



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

December 21, 2009

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

RE: Third round of review comments on Appendices D-5 and D-6, TFN: 4 6/268

Dear John:

I have completed the latest round of review of the D-5 D-6 comments. Many of the comments have been resolved. If there are any questions regarding the remaining comments, please feel free to call me to discuss.

Sincerely,

Amy Boyle
Project Geologist
Land Quality Division

ATTACH: December 21, 2009 Review Comments, TFN 4 6/268

COPY : M. Moxley / Lander
LQD / Cheyenne
NRC
Mark Newman / BLM - Rawlins



MEMORANDUM

TO : Lost Creek ISR, Permit Application Review, TFN 4 6/268

FROM : Amy Boyle, Project Geologist - Lander *ABG 12/21/09*

DATE : December 21, 2009

SUBJECT : LQD's third round of review comments on Lost Creek's responses to Amy Boyle's original August 26, 2008 Memo reviewing Appendices D-5 and D-6, TFN: 4 6/268

This memorandum provides the third round of Land Quality Division (LQD) review comments for the aforementioned submittal. The following dates summarize the reviews for this section of the permit. It is requested that all future submittals to these comments, be submitted in conjunction with the main review comments.

August 26, 2008: First round of review comments specific to Appendix D5 and D6
May 5, 2009: Lost Creek's response received.
June 22, 2009: Second round of review comments specific to Appendix D5 and D6
November 23, 2009: Lost Creek response received.

The review is organized as follows. The original Land Quality Division (LQD) comment appears in regular font. A summary of Lost Creek's (LC's) response appears in italicized font. Then, LQD's review of that response appears in bold faced and/or underlined font. A summary of the November 23rd response is also in italics, and the current LQD response is in bold regular font.

Section D-5 Geology

2. Figure D5-1 is a Regional Geologic Map. This map indicates the faults in the area, but does not indicate the Lost Creek Fault within the permit area. This is a significant and well documented feature within the permit area, and should be indicated on the Figure.

*Figure D5-1 is only intended to depict major regional faults. Since the Lost Creek Fault zone is a minor fault system, it is not illustrated on the regional map. It is, however, illustrated on the property-scale maps. **The legend on Figure D5-1 should be changed to read "Major regional faults".***

(LQD 12/09) The legend was changed as requested. **This item is resolved.**

4. Plates D5-1a – D5-1e. These plates provide one generalized and several detailed geologic cross sections down the centerline of the ore body, and across the centerline of the ore body. In addition, Figure D5-2a provides a very generalized geologic cross section across the northern portion of the permit area. LQD Non-Coal Rules, Chapter 11, Section 3(a)(viii) requires cross sections that show geologic features within the entire permit area, and how

they relate to the production zone. Extending cross sections F, G, and H to the boundaries of the permit area with any available drill hole data, will help to provide this information.

The cross sections have been updated with the information from new borings and wells completed in 2008. Plates D5-1b through D5-1e have been replaced and two new plates have been added (D5-1f and D5-1g). The references in the text to these plates have also been updated.

- a) **The northern (left) edge of cross section F-F', presented on Plate D5-1e appears to have 880 feet of extrapolation. What boring provides data for the northern extent of this cross section?**

(LQD 12/09) Given the variability of stratigraphy and faulting in the area, the projection of the cross section an additional 880 feet to the northern permit boundary could be misrepresentative. Although we have requested that cross sections represent the entire permit area, if there is no data available there can not be any confidence in the information presented. Please revise Plate D5-1e to eliminate this extrapolation, and revise Section D5.2 to drop the statement that "endpoints of each cross section are projected to the permit boundaries".

- b) **The piezometric surfaces are indicated for the DE, LFG, HJ and UKM aquifers, though it is not clear if there are any monitoring wells on the cross sections from which the water tables were derived. Please designate any monitoring wells on the cross section, and indicate their screened intervals and water levels with date.**

(LQD 12/09) As stated previously, the cross section should indicate where specific groundwater elevation data is available from monitoring wells, and if the data points are close enough it can be extrapolated, otherwise projecting a potentiometric surface across an entire cross section could be misrepresentative. For example, on Plate D5-1e, cross section F-F', there are two clusters of monitoring wells that fall on the cross section yet are not indicated. Wells MB-01, MB-02, MB-03A, and MB-04 lay in a cluster approximately 312 feet south of the North Fault. There is no groundwater data north of the fault yet the cross section assumes that the water level across the fault is consistent. Similarly, there is a well cluster (LC21M, LC22M, LC23M, and LC30M approximately 250 feet south of the Lost Creek Fault (Subsidiary) yet these wells are also not indicated on the cross section. The potentiometric surface is projected on the cross section, an additional 1.5+ miles to the south, with no data available. Granted, the surfaces appear as dashed lines or implied, however, please add the known groundwater elevations on the cross section for each available monitoring well, and indicate the screened interval and the date for the water elevation. Extrapolation should be limited to those areas on the cross sections where there is enough data available. Please also revise Section D5.2 by deleting the statement that "Depiction of these (*potentiometric*) surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with potentiometric contours plotted for the given horizons...".

- c) **Additional faults are indicated on the north/south trending cross sections. Please add these faults to the map key, as well as within the discussion of Section D5.2.2 the permit document. In addition, these faults should be indicated on all maps where the Lost Creek Fault is included, if they fall within the scale of the map.**

(LQD 12/09) Plate D5-3 has been added and indicates the location of the other known faults in the permit area. The text states that the southern fault's downthrown block is on the north side, yet Plate D5-3 indicates that the downthrown block is to the south. Please correct this deficiency. As requested previously, any map (e.g. Plates D5-2a through D5-2d) which showed the location of the Lost Creek Fault needs to be revised to indicate the updated version of the multiple fault locations within those maps. The permit area template within the map legends will also need to be revised to include the additional fault locations.

- d) **Section D5.2.1 Stratigraphy. Paragraph 3 references trends in stratigraphy relative to "the Fault". This wording needs to be changed since it is now apparent that there are many faults within the permit area. Please specifically state the Lost Creek fault.**

(LQD 12/09) The wording was revised to state 'Lost Creek Fault' This item is resolved.

- e) **No cross section has been provided for Section 16, which represents approximately 1/6 of the permit area. What is known about this section? Do the stratigraphic units extend to this part of the permit area? Are there any faults? Is there any potential mineral reserve? If not, why is this section included within the permit area? An additional cross section, which includes Section 16 should be added.**

(LQD 12/09) No cross section was provided yet the response indicates that there are 20 widely spaced drill holes in this section. The 20 exploration holes from Section 16 should be sufficient to provide some geologic information for this part of the permit area. Please provide a baseline cross section for Section 16.

6. Several of the Plates, beginning with Plate D5-2a indicate the mine unit boundaries, yet the proximity of Mine Unit 6 to the eastern boundary of the proposed permit area, will need to be changed to allow for the monitor well ring and aquifer exemption boundary to be within the permit boundary.

The mine unit boundaries displayed on the figures and plates are conceptual and not intended to indicate the specific extent of either the "pattern area", monitor well ring, or aquifer exemption area for a given mine unit. The maps LC sends with each mine unit application will show the definitive boundaries, based on the specific physical conditions for

that mine unit. A comment explaining the conceptual nature of the mine unit boundaries must be added to the plates which indicate the conceptual boundaries. In addition, a disclaimer which states, "In order for the mine unit No. 6 boundary to be located as depicted, a permit boundary revision would be necessary."

(LQD 12/09) A statement was added to the Mine Plan section stating that the mine unit boundaries are conceptual. The original comment was regarding the mine unit boundaries depicted on maps in Appendix D-5. These maps do state "Proposed Mine Unit" and will not be the realistic boundary due to the proximity of the permit boundary. **This item is resolved.**

7. Section D5.3.5 discusses the Short-Term Probabilistic Hazard Analysis, yet does not explain how the potential estimated accelerations would affect the well structure, pipelines or buildings on site. Please add this information to the text.

Text was added near the end of Section D5.3.5 to explain the potential impacts. The added text explains how facility structures, pipelines, and well structures will be designed to sustain an intensity V earthquake. The added text also explains that observations of injection, production, and pipeline pressures and associated monitor well measurements, necessary for the in situ operation, will provide short term information about any unanticipated seismic impacts. The text in this section must also include a discussion of reporting protocol that will be followed if such a seismic event occurs. The protocol should include inspection of all buildings, equipment pipelines and injection, production and monitoring wells, including monitoring well measurements. How soon after the seismic event such inspections and measurements will be made and how soon a report would be sent to LQD should be stated.

(LQD 12/09) A protocol for inspection and reporting in the case of a seismic event has been added to the Operating Plan, Section OP2.9. **This item is resolved.**

8. Section D5.2.2, Structure. This section discusses there being one minor fault, the Lost Creek Fault, within the permit area, yet the maps in this section indicate a second fault to the west of the Lost Creek fault, yet within the permit area. This fault should be discussed in detail.

The text in Section 5.2.2 has been updated to reflect the most current information (2008 exploration drilling). As additional information about the fault system is collected in the vicinity of a given Mine Unit, that information will be provided with the relevant Mine Unit Package. Given that LQD is requiring Mine Unit 1 to be included in the application, it is expected that this information be provided for Mine Unit 1 at this time (prior to permit approval). It will be acceptable to submit fault information for future mine units (i.e. Mine Units 2 through 6) with the relevant mine unit packages. However, information that is currently known about other faults within the permit area, should be discussed within Section D5.2.2. (See comment 4(c)).

(LQD 12/09) New information about additional faulting in the area has been added to Appendices D5 and D6. **This item is resolved.**

11. Plates D5-1b – D5-1e show many places where the Sage Brush Shale has mineralized zones of ore, e.g. TG19-20, TG68-20, TG12-20, TG58-20, TG2-10, TG9-17, TG10-17, and TG11-17. The presence of mineralized zones within the Sage Brush Shale brings to question the ability of this unit to act as an adequate aquitard between the LHJ and UKM sands. The Sage Brush Shale is defined as a fine sand and shale unit. How fine is the sand if it had enough transmissivity to be a receiving unit for the Uranium? The overlying Lost Creek Shale also has some minimal mineralization within it. What is the likelihood that these shales could leach out Uranium altering the integrity of the unit. It is requested that the MKM be fully characterized for baseline, north and south of the fault, as it may end up being the underlying aquifer that needs to be protected during mining of both the HJ horizon and potentially the UKM horizon.

*Given the nature of the Battle Spring Formation LC maintains that aquicludes and aquitards (e.g. the Lost Creek or Sage Brush Shales) have lithologies dominated by mudstones and claystones; but may also include substantial amounts of siltstone and fine-grained sands. Given the extremely low concentration of uranium mineralization in the shale, even if the uranium were removed through mining, it would not result in any noticeable alteration of the shale's integrity. Also, the uranium mineralization is epigenetic so the structural integrity of the shale was established prior to the emplacement of uranium and is therefore independent of the uranium. The shale layers in question are strongly reduced which will largely prevent the oxidation and subsequent of dissolution of uranium mineralization even if mining solutions were to come in contact with the uranium [in the shales]. The response provides greater detail in describing that the lithologies provide considerable lateral facies changes and interfingering, and are often transitional to the aquifers above or below. As a result, dramatic thickening and thinning of the aquicludes can occur locally. In addition, their upper and lower boundaries are often gradational. Aquicludes may even exhibit localized occurrences of mineralization in the vicinity of lithologic interfingering and facies changes with mineralized sands." **The description in the response about the gradational and interfingering characteristics of the aquitards and aquicludes, as well as the cross section illustrating the character of the aquitards and aquicludes, provides a more detailed description of the nature of the stratigraphy at the site. Please incorporate this information into Section D5.2 Site Geology. In addition, it is understood that due to the epigenetic nature of the mineralized zones the structural integrity of the strata will not be impacted, yet a discussion of how mining will affect the storativity and transmissivity of the mineralized zones within the aquitards needs to be presented.***

(LQD 12/09) The text was added to Section D.5.2.1 and a new Figure D5-2c was added to the permit application to more clearly reflect the interbedding of the stratigraphy and the nature of the aquitards and aquicludes. **This item is resolved.**

12. Plate D5-2a, and D5-2c Isopach Maps of the Lost Creek Shale and Sagebrush Shale (respectively). For areas where the isopachs indicate the unit thickness is less than ten feet thick, please indicate at specific drill hole sites, what the thickness is at that location, so the reviewer knows how much less than ten feet in thickness the aquitard is at a given location.

Isopach maps have been updated with the information from new borings and wells completed in 2008, and the actual unit thicknesses have been added where the thicknesses are less than 10 feet. There are a number of borings within the <10 ft. zone where no data is provided, in addition, the footage and the drill hole location overlap in many places on Plate D5-2c making them un-readable. Also, a statement should be added to Section D5.2.1 Stratigraphy, regarding the minimum known thickness of each of these aquitards. Please revise accordingly.

(LQD 12/09) Plate D5-2c was revised to address the overlap issue, and additional thickness data was added to the map. Section D5.2.1 Stratigraphy now states that “the thinnest observed occurrences of these units are **approximately** five feet thick.” The lowest number on the map is ‘5’, yet the statement leads the reader to question if there are areas where the aquitard is less than five feet, and perhaps were rounded up to 5 feet. Please provide the smallest known thickness of the aquitard in tenths of a foot (e.g. 4.7 ft.) in the statement in Section D5.2.1.

13. Section D5.2.4 Historic Uranium Exploration Activities, and Plate AD5-2a-c Location Map of Historical Drill Holes. It is stated that there are at least 560 exploration holes in the area, and Attachment D5-2 lists the holes northing and easting, year drilled and ID. Please also include depth of hole and discuss further the efforts made to locate the old drill holes, and whether or not it was confirmed that the hole had been properly abandoned. If the hole was abandoned through recent efforts, the plugging procedure and date should be indicated as well. The map should be updated to indicate the status of each drill hole location. Once operations commence, it is important that these historic drill holes do not provide a pathway for production fluids to migrate to underlying or overlying aquifers.

Section D5.2.4 has been renamed (Subsurface Exploration Activities) because more than just historic uranium exploration is discussed in the section. It has also been divided into two subsections. The first subsection describes uranium exploration and the second summarizes other exploration. The first subsection has been further expanded to include: The results of efforts to obtain information about the known historic holes, including hole depths; descriptions of re-abandonment efforts that have been needed to date; and steps that will be taken to identify any improperly abandoned drill holes in the mine units. Table D5-2 (Abandonment Information for Historic Exploration Holes and Attachment D5-3 (Communication with WDEQ LQD related to Drill Hole Abandonment) have also been added.

Attachment D5-3 and the updating of Table D5-2 are welcome additions to the permit document.

However, essential to LQD's review is an understanding of the location of historic drill holes and their status as related to the location of proposed mine units. For this reason, Plates AD5-2a, AD5-2b, and AD5-2c (in Attachment D5-2) must include the location of the proposed mine units, a topographic layer, and the status of each known hole via a legend.

The efforts made by Tg in the early 80's were extensive, yet many holes were unlocatable, many holes had caps which had fallen downhole, and were therefore not probed, and the majority of holes probed had standing water. Yet, only those holes found with 200 ft. or more of water above the mud seal, were re-sealed.

The efforts made in 2006 by UR Energy to provide sealing of drill holes due to a localized pump test only involved fifteen wells, three could not be located. Twelve wells were reamed out down to 600-650 feet and then grouted. It seems that the majority of holes may be open from the concrete cap to 200 ft. depth. (As noted in the January 2009 review comments, the LQD has concerns about the lack of these old drill holes being sealed to the surface.)

The information in Attachment D5-3 presented for the Tg NOV illustrates the significance of the problem created by historic drill holes. Due to the site conditions the majority of the drill holes were not sealed to the surface, and were also not sealed to a point above the first aquifer.

Texasgulf drill hole summary in response to LQD NOV

	No. of holes inspected	No. of holes recapped	No. of holes w/ standing water	No. of dry holes	Holes resealed	No. of holes unable to locate	Holes with cap slipped down hole, unable to probe
1982	79	79	79				
1983	269	111		21	10	noted but not tallied	?
1984	427	371	213	72	27	56 (13%)	86 (20%)
TOTAL	775	561 (72%)					

- 775 Total holes exceeds total Tg holes reported in Table D5.2, possibly due to holes outside the Lost Creek proposed permit area.

Dry holes could indicate that hole was properly abandoned above uppermost aquifer, or hole had caved or bridged

As previously stated, the Division will require that these holes be located and sealed to the surface, as per ASTM D-5299-99 standards, in order to ensure that these historic holes do not compromise the confinement of the production zone during mining.

In order to clarify which historic holes are located in or near which mine units, a column should be added to Table D5-2 that indicates which proposed mine unit (if any) each historic drill hole is located in. This approach would eliminate confusion and provide clarity to the efforts LC has made in addressing historic drill holes at the site. Attachment D5-2 Plates AD5-2a, 2b, and 2c should be cross referenced to the Table;

and need to include topography, the mine unit boundaries, and the proposed permit boundary.

(LQD 12/09) Plates AD5-2a, 2b and 2c were revised and now include the topography and mine permit boundary. Please also include the conceptual mine unit boundaries and include the permit boundary and mine unit boundary on the map's legends. The individual mine unit data packages must include the historic drill holes information relative to that mine unit.

Section D-6 Hydrology

14. Section D-6. Detailed stratigraphic and well completion logs should be provided within the permit document for all monitoring wells. It is preferable if this information can be compiled on one log form. Notation of each horizon within the stratigraphic column would also be helpful. LQD Guideline 8, Appendix 5 describes the information to be included for each well.

A new attachment has been added with the well completion logs for the permit area monitoring wells. Existing Attachment D6-3 has been renumbered to D6-4 and Attachment D6-3 now contains Well Completion Logs. Cross references have been added to Section D6.2.2 of the text in Attachment D6-2a. Because of the size of the new Attachment (D6-3, Well Completion Logs), Volume 3 of the application has been divided into two binders; Volumes 3a and 3b. The following comments have been generated from a review of the well logs:

- a. **Volume 3b of 5, which now contains the well completion logs, needs to be added to the Table of Contents for each volume.**

(LQD 12/09) The Table of Contents was revised. **This item is resolved.**

- b. **Figure D6-9, Lost Creek Monitoring Wells, should include all monitoring well locations. There are 85 monitoring wells included in Attachment D6-3, and listed on Table D6-5, Monitoring Well Data, yet Figure D6-9 only has 46 monitoring wells shown. All 85 monitoring wells should be shown. Figure D6-9 should also be at a scale so that all well locations are clearly defined.**

(LQD 12/09) Plate D5-3 has been added to show the locations of all 85 monitoring wells, and the text in Section D6.2.2 has been revised to describe Figure D6-9, Plate D5-3 and Attachment D6-3 and Table D6-5. There still needs to be additional clarity. Plate D5-3 is titled 'General Location Map – Geology' yet indicates the locations of all existing monitoring wells. It also shows exploration drill holes yet from the legend, it is not clear which exploration holes are being represented. Please note on the legend, "Exploration drill holes (pre - YYYY)" Figure D6-9 is titled "Location Map, Lost Creek Monitor Wells", yet includes historic Tg monitor wells which are not designated as abandoned. It also does not include the additional wells installed in 2008. Figure D6-9 should be re-titled, since the current monitoring wells are on Plate D5-3, and there should be some indication in the legend that the Tg wells no longer exist.

- c. **Figure D6-9 includes 1982 monitoring wells with the designation M-25-92-18-1S. These wells were abandoned by Tg in 1985, and should not be included in a Figure titled 'Lost Creek Monitoring Wells'.**

(LQD 12/09) If the Tg wells are to be included on Figure D6-9 then the legend should indicate that they are historic well locations and no longer viable monitoring points. If someone was currently reviewing the Figure title Lost Creek Monitoring Wells, they would be led to assume that all of these wells indicated are existing wells.

- d. **Well Completion Log HJMU-104 is incorrectly labeled as HMJU-104.**

(LQD 12/09) The log was corrected. This item is resolved.

- e. **A number of wells indicate no well development efforts, yet there is water in the hole. (e.g. LC29M, LC31M, LC21M, LC25M, LC27M...) Chapter 11, Section 6(f) requires that the wells be developed and LQD Guideline 8, Appendix 5 discusses efficiency testing during well development. Development of these wells should be documented and submitted as part of the application.**

(LQD 12/09) LC indicates that all wells were airlifted after placement of the screen, swabbed prior to sampling, and three casing volumes removed prior to sampling. If this is the case, why do some of the well logs indicate that there was no development done on the well? Well development needs to be documented for all monitoring wells.

- f. **If airlifting produced poor yields, were any additional efforts made to develop these wells?**

(LQD 12/09) LC refers to the fact that all wells were airlifted. Yet, this response does not answer the question of whether any additional efforts were made to develop the wells in those cases where there was poor yield (HJT-106, MB-01, MB-07, MB-10, HJMO-109, HJMO-110, HJMO-11, MB-03B, LC23M, UKMP-102, UKMU-103).

- g. **Wells MB01, MB07 and MB10 all state there was no water, and the well was not logged, yet the log indicates 67 ft, 17 ft, and 22 ft of water respectively, and the wells were airlifted with poor yield. Please explain.**

(LQD 12/09) LC indicates that there was no water when these wells were initially drilled, therefore no logging could be done, and due to their 50-100 ft. proximity

to nearby monitoring wells that information was superimposed. **This item is resolved.**

- h. Wells MB01, MB07, and MB10 have substitute well logs with the well construction diagram superimposed on it. If these wells were logged for stratigraphy, then it would be clearer to show the well construction with the stratigraphy for that hole, as opposed to superimposing another hole. The proximity of these superimposed drill holes is not noted.**

(LQD 12/09) No stratigraphy was logged, and the nearby adjacent holes were noted. In the future, the logging of drill cuttings should be utilized for verification of stratigraphy for those holes where geophysical logging cannot be performed. **This item is resolved.**

- i. There are many wells where there is additional footage between the base of the well screen and the bottom of the hole, yet it is not indicated on the well diagram (e.g. LC29M, MB01, MB07, MB10, HJMO-105, HJMO-106, HJMO-112, HJMO-113, MB-02, MB-05, MB-08, HJMP-101, HJMP-102, HJMP-109, HJT-102, MB-06, MB-09, HJMU-105, HJMU-113, HJMU-114, UKMP-102, UKMP-103, MB-04, UKMU-101, UKMU-103). Please indicate on the schematic if the boring caved into this level, if there is a sump below the screen, or if it is an open hole.**

(LQD 12/09) LC added a page at the beginning of Attachment D6-3 to explain some of the drill log discrepancies. The page is titled "Notes on the Well Completion Logs in Attachment D6-3". In the first paragraph, please explain in further detail the penetration into the EF shale at wells MB-1 and MB-7. Specifically, how far into the shale did each drill hole penetrate, and what is the approximate thickness of the shale at the location.

- j. There are a number of holes where the bottom of the well screen (or under reamed interval) is deeper than the total depth recorded for the drill hole. (e.g. HJMP-105, UKMO-101, UKMO-103, HJMU-101, HJMU-104, HJMU-107, UKMP-101). Please correct the well logs accordingly.**

LQD (12/09) This discrepancy is explained in the new page titled "Note on the Well Completion Logs in Attachment D6-3". In the second paragraph, for those wells with a discrepancy with Total Depth, please provide details (a Table) indicating the true Total Depth vs. the Total Depth indicated on their well log.

- k. When well screen was used, it was placed below a K-packer, and telescoped from the SDR17 4.5 " ID to a 3" Screen. This narrow a screen may preclude the use of a pump within the screened interval for required bailing. LQD Non-Coal Chapter 11, Section 6(d) requires that the monitoring well casing be designed to allow for sampling.**

(LQD 12/09) LC indicates that a small diameter, low flow plump will be utilized in those wells where the water level is within the screened interval. **This item is resolved.**

16. Figure D6-27a, Piper Diagram – Average Water Quality at Individual Monitoring Wells. The legend designates which well is represented by which symbol, and the wells are grouped by color, yet it does not indicate which horizon the wells are monitoring. Please add the horizon noted by each color. (The colors are not consistent with which formation they represent, i.e. other Figures use green to indicate the DE horizon wells, whereas the Piper diagrams use red).

The figure has been revised to clearly indicate which horizon each well is monitoring.

There are 27 baseline monitoring wells, yet the two Piper Diagrams are only based on data from 17 wells. Please add the additional baseline information to the diagram, or provide an explanation as to why certain wells were not included.

(LQD 12/09) The diagrams will be updated once the data becomes available. This comment will remain open until that time. In addition, Comments 35, 36, and 37 have been dropped and are noted here. Table D6-15a and Section D6.4.2.2 will also need to be updated when the 2009 groundwater monitoring data is finalized and incorporated into the permit.

18. Figures D6-11a through D6-11c. The potentiometric surface maps are limited in scope and only represent a small portion of the permit area. The potentiometric surface maps should be representative of the entire permit area. Also given the barrier nature of the fault, both sides of the fault need to be adequately characterized. Additional baseline groundwater monitoring wells with adequate distribution across the permit area will need to be installed for this purpose.

*Ten additional baseline ground water monitoring wells were installed in the fall of 2008. The new wells are identified by the prefix MB in the well name. The locations of the new wells are shown on revised Figures D6-9 and D6-24, and Table D6-5 has been revised to include the new well completion information. The water levels were measured in the new wells in December 2008 and that information was used to generate potentiometric surface maps of the DE, LFG, JG and UKM horizons (Figures D6-11e through D6-11h). These maps are discussed in Section D6.5.2.2 of the text. **The potentiometric maps for UKM, HJ, LFG, and DE are based on data from 6 - 7 monitoring points. According to the new monitoring well information, presented in Table D6-5, Monitoring Well Data, and Attachment D6-3, Well Completion Logs, there is water level data available for 24 monitoring wells in the UKM aquifer, 29 monitoring wells in the HJ aquifer, 19 monitoring wells in the LFG aquifer (plus 2 in the FG), and 8 monitoring wells in the DE aquifer. These additional data points should be used to provide a more detailed map of the potentiometric surface for these aquifers.***

(LQD 12/09) LC explained that the level of detail provided by the additional monitoring wells is available on Figures D6-11a through D6-11d. **This item is resolved.**

22. Section D6.2.2.2, Potentiometric Surface, Groundwater Flow Direction and Hydraulic Gradient, page D6-14. Although hydraulic gradient is the change in head over distance between two wells, for the sake of the permit application, the hydraulic gradient across the potentiometric surface needs to be determined. As stated in comments 18 and 19, the potentiometric surface of each aquifer needs to be established, on both sides of the fault, and then the hydraulic gradient of this surface calculated with a minimum of three wells. The potentiometric surface should be representative of the permit area, and not just the area in the center of the permit area, adjacent to the fault zone. It seems possible that the gradient may be more generally to the south, yet when the fault zone is encountered, it changes to parallel this hydrologic barrier. Additional groundwater monitoring wells will need to be installed to obtain this information.

*The new monitoring wells installed in the fall of 2008 provide more complete coverage across the permit area. Potentiometric surface maps were generated from water level data obtained from the new wells and previously existing baseline wells. Hydraulic and vertical hydraulic gradients have been calculated from the 1982 Conoco well data and the 2006-2007 data and are included in revised Tables D6-7 and D6-8, which have been renumbered as Tables D6-7a and D6-7b. The additional well locations confirm that the predominant ground water flow direction is to the southwest, generally parallel to the Lost Creek Fault System. **If the potentiometric surface maps change significantly, then the horizontal gradient calculations (Table D6-7a, page 3 of 3) will need to be revised accordingly.***

(LQD 12/09) The additional wells did not make any change in the gradient information; therefore revision of the calculations is not necessary. **This item is resolved.**

24. Section D6.3, Table D6-12a. There are numerous Kennecott, Tg and BLM/Tg groundwater permits within or adjacent to the permit area. The status is listed as adjudicated, abandoned, or cancelled. Further discussion regarding the status of these permits needs to be included in Section D6.3 and Table D6-12a. Were wells drilled under all of the permits listed? Are there abandonment records for any of the wells? Has any effort been made to locate these wells and verify their status? There needs to be assurances that these wells will not act as a potential conduit for the movement of production fluids between aquifers.

Tables D6-12a and D6-12b have been modified (as well as the associated Plates D6-1a and D6-1b) for clarification between a well and a point of use. Additionally, LC's responses to Comments #13 and #30 address the concerns about efforts to locate drill holes and wells and the potential for wells outside the Permit Area to act as conduits for movement of production fluid.

- a. **Plate D6-1a does not have a location for well ID 1.**

(LQD 12/09) The well is five miles from the project area but has “points of use” associated with it. A footnote has been added to Table D6-12a and Plate D6-1a. The use points are listed on the Table. **This item is resolved.**

- b. **Well ID 21 is shown on Plate D6-1a, but is not listed in Table D6-12a.**

(LQD 12/09) Well ID 20 was incorrectly labeled as Well ID 21. The correction was made to the map. **However, the map now reads as Well “207” Please correct the map to read as Well 20.**

- c. **The addition of Well 6b to Table D6-12a, seems to have resulted in the following errors:**

- **Plate D6-1a shows well ID 7 as a potentially active permit in T25N R92W, Section 30, yet Table D6-12a lists it as an abandoned well in Section 20.**
- **Well ID 20 is shown on Plate D6-1a in T25N R93W, Section 24, yet is listed on Table D6-12a as being in T25N R93W, Section 13.**
- **Well ID 10 is shown on Plate D6-1a as being in T25N R92W, Section 20, yet on Table D6-12a the location is T25N R92W Section 19.**
- **Well ID 13 is shown on Plate D6-1a as being in T25N R92W, Section 19, yet on Table D6-12a the location is T25N R92W, Section 18.**
- **Well ID 16 is shown on Plate D6-1a as being in T25N R92W, Section 18, yet on Table D6-12a the location is T25N R92W, Section 17.**
- **Well ID 19 is shown on Plate D6-1a as being in T25N R92W, Section 17, yet on Table D6-12a the location is T25N R92W, Section 24.**

(LQD 12/09) The errors on the Plate D6-1a have been corrected. **This item is resolved.**

- d. **Wells shown at one location have overlapping symbols. They need to be designated differently on Plate D6-1a and Plate D6-1b so that their status can be ascertained.**

(LQD 12/09) The overlap has been eliminated. **This item is resolved.**

28. In addition to Table D6-14, the permit application must provide the Groundwater Monitoring Program for the site. It should include a list of the monitoring wells, sampling frequency, sampling protocol, QA / QC procedures etc. As new monitoring wells are added in the future, the permit will be revised by a Non-Significant revision to the permit to add or drop monitoring wells.

A copy of the Groundwater Monitoring Program is attached. Rather than incorporate it into the baseline portion of the permit application, LC will incorporate it into the Operations Plan, which is currently being revised in response to LQD comments of January

2009. LQD will review the Groundwater Monitoring Program with LC's forthcoming responses to LQD's January 2009 technical comments.

(LQD 12/09) The Groundwater Monitoring Plan was incorporated into the Permit as Attachment OP-8. **This item is resolved.**

30. Section D6.3, Page D6-21, last paragraph states that throughout the phases of the project the operator will correspond with BLM to ensure the wells that provide stock water are not adversely impacted. Since it is not clear where any of these wells are screened [Well 4775 (at 280 ft. depth), and 4777 (at 200 ft. depth), 4451 at 900 ft. depth, and the Eagles Nest Draw well (at 370 ft. depth)], it may be necessary to replace these water supplies prior to mining operations, to ensure that they are clearly isolated from any mining influence.

*As a precaution the BLM wells will be periodically monitored to determine if mining from the proposed ISR has impacted the wells. The technically sound and legally mandated safeguards of installing a monitor ring for excursion detection and of excursion control are sufficient to ensure the wells noted by the reviewer are not impacted by mining lixiviant. Pursuant to the discussion during the September 22, 2008 meeting with WDEQ LQD in Lander, these wells will not need to be preemptively replaced. **Monitoring of the BLM wells must be included in the permit's Groundwater Monitoring Plan. In addition, please add a statement to the last paragraph of Section D6.3 that if the mining operations adversely impact these wells, that Lost Creek ISR, LLC, will work with the BLM and replace the wells if required. LQD understands LC plans to submit the Groundwater Monitoring Plan with the responses to LQD's January 2009 comments.***

(LQD 12/09) A statement was added to Section D6.3 that LC "will work with BLM to replace the water source if any wells are rendered unusable due to LC ISR's mining activities." **This item is resolved.**

34. Table D6-13 Lost Creek Project Groundwater Permits. In addition to this table, a separate table should be presented which is the comprehensive groundwater monitoring network wells. If viable information is available from historic monitoring wells (e.g. the Conoco wells), i.e. the screened interval is known, then these wells can be presented as a subset of the table. If the water supply wells are going to be sampled they should also be included.

Table D6-13, as originally submitted, included all of the LC wells in the comprehensive ground water network; however, the table has been re-arranged for clarity. All those permits for which wells have been drilled, including monitoring and supply wells, are included at the beginning of the table. Those permits for which wells have not yet been drilled are included at the end of the table. Future information about wells will be included in the mine unit applications. As noted in the response to Comment #33, the information about the Conoco wells is included in Table D6-12a. The information about the LC permit (Table D6-13) was purposely separated from the information about permits granted to other entities because LC has control over the content and quality of the information and construction related to its permits, but does not have similar control over information or

construction related to other permits. **The response states that permits that have yet to be drilled are listed at the end of the Table. These wells appear to be on Page 8 of 8 under the subheading of 'Other Wells' and have 'Priority dates' of 2008. Please add a subheading for the wells that have permits but have not been installed. In addition, pertinent well information for Mine Unit 1 is expected to be submitted prior to permit approval.**

(LQD 12/09) The Table will be updated with the submittal of the Mine Unit One application. **This item is resolved.**

35. See response to Comment No. 16. **This item is resolved.**

36. See response to Comment No. 16. **This item is resolved.**

37. See response to Comment No. 16. **This item is resolved.**

39. Section D6.5.2.2 Potentiometric Surface and Hydraulic Gradients. Paragraph one provides the hydraulic gradient for the HJ Horizon. As mentioned in previous comments, the Division is requesting that both sides of the fault be characterized separately.

Horizontal and vertical hydraulic gradients have been calculated for both sides of the fault and are included in revised Tables D6-7a and D6-8. The text in this section of the permit application has also been revised with the updated gradient information. Tables D6-7a and D6-7b were previously numbered Tables D6-7 and D6-8, but were renumbered to allow for addition of Table D6-1 without renumbering all the tables in the section. Tables D6-9, D6-10a, and D6-10b, and D6-11a and D6-11b were also renumbered to D6-8, D6-9a and D6-9b, and D6-10a and D6-10b, respectively.

- a. **Table D6-9b and Table D6-10b are both titled '2007 LC16M Long Term Pump Test Monitor Wells'. The top and bottom of the underreamed zone in the Table D6-9b version do not correspond to the well completion log data, though the Table D6-10b version appears to be correct. Please determine the correct version, and address the change in an Index Sheet.**

(LQD 12/09) The Tables were revised. **This item is resolved.**

- b. **Table D6-10b, 2007 LC16M Long Term Pump Test Results (from the original submittal) seems to have been inadvertently eliminated with the second version of LC16M Long Term Pump Test Monitoring Wells. Please resubmit the LC16M Pump Test Results.**

(LQD 12/09) The Tables were revised. **This item is resolved.**

40. Section D.5.2.2 Potentiometric Surface and Hydraulic Gradients. Paragraph one states that from the pump tests the communication between the HJ aquifer and the overlying and underlying aquifers may be through historic boreholes that were improperly abandoned, leakage through the confining shale units, or contact of sands juxtaposed across the fault. All work done to relocate and either verify proper abandonment or re-abandon old drill

holes, should be included within the permit application. Any additional work completed to better define the cause for the communication must be submitted as a revision to the permit document.

Table D5-2 was generated for inclusion into the application in response to this comment as well as Comment #13. The table summarizes the re-abandonment work conducted by LC of historic holes. Additional pump tests will be performed in the future to further characterize ore zone confinement. Text has been added to Section D6.5.2.2 to provide a cross-reference to the discussion in Section D5.2.4.1 about abandonment work.

Mine Unit 1 characterization and demonstration of ore zone confinement is required prior to approval of the application. Additionally, Table D5-2 must include a column indicating which Mine Unit (MU-1, MU-2...), if any, a given Abandoned Drill Hole is located within. The addition of Table D5-1 and Attachment D5-3 are welcome additions to the permit application, yet does not address the need to re-abandon historic drill holes in order to obtain confinement of the production zone.

(LQD 12/09) The abandoned drill hole topic will be reviewed in detail with the mine unit package. Given the number of improperly abandoned historic drill holes, and the presence of multiple faults in the area, the ability to demonstrate confinement within the ore zone will be a challenge. This item is carried over to the review of the Mine Unit 1 submittal, (received 12/21/09)

41. Section D6.5.2.3 Aquifer Properties. The second paragraph states that additional long term multi-well pump tests were to be performed in the fall of 2007. These tests would provide more data on overlying and underlying aquifer characteristics. If this information is now available, it should be submitted for review as part of the permit application.

The pump test in question was used to further characterize the UKM aquifer and therefore, pursuant to discussions at the September 22, 2008 meeting with WDEQ-LQD and LC personnel, is not required for permitting of the HJ aquifer. The Section referenced by LQD (D6.5.2.3) was incorrect on the first review and has been corrected. The last sentence of the second paragraph states, "Long-term multi-well pump tests will be performed in the fall of 2007 to collect additional data regarding aquifer properties of the overlying and underlying aquifers" This seems to be referring to the Petrotek pump tests of LC16 and LC19 and should therefore state that, and cross reference Attachments D6-2a and D6-2b.

(LQD 12/09) The cross reference was added to Section D6.5.2.3. This item is resolved.

45. Section D.5.1 Structure. The newly submitted north/south trending cross sections F-F', G-G', and H-H' (Plates D5-1e through D5-1g) indicate additional faults north and south of the Lost Creek Fault. These faults need to be discussed within this section of the permit application. The extent of the faults, displacement, relative age, and any potential groundwater communication across them should be presented.

(LQD 12/09) Section D5.2.2 has been revised to include details regarding the other faults currently identified within the permit area. The behavior of the groundwater system across the faults will be reviewed in detail with the review of the Mine Unit packages. **This item is resolved.**

46. **Section D.5.2 Site Geology.** The last sentence of the paragraph states that Attachment D5-1 contains copies of typical geophysical logs from the permit area. Please also reference Attachment D6-3 which contains the geophysical logs for all the monitoring wells.

(LQD 12/09) The cross reference was added to Section D.5.2. **This item is resolved.**

47. **Section D5.2.2 Structure, Paragraph 1.** Please change the reference to the Plates to also include Plates D5-1f and D5-1g.

END OF MEMORANDUM