Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Dave Freudenthal, Governor

John Corra, Director

February 19, 2010

Mr. John Cash
Lost Creek ISR, LLC
5880 Enterprise Drive, Suite 200
Casper, WY 82609

RE: **Lost Creek ISR LLC, In-Situ Recovery Mine Unit 1 (MU1) Application Package Completeness Review, TFN 4 6/268**

Dear Mr. Cash,

Enclosed please find the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ/LQD) Completeness Review of the MU1 Application Package. The MU1 Application Package was received by the WDEQ/LQD District II Field Office on December 20, 2009. **The enclosed review reveals the MU1 Package to be incomplete at this time.**

In addition to other deficiencies, the MU1 Package revealed that the production zone proposed to be mined is hydraulically connected to the overlying and underlying aquifers. That is, confinement of the production zone has not been demonstrated. Specifically, LQD's concerns lie with Lost Creek ISR's ability to prevent mining fluids from entering and polluting the overlying and underlying aquifers.

The MU1 Package states that "engineering practices" can be employed to protect the overlying and underlying aquifers. However, the application does not demonstrate that the overlying and underlying zones will be protected. LQD Non-Coal Rules and Regulations, Chapter 11, section 10 (a)(iii) and section 11(d) require that the operator demonstrate that movement of fluids into unauthorized zones can be prevented. W.S. §35-11-406(m)(v) states that a permit may be denied: *"If the proposed mining operation will cause pollution of any waters in violation of the laws of this state or of the federal government."*

In light of this, issuance of a permit, based on the information presented to date, is untenable. Lost Creek ISR personnel may want to consider a Research and Development (R & D) License for the Lost Creek site to demonstrate that fluids can be controlled by "engineering practices".

Please do not hesitate to contact me or my supervisor, Mark Moxley, regarding this letter or the enclosed memorandum.

Sincerely,

Melissa L. Bautz

Melissa L. Bautz, P.G.
District II Natural Resources Analyst

w/ enclosure, Memorandum: **Completeness Review of Mine Unit 1 (MU1) Package**

Cc Mr. Harold Backer, Ur-Energy USA, 10758 W. Centennial Rd. Suite 200, Littleton, CO 80127 (w/encl)
Mark Newman – BLM Rawlins, P. O. Box 2407, Rawlins, WY 82301 (w/encl)
Tanya Oxenberg, U.S. Nuclear Regulatory Commission, Federal and State Materials and Environmental Management Programs Uranium Recovery Licensing Branch, Mail Stop T-8F5, Washington, D.C. 20555-0001 (w/encl)
Don McKenzie/Matthew Kunz, Cheyenne WDEQ/LQD→ TFN 4 6/268 Lost Creek ISR File (w/encl)
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MEMORANDUM

File: Lost Creek ISR Application, TFN 4 6/268

Date: February 19, 2010

From: Melissa Bautz, Geologist, WDEQ/LQD Lander MLB
Amy Boyle, Geologist, WDEQ/LQD Lander AB
Mark Moxley, District II Supervisor, WDEQ/LQD Lander MM
Brian Wood, Hydrologist, WDEQ/LQD Lander

Subject: Completeness Review of Mine Unit 1 (MU1) Package, TFN 4 6/268

Below is the Wyoming Department Environmental Quality - Land Quality Division (WDEQ/LQD) review of Lost Creek ISR's (LC) Mine Unit 1 Package received on December 20, 2009. The WDEQ/LQD is characterizing this initial review of the mine unit package as a "completeness" review. The rationale for this approach is as follows:

1. This is WDEQ/LQD's first look at the material in the mine unit package. LQD was not afforded the opportunity to review a hydrologic test proposal for this mine unit, as is normal protocol. This will undoubtedly result in many questions about the hydrologic testing that was conducted.
2. There are still a number of major issues outstanding from the permit application review, as well as some from the Appendix D5/D6 package, that have a direct bearing on the contents of the mine unit package.
3. Given that there are some major issues to be resolved, the WDEQ/LQD anticipates there will be significant revisions to both the permit application and the mine unit package that will generate additional technical comments.
4. In this context, the WDEQ/LQD does not view this as a technical review because a technical review (following a completeness determination) is intended to be comprehensive. Ideally, a technical review should identify any and all deficiencies. In the case of your mine unit package, we do not expect to be able, at this point in time, to identify all deficiencies.
5. In the future, as you respond to our comments, we will attempt to adhere to the prescribed 30 day response time.

Despite the fact that this review is considered a completeness review, WDEQ/LQD staff members have made every attempt to provide as many technical comments in this review as possible to enable LC personnel to anticipate and address technical issues with the Mine Unit 1 Package.

This review is referenced with footnotes at the end of each comment, when appropriate, (superscript number from 1 – 35), which relate to the numbered items in the attached Addendum, entitled "Addendum 1 – Mine Unit Package Requirements". The Addendum items correspond to guidance on Mine Unit (MU) packages provided by Don McKenzie in an attachment to his letter dated March 13, 2009.

The initials in parentheses at the end of each comment denotes the reviewer; AB is Amy Boyle, MLB is Melissa Bautz, MM is Mark Moxley, and BRW is Brian Wood.

COMMENTS:

1. No map has been provided (in the Permit Application or the MU1 Package) depicting the following three items <u>on the same map:</u>
   - 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)**

2. 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)**

3. 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. <u>*Section OP 3.2 Mine Unit Design.*</u> *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)**

4. 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. <u>*Figure OP-2a Site Layout:*</u> *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)**

5. 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)**

6. 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)**

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

8. 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)**

9. 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 <u>formal</u> 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)**

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)**

11. 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)**

12. <u>Sections 2.2.1 and 2.2.3.1:</u> 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)**

13. <u>Sections 2.2</u>. 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)**

14. 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)**

15. 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)**

16. 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)**

17. 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)**

18. 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)**

19. 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)**

20. 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?

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?

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?

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?

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)**

21. 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)**

22. 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)**

23. 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)**

24. 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)**

25. 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)**

26. 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)**

27. 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)**

28. 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)**

29. 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)**

30. 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)**

31. 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)**

32. 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,S 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)**

33. 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)**

34. 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)**

35. 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)**

36. 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)**

37. 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)**

38. 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)**

39. 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)**

40. 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)**

41. 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)**

42. 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)**

43. 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)**

SUMMARY

The information required to be included relative to the first mine unit, as part of an ISL permit application, was outlined by WDEQ-LQD Administrator, Donald McKenzie, in a letter to the WMA dated 3/13/09. Lost Creek has failed to address a number of significant issues in this mine unit package. Some of these deficiencies have been previously identified in LQD's review of mine permit application. Based on these deficiencies, the mine unit package is <u>incomplete</u>, as is the mine permit application as a whole.

The most critical element of the ISL operation is the confinement of production fluids and prevention of movement of contaminated fluids into unauthorized zones. The information presented in the mine permit application and in this first mine unit package does not demonstrate that production fluids will be confined or contained within the production zone. The pump tests show significant communication between the production zone and both overlying and underlying aquifers. The description of operational controls does not demonstrate how production fluids can or will be contained. Thus, LC has not made an adequate demonstration that the proposed operation will not result in a violation of W.S. §35-11-406 (m)(v).

Attachments: Addendum 1 - Mine Unit Package Requirements
Table 1. – Summary of Lost Creek overlying and underlying wells showing >1' of drawdown during HJ horizon pump tests.

Cc: Ramona Christensen/Jennifer Mickle, LQD Cheyenne, TFN 4 6/268 (w/attachments)
Chron – A. Boyle, B. Wood, M. Moxley, M. Bautz

Addendum 1 - Mine Unit Package Requirements
(To accompany LQD's Completeness Review of Lost Creek ISR's MU1 Package)

Mine Unit Package requirements (from attachment to Don McKenzie's letter dated March 13, 2009). Numbers in front of each requirement below may appear as footnotes in the body of the attached Mine Unit Package Review.

Geology (Appendix D-5) – These requirements may be included in Appendix D5 of the main permit document or they may appear in the Mine Unit Package.

1. Detailed geologic description of the first wellfield.
2. Lateral and vertical extent of the ore reserves within the first wellfield.
3. Detailed geologic cross-sections for the first wellfield that include the location and lithologic information for all drill holes utilized in cross-section development. [Ch 11, Sec 3(a)(viii)(A)]
4. Inventory and map of all known drill holes within and surrounding the first mine unit (generally extending at least 500' past the proposed monitor ring). The inventory should describe the condition of each hole, if known, and any efforts to locate, investigate, plug and abandon each hole, as appropriate. [Ch 11, Sec 3(a)(xii)]

Hydrology (Appendix D-6) – These requirements may be included in the Appendix D6 of the main permit document or they may appear in the Mine Unit Package.

5. Installation and sampling of production zone baseline/restoration wells to establish baseline and target restoration values (TRV's). Guideline 4 recommends one well per 3 acres.
6. Installation and sampling of underlying and overlying aquifer monitoring wells at a density of one well per 3 acres of wellfield to establish baseline and UCL's.
7. Completion details and stratigraphy for all monitor wells and pump test wells. [Ch 11, Sec 4(a)(xiv)(A)]
8. Pump test results for the first mine unit. As per Guideline 4: "The testing should be designed to define aquifer properties within the affected area, hydrologic boundary conditions, layering effects, directional permeability and the vertical confinement of the production zone. Transmissivity data should be of sufficient detail to confidently identify axes of directional transmissivities in the production zone." LQD anticipates that long-term (72-120 hour) pump tests will be necessary to sufficiently stress the aquifers.
9. Detailed description of the first wellfield groundwater quality and flow characteristics. This discussion should describe the aquifer characteristics of the ore zone and any aquifers that may be affected by the mining process. The description should include aquifer thickness, velocity and direction of ground water movement, storage coefficient or specific yield, transmissivity or hydraulic conductivity and the direction(s) of preferred flow under hydraulic stress in the saturated portion of the ore zone. The extent of hydraulic connection between the ore zone and over and underlying aquifers and the hydraulic characteristics of any influencing boundaries in or near the proposed well field area shall be determined and described. [Ch 11, Sec 3 (a)(xiv)].
10. Calculation of appropriate distance for monitor well ring allowing for preferential flow and directional transmissivities. (Guideline 4, Attachment 2)

11. Sufficient information must be provided to demonstrate that movement of mining fluids into unauthorized zones can be prevented. [Ch 11 Sec 10(a)(iii) and 11(d)]
12. Potentiometric surface and isopach maps for all identified aquifers (generally any wet sand unit that is at least 10'x 500'x 500' capable of producing **0.5 gpm**, sustained over a 24 hour period) including the ore body, underlying aquifer and all overlying aquifers. Isopach maps for the confining units above and below the ore zone. [Ch 11 Sec 3 (a)(xiii)]
13. Baseline water quality data for all production zone wells, underlying and overlying aquifer monitoring wells for classification by WQD. [Ch 11 Sec 3(a)(xv)]

Mine Plan – These requirements may appear in the Mine Plan section of the main permit document or they may appear in the Mine Unit Package.

14. A map and description of the proposed wellfield layout, including the approximate pattern area, mine unit monitor well locations, approximate number of injection and production wells, approximate location of monitor ring wells, proposed surface facilities, utilities, etc. [Ch 11 Sec 4(a)(ii)(B)]
15. Projected mining and restoration schedule for the first wellfield. [Ch 11 Sec 4(a)(ii)(C)]
16. Estimate acreage to be affected by the first wellfield and associated facilities. [Ch 11 Sec 4(a)(ix)]
17. Description of the proposed injection rates and pressures, fracture pressure, stimulation program, type of lixiviant, physical and chemical characteristics of the receiving strata fluids. [Ch 11 Sec 4(a)(x)(A-E) and (xi)]
18. 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. (Ch 11 Sec 4(a)(x)(F)]
19. Procedures to assure that installation of recovery, injection, and monitor wells will not result in hydraulic communication between the production zone and overlying and underlying stratigraphic horizons. [Ch 11 Sec 4(a)(xii)]
20. Procedures to verify that the injection and recovery wells are in communication with the monitor ring wells completed in the receiving strata and employed for the purpose of detecting excursions. [Guideline 4 Sec III(c)(5)(b)]
21. Description of measures to be employed to prevent an excursion, and contingency and corrective action plans to be implemented in the event of an excursion. [Ch 11 Sec 4(a)(xx)]
22. Pore volume calculation, including an explanation of all assumptions.
23. Detailed water balance. [Ch 11 Sec 4(a)(ii)(D)]
24. Description of the process and timing for the establishment of UCLs for monitoring ring wells. [Guideline 4 Sec III (c)(5)(c)]
25. Comprehensive monitoring plan and schedule. [Ch 11 Sec 4(a)(xv)]

Reclamation Plan – These requirements may appear in the Reclamation Plan section of the main permit document or they may appear in the Mine Unit Package.

26. Specific discussion of how and when the restoration goals and target restoration values will be established. [Ch 11 Sec 5(a)(i)]
27. A demonstration that, using best practicable technology, the operation will return all affected groundwater to a condition such that its quality of use is equal to or better than the premining use within the wellfield and to baseline outside of the wellfield. [Ch 11 Sec 5(a)(ii)]
28. Water balance correlated with the mining and restoration schedule.[Ch 11 Sec 5(a)(i)(D)]
29. Bond estimate for first year of operation, including the first wellfield. [Ch 11 Sec 5(a)(xiii)]

Following Permit Approval

30. Installation of Class III production and injection wells, including MIT's.
31. Installation of monitoring ring wells and observation/trend wells as warranted.
32. Collection of baseline data for the monitor ring wells.
33. Pump test to verify connectivity of production zone with all monitoring ring wells and observation/trend wells.
34. Submittal of notice of completion of wellfield installation, including: "as-built" wellfield layout, baseline water quality data and UCL's for ring wells, verification of connectivity of ring wells with the production zone, and MIT's for all Class III wells. All of this material is to be inserted into the wellfield package. [Ch 11 Sec 11(b)]
35. LQD review, inspection and approval to start injection. [Ch 11 Sec 11(b)]

*************************************END OF ADDENDUM 1 ***

Table 1. Summary of Lost Creek overlying and underlying wells showing >1' of drawdown during the HJ horizon pump tests
Comparison of those wells' proximity to historic drill holes and the status of those drill holes
(Table compiled by LQD Lander (M.Bautz) Feb. 5, 2010)

Late 2008 Pump Test Location wrt Fault	Monitoring Well ID	Well is on North or South side of fault?	Drawdown during pump test	Distance between Monitoring Well and pumping well (PW)	Screened interval	Distance to fault	Distance to nearest *historic drill hole(s)	Hole ID(s) of nearest *historic drill hole(s)	Depth to top of grout/plug in historic drill hole	Screened interval of well and open hole in historic drill coincide? Y/N	Comment
South Test (PW-101)	MO-114	South of main fault but north of splay	1.9'	469'	366'-386' (LFG sand)	70'	200'	TG73-20	unknown	potentially	Well is nearly equidistant from fault and fault splay. Historic drill hole is on opposite side of fault. Historic Hole TD=580', In 1980 inspection WL=150', Bridge or Bottom = 162'
South Test (PW-101)	HJMO-109	South of main fault and on the splay	+0.9'	298'	345'-375' (LFG sand)	0'	330'	TG72-20	unknown	potentially	Well is constructed on/through the fault.
South Test (PW-101)	MU-104	South	5.7'	285'	550'-580' (UKM sand)	30'	110'	**TG21-20	unknown	potentially	Historic Hole TD=500'
							170'	**TG21-19	unknown	potentially	Historic Hole TD=580'
							500'	TG23-18	unknown	potentially	TG23-18 is on opposite side of fault from well. TG23-18 was dry and never sealed.
							580'	TG18-19	unknown	potentially	TG18-19 is on the same side of the fault as the well. In 1980 inspection, Perma-Plug "slid down hole"
South Test (PW-101)	HJMU-109	South of main fault and on the splay	1.8'	298'	524'-574' (UKM sand)	0'	330'	TG72-20	unknown	potentially	Well is constructed on/through the fault.
South Test (PW-101)	MU-109	South	3.8'	1215'	525'-545' (UKM sand)	40'	80'	TG15-19	unknown	potentially	Historic drill hole is on opposite side of fault
South Test (PW-101)	HJMU-113	South	1.2'	514'	524'-554' (UKM sand)	60'	130'	TG72-20	unknown	potentially	Historic Hole TD=580'
South Test (PW-101)	MU-103	South	1.3'	566'	525'-565' (UKM sand)	200'	190'	TG72-20	unknown	potentially	Historic Hole TD=580'
South Test (PW-101)	LC17M	South	1.2'	765'	529'-565' (UKM sand)	70'	260'	TG8-20	unknown	potentially	No screen on LC17M; TD in TG8-20 = 600'
South Test (PW-101)	UKMP-102	North	1.1'	703'	475'-495' (UKM sand)	110'	110'	TG9-17	163'	No	Historic Hole TD=560', WL=151' in 1983
							140'	**TG38-17	>300'	potentially	Historic Hole TD=580', No bottom found to 300'
							220'	**TG5-17	368'	No	Historic Hole WL=151'
North Test (PW-102)	HJMO-109	South	1.8'	1357'	345'-375' (LFG sand)	0'	330'	TG 72-20	unknown	potentially	Well is constructed on/through the fault.
North Test (PW-102)	MO-107	North	1.2'	71'	291'-331' (FG sand)	540'	120'	TG17-19	unknown	potentially	Historic Hole TD = 580'
							120'	TG20-18	unknown	potentially	Historic Hole TD = 580'
							170'	TG11-19	unknown	potentially	Historic Hole TD = 500', hole was dry in 1983/84
							280'	TG1-18	156'	No	Historic Hole WL = 151'
North Test (PW-102)	MO-108	North	1.1'	372'	290'-330' (FG sand)	200'	75'	TG16-19	unknown	potentially	Historic Hole TD = 580', couldn't
							165'	TG8-19	unknown	potentially	Historic Hole TD = 600', In 1980's cap
							165'	TG15-19	unknown	potentially	Historic Hole TD = 500'
North Test (PW-102)	MO-106	North	1.0'	595'	296'-326' (LFG sand)	480'	50'	TG8-18	341'	Yes	Historic Hole TD = 600'; WL = 157' in 1983
							160'	TG15-18	238'	No	Historic Hole TD = 500'; WL = 156' in 1983
							160'	TG21-18	>300'	Yes	Historic Hole TD = 580' - Top of mud not found in 1980's - "too deep"

Late 2008 Pump Test Location wrt Fault	Monitoring Well ID	Well is on North or South side of fault?	Drawdown during pump test	Distance between Monitoring Well and pumping well (PW)	Screened interval	Distance to fault	Distance to nearest *historic drill hole(s)	Hole ID(s) of nearest *historic drill hole(s)	Depth to top of grout/plug in historic drill hole	Screened interval of well and open hole in historic drill coincide? Y/N	Comment
North Test (PW-102)	MO-106 continued...	North	1.0'	595'	296'-326' (LFG sand)	480'	210'	TG22-18	unknown	potentially	Historic Hole TD = 580' - Top of mud not found in 1980's - "too deep"
							275'	TG24-18	unknown	potentially	Historic Hole TD = 580' - Top of mud not found in 1980's - "too deep"
North Test (PW-102)	MO-104	South	3.4'	1165'	339'-369' (LFG sand)	30'	500'	TG23-18	unknown	potentially	TG23-18 is on opposite side of fault from well; TD = 580'. TG23-18 was dry and never sealed.
North Test (PW-102)	MO-114	South of main fault but north of splay	2.0'	1514'	366'-3[illegible]' (LFG sand)	70'	200'	TG73-20	unknown	potentially	Well is nearly equidistant from both fault and splay and historic drill hole is on opposite side of fault; TD = 580'. In 1980 inspection WL=150', Bridge or Bottom = 162'
North Test (PW-102)	MU-107	North	2.1'	82'	500'-540' (UKM sand)	540'	100'	**P7-19	unknown	potentially	Historic Hole TD=500'
							120'	TG17-19	unknown	potentially	Historic Hole TD = 580'
							120'	TG20-18	unknown	potentially	Historic Hole TD = 580'
							250'	**P8-19	unknown	potentially	Historic Hole TD=500'
							170'	TG11-19	unknown	potentially	Historic Hole TD = 500', hole was dry in 1983/84
							280'	TG1-18	156'	No	Historic Hole WL=151'
North Test (PW-102)	HJMU-105	North	1.8'	363'	502'-542' (UKM sand)	400'	100'	TG20-19	unknown	potentially	Historic Hole TD = 580' - "cap too deep" according to 1980's ADH report
							140'	TG21-18	unknown	potentially	Historic Hole TD= 580'
							160'	TG11-19	unknown	potentially	Historic Hole TD = 500', hole was dry in 1983/84
							190'	TG9-18	n/a	n/a	TG9-18 was not located on the ground
							200'	**P7-19	unknown	potentially	Historic Hole TD=500'
North Test (PW-102)	HJMU-104	North	2.0'	382'	512'-552' (UKM sand)	250'	100'	**P8-19	unknown	potentially	Historic Hole TD=500'
							130'	TG11-19	unknown	potentially	Historic Hole TD = 500', hole was dry in 1983/84
							140'	TG9-19	>450'	potentially	Historic Hole TD = 600'
							140'	TG20-19	unknown	potentially	Historic Hole TD = 580'
							150'	TG19-19	173'	No	Historic Hole WL=159', Bottom or Bridge at 173'

Note: The above information was taken from Table MU1 5-1 from the Mine Unit 1 application package, Figure 2-6 and Table 4-3 from the October 2009 Petrotek Pump Test Report, and Table D5-2 and Attachment D5-2 and D5-3 from Volume 2 of the Permit.

The highlighted rows (pink & yellow) denote situations in which the monitoring well is on the opposite side of the fault from the pumping well.

* Historic Drill Holes on this table are derived primarily from the holes depicted on Figure 2-6 of Petrotek Report for MU1 Package. According to Plate AD5-2b, there are additional historic drill holes in the MU-1 area not depicted on Figure 2-6.

**Wells with this designation were not depicted on Figure 2-6 in the Petrotek report but were depicted on Plate AD5-2b from Volume 2 of the Permit application document.

‡HJMO-109 only had 0.9' of drawdown during the south pump test but was included on this table because of it's high level of interest due to its location on/through the fault splay.