1	3.3	3.8	1.5	2.1	3.3	3.3

Table MU1 4-10 Example of Outlier Calculations (Page 2 of 4)

Parameters	Units	Parameter Values [1]																			
		MO-106				MO-107				MO-108				MO-109				MO-110			
		4/22/09	5/6/09	5/20/09	6/3/09	4/22/09	5/6/09	5/20/09	6/3/09	4/22/09	5/6/09	5/20/09	6/3/09	4/22/09	5/6/09	5/20/09	6/3/09	4/21/09	5/5/09	5/19/09	6/2/09
Total Alkalinity as $CaCO_3$	mg/L	71	96	99	86	105	103	103	104	109	107	103	103	100	108	107	107	87	92	95	96
CO_3	mg/L	2	5	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	8	6	-1	-1
HCO_3	mg/L	82	107	119	105	128	126	126	127	134	130	125	126	123	131	130	131	89	101	115	117
Dissolved Calcium	mg/L	35	50	51	49	52	56	57	57	57	60	59	58	55	63	59	58	45	45	47	47
Total Chloride	mg/L	4	5	5	5	5	4	4	5	5	5	5	5	8	6	6	7	7	7	7	8
Dissolved Fluoride	mg/L	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dissolved Magnesium	mg/L	1	2	2	2	3	3	2	3	3	3	2	3	3	3	3	3	-1	1	1	1
Total NH_3-N	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.5	0.36	0.16	0.14	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved NO_3+NO_2-N	mg/L	0.14	0.13	0.17	0.15	-0.05	0.06	0.08	0.08	-0.05	-0.05	-0.05	-0.05	0.16	0.17	0.19	0.18	0.16	0.13	0.13	0.13
Dissolved Potassium	mg/L	3	3	2	3	2	2	2	2	3	3	2	2	5	3	3	3	5	4	4	3
Dissolved SiO_2	mg/L	12.2	13.4	11.9	14.1	13.1	14.3	12.1	14.3	13.9	14.9	12.3	14.1	14.1	15.5	12.6	14.8	12.7	12.6	11.7	13.6
Dissolved Sodium	mg/L	39	30	31	31	33	31	34	33	34	31	34	32	33	29	31	30	35	33	33	31
Total $S0_4$	mg/L	98	108	114	116	115	114	118	116	120	119	126	127	120	122	126	124	98	96	99	101
Specific Conductance at 25 °C	µmhos/cm	362	432	438	428	458	459	439	456	480	471	457	473	479	484	468	481	398	417	398	421
Laboratory pH	SU	9	8.72	8.39	8.25	8.01	7.96	8.06	7.93	7.99	8.02	8.1	7.94	7.65	7.9	8.1	7.93	9.16	8.78	8.57	8.06
TDS Dried at 180 °C	mg/L	240	291	304	276	298	297	316	300	316	312	322	310	310	324	335	318	264	258	283	285
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Arsenic	mg/L	0.008	0.005	0.004	0.003	0.002	0.002	0.001	0.002	0.002	0.002	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.003	0.002	0.002	0.001
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.002	0.002	0.002	0.001
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	0.02	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Selenium	mg/L	0.029	0.028	0.031	0.037	0.012	0.02	0.02	0.022	0.003	0.005	0.005	0.005	0.025	0.026	0.025	0.027	0.02	0.021	0.019	0.019
Dissolved Uranium	mg/L	0.262	0.353	0.371	0.359	0.430	0.424	0.409	0.419	0.506	0.347	0.324	0.334	0.378	0.418	0.399	0.397	0.266	0.313	0.302	0.294
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Zinc	mg/L	$\boxed{0.16}$	0.01	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.01	0.01	-0.01	0.05	-0.01	0.04	-0.01
Total Iron	mg/L	-0.07	0.14	0.03	0.08	-0.03	-0.03	-0.03	-0.03	-0.07	-0.03	-0.03	-0.03	-0.07	-0.03	-0.03	-0.03	-0.03	-0.07	-0.03	-0.07
Total Manganese	mg/L	-0.01	-0.01	-0.02	-0.01	0.01	-0.02	-0.02	-0.01	-0.01	-0.02	0.02	0.02	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
Gross Alpha	pCi/L	217	271	261	378	383	326	343	408	402	302	397	290	371	424	481	443	234	294	319	385
Gross Beta	pCi/L	81.9	221	160	122	124	177	137	98.7	137	87.6	94.5	91.4	116	169	122	122	80.3	89.2	98.8	96.7
Dissolved Ra-226	pCi/L	2.2	5.4	5.5	4.9	8.1	6.4	5.9	5.1	8.7	4.7	4	3.4	4	3.9	3.1	2.8	2.4	3.1	2.5	2.6
Dissolved Ra-228	pCi/L	1.5	1.3	2.4	3	1.6	1.1	1.8	2	2	1.9	2.5	4.7	2.5	2.6	3.7	3.9	1.2	7	2.5	4.2

Table MU1 4-10 Example of Outlier Calculations (Page 3 of 4)

Parameters	Units	Parameter Values [1]															
		MO-111				MO-112				MO-113				MO-114			
		5/5/09	5/19/09	6/2/09	11/18/09	4/21/09	5/5/09	5/19/09	6/2/09	4/21/09	5/5/09	5/19/09	6/2/09	12/1/09	12/16/09	1/14/10	2/3/10
Total Alkalinity as $CaCO_3$	mg/L	101	91	98	105	36	43	73	70	102	104	104	105	106	107	110	111
CO_3	mg/L	5	-1	-1	-5	9	6	4	4	-1	-1	-1	-1	-5	-5	-5	-5
HCO_3	mg/L	113	111	120	128	26	41	81	78	125	126	127	129	129	130	134	136
Dissolved Calcium	mg/L	51	45	46	49	26	30	38	42	53	49	50	56	72	68	77	68
Total Chloride	mg/L	5	6	6	5	10	9	7	7	7	7	6	6	7	6	6	6
Dissolved Fluoride	mg/L	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Dissolved Magnesium	mg/L	2	2	2	2	1	2	2	2	3	3	3	2	3	3	3	3
Total NH_3-N	mg/L	0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved NO_3+NO_2-N	mg/L	-0.05	0.16	0.16	0.2	0.3	0.31	0.33	0.33	0.17	0.16	0.15	0.17	-0.1	-0.1	-0.1	0.1
Dissolved Potassium	mg/L	8	3	2	2	3	2	2	2	2	2	2	2	4	4	3	3
Dissolved SiO_2	mg/L	13.4	12.7	14.8	14.4	15.6	14.9	14.2	17.5	15.5	14.5	13.1	15.6	16.7	15.5	16.2	14.1
Dissolved Sodium	mg/L	33	31	31	32	29	27	26	29	31	29	30	32	33	31	33	30
Total SO_4	mg/L	126	94	96	97	82	87	82	83	103	102	101	106	165	159	160	160
Specific Conductance at 25 °C	µmhos/cm	499	380	408	415	307	322	329	347	432	446	418	436	534	537	536	538
Laboratory pH	SU	8.73	8.15	7.81	7.92	9.69	9.36	8.88	8.75	8.08	8.22	8.1	7.85	8.19	8.17	7.95	8.05
TDS Dried at 180 °C	mg/L	310	265	261	246	214	205	229	218	292	292	299	273	366	357	366	384
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Arsenic	mg/L	0.011	0.002	0.001	-0.001	0.002	0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001	0.001	-0.001	-0.001
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	0.1
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Selenium	mg/L	-0.001	0.021	0.022	0.027	0.03	0.03	0.03	0.032	0.04	0.043	0.04	0.042	0.019	0.021	0.018	0.017
Dissolved Uranium	mg/L	0.424	0.288	0.369	0.320	0.132	0.146	0.312	0.331	0.609	0.629	0.581	0.641	0.408	0.405	0.409	0.383
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Zinc	mg/L	0.01	0.06	-0.01	-0.01	0.04	-0.01	-0.01	-0.01	0.06	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.01
Total Iron	mg/L	-0.07	-0.03	-0.07	-0.03	-0.03	-0.07	-0.03	-0.07	-0.03	-0.07	-0.03	-0.07	-0.03	-0.03	-0.03	-0.03
Total Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Gross Alpha	pCi/L	1060	298	439	372	137	148	287	334	490	612	568	587	361	335	346	528
Gross Beta	pCi/L	544	136	138	101	53.1	56.8	110	94.6	213	237	175	202	118	90.6	112	139
Dissolved Ra-226	pCi/L	360	5.5	6.2	6.6	1.4	0.74	1.3	1	37	34	37	38	2.4	2.7	2.6	2.7
Dissolved Ra-228	pCi/L	5.1	2.5	1.4	2	0.8	0.6	0.7	0.4	1.4	1.9	1.5	2.9	3.3	3.7	3.6	4.4

Table MU1 4-10 **Example of Outlier Calculations** (Page 4 of 4)

Parameters	Units	Outlier Tolerance Interval Calculation					
		No. of Obs.	Mean	Tolerance Limit Factor	Standard Deviation	Lower Range	Upper Range
Total Alkalinity as $CaCO_3$	mg/L	56	101.21	3.066	16.17	51.64	150.79
CO_3	mg/L	56	2.07	3.066	2.04	-4.19	8.34
HCO_3	mg/L	56	121.75	3.066	23.13	50.83	192.67
Dissolved Calcium	mg/L	56	61.07	3.066	16.16	11.53	110.62
Total Chloride	mg/L	56	6.36	3.066	1.49	1.77	10.94
Dissolved Fluoride	mg/L	56	0.20	3.066	0.02	0.13	0.27
Dissolved Magnesium	mg/L	56	2.86	3.066	1.02	-0.26	5.97
Total NH_3-N	mg/L	56	0.07	3.066	0.07	-0.16	0.29
Dissolved NO_3+NO_2-N	mg/L	56	0.17	3.066	0.19	-0.42	0.77
Dissolved Potassium	mg/L	55	2.69	3.094	0.79	0.25	5.14
Dissolved SiO_2	mg/L	56	14.42	3.066	1.26	10.57	18.27
Dissolved Sodium	mg/L	56	31.66	3.066	2.57	23.77	39.55
Total $S0_4$	mg/L	56	133.95	3.066	36.18	23.02	244.87
Specific Conductance at 25 °C	µmhos/cm	56	486.14	3.066	87.11	219.07	753.22
Laboratory pH	SU	56	8.14	3.066	0.43	6.81	9.47
TDS Dried at 180 °C	mg/L	56	330.02	3.066	65.96	127.77	532.26
Dissolved Aluminum	mg/L	56	0.10	3.066	0.00	0.10	0.10
Dissolved Arsenic	mg/L	55	0.002	3.094	0.001	-0.002	0.006
Dissolved Barium	mg/L	56	0.10	3.066	0.00	0.10	0.10
Dissolved Boron	mg/L	56	0.10	3.066	0.00	0.10	0.10
Dissolved Cadmium	mg/L	56	0.005	3.066	0.000	0.005	0.005
Dissolved Chromium	mg/L	56	0.05	3.066	0.00	0.05	0.05
Dissolved Copper	mg/L	56	0.01	3.066	0.00	0.00	0.02
Dissolved Iron	mg/L	56	0.03	3.066	0.01	0.00	0.06
Dissolved Lead	mg/L	56	0.001	3.066	0.000	0.000	0.002
Dissolved Manganese	mg/L	56	0.01	3.066	0.00	0.00	0.02
Dissolved Mercury	mg/L	56	0.00100	3.066	0.00000	0.00100	0.00100
Dissolved Molybdenum	mg/L	56	0.10	3.066	0.00	0.10	0.10
Dissolved Nickel	mg/L	56	0.05	3.066	0.00	0.05	0.05
Dissolved Selenium	mg/L	56	0.02	3.066	0.01	-0.02	0.06
Dissolved Uranium	mg/L	56	0.41	3.066	0.16	-0.07	0.89
Dissolved Vanadium	mg/L	56	0.10	3.066	0.00	0.10	0.10
Dissolved Zinc	mg/L	55	0.016	3.094	0.013	-0.024	0.056
Total Iron	mg/L	56	0.04	3.066	0.02	-0.03	0.11
Total Manganese	mg/L	56	0.01	3.066	0.00	0.00	0.03
Gross Alpha	pCi/L	55	406.16	3.094	144.44	-40.72	853.05
Gross Beta	pCi/L	55	132.02	3.094	60.10	-53.93	317.97
Dissolved Ra-226	pCi/L	55	6.40	3.094	8.74	-20.63	33.43
Dissolved Ra-228	pCi/L	56	2.57	3.066	1.21	-1.15	6.29

[1] Less than values are denoted by a minus sign in front of the detection limit.

Value is an outlier or calculation excludes outlier(s).

Table MU1 4-11 Monitor Well Water-Quality Data Outliers

Monitor Wells		Parameters	Units	Outlier Values[1]	Well-Type Statistics with Outliers Removed			
					Minimum	Mean	Maximum	Standard Deviation
M Wells	M-106	Total Iron	mg/L	2.71	0.03	0.06	0.99	0.13
MO Wells	MO-106	Dissolved Zinc	mg/L	0.16	0.01	0.02	0.06	0.01
	MO-111	Dissolved Potassium	mg/L	8	2.00	2.64	5.00	0.78
		Dissolved Arsenic	mg/L	0.011	0.001	0.002	0.008	0.001
		Gross Alpha	pCi/L	1060	137.00	407.94	837.00	149.81
		Gross Beta	pCi/L	544	53.10	134.01	382.00	62.52
		Dissolved Ra-226	pCi/L	360	0.74	6.70	38.00	9.10
MU Wells	MU-106	Gross Alpha	pCi/L	828	16.60	110.14	521.00	126.92
		Gross Beta	pCi/L	343	5.70	48.65	202.00	50.87
	MU-110	CO_3	mg/L	19	1.00	3.86	14.00	3.24
	MU-111	Dissolved Potassium	mg/L	26	2.00	7.00	20.00	4.89
	MU-113	Total Chloride	mg/L	16	4.00	6.25	12.00	2.49
MP Wells	MP-110	Gross Beta	pCi/L	816	11.30	231.19	646.00	149.45
		Dissolved Ra-228	pCi/L	10.8	0.30	4.04	8.90	1.95
	MP-111	Dissolved Selenium	mg/L	0.023	0.001	0.003	0.015	0.004
	MP-112	CO_3	mg/L	24	1.00	1.61	9.00	1.77
				20				
		HCO_3	mg/L	-1	41.00	124.96	158.00	23.60
				-1				

[1] Less than values are denoted by a minus sign in front of the detection limit.

Table MU1 4-12 MU1 Monitor Well UCLs

Well Group or Well [1]	Alkalinity as CaCO3 (mg/L)			Chloride (mg/L)			Specific Conductance (μmhos/cm)		
	Mean	Standard Deviation	UCL	Mean	Standard Deviation	UCL [2]	Mean	Standard Deviation	UCL
M Wells									
All wells	110.09	16.65	193.33	5.44	1.06	20.44	557.65	110.93	1,112.30
MO Wells									
All wells [3]	101.21	16.17	182.05	6.36	1.49	21.36	486.14	87.11	921.69
MU Wells									
All wells [4]	81.87	24.83	206.01	6.25	2.49	21.25	432.13	45.36	658.94

[1] See **Attachment MU1 4-1** for the sampling results of each well.

[2] Per WDEQ-LQD Guideline 4 (2000), the UCL was calculated by adding five standard deviations to each mean chloride concentration or by adding 15 mg/L to each mean chloride concentration, whichever was larger.

[3] The first two alkalinity values of well MO-112 were outside the tolerance intervals, but were not considered outliers; therefore, they are included in these calculations.

[4] The first chloride value for well MU-113 was outside the tolerance interval and considered to be an outlier; therefore, it is not included in these calculations.

Table MU1 5-1 Historic Dril Hole Abandonment (Page 1 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
1D-18	596222	2210916	18	25	92	6943	590	1982	TG	Concrete									
1D-20	595224	2213368	20	25	92	6933	530	1982	TG	Concrete									
1M-18	596220	2210943	18	25	92	6943	450	1982	TG	Concrete									
1M-19	595179	2210943	19	25	92	6922	450	1982	TG	Concrete									
1M-20	595225	2213343	20	25	92	6933	440	1982	TG	Concrete									
1S-18	596218	2210968	18	25	92	6943	357	1982	TG	Concrete									
1S-20	595226	2213318	20	25	92	6932	300	1982	TG	Concrete									
2M	594961	2204468	24	25	93	6952	640												
3M	595205	2210943	19	25	92	6923	680	1982	TG	Concrete									
558	595807	2211804	18	25	92	6944	650												
72-1	595290	2209052	19	25	92	6930	800												
A178	596051	2213327	17	25	92	6950	500	1970	Conoco										
A179	596451	2213324	17	25	92	6960	500	1970	Conoco										
A181	596250	2213328	17	25	92	6955	520	1970	Conoco										
A185	595260	2213348	20	25	92	6939	500/600	1970/1978	Conoco										
A187	594860	2213350	20	25	92	6935	500	1970	Conoco										
A188	595061	2213350	20	25	92	6935	500	1970	Conoco										
A190	595445	2213345	20	25	92	6935	500	1970	Conoco										
D131	595100	2214398	20	25	92	6942	520	1977											
D132	596555	2210458	18	25	92	6940	640	1977											
D144	596455	2210449	18	25	92	6943	540												
D149	595117	2213688	20	25	92	6935	540	1970											
D150	595105	2214195	20	25	92	6937	540	1970											
D156	595125	2213586	20	25	92	6935	540	1970											
D22	596360	2210438	18	25	92	6942	640												
D49	595115	2212805	20	25	92	6920	660	1970											
D50	595060	2210459	19	25	92	6921	600												
D96	595113	2214010	20	25	92	6935	540	1970											
P10-17	596207	2211923	17	25	92	6950	500	1990	PNC	PlugGel									
P1-18	595993	2211572	18	25	92	6939	560	1987	PNC	PlugGel							Couldn't locate		
P1-20	595263	2212905	20	25	92	6927	560	1987	PNC	PlugGel									
P2-17	596435	2213125	17	25	92	6949	660	1988	PNC	PlugGel									
P2-18	595955	2211702	18	25	92	6949	500	1990	PNC	PlugGel							Couldn't locate		
P2-20	595325	2213920	20	25	92	6935	560	1987	PNC	PlugGel									
P3-18	596042	2211702	18	25	92	6944	500	1990	PNC	PlugGel									

Table MU1 5-1 Historic Dril Hole Abandonment (Page 2 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
P3-19	595757	2210925	19	25	92	6931	500	1992	PNC	PlugGel									
P3-20	595415	2212912	20	25	92	6934	520	1990	PNC	PlugGel									
P4-18	596141	2211693	18	25	92	6942	500	1990	PNC	PlugGel									
P4-19	595632	2210922	19	25	92	6929	500	1992	PNC	PlugGel									
P4-20	595465	2212912	20	25	92	6934	520	1990	PNC	PlugGel									
P5-17	596255	2212964	17	25	92	6945	650	1988	PNC	PlugGel									
P5-18	596192	2211689	18	25	92	6940	500	1990	PNC	PlugGel									
P5-19	595456	2210913	19	25	92	6933	500	1992	PNC	PlugGel									
P5-20	595565	2212915	20	25	92	6936	520	1990	PNC	PlugGel									
P6-17	596009	2212119	17	25	92	6946	500	1990	PNC	PlugGel									
P6-18	595856	2210922	18	25	92	6935	500	1992	PNC	PlugGel									
P6-19	595359	2210916	19	25	92	6933	500	1992	PNC	PlugGel									
P6-20	595615	2212916	20	25	92	6937	520	1990	PNC	PlugGel									
P7-17	596059	2212118	17	25	92	6948	500	1990	PNC	PlugGel									
P7-19	595801	2211125	19	25	92	6933	500	1992	PNC	PlugGel									
P7-20	595652	2212925	20	25	92	6935	520	1990	PNC	PlugGel									
P8-17	596208	2212115	17	25	92	6953	500	1990	PNC	PlugGel									
P8-19	595602	2211118	19	25	92	6936	500	1992	PNC	PlugGel									
P9-17	596005	2211912	17	25	92	6947	500	1990	PNC	PlugGel									
RD343	594646	2214392	20	25	92	6947	650	1968											
RD345	596004	2214099	17	25	92	6950	650	1968											
RD436	595141	2211158	19	25	92	6925	670	1968											
TG10-17	596105	2212720	17	25	92	6941	600	1978	TG		Permaplug	153	313		Yes				
TG10-18	596305	2211120	18	25	92	6946	600	1978	TG		Permaplug	166	298		Yes				
TG10-19	595305	2211120	19	25	92	6932	500	1978	TG		Permaplug	154	283		Yes				
TG10-20	595305	2212720	20	25	92	6930	600	1978	TG										
TG11-17	596305	2212720	17	25	92	6949	600	1978	TG		Permaplug	159	186		Yes				
TG11-18	596711	2211120	18	25	92	6951	660	1978	TG			Not Located							
TG11-19	595705	2211120	19	25	92	6932	500	1978	TG		Permaplug	Dry			Yes				
TG11-20	595305	2212320	20	25	92	6931	600	1978	TG										
TG1-17	595905	2211920	17	25	92	6944	500	1978	TG		Permaplug	160	238		Yes				
TG1-18	595705	2210720	18	25	92	6929	600	1978	TG		Permaplug	151	156		Yes				
TG1-20	595505	2211920	20	25	92	6936	500	1978	TG										
TG12-17	595826	2213108	17	25	92	6939	560	1978	TG		Permaplug	152	154		Yes				
TG12-19	595705	2211520	19	25	92	6942	500	1978	TG		Permaplug	160	331		Yes				
TG12-20	595705	2213320	20	25	92	6938	600	1978	TG										
TG13-17	596105	2213120	17	25	92	6949	600	1978	TG		Permaplug	158	288		Yes				

Table MU1 5-1 Historic Dril Hole Abandoment (Page 3 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
TG13-18	595905	2211220	18	25	92	6936	500	1979	TG		Permaplug	154	379	ShurGel & QuickGel	Yes				
TG13-19	595305	2211520	19	25	92	6932	540	1978	TG		? Down Hole				Yes				
TG13-20	595705	2213720	20	25	92	6942	600	1978	TG										
TG14-18	597105	2211520	18	25	92	6949	600	1978	TG			Not Located							
TG14-19	595505	2211520	19	25	92	6941	500	1978	TG		Permaplug	159	175		Yes				
TG14-20	595505	2213720	20	25	92	6941	540	1978	TG										
TG15-17	596505	2213720	17	25	92	6961	600	1978	TG		Permaplug	167	341		Yes				
TG15-18	596116	2211511	18	25	92	6943	500	1978	TG		Permaplug	156	238		Yes				
TG15-19	595305	2210920	19	25	92	6930	580	1980	TG		? Too Deep				Yes				
TG15-20	595305	2213720	20	25	92	6938	540	1978	TG										
TG16-19	595505	2210920	19	25	92	6930	580	1980	TG			Not Located							
TG16-20	595305	2214120	20	25	92	6938	600	1978	TG										
TG17-17	596105	2214520	17	25	92	6949	600	1978	TG		Permaplug	160	205		Yes				
TG17-19	595705	2210920	19	25	92	6929	580	1980	TG		? Too Deep				Yes				
TG17-20	595505	2214120	20	25	92	6940	540	1978	TG										
TG18-19	595305	2211320	19	25	92	6931	580	1980	TG		Yes				Yes				
TG18-20	595705	2214120	20	25	92	6943	600	1978	TG										
TG19-19	595505	2211320	19	25	92	6940	580	1980	TG		? Too Deep				Yes				
TG19-20	595715	2214516	20	25	92	6948	600	1978	TG										
TG1A-19 (60deg)	595427	2211712	19	25	92	6940	200	1980	TG										
TG1A-19 (75deg)	595427	2211712	19	25	92	6940	380	1980	TG		? Angle Hole				Yes				
TG1A-20 (60deg)	595607	2212520	20	25	92	6933	200	1980	TG		? Angle Hole				Yes				
TG1A-20 (75deg)	595605	2212520	20	25	92	6933	380	1980	TG										
TG20-18	595905	2210920	18	25	92	6935	580	1980	TG		? Too Deep				Yes				
TG20-19	595705	2211320	19	25	92	6935	580	1980	TG		? Too Deep				Yes				
TG20-20	595505	2214520	20	25	92	6941	540	1978	TG										
TG21-17	596305	2214120	17	25	92	6954	600	1978	TG		Permaplug	163	357	ShurGel & QuickGel	Yes				
TG21-18	595905	2211320	18	25	92	6933	580	1980	TG		? Too Deep				Yes				
TG21-19	595505	2211720	19	25	92	6936	580	1980	TG		? Down Hole				Yes				

Table MU1 5-1 Historic Dril Hole Abandonment (Page 4 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
TG21-20	595305	2214520	20	25	92	6949	516	1978	TG										
TG2-18	595905	2210720	18	25	92	6933	600	1978	TG		Permaplug	156	242		Yes				
TG2-20	595705	2211920	20	25	92	6940	500	1978	TG										
TG22-18	596105	2211320	18	25	92	6938	580	1980	TG		? Down Hole				Yes				
TG22-19	595705	2211720	19	25	92	6942	580	1980	TG		? Too Deep				Yes				
TG22-20	595305	2214920	20	25	92	6947	540	1978	TG										
TG23-18	595905	2211720	18	25	92	6942	580	1980	TG		None	Dry			Yes		Couldn't locate		
TG23-19	595705	2210520	19	25	92	6936	580	1980	TG		? Too Deep				Yes				
TG23-20	595505	2214920	20	25	92	6944	540	1978	TG										
TG24-18	596119	2211707	18	25	92	6948	580	1980	TG		? Too Deep				Yes				
TG24-19	595505	2210520	19	25	92	6931	580	1980	TG										
TG24-20	595705	2214920	17	25	92	6951	600	1978	TG										
TG25-18	596305	2211720	18	25	92	6942	580	1980	TG		? Too Deep				Yes				
TG25-19	595305	2210520	19	25	92	6931	580	1980	TG		? Too Deep				Yes				
TG27-18	596005	2211699	18	25	92	6951	580	1980	TG		None	Dry			Yes				
TG29-17	596305	2213720	17	25	92	6946	600	1978	TG		Permaplug	161	238		Yes				
TG3-17	596105	2213720	17	25	92	6945	600	1978	TG		Permaplug	155	160		Yes				
TG3-18	596105	2210720	18	25	92	6939	600	1978	TG		? Too Deep				Yes				
TG3-20	595705	2212320	20	25	92	6937	500	1978	TG										
TG36-17	595905	2212120	17	25	92	6940	580	1980	TG		? Too Deep				Yes				
TG37-17	596105	2212120	17	25	92	6947	580	1980	TG		Permaplug	161	317		Yes				
TG38-17	595905	2212520	17	25	92	6937	580	1980	TG		Permaplug	151	176		Yes				
TG39-17	596105	2212520	17	25	92	6941	580	1980	TG		? Too Deep				Yes				
TG40-17	596305	2212520	17	25	92	6949	580	1980	TG		? Too Deep				Yes				
TG41-17	595905	2212920	17	25	92	6938	580	1980	TG		? Too Deep				Yes				
TG4-18	596305	2210720	18	25	92	6940	600	1978	TG		Permaplug	164	176		Yes				
TG4-19	594305	2210720	19	25	92	6923	600	1978	TG		Permaplug	138	>450	ShurGel & QuickGel	Yes				
TG4-20	595505	2212320	20	25	92	6934	600	1978	TG										
TG42-17	596145	2212920	17	25	92	6942	580	1980	TG		? Too Deep				Yes				
TG43-17	596305	2213120	17	25	92	6950	580	1980	TG		Permaplug	161	438	ShurGel & QuickGel	Yes				
TG44-17	596505	2213520	17	25	92	6958	580	1980	TG		Permaplug	166	286		Yes				
TG48-17	596305	2212120	17	25	92	6951	580	1980	TG		? Too Deep				Yes				
TG49-17	596005	2212520	17	25	92	6938	580	1980	TG		Permaplug	151	159		Yes				

Table MU1 5-1 Historic Dril Hole Abandoment (Page 5 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
TG50-17	596205	2212520	17	25	92	6945	580	1980	TG		? Too Deep				Yes				
TG5-17	595905	2212320	17	25	92	6939	500	1978	TG		Permaplug	151	368	ShurGel & QuickGel	Yes				
TG5-18	596505	2210720	18	25	92	6944	660	1978	TG		Permaplug	159	168		Yes				
TG5-19	594705	2210720	19	25	92	6934	600	1978	TG		Permaplug	145	215		Yes				
TG5-20	595705	2212720	20	25	92	6934	600	1978	TG										
TG52-20	595305	2212120	20	25	92	6929	580	1980	TG										
TG53-20	595505	2212120	20	25	92	6933	580	1980	TG										
TG54-20	595705	2212120	20	25	92	6936	580	1980	TG										
TG55-20	595105	2212520	20	25	92	6926	580	1980	TG										
TG56-20	595305	2212520	20	25	92	6928	580	1980	TG										
TG57-20	595505	2212520	20	25	92	6932	580	1980	TG										
TG58-20	595705	2212520	20	25	92	6936	580	1980	TG										
TG59-20	595305	2212920	20	25	92	6928	580	1980	TG										
TG60-20	595505	2212920	20	25	92	6930	580	1980	TG										
TG61-20	595717	2212910	20	25	92	6939	580	1980	TG										
TG6-17	596105	2211920	17	25	92	6950	600	1978	TG		Permaplug	166	395	ShurGel & QuickGel	Yes				
TG6-18	596705	2210720	18	25	92	6947	660	1978	TG		Permaplug	166	306		Yes				
TG6-19	595105	2210720	19	25	92	6927	600	1978	TG		? Too Deep				Yes				
TG6-20	595505	2212720	20	25	92	6931	600	1978	TG										
TG62-20	595505	2213320	20	25	92	6933	580	1980	TG										
TG63-20	595305	2213520	20	25	92	6938	580	1980	TG										
TG64-20	595505	2213520	20	25	92	6938	580	1980	TG										
TG65-20	595705	2213520	20	25	92	6936	580	1980	TG										
TG66-20	595305	2213920	20	25	92	6935	580	1980	TG										
TG67-20	595505	2213920	20	25	92	6939	580	1980	TG										
TG68-20	595705	2213920	20	25	92	6941	580	1980	TG										
TG69-20	595305	2214320	20	25	92	6937	580	1980	TG										
TG70-20	595505	2214320	20	25	92	6941	580	1980	TG										
TG71-20	595705	2213120	20	25	92	6935	580	1980	TG										
TG7-17	596105	2212320	17	25	92	6945	540	1978	TG		Permaplug	157	239		Yes				
TG7-18	596905	2210720	18	25	92	6949	660	1978	TG		Permaplug	167	224		Yes				
TG7-19	595305	2210720	19	25	92	6929	600	1978	TG		? Down Hole				Yes				
TG7-20	595105	2213120	20	25	92	6932	520	1978	TG										
TG72-20	595405	2212520	20	25	92	6930	580	1980	TG										

Table MU1 5-1 Historic Dril Hole Abandoment (Page 6 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
TG73-20	595805	2212520	20	25	92	6935	580	1980	TG										
TG8-17	596305	2212320	17	25	92	6953	560	1978	TG		? Down Hole								
TG8-18	595914	2211508	18	25	92	6944	600	1978	TG		Permaplug	157	341		Yes				
TG8-19	595505	2210720	19	25	92	6926	600	1978	TG		Yes				Yes				
TG8-20	595505	2213120	20	25	92	6934	600	1978	TG										
TG9-17	595828	2212707	17	25	92	6936	560	1978	TG		Permaplug	151	163		Yes				
TG9-18	595905	2211120	18	25	92	6935	600	1978	TG			Not Located							
TG9-19	595505	2211120	19	25	92	6935	600	1978	TG		Permaplug	158	>450	ShurGel & QuickGel	Yes				
TG9-20	595305	2213120	20	25	92	6932	600	1978	TG										
TGC1-19	595405	2210920	19	25	92	6932	500	1980	TG		Permaplug	154	180		Yes				
TGC16	595905	2211170	18	25	92	6936	475	1979	TG										
TGC17	595905	2211160	18	25	92	6935	423	1979	TG		? Too Deep				Yes				
TGC18	595905	2211150	18	25	92	6935	442	1979	TG		Permaplug	155	369	ShurGel & QuickGel	Yes				
TGC19	595905	2211130	18	25	92	6935	465	1979	TG		Permaplug	155	389		Yes				
TGC1A (45deg)	595207	2210920	19	25	92	6927	140	1980	TG		? Angle Hole				Yes				
TGC1A (60deg)	595205	2210920	19	25	92	6927	200	1980	TG		? Angle Hole				Yes				
TGC20	596005	2210920	18	25	92	6939	460	1980	TG		? Too Deep				Yes				
TGC21	595805	2210920	18	25	92	6933	477	1980	TG		? Down Hole				Yes				
TGC2-19	595565	2210920	19	25	92	6935	480	1980	TG		Yes				Yes				
TT110	594768	2208715	19	25	92	6932	560	1978	TG		Octoplug	176	229		Yes				
TT111	595446	2210267	19	25	92	6928	500	1978	TG		Octoplug	155	170		Yes				
TT19	595115	2209294	19	25	92	6921	600	1976	TG		None	Dry			Yes				
TT34	594905	2209306	19	25	92	6921	600	1977	TG		None	Dry			Yes				
TT37	595908	2209670	19	25	92	6936	800	1977	TG			Not Located							
TT38	593926	2210194	19	25	92	6911	600	1977	TG		None	115	120		Yes				
TT39	595302	2209531	19	25	92	6930	600	1977	TG		Octoplug	Dry			Yes				
TT40	594804	2208920	19	25	92	6924	800	1977	TG		Octoplug	Dry			Yes				
TT41	594695	2209407	19	25	92	6916	600	1977	TG		Octoplug	151	174		Yes				
TT42	595128	2209429	19	25	92	6925	600	1977	TG			Not Located							
TT43	594180	2209901	19	25	92	6913	1000	1977	TG			Not Located							
TT63	595435	2209681	19	25	92	6933	600	1977	TG		Octoplug	Dry			Yes				

Table MU1 5-1 Historic Dril Hole Abandoment (Page 7 of 7)

Hole ID	Location					Elevation (feet above mean sea level)	Total Depth (feet)	Year	Exploration Company	Original Plug		1983-1984 TG Reopening, Probing & Re-Plugging Program				URE Replugging Program			
	North (NAD 83)	East (NAD 83)	Section	Township	Range					Material	Cap	Water Level (feet)	Mud Depth (feet)	Resealing Material	Concrete Recap	Date	Plug Depth (feet)	Replug Material	Concrete Recap
TT64	594910	2209108	19	25	92	6923	600	1977	TG		Octoplug	155	193		Yes				
TT66	595025	2208968	19	25	92	6927	600	1977	TG			Not Located							
TT74	595224	2209765	19	25	92	6928	600	1977	TG		Octoplug	156	170		Yes				
TT75	595342	2210066	19	25	92	6927	600	1977	TG			Not Located							
TT78	595072	2209155	19	25	92	6925	600	1977	TG		Sagebrush	159	184		Yes				
TT79	594757	2208708	19	25	92	6931	600	1977	TG		Sagebrush	Dry			Yes				
TT85	594997	2209563	19	25	92	6921	600	1977	TG		Octoplug	153	320		Yes				
TT86	595136	2210060	19	25	92	6921	600	1977	TG			Not Located							
TT87	595404	2209864	19	25	92	6932	600	1977	TG		Octoplug	161	190		Yes				
TT88	595437	2210272	19	25	92	6926	600	1977	TG			Not Located							
TT89	594598	2210127	19	25	92	6909	600	1977	TG		Octoplug	Dry			Yes				
TT9	595215	2209136	19	25	92	6928	600	1976	TG			Not Located							
TT90	595901	2210184	19	25	92	6937	600	1977	TG		Octoplug	Dry			Yes				
TT94	596605	2210420	18	25	92	6948	660	1978	TG		? Down Hole				Yes				
TT95	596205	2210420	18	25	92	6938	660	1978	TG		? Too Deep				Yes				
TT96	595805	2210420	18	25	92	6934	660	1978	TG		Sagebrush	Dry			Yes	39717	600	Grout	8' Cement
TT97	595425	2210413	19	25	93	6927	600	1978	TG		? Down Hole				Yes				
TT98	595105	2208720	19	25	92	6912	700	1978	TG		? Down Hole				Yes				

Table MU1 5-2 **MU1 Groundwater Permits** (Page 1 of 2)

MU1 Well ID	Permit Number	Applicant	Township	Range	Section	¼ of the ¼	Uses	Priority	Status	Permit Facility Name	Yield [2]	Well Depth (feet) [3]	Static Water Level (feet) [3]
FG Horizon													
MO-101	P187661W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20MO	ND	350	158
MO-102	P179904W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-114	ND	364	162
MO-103	P179898W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-112	ND	355	157
MO-104	P179883W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-107	ND	370	163
MO-105	P179895W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-111	ND	333	166
MO-106	P179880W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-106	ND	336	162
MO-107	P179871W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-103	ND	331	158
MO-108	P179868W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	3/1/2007	Good Standing Incomplete	HJMO-102	ND	330	156
MO-109	P187658W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MO	ND	360	168
MO-110	P187658W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MO	ND	340	169
MO-111	P187658W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MO	ND	330	168
MO-112	P187658W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MO	ND	350	169
MO-113	P187658W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MO	ND	365	162
MO-114	P179905W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	3/1/2007	ND	UKMU-101	ND	850	ND
HJ Horizon													
M-101	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	450	177
M-102	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	450	182
M-103	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	450	176
M-104	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	460	184
M-105	P187652W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	7/3/2008	Good Standing Incomplete	NWNW20M	ND	450	178
M-106	P187652W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	7/3/2008	Good Standing Incomplete	NWNW20M	ND	440	169
M-107	P187652W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	7/3/2008	Good Standing Incomplete	NWNW20M	ND	420	180
M-108	P187653W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	7/3/2008	Good Standing Incomplete	NENE19M	ND	450	181
M-109	P187653W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	7/3/2008	Good Standing Incomplete	NENE19M	ND	450	176
M-110	P187653W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	7/3/2008	Good Standing Incomplete	NENE19M	ND	430	180
M-111	P187654W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19M	ND	480	171
M-112	P187655W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	SWNE	Monitoring	7/3/2008	Good Standing Incomplete	SWNE19M	ND	490	181
M-113	P187656W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW19M	ND	500	192
M-114	P187656W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW19M	ND	490	190
M-115	P187656W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW19M	ND	460	185
M-116	P187646W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESW	Monitoring	7/3/2008	Good Standing Incomplete	SESW18M	ND	464	179
M-117	P187647W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SWSE	Monitoring	7/3/2008	Good Standing Incomplete	SWSE18M	ND	465	186
M-118	P187647W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SWSE	Monitoring	7/3/2008	Good Standing Incomplete	SWSE18M	ND	484	184
M-119	P187647W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SWSE	Monitoring	7/3/2008	Good Standing Incomplete	SWSE18M	ND	464	184
M-120A	P187648W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	7/3/2008	Good Standing Incomplete	SESE18M	ND	464	179
M-121	P187648W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	7/3/2008	Good Standing Incomplete	SESE18M	ND	484	182
M-122	P187649W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	7/3/2008	Good Standing Incomplete	SWSW17M	ND	495	181
M-123	P187649W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	7/3/2008	Good Standing Incomplete	SWSW17M	ND	465	179
M-124	P187649W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	7/3/2008	Good Standing Incomplete	SWSW17M	ND	463	183
M-125	P187650W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SESW	Monitoring	7/3/2008	Good Standing Incomplete	SESW17M	ND	450	174
M-126	P187650W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SESW	Monitoring	7/3/2008	Good Standing Incomplete	SESW17M	ND	420	175

Table MU1 5-2 MU1 Groundwater Permits (Page 2 of 2)

MU1 Well ID	Permit Number	Applicant	Township	Range	Section	¼ of the ¼	Uses	Priority	Status	Permit Facility Name	Yield [2]	Well Depth (feet) [3]	Static Water Level (feet) [3]
M-127	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	480	174
M-128	P187651W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20M	ND	460	175
MP-101	P187662W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20MP	ND	450	170
MP-102	P179903W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-114	ND	460	181
MP-103	P179897W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-112	ND	400	178
MP-104	P179882W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-107	ND	464	184
MP-105	P179894W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-111	ND	440	178
MP-106	P179879W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-106	ND	480	173
MP-107	P179870W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-103	ND	432	171
MP-108	P179867W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	3/1/2007	Good Standing Incomplete	HJMP-102	ND	450	175
MP-109	P187659W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MP	ND	460	186
MP-110	P187659W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MP	ND	460	178
MP-111	P187659W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MP	ND	440	177
MP-112	P187659W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MP	ND	450	178
MP-113	P187659W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MP	ND	475	185
KM Horizon													
MU-101	P187660W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	7/3/2008	Good Standing Incomplete	NENW20MU	ND	550	188
MU-102	P179902W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NENW	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-114	ND	557	190
MU-103	P179896W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	20	NWNW	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-112	ND	802	185
MU-104	P179881W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-107	ND	855	193
MU-105	P179893W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	17	SWSW	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-111	ND	853	209
MU-106	P179878W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-106	ND	550	201
MU-107	P179869W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	18	SESE	Monitoring	3/1/2007	Good Standing Incomplete	HJMU-103	ND	850	195
KPW-2 [1]	P189593W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NENE	Monitoring	2/4/2009	Good Standing Incomplete	KPW-2	ND	600	ND
MU-109	P187657W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MU	ND	570	194
MU-110	P187657W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MU	ND	564	203
MU-111	P187657W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MU	ND	550	201
MU-112	P187657W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MU	ND	550	201
MU-113	P187657W	USDI, BLM -- Lost Creek ISR, LLC	25 N	92 W	19	NWNE	Monitoring	7/3/2008	Good Standing Incomplete	NWNE19MU	ND	580	189

[1] Well KPW-2 replaces well MU-108, which was properly abandoned after failing an MIT. Well KPW-2 was originally used as a pump test well within the same horizon as and 17 feet from well MU-108.
[2] ND = No data at this time.
[3] Information from well completion reports in Attachment MU1 2-1.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

"PLATE MU1 5-1 Historic Drill Holes in Area of Mine Unit 1 Lost Creek Permit Area T25N r92W Sweetwater County, WY"

WITHIN THIS PACKAGE...OR BY SEARCHING USING THE

D-02

COLORADO OFFICE
10758 W. CENTENNIAL RD., STE. 200
LITTLETON, CO 80127
TEL: (866) 981-4588
FAX: (720)-981-5643

WYOMING OFFICE
5880 ENTERPRISE DR., STE. 200
CASPER, WY 82609
TEL: (307) 265-2373
FAX: (307) 265-2801

LOST CREEK ISR, LLC

August 4, 2008

Melissa L. Bautz
Senior Environmental Analyst
State of Wyoming Dept. of Environmental Quality
Land Quality Division
510 Meadowview Drive
Lander, WY 82520

Re: Drilling Notification No. 334DN; Revision to Update 4

Dear Mrs. Bautz,

Recently, BLM determined an Environmental Assessment (EA) is necessary before approving certain construction aspects of Lost Creek ISR, LLC's (LC ISR) application dated June 5, 2008. However, LC ISR is currently involved in the EA process with the Nuclear Regulatory Commission for this property and does not wish to initiate a redundant EA at this time. Therefore, please find behind this cover letter an Updated Plan of Operations without the activities which require an EA. Specifically, this Update will add the installation of the Deep Exploration Well.

An updated Form 9 covering the work proposed in the updated Plan of Operations, an area map, and a table detailing the remaining bond for each DN Update is included with this letter. The additional 10% fuel contingency and increase in revegetation costs is applied to Updates 3 and 4 since most of this work has not been performed yet. The total number of monitor wells has been significantly reduced from earlier conservative numbers that were developed before the exact shape of the first mine unit was known. The total bond required to reclaim the entire site, inclusive of any disturbance created by Update 4, is $1,088,800. A bond of $968,000 is currently in place so an additional $120,800 will need to be posted.

As discussed during our June 25th meeting at the WDEQ-LQD Lander Field Office, please find enclosed a Monitor Well Plan for Mine Unit 1. The bond for the monitor well was previously approved and work has been initiated on installing the outer ring of monitor wells.

Finally, as requested during our June 25th meeting, please find below additional information regarding the installation of the deep exploration well. The well is being installed for the purposes of mineral exploration and to gain a better understanding of geologic conditions.

The surface hole (approximately 3,000 feet) likely will be drilled with fresh water and sweeps of gel (bentonite). The production hole (3,000 to approximately 11,000 feet) will be drilled with low-solids non-dispersed mud typical of oil and gas wells drilled in Wyoming. Additives to maintain fluid properties will depend on mud and hole condition. Significant lost circulation is not anticipated, but if encountered would be handled with conventional additives (sawdust, mica, walnut hulls, cottonseed hulls, etc.).

Upon completion of the hole, a full suite of geophysical logs is anticipated. The logs likely will include, at a minimum, SP, gamma, induction resistivity, conductivity and porosity (neutron/density or sonic).

ASTM pipe will be used for the conductor casing (set to approximately 60 to 90 feet). API tubulars will be used for the surface and production casing. The casing program has not been finalized, and may depend on availability of certain types of casing. Regardless, the casing design will be consistent with typical oilfield practices; standard oilfield design criteria (tension, burst, collapse) will be used.

ASTM cement (Type I/II) will be used to isolate the conductor casing. API cements will be used on the surface and production casing. The cement design has not been finalized. In general, however, the cement likely will consist of "Lite" lead (approx. 11.4 to 12.0#/gallon) and Class G tail (approximately 15.6#/gallon). The lite cement will be used to lighten the cement column in an effort to prevent lost circulation during cementing. The anticipated bottom-hole temperature at total depth (11,000') likely will be approximately 180 degrees F. Typical ultimate strength of the tail (Class G) cement is on the order of 4,000 psi. Final design values can be provided at a later time if requested.

Centralizers will be used as warranted to center the casing in the well and enhance the quality of the cement job. A float shoe and float collar will be used for the surface and production casing. Dual wiper plugs will also be used. Because of significant depth, it is possible the production casing will be cemented in two stages, with the stage tool placed at an approximate depth of 6,000 feet. The hole will be conditioned as warranted prior to cementing casing.

If you need any additional information, please do not hesitate to contact me at the Casper office.

Sincerely,
Lost Creek ISR, LLC
By: Ur-Energy USA Inc., Manager

John W. Cash
Manager EHS and Regulatory Affairs

Cc: Nancy Fitzsimmons, URE, Littleton, CO

Attachments: DN9; Update 4
Mine Unit 1 Monitor Well Plan
Table of Bond Status

UNIT DRILLING COMPANY

RIG 138

WORKING DEPTH: 11,000'

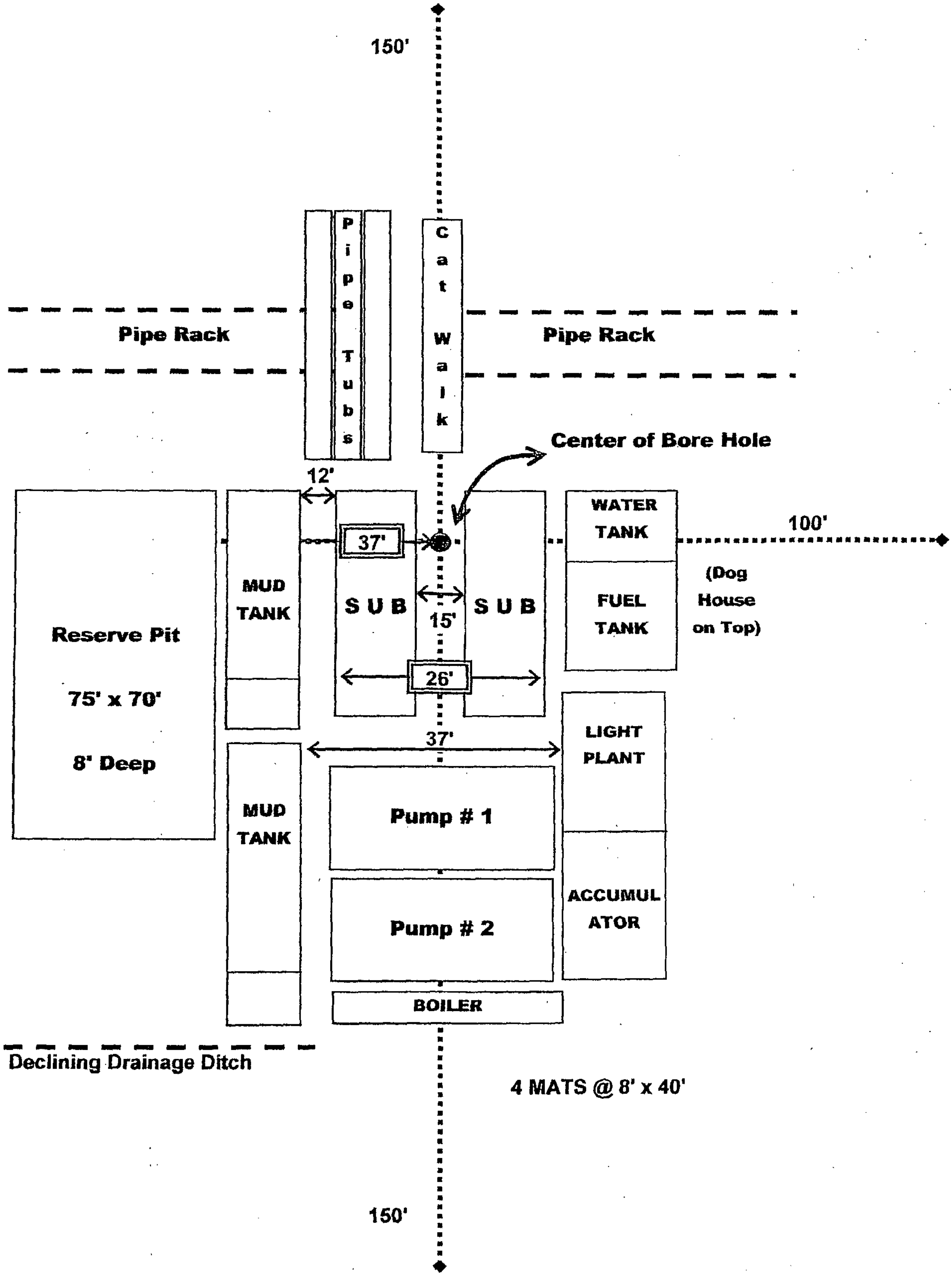
NOTE: SUMMARY IS SUBJECT TO CHANGE

DRAWWORKS	Brewster	N-46 700 HP
	Powered by:	2 C-15 Caterpillar diesel engines w/ National torque converters
	Auxiliary Brake:	Parmac V-80
SCR HOUSE	N/A	
POWER	2 - 275 KW CAT SR4-275 generators powered by Caterpillar 3406 diesel engines	
#1 PUMP	Oilwell 1100 PT	Triplex 50 HP 5 X 6 X 10 Mag Changer
	Powered by:	Caterpillar D-399 diesel engine
#2 PUMP	Oilwell 850B-PT	Triplex 50 HP 5 X 6 X 10 Mag Changer
	Powered by:	Caterpillar D-398 diesel engine
#3 PUMP	N/A	
	Powered by:	
MAST	135' Lee C. Moore	413,000#
SUBSTRUCTURE	12' H x 46' L x 26' W 413,000# capacity	
TRAVELING EQUIPMENT	*Block:*	IDECO shorty unitized with hook265 t
	Hook:	
	Swivel:	Oilwell PC 225 ton
	Top Drive:	N/A
ROTARY TABLE	Emsco 20 1/2"	
BOP EQUIPMENT	*Ram Preventor:*	11" 5,000# Atlas
	Annular Preventor:	11" 5,000# Shaffer
	Closing Unit:	Valvcon 150 gallons with 4 station closing unit
DRILL PIPE	4 1/2" 16.60# 329-G-105	
DRILL COLLARS	18 - 6" 4-1/2 XH & 2 - 8" 6-5/8 Reg	
MUD SYSTEM	*Working Pits:*	Sand: 30'L x 9'W x 7'D
		Suction: 30'L x 9'W x 7'D
	Premix Pit:	19'L x 10'W x 9'D
	Mud Mixing Pumps:	3 Mission Magnum 5" x 6" x 10" centrifugal
SOLIDS CONTROL EQUIPMENT	*Shale Shaker:*	2 - Swaco linear motion
	Desander:	Harrisburg 2-cone
	Desilter:	Swaco 8-cone
	Prime Movers:	
	Degasser:	3 agitators w/ 5 HP electric motors
AUXILIARY EQUIPMENT	*Water Tank:*	450 bbl
	Fuel Tank:	10,000 gallons
	Penetration Recorder:	Pason
	Survey Instrument:	A-1 Sure-Shot 7 degree
	Pipe Spinner:	
	Kelly Spinner:	
	Mud House:	
	Trip Tank:	
	Transformer:	

Last Updated
JS
2/3/2006

Unit Drilling Company

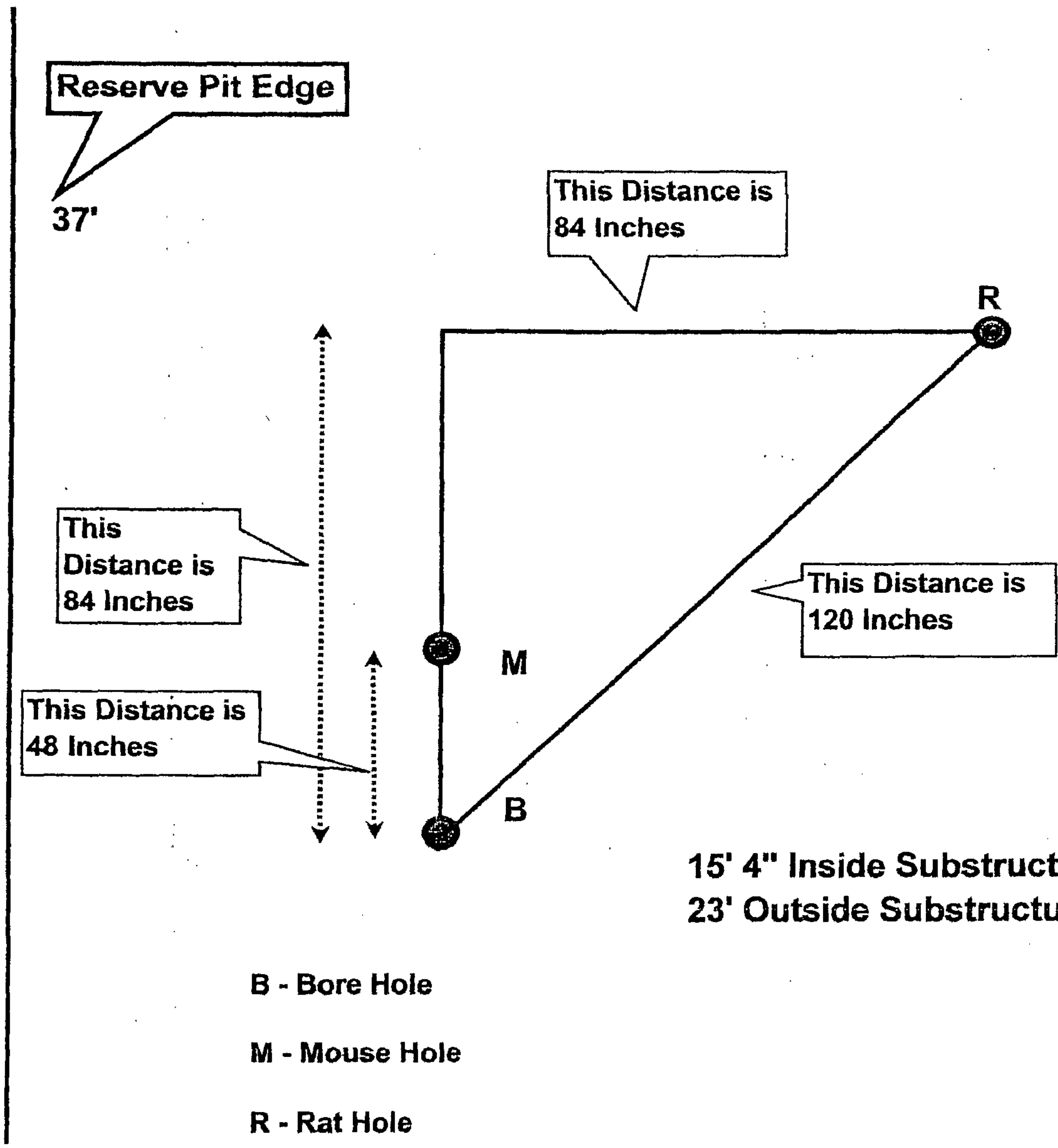
Rocky Mountain Division



RIG 138 LAYOUT

6/3/2008

Unit Drilling Company
Rocky Mountain Division



15' 4" Inside Substructure
23' Outside Substructure

B - Bore Hole

M - Mouse Hole

R - Rat Hole

From Center Hole to Pit is 37 Feet

From Corner of Pit to the Center of Hole is 12 Feet

RIG 138 RAT HOLE
6/3/2008

STATE OF WYOMING

DEPARTMENT OF ENVIRONMENTAL QUALITY – LAND QUALITY DIVISION

UPDATE TO A NONCOAL NOTIFICATION TO EXPLORE BY DRILLING

This notification update and all attachments in duplicate (or in triplicate if Federal lands are involved), showing intent to explore for noncoal minerals by drilling is submitted in accordance with the provisions of the Land Quality NonCoal Rules and Regulations, Chapter 8 and accompanies the bond required by Chapter 8 Section 3. This notification update is submitted in accordance with the Cooperative Agreement between the State and the Bureau of Land Management (43 CFR 3809) if applicable by involvement of Federal locatable minerals. This form is to be used only for updating an existing Drilling Notification where the proposed exploratory activity will remain within the area previously authorized for exploration.

1. Drilling Notification Information

Drill Notification # 334DN Project Name Lost Creek ISR

Update Number # 4 Update Name deep exploration hole

2. Discoverer Information

Name: Lost Creek ISR, LLC

Address: 5880 Enterprise Drive Suite 200, Casper, WY 82609

Contact Person: John Cash Telephone # (307) 265-2373

3. Location

Provide a map that clearly illustrates the location of the proposed activity. The map must be oriented, contain a scale, and identify area using the Public Land Survey System (Township, Range, and Section).

4. Reclamation Cost Estimate

Provide a separate, detailed bond estimate for this Update and submit as an Attachment to this Form. Once a bond estimate for this Update has been developed, prepare a cumulative Reclamation Performance Bond estimate using the table below. Tabulate each permit action (original DN, Amendment(s), prior update(s), and this request) as an individual line item and identify the most recent WDEQ/LQD bond approval date.

Description	Bond Approval Date	Quantity (# of holes)	Bond Amount
Original Form 9DN Activity (2005)	4-11-08	14	$1,200
Update 1 (2006)	4-11-08	12	$1,200
Update 2 (2007)	4-11-08	195	$4,000
Update 3 (2008)	4-11-08	451	$748,664
Update 4 (July 2008)	Pending	deep well	$139,636
Wells	various (n/a)	60 wells	$194,100
Total			$1,088,800

5. All stipulations cited in the original Form 9DN are in effect concerning disposal of hazardous material, site inspection and reporting requirements.

Applicant Signature

8/4/2008
Date

John W. Cash
Manager EHS and Reg. Affairs
Applicant Name and Title

Approval and Date

Form 9DN-Update
Revised 4/08 ALJ

TFN # 5 5/022
District

334DN Update 4; Bond Status

2005 Drilling 334DN (Original DN)

Description	Unit cost (cost/hole)	Total
14 holes (reveg)	$11/hole	$154.00
33% of one-time mob/demob cost ($2,500):		$833.33
	Subtotal:	$987.33
	BLM contingency (22%):	$217.21
	Total:	$1,204.55
Bond for 2005 rounded to nearest $100		$1,200

2006 Drilling 334DN (Update 1)

Description	Unit cost (cost/hole)	Total
12 holes (reveg)	$11/hole	$132.00
33% of one-time mob/demob cost ($2,500):		$833.33
	Subtotal:	$965.33
	BLM contingency (22%):	$212.37
	Total:	$1,177.71
Bond for 2005 rounded to nearest $100		$1,200

2007 Drilling 334DN (Update 2)

Description	Unit cost (cost/hole)	Total
195 holes (reveg)	$11/hole	$2,145.00
30 holes (capping)	$7.50/hole	$225.00
	Subtotal:	$2,370.00
33% of one-time mob/demob cost ($2,500):		$833.33
	Subtotal:	$3,203.33
	BLM contingency (22%):	$704.73
	Total:	$3,908.07
Bond for 2007 rounded to nearest $100		**$4,000**

2008 Drilling 334DN (Update 3)

Description	Unit cost (cost/hole)	Total
P & A 100 Boreholes	$62.50/ site +$6.28/foot	$445,850
P & A 51 Wells(1)	$40/site + $4/foot	$108,320
Existing Roads	$1,000/acre	$13,000
	Subtotal:	$567,170
BLM & fuel contingency (32%):		$181,494
	Total:	$748,664

(1) Number of planned wells reduced from 85 to 51

2008 Drilling 334DN (Update 4)

Description	Unit cost (cost/hole)	Total
P & A Deep Well	$105,785	$105,785
	Subtotal:	$105,785
BLM & fuel contingency (32%):		$33,851
	Total:	$139,636

Bond Calculation for wells in 334DN project

Description	Unit cost (cost/hole)	Total
78	*Lump sum	$156,575.00
One time mob/demob cost:		$2,500.00
Subtotal:		159,075.00
	BLM contingency (22%):	$34,996.50
	Total:	$194,071.50
Bond for wells rounded to nearest $100		**$194,100**

Lost Creek ISR, LLC; Aug 4, 2008

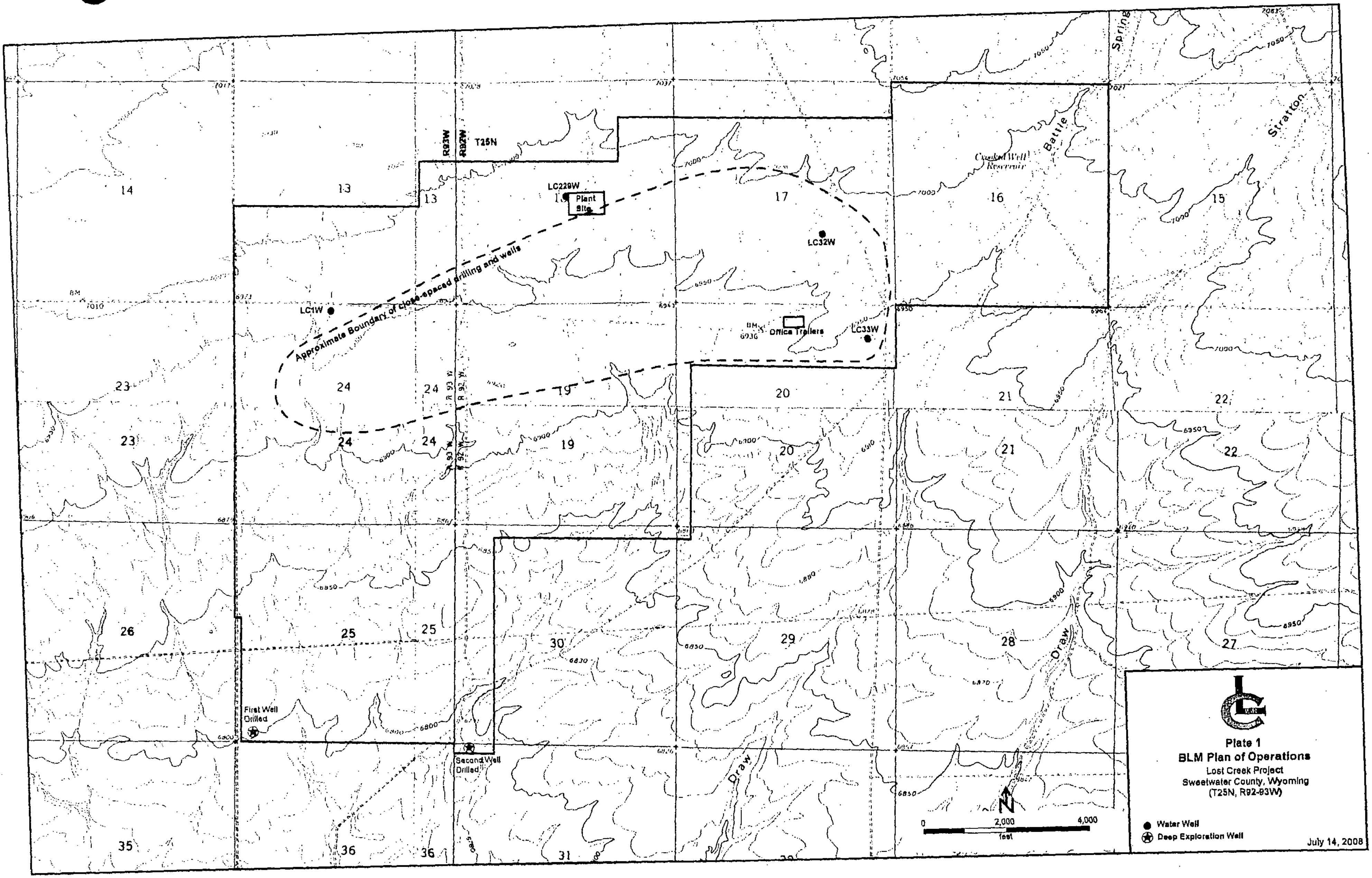


Plate 1
BLM Plan of Operations
Lost Creek Project
Sweetwater County, Wyoming
(T25N, R92-93W)
Water Well
Deep Exploration Well
July 14, 2008
0
2,000
4,000
feet
Approximate Boundary of close-spaced drilling and wells
Plant Site
Office Trailers
LC229W
LC32W
LC33W
LC1W
First Well Drilled
Second Well Drilled
R93W
R92W
T25N
Crooked Well Reservoir
Battle
Spring
Stratton
Draw
Draw
14
13
13
17
16
15
23
24
24
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31

LOST CREEK ISR, LLC

MINE UNIT 1 MONITOR WELL PLAN

SUBMITTED TO WDEQ-LQD LANDER FIELD OFFICE

AUGUST 4, 2008

Contents

1. Bonding

The proposed bond for the installation of monitor wells, and other activities, was submitted to WDEQ-LQD as part of Update 3 to 334DN on April 3, 2008. The bond was subsequently approved by letter from WDEQ on May 14, 2008. The approved bond, issued by Colorado Business Bank on May 1, 2008, remains in full force and effect.

2. Monitoring Plan

2.1 Methodology for Determining Zones to be Monitored

The Mine Unit 1 monitor well plan (Figure 1) contains 28 perimeter monitor wells. Perimeter ring wells are planned 500 ft. from the nearest production pattern and approximately 490 ft. from each consecutive monitor well in the ring.

Mine Unit 1 will have a total pattern area of 37 acres. The interior monitor wells are planned so that there is 1 overlying well (MO), 1 production zone well (MP) and 1 underlying well (MU) placed for every three acres of pattern area. Therefore there are a total of 39 interior monitor wells (13 sets). Each of these well sets is planned no more than 1,000 ft. from each other within Mine Unit 1.

Within Mine Unit 1 there are four targeted production zones within the HJ sand: Zone 1 (UHJ), Zone 2 (MHJ1), Zone 3 (MHJ2) and Zone 4 (LHJ). Completion of each perimeter monitor well is dictated by the nearest production patterns to a particular well. Since each perimeter monitor well is placed at a distance of 500 feet from the edge of the pattern area, the planned monitor well completion is defined by whichever Zones will be in production within 600 feet from that monitor well (Figure 2 and 3).

Interior production zone monitor wells will be completed for the appropriate Zone depending on which pattern area it is dedicated to. The overlying monitor wells will be completed in the LFG sand (nearest overlying aquifer) and the underlying monitor wells will be completed in the UKM sand (nearest underlying aquifer).

Two pump test wells are planned for installation in Mine Unit 1. These wells are positioned centrally and will be completed for the entire HJ sand (approximately 120 ft).

2.2 Methodology for Determining Baseline

LC ISR, LLC commits to return the groundwater to the pre-operational class-of-use in accordance with WDEQ statutes and regulations. Restoration will demonstrate that Best Practicable Technology (BPT) has been applied. If possible, restoration will be conducted to achieve water quality that approximates baseline levels.

Prior to operation of each mine unit, groundwater class-of-use will be determined by the WDEQ-Water Quality Division (WQD) on the basis of baseline water quality data collected in accordance with WDEQ requirements and submitted to WDEQ by LC ISR, LLC. For the wells in the perimeter monitor ring and for wells in overlying and underlying aquifers, the class-of-use will be determined on a well-by-well basis. For the pattern area, baseline water quality data from monitor wells in the pattern area will be averaged to determine the class-of-use for that mine unit.

Baseline water quality data will be collected from the monitor wells in the perimeter ring, in the pattern area, and in the overlying and underlying aquifers before initiating ISR operations in each mine unit, in accordance with Section 4 of this Plan.

The baseline water quality and Upper Control Limits (UCL) will be set by first analyzing the data set for outliers using the iterative Loftis technique described in WDEQ-LQD Guideline 4. Outliers will be removed from the data set. If one or more wells have parameter values that contain a relatively large number of outliers, then these wells will be treated separately as an additional baseline database for one or more parameters.

UCLs are used to determine when an excursion of mining lixiviant outside the mining zone has occurred. The UCLs for the site will be calculated following WDEQ-LQD Guideline 4 which is baseline mean plus five (5) standard deviations. For situations where chloride concentrations are very low and show little variability during baseline sampling, the UCL will be set at the baseline mean plus 15 mg/l if the result is greater than baseline mean plus five (5) standard deviations.

3. Field and Well Completion Procedures

3.1 Drill Rigs

The contract drill rigs are standard water well rotary mud rigs with the ability to install PVC cased water wells to a depth of approximately 1,000 ft. While 1400 or 1500 class drill rigs with tandem axle drive train are most commonly used, other types may be employed based on availability. Each rig will have the ability to airlift wells (capacity of 450 CFM @ 250 PSI) and have drill pipe and collars totaling at least 1,000 ft. and a mud pump to support operations at this depth. Each 60,000 pound drill rig is supported by a water truck (approximately 53,000 pounds), a pipe truck (approximately 25,000 pounds) and a light pickup (approximately 6,000 pounds).

3.2 Drilling Fluids

The following materials will be used in varying concentrations to minimize fluid loss, create wall cake, lubricate the bit and transport drill cuttings to the surface:

- Polymer: Alcomer 123LA, Drispac Plus
- Bentonite: Plug Gel, Super Gel
- Lost Circulation Material: Cedar Fiber, Magma Fiber

Polymer is added to the drill water during piloting and reaming to aid in lubrication and cuttings transport. A typical Alcomer mixture for a 500 ft. hole is 1 gallon added to the pit before/during drilling. A typical Drispac Plus mixture is 1 cup added to the pit before/during drilling.

Bentonite, commonly referred to as gel, is used as a viscosifier and for filtration control in water based muds. When mixed appropriately, it may also be used to plug holes and isolate formations. Most pilot holes are drilled with just water and little or no bentonite products.

Lost circulation material is used only as needed to reduce loss to a thief zone and may also incorporate varying quantities of bentonite gel.

Attachment A contains Material Safety Data Sheets for each of the drilling fluids.

3.3 Geophysical Logging

Geophysical logging is performed immediately after the borehole has been completed and is done within an open hole (uncased hole and not through drill-pipe). The Geophysical Logging Unit typically consists of a ¾ ton pickup or small box van equipped with:

- An electronic sonde (probe). Typically, the sonde is approximately seven feet long and approximately 2-½" in diameter;
- Hydraulic draw-works for lowering and raising the sonde; and
- Computer electronics for field processing of the data.

The logging procedure involves lowering the probe down the borehole to the total drilled depth (TD) and then measuring the formation characteristics as the probe is raised to the surface at a rate of approximately 50 feet per minute. Total time required for logging a typical bore hole is approximately ½ to 1 hour.

The probe measures rock characteristics by recording three data-output curves:

1. Natural Gamma: For indirect detection of uranium
2. Spontaneous Potential (SP): Indicates formation lithology
3. Single Point Resistance: Indicates formation lithology

Additional output includes:

1. Bore hole deviation data
2. Ore grade analysis data

No radioactive source is employed in this logging procedure.

In boreholes of particular interest, a second geophysical logging procedure may be performed by a PFN (Prompt Fission Neutron) Unit. This unit provides a direct measurement of the uranium content. Once again, this logging procedure is done in an open-hole as soon as possible after the completion of the borehole. In general, the PFN vehicle, draw-works, probe, and computer electronics are very similar to that of the standard Geophysical Logging Unit described above. This type of logging utilizes a neutron source, consequently special safety measures are employed as per regulations and guidelines established by the NRC (Nuclear Regulatory Commission).

3.4 Well Design

The well casing will be polyvinyl chloride (PVC) pipe. A typical casing will be CertainTeed's spline-locking standard dimension ratio (SDR) 17 PVC well casing, which has a nominal 4.5 inch O.D, 0.291 inch minimum wall thickness, and is rated for 160 pounds per square inch (psi) burst pressure and 224 psi collapse pressure. The PVC casing joints normally have a length of 20 feet each. Each connection is sealed with an o-ring and spline lock. This configuration provides a seal without the installation of screws to hold each joint together and has been proven effective at other ISR facilities. Casing centralizers, located every 40 feet, are run on the casing to ensure it is centered in the drill hole and that an effective cement seal is provided.

3.5 Well Construction and Cementing

Upon completion of reaming the hole to at least 3 inches in diameter greater than the casing OD and prior to installation of the casing, the hole will be circulated bottoms up with drilling fluid to remove any remaining cuttings. No chemicals are used to treat the well bore.

Cementing operations will utilize PVC or steel centralizers capable of centralizing the casing at least 1-1/2 inches in all directions (3 inches total) positioned at least every 40 feet vertically in the well. A rubber wiper plug may or may not be used depending on the extent of the completion interval and the desired positioning of the casing shoe. A "proper" float shoe will not be utilized. However, in the case of a wiper plug, a dowel will be installed within a foot of the casing bottom to stop the wiper plug. In the cases where a wiper plug is not used, chase fluid will be utilized to displace the cement and a heel of 5 to 10 feet will be left in the casing and drilled out prior to completion.

The purpose of the cement is to stabilize and strengthen the casing and seal the well annulus to prevent vertical migration of solutions. WDEQ-LQD Rules and Regulations Chapter 11, Sect. 6(c)(iv)(A) requires, *"Neat cement slurry shall be composed of Portland Cement and clean water in a proportion to yield a slurry weight of approximately 15 pounds per gallon."* 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 mechanical integrity test (MIT). In all cases, wells are required to pass an MIT before operations approval. This will ensure that there is sufficient integrity to allow the use of the well in handling lixiviant.

Type I/II Portland cement will be mixed in a trailer mounted cementing unit. The unit is comprised of a 20 barrel mix tank, an eductor assembly, a diesel motor, transmission and a centrifugal pump. The cementer will utilize the pump to circulate fresh water while the dry cement is added through the eductor to create a uniform slurry prior to pumping downhole. The cementer and the dry cement are delivered to the well of interest prior to running of casing. Once the casing is installed downhole, the cementer is partially filled with fresh water. The dry cement along with 2% bentonite gel, 2% calcium chloride and additional fresh water are mixed to achieve a slurry of 15 pounds per gallon. The cementer utilizes the centrifugal pump to force the slurry down the PVC well casing and up the annulus. Two procedures exist depending on whether the well will be cased above the zone of interest or cased through the zone of interest.

Case Above The Zone: Depending on the depth of the well, either weighted mud or fresh water will be used to displace the cement in the casing to the annulus. Once the prescribed amount of cement is pumped into the casing using the cementing unit, the cementing tank is filled with the appropriate amount of displacement fluid to maintain approximately 10 feet of cement in the casing. The casing head valve is then shut and the cement allowed to cure for a minimum of 72 hours.

Case Through The Zone: Depending on the depth of the well, either weighted mud or fresh water will be used to displace the cement in the casing to the annulus. Once the prescribed amount of cement is pumped into the casing using the cementing unit, a wiper plug is installed in the casing head. The cementing tank is filled with the appropriate amount of displacement fluid to push the wiper plug and the cement to total depth. The cementing unit pump will pump the displacement water. Pumping pressure and volume pumped will be monitored to determine when the wiper plug has bottomed out. Once the plug is at TD, the casing head valve is then shut and the cement allowed to cure for a minimum of 72 hours.

Prior to any additional work, all the monitor wells will be topped off with neat cement from surface and allowed to cure. Once topped off, the following procedures apply for completing those scenarios:

Case Above The Zone: In this case there will be 5 to 10 feet of cement in the casing. The drill will enter the well with the underreamer and a 4 inch roller cone bit on the bottom. The cement in the casing will be drilled out as well as the formation to the underream depth plus 3 to 5 feet for rat hole. The drill operator will open the blade underreamer to a diameter of approximately 11 inches and underream the zone of interest. Upon completion, the drill operator will close the underreamer blades and remove the tool from the well.

Case Through The Zone: In this case the zone of interest will have cemented casing through it with approximately 5 to 10 feet of rat hole below it and a cement plug at the bottom. The drill will enter the well with the underreamer. The drill operator will open the blade underreamer to a diameter of approximately 11 inches and underream the zone of interest. Upon completion, the drill operator will close the underreamer blades and remove the tool from the well.

The screen will be either PVC or Stainless Steel with the following specifications:

Screen OD: 3.781" Nom.
Screen ID: 3.068" Nom.
Screen Size: 0.020
Open Area: 18.23 square inches per foot
Collapse Strength: 154 psi

Monitor well screen assemblies will not be gravel packed typically. If abnormal hole conditions exist, 10-20 mesh gravel pack sand and the cementing unit will be used to transport gravel into the annular space surrounding the well screen.

Two (2) K-Packer assemblies will be utilized to support and hold the well screen in each well. They are 4.5" OD rubber attached to 3" threaded steel pipe. There are various manufacturers of the product and they are specifically turned down to fit in 4.5" SDR-17 well casing.

The monitor well cap will be made using either a sanitary water well cap with holes for wire and the production tubing or from a PVC, spline-lock completion cap. The spline-lock cap serves the same purpose as a sanitary seal except it is held in place with an o-ring and a spline similar to the connections for each casing joint. Both methods will ensure a seal to the surface.

Well development occurs in two stages. The first stage occurs after underreaming is complete and the well screen is set. The drill operator will move down the hole from static water level air lifting the well for approximately 1 to 2 hours. The second stage of well development will be completed by a swabbing unit. The truck mounted swabbing unit lowers a swab cup into the well until water level is reached. The swab cup is lowered approximately 50 feet below water level and the cup is pulled out of the hole. This action pulls fresh water into the wellbore from the completion zone. To ensure the well is adequately developed, the water sampler will purge the well with a submersible pump until field parameters are stable.

3.6 Waste Water Disposal

During the drilling and development of monitor wells two types of water will be generated.

While boring the well, fresh water will be fortified with drilling fluids such as bentonite and polymer. The resulting drill solution will be circulated down hole and through a mud pit. Upon the completion of drilling, the water remaining in the mud pit will be allowed to dissipate through evaporation and soaking into the soil.

The second source of water is from well development discussed in Section 3.5. Well development sorts the gravel pack in the completed interval and removes native fines that may restrict flow into the well. The water resulting from air lifting will be directed to the mud pit where it will dissipate through evaporation and soaking into the ground. Water resulting from swabbing will be directed to the mud pit if it is still present. If the mud pit is not open, the water will be allowed to soak into the ground.

None of the water types generated during well boring and development is hazardous and the procedures described above follow standard industry practices.

3.7 Mechanical Integrity Testing

After a well has been completed and before it is made operational, an MIT of the well casing will be conducted. An MIT will also be conducted on any monitor well that has been damaged by surface or subsurface activity or that has had a drill bit or cutting tool inserted in the well. Any well with evidence of subsurface damage will require an MIT prior to the well being returned to service.

In the integrity test, the bottom of the casing adjacent to or below the confining layer above the zone of interest is sealed with an inflatable packer or other suitable device. The top of the casing is then sealed in a similar manner or with a cap, and a pressure gauge is installed to monitor the pressure inside the casing. The pressure in the sealed casing is then increased to a specified test pressure and will maintain 95 percent of this pressure for ten minutes to pass the test. If any well casing that fails the test cannot be repaired, the well shall be plugged and abandoned.

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

If a well casing does not meet the mechanical integrity criteria, the casing will be repaired and the well re-tested or the well will be properly plugged within 120 days of the failed test. If a repaired well passes the MIT, it will be employed in its intended service. Also, if the well defect occurs at depth, the well may be plugged back and re-completed, within 120 days of the failed test, for use in a shallower zone, provided it passes an MIT after re-completion. If an acceptable test cannot be obtained after repairs, the well will be plugged within 120 days of the failed post-repair test. The documentation for the MITs will include the well designation, date of the test, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the integrity tests shall be maintained on-site and will be available for inspection by WDEQ.

4. Water Sampling Protocol

4.1 Mining Unit Monitor Wells

As a part of the baseline water quality assessment, all the mine unit monitor wells (monitor well ring, overlying and underlying aquifer wells) will be sampled at least four times at intervals at least 14 days apart. Water levels will be measured at the same frequency as the monitor well sampling to within 1/10 of a foot. One round of samples will be analyzed for the parameters listed in LQD Guideline 8 (Appendix 1 parts II, IV, V(A)(1) and V(E) as updated in March 2005) and three rounds will be analyzed for just the UCL parameters. UCLs will be set for parameters that would be indicative of a migration of lixiviant from the mine unit, and it is anticipated that these parameters will be chloride, conductivity, and total alkalinity. Chloride is a common UCL in Wyoming due to its low natural levels in the native groundwater and because chloride is introduced into the lixiviant from the ion exchange process (uranium is exchanged for chloride on the ion exchange resin). Chloride is also a very mobile constituent in the groundwater and will show up quickly in the case of a lixiviant migration to a monitor well. Conductivity is another common UCL because it is an excellent general indicator of overall groundwater quality. Total alkalinity concentrations should be affected during a potential excursion, as bicarbonate is the major constituent added to the lixiviant during mining.

As recommended in LQD Guideline 4, the QA/QC will include at least one duplicate, one standard, and one blank per set of Guideline 8 samples. The samples will be preserved and analyzed using the EPA approved analytical methods described in LQD Guideline 8 and within the prescribed holding times. Preservation techniques generally involve filtration to 0.456 micron and/or acidification with nitric or sulfuric acid depending on the parameters to be analyzed. Field parameters will be measured using instruments calibrated in accordance with the manufacturer's instructions. Additionally, the contract lab performing the Guideline 8 analysis will complete an anion/cation balance to ensure no significant ions are being left out of the analysis. The field samplers will maintain sampling data as outlined in LQD Guideline 8(VI). Samples will be stored in a cool dark location until analysis. A chain of custody record will be maintained for each sample and will detail the company name and contact information, sample name, date and time of collection, parameters to be analyzed, preservation techniques and a timeline describing who handled the samples and when. A copy of the chain of custody will be maintained by the company and the original will be sent to the laboratory to ensure quality control.

4.2 Interior Monitor Wells

As a part of the baseline assessment, all the interior monitor wells (ore zone baseline wells) will be sampled at least four times at intervals at least 14 days apart. Water levels will be measured at the same frequency as the monitor well sampling. The first two rounds of samples will be analyzed for the parameters listed in LQD Guideline 8 (Appendix 1 parts II, IV, V(A)(1) and V(E) as updated in March 2005). The third and fourth rounds will be analyzed for just the parameters which were above detection limits in either or both of the first two rounds.

The QA/QC program for well field monitor wells will be the same as that for mining unit monitor wells described in section 4.1.

4.3 Monitor Well Purging

Before collecting the final sample, each well is to be purged until the field parameters are stable (per LQD Guideline 8 Section IV(A)(4)(b). Stability will be defined as a change of less than 0.2 standard units in pH, 1.0 degree change in temperature (Celsius) and less than 10% change in specific conductance in the time period it takes to pump at least one casing volume. In the event that the well pumps dry, the sample may be collected after pumping the well dry and allowing enough recharge to collect a sample. Field parameters will consist of pH, specific conductance, and temperature with accuracies as defined in WDEQ-LQD Guideline 8, Appendix 1.

5. Drill Water Supply

A total of four water supply wells have been permitted through the State Engineer's Office and are capable of supplying the water needed to drill the monitor wells and support regional exploration drilling. The three existing wells are LC1W in the NE, NW of Section 24, LC32W in the NW, SE of Section 17, and LC33W in the NE, NE of Section 20. The fourth well, LC 229W, is to be drilled in the SW, NE of Section 18 near the proposed plant location. Water well LC28M was originally permitted as a monitor well but a request to the State Engineer's Office is being prepared to convert the well to a water supply well. If the request is successful, water from LC28M will be used to drill the deep exploration well.

6. Surface Disturbance Mitigation and Reclamation

6.1 Topsoil Protection

LC ISR will continue the topsoil protection measures historically used for exploration drilling during delineation drilling (generally on closer spacing than exploration drilling) and monitor well installation. Those measures include topsoil removal and replacement from specific locations (e.g., mud pits), minimizing traffic routes, and general maintenance.

At drilling sites, which are in use for only a few days, topsoil will be protected by:

- Stripping topsoil from the mud pit locations. Topsoil in the area is generally 12" deep;
- Stockpiling the topsoil separate from the stockpile of the deeper material excavated from the mud pit;
- After drilling, allowing the mud pit to dry and replacing the deeper excavated material;
- Replacing topsoil; and
- Surface preparation and reseeding

In addition, care will be taken to prevent drilling mud from flowing out of mud pits and to keep rig and support vehicle traffic to a minimum number of routes so topsoil compaction, tire ruts, and similar problems are minimized.

Access to the Plan area will be restricted and vehicular traffic will be minimized during drilling activities and restricted to specific routes. In particular, traffic routes will be established within areas of dense drilling. This will reduce the occurrence of compacted soils.

Erosion control will be an important factor in protecting the topsoil resource. When soil is disturbed in such a manner that wind or water erosion may result, one or more of the following practices will be followed to mitigate the potential risk:

- mulching;
- terracing;
- wind breaks;
- dust suppression with water; and/or
- sediment trapping structures

6.2 Drill Pits

Drill pits will be constructed so that they are at least 25% greater in volume than the anticipated volume of drill cuttings and mud. The pits will be backfilled as soon as the moisture dissipates sufficiently to prevent mud from flowing out of the pit. Depending on numerous factors (including soil moisture content, temperature, size of pit, volume of water, etc.) it may take from two weeks to four weeks before pits can be safely backfilled. Regardless of the time required before backfilling, the pits will remain fenced to prevent entry by wildlife and livestock. Once the backfilled pit can support the weight of a vehicle, the topsoil will be re-applied. The soil will be slightly mounded, 6 to 12", to allow for settling.

6.3 Revegetation

The permanent seed mix and seeding rates for re-vegetation are provided in Table 1. This seed mix will adequately support the post-operational land uses, livestock grazing and wildlife habitat, and was previously approved by Mark Newman of the BLM Rawlins Office on November 17, 2006 and by Melissa Bautz of the WDEQ-LQD Lander Field Office on November 3, 2006 (e-mail communications). If any of the approved seed is unavailable or prohibitive in cost at the time of seeding, other locally adapted and certified seed may be substituted with prior approval of BLM and WDEQ-LQD. On occasion it may be beneficial to stabilize soil by planting a vigorous annual cover crop of rhizomatous species as directed in LQD Guideline 2. LC ISR will seek and receive approval from BLM and LQD before planting such species.

TABLE 1: Seed Mixture

SEED	LBS/ACRE
Thickspike Wheatgrass	4
Western Wheatgrass	2
Indian Ricegrass	2
Prairie Sandreed	2
Great Basin Wildrye	2
Big Sagebrush	1
Rubber Rabbitbrush	1
Winterfat (Ceratoides lanata)	1.5
Slender Wheatgrass	2.5
Sandberg Bluegrass	1.5

The seed bed will be prepared by first leveling with a tractor, backhoe or other implement. As discussed above, the pit will be left slightly mounded to allow for settling over time. If the ground surface is hard it may be necessary to rip or scarify the soil before planting in order for the seed drill to work properly.

Three methods of seeding (drill, pit and broadcast) will be used. Seeding will be performed as a continuous operation when conditions allow. In general, seeding will be completed during the spring or fall, whichever is the first normal period for favorable planting after the seed bed preparation.

Drill seeding will be the primary method. Areas with little gradient will be seeded with the rows perpendicular to the direction of the prevailing wind. Where necessary to prevent erosion, seeding will be done along the contour. Broadcast seeding will be performed on any steep slopes and drainage areas that may be disturbed in the Permit Area. The seed will be distributed uniformly over the area using a mechanical seed spreader. Immediately after broadcast seeding, the areas will be raked or dragged along the contour. This will cover the seeds with approximately one-quarter inch of soil. Pit seeding will be used in areas in which vegetation re-establishment is particularly difficult because the method allows for sheltering seeds from eolian erosion and capturing moisture in the area of the seed.

6.4 Isolation of Deleterious Material

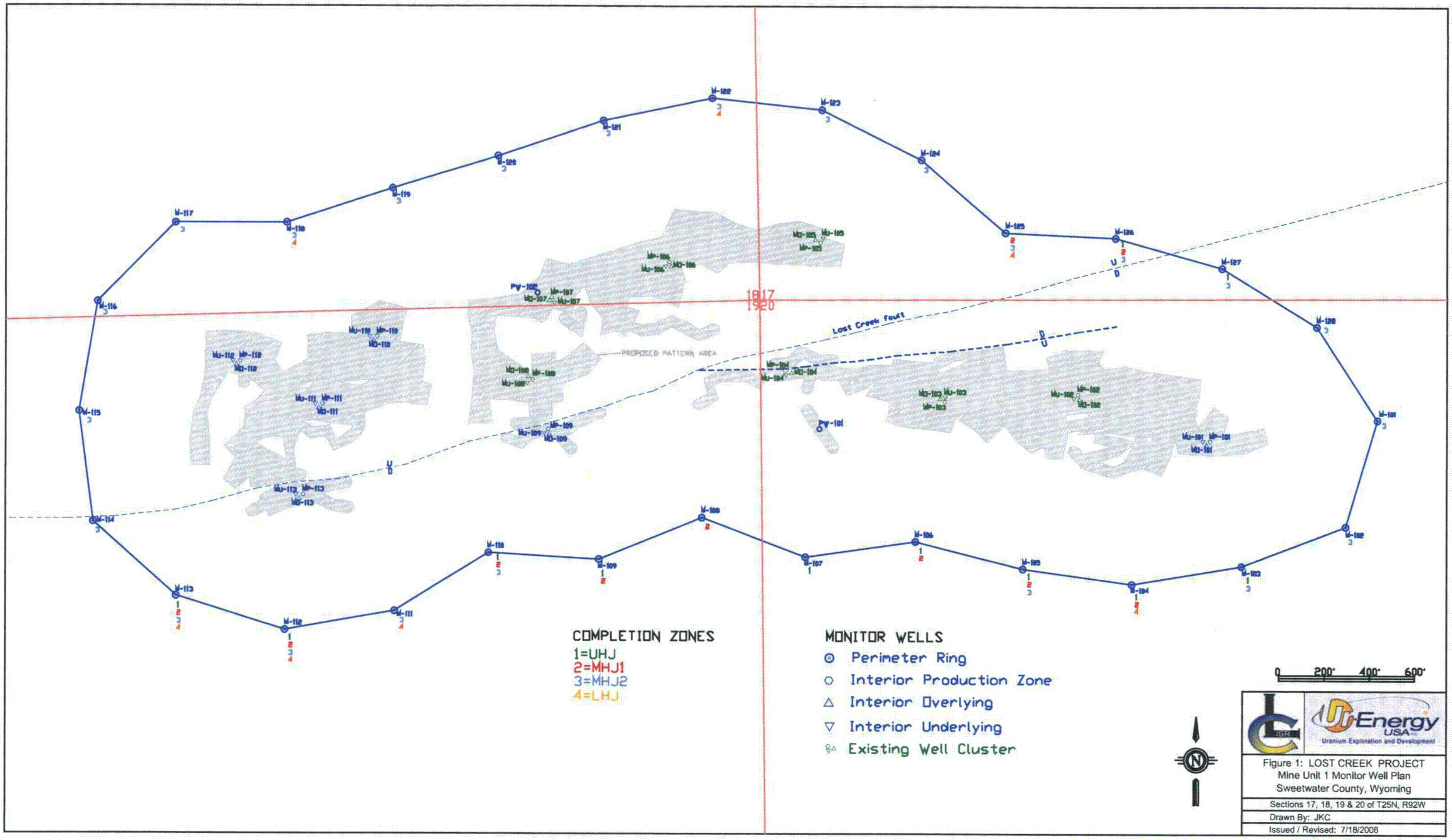
Any leaks of petroleum products from equipment will be repaired or controlled in such a manner as to prevent spills to the ground (i.e. placement of catchment basins). Any soil contaminated with petroleum products will be collected and farmed in a waterproof tank pursuant to *de minimis* quantity guidance found in WDEQ-SHW Guideline 2. Section 7 describes thé procedures for ensuring vehicle leaks are found and properly mitigated.

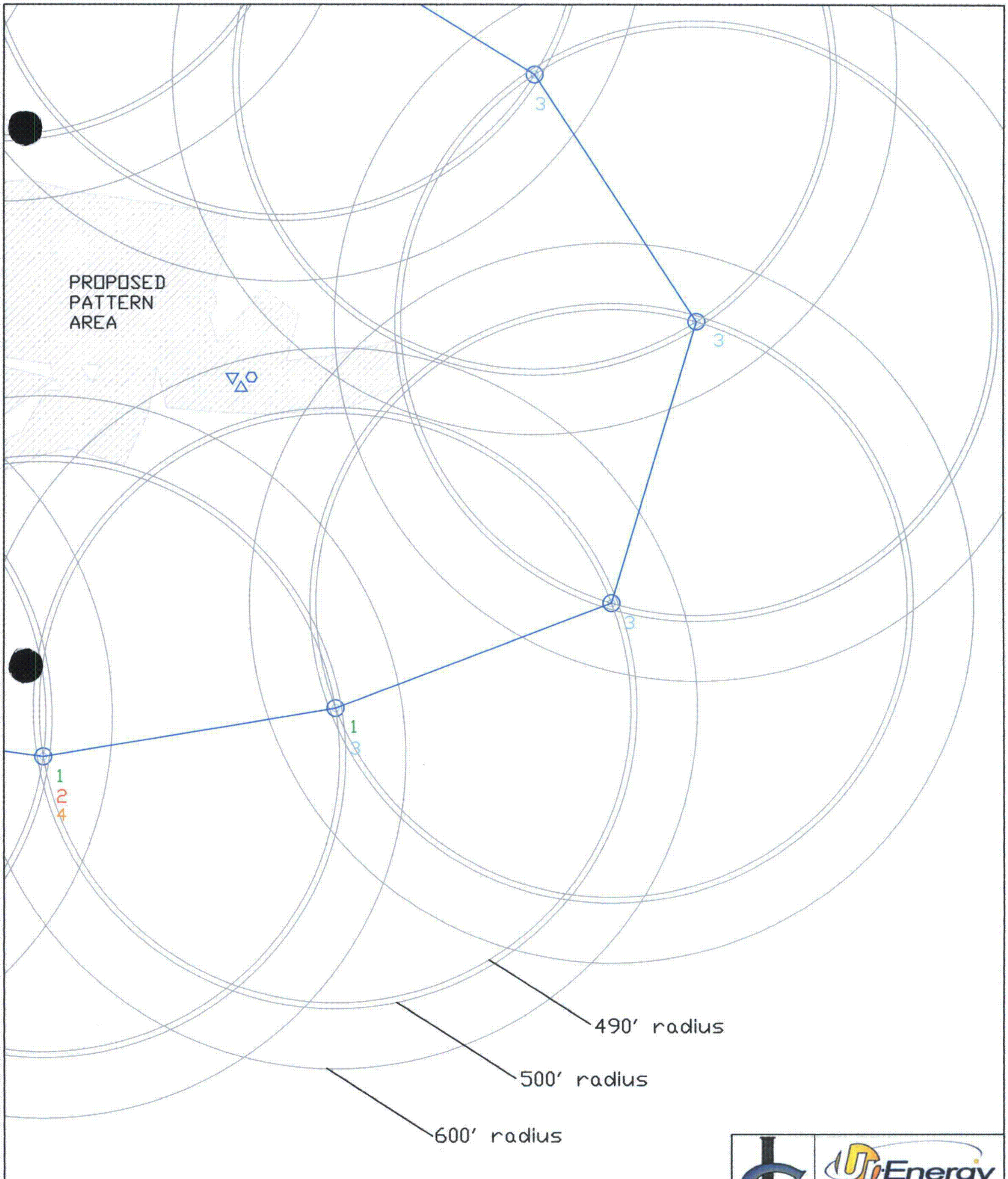
7. Site Inspection Plan

During the life of the project, a weekly inspection will be performed and documented by an individual familiar with the commitments of the Plan of Operations. Inspections may be delayed in the event of inclement weather or work stoppage. The inspector will review the following items:

- Leakage from equipment;
- Growth of noxious weeds;
- Proper backfilling of pits with capture of all drilling mud in pits;
- Proper removal and storage of topsoil;
- Proper trash storage and removal;
- Proper installation and maintenance of erosion control structures; and
- Proper drill hole and well abandonment

Any problems noted by the inspector will be documented and passed on to the Site Supervisor. The Site Supervisor will mitigate the issue in a timely manner and document the results.


1817
1920
Lost Creek fault
PROPOSED PATTERN AREA
COMPLETION ZONES
1=UHJ
2=MHJ1
3=MHJ2
4=LHJ
MONITOR WELLS
Perimeter Ring
Interior Production Zone
Interior Overlying
Interior Underlying
Existing Well Cluster
0
200'
400'
600'
Energy USA
Uranium Exploration and Development
Figure 1: LOST CREEK PROJECT
Mine Unit 1 Monitor Well Plan
Sweetwater County, Wyoming
Sections 17, 18, 19 & 20 of T25N, R92W
Drawn By: JKC
Issued / Revised: 7/18/2008



MONITOR WELLS
- O Perimeter Well
- o Interior Production Zone
- △ Interior Overlying
- ▽ Interior Underlying

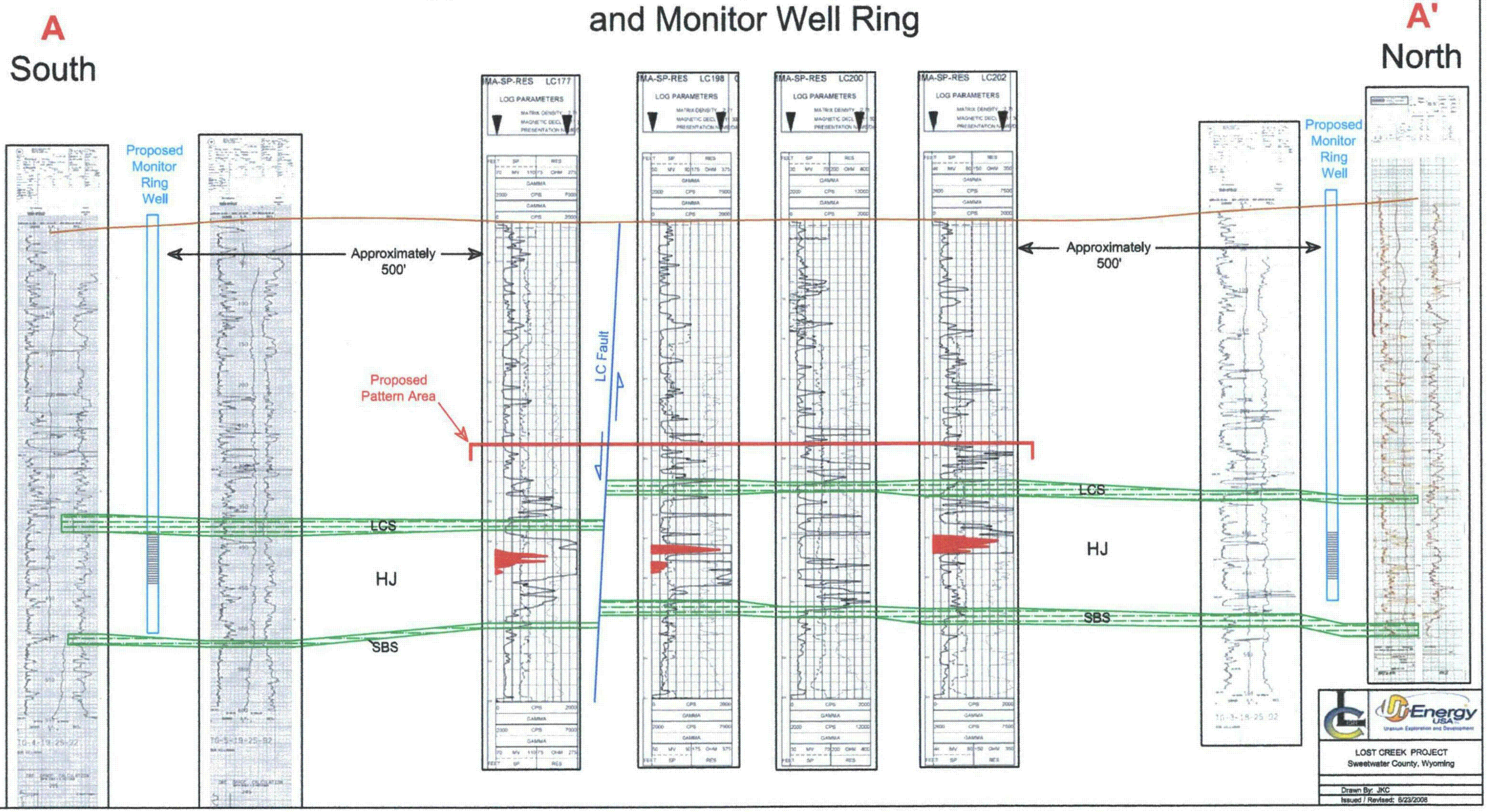
COMPLETION ZONES
- 1=UHJ
- 2=MHJ1
- 3=MHJ2
- 4=LHJ

Ur-Energy USA Inc. — Uranium Exploration and Development

Figure 2: LOST CREEK PROJECT Mine Unit 1
Monitor Well Ring Completions
Sweetwater County, Wyoming

Sections 17, 18, 19 & 20 of T25N, R92W
Drawn By: JKC
Issued / Revised: 7/1/2008

Typical Section Through Proposed Mine Unit 1 and Monitor Well Ring



Attachment A

Ciba Specialty Chemicals Corporation

Ciba

Material Safety Data Sheet

OSHA / ANSI 2003 Compliant

MSDS date: 07-May-2004

NFPA Rating:	**Health:** 2	**Flammability:** 1	**Instability:** 0	**Special Hazards:** None known.
HMIS Rating:	**Health:** 2	**Flammability:** 1	**Physical Hazard:** 0	**Personal Protection:** B

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: ALCOMER 123LA

Product Number: 7861709

Chemical Family: Anionic polyacrylamide emulsion

Manufacturer/Supplier:
Ciba Specialty Chemicals Corporation
2301 Wilroy Road
Suffolk, VA 23434
8:30am - 5pm Phone Number: 1-757-538-3700
MSDS Request Line (voicemail): 1-800-431-2360
Customer Service/Product Information 1-800-322-3885

Emergency 24-Hour Health/Environmental Phone: 1-800-873-1138

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Signal Word: CAUTION!
Physical Form: Liquid
Color: White
Odor: Hydrocarbon-like
Health: This product may cause eye, skin and respiratory tract irritation. Prolonged or repeated contact may cause dermatitis and serious irreversible skin disorders. Mists and vapors may cause irritation to nose and respiratory tract. Exposure to aerosols may result in lung damage. Ingestion may cause nausea, vomiting and diarrhea. Aspiration of liquid during ingestion or vomiting may cause severe chemical pneumonitis..
Physical Hazards: Spills are very slippery.

OSHA Hazardous Substance: This material is classified as hazardous under OSHA regulations.

Primary Route(s) of Entry: Skin, Inhalation, Eyes.

3. COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS

Components	CAS Number	Weight %
DISTILLATES, PETROLEUM, HYDROTREATED LIGHT	64742-47-8	20-40

NON-HAZARDOUS COMPONENTS

Components	CAS Number	Weight %
2-Propenamide, polymer with 2-propenoic acid, ammonium salt	26100-47-0	20-40

4. FIRST AID MEASURES

Eyes: Flush the eye(s) with lukewarm, gently flowing water for 5-10 minutes or until the chemical is removed. Get medical attention if irritation persists.

Skin: Wash off immediately with soap and plenty of water. Get medical attention if irritation occurs. If clothing is contaminated, remove and launder before reuse.

Inhalation: Remove to fresh air, if not breathing give artificial respiration. If breathing is difficult, give oxygen and get immediate medical attention.

Ingestion: Do not induce vomiting. If vomiting occurs naturally, have casualty lean forward to reduce the risk of aspiration. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

Fire Fighting Measures: Standard procedure for chemical fires. Cool fire-exposed containers with water.

Suitable Extinguishing Media: Carbon dioxide, dry chemical or foam.

Fire Fighting Equipment: Wear self-contained breathing apparatus and protective suit.

Hazardous Combustion Products: Burning may produce toxic combustion products.

6. ACCIDENTAL RELEASE MEASURES

Cleanup Instructions: Absorb spill with inert material (e.g. dry sand or earth), then place in a chemical waste container. Wear suitable protective equipment. Should not be released into the environment. Spills are very slippery. Clean up promptly.

Other Information: The petroleum distillates in this product is/are classified as an oil under Section 311 of the Clean Water Act. Spills entering (A) surface waters or (B) any water courses or sewers entering/leading to surface waters that cause a sheen must be reported to the National Response Center (NRC: 800-424-8801).

7. HANDLING AND STORAGE

Handling: As with all industrial chemicals, use good industrial practices when handling. Avoid eye, skin, and clothing contact. Do not inhale. Do not taste or swallow. Use only with adequate ventilation. Keep away from heat, sparks and flame.

Storage: Avoid extremes of temperature. Store between 10 - 40 °C (50 - 104 °F). Do not store in mild steel containers.

For Industrial Use Only

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines:

There are no OSHA or ACGIH exposure guidelines available for component(s) in this product.

Components	OSHA PEL	OSHA STEL	ACGIH TWA	ACGIH STEL	Ciba/ Manufacturer IEL:
DISTILLATES, PETROLEUM, HYDROTREATED LIGHT 64742-47-8			200 mg/m^3		

Personal Protective Equipment

Eye/Face Protection: Wear splash proof chemical goggles.

Skin Protection: Wear chemical resistant gloves and protective clothing.

Respiratory Protection: Use NIOSH approved respirator as needed to mitigate exposure.

Engineering Controls: Work in well ventilated areas. Do not breathe vapors or mist. Local exhaust recommended.

Other Protective Equipment: Eye wash station and safety shower should be available in immediate work area. Select additional protective equipment based upon potential for exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form: Liquid
Color: White
Odor: Hydrocarbon-like.
Boiling Point: Not determined
Freezing/Melting Point: -18°C (0°F)
Solubility in water: Soluble, solubility limited by viscosity
Vapor Density: Not determined
Vapor Pressure: As water
Specific Gravity: ~ 1
pH: 6 - 9.5
Percent Volatile: Not determined
VOC: Not determined
Partition Coefficient (Octanol/Water): Not determined
Autoignition Temperature: Not determined
Decomposition Temperature: Not determined
Flammability Limits in Air:
Upper Not determined
Lower Not determined

Flash point: > 93.33°C (200°F)
Test Method (for Flash Point): Pensky-Martens Closed Cup (ASTM D-93)

10. STABILITY AND REACTIVITY

Stability:	Stable.
Conditions to Avoid:	Avoid wet and humid conditions. Avoid high temperatures.
Incompatibility:	Strong oxidizing agents. (may degrade polymer)
Hazardous Decomposition Products:	No decomposition expected under normal storage conditions.
Possibility of Hazardous Reactions:	None expected.

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:	Low oral toxicity.
Acute Dermal Toxicity:	Not determined
Acute Inhalation Toxicity:	Not determined
Eye Irritation:	May cause eye irritation.
Skin Irritation:	Prolonged or repeated contact can remove skin oils, possibly leading to dry skin, irritation, or dermatitis.
Skin Sensitization:	Not determined
Carcinogenicity (IARC; NTP; OSHA; ACGIH):	None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.
Carcinogenicity Studies:	Not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.
Mutagenicity:	No data for product.
Reproductive Toxicity:	No data for product.
Teratogenicity:	No data for product.
Neurotoxicity:	Not determined
Subacute Toxicity:	Not determined
Subchronic Toxicity:	Not determined
Chronic toxicity:	Not determined
Absorption / Distribution / Excretion / Metabolism:	Not determined
Additional Information:	Not determined

12. ECOLOGICAL INFORMATION

Toxicity to Fish:	Not determined
Toxicity to Invertebrates:	Not determined
Toxicity to Algae:	Not determined
Toxicity to Sewage Bacteria:	Not determined
Activated Sludge Respiration Inhibition Test:	Not determined
Biochemical Oxygen Demand (BOD):	Not determined
Chemical Oxygen Demand (COD):	Not determined
Total Oxygen Demand (TOD):	Not determined
Biodegradability:	Not determined
Bioaccumulation:	Not determined
Additional Environmental Data:	No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal:	Dispose in accordance with local, state, provincial and federal regulations.
Container Disposal Information:	Emptied containers may contain product residue and should not be reused.

14. TRANSPORT INFORMATION

<u>U.S. Department of Transportation (DOT):</u>

Not regulated for this mode of transport.

DOT (Bulk) Oil Statement:
This product is considered to be an oil per the definitions in 49 CFR 130.2. If packed in a container with a capacity of 3,500 gallons or more, the Communication Requirements at 49 CFR 130.11 and the Response Plan Requirements at 49 CFR 130.31 and 130.33 apply to Domestic transportation by motor vehicles and rolling stock.

Notification of releases to the National Response Center (NRC), 800-424-8802, may be necessary. In the Washington, DC metropolitan area, call 202-426-2675.

<u>International Maritime Dangerous Goods (IMDG):</u>

Not regulated for this mode of transport.

International Air Transportation Authority (IATA):

Not regulated for this mode of transport.

15. REGULATORY INFORMATION

Federal Regulations

OSHA Hazardous Substance: This material is classified as hazardous under OSHA regulations

Clean Air Act - Hazardous Air Pollutants (HAP): This product contains the following Hazardous Air Pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).

Components	CAA Section 112 Statutory Hazardous Air Pollutants
2-propenamide 79-06-1	Listed.

Clean Air Act - Volatile Organic Compounds (VOC): This product contains the following SOCMI Intermediate or Final Volatile Organic Compounds (VOC), as defined by the U.S. Clean Air Act Section 111 (40 CFR 60.489).

Components	CAA Section 111 Volatile Organic Compounds
2-propenamide 79-06-1	Listed.

Clean Air Act - Ozone Depleting Substances (ODS): This product neither contains, nor was manufactured with, a Class I or Class II ozone depleting substance (ODS), as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App. A+B).

Clean Water Act - Priority Pollutants (PP): This product does not contain any priority pollutants listed under the U.S. Clean Water Act Section 307 (2)(1) Priority Pollutant List (40 CFR 401.15).

Resource Conservation and Recovery Act (RCRA): Not a hazardous waste under RCRA (40 CFR 261.21).

SARA Section 302 Extremely Hazardous Substances (EHS): This product contains the following component(s) regulated under Section 302 (40 CFR 355) as Extremely Hazardous Substances.

Components	Section 302 Extremely Hazardous Substances (EHS)
2-propenamide 79-06-1 (0-0.05 %)	Listed.

SARA Section 304 CERCLA Hazardous Substances: This product contains the following component(s) regulated under Section 304 (40 CFR 302) as hazardous chemicals for emergency release notification ("CERCLA" List).

Components	Section 304 CERCLA Hazardous Substances	CERCLA Reportable Quantity
2-propenamide 79-06-1 (0-0.05 %)	Listed.	5000 LBS

SARA Section 311/312 Hazard Communication Standard (HCS): This product is regulated under Section 311/312 HCS (40 CFR 370), Acute (immediate) health hazard.

SARA Section 313 Toxic Chemical List (TCL): This product does not contain any component(s) listed on the Section 313 Toxic Chemical List.

TSCA Section 8(b) Inventory Status: All component(s) comprising this product are either exempt or listed on the TSCA Inventory.

TSCA Section 5(e) Consent Orders: This product is not subject to a Section 5(e) Consent Order.

TSCA Significant New Use Rule (SNUR): This product is not subject to a Significant New Use Rule (SNUR).

TSCA Section 5(f): This product is not subject to a Section 5(f)/6(a) rule.

TSCA Section 12(b) Export Notification: This product does not contain any component(s) that are subject to a Section 12(b) Export Notification

FDA Status: Has been cleared for use as Adhesives complying with 21 CFR 175.105 and also cleared for use as Acrylamide-acrylic acid resins complying with 21 CFR 176.110, 176.170 and 176.180 used as an adjuvant in the manufacture of paper and paperboard at a use level not to exceed 2% by weight of the paper or paperboard.

State Regulations

California Proposition 65: This product contains the following component(s) currently on the California list of Known Carcinogens and Reproductive Toxins.

Components	California Proposition 65
2-propenamide *79-06-1*	Carcinogenic.

Pennsylvania Right-To-Know: This product contains the following component(s) which are subject to Pennsylvania Right-to-Know disclosure requirement.

Components	CAS Number	Pennsylvania Right-to-Know
2-Propenamide, polymer with 2-propenoic acid, ammonium salt	26100-47-0	Not Listed.
2-propenamide	79-06-1	Listed. Environmental hazard.
Water	7732-18-5	Not Listed.
DISTILLATES, PETROLEUM, HYDROTREATED LIGHT	64742-47-8	Not Listed.
VENDOR PROPRIETARY	T179	Not Listed.

International Regulations

Chemical Weapons Convention (CWC): This product does not contain any component(s) listed under the Chemical Weapons Convention Schedule of Chemicals.

Domestic Substance List (DSL) Status: All components are listed on the DSL.

16. OTHER INFORMATION

Reason for revision: New MSDS format.

Product Safety & Regulatory (PS&R) contact: Amy Perkins (757) 538-5126

Disclaimer: The information contained herein is based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to such data or information. The user is responsible for determining whether the product is suitable for its intended conditions of use.

MATERIAL SAFETY DATA SHEET
DRISPAC POLYMER (All grades)

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: [redacted]

CHEMICAL CLASS: Cellulosic polymer.

APPLICATIONS: Oil well drilling fluid additive. Fluid Loss reducer

EMERGENCY TELEPHONE: 281-561-1600

SUPPLIER: Supplied by a Business Unit of
M-I L.L.C.
P.O. Box 42842, Houston, Texas 77242-2842
See cover sheet for local supplier.

TELEPHONE: 281-561-1509
FAX: 281-561-7240

CONTACT PERSON: Sam Hoskin - Manager, Occupational Health

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Cellulosic Polymer		100 %		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing airborne product. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling.

May form explosive dust-air mixtures. This product is a/an white powder. Slippery when wet. No significant immediate hazards for emergency response personnel are known.

ACUTE EFFECTS:
HEALTH HAZARDS, GENERAL:

Particulates may cause mechanical irritation to the eyes, nose, throat and lungs. Particulate inhalation may lead to pulmonary fibrosis, chronic bronchitis, emphysema and bronchial asthma. Dermatitis and asthma may result from short contact periods.

INHALATION: May be irritating to the respiratory tract if inhaled.

INGESTION: May cause gastric distress, nausea and vomiting if ingested.

SKIN: May be irritating to the skin.

EYES: May be irritating to the eyes.

CHRONIC EFFECTS:

CARCINOGENICITY:
IARC: Not listed. OSHA: Not regulated. NTP: Not listed.

ROUTE OF ENTRY:
Inhalation. Skin and/or eye contact.

TARGET ORGANS:
Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this MSDS with them.

INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.

INGESTION: Drink a couple of glasses water or milk. Do not give victim anything to drink of he is unconscious. Get medical attention.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.

EYES: Promptly wash eyes with lots of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (°F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D

EXTINGUISHING MEDIA:
Carbon dioxide (CO2). Dry chemicals. Foam. Water spray, fog or mist.

SPECIAL FIRE FIGHTING PROCEDURES:
No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

HAZARDOUS COMBUSTION PRODUCTS:
Irritating gases/vapors/fumes. Oxides of: Carbon.

6. ACCIDENTAL RELEASE MEASURES

HANDLING PRECAUTIONS:

Avoid handling causing generation of dust. Wear full protective clothing for prolonged exposure and/or high concentrations. Eye wash and emergency shower must be available at the work place. Wash hands often and change clothing when needed. Provide good ventilation. Mechanical ventilation or local exhaust ventilation is required.

STORAGE PRECAUTIONS:

Store at moderate temperatures in dry, well ventilated area. Keep in original container.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

		OSHA PEL:		ACGIH TLV:		OTHER:		
INGREDIENT NAME:	**CAS No.:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**TWA:**	**STEL:**	**UNITS:**
Cellulosic Polymer		15		10				mg/m3 total dust

INGREDIENT COMMENTS:

Exposure limits for Particulates Not Otherwise Classified (PNOC) apply to dust/mist/aerosol of the proprietary ingredients this product. TLV: 3 mg/m3 resp dust; PEL: 5 mg/m3 resp. dust.

PROTECTIVE EQUIPMENT:

ENGINEERING CONTROLS:

Use appropriate engineering controls such as, exhaust ventilation and process enclosure, to reduce air contamination and keep worker exposure below the applicable limits.

VENTILATION: Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.

RESPIRATORS: Use at least a NIOSH-approved N95 half-mask disposable or reuseable particulate respirator. In work environments containing oil mist/aerosol use at least a NIOSH-approved P95 half-mask disposable or reuseable particulate respirator.

PROTECTIVE GLOVES:

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION:

Wear dust resistant safety goggles where there is danger of eye contact.

PROTECTIVE CLOTHING:

Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK PRACTICES:

Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE:	Powder, dust.	
COLOR:	White.	
ODOR:	Odorless or no characteristic odor.	
SOLUBILITY DESCRIPTION:	Soluble in water.	
DENSITY/SPECIFIC GRAVITY (g/ml):	1.6	TEMPERATURE (°F): 68
BULK DENSITY:	34.2 lb/cu ft; 548 kg/m3	
VAPOR DENSITY (air=1):	N/A	
VAPOR PRESSURE:	N/A	TEMPERATURE (°F):
pH-VALUE, DILUTED SOLUTION:	6.5 - 8.0	CONCENTRATION (%,M): 1%

10. STABILITY AND REACTIVITY

STABILITY: Normally stable.

CONDITIONS TO AVOID:
Avoid heat.

HAZARDOUS POLYMERIZATION:
Will not polymerize.

POLYMERIZATION DESCRIPTION:
Not relevant.

MATERIALS TO AVOID:
Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS:
No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

Component:	**Cellulosic Polymer**
TOXIC DOSE - LD 50:	>25,000 mg/kg (oral rat)

12. ECOLOGICAL INFORMATION

LC 50, 96 HRS, FISH, mg/l: >21,000

ACUTE AQUATIC TOXICITY:
This product is approved for use under the U.S. Environmental Protection Agency (EPA) Region IX (California) General NPDES Permit which regulates offshore discharges of drilling fluids. Contact M-I's Environmental Affairs Department for more information.

This product passes the mysid shrimp toxicity test required by the U.S. Environmental Protection Agency (EPA) Region VI (Gulf of Mexico) NPDES Permit, which regulates offshore discharge of drilling fluids, when tested in a standard drilling fluid. Contact M-I's Environmental Affairs Department for more information.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:
This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc, may render the resulting materials hazardous.

DISPOSAL METHODS:
Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

U.S. DOT:
U.S. DOT CLASS: Not regulated.

CANADIAN TRANSPORT:
TDGR CLASS: Not regulated.

SEA TRANSPORT:
IMDG CLASS: Not regulated.

AIR TRANSPORT:
ICAO CLASS: Not regulated.

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:

NAME:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL(CAN):
Cellulosic Polymer		Yes	No	No	No	Yes

US FEDERAL REGULATIONS:
WASTE CLASSIFICATION: Not a hazardous waste by U.S. RCRA criteria. See Section 13.

REGULATORY STATUS: This Product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):

SECTION 313: This product does not contain toxic chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372.

SARA 311 Categories:
1: Immediate (Acute) Health Effects.

The components of this product are listed on or are exempt from the following international chemical registries:
TSCA (U.S.)
DSL (Canada)
ENCS (Japan)
AICS (Australia)

STATE REGULATIONS:
STATE REGULATORY STATUS: This product or its components, if a mixture, is subject to following regulations (Not meant to be all inclusive - selected regulations represented):.

None.

CANADIAN REGULATIONS:
REGULATORY STATUS: This Material Safety Data Sheet has been prepared in compilance with the Controled Product Regulations.

Canadian WHMIS Classification: Not a Controlled Product.

16. OTHER INFORMATION

NPCA HMIS HAZARD INDEX: 1 Slight Hazard
FLAMMABILITY: 1 Slight Hazard
REACTIVITY: 0 Minimal Hazard
NPCA HMIS PERS. PROTECT. INDEX: E - Safety Glasses, Gloves, Dust Respirator

USER NOTES: N/A = Not applicable N/D = Not determined

INFORMATION SOURCES: OSHA Permissible Exposure Limits, 29 CFR 1910, Subpart Z, Section 1910.1000, Air Contaminants.

ACGIH Threshold Limit Values and Biological Exposure Indices for Chemical Substances and Physical Agents (latest edition).

Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997).

Product information provided by the commercial vendor(s).

PREPARED BY: Sam Hoskin/bb

REVISION No./Repl. MSDS of: 2/January 12, 1998

MSDS STATUS: Approved.

DATE: January 29, 2001

DISCLAIMER:

AMERICAN COLLOID COMPANY

One North Arlington • 1500 West Shure Drive
Arlington Heights, Illinois 60004-1434 • USA
(708) 392-4600 • Telex ITT 4330321
Fax (708) 506-6199

50302
101

MATERIAL SAFETY DATA SHEET - May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

PRODUCT NAME: PLUG-GEL

Section I MANUFACTURER'S INFORMATION

Manufacturer's Name & Address:

American Colloid Company
1500 West Shure Drive
One North Arlington
Arlington Heights, Illinois 60004

Emergency Telephone Number: 708-392-4600
Telephone Number for Information: 708-392-4600
Date Prepared: July 5, 1990

Section II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components (Specific Chemical Identity: Common Name(s))		OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz CAS# 14808-60-7		-	-	*	2-6%
Respirable Crystalline Quartz				NIOSH	
	present (TWA)	0.1mg/m^3	0.1mg/m^3 TWA	50ug/m^3 TWA	<2%
	proposed (TWA)		50ug/m^3 TWA	-	-
Nuisance Dust					
	- Respirable	5mg/m^3	5mg/m^3	-	-
	- Total Dust	15mg/m^3	10mg/m^3	-	-

* WARNING:
This clay product contains a small amount of crystalline silica which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 42, 1987) concludes that there is "limited evidence" of the carcinogenicity of crystalline silica to humans. IARC classification 2A.

PRODUCT IDENTIFICATION

Chemical Name: Bentonite Clay
Chemical Family: Natural Mineral, Montmorillonite
CAS No.: 1302-78-9
FORMULA: Naturally occurring hydrated aluminosilicate of sodium, calcium, magnesium, and iron
NFPA/HMIS: Health - 1, Fire - 0, Reactivity - 0, Specific Hazard - See Section VI
Dot Class: Not Regulated

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PRODUCT NAME: PLUG-GEL

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point	- Not Applicable	Specific Gravity (H_2O = 1)	- 2.5
Vapor Pressure (mm Hg.)	- Not Applicable	Melting Point	- Not Applicable
Vapor Density (AIR = 1)	- Not Applicable	Evaporation Rate (Butyl Acetate = 1)	- Not Applicable
Solubility in Water	- Negligible		
Appearance and Odor	- Pale grey to buff powder or granules, odorless		

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used) - Not Applicable
Flammable Limits - Not Applicable LEL- - UEL- -
Extinguishing Media - Not Applicable
Special Fire Fighting Procedures - Inorganic Mineral/Non-Flammable
Unusual Fire and Explosion Hazards - Not Applicable

Section V REACTIVITY DATA

Stability Unstable -
Stable - X
Conditions to Avoid - None Known

Incompatibility (Materials to Avoid) - None Known
Hazardous Decomposition or By-products - None Known

Hazardous Polymerization May Occur -
Will Not Occur - X
Conditions to Avoid - None Known

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic) - May cause delayed respiratory disease if dust inhaled over a prolonged period of time.

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 42, 1987) concludes that there is "limited evidence" of the carcinogenicity of crystalline silica to humans. IARC classification 2A.

Signs and Symptoms of Exposure - Excessive inhalation of dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure - Individuals with pulmonary and/or respiratory disease including but not limited to asthma and bronchitis should be precluded from exposure to dust.

Emergency and First Aid Procedures - Eyes - Flush with water.
- Gross inhalation of dust - Remove to fresh air; give oxygen or artificial respiration if necessary; get medical attention.

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PRODUCT NAME: PLUG-GEL

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled - Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water, the product will become slippery when wet.

Waste Disposal Method - Follow federal, state and local regulations for solid waste.

Precautions to Be Taken in Handling and Storing - Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.

Other Precautions - Slippery when wet.

Section VIII CONTROL MEASURES

Respiratory Protection (Specify Type) - OSHA standard 1910.134 or ANSI Z88.2-1980 specification.

Ventilation - Local Exhaust - As appropriate
- Mechanical (General) - As appropriate

Special - None
Other - None

Protective Gloves - Not Required

Eye Protection - Recommended

Other Protective Clothing or Equipment - None

Work/Hygienic Practices - Use good housekeeping practices.

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PRODUCT NAME: SUPER GEL-X®

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (*Method Used*): Not Available. **Flammable Limits:** Not Available. LEL - NA. UEL - NA.
Extinguishing Media: Not Applicable. **Special Fire Fighting Procedure:** Not Applicable.
Unusual Fire/Explosion Hazards: Product may pose possible dust explosion under *extremely rare* circumstances or conditions.

Section V REACTIVITY DATA

Stability: Stable **Conditions to Avoid** - None Known.
Incompatibility (*Materials to Avoid*): Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.
Hazardous Decomposition or By-products: Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.
Hazardous Polymerization: Will Not Occur **Conditions to Avoid** - None Known.

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No
Health Hazards (Acute and Chronic):

Inhalation: Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:
Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.
Cancer Status: The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to *IARC Monograph 68, Silica, Some Silicates and Organic Fibers* (published in June 1997) in conjunction with the use of these materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information *See*: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

Other Data with Possible Relevance to Human Health: The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect,...due mainly to clay minerals..."

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No
Signs and Symptoms of Exposure: Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.
Medical Conditions Generally Aggravated by Exposure: Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.
Emergency and First Aid Procedures:

Eyes & Skin: Flush with water.
Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.
Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.
Waste Disposal Method: Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing: Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.
Other Precautions: Slippery when wet.

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May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

69101/69101

PRODUCT NAME: SUPER GEL-X®

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME & ADDRESS:

Date Prepared: June 1, 2002

CETCO – *Drilling Products Group*
1500 West Shure Drive
Arlington Heights, IL 60004

Telephone Number: 847-392-5800 Fax 847-506.6150
EMERGENCY CONTACT: CHEMTREC 800-424-9300
E-mail: www.cetco.com

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS: (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz: CAS# 14808-60-7			*	< 6%
Respirable Crystalline Quartz:			NIOSH	< 2%
Present (TWA)	0.1 mg/m³	0.1 mg/m³	50 ug/m³	
Proposed (TWA)		50.0 ug/m³		
Nuisance Dust:				
Respirable	5 mg/m³	5 mg/m³		
Total Dust	15 mg/m³	10 mg/m³		

* **WARNING:** This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 68, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/ m³) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. See: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.
TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.
TWA - 8 hour time weighted average
Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PELs. More restrictive exposure limits may be enforced by some other jurisdictions.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Inorganic Mineral Compounds.
NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - *See Section VI.*
Shipping Class: Not Regulated (DOT / 49CFR, IMDG, ICAO / IATA).

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable.
Vapor Pressure (mm Hg.): Not Applicable.
Vapor Density (AIR = 1): Not Applicable.
Solubility in Water: Negligible.
Specific Gravity (H_2O = 1): 2.5
Melting Point: 1400°F
Evaporation Rate (Butyl Acetate = 1): Not Applicable.
Appearance and Odor: Tan or beige to light gray colored powder to fine granules, odorless.

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MATERIAL SAFETY DATA SHEET

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PRODUCT NAME: SUPER GEL-X®

Section VIII CONTROL MEASURES

Respiratory Protection: Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

Ventilation: Use local exhaust as required to maintain exposures below applicable occupational exposure limits (*See Section II*). See also ACGIH "Industrial Ventilation – A Manual for Recommend Practice", (*current edition*).

Protective Gloves: Not Required. **Eye Protection:** Recommended.

Other Protective Clothing or Equipment: None. **Work/Hygienic Practices:** Use good housekeeping practices.

Section IX REGULATORY INFORMATION

SARA 311/312: Hazard Categories for SARA Section 311/312 Reporting: Chronic Health
SARA 313: This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

CERCLA section 103 Reportable Quantity: None

California Proposition 65: *This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."*

Toxic Substances Control Act: All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

Canadian Environmental Protection Act: All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

European Inventory of Commercial Chemical Substances: All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)
European Community Labeling Classification: Harmful (Xn)
European Community Risk and Safety Phrases: R40, R48, S22

Japan MITI: All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

Australian Inventory of Chemical Substances: All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

Canadian WHMIS Classification: Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

NFPA Hazard Rating:	Health: 2	Fire: 0	Reactivity: 0
HMIS Hazard Rating:	Health: *	Fire: 0	Reactivity: 0

***Warning** - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. *See Section II.*

REFERENCES:

Registry for Toxic Effects of Chemical Substances (RTECS), 1995.

Patty's Industrial Hygiene and Toxicology.

NTP Seventh Annual Report on Carcinogens, 1994.

IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.

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Well M-120A

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		11/18/2009	12/1/2009	12/15/2009	1/14/2010	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Total Alkalinity as $CaCO_3$	mg/L	107	110	119	113	107.00	112.25	119.00	5.12	96.88	127.62
CO_3	mg/L	-5	-5	-5	-5	5.00	5.00	5.00	0.00	5.00	5.00
HCO_3	mg/L	130	134	146	138	130.00	137.00	146.00	6.83	116.51	157.49
Dissolved Calcium	mg/L	58	57	57	64	57.00	59.00	64.00	3.37	48.90	69.10
Total Chloride	mg/L	6	6	6	6	6.00	6.00	6.00	0.00	6.00	6.00
Dissolved Fluoride	mg/L	0.1	0.1	0.1	0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Magnesium	mg/L	3	3	3	3	3.00	3.00	3.00	0.00	3.00	3.00
Total NH_3-N	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved NO_3+NO_2-N	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Potassium	mg/L	2	2	2	2	2.00	2.00	2.00	0.00	2.00	2.00
Dissolved SiO_2	mg/L	17.4	17.2	16.9	17.3	16.90	17.20	17.40	0.22	16.55	17.85
Dissolved Sodium	mg/L	31	32	33	34	31.00	32.50	34.00	1.29	28.63	36.37
Total $S0_4$	mg/L	121	123	123	118	118.00	121.25	123.00	2.36	114.16	128.34
Specific Conductance at 25 °C	µmhos/cm	463	464	469	461	461.00	464.25	469.00	3.40	454.04	474.46
Laboratory pH	SU	7.98	7.94	7.97	7.88	7.88	7.94	7.98	0.05	7.81	8.08
TDS Dried at 180 °C	mg/L	294	304	295	266	266.00	289.75	304.00	16.46	240.37	339.13
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Arsenic	mg/L	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	0.000	0.00	0.00
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	0.005	0.005	0.005	0.000	0.01	0.01
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	0.03	0.03	0.03	0.00	0.03	0.03
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	0.000	0.00	0.00
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01

Well M-120A

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		11/18/2009	12/1/2009	12/15/2009	1/14/2010	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	**0.00100**	**0.00100**	**0.00100**	0.00000	0.00	0.00
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Selenium	mg/L	0.003	0.003	0.003	0.003	0.00	0.00	0.00	0.00	0.00	0.00
Dissolved Uranium	mg/L	**0.089**	**0.090**	**0.085**	**0.089**	**0.08**	**0.09**	**0.09**	0.00	0.08	0.09
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Zinc	mg/L	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
Total Iron	mg/L	-0.03	-0.03	-0.03	-0.03	0.03	0.03	0.03	0.00	0.03	0.03
Total Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Gross Alpha	pCi/L	**116**	**83.6**	**85.4**	**102**	**83.60**	**96.75**	**116.00**	15.27	50.93	142.57
Gross Beta	pCi/L	30.8	26.1	25	32.2	25.00	28.53	32.20	3.51	17.99	39.06
Dissolved Ra-226	pCi/L	1.5	1.5	1.2	1.1	1.10	1.33	1.50	0.21	0.71	1.94
Dissolved Ra-228	pCi/L	0.9	1.4	1.5	2.3	0.90	1.53	2.30	0.58	ND	3.26
Dissolved Ra-226+Ra-228	pCi/L	2.4	2.9	2.7	3.4	2.40	2.85	3.40	0.42	1.59	4.11

[1] Less than values are denoted by a minus sign in front of the detection limit.

[2] When the mean minus three standard deviations is a negative value, ND is written for "not detected".

Parameter value exceeds WDEQ-WQD Domestic Class-of-Use (Class I).

Parameter value exceeds WDEQ-WQD Agriculture Class-of-Use (Class II).

Parameter value exceeds WDEQ-WQD Livestock Class-of-Use (Class III).

Parameter value exceeds EPA MCL criterion.

Value is an outlier or calculation excludes outlier(s).

Outliers were identified based on the data from all M wells, not on a well-by-well basis. Outlier identification is explained in **Section 4.3**.

Well MO-111

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		5/5/2009	5/19/2009	6/2/2009	11/18/2009	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Total Alkalinity as $CaCO_3$	mg/L	101	91	98	105	91.00	98.75	105.00	5.91	81.02	116.48
CO_3	mg/L	5	-1	-1	-5	1.00	3.00	5.00	2.31	ND	9.93
HCO_3	mg/L	113	111	120	128	111.00	118.00	128.00	7.70	94.89	141.11
Dissolved Calcium	mg/L	51	45	46	49	45.00	47.75	51.00	2.75	39.49	56.01
Total Chloride	mg/L	5	6	6	5	5.00	5.50	6.00	0.58	3.77	7.23
Dissolved Fluoride	mg/L	0.1	0.2	0.2	0.2	0.10	0.18	0.20	0.05	0.02	0.33
Dissolved Magnesium	mg/L	2	2	2	2	2.00	2.00	2.00	0.00	2.00	2.00
Total NH_3-N	mg/L	0.06	-0.05	-0.05	-0.05	0.05	0.05	0.06	0.01	0.04	0.07
Dissolved NO_3+NO_2-N	mg/L	-0.05	0.16	0.16	0.2	0.05	0.14	0.20	0.06	ND	0.34
Dissolved Potassium	mg/L	8	3	2	2	2.00	2.50	3.00	0.71	0.37	4.63
Dissolved SiO_2	mg/L	13.4	12.7	14.8	14.4	12.70	13.83	14.80	0.95	10.96	16.69
Dissolved Sodium	mg/L	33	31	31	32	31.00	31.75	33.00	0.96	28.88	34.62
Total $S0_4$	mg/L	126	94	96	97	94.00	103.25	126.00	15.22	57.60	148.90
Specific Conductance at 25 °C	µmhos/cm	499	380	408	415	380.00	425.50	499.00	51.28	271.66	579.34
Laboratory pH	SU	**8.73**	8.15	7.81	7.92	7.81	8.15	**8.73**	0.41	6.92	9.38
TDS Dried at 180 °C	mg/L	310	265	261	246	246.00	270.50	310.00	27.57	187.78	353.22
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Arsenic	mg/L	**0.011**	0.002	0.001	-0.001	0.001	0.002	0.002	0.001	ND	0.01
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	0.005	0.005	0.005	0.000	0.01	0.01
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	0.03	0.03	0.03	0.00	0.03	0.03
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	0.000	0.00	0.00
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01

Well MO-111

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		5/5/2009	5/19/2009	6/2/2009	11/18/2009	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	**0.00100**	**0.00100**	**0.00100**	0.00000	0.00	0.00
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Selenium	mg/L	-0.001	**0.021**	**0.022**	**0.027**	0.00	0.02	**0.03**	0.01	ND	0.05
Dissolved Uranium	mg/L	**0.424**	**0.288**	**0.369**	**0.320**	**0.29**	**0.35**	**0.42**	0.06	0.17	0.53
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Zinc	mg/L	0.01	0.06	-0.01	-0.01	0.01	0.02	0.06	0.03	ND	0.10
Total Iron	mg/L	-0.07	-0.03	-0.07	-0.03	0.03	0.05	0.07	0.02	ND	0.12
Total Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Gross Alpha	pCi/L	**1060**	**298**	**439**	**372**	**298.00**	**368.50**	**439.00**	99.70	69.40	667.60
Gross Beta	pCi/L	544	136	138	101	136.00	137.00	138.00	1.41	132.77	141.23
Dissolved Ra-226	pCi/L	360	5.5	6.2	6.6	5.50	5.85	6.20	0.49	4.38	7.32
Dissolved Ra-228	pCi/L	5.1	2.5	1.4	2	1.40	2.75	5.10	1.63	ND	7.64
Dissolved Ra-226+Ra-228	pCi/L	**5.1**	**8**	**7.6**	**8.6**	**5.10**	**7.33**	**8.60**	1.54	2.71	11.94

[1] Less than values are denoted by a minus sign in front of the detection limit.

[2] When the mean minus three standard deviations is a negative value, ND is written for "not detected".

Parameter value exceeds WDEQ-WQD Domestic Class-of-Use (Class I).

Parameter value exceeds WDEQ-WQD Agriculture Class-of-Use (Class II).

Parameter value exceeds WDEQ-WQD Livestock Class-of-Use (Class III).

Parameter value exceeds EPA MCL criterion.

Value is an outlier or calculation excludes outlier(s).

Outliers were identified based on the data from all MO wells, not on a well-by-well basis. Outlier identification is explained in **Section 4.3**.

Well MO-114

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		12/1/2009	12/16/2009	1/14/2010	2/3/2010	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Total Alkalinity as $CaCO_3$	mg/L	106	107	110	111	106.00	108.50	111.00	2.38	101.36	115.64
CO_3	mg/L	-5	-5	-5	-5	5.00	5.00	5.00	0.00	5.00	5.00
HCO_3	mg/L	129	130	134	136	129.00	132.25	136.00	3.30	122.34	142.16
Dissolved Calcium	mg/L	72	68	77	68	68.00	71.25	77.00	4.27	58.43	84.07
Total Chloride	mg/L	7	6	6	6	6.00	6.25	7.00	0.50	4.75	7.75
Dissolved Fluoride	mg/L	0.2	0.2	0.2	0.2	0.20	0.20	0.20	0.00	0.20	0.20
Dissolved Magnesium	mg/L	3	3	3	3	3.00	3.00	3.00	0.00	3.00	3.00
Total NH_3-N	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved NO_3+NO_2-N	mg/L	-0.1	-0.1	-0.1	0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Potassium	mg/L	4	4	3	3	3.00	3.50	4.00	0.58	1.77	5.23
Dissolved SiO_2	mg/L	16.7	15.5	16.2	14.1	14.10	15.63	16.70	1.13	12.24	19.01
Dissolved Sodium	mg/L	33	31	33	30	30.00	31.75	33.00	1.50	27.25	36.25
Total $S0_4$	mg/L	165	159	160	160	159.00	161.00	165.00	2.71	152.88	169.12
Specific Conductance at 25 °C	µmhos/cm	534	537	536	538	534.00	536.25	538.00	1.71	531.13	541.37
Laboratory pH	SU	8.19	8.17	7.95	8.05	7.95	8.09	8.19	0.11	7.75	8.43
TDS Dried at 180 °C	mg/L	366	357	366	384	357.00	368.25	384.00	11.32	334.28	402.22
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Arsenic	mg/L	0.001	0.001	-0.001	-0.001	0.001	0.001	0.001	0.000	0.00	0.00
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	0.005	0.005	0.005	0.000	0.01	0.01
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	0.1	0.03	0.05	0.10	0.04	ND	0.15
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	0.000	0.00	0.00
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01

Well MO-114

Parameters	Units	Parameter Values [1]				Values with Outliers (if any) Removed					
		12/1/2009	12/16/2009	1/14/2010	2/3/2010	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	**0.00100**	**0.00100**	**0.00100**	0.00000	0.00	0.00
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Selenium	mg/L	0.019	**0.021**	0.018	0.017	0.02	0.02	**0.02**	0.00	0.01	0.02
Dissolved Uranium	mg/L	**0.408**	**0.405**	**0.409**	**0.383**	**0.38**	**0.40**	**0.41**	0.01	0.36	0.44
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Zinc	mg/L	-0.01	-0.01	0.02	-0.01	0.01	0.01	0.02	0.01	ND	0.03
Total Iron	mg/L	-0.03	-0.03	-0.03	-0.03	0.03	0.03	0.03	0.00	0.03	0.03
Total Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.00	0.01	0.01
Gross Alpha	pCi/L	**361**	**335**	**346**	**528**	**335.00**	**392.50**	**528.00**	90.96	119.62	665.38
Gross Beta	pCi/L	118	90.6	112	139	90.60	114.90	139.00	19.91	55.17	174.63
Dissolved Ra-226	pCi/L	2.4	2.7	2.6	2.7	2.40	2.60	2.70	0.14	2.18	3.02
Dissolved Ra-228	pCi/L	3.3	3.7	3.6	4.4	3.30	3.75	4.40	0.47	2.35	5.15
Dissolved Ra-226+Ra-228	pCi/L	**5.7**	**6.4**	**6.2**	**7.1**	**5.70**	**6.35**	**7.10**	0.58	4.61	8.09

[1] Less than values are denoted by a minus sign in front of the detection limit.

[2] When the mean minus three standard deviations is a negative value, ND is written for "not detected".

Parameter value exceeds WDEQ-WQD Domestic Class-of-Use (Class I).

Parameter value exceeds WDEQ-WQD Agriculture Class-of-Use (Class II).

Parameter value exceeds WDEQ-WQD Livestock Class-of-Use (Class III).

Parameter value exceeds EPA MCL criterion.

MP-Well Data, Water Quality Criteria Exceedances and Outliers

Parameters	Units	Parameter Values [1]				Outlier Tolerance Interval Calculation						Values with Outliers (if any) Removed					
		MP-113				No. of Obs.	Mean	Tolerance Limit Factor	Standard Deviation	Lower Range	Upper Range	Minimum	Mean	Maximum	Standard Deviation	Mean ± 3 Standard Deviations [2]	
		4/22/09	5/6/09	5/20/09	6/3/09												
Total Alkalinity as $CaCO_3$	mg/L	101	99	106	105	52	98.62	3.094	23.48	25.98	171.25	33.00	98.62	130.00	23.48	28.19	169.04
CO_3	mg/L	9	7	5	5	52	2.79	3.094	4.49	-11.09	16.67	1.00	1.61	9.00	1.77	ND	6.92
HCO_3	mg/L	106	107	119	118	52	116.10	3.094	35.20	7.17	225.02	41.00	124.96	158.00	23.60	54.16	195.75
Dissolved Calcium	mg/L	66	58	66	63	52	59.46	3.094	13.85	16.60	102.33	32.00	59.46	85.00	13.85	17.90	101.02
Total Chloride	mg/L	20	17	11	11	52	6.48	3.094	2.95	-2.66	15.62	4.00	6.48	20.00	2.95	ND	15.34
Dissolved Fluoride	mg/L	0.2	0.2	0.2	0.1	52	0.17	3.094	0.05	0.01	0.33	0.10	0.17	0.30	0.05	0.02	0.32
Dissolved Magnesium	mg/L	3	2	2	3	52	2.62	3.094	0.93	-0.27	5.50	1.00	2.62	4.00	0.93	ND	5.41
Total NH_3-N	mg/L	0.08	0.08	-0.05	-0.05	52	0.06	3.094	0.06	-0.12	0.24	0.05	0.06	0.39	0.06	ND	0.24
Dissolved NO_3+NO_2-N	mg/L	-0.05	-0.05	-0.05	-0.05	52	0.06	3.094	0.02	-0.01	0.12	0.05	0.06	0.16	0.02	ND	0.12
Dissolved Potassium	mg/L	7	5	5	4	52	4.77	3.094	3.38	-5.69	15.23	2.00	4.77	16.00	3.38	ND	14.91
Dissolved SiO_2	mg/L	12.6	14.3	11.9	13.7	52	14.48	3.094	1.16	10.88	18.08	11.60	14.48	17.20	1.16	10.99	17.97
Dissolved Sodium	mg/L	40	34	37	35	52	35.21	3.094	9.29	6.48	63.95	25.00	35.21	72.00	9.29	7.35	63.07
Total SO_4	mg/L	143	142	148	146	52	141.46	3.094	20.93	76.69	206.23	95.00	141.46	192.00	20.93	78.66	204.27
Specific Conductance at 25 °C	µmhos/cm	567	551	529	531	52	502.98	3.094	58.99	320.47	685.49	367.00	502.98	606.00	58.99	326.02	679.95
Laboratory pH	SU	**8.95**	**8.9**	**8.64**	**8.57**	52	8.36	3.094	0.61	6.48	10.25	7.69	8.36	**10.70**	0.61	6.54	10.19
TDS Dried at 180 °C	mg/L	375	366	370	371	52	341.12	3.094	48.23	191.90	490.33	236.00	341.12	425.00	48.23	196.43	485.80
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	52	0.11	3.094	0.04	-0.02	0.24	0.10	0.11	0.30	0.04	ND	0.24
Dissolved Arsenic	mg/L	0.006	0.004	0.004	0.004	52	0.01	3.094	0.007	-0.015	0.029	0.001	0.007	**0.027**	0.007	ND	0.03
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	52	0.10	3.094	0.00	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	52	0.10	3.094	0.00	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	52	0.01	3.094	0.000	0.005	0.005	0.005	0.005	0.005	0.00	0.00	0.01
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	52	0.05	3.094	0.00	0.05	0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	52	0.01	3.094	0.00	0.00	0.02	0.01	0.01	0.02	0.00	0.00	0.02
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	-0.03	52	0.03	3.094	0.02	-0.02	0.08	0.03	0.03	0.14	0.02	ND	0.08
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	52	0.00	3.094	0.000	0.000	0.002	0.001	0.001	0.002	0.000	0.00	0.00
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	52	0.01	3.094	0.01	-0.01	0.04	0.01	0.01	0.04	0.01	ND	0.04
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	52	0.00	3.094	0.00000	0.00100	0.00100	**0.00100**	**0.00100**	**0.00100**	0.00000	0.00	0.00
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	52	0.10	3.094	0.00	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	52	0.05	3.094	0.00	0.05	0.05	0.05	0.05	0.05	0.00	0.05	0.05
Dissolved Selenium	mg/L	-0.001	-0.001	-0.001	-0.001	52	0.003	3.094	0.005	-0.01	0.02	0.001	0.003	0.015	0.004	ND	0.01
Dissolved Uranium	mg/L	**0.184**	**0.144**	**0.138**	**0.142**	52	0.17	3.094	0.13	-0.22	0.56	0.01	**0.17**	**0.45**	0.13	ND	0.55
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	52	0.10	3.094	0.00	0.10	0.10	0.10	0.10	0.10	0.00	0.10	0.10
Dissolved Zinc	mg/L	-0.01	-0.01	-0.01	-0.01	52	0.02	3.094	0.01	-0.02	0.05	0.01	0.02	0.05	0.01	ND	0.05
Total Iron	mg/L	-0.07	-0.03	-0.03	-0.03	52	0.63	3.094	3.34	-9.70	10.97	0.03	**0.63**	**23.80**	3.34	ND	10.65
Total Manganese	mg/L	-0.01	-0.02	-0.02	-0.01	52	0.03	3.094	0.08	-0.21	0.27	0.01	0.03	**0.57**	0.08	ND	0.26
Gross Alpha	pCi/L	**1270**	**682**	**1260**	**1050**	52	640.86	3.094	478.56	-839.80	2121.52	**23.80**	**640.86**	**2040.00**	478.56	ND	2076.54
Gross Beta	pCi/L	466	385	340	351	52	228.23	3.094	171.82	-303.38	759.85	11.30	231.19	646.00	149.45	ND	679.55
Dissolved Ra-226	pCi/L	515	595	530	568	52	241.72	3.094	218.69	-434.91	918.36	2.50	241.72	732.00	218.69	ND	897.80
Dissolved Ra-228	pCi/L	4.6	6.8	5	5.8	52	4.12	3.094	2.09	-2.36	10.60	0.30	4.04	8.90	1.95	ND	9.90
Dissolved Ra-226+Ra-228	pCi/L	**519.6**	**601.8**	**535**	**573.8**	52	245.63	3.094	219.80	-434.42	925.69	3.20	**245.63**	**737.60**	219.80	ND	905.03

[1] Less than values are denoted by a minus sign in front of the detection limit.

[2] When the mean minus three standard deviations is a negative value, ND is written for "not detected".

Parameter value exceeds WDEQ-WQD Domestic Class-of-Use (Class I).

Parameter value exceeds WDEQ-WQD Agriculture Class-of-Use (Class II).

Parameter value exceeds WDEQ-WQD Livestock Class-of-Use (Class III).

Parameter value exceeds EPA MCL criterion.

Value is an outlier or calculation excludes outlier(s).

MP-Well Data, Water Quality Criteria Exceedances and Outliers

Parameters	Units	Parameter Values [1]															
		MP-109				MP-110				MP-111				MP-112			
		12/1/09	12/16/09	1/5/10	2/2/10	4/21/09	5/5/09	5/19/09	6/2/09	4/21/09	5/7/09	5/21/09	6/4/09	4/21/09	5/5/09	5/19/09	6/2/09
Total Alkalinity as $CaCO_3$	mg/L	73	55	69	74	104	103	105	108	94	120	108	110	47	35	33	39
CO_3	mg/L	9	-5	8	-5	2	-1	-1	-1	-1	6	1	-1	24	20	-1	1
HCO_3	mg/L	70	67	67	83	123	126	128	132	114	134	129	134	-1	-1	41	45
Dissolved Calcium	mg/L	53	45	51	52	51	50	54	53	46	56	60	55	36	32	33	38
Total Chloride	mg/L	7	7	7	6	5	5	5	5	7	6	5	6	8	7	7	7
Dissolved Fluoride	mg/L	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2
Dissolved Magnesium	mg/L	2	2	2	2	2	2	3	3	2	2	3	3	-1	-1	-1	-1
Total NH_3-N	mg/L	-0.05	-0.05	-0.05	-0.05	0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved NO_3+NO_2-N	mg/L	-0.1	-0.1	-0.1	-0.1	-0.05	-0.05	-0.05	-0.05	0.16	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Potassium	mg/L	5	5	5	5	16	12	10	8	2	7	6	5	13	11	10	9
Dissolved SiO_2	mg/L	15.2	13.7	15.6	13	15	14.3	13.6	16.8	15	13.7	14.8	14.5	12.6	13.4	11.6	15
Dissolved Sodium	mg/L	32	29	35	35	38	35	34	33	32	35	33	34	38	37	36	40
Total SO_4	mg/L	142	139	139	138	128	128	129	130	95	132	131	127	126	127	126	128
Specific Conductance at 25 °C	µmhos/cm	456	423	455	449	498	497	466	486	400	491	469	493	469	415	367	405
Laboratory pH	SU	**9.28**	**8.58**	**8.88**	**9.07**	8.41	8.38	8.26	8.14	8.08	**8.61**	8.49	8.31	**10.7**	**10.2**	**9.21**	**9.3**
TDS Dried at 180 °C	mg/L	313	294	290	236	328	314	328	341	259	340	348	340	279	261	257	240
Dissolved Aluminum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3	0.3	0.2	0.2
Dissolved Arsenic	mg/L	0.002	0.002	0.001	0.001	0.009	0.007	0.005	0.005	0.001	0.008	0.006	0.005	**0.022**	**0.026**	**0.027**	**0.027**
Dissolved Barium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Boron	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Cadmium	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Dissolved Chromium	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Copper	mg/L	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01
Dissolved Iron	mg/L	-0.03	-0.03	-0.03	0.14	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Dissolved Lead	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Dissolved Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Molybdenum	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Nickel	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Dissolved Selenium	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	**0.023**	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Dissolved Uranium	mg/L	**0.085**	**0.082**	**0.082**	**0.083**	**0.241**	**0.254**	**0.254**	**0.275**	**0.320**	**0.297**	**0.295**	**0.273**	**0.263**	**0.301**	**0.408**	**0.405**
Dissolved Vanadium	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Dissolved Zinc	mg/L	-0.01	-0.01	0.01	-0.01	0.05	0.01	0.04	-0.01	0.05	-0.01	-0.01	-0.01	0.04	-0.01	-0.01	-0.01
Total Iron	mg/L	-0.03	-0.03	-0.03	-0.03	-0.03	-0.07	-0.03	-0.07	-0.03	-0.03	-0.03	-0.03	-0.03	-0.07	-0.03	-0.07
Total Manganese	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Gross Alpha	pCi/L	**107**	**109**	**136**	**148**	**2040**	**1700**	**1690**	**1460**	**300**	**1190**	**1380**	**1010**	**554**	**635**	**885**	**760**
Gross Beta	pCi/L	44.7	35.8	51.3	54.2	816	646	507	479	111	457	399	337	275	270	261	271
Dissolved Ra-226	pCi/L	17	18	17	21	732	689	675	698	6.3	411	411	445	155	121	127	120
Dissolved Ra-228	pCi/L	3.6	3	4.1	2.8	5.6	10.8	5.9	7	1.5	5	4.2	6.2	1.9	2	2.4	2.2
Dissolved Ra-226+Ra-228	pCi/L	**20.6**	**21**	**21.1**	**23.8**	**737.6**	**689**	**680.9**	**705**	**7.8**	**416**	**415.2**	**451.2**	**156.9**	**123**	**129.4**	**122.2**

[1] Less than values are denoted by a minus sign in front of the detection limit.

[2] When the mean minus three standard deviations is a negative value, ND is written for "not detected".

Parameter value exceeds WDEQ-WQD Domestic Class-of-Use (Class I).

Parameter value exceeds WDEQ-WQD Agriculture Class-of-Use (Class II).

Parameter value exceeds WDEQ-WQD Livestock Class-of-Use (Class III).

Parameter value exceeds EPA MCL criterion.

Value is an outlier or calculation excludes outlier(s).