Uranerz ENERGY CORPORATION

June 10, 2015

Mr. Dorran Larner
Department of Environmental Quality – Land Quality Division
2100 West 5th Street
Sheridan, WY 82801

RE: TFN 5 5/166, Uranerz Energy Corporation, Nichols Ranch ISR Project, Permit to Mine No. 778
Jane Dough Amendment, Round 1 Technical Comments

Dear Mr. Larner,

Uranerz Energy Corporation (Uranerz) received WDEQ-LQD's first round of comments regarding the Jane Dough Amendment on March 12, 2015. The Jane Dough Amendment submittal is a revision by incorporation to the currently approved Permit to Mine No. 778. Herein are Uranerz responses addressing WDEQ-LQD's comments. For responses requiring page changes, the text is in bold print, and the pages are included with this submittal along with an Index of Change.

Uranerz noticed several comments by WDEQ-LQD reviewers questioned existing and approved permit language. As stated previously, operational activities will continue to be conducted in accordance with the current approved mining permit. Changes to the Mine Plan and Reclamation Plan to incorporate Jane Dough were provided in bold print text. Likewise, text in normal non-bolded print represents the permit as currently approved. Since the Jane Dough Amendment is by incorporation, the existing approved language remains unchanged and approved in accordance to Chapter 11 Section 19(e) which states "Only those conditions to be revised shall be reopened when a revision is necessary. All other aspects of the existing permit shall remain in effect for the duration of the unrevised permit."

It is worth noting that often times there may be unique differences between ISR permits resulting from unique site circumstances for which the Administrator granted or agreed to a variance or deviation from the requirements as they are given the authority to do. The original permit application was prepared in accordance with the current Chapter 11 requirements. The permit was approved by the WDEQ-LQD Administrator on December 29, 2010 following a rigorous five (5) rounds of technical comments which included meetings with District III staff and the Administrator to discuss, coordinate, and agree on various permit provisions. WDEQ-LQD reviewing staff may have already done so, but it might be beneficial to review the comment rounds from the original permit to help facilitate understanding of various permit commitments, specifically those pertaining to topsoil.

Since Uranerz submitted the Jane Dough Amendment in July 2014, there have been a few non-significant revisions (NSR) approved into the current permit. As discussed with WDEQ-LQD staff, the changes should be updated into the amendment document. Uranerz agreed with WDEQ-LQD staff that

the best way to do that is to include the changes with this response submittal. (Note: The text related to these items is not provided in bolded text because they have been approved into the current permit). The following summarizes the approved changes which need to be incorporated into the amendment documents.

- Change No. 11 (TFN 6 4/112) – Mine Plan Section 3.1.1.2 and 3.1.1.2.2 were revised and Figure 3-1
- Change No. 12 (TFN 6 5/124) - Mine Plan Section 3.14.1.1 was revised and Figure 3-18 updated
- Change No. 13 (TFN 6 1/166) - Mine Plan Section 3.14.1.1 was revised and Figure 3-18 updated
- Change No. 14 (TFN 6 3/147) – Mine Plan, Section 3.10.1 was revised and Figures 3-12A and 3-12B were updated.
- Change No. 15 (TFN 6 4/097) – Reclamation Plan, Table of Contents and Section 3.6

Additionally, Uranerz recently made revisions to the NRC application of the Jane Dough Amendment with regard to geology and hydrology. The revisions addressed coalescing geologic units described and discussed in the Mine Plan and Appendix JD-D5 *Geology*. To maintain consistency between applications, those revisions are being included with this submittal and are also provided in bold type.

If there are any questions regarding the Nichols Ranch ISR Project, Jane Dough Amendment submittal, please contact me at the Casper office at 307-265-8900 or by email at mthomas@uranerz.com.

Sincerely,

Michael P. Thomas
Vice President, Regulatory and Public Affairs
Uranerz Energy Corporation

MT/dk

Enclosures: Uranerz Response to WDEQ-LQD Comments
Revised pages & Index of Change

cc: David Brown, NRC

Jane Dough Amendment, Permit No. 778
TFN 5 5/166
Round 1 Technical Review Responses

URANERZ RESPONSE TO WDEQ/LQD COMMENTS

The following information contained in this document is the responses by Uranerz Energy Corporation (URZ) to the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ/LQD) in regards to Round 1 Technical Review.

All information provided by Uranerz in response to the WDEQ/LQD comments is enclosed with this document, complete with WDEQ/LQD index sheets.

The responses follow the comment format found in the WDEQ/LQD Round 1 Technical Review dated March 9, 2015. Missing comment numbers are a result of no comment being asked by the WDEQ/LQD.

GENERAL OMISSIONS & COMMENTS – Dorran Larner

1. WDEQ/LQD Comment: Ensure that all permit language which is based upon WDEQ/LQD Rules & Regulations are using the most current version of said rule or regulation.

Uranerz Response: Duly noted.

2. WDEQ/LQD Comment: Verify that the changes to the organizational structure, which were tracked under TFN 6 5/124 and approved on March 6, 2015 as Change #12 were included in the amendment package.

Uranerz Response: Agreed. Uranerz has incorporated the organizational structure changes approved as Change #12, into the amendment package. The changed documents are included and provided for on the attached Index of Change.

3. WDEQ/LQD Comment: Per WQDE/LQD Chapter 11, Section 5(a)(i)(D), address the capacity of water/wastewater treatment and correlation with the mining and restoration values.

Uranerz Response: Uranerz addressed capacity in the Mine Plan Section 3.3.7 Water Balance Calculations.

4. WDEQ/LQD Comment: Per WDEQ/LQD Chapter 11, Section 4(a)(x) discussion for mitigating and controlling subsidence in the Mine Plan is required.

Uranerz Response: The In-situ process does not remove physical underground structures that would create voids and cause subsidence. A paragraph discussing these details has been added to Volume VII, Mine Plan, Section 3.12. The revised page is enclosed.

5. WDEQ/LQD Comment: Per WDEQ/LQD Chapter 11, Section 5(a)(xix) discussion for mitigating and controlling subsidence in the Reclamation Plan is required.

Uranerz Response: A reference to subsidence has been made in Volume VII, Reclamation Plan, Section 3.3. The revised page is enclosed.

MINE PLAN COMMENTS

1. WDEQ/LQD Comment: The double-lined, leak detection impoundment was not discussed. A certified, as-built drawing as well as an operations and maintenance plan should be included in the Mine Plan.

Uranerz Response: As discussed with WDEQ-LQD staff, Uranerz has no impoundments at this time and not requesting any with this amendment.

2. WDEQ/LQD Comment: Section 3.3.1: Update paragraph one (1) to include the initial production rate of the Jane Dough Mine Unit (JDMU). The revised page is enclosed.

Uranerz Response: Section 3.3.1 has been revised to include the initial flow and production rate at the Jane Dough Unit.

3. WDEQ/LQD Comment: Section 3.3.2: Discuss pressures at the JDMU such as was done for the Hank and Nichols Mine Units.

Uranerz Response: A discussion of the pressures were provided for Jane Dough; however, the incorrect name was designated making the discussion unclear. The name has been corrected and the revised page is enclosed.

4. WDEQ/LQD Comment: Section 3.3.5: In the last paragraph there is discussion regarding line breaks; this discussion only covers the recovery lines. Update to include the injection lines.

Uranerz Response: The text in the last paragraph of Section 3.3.5 has been revised to remove the word "recovery" so as to speak to lines in general. Additionally, please note that the reference to Section 3.14.4 was incorrect and has been corrected to state Section 3.19. The revisions are enclosed.

5. WDEQ/LQD Comment: 3.3.6.2: Bold text on MP-15a states the horizontal flare should be similar to Nichols Ranch. From this statement it appears a model was not used. Expand on reasoning for the similarities expected.

Uranerz Response: In section 3.3.6.1, bold text on page MP-14 it does state that an analytical model was not used because a numerical model was. The bold text on page MP-15a is merely a statement identifying that since the units are similarly aligned that a composite flare factor could

be estimated. The numerical model for Jane Dough is provided in Addendum MP-I, as indicated in bold text on page MP-15a.

6. WDEQ/LQD Comment: 3.5.3:

a. Paragraph 1: Verify the Gantt Chart was updated to reflect the most recent changes.

Uranerz Response: Agreed. The Gantt Chart was up-to-date when the amendment was first submitted, but has since changed with the last Annual Report review. Uranerz has included a revised Figure 3-11 illustrating the updates.

b. Paragraph 2: This paragraph makes reference to two units. If I understand correctly, the addition of the Jane Dough makes a total of three units.

Uranerz Response: Correct, the reference should be for three units and has been changed in the text. The revised page is enclosed.

7. WDEQ/LQD Comment: 3.5.4, Paragraph 2: See note 5.b.

Uranerz Response: Text changed to reference three units.

8. WDEQ/LQD Comment: 3.6: Where did the MIT procedure evolve from, explain.

Uranerz Response: The MIT procedure remains unchanged to that which is currently provided in the approved Permit to Mine No. 778 and no changes to the procedure are being requested with this amendment package. The current MIT procedure was approved as Change No.9 (TFN 6 4/038) in coordination and discussion with WDEQ-LQD staff.

9. WDEQ/LQD Comment: 3.6, Paragraph 3: This paragraph discusses injection and recovery wells but excludes production and monitor wells. If production and monitor wells are to be tested update accordingly, if they are not to be tested justify the exclusion of said wells from MIT testing.

Uranerz Response: A recovery well is a production well and is accounted for under the MIT program. WDEQ-LQD only requires that Class III wells be MIT'd; however, NRC has stipulated, and Uranerz has agreed, to MIT all wells. The section has been updated to include monitor wells. The revised page is enclosed.

10. 3.12 WDEQ/LQD Comment

a. Paragraph 1: Uranerz states that they will strip to a depth of six inches (6"). What if the topsoil exceeds that depth? Revise this paragraph to reflect the requirements stated in Noncoal Rules & Regulations, Chapter 3 regarding topsoil handling.

Uranerz Response: Uranerz was requested by WDEQ-LQD staff during the initial permitting process of the existing permit to utilize a six inch salvage depth. The WDEQ-LQD comment can be found in the Round 1 Technical Review for the Nichols Ranch ISR Project. Uranerz has supplied a copy of that comment and response (which was approved by WDEQ-LQD).

> *68. WDEQ/LQD Comment (Section 3.12, Construction Considerations and Topsoil Handling, Page MP-31)*
>
> *My review of the baseline information suggests that the soil handling plans for the operation could be presented much more simply. It seems that an overall commitment to salvage to six inches of "topsoil" and an appropriate depth of "subsoil", depending on the actual construction practice involved, would provide for adequate salvage of resources. A commitment of this nature would protect the topsoil resource and would not require reference to the baseline materials to evaluate what is the better material. Six inches of topsoil may result in the salvage of a minor amount of subsoil along with the topsoil, but it is an easy and verifiable commitment. I also believe it mimics the surface owner's request, more or less, that the better materials be separately handled. (JS)*
>
> *URZ response to Comment #68.*
>
> *In Section 3.12 Construction Considerations and Topsoil Handling, URZ modified the text and has committed to salvage to six inches of "topsoil" and an appropriate depth of "subsoil", depending on the actual construction practice involved. This provides for an adequate salvage of resources.*

Furthermore, Chapter 3 Section 2(c)(i) states "All topsoil or <u>approved surface</u> material shall be removed from all areas to be affected in the permit area prior to these areas being affected <u>unless otherwise authorized by the Administrator</u>". The commitment to strip six inches presently approved in the permit is not a new request nor a revision. It is a commitment that by approval of the Administrator, has been agreed upon with the original issuance of Permit to Mine No. 778 in 2010 and requires no change.

b. Last Paragraph: There appears to be conflicting statements regarding topsoil stripping with regards to trenching within this paragraph. Clarify and justify situations in which Uranerz does not intend to strip topsoil during trenching operations.

Uranerz Response: The trenching discussion was approved under TFN 5 4/350 per discussion and with the assistance of WDEQ/LQD staff. Uranerz is not requesting any changes to this paragraph as currently approved with the Permit to Mine No. 778.

c. Per WDEQ/LQD Chapter 11, Section 4(a)(iii), expand discussion to include water erosion from sources such as run-off and storm events.

Uranerz Response: Erosion control practices are discussed in the Reclamation Plan Section 3.5. A reference to the location of this information has been added to the Mine Plan Section 3.12. The revised page is enclosed.

d. Per WDEQ/LQD Chapter 11, Section 4(a)(iv), include discussion addressing impoundments.

Uranerz Response: As described in Comment #1 above, Uranerz has no impoundments nor is requesting any with this amendment submittal, therefore a discussion of such is not needed at this time.

e. Per WDEQ/LQD Chapter 11, Section 4(a)(ix), include a description of the location of the underground injection site.

Uranerz Response: The Mine Plan Section 1.0 and 1.1 contain the site description and facilities layout. For the purposes of this amendment, the Jane Dough Unit wellfield areas, specifically, have been described and discussed in Appendices JD-D5 and JD-D6 along with various figures and exhibits to provide as much detail as possible at this time. Additional details of wellfield areas are provided through the preparation and submittal of the Production Area Pump Test Document (aka Hydrologic Test Document) prior to operation of those production areas. Section 3.14.7.8.4 of the Mine Plan lists out what is included in the document which includes a description of the location, extent, etc. of the wellfield production area.

11. 3.13.2.2.1 & 3.20.2.2.1 WDEQ/LQD Comment:

a. A designated area for disposal is referred to, is this area depicted on a map?

i. Update text to call out map.

ii. Update map, if necessary, to depict disposal area.

Uranerz Response: The text being referred to is presently approved and not being requested to change. Sections 3.13.2.2.1 and 3.20.2.2.1 discuss normal mining refuse that is noncontaminated. The permit in this instance speaks generally that noncontaminated solid waste will be in designated areas versus all over the place.

b. Verify that the estimated solid waste volumes reflect what has been seen since operations have started.

Uranerz Response: Uranerz is not requesting any changes to this section as currently approved. The volumes provided in the permit are both an estimate and an approximation and may change annually; however, these estimates remain valid.

12. 3.13.2.2.2 WDEQ/LQD Comment: Add reference to which map shows the 11.e(2) disposal area(s).

Uranerz Response: A reference has been added to Section 3.13.2.2.2 and Figure 1-5 is being submitted as an updated figure. The revised pages are enclosed.

13. 3.15.1 & Addendum MP-C WDEQ/LQD Comment:

a. Show known lek location(s) & ¼ mile buffer on a map. Update text to reference map.

Uranerz Response: A ¼ mile buffer has been added to Figure JD-D9-3 and text for Section 3.15.1 has been updated to reference map. The revised pages are enclosed.

b. Wyoming Game & Fish's letter appears to only address the amended area. If there was a letter addressing this subject for the original permit boundary it should be included so it is clear that the entire permit has been evaluated by the wildlife officials.

Uranerz Response: Addendum MP-C contains a letter from the Wyoming Game and Fish Department that only addresses the amended area. Uranerz will move it to Addendum JD-D9-A in Appendix JD-D9. Uranerz would refer WDEQ-LQD staff to the current approved permit document, Appendix D9 for similar letters regarding the approved permit area. The reference on page MP-73a will be changed to Addendum JD-D9-A. Addendum MP-C will be changed to "Reserved."

14. WDEQ/LQD Comment - Addendum MP-B:

a. This model does not appear to have been updated with the requested amendment. Does this model accurately reflect the new/added mine unit impacts?

Uranerz Response: Addendum MP-B includes the results of the analytical modeling for the Nichols Ranch and Hank Units only and remains unchanged from what was originally reviewed and approved with the existing permit. No revisions are being requested to this analytical model. Because the numerical modeling is considered more informative, additional modeling was performed with MODFLOW and the analytical modeling was not updated. Addendum MP-I includes the results of the expanded and updated MODFLOW modeling for the Nichols Ranch and Jane Dough Units.

b. How does the model compare to the real-time data collected since operations began?

Uranerz Response: The operational bleed rates are slightly higher than those included in the model, but in general, the wellfield response is consistent with expectations.

15. WDEQ/LQD Comment - Addendum MP-G: Modeling appears to be based on two (2) wellfields. Update model to include additional wellfields.

Uranerz Response: Addendum MP-G pertains to Nichols Ranch and Hank Units only and remains unchanged from what was originally reviewed and approved with the existing permit.

No revisions are being requested to this model. The model in Addendum MP-G is correct with two (2) wellfields. The wellfields for the Nichols Ranch Unit are more commonly known as production areas. There is a Production Area #1 and #2. Please refer to Addendum MP-I which contains the modelling for the Jane Dough Unit.

RECLAMATION PLAN COMMENTS

1. WDEQ/LQD Comment: 1.7

a. In all descriptions of the production areas for the various mine units the term "down" is used to describe direction. Since active mining is underground update this text to reflect the direction horizontally, i.e. south, southerly, etc.

Uranerz Response: Uranerz is not requesting any change of this section as currently approved. The only change to this section being requested is the bold text paragraph which discusses the Jane Dough Unit specifically. The Administrator has approved the words as is and the Jane Dough Unit discussion remains consistent with that format.

b. Begin the Nichols and Jane Dough descriptions similar to the method used to describe the Hank Unit to include Section, Township & Range. Update the Hank Unit description to show location in this order also.

Uranerz Response: The Nichols Ranch Unit description is what is currently approved and Uranerz is not requesting any change to it. The Jane Dough Unit description remains consistent with that format.

2. WDEQ/LQD Comment: 3.1, Last Paragraph: Should pipelines be included in this statement?

Uranerz Response: Pipelines is not necessary to add in this last paragraph as it is discussed in the second paragraph of the section.

3. WDEQ/LQD Comment: 3.3, Topsoil Handling: Per WDEQ/LQD Chapter 11, Section 5(a)(xi) discuss depth of topsoil replacement.

Uranerz Response: Except for the estimated topsoil acreage, this section remains unchanged from the existing permit approved by the WDEQ-LQD Administrator who, by approval, has accepted and agreed to the topsoil depths.

4. WDEQ/LQD Comment: 3.4, Final Contouring: Per WDEQ/LQD Chapter 11, Section 5(a)(v) include a final contour map, ensure the scale is the same as MP map for direct comparison purposes.

Uranerz Response: This section remains unchanged from the existing permit approved by the WDEQ-LQD Administrator. Please refer to the last sentence of the section that indicates that no final contour map has been included since no significant changes in the topography will result from the proposed mining. ISR is neither an open pit or surface mine.

5. WDEQ/LQD Comment: 3.5, Erosion Control:

a. Much of the discussion in this section centers on the construction and operation phases of mining. Erosion control during construction and operation need to be included in the Mine Plan. Only address erosion control during reclamation in the Reclamation Plan.

Uranerz Response: This section remains unchanged from the existing permit approved by the WDEQ-LQD Administrator. Uranerz would refer WDEQ-LQD staff to review comments from WDEQ-LQD's initial technical review of the approved permit as it provides the basis for the permit as it is today. To that end, a reference to Section 3.5 of the Reclamation Plan has been added to the Mine Plan.

COMMENTS ON GEOLOGY, HYDROLOGY, RADIOLOGY, MINE PLAN – Bj Kristiansen

APPENDIX JD-D5 – GEOLOGY

Section JD-D5.1 – Page JD-D5-1

1. WDEQ/LQD Comment: The last complete sentence on the page ends with "…ore is not likely along every mile of the front." Is the word "ever" supposed to be "every"? Please clarify this narrative.

Uranerz Response: Agreed. The typographical error has been corrected. The revision is enclosed.

2. WDEQ/LQD Comment: The last sentence on the page uses the word "mesozoictime". Should this read "Mesozoic Time"? Please clarify the narrative.

Uranerz Response: Agreed. The typographical error has been corrected. The revision is enclosed.

Section JD-5.3 – Page JD-D5-9

3. WDEQ/LQD Comment: The second to last paragraph discusses pump tests performed within the Jane Dough unit. The tests on well URZ-J1-12 indicate that a flow rate of 1.0 gpm was achieved for "a few days". How long of a period of time is "a few days"? Is this an approximation of an unrecorded time period? Please indicate a more definitive time period for the test.

Uranerz Response: The aquifer properties testing for the Jane Dough unit are described in Addendum JD-D6B of Appendix JD-D6. Two tests were performed for well URZ-J1-12d with each test lasting approximately one day. The text has been revised to define the time.

4. WDEQ/LQD Comment: Test well URZ-J1-23-1 was pumped at 1.5 gpm for "a short time". Approximately how long was "a short time"?

Uranerz Response: The reference to pumping of well URZ-J1-23-1 for a short time is likely associated with a sampling event and no aquifer properties testing of this well is included in Appendix JD-D6.

Figures

Figure JD-D5-a

5. WDEQ/LQD Comment: The proto-ore zone is labeled "Protore Zone" at the bottom, right-hand side of the page. Please correct the designation.

Uranerz Response: The figure label has been revised to read "Proto-ore". The revised page is included with this submittal.

Figure JD-D5-b

6. WDEQ/LQD Comment: The pattern used to depict the oxidized sandstone is very similar to the one used for reduced sandstone. The only difference appears to be a slight modification in the distance between the dots. Is it possible to recreate the figure so that there is a greater differentiation between the two different types of sandstone? If so, please recreate the cross-section to better depict the chemically distinct rock units representing the disparate redox conditions.

Uranerz Response: The figure JD-D5-b has been revised and the oxidized sandstone is now shown as a reddish color. The revised page is included with this submittal.

APPENDIX JD-D6 – HYDROLOGY

Section JD-D6.2.1 – Page JD-D6-4

7. WDEQ/LQD Comment: The first sentence in paragraph 2 indicates that the aquifer and aquitard sequence is depicted in Figure JD-D6-2. The referenced Figure is a map of the Inundated Areas for the 25 Year Flood. Figure JD-D6-3 is the appropriate reference for the aquifer and aquitard sequence.

Uranerz Response: The reference to the figure has been corrected. The revised page is enclosed.

Section JD-D6.2.2.2 – Page JD-D6-6

8. WDEQ/LQD Comment: Paragraph 2 references Exhibit JD-D5-2 as an isopach map of the AB Mudstone. This exhibit is actually the North-South cross-section B-B'. Also, Exhibit JD-D5-4 is referenced as an isopach of the material between the 1 and A Sands. This exhibit is actually the East-West cross-section D-D'. Where are these isopach maps located? Please provide an appropriate reference or insert maps if they are absent.

Uranerz Response: The references to isopach maps have been corrected to Exhibit JD-D5-17 for the AB Mudstone isopach map and Exhibit JD-D5-19 for the 1A Mudstone isopach map. The revisions are enclosed.

Section JD-D6.2.3.1 – Page JD-D6-9

9. WDEQ/LQD Comment: Paragraph 2, third sentence states that "the underlying 1 Sand is roughly 18 feet above the A Sand in this cluster." It appears that it would be more accurate to refer to the 1 Sand potentiometric surface as being 18 feet above the A Sand. Please clarify the statement.

Uranerz Response: The text has been modified to include the suggested changes. The revisions are enclosed.

Section JD-D6.2.3.2 – Page JD-D6-10

10. WDEQ/LQD Comment: Paragraph 2 discusses the possibility of intervening sandstone units acting as conduits between coal beds developed for CBM and A Sand. The paragraph is difficult to understand. The description delineating the potential for cross communication between sandstones and coal needs to be rewritten for clarity. The hypothesis that the odds of interconnectivity between the sands and coal seams are very small needs to be better described in a manner that is transparent to all readers. At the point where the narrative turns to the description of the MODFLOW analysis, the clarity of the text tightens up and is adequate.

Uranerz Response: Paragraph 2 of Section JD-D6.2.3.2 makes reference to and draws heavily from Appendix D6 of the approved Nichols Ranch ISR Project Permit to Mine No 778. Because the general geologic section for the Nichols Ranch Unit and Jane Dough Unit areas is very similar, the discussion of geologic sequence is applicable for both areas. The remainder of the discussion in paragraph 2 is only intended to convey that, despite some interconnectivity between some adjacent fluvial sands, the geologic sequence includes many shales, claystones and mudstones that restrict vertical ground-water flow. These confining or restrictive layers occur both as thin layers within a larger sand interval, and as thicker shales between sand intervals.

The discussion that follows paragraph 2 and continues through the introduction of the numerical modeling includes the topics of wells that could potentially cause a vertical connection between the CBM coals and ore sands, and available water level data that demonstrates the hydrologic separation between CBM activity and the proposed mining intervals. An improperly completed well in the vicinity of the mining could potentially transmit CBM impacts into the ore zone, so this is an important consideration. Likewise, the available monitoring of CBM impacts on adjacent aquifers is very useful in confirming that, absent an artificial connection, CBM activity has very little if any impact on water levels in the ISR mining intervals.

Page JD-D6-13

11. WDEQ/LQD Comment: Figure JD-D6-B is extremely helpful at this juncture. Perhaps the first part of this section in question could be removed and discussion could begin with focusing on the modeling, leaving the inferred geology, discussed above, out of the narrative entirely rather than rewrite it.

Uranerz Response: The conceptual model for the numerical CBM impacts evaluation was developed using the geologic information described earlier in Section JD-D6.2.3.2 and in the parallel sections of Appendix D6 for the Nichols Ranch Unit. Although the presentation of the model results in Figure JD-D6-13 quantifies and summarizes the CBM impacts in a more understandable format, the construction of the model requires the geologic interpretation presented earlier. Likewise, the available water level monitoring information pertaining to CBM impacts is very helpful in confirming that the model produces reasonable estimates of CBM impacts.

Section JD-D6.5 – Page JD-D6-20

12. WDEQ/LQD Comment: The second paragraph references several years where specific abandonment procedures were being followed. Initially, year 1997 is identified as a cut-off point. Then, in the fourth sentence, the year 1977 is mentioned. Was this supposed to be 1997 as mentioned previously or was it actually 1977?

Uranerz Response: To avoid confusion, the fourth sentence in which the year 1977 is mentioned has been deleted. The revised page is enclosed.

Table JD-D-3

13. WDEQ/LQD Comment: The transmissivity and permeability of the aquifer tested in this well (JF-22) are significantly higher than the others tested. What causes these anomalous values? Please discuss.

Uranerz Response: Well JF-22 is completed in the F Sand, and the F Sand potentially has much greater transmissivity. As an example, aquifer properties testing of the F Sand in the Hank Unit generally indicates large transmissivity.

APPENDIX JD-D11 – RADIOLOGY

Section JD-D11.3.2 – Page JD-D11-17

14. WDEQ/LQD Comment: Table JD-D11-6: The reporting periods listed in the column headers indicate that the samples were taken during the third, fourth, first and second quarters of 2010, respectively. Were columns 3 and 4 supposed to be from the first two quarters of 2011, not 2010? Please respond.

Uranerz Response: Agreed the first and second quarter should be 2011. The table has been corrected and is enclosed.

Section JD-D11.3.3 – Page JD-D11-19

15. WDEQ/LQD Comment: The narrative covering the results of the surveys in this table describe the low values recorded in the second quarter, 2011 compared to the higher values recorded in 2010 and early 2011. These numbers are consistently low, regardless of the recording station. This brings the accuracy of the data into question when comparing the data sets statistically. What is the reason for the lower values during the second quarter, 2011? A brief discussion would be appreciated.

Uranerz Response: Agreed. The data provided for first and second quarter 2011 was incorrect and has been corrected. Although weather conditions that produce excessive snow cover or prolonged soil saturation can reduce gamma radiation from terrestrial sources, Uranerz discovered that the erroneous data contributed to what appeared at that time to be an anomaly. The correct data from the second quarter of 2011 was evaluated and used herein to revise Section JD-D11.3.3. As can be seen from the full data summary in Table JD-D11-7, the corrected values from the second quarter of 2011 are much more consistent with the range and average values recorded at the other locations. The revised page is enclosed.

MINE (OPERATIONS) PLAN

Section 3.1.1 – Page MP-7

16. WDEQ/LQD Comment: The second paragraph discusses the geometry of the monitor well ring. The figures referenced in the text to illustrate the geometry are Figures 1-2, 1-2A and 1-3. However, these three figures illustrate the contours and ore zone extent of the Nichols Ranch, Jane Dough, and Hank Units, respectively. The figures that demonstrate the monitor well ring spacing are Figures 1-7, 1-7a and 1-8. Is the labeling of the figures in the narrative a typographical error? Please respond.

Uranerz Response: Agreed. The figure references have been changed to 1-7, 1-7a and 1-8. The revised page is enclosed.

RECLAMATION PLAN

Section 1 – ALL

WDEQ/LQD Comment: In Section 1.1, the term 'baseline" is used to define groundwater quality characteristics prior to ISL operations occurring. LQD does not recognize the term "baseline". Rather, the defined terminology referencing pre-injection groundwater quality is "Background". Please re-read LQD Rules and Regulations Chapter 11. In-situ operations do not necessarily have to restore groundwater quality to pristine, background chemical conditions. LQD requests that the operator restores the aquifer characteristics to class of use, a more realistic, achievable condition within the aquifer exemption boundary. Concurrent NRC regulations also apply, of course. Outside the aquifer exemption boundary, water quality must be stable and meet the requirements of the applicable MCLs defined by the EPA (40CFR141, 2001).

Please reexamine LQD Rules & Regulations, Chapter 11, groundwater restoration narrative and requirements. Compare these to your narrative and determine where compliance to LQD R&R would modify Uranerz's groundwater restoration plan. We believe that this reevaluation may simplify your reclamation requirements and make long-term aquifer restoration achievable. If you have any questions concerning this topic, feel free to contact us for clarification.

Uranerz Response: Section 1.1 remains unchanged from what is provided in the current and approved permit document. While the term 'baseline' is not in the Chapter 11 Section 1 definitions it is used synonymously in the Chapter 11 regulations. Please see Chapter 11 Section 3 titled *Application Content Requirements – Adjudication and Baseline Information*, in which 'baseline' is used to denote characteristics prior to ISR operations. Therefore the term 'baseline' is appropriate as currently approved by the WDEQ/LQD Administrator.

Uranerz appreciates the reviewers understanding that the waters we are operating in are far from pristine, thus the reason they are exempted. Uranerz also recognizes that it may be more appropriate to restore to class of use; however, as WDEQ-LQD staff indicates NRC has a different standard at this time for which Uranerz is required to meet. Based on the LQD/Uranium workgroup meetings, it is also worth mentioning that there still remains some question about whether or not WQD is in agreement with class of use.

REVIEW OF SURFACE WATER AND WILDLIFE RELATED SECTIONS – David Myers

VOLUME IV

Appendix JD-D10-Wetlands

WDEQ/LQD Comment: Consultant states that one jurisdictional wetland exists within the survey area. Jurisdictional Determinations (JD) can only be performed by the U.S. Army Corps of Engineers (ACOE). I was not able to locate a JD anywhere in the provided materials. Please EITHER: provide a JD from the ACOE in the submitted materials OR, if there is to be no disturbance of the suspected jurisdictional wetland, a JD is not required and that language should be removed from the submitted materials.

Uranerz Response: Wetland information is provided in Appendix JD-D10 of the permit application. A jurisdictional determination will be submitted to the ACOE prior to the completion of permitting activities. A package of information including the wetland delineations for wetland areas and WUS's will be submitted as part of a NWP permit application.

WDEQ/LQD Comment: Consultant identifies two Waters of the United States (WUS) within the proposed amendment area and some disturbance of one of the identified WUSs. Consultant also invokes Nationwide Permit (NWP) Nos. 12 and 14 as being applicable to the identified disturbance of these waters. Consultant's conclusion states that ACOE approval will be obtained before disturbance will take place. Identification of WUS, and invocation of a NEP must be accompanied by an ACOE concurrence letter in the submitted materials. Please provide the ACOE concurrence letter.

Uranerz Response: A jurisdictional determination will be submitted to the ACOE prior to the completion of permitting activities. A package of information including the wetland delineations for wetland areas and WUS's will be submitted as part of a NWP permit application.

WDEQ/LQD Comment: There is one National Wetland Inventory (NWI) identified wetland that was determined by the consultant to not have wetland characteristics. It appears that this area will not be disturbed by mine-related activity, however, if there will be any disturbance of an NEI-identified area that has been determined not to exhibit wetland properties, there must be an ACOE concurrence letter on file stating that the area is not a wetland before that disturbance can be authorized. Please verify that there will be no mine-related activity within this area.

Uranerz Response: Uranerz has verified that there will be no disturbance in the identified wetland area.

VOLUME VIII – Mine Plan

MP 3.15.2.7 – Raptors

WDEQ/LQD Comment: More information needed. How will Uranerz address the recommendations from the USFWS for seasonal avoidance of active raptor nests as listed in the

USFWS correspondence provided in Addendum JD-D9-A? If active raptor nests are located within the buffer recommendations provided by the USFWS, how will Uranerz proceed?

Uranerz Response: A statement of clarification has been added to section 3.15.2.7 stating that Uranerz will comply with seasonal disturbance restrictions as directed by the USFWS.

GENERAL COMMENT – Dave Schellinger

1. WDEQ/LQD Comment: If any of the following regulatory requirements are not provided in the original permit language for the Nichols Ranch Permit as requested below for the Jane Dough Amendment, an NSR must be submitted to correct deficiencies in the original permit to bring it into compliance with the approved statutes and regulations governing non-coal and in-situ mining operations.

Uranerz Response: The original permit was prepared and reviewed and approved following the regulations as promulgated in 2005. Uranerz permit was approved, after 5 rounds of technical review from WDEQ-LQD to determine and correct deficiencies. The final permit was approved by the WDEQ-LQD Administrator in 2010 deeming the permit to be in compliance.

Appendix D7 – Soils

1. WDEQ/LQD Comment: Appendix D7 must provide a depth of topsoil expected from proposed affected lands as required under the Rules, Chapter 11 Section 1(a)(iv). The text of Appendix D7 should provide and estimated average topsoil salvage depth expected on all affected areas. The Map JD-D7-1 should also show the affected area locations including well fields, header houses, roads and pipeline corridors.

Uranerz Response: A review of Chapter 11 Section 1(a)(iv) requires a description of the nature and depth of the topsoil that will be removed from the proposed affected land prior to disturbance by mining activities. Uranerz provided that information in the Volume VII, Mine Plan Section 3.12 and the Reclamation Plan Section 3.3. Chapter 2 Section 2(b)(a)(i)(F)(II) requires the operator submit a description of the thickness and nature of the topsoil, if any, over the proposed affected lands. A soils survey and analysis…may be required to show variations in topsoil depth and suitability. Please also see Uranerz response to Comment #10 from Dorran Larner.

Looking at Appendix JD-D7, Section JD-D7.3.2 indicates that salvage depths for the area will vary. Additionally, Uranerz has committed to removing six inches of topsoil for affected areas as described in the Mine Plan. In regards to the Map JD-D7-1, unlike coal mining, when ISR submits a permit to mine, general information like the wellfield configuration is provided; however, the details such as header houses, roads and pipeline corridors may not yet be known. As such, the wellfields are generally displayed as described in the legend of Exhibit JD-D7-1.

2. WDEQ/LQD Comment: Table JD-D7-1 or another table must show the average topsoil/subsoil salvage depth(s) for each soil series encountered on the proposed permit acreage.

Uranerz Response: Please refer to response to Comment #10 from Dorran Larner.

Mine Plan

3. WDEQ/LQD Comment: Section 3.11. If improvements to existing roads take place that require additional topsoil acreage to be disturbed, topsoil salvage, stockpiling, signing and protection will be required. Such language must be added to the Mine Plan. Likewise, if new roads are constructed, the same or similar permit commitments must apply. The LQD will not require salvage of topsoil from temporary use roads, but will require a commitment to access these areas under dry or frozen conditions to prevent undue compaction of the topsoil or destruction of vegetation.

Uranerz Response: Chapter 3, Section 2(i) provides the environmental standards for road construction not distinguishing between new or improved. Therefore, regardless of new road construction or changes to existing roads the steps are the same (i.e. road construction is road construction) and therefore Uranerz existing commitment to topsoil salvage with regard to roads is sufficient and no additional commitment should be needed. While accessing temporary use roads during dry and frozen conditions is optimal and a best practice, there is no known Non-Coal Rules or statutes requiring that specific commitment in the mining permit. Uranerz does however, instruct and train employees on our landowner surface agreements and best practices to reduce and suspend activities during adverse weather conditions to prevent potential impacts. Please refer to Volume I of the current approved permit for those agreements.

4. WDEQ/LQD Comment: Section 3.12, first paragraph. The anticipated topsoil and subsoil salvage depths stated in this section must be consistent with the average salvage depth expected as a result of the baseline soil study.

Uranerz Response: Please see response to comment #10 from Dorran Larner.

5. WDEQ/LQD Comment: Section 3.12, second and fourth paragraphs. The landowner agreement cannot dictate topsoil salvage operations on disturbances expected to occur within the LQD permit. The LQD Rules are specific and must be applied to all disturbances within the permit acreage with the exception of temporary access for drilling purposes as previously discussed. Please remove reference to landowner's road construction practices or landowner agreements dictating soil salvage practices, including the letter in the Mine Plan, unless those practices are consistent with practices in LQD rules.

Uranerz Response: Uranerz is not requesting any revisions to these paragraphs as they represent the current approved permit commitments. The landowner can and has dictated what is to be salvaged on their surface property. It is their property as WDEQ-LQD has acknowledged in the

past. Please be advised that Uranerz was specifically requested by WDEQ-LQD, during LQD's 2nd round technical review of the original permit, to include the topsoil handling practices requested by the surface owner. Having the land owner agreement in the permit is something that Uranerz and LQD agreed on during the original permit approval process which was ultimately approved in 2010.

6. WDEQ/LQD Comment: Section 3.12, fourth paragraph. Subsoil and overburden are not synonymous. If only 12 inches of surface material was salvaged for topsoil and subsoil, any additional materials removed from the mud pit location or from ditches for placement of pipelines will be considered overburden. **Topsoil and subsoil salvage must occur on the location of all mud pits and pipelines, and where overburden stockpiles from the mud pit or pipelines will be placed as required under the Rules, Chapter 3, Section 2(c)(iv)(C).** The permit must commit to this requirement.

Uranerz Response: Please see response to Comment #10 from Dorran Larner.

7. WDEQ/LQD Comment: Section 3.13.4, third paragraph. The Rules, Chapter 11, Section 12 provides a detailed accounting of steps required to be followed in case of any incident that may endanger the public health or the environment. This section and the section discussing excursions and spills (3.14.7.8.10.3 and 3.19, respectively) must provide commitments to follow Chapter 11, Section 12 of the Rules. The general language provided in this section of the Jane Dough Amendment is not adequate to meet LQD requirements.

Uranerz Response: Uranerz commitment is stated in the first paragraph of Section 3.19. However, for clarity additional text has been inserted to the sections mentioned to include WDEQ-LQD Chapter 11 regulations. Those changes are included in this submittal.

Reclamation Plan

8. WDEQ/LQD Comment: Section 3.3. Topsoil handling that includes salvage, stockpiling, signing and protection belongs in the Mine Plan, not the Reclamation Plan. The language shown in the first, second and third paragraphs related to topsoil salvage, stockpiling and protection should be moved to the Mine Plan and stricken from the Reclamation Plan. Only discussions of topsoil replacement and seedbed preparation should be presented in the Reclamation Plan.

Uranerz Response: Please see response to Comment #5 (Reclamation Plan) from Dorran Larner.

9. WDEQ/LQD Comment: As required under statute and rule, all permit reclamation plans require contour maps showing final contours, even if those contours are pre-disturbance contours or not [WS § 35-11-406(b)(viii) and the Rule, Chapter 11 Section 4(a)(v)]. Please provide an appropriate contour map.

Uranerz Response: Please see response to Comment #4 (Reclamation Plan) from Dorran Larner.

10. WDEQ/LQD Comment: Section 3.5. Several discussions related to Mine Plan issues of disturbances of ephemeral drainages have been added to the Reclamation Plan. They should be added to the Mine Plan and removed from the Reclamation Plan. This also includes any discussions related to pre-reclamation disturbances and erosion/runoff control that will occur during active mining operations.

Uranerz Response: Please see response to Comment #4 (Reclamation Plan) from Dorran Larner.

11. WDEQ/LQD Comment: Section 5.0. Reclamation success is also accompanied by stable conditions. Erosion will not be allowed on reclaimed surfaces prior to permit termination without a requirement for repair or stabilization.

Uranerz Response: No response required other than Wyoming Statute 35-11-423 Release of Bonds and Chapter 3 Section 2(d)(v) establishes how bonds will be released based on revegetation.

Reclamation Plan – Stacy Page

1. WDEQ/LQD Comment: Page RP-15. Section 3.2.1 and Section 3.2.2. This reclamation plan does not follow Patricia Clark's letter in Addendum MP-A. For reclamation of the roads she requests that the topsoil from the road ditches be windrowed to the outside of the back slope of the ditch, the road gravel removed, the road surface and ditch area ripped, the subsoil from the top of the road back placed back into the ditch, the topsoil replaced on the road and previous ditch area and seeding. The reclaimed road will blend with the surrounding surface.

Uranerz Response: A sentence referencing Addendum MP-A for road reclamation on T-Chair surface has been added to each section. The revised changes are enclosed.

2. WDEQ/LQD Comment: Page RP-19. Table 3-1. The reclamation plan is being entirely replaced which means this seed mix will now also apply to the Hank and Nichols Ranch Units. The three surface owners in the Jane Dough Unit have given surface owner consent for this seed mix however Betty Lou Payne and Kenneth Reed Zink, surface owners for the Nichols Ranch Unit, and Jess and Max Ruby and the BLM, surface owners for the Hank Unit, have not provided consent for the mix. Although the see mix has similar species the rate of pubescent wheatgrass has doubled to 3 lbs, intermediate wheatgrass has been added at 3 pounds and the alfalfa rate has been tripled to 3 lbs. Please provide surface owner consent for this seed mix or add the currently approved seed mix to this reclamation plan identifying it to be used on the Nichols Ranch and Hank Units.

Uranerz Response: Changes were made to this page and table in the current approved permit under TFN 6 4/097 to address these very items. Pages RP-19 through RP-20a have been revised to incorporate those changes and are included with this submittal. Please note that Table 3-1 is the interim mix, Table 3-2 is the final mix and Table 3-3 is the BLM mix. The revised pages are enclosed.

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INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

Date 6/10/15
TFN 5 5/166
PERMIT NO.: 778

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MINE NAME: Nichols Ranch ISR Project

Statement: I, Michael P. Thomas, an authorized representative of Uranerz Energy Corporation declare that only the items listed on this and all consecutively numbered Index Sheets are intended as revisions to the current permit document. In the event that other changes inadvertently occurred due to this revision, those unintentional alterations will not be considered approved. Please initial and date. MPT 6-10-15

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Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
Jane Dough Amendment Volume VII	Mine Plan: Section 3.1.1, pg MP-7	Mine Plan: Section 3.1.1, pg MP-7	Pg. MP-7 was revised to correct a reference per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.1.1.2 and 3.1.1.2.2, pg. MP-8, MP-8c, and Figure 3-1	Mine Plan: Section 3.1.1.2 and 3.1.1.2.2, pg. MP-8, MP-8c, and Figure 3-1	These pages and figure were revised and approved into the current permit under Change No. 11 (TFN 6 4/112) and need to be incorporated into the JD amendment documents.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.3.1, pg MP-10	Mine Plan: Section 3.3.1, pg. MP-10	Section 3.3.1, pg MP-10 was revised to include flow and production rate at Jane Dough per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.3.2, pg MP-10a	Mine Plan: Section 3.3.2, pg MP-10a	Section 3.3.2, pg MP-10a was revised to correct the bolded word Nichols Ranch to Jane Dough per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.3.5, pg MP-12a	Mine Plan: Section 3.3.5, pg MP-12a	Section 3.3.5, pg MP-12a bolded sentence was revised to say that if any line breaks it will be taken care of appropriately.
Jane Dough Amendment Volume VII	Mine Plan: Sections 3.5.3 and 3.5.4, pg. MP-19, Figure 3-11	Mine Plan: Section 3.5.3, pg MP-19 and Figure 3-11	Pg MP-19 was revised to correct for three units in Sections 3.5.3 and 3.5.4. Figure 3-11, referenced in Section 3.5.3, was updated. This figure is located at the end of the Mine Plan document with the other figures.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.6, pg. MP-20	Mine Plan: Section 3.6, pg. MP-20	Pg. MP-20 was revised to account for monitor wells per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Table of Contents pg MP-viii	Mine Plan: Table of Contents pg MP-viii	The page was revised and approved into the current permit under Change No. 14 (TFN 6 3/147) and need to be incorporated into the JD amendment documents.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.10.1, pgs. MP-25 and 25a, Figures 3-12A and 3-12B	Mine Plan: Section 3.10.1, pgs. MP-25, 25a and 25b, Figures 3-12A and 3-12B	The pages and figures were revised and approved into the current permit under Change No. 14 (TFN 6 3/147) and need to be incorporated into the JD amendment documents.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.12, pg. MP-31a	Mine Plan: Section 3.12, pg. MP-31a	Pg. MP-31a was revised to include a discussion regarding subsidence in response to LQD comment. A reference has also been added on this page to point to the Reclamation Plan for the discussion of erosion controls.

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Jane Dough Amendment Volume VII	Mine Plan: Section 3.13.2.2.2, pg. MP-36, Figure 1-5	Mine Plan: Section 3.13.2.2.2, pg. MP-36, Figure 1-5	Pg. MP-36 was revised to include a reference to Figure 1-5 per LQD comment. Figure 1-5 has also been updated and revised. This figure is located at the end of the Mine Plan document with the other figures.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.13.4, pg. MP-37	Mine Plan: Section 3.13.4, pg. MP-37	Pg. MP-37 was revised to include a reporting commitment per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.14.1.1, pgs. MP-39-41 and Figure 3-18	Mine Plan: Section 3.14.1.1, pgs. MP-39-41 and Figure 3-18	These pages represent changes approved under permit 778 Change No. 12 (TFN 6 5/124) and Change No. 13 (TFN 6 1/166) and need to be incorporated into the JD amendment to maintain consistency between the approved permit and the amendment document.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.14.7.8.10.3, pg. MP-73	Mine Plan: Section 3.14.7.8.10.3, pg. MP-73	Pg. MP-73 was revised to include a reporting commitment per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.15.1, pg. MP-73a	Mine Plan: Section 3.15.1, pg. MP-73a	Pg. MP-73a has been revised to include a reference to a figure.
Jane Dough Amendment Volume VII	Mine Plan: Section 3.15.2.7, pg. MP-77	Mine Plan: Section 3.15.2.7, pg. MP-77	Pg. MP-77 was revised per LQD comment
Jane Dough Amendment Volume VII	Mine Plan: Section 3.19, pg, MP-84b	Mine Plan: Section 3.19, pg, MP-84b	Pg. MP-84b was revised to include a reporting commitment per LQD comment.
Jane Dough Amendment Volume VII	Mine Plan: Addendum MP-I	Mine Plan: Addendum MP-I	The Addendum MP-I is being replaced in its entirety and includes 6 additional figures
Jane Dough Amendment Volume VII	Mine Plan: Addendum MP-C letter from Wyoming Game and Fish	Mine Plan: Addendum MP-C "Reserved"	The letter has been removed from this Addendum and placed in Appendix JD-D9, Addendum JD-D9-A.
Jane Dough Amendment Volume VII	Reclamation Plan: Section 3.2.1 and 3.2.2, pg. RP-15	Reclamation Plan: Section 3.2.1 and 3.2.2, pg. RP-15	The sections were revised to provide a reference regarding roads per LQD comment.
Jane Dough Amendment Volume VII	Reclamation Plan: Section 3.3, pg. RP-17	Reclamation Plan: Section 3.3, pg. RP-17	The section and page have been revised to provide a reference to where the discussion of subsidence is located.

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Jane Dough Amendment Volume VII	Reclamation Plan: Table of Contents pg. RP-iii	Reclamation Plan: Table of Contents pg. RP-iii	The pages were revised to incorporate changes from TFN 6 4/097.
Jane Dough Amendment Volume VII	Reclamation Plan: Section 3.6, pg. RP-19, 20, 20a	Reclamation Plan: Section 3.6, pg. RP-19, 20, 20a	The pages were revised to incorporate changes from TFN 6 4/097 Change No. 15.
Jane Dough Amendment Volume II	Appendix JD-D5	Appendix JD-D5	The Appendix narrative is being replaced in its entirety. Specially, the following changes were made. Pg JD-D5-1 is being replaced to correct for typographical errors. Pg JD-D5-9 was revised per LQD comment regarding pump test times for various wells. Figure JD-D5-a is being replaced to correct a typographical error. Figure JD-D5-b was revised to illustrate a shaded area. Sections JD-D5.3 Site Geology, subsection Jane Dough Uranium Deposition was revised per NRC discussion of the information.
Jane Dough Amendment Volume III		Appendix JD-D5, Exhibits JD-D5-21 through JD-D5-26	Exhibits JD-D5-21 through JD-D5-26 are new exhibits to go with the revised JD-D5 text as per discussion and submittal to NRC.
Jane Dough Amendment Volume IV	Appendix JD-D6, Section JD-D6.2.1, Pg. JD-D6-4	Appendix JD-D6, Section JD-D6.2.1, Pg. JD-D6-4	Pg JD-D6-4 was revised to correct a figure reference
Jane Dough Amendment Volume IV	Appendix JD-D6, Section JD-D6.2.2.2, Pg JD-D6-6	Appendix JD-D6, Section JD-D6.2.2.2, Pg JD-D6-6	Pg. JD-D6-6 was revised to correct figure references
Jane Dough Amendment Volume IV	Appendix JD-D6, Section JD-D6.2.3.1, Pg. JD-D6-9	Appendix JD-D6, Section JD-D6.2.3.1, Pg. JD-D6-9	Pg. JD-D6-9 was revised per LQD comment
Jane Dough Amendment Volume IV	Appendix JD-D6, Section JD-D6.5, Pg. JD-D6-20	Appendix JD-D6, Section JD-D6.5, Pg. JD-D6-20	_Pg. JD-D6-20 was revised to remove a sentence not relevant to the discussion – per LQD comment.

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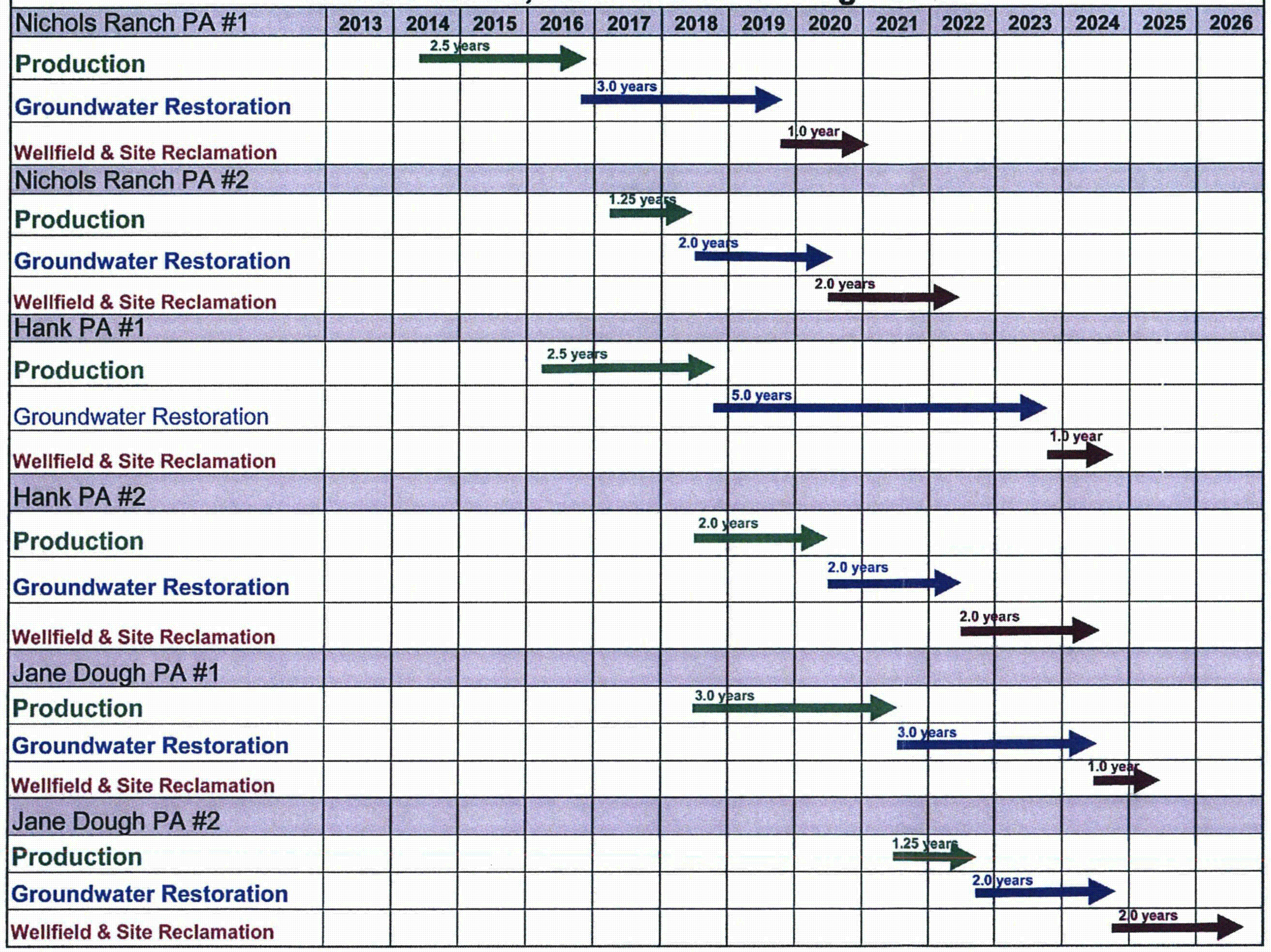
Jane Dough Amendment Volume VI	Figure JD-D9-3	Figure JD-D9-3	Figure was revised to provide buffer per LQD comment.
Jane Dough Amendment Volume VI	Appendix JD-D11, Section JD-D11.3.2, Pg. JD-D11-7	Appendix JD-D11, Section JD-D11.3.2, Pg. JD-D11-7	Pg. JD-D11-7 is being replaced as Table JD-D11-6 was revised to correct sampling dates.
Jane Dough Amendment Volume VI	Appendix JD-D11, Section JD-D11.3, pgs. JD-D11-18 and JD-D11-19	Appendix JD-D11, Section JD-D11.3, pgs. JD-D11-18 and JD-D11-19	Pages were revised for narrative changes as well as corrected data on Table JD-D11-7

Projected Production, Restoration, and Reclamation Schedule
Nichols Ranch, Hank and Jane Dough Units



Note: Nichols Ranch Unit is divided into two production areas: Nichols Ranch Production Area #1 and Nichols Ranch Production Area #2. Hank Unit is divided into 2 production areas: Hank Production Area #1 and Hank
This is a projected estimate for Production, Restoration and Reclamation. The actual schedule will depend on construction efficiency, actual production results and actual restoration of the groundwater.

5/8/2015

Uranerz
ENERGY CORPORATION
1701 East "E" Street
P.O. Box 50850
Casper, Wyoming
USA 82605-0850

Figure 3-11

Nichols Ranch ISR Project

Production, Restoration & Reclamation Schedule

Drawn: BW Checked: SK
Date: 01/05/2014

Revision	Description
3/11/14	Add Jane Dough
05/11/15	Add Jane Dough

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3.0 WELLFIELD DESIGN, CONSTRUCTION AND OPERATION

3.1 WELLFIELD DESIGN

Wellfields are designated areas above the ore zone that are sized to reach the desired production goals. The ore zone is the geological sandstone unit where the leaching solutions are injected and recovered in an in situ recovery wellfield and it is bounded between aquatards. Production areas are the individual areas that will be mined in the wellfield. The injection and recovery wells are completed in the ore zone intervals of the production sand. Perimeter monitor wells are located in a ring around the wellfields. Vertical monitor wells will be placed in the overlaying and underlying aquifers, accordingly.

3.1.1 Monitor Wells

The density and spacing of monitor wells for the Nichols Ranch Unit and the Hank Unit is determined during the geologic and hydrologic assessment of a proposed wellfield. Monitor wells will be installed in the ore zone at a density of one monitoring well per four acres in the proposed wellfield. These wells will be used to obtain baseline water quality data for the proposed wellfield to determine groundwater Restoration Target Values (RTV's).

Perimeter monitor wells will also be installed on the edge of the wellfield in the same zone as the ore zone. This "ring" of wells will be used to obtain baseline water quality data in the area outside of the wellfield and to ensure that recovery solutions do not migrate outside of the ore zones. Upper Control Limits (UCL's) will be determined for these wells from the baseline water quality data that are collected. The distance between these wells and the wellfield is approximately 500 ft. The distance from perimeter monitor well to perimeter monitor well is also 500 ft. **(Figures 1-7, 1-7A, and 1-8).** Numerical modeling presented in Addendums MP-G, MP-H, and **MP-I** was used to support these well spacings. These distances were determined using a groundwater flow model and estimated hydrologic properties for the proposed wellfield. This distance also takes into consideration that if an excursion were to occur, processing fluids could be controlled within 60 days as required by the Wyoming Department of Environmental Quality.

Vertical monitor wells will also be installed in the overlying and underlying aquifers at a density of one underlying and one overlying well per every four acres of wellfield. These wells will be used to collect baseline water data that will be used to determine UCL's for the overlying and underlying aquifers. If the immediate overlying or underlying aquifers in the wellfield are non-existent, or the confining unit (aquitard) is thin (less than five feet in thickness) within the proposed wellfield or section of the wellfield, then monitor well spacing and density will be determined in consultation with the regulatory agencies. In the case of the wellfield becoming very narrow where a line drive pattern may be utilized, overlying and underlying aquifer monitor wells will not be more than approximately 1,000 ft from one another.

3.1.1.1 Completion Details for Monitor Wells

The final locations of the perimeter and vertical monitor wells will be submitted in the Wellfield Data Package (Production Area Pump Test). This is because the actual locations might need to be changed because of topography, access, etc. The screened intervals for the excursion monitor wells are across the entire production zone. The specific details on the monitor well completions are discussed in the next section. Procedures for well completion are described in Section 3.1.1.2.2 below. Standard operating procedures are available for review on site.

3.1.1.2 Completion Details for Injection and Recovery Wells

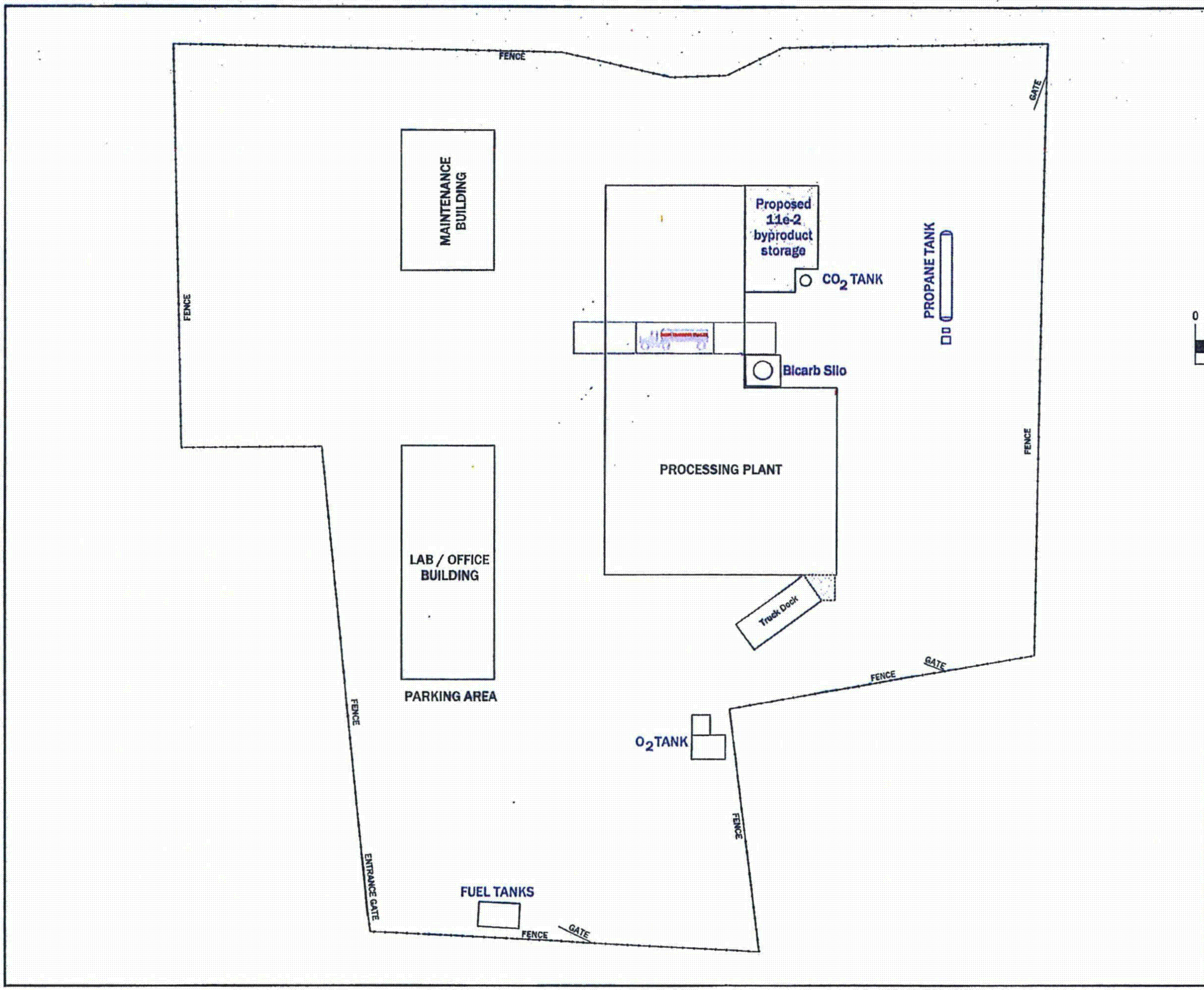
Pilot holes for monitor, production, and injection wells are drilled through the target completion interval with a small rotary drilling unit using local mud and a small amount of commercial drilling fluid additive for viscosity control. In some instances, pilot holes may be drilled into the underlying aquitard if a completion interval is at the bottom of the production sandstone to allow for maneuverability during logging and well completion of the production zone. The hole is logged, reamed, casing set, and cemented to isolate the completion interval from all other aquifers and prevent fluid migration. The cement will be placed by pumping it down the casing and forcing it out the bottom of the casing and back up the casing-drill hole annulus. The drill holes will be large enough in 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.

Typical well completion schematics for production wells (recovery and injection wells), and monitor wells are shown on Figures 3-1 (see map pocket) and 3-2 (see map pocket), respectively.

Casing centralizers, located at a minimum of every 40 ft along the casing, are normally placed around the casing to ensure it is centered in the drill hole.

3.1.1.2.2 General Well Completion Procedure

1. Typically, mud rotary drill rigs will be used for well completion. Drilling fluid such as the drill mud and loss circulation materials consist generally of bentonite gels and fiber material respectively. The drilling fluids will be mixed to a Marsh funnel viscosity of 32-40 seconds.
2. A pilot hole will be drilled into and through the ore zone to a specified depth. The outside diameter of the pilot hole is approximately 5 ¼ to 5 5/8 inches. The lithology of the pilot hole will be recorded.
3. When the pilot hole is finished, the hole is then geophysically logged using tools including natural gamma, SP, and single point resistance tools to determine lithology, grade, thickness and distribution of the ore. Deviation logs will be run to determine the location of the bottom of the hole. The procedure for geophysical logging is available on site for review.
4. After the pilot hole is logged, management will determine mineralized viability of the hole location. Non-viable pilot holes will be plugged and abandoned in accordance with WDEQ-LQD Chapter 11 Non-Coal Rules and Regulations.
5. Viable pilot holes will typically be reamed 8 5/8 inch diameter or to a sufficient annulus diameter to meet regulatory requirements.
6. Once the hole is reamed, it is then conditioned with water or drilling mud to depth, to remove obstructions, and prepare the hole for casing.
7. The casing and centralizers are then installed using the materials described above.
8. The casing will be sealed into place using materials such as neat cement slurry and/or sand-cement grout meeting DEQ Wyoming State requirements described in Section 6, Chapter 11 of the LQD Non Coal Rules and Regulations unless a variance is obtained from the LQD Administrator. The purpose of the cement is to stabilize and strengthen the casing and plug the annulus of the hole to prevent vertical migration of solutions. The cement slurry will be pumped down through the casing. Once in the casing the cement will be displaced via a wiper plug and displacement fluid (e.g. water) such that the cement is



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NICHOLS RANCH ISR PROJECT
FIGURE 3-1
NICHOLS RANCH UNIT
SITE FACILITY DIAGRAM

By: S.M.F.	Date: OCTOBER 17, 2007
Contour Interval: N/A	Revision Date: July 22, 2013
Scale: 1"=60'	Datum: NAD 27 UTM 13

3.3 WELLFIELD METHODS OF OPERATION

3.3.1 Injection Rates

Uranerz Energy Corporation estimates the U_3O_8 content for the Nichols Ranch Unit to be 2,521,000 pounds, **the U_3O_8 content for the Jane Dough Unit to be 2,735,000 pounds**, and the U_3O_8 content for the Hank Unit to be 2,482,000 pounds. The central processing plant at the Nichols Ranch Unit will have a nameplate capacity to produce 2,000,000 pounds per year of U_3O_8 (yellowcake). Initially, the Nichols Ranch Unit will have a designed flow rate of 3,500 gallons per minute (gpm) and an annual designed production of 500,000 pounds. **Jane Dough will have a similar flow rate and production to Nichols Ranch Unit of 3,500 gpm and 500,000 pounds respectively.** The satellite facility at the Hank Unit will have a designed flow rate of 2,500 gpm and an annual designed production of 300,000 pounds.

The Nichols Ranch Unit will have a designed recovery of approximately 3,500 gpm (5.04 million gallons per day) and injection of approximately 3,465 gpm (4.99 million gallons per day). **Jane Dough Unit only consists of production areas and therefore production and recovery will be dependent on the Nichols Ranch Unit CPP**. The Hank Unit will have designed recovery of about 2,500 gpm (3.60 million gallons per day) and injection of nearly 2,425 gpm (3.49 million gallons per day). Injection well and recovery well flow rates are monitored in order that injection and recovery can be balanced for each pattern and the entire wellfield. This information is also needed for assessing operational conditions and mineral royalties.

3.3.2 Injection Pressures

The injection pressures for the Class III wells for the Nichols Ranch, **Jane Dough**, and Hank Units will be calculated to assure the pressure in the production zones do not generate new fractures or spread existing fractures. Uranerz Energy Corporation will operate the Class III wells in a manner that the injection pressure will be lower than the calculated pressure that could fracture the confining zone, or cause the injection fluid to migrate to unauthorized zones. The injection pressure for the Nichols Ranch, **Jane Dough**, and Hank Units will be no greater than 60% (range – 38% to 60%) of the formation fracture pressure and will not exceed the pressure rating of the casing.

Search of published fracture gradient information resulted in selecting a conservative fracture gradient of 0.80 psi/foot of depth, for reservoir rock formations of 2,000 fee in depth or less. The following range for maximum injection pressures are: average depth for Nichols Ranch (600 ft X 0.80 psi/foot = 480 psi), **average depth for Jane Dough (500 ft X 0.80 psi/foot = 400 psi)** and average depth for Hank (375 ft X 0.80 psi/foot = 300 psi). The range of 480 psi to 300 psi is greater than the maximum injection pressure ratings for PVC casing that Uranerz intends to use. The maximum operating pressure rating for SDR 17 casing is 180 psi and for SDR 21 casing (if used would only be at Hank) is 130 psi. MIT testing will be conducted at the maximum operating pressure of the installed casing. The casing pressure rating therefore, will be the limiting factor and maximum injection pressure would be 180 psi if SDR 17 is in use and 130 psi if SDR 21 is in use. At Nichols Ranch 180 psi is 38% of the formation fracture pressure and for Hank is 60% of the formation fracture pressure.

will be used. The types of fittings that may be used in the wellfield plumbing include stainless steel, Victaulic type, and HDPE or equivalent. There will be no uncoated black iron or steel fittings used in contact with the lixiviant.

Trunk lines to and from the wellfield will be up to 14 inches in diameter HDPE. Feeder lines to and from the well head will be 1 to 2-inch HDPE or PVC pipe. The HDPE pipe will be butt fused with a machine designed for the task. PVC pipe, if used, will be glued. The entire wellfield pipe pressure system will be tested to the maximum rated pressure of the lowest rated pressure component. The trunk lines will be buried to a depth of at least 2.0 feet. Trenches for the pipe burial will have the top soil removed and stored separately. The subsoil will be placed next to the trench which will be excavated with a backhoe or trenching machine. Following a successful pressure test, the subsoil and topsoil will be replaced. During mining and restoration, the piping system will be under pressure conditions with no routine maintenance needed. Wellfield personnel will continuously monitor the wellfield area. If a **line break** should occur, the line will be isolated, exhumed, and repaired. If **a** line **breaks, and an unplanned release occurs, the spill will be treated as described in Section 3.19.** The well field flow lines are expected to last for the life of the wellfield (+5 years or more). The trunk lines being very sturdy will be used for another wellfield if possible, and should last 10 years or more. At the conclusion of restoration, the wellfield flow lines will be exhumed and properly disposed of or if in serviceable condition will be reused.

3.5.3 Proposed Time Schedule for Each Production Area

A Gantt chart showing Nichols Ranch, **Jane Dough**, and Hank Production Areas is presented in **Figure 3-11** (see map pocket). The chart shows the proposed plan for production, groundwater restoration, and decommissioning of each production area. However, the plan is subject to change because of extraction schedules, variations with production area recoveries, production plant issues, economic conditions, etc. The exact annual extraction schedules will be updated in the Annual Report to the WDEQ. The exact production area size and location may change based on the final delineation results of the ore zone and the actual production performance of the particular production area.

Construction for the **three** units is estimated at approximately one year, but could be completed in an accelerated construction schedule. The Nichols Ranch Unit should have a 6 month ramp up to the full annual production, and after the Nichols Ranch Unit ramp up, the Hank Unit will start a 6 month ramp up phase to the full annual production. It will take an estimated 3-4 years to extract the uranium from the Nichols Ranch Unit and an estimated 5-6 years to extract the uranium from the Hank Unit.

The wellfield production from the Jane Dough Unit is planned to start at the end of the Nichols Ranch production. Therefore only restoration at Nichols Ranch will be occurring while the production from Jane Dough PA #1 occurs. Wellfield production from Jane Dough PA #1 is planned for 3 years while production from PA #2 is planned for 1.25 years. Restoration at Nichols Ranch should be complete prior to any restoration at Jane Dough.

3.5.4 Capacity of Water Treatment for Mining and Restoration

The proposed plan incorporates adequate water balance calculations so that the deep disposal well can process the proposed production and restoration efforts at any given time. After each production area is completed, aquifer restoration will begin as soon as practical. If a completed production area is near a unit that is currently being mined, a portion of the first production area's restoration may be delayed to limit interference with the current extraction production area.

A water balance was completed for the production and restoration phases for the **three** units. The capacity of the deep disposal well is approximately 100 gpm. The water balance was discussed in section 3.3.7.

3.6 MECHANICAL INTEGRITY TESTING

After an injection, recovery **or monitor** well has been completed, and before it is made operational, a Mechanical Integrity Test (MIT) of the well casing is conducted. The procedure for the integrity test is as follows,

1. The bottom of the casing adjacent to or below the confining layer above the production zone is sealed with a plug, down hole packer, or other suitable device.
2. The top of the casing is then sealed in a similar manner or with a sealed cap, and a pressure gauge is installed to monitor the pressure inside the casing.
3. The pressure in the sealed casing is then increased to 125% of the maximum operating wellhead casing pressure or to an amount less than the formation fracture pressure (whichever is less).
4. The well pressure is then monitored for a period of ten (10) minutes. A well is considered satisfactory with a pressure drop of no more than 10% in the 10 minute timeframe.

If there are obvious leaks, or the pressure drops by more than 10% during the 10 minute period, the seals and fittings will be reset and/or checked and another test is conducted. If the pressure drops less than or equal to 10% the well casing is considered to have demonstrated acceptable mechanical integrity. A Standard Operating Procedure for Mechanical Integrity Testing is available on site for review.

The results of the MITs conducted during a quarter are documented on a quarterly basis to include the well designation, date of the test, method by which the MIT was completed, verification of whether the MIT was or was not established, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MITs are maintained on site and are available for inspection by NRC and WDEQ personnel. In accordance with regulatory requirements the results of MITs are reported to the WDEQ on a quarterly basis for those wells that were tested. In accordance with WDEQ and EPA requirements, MITs are repeated once every five (5) years for all wells used for injection of lixiviant, or injection of fluids for restoration operations. **MITs on production area monitor wells are also repeated every 5 years as required by NRC license.**

If a well casing does not meet the MIT criteria, the well will be placed out of service and the casing may be repaired and the well retested or abandoned. If a Class III injection well fails an MIT, and is converted to a recovery well, Uranerz commits to continuously pumping the

LIST OF FIGURES (Continued)

LIST OF TABLES

The yellowcake production circuit starts when the eluate is treated with acid to destroy the carbonate portion of the dissolved uranium complex. In addition to adding the acid slowly, a common defoamer may be used to reduce the foaming activity. The precipitation reagents, hydrogen peroxide and sodium hydroxide, or ammonia are added to the eluate to precipitate uranium yellowcake. The yellowcake slurry is then filtered, washed, dried, and drummed.

A bleed from the elution and the yellowcake precipitation circuits is used to control the concentration of undesirable ions such as sulfates. The chemical strength is refortified during each cycle.

The Nichols Ranch Unit and Hank Unit wellfields will have header houses that contain manifolds with valves, piping, and instrumentation for injection and recovery wells. Each header house will contain up to **110** well accommodations, **but may contain more or less**. The design of a typical header house is shown in Figure 3-12A Header House Details (see map pocket), and the details of the piping and instrumentation for the header house is shown in Figure 3-12B Header House Piping and Instrumentation (see map pocket).

The header house will be a metal building. **The dimensions for the header houses will be approximately 40 feet by 20 feet, but may be more or less. The terrain and logistics in the wellfield will determine which engineered foundation (e.g. curbed pad, pillar, or basement) the header house will be built on.** The foundations will be constructed of durable materials that meet engineering requirements, or other materials as approved by the Administrator **with sealed penetrations (as needed) to provide containment.** The foundations will have grating which will allow access to the sub floor containing valves and hose runs. The floor will **curb and/or** slope to a sump with an automatic level control pump. The sump will pipe to the recovery **system** and will include check valves. **In header houses with basements, the basement will contain the hose runs and injection and recovery lines. The header house may be designed to contain the electrical equipment in the same room with the piping or the electrical room may be attached to the main header house building and placed on concrete pillars that are buried underground for structural support.**

Individual well flow readings will be recorded on a shift basis, and over all wellfield flowrates will be balanced at least once per day. Alternately, flow and totalizer data will be transferred to the main plant and checked automatically.

3.10.2 Nichols Ranch Unit

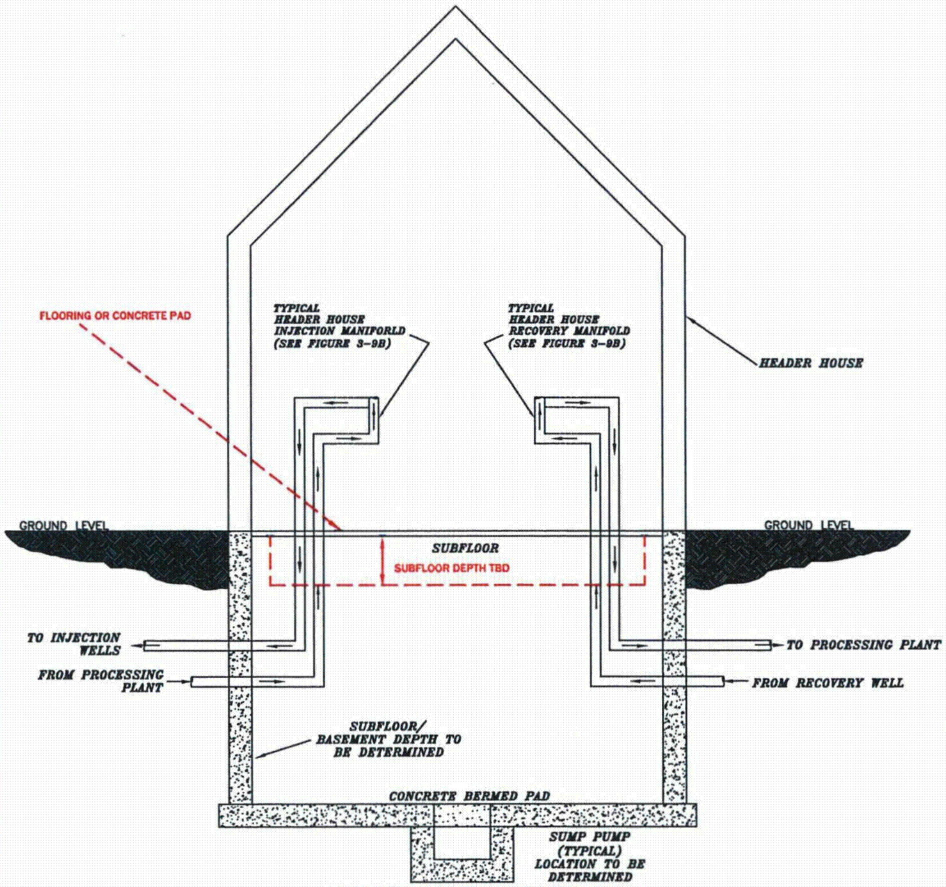
At the Nichols Ranch Unit processing facility, most of the process equipment will be housed in an approximate 150 x 250 ft metal building with eave heights less than 50 ft. The major process equipment is shown in Figure 3-13 (see map pocket) with some of the bulk chemical storage tanks will be located outside of the process building on cement pads with protective berms. A detailed diagram of the Nichols Ranch Unit is shown in Figure 3-13A (see map pocket). The major equipment inside the process building will be the ion exchange circuit, the lixiviant make-up circuit, the elution/ precipitation circuit, and the yellowcake drying facility. During restoration, the water treatment system for aquifer restoration will also be located in the process building.

The yellowcake drying and drumming facilities will be located at one end of the process building. Due to the height of the dust abatement equipment, the building's eave height is approximately 40 ft at this end. A yellowcake storage area will be located adjacent to the yellowcake drying and packaging area. This will be an enclosed, heated area approximately 60 x 60 ft. By storing the drummed yellowcake within an enclosed area, employee safety will be improved (no snow or ice to work around) and the packaged product will be secured under locked conditions. The floors on the processing, drying, and yellow cake drumming facilities will be eight inch concrete reinforced with rebar. Areas with higher stress because of tank weights, etc., will be designed to handle the additional stress. These plant areas will have sloped flooring with sumps, and the sumps will be pumped to the waste tanks. Routine cleaning and plant generated spills will also drain to the sumps. The waste storage tank contents will be pumped down the deep disposal well. The final floor and building designs will be shown in the final design for construction diagrams.

An office building, now planned to be approximately 150 x 60 ft, will be located adjacent to the process building. The office will have standard eight foot ceilings plus eaves and four inch concrete floors. The office will be very near to the process building to allow use of a centralized lunchroom and restroom facilities. A central security monitoring room, computer server room and the on-site laboratory will be located in the office building.

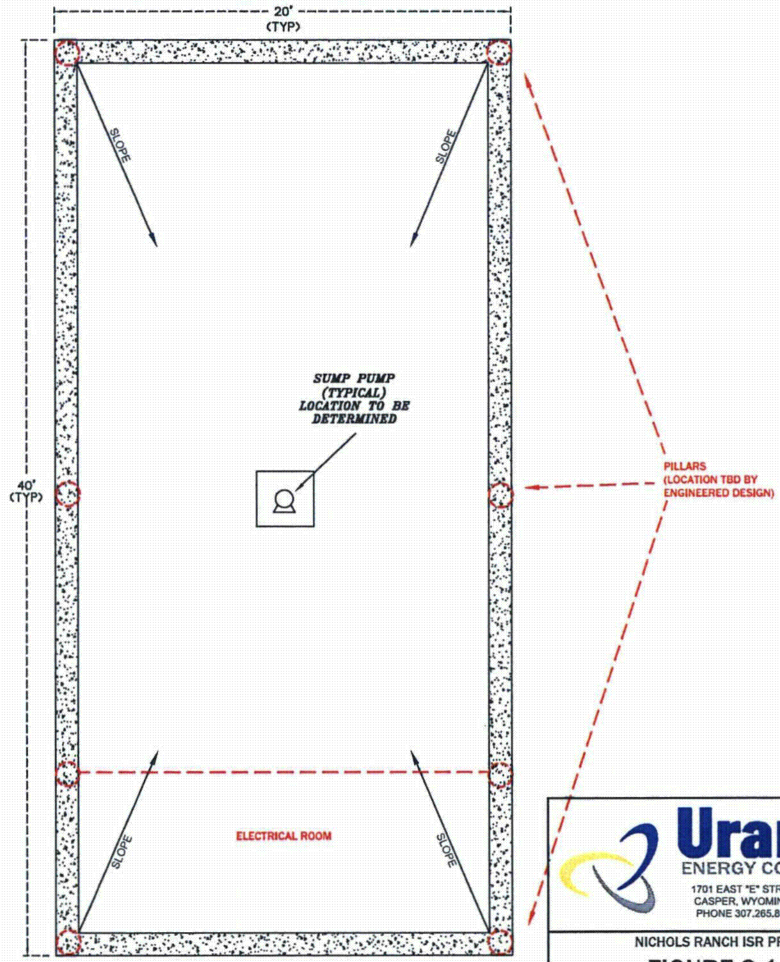
A second auxiliary building (maintenance building) will house the vehicle, electrical and rotating equipment maintenance area, as well as provide an area for additional office spaces for field and operating personnel. The first aid area may be located in the maintenance building. This auxillary building will have fifteen to twenty foot ceilings plus eaves and six inch concrete floors.

Section view



*Text in red designates when the basement option is not used

Plan view



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NICHOLS RANCH ISR PROJECT

FIGURE 3-12A
HEADER HOUSE DETAILS (TYPICAL)

By: ADAM EVENSON	Date: 2/22/2008
Datum: N/A	Revision Date: 04/9/2015
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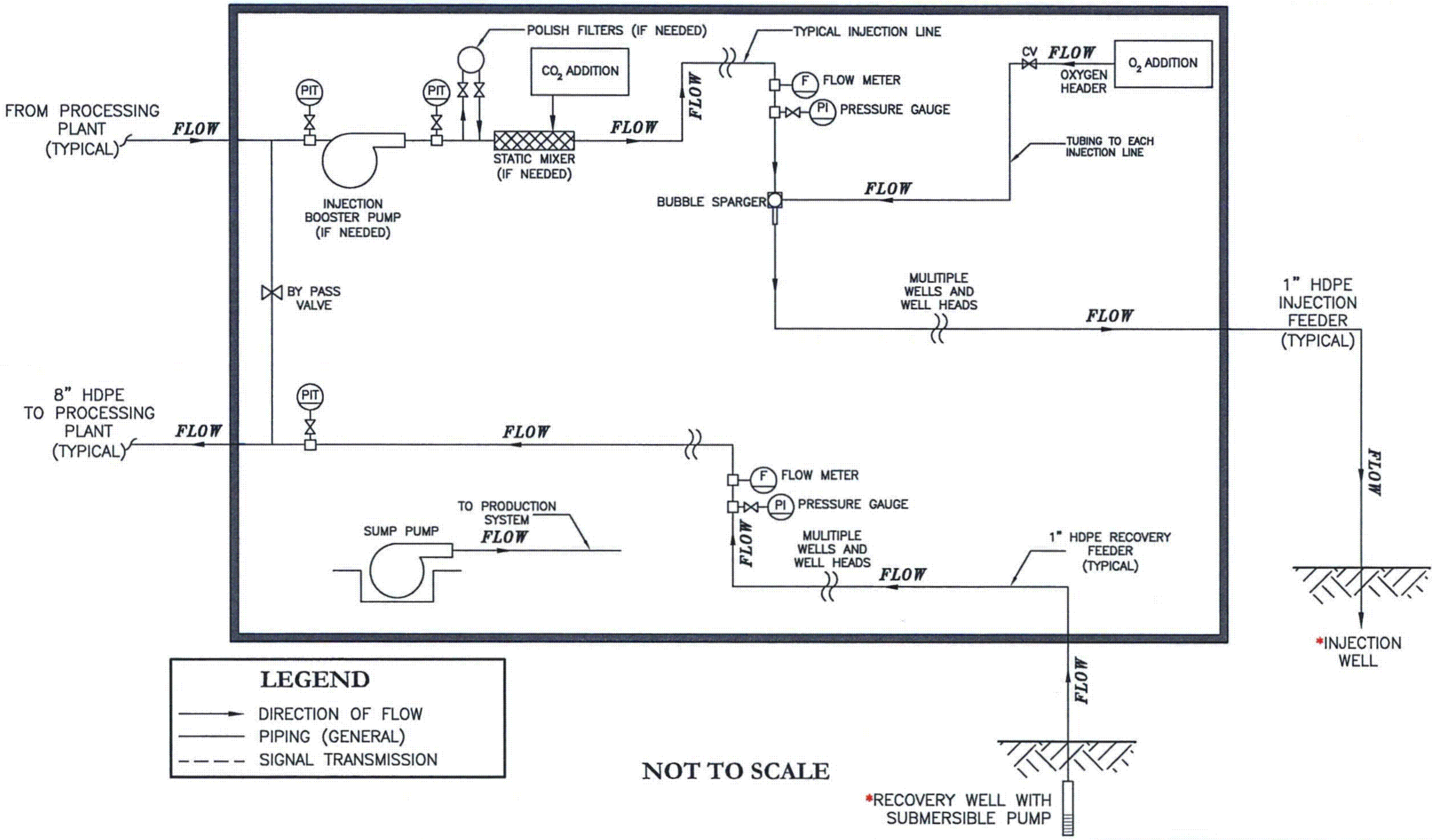

*NOTE: MAY CONTAIN UP TO 110 WELL ACCOMMODATIONS, APROXIMATELY 70 INJECTION AND 40 RECOVERY, OR A VARIATION THEREOF

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NICHOLS RANCH ISR PROJECT

FIGURE 3-12B
HEADER HOUSE PIPING AND INSTRUMENTATION (TYPICAL)

By: DALTON TIMM	Date: 2/22/2008
Datum: N/A	Revision Date: 04/14/2015
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ditch has been backfilled. Trenching equipment may be used for trenching a nominally 6-inch, and no more than 12-inch, wide trench line. Topsoil will not be salvaged unless specifically required or requested in the surface owner agreement. Following installation, the trench is backfilled with the excavated material. These methods of topsoil salvaging have proven to be adequate as demonstrated by the successful revegetation and reclamation at prior and existing ISR operations. **Please refer to Section 3.5 of the Reclamation Plan for erosion control practices.**

The Nichols Ranch ISR Project will not result in any subsidence to the project area or surrounding areas. The proposed in situ recovery process does not remove any physical structures underground that would cause a void to occur and subside. The in situ process removes only the uranium mineral that is present on the surface of the host sandstone formation. The physical structure of the host sandstone is unaffected. Because the host sandstone formation is not affected subsidence will not result from the in situ process; therefore, no subsidence mitigation or control plans have been developed or included in this application.

3.13.2.2.2 Contaminated Solid Waste

Contaminated solid waste consists of solid waste contaminated with radioactive material that cannot be decontaminated. This waste will be classified as 11.e (2) byproduct material. This byproduct material will consist of filters, personal protective equipment, spent resin, piping, etc. These materials will be temporarily stored on site and periodically transported for disposal. **Figure 1-5 depicts the general location of the disposal area.** Uranerz will establish an agreement for disposal of this waste as 11.e (2) byproduct material in a licensed waste disposal site or licensed mill tailings facility.

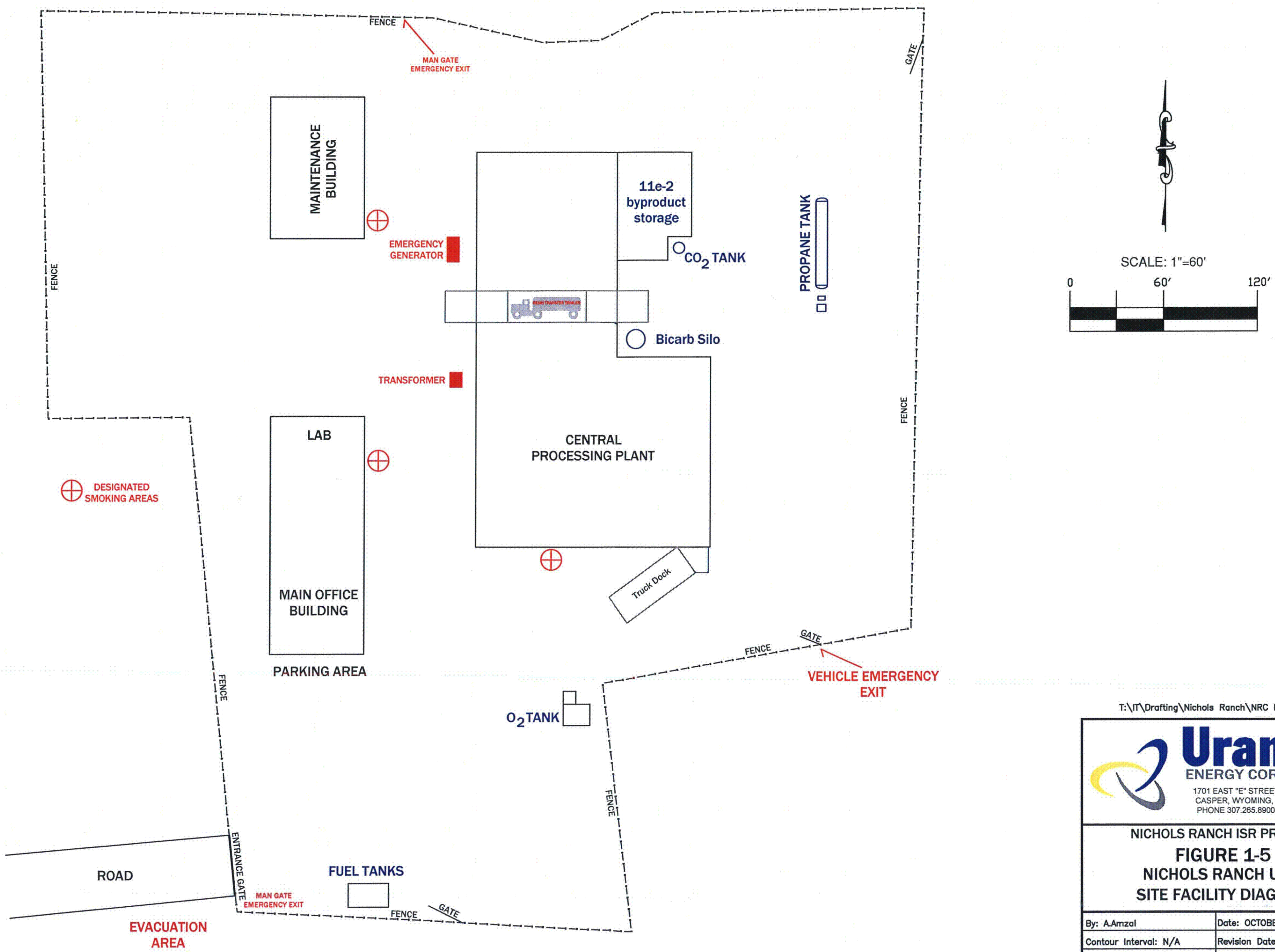
It is estimated that the site will produce approximately 60 to 90 cubic yards of 11.e (2) byproduct material as waste per year. This estimate is based on the waste generation rates of similar ISR uranium recovery facilities.

3.13.3 Contaminated Equipment

Surface contamination surveys will be conducted of potentially contaminated equipment and materials before they are released to unrestricted areas. The applicable surface contamination limits are provided by USNRC, *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material*, Division of Fuel Cycle and Material Safety, April 1993. A comprehensive radiation survey will be made in conformance with these guidelines which establishes that contamination is within the limits specified within the referenced guidelines and is as low as is reasonably achievable before release of the equipment or material for unrestricted use.

If contamination above these limits is detected, the equipment or material will be decontaminated until the limits are satisfied, or the item will not be released to unrestricted use.

Radioactivity on surfaces will not be covered by paint, plating, or other covering unless contamination levels, as determined by a survey and documented, are below the aforementioned



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NICHOLS RANCH ISR PROJECT

FIGURE 1-5
NICHOLS RANCH UNIT
SITE FACILITY DIAGRAM

By: A.Amzal	Date: OCTOBER 17, 2007
Contour Interval: N/A	Revision Date: 4-29-2015
Scale: 1"=60'	Datum: NAD 27 UTM 13

DWG #: FIGURE 1-5

limits before application of the covering. A reasonable effort will be made to minimize the contamination before use of any covering.

The radioactivity of the interior surfaces of pipes, drain lines, or duct work will be determined by making measurements at all traps and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or duct work.

3.13.4 System Failures

In the event that a spill occurs in the wellfield or process plants, measures will be taken to safely and quickly contain the spill and mitigate the impacts of any released material. Proper notification of plant and corporate management will be made along with properly contacting the NRC and State.

Spills are likely to occur from leaking pipelines and fittings. If a pipeline leak or spill occurs in the plants, the spill or leak will be contained within the building with all spilled material collected in the plant sump. This material will either be pumped back into the process or sent to the deep disposal well.

Wellfield spills will be contained as soon as possible. **In the event of a wellfield fluid spill, the spill area will be surveyed. Spills that occur at Nichols Ranch ISR Project will be evaluated to determine the prudence of reclamation at the time of the spill or at decommissioning. Spills will be assessed to the radium benchmark dose using the unity rule at the time of decommissioning per NRC requirements. Spills that result in a total effective dose greater than 100 mrem per year analyzed through sampling and RESRAD modeling software will be cleaned up prior to decommissioning. Spill reporting is done in accordance with WDEQ-LQD Chapter 11 Non-Coal Rules and Regulations as described in Section 3.19.**

If any process vessels or tanks that contain or have contained radioactive materials have to be entered for any reason such as cleaning, inspection, or repairs, a radiation work permit (RWP) will be issued detailing the requirements for special air sampling, protective equipment, and increased exposure surveillance.

To notify operating personnel of potential issues with process and wellfield operations, instrumentation such as flow meters and pressure indicators will be used. If any process

Chief Executive Officer

The Chief Executive Officer (CEO) has the overall responsibility and authority for the radiation safety and environmental compliance programs. The CEO is responsible for ensuring that operations are compliant with applicable regulations and permit/license conditions. The CEO is also responsible for maintenance of the license. The CEO provides for direct supervision of the Chief Operating Officer.

Chief Operating Officer

The Chief Operating Officer (COO) reports to the CEO and is directly responsible for **all production activity at the site. In addition to production activities, the COO is also directly responsible for** ensuring that operations personnel comply with **and implement industrial and** radiation safety, and environmental protection programs. The COO is also responsible for compliance with all federal and state regulations, license conditions, and reporting requirements. The COO has the responsibility and authority to terminate immediately any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations. The COO directly supervises the **Mine Manager and** other Vice Presidents.

Mine Manager

The Mine Manager reports directly to the **COO**. All site operations, maintenance, construction, environmental health and safety, and support groups report to the Mine Manager. The Mine Manager is authorized to implement immediately any action to correct or prevent hazards. The Mine Manager has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations.

Line Management

Line management reports directly to the Mine Manager. Line management is responsible for management oversight and direct supervision of activities including construction, operations, maintenance, and support for the respective functional area. Line management is responsible for line implementation of industrial and radiation safety, and environmental protection program requirements associated with the respective functional area. Line management is responsible for line conduct and enforcing compliance with management controls (e.g. operating procedures, radiation work permits, and ALARA requirements within the respective functional area). Line management has the authority to stop any activity, immediately if necessary, that is determined to be a threat to employee or public health, the environment, or a potential violation of state or federal regulations. Line management oversees all wellfield, production, and lab personnel.

Vice President Regulatory and Public Affairs

The Vice President Regulatory and Public Affairs reports directly to the **COO.** The Vice President Regulatory and Public Affairs is responsible to oversee the preparation and submittal of permit and license applications to pertinent regulatory agencies. This position supports the Manager Environment, Safety, and Health (ESH) as a resource and ensures permit conditions, agency responses, and regulatory notifications are met. The Vice President Regulatory and Public Affairs also has the responsibility to advise senior management on matters involving radiation safety and to implement changes and/or corrective actions involving radiation safety authorized by senior management. The Vice President Regulatory and Public Affairs is tasked

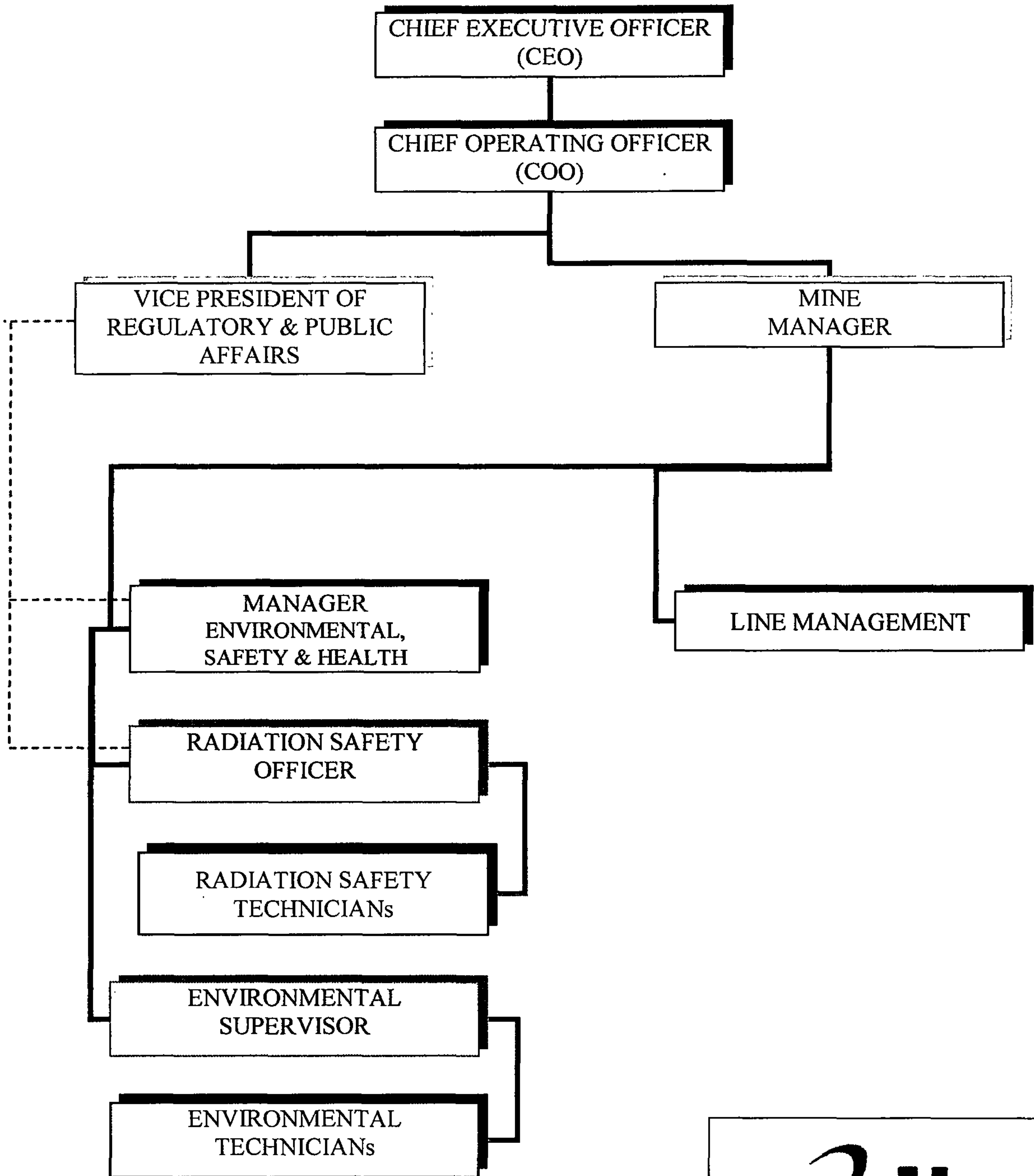
to ensure that the environmental and radiation safety programs are conducted in a manner consistent with regulatory requirements. The Vice President Regulatory **and Public** Affairs has no production-related responsibilities.

Manager Environment, Safety, and Health

The Manager Environment, Safety, and Health (ESH) reports directly to the Mine Manager and indirectly to the Vice President Regulatory and Public Affairs. This position has the responsibility and authority for, environmental, occupational safety and radiation safety programs, ensuring compliance with all applicable regulatory requirements. This position assists in the development and review of radiological and environmental sampling and analysis procedures and is responsible for routine auditing of the programs. The Manager ESH has no production related responsibilities. As such, the Manager ESH has the responsibility and authority to suspend, postpone, or modify any activity that is determined to be a threat to employees, public health, the environment or potentially a violation of state or federal regulations. Additionally, this position could fulfill the duties of the RSO on an interim basis. If required to fulfill RSO duties, the position will meet the requirements of the NRC Regulatory Guide 8.31 for the RSO.

Radiation Safety Officer

The Radiation Safety Officer (RSO) reports directly to the Manager Environment, Safety, and Health. The RSO is responsible for conducting the radiation safety program and for providing assistance in ensuring compliance with NRC regulations and license conditions applicable to worker health protection. The RSO is responsible for overseeing the day-to-day operation of the radiation safety program and for ensuring that records required by NRC are maintained. The RSO has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations, including the ALARA program. The RSO has no production-related responsibilities. As such, the RSO has an indirect line to the Vice President Regulatory **and Public** Affairs. The RSO supervises the Radiation Safety Technician(s).



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NICHOLS RANCH ISR PROJECT

FIGURE 3-18

URANERZ ORGANIZATION

BY:Dalton Timm	DATE: OCTOBER 29, 2007
CONTOUR INTERVAL:N/A	REV. DATE: March 4, 2015,
SCALE:N/A	REV. #: 3
FILE LOCATION:t:\it\drafting\nichols ranch\permitting-licensing\figure 3-18 REV-2 doc	

duplicate to assess any analytical error. If two of the three UCL's are exceeded, an excursion is then verified. If the second sample does not exceed the UCL's, then a third sample will be taken in 48 hours. **All re-samples need to be completed within 30 days or the excursion is confirmed**. During an excursion event, all monitoring wells that are placed on excursion status will be sampled at least every seven days for the UCL parameters.

If an excursion is verified by the second or third sample, **steps for notification and reporting will be followed in accordance with WDEQ-LQD Chapter 11 and the NRC license.** The WDEQ-LQD and NRC Project Manager will be notified by telephone or email within 24 hours. The WDEQ-LQD and NRC Project Manager will also be notified in writing within **five** days of a verified excursion. Corrective actions such as changes in the injection and recovery flow rates in the affected area will be implemented as soon as practical. The corrective actions will continue until the excursion is mitigated. A written report describing the excursion event, corrective actions, and the corrective action results must also be submitted to the NRC Project Manager within 60 days of the excursion confirmation.

An excursion is controlled when it can be demonstrated that recovery fluid in unauthorized areas (i.e. monitoring well) is declining. In the event that the concentration of the UCL parameters that were detected in the monitor well(s) do not begin to decline within 60 days after the verification of an excursion, all injection into the ore zone (production zone) adjacent to the excursion will be suspended to further increase the amount of net water withdrawal from the excursion area. Injection will be suspended until such time that a declining trend in the UCL parameters concentration is established. **If the excursion is controlled, but the fluid has not been recovered, Uranerz will submit, within 90 days of the excursion, a plan and compliance schedule.** When a significant declining trend is established, normal operations will resume with injection and/or production rates monitored such that net water withdrawals for the excursion area will continue. The declining trend will be maintained; until such time, that the concentrations of excursion parameters in the affected monitor well(s) have returned to concentrations less than the established UCL's. **Monthly reports will be submitted to the WDEQ until the excursion is over.**

3.15 WILDLIFE MITIGATION AND MONITORING

A wildlife survey/study was conducted for the Nichols Ranch ISR Project **(including the Nichols Ranch, the Jane Dough, and the Hank Units).** The wildlife study area includes the

Nichols Ranch ISR Project area and a 2-mile buffer. The entire wildlife survey area (project area plus the 2-mi survey area) encompasses approximately **79.4 mi^2 (50,827 acres).**

3.15.1 Threatened, Endangered, Proposed, and Candidate Species and Special Status Species

As discussed in Appendix JD-D9, only one threatened, endangered, proposed, or candidate plant or animal species, the greater sage-grouse (*Centrocercus urophasianus*), a candidate species, was documented as occurring in the Jane Dough Unit.

To mitigate potential impacts to greater sage-grouse, Uranerz will undertake the following mitigation measures and monitoring:

1. **Uranerz would not conduct any ground disturbing activities within 0.25 miles of any occupied greater sage-grouse lek.**
2. **Uranerz will annually monitor attendance at all leks during the lekking season (April 1 through May 7).**
3. **Uranerz will not conduct any surface-disturbing activities (e.g., topsoil removal) within 2 miles of any occupied lek from March 15 through June 30.**
4. **If an area is physically disturbed (i.e., stripped of topsoil) prior to March 15, Uranerz will be able to continue all non-surface disturbing activities (e.g., construction, drilling, well completion, pipeline installation, etc.) within 2 miles of any occupied lek between March 15 and June 30.**
5. **During the seasonal buffer period, Uranerz will limit non-surface disturbing activities to daylight hours and will minimize noise to the extent possible.**
6. **Once uranium extraction facilities have been installed, Uranerz will be able to conduct year-round routine and emergency maintenance and service on all facilities within the Jane Dough Unit.**
7. **To reduce raptor predation on greater sage-grouse, the construction of overhead power lines, permanent high-profiled structures such as storage tanks, and other perch sites would not be constructed within 0.25 mi of any active lek.**
8. **Some greater sage-grouse could be lost due to vehicle collisions. Therefore, Uranerz will advise project personnel of appropriate speed limits for specific access roads, that they are not allowed to haze or harass the animals, and that they should minimize any direct disturbance to all wildlife whenever possible.**

These mitigation measures were submitted to and concurred to by the Wyoming Game and Fish Department (refer to Addendum JD-D9-A).

3.15.2.7 Raptors

One hundred and forty one raptor nests occur within the Nichols Ranch, **Jane Dough** and Hank Units **and a 0.5 mi buffer. In 2013, only three of the nests were active and they included one prairie falcon and two golden eagle nests.** Based on the proposed permit boundaries, those trees with nests will not be removed during project activities. The principal impact to these nests from project activities and associated increased human access is potential disturbance during nesting, which could result in nest abandonment and decreased reproduction success. **Uranerz will comply with seasonal disturbance restrictions and requirements by the USFWS (refer to letter included in Addendum JD-D9-A).** Potential conflicts between active nest sites and project-related activities will be mitigated by annual raptor monitoring and mitigation plans such avoiding areas, when possible, where raptor nest sites are located, and limiting the constructing of overhead power lines so that raptors will not come in contact with them or use them as perches for viewing prey such as sage grouse.

Well abandonment reports will be made to the LQD and the State Engineer's office within sixty days after the abandonment of any well which has artesian or gassy flow at the surface. The report, set forth in affidavit form, will contain the location of the hole to the nearest two hundred feet, the depth of the well, estimated rate of flow, and the facts of the plugging technique. A report will also be submitted within twelve months after the abandonment of any well. The report will include the location of the well to the nearest 40-acre legal subdivision (quarter quarter section) utilizing Wyoming state plane coordinates, the depth of the well, and the facts of the plugging technique.

An overview of excursion occurrences if any and control actions taken will be included in each annual report. The specifics of the excursion control and reporting **is discussed in Section 3.14.7.8.10.3. Excursions. Spills and noncompliance** are discussed in Section 3.19.

Uranerz will report well stimulation activities, as described in in Section 3.3.3, for Class III wells in the Annual Report.

On an annual basis, Uranerz will review and update as needed the table, Typical Lixiviant Solution Composition. The table is located in this Mine Plan in Section 3.3.4, Type of Recovery Fluid Used.

Annual raptor and sage grouse surveys will also be conducted and reported to the WDEQ. The sage-grouse survey will take place in April or May when sage-grouse can be observed on leks.

The raptor surveys will also take place in April or May to observe known nests and to identify any new nests.

3.19 SPILLS AND NONCOMPLIANCE

The proper handling of spills and **noncompliance (e.g. excursions) occurrences** is extremely important to Uranerz. Uranerz commits to the proper reporting of spills and **noncompliance occurrences as required in WDEQ-LQD Chapter 11 regulations and the NRC license.**

3.19.1 Non-Compliance Reporting

Uranerz Energy Corporation will verbally report to the WDEQ within 24 hours of becoming aware of noncompliance occurrences which may endanger public health or the environment

ADDENDUM MPI:

JANE DOUGH SITE NUMERICAL GROUND-WATER MODELING

April 2015

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List of Figures

Acronyms and Abbreviations

gpd	gallons per day
gpm	gallons per minute
ID	inner (inside) diameter
ISR	In-Situ Recovery
WDEQ	Wyoming Department of Environmental Quality
WY	Wyoming

MPI.1 JANE DOUGH SITE NUMERICAL GROUND-WATER MODELING

The primary modeling approach used a version of the MODFLOW model to evaluate ground-water flow and drawdown resulting from the planned mining operations. The MODFLOW model was developed by the USGS in 1988 and has been updated and revised several times. MODFLOW-96 (Harbaugh and McDonald, 1996) was used for modeling of the ground-water system at the Jane Dough Project. The names MODFLOW and MODFLOW-96 are used interchangeably in the remainder of the addendum.

MPI.1.1 Jane Dough Project Modeling

MODFLOW-96 was used to model the ground-water flow prior to, during and after operation of the production area(s). A model grid was developed to cover the proposed mine area with a relatively fine grid (50 foot by 50 foot cells) and extending the modeled area with increased cell size to encompass approximately 5,050 square miles. The fine model grid was expanded from that described in Addendum G for the Nichols Ranch area to encompass the Jane Dough mine area. The model injection and production wells were included as well stresses within the fine grid area.

MPI.1.1.1 Model Configuration

The five layer model utilized a confined aquifer type for all five layers, with a series of general head boundaries on the perimeter of the model grid. The initial potentiometric head in each of the five layers was approximated as a uniform gradient across the model grid areas. This surface was developed using the typical gradient of 0.0033 feet/feet. The general gradient is from southeast to northwest. This initial potentiometric surface was the same as that used for the Nichols Ranch area modeling. Because the aquifer is confined, no structural information is necessary to define the ground-water system.

On the periphery of the model grid, selected cells were designated as general head boundary cells to stabilize the potentiometric surface. The head in each of the 107 designated general head boundary cells for each layer was set at the initial model head and the cell conductance was set at a relatively high level to provide a generally stable regional potentiometric surface.

MPI.1.1.1.1 Model Grid

The model grid consists of 439 rows x 244 columns and is rotated approximately 35 degrees counterclockwise from the orthogonal directions. The smallest cell dimension is 50 feet by 50 feet, and the largest cell dimension is 73,895 feet by 73,895 feet as shown in Figure MPI.1-1.

The model grid extends beyond the limits of the Wasatch aquifer on the west and southeast sides of the grid and some of the model cells are inactive. Figure MPI.1-2 presents the cells that are inactive, and also shows the initial potentiometric surface used in the modeling.

MPI.1.1.1.2 Aquifer Properties

The primary aquifer properties information used in the model included transmissivity, storage coefficient, and vertical conductance. The transmissivity and storage coefficient were distinct

for each of the five layers primarily as a function of the typical layer thickness. Three distinct ore zones are identified in layers three, four, and five. These ore-bearing intervals are hereafter described as upper, middle, and lower ore zones. The transmissivity of layers one, two, and four was set at 10.0 ft^2/day (75 gal/day/ft). The transmissivity of layers three and five was set at 8.4 ft^2/day (63 gal/day/ft). The storage coefficient for layer one was set at 6E-05 and the storage coefficient for layer two was set at 5E-05. The storage coefficient of layers three and five was set at 2E-05 and the storage coefficient of layer four was set at 3E-05. These values of storage coefficient were adjusted from the composite storage coefficient for the A sand to reflect the individual sand thicknesses. Layer one represents the lower interval of the B sand and layer two generally represents the upper interval of the A sand above the ore zones.

The vertical conductance between layers is specified by the term VCONT which is the vertical hydraulic conductivity divided by the thickness between the layers and has units of day^{-1}. Because vertical continuity is profoundly reduced by even a thin layer of low permeability material, the effective values of VCONT primarily reflect the presence of shale and siltstone layers within the sequence of ore bearing sands and sandstones. There is a significant thickness of siltstone or mudstone between the A and B sands over the majority of the mining area. However, the mudstone is not present in the Jane Dough Production Area #2, and the vertical conductance between the A and B sands is expected to be significantly greater where this mudstone is absent. VCONT was set at 5E-08 day^{-1} for the interface between layers one and two and the interface between layers two and three where the mudstone is present. Where the mudstone is missing, VCONT was increased by two orders of magnitude to 5E-06 day^{-1} for the interface between layers one and two and the interface between layers two and three. VCONT was set at 1E-06 day^{-1} for the remaining layer interfaces.

MPI.1.1.1.3 Model Setup and Stabilization

The model setup and evaluation of model stability included reviewing changes in the potentiometric surface within the modeled area over the model runs. As discussed previously, the initial potentiometric surface was a uniform gradient across the entire model area as shown in Figure MPI-2 with the same head in each of the five layers. The specified head and conductance in each general head boundary cell on the periphery of the model grid was adjusted until a relatively stable potentiometric surface was maintained over the model grid. As the five modeled layers represent the confined A and B sands the potentiometric surfaces are controlled primarily by horizontal ground-water flow through the project area; and the model was configured to give a simple representation of this ground-water system. A very small recharge rate was included in the model, but it had no significant impact on potentiometric surfaces. The model grid was also extended a large distance beyond the project area to avoid model boundary effects on the prediction of drawdown in the production area.

MPI.1.1.1.4 Production Area Configuration

The proposed mining sequence includes two distinct production areas with an anticipated mining period of three years for Production Area #1 and a mining period of fifteen months for Production Area #2. The modeled period also included the operation of two production areas in the Nichols Ranch area for a total of three years prior to mining at Jane Dough. The results of the modeling for the Nichols Ranch production areas are presented in Addendum 3B. Each production area consists of a combination of staggered recovery and injection wells arranged

generally in a line drive layout for the sinuous ore body. There are areas in the ore bodies where the wells are arranged in a general 5-spot pattern. Number of wells and well locations is preliminary and may be adjusted with further delineation of the ore bodies. The well locations for the modeling are also adjusted to correspond with the center of the model cell, and the actual location may differ from the model location by up to 35 feet. Several model runs were conducted to evaluate general production area operation, and excursion control and retrieval. For the purposes of presentation, both production areas are shown with a bounding line for the upper, middle, and lower ore zones in Figures MPI.1-3, MPI.1-4, and MPI.1-5, respectively. The middle ore zone represents the largest ore body within the project area for both Production Area #1 and Production Area #2.

MPI.1.1.1.5 Operational Parameters

The anticipated recovery rate from the Production Area #1 wells is approximately 10.4 gpm. A total of 337 recovery wells were included in the full Production Area #1 operation with all wells in the middle ore zone. Total recovery rate was 3,499 gpm. Injection well operational rates ranged from 1.4 to 8.7 gpm with a total of 591 injection wells. Excess recovery or wellfield bleed rate was set at 1% of total production with a resulting injection rate of 3,465 gpm.

The anticipated recovery rate from the Production Area #2 wells is 18 gpm. A total of 195 recovery wells were included in the full Production Area #2 operation with 20 wells in the upper ore zone, 131 wells in the middle ore zone, and 44 wells in the lower ore zone. Total recovery rate was 3,500 gpm. Injection well operational rates ranged from 3.2 to 17.1 gpm with a total of 356 injection wells, with 40 wells in the upper ore zone, 235 wells in the middle ore zone, and 81 wells in the lower ore zone. Excess recovery or wellfield bleed rate was set at 1% of total recovery with a resulting injection rate of 3,464 gpm.

MPI.1.1.1.6 Stress Periods

Numerous stress periods were included to allow comparison of predicted aquifer response to the production area operations at several times during the simulation period. A transient simulation also requires very small computational time steps after each significant change in aquifer stresses including startup or shutdown of well operation. This is necessary to prevent a failure to converge in the model computation. The initial stress period was set at a very small value (0.0001 day with 5 time steps) to produce a model output result that essentially reflects initial head conditions. The stress period lengths were then gradually increased until there was a significant change in model stresses, at which point the sequence reverted to a short stress period followed by gradually increasing stress period lengths. A total of 20 stress periods were used in a total simulation period of 10.25 years which included 1.5 years of operation of each production area in the Nichols Ranch area, three years of operation of Jane Dough Production Area #1, 1.25 years of operation of Jane Dough Production Area #2, and a three year period of post-mining recovery. The Nichols Ranch production areas are included in the model sequence to provide a more complete sequence of stresses from mine operation, but the results are described in Addendum 3B and are not repeated in this addendum.

MPI.1.1.2 Model Results

The MODFLOW model produces output in terms of predicted drawdown or predicted head at selected times within the simulation. The drawdown or water-level rise is calculated as the difference between head at a selected time and the initial head for the aquifer at the start of the simulation. Both results are useful in the interpretation of aquifer response to the mining and are used to evaluate the modeling predictions.

MPI.1.1.2.1 Production Area #1

The configuration for Production Area #1 includes wells in the middle ore zone as shown in Figure MPI.1-4. The modeled potentiometric surface for all layers prior to the start of mining is presented Figure MPI.1-2. The mining operation of the recovery and injection wells is expected to continue for 36 months, after which mining of Production Area #2 begins. Figure MPI.1-6 presents the predicted drawdown contours for layer four of Production Area #1 after one year of operation. Figure MPI.1-7 presents the predicted water-level elevation contours for layer four of Production Area #1 after one year of operation. The operation of the production area at a wellfield bleed rate of 1% of the planned 3,500 gpm recovery rate has resulted in development of a significant cone of depression around the operating production area. There is also significant residual drawdown in the Nichols Ranch mining area. The area of gradient reversal in layer four extends approximately 3,000 feet to the northwest of the southwestern portion of the Production Area #1 ore body.

MPI.1.1.2.2 Production Area #2

Production Area #2 consists of injection and recovery wells in the upper, middle, and lower ore zones as shown in Figures MPI.1-3, MPI.1-4, and MPI.1-5. Because the generally sinuous ore bodies are in the same area, there may be up to three wells completed in a single planar cell. The operation of Production Area #2 will begin after mining is completed in Production Area #1. In Production Area #2, the expected middle zone recovery constitutes 2,351 gpm of the total three layer production area recovery rate of 3,500 gpm. Because the majority of the production is from the middle ore zone, the drawdown and gradient reversal is evaluated primarily in this layer. Figure MPI.1-8 presents the predicted potentiometric surface after 15 months of operation in Production Area #2. The area of gradient reversal to the northwest of the production area extends more than 2,500 feet from the production area.

MPI.1.1.2.3 End of Mining

The predicted end of mining water levels and water-level changes are reflected in Figures MPI.1-8 through MPI.1-13. The planned Jane Dough area ISR project includes two adjacent production areas operated in sequence for a total period of 51 months. The area of the production areas is similar, but Production Area #1 has a larger number of operating wells. The mining operation for Production Area #1 is in the middle ore zone (layer four) and a large fraction of the total recovery rate for Production Area #2 is in the middle ore zone. The cone of depression for the middle and lower ore zones is similar at the end of 15 months of operation of Production Area #2 (see Figures MPI.1-12 and MPI.1-13).

MPI.1.1.2.4 Extent of Drawdown

The drawdown in the middle and lower ore zones at the end of mining is presented in Figures MPI.1-12 and MPI.1-13, respectively. The middle ore zone represents significantly more than one-half of the total production area recovery rate, and when the proportioning of the aquifer storage to the ore sand thickness is considered, this ore zone represents the maximum drawdown impact on the aquifer. The extent of the drawdown is relatively large with a five foot drawdown contour extending approximately 7.5 miles to the north or northwest from the central Jane Dough mining area. The drawdown cone is elongated to north and slightly to the west and this is attributed to the mining in the Nichols Ranch area prior to mining at Jane Dough. The extent of drawdown in the lower ore zone is generally similar to that of the middle ore zone (see Figure MPI.1-12) with some residual drawdown from the mining in the Nichols Ranch area.

The predicted drawdown in the upper ore zone of the Jane Dough mining area is significantly less than that of the middle and lower ore zones because only limited production occurs in the upper ore zone for Production Area #2 (see Figure MPI.1-11). However, several feet of drawdown is predicted over a large area and this drawdown results from a combination of mining in Production Area #2, vertical communication with the middle ore zone, and mining in the Nichols Ranch area. The drawdown in the upper ore zone (layer three) also results in predicted drawdown in overlying layers two and one, and the greatest drawdown is within the area of increased vertical communication where the mudstone is absent. This predicted drawdown for the lower B sand (layer one) is presented in Figure MPI.1-9. The predicted drawdown for the upper A sand (layer two) is presented in Figure MPI.1-10.

MPI.1.2 Production Area #1 Excursion Control and Retrieval

The potential for excursion was considered in a MODFLOW-96 modeling scenario by adjusting modeling parameters to produce a temporary and local imbalance in production area operation. The imbalance involves either insufficient recovery rate or excess injection rate for a local area such that the local wellfield bleed rate is zero or actually negative representing more injection than recovery. Limiting this condition to a local area of a few wells is considered appropriate because a wider scale imbalance with insufficient bleed is unlikely given continuous monitoring of recovery and injection rates.

Simulation of retrieval of an excursion is essentially a reversal of the process that created the excursion. Increasing the effective wellfield bleed rate for a local area will increase the local drawdown and cause an expansion of the area of gradient reversal. Within this zone of gradient reversal, ground water will be flowing to the recovery wells and any ground water that has been impacted by mining fluids will be retrieved.

MPI.1.2.1 MODFLOW Modeling Changes

The MODFLOW-96 modeling configuration described in Section MPI.1.1.1 was used for the simulation of excursion and retrieval. The model included operation of Production Area #1 with adjustment of recovery rates from two wells in the middle ore zone to create a local imbalance resulting in excursion, followed by overproduction to affect retrieval. In the simulations, the rate adjustments were preceded by a period of normal production area operation.

The production area operation simulation included a 60 day period of normal operation with a 1% wellfield bleed rate followed by a period of local imbalance. In order to simulate a local imbalance, the extraction rate for two middle ore zone recovery wells in the southwestern portion of the production area was reduced by 5.0 gpm/well for a 60 day period. This was followed by a 60 day stress period in which the extraction rate for the two designated wells was increased by 5.0 gpm/well. This is a significant change in the well recovery rate for the two wells, but only resulted in a wellfield bleed rate range of 0.7 to 1.3% of total production area recovery rate. The operation for all other wells was unchanged from the previous simulations.

MPI.1.2.2 60 Day Excursion and Retrieval Simulation

The results of a MODFLOW-96 simulation of 60 days of normal production area operation are presented in Figure MPI.1-14. The cone of depression around the production area is expanding, and on the potentiometric surface is generally convergent to the production area. At the end of the initial 60 day period, the recovery rates were reduced for two wells within the area indicated in Figure MPI.1-15. At the end of 60 days with this local imbalance, there is a significant zone where gradient reversal has been lost on the west side of Production Area #1. This area where there is a potential excursion is over 900 feet wide and extends a distance of more than 1,200 feet from the production area (see Figure MPI.1-15). The reduction of recovery rates for this simulation has resulted in significant gradient away from the production area and significant potential for excursion. Based on the surface presented in Figure MPI.1-15, the potential excursion of mining fluids would be spread over a width that is much larger than the planned spacing for monitoring ring wells. Figure MPI.1-16 presents the potentiometric surface after an additional 60 day stress period with increased well recovery rates to offset the smaller rates during the period of imbalance. A strong gradient reversal has been regained and extends over 1,000 feet to the northwest of the production area. This indicates that retrieval will be effective, and could occur at moderate rates under strong gradients.

MPI.1.2.3 Discussion of Excursion Simulation

The excursion and retrieval simulations indicate that potential excursion conditions will be produced under local but rather severe production area imbalances. The confined aquifer conditions contribute to relatively rapid changes in gradients and gradient reversal with imbalance or overproduction. The width of the zone over which gradient reversal is lost is also relatively wide at over 900 feet. Mining fluids that are migrating away from the active production area will be spread over a width that is approaching the width of the area where gradient reversal is lost, and there will be additional flare as the impacted ground water moves away from the production area. This indicates that the anticipated monitoring ring well spacing of 500 feet will be sufficient to detect potential excursions.

MPI.1.3 Production Area #2 Excursion Control and Retrieval

The potential for excursion in Production Area #2 was evaluated in essentially the same manner as that for Production Area #1 as described in Section MPI.1.2. A temporary and local imbalance was created by reducing production rates for a period of 60 days followed by a period of overproduction to affect retrieval of the excursion.

MPI.1.3.1 MODFLOW Modeling Changes

The MODFLOW-96 modeling operational sequence included a 60 day period of normal operation with a 1% wellfield bleed rate followed by a period of local imbalance. The imbalance was created by reducing the extraction rate for two middle ore zone recovery wells in the central portion of the production area by 5.0 gpm/well for a 60 day period. This was followed by a 60 day stress period in which the extraction rate for the two designated wells was increased by 5.0 gpm/well. This is a significant change in the well recovery rate for the two wells, but only resulted in a wellfield bleed rate range of 0.7 to 1.3% of total production area recovery rate. The operation for all other wells was unchanged from the previous simulations.

MPI.1.3.2 60 Day Excursion and Retrieval Simulation

The results of a MODFLOW-96 simulation of 60 days of normal production area operation are presented in Figure MPI.1-17. The cone of depression around the production area is expanding, and on the potentiometric surface is generally convergent to the production area. At the end of the initial 60 day period, the recovery rates were reduced for two wells within the area indicated in Figure MPI.1-18. At the end of 60 days with this local imbalance, there is a significant zone where gradient reversal has been lost on the west side of Production Area #2. This area where there is a potential for excursion is over 1,200 feet wide and extends a distance of more than 1,000 feet from the production area (see Figure MPI.1-18). The reduction of recovery rates for this simulation has resulted in significant gradient away from the production area and significant potential for excursion. Based on the surface presented in Figure MPI.1-18, the potential excursion of mining fluids would be spread over a width that is much larger than the planned spacing for monitoring ring wells. Figure MPI.1-19 presents the potentiometric surface after an additional 60 day stress period with increased well recovery rates to offset the smaller rates during the period of imbalance. A strong gradient reversal has been regained and extends over 1,500 feet to the southwest of the production area. This indicates that retrieval will be effective, and could occur at moderate rates under strong gradients.

MPI.1.3.3 Discussion of Excursion Simulation

The excursion and retrieval simulations for Production Area #2 indicate that potential excursion conditions will be produced under local but rather severe production area imbalances. The confined aquifer conditions contribute to relatively rapid changes in gradients and gradient reversal with imbalance or overproduction. The gradient away from the wellfield can be relatively strong with the local imbalance, but a strong retrieval gradient can be achieved with significant overproduction to correct the temporary imbalance. The widths and areas of simulated excursion conditions also indicate that a monitoring ring well spacing of 500 feet will be sufficient to detect potential excursions.

MPI.1.4 Flare Evaluation

The estimation of flare in the Jane Dough production areas is based on estimation of flare at the Nichols Ranch Production Area #1 as described in Addendum 3B. The ore bodies in the Jane Dough area are similar to those in the Nichols Ranch area, and the general wellfield configurations reflect these similarities. Three ore intervals are planned to be mined at both Nichols Ranch and Jane Dough and the middle ore zone is the primary production interval. In comparing middle ore zone well patterns at the two sites (see Figure MPG.1-4 of Addendum 3B

and Figure MPI.1-4), the ore bodies are long narrow and sinuous. The typical middle ore body width at the Jane Dough Project is slightly greater than that at the Nichols Ranch Project and, in general, an increase in the ratio of width to length of narrow ore bodies will reduce the horizontal flare. Hence, although the ore body width differences are small, the Nichols Ranch horizontal flare estimates should be conservatively large when applied to the Jane Dough production areas.

The estimation of vertical flare is typically based on industry experience and some interpretation of the stratigraphic sequence and corresponding hydrologic properties that may limit vertical fluid movement. Vertical permeability or hydraulic conductivity within the ore bearing sedimentary strata is typically dramatically smaller than the horizontal permeability. Shales, mudstones, and siltstones within the stratigraphic sequence can also dramatically limit vertical fluid movement even when the layers are very thin or have limited continuity.

A vertical gradient away from the production interval can occur in the immediate vicinity of injection wells, but the bleed from the production interval causes an overall depression in the production area potentiometric surface. With this depression, the typical vertical gradient in the wellfield is toward the production interval and a reversal of this vertical gradient away from the production interval usually only occurs in the immediate vicinity of the injection wells. Because the injection head dissipates dramatically at a small distance from the injection well, the area where vertical excursion can occur is a relatively small fraction of the overall production area.

MPI.1.4.1 Horizontal Flare Evaluation

As shown in Figure MPG.1-15 of Addendum 3B, the lixiviant does flare beyond the boundary of the ore body. This horizontal flare is quantified as the ratio of the area contacted by the injectate to the area of the ore body under production area pattern. The area contacted by the injectate is represented by the contour line where there is a 0.5 unit concentration increase over the background concentration of 1.0. The ratio of the area within the 1.5 concentration contour to the area of the ore body within the well pattern is 1.19 and this is considered the horizontal flare factor. As discussed previously, this flare factor is considered applicable for the Jane Dough project area with a modest degree of conservatism.

MPI.1.4.2 Vertical Flare Estimation

As discussed above, the estimates of vertical flare are generally derived from industry experience and comparison with observed flare for similar operational conditions. The composite flare factor of 1.45 used in the Nichols Ranch Project area included the horizontal flare factor of 1.19 and approximate vertical flare factor of 1.22. This vertical flare factor was estimated for the Hank Project area and is also generally consistent with industry estimates. The composite flare factor of 1.45 which includes vertical flare is considered appropriate for the Jane Dough Project area given the similarities to the Nichols Ranch Project.

MPI.1.4.2.1 Qualitative Estimate of Vertical Flare

In order to further support the preceding estimate of vertical flare, the MODFLOW model results at the end of production from Production Area #2 were used to make a comparison of potentiometric surfaces in the five layers. If the operation of any injection well(s) in a production interval causes the head in the production interval to exceed that of the overlying

model layer, fluids can potentially flow vertically upward over the area where the head around the injection well(s) exceeds that of the overlying layer. The same relationship exists for the production interval and the underlying layer. Because each production interval and the two overlying zones are modeled as single layers in MODFLOW, this approach does not allow a refined quantitative assessment of vertical fluid migration. However, the comparison of potentiometric surfaces does allow at least a qualitative estimation of the portion of the operating wellfield area where the vertical gradient is from the production zone to an overlying or underlying layer.

Because roughly two-thirds of the Production Area #2 operating wells are in the middle ore zone (layer 4), the vertical flare from the middle ore zone constitutes the majority of the vertical flare. A comparison of potentiometric surfaces between the lower B sand (layer 1) and the upper A sand (layer 2) indicates that head in layer 1 is equal to or greater than that in layer 2 at the end of Production Area #2 mining. This indicates that no vertical flare is expected to extend from production in the upper ore zone (layer 3) up to layer 1.

The composite wellfield in the middle ore zone (layer 4) represents approximately two-thirds of the total production in Production Area #2. In comparing the potentiometric surfaces for layer 4 and layer 3, the approximate area (within the operating layer 4 wellfield[s]) where the head in layer 4 exceeds that of layer 3 is roughly 10 to 11 percent of the operating wellfield area. This can be interpreted qualitatively as the area where vertical upward flare could occur. The downward vertical flare from layer 4 to the lower ore zone (layer 5) is expected to be generally similar to the upward vertical flare. With a combination of upward and downward vertical flare from the middle ore zone occurring over an estimated at 20 to 22 percent of the operating wellfield area, the equivalent qualitative vertical flare factor is reasonably consistent with the value of 1.22 discussed earlier. There will also be vertical flare from the upper ore zone and lower ore zone and this analysis should be generally applicable for the three production intervals.

MPI.2 REFERENCES

Harbaugh, A.W., and M.G. McDonald, 1996, User's Documentation for MODFLOW-96, an update to the U.S. Geological Survey Modular Finite-Difference Ground-Water Flow Model, U.S. Geological Survey Open-File Report 96-485, Reston Virginia.

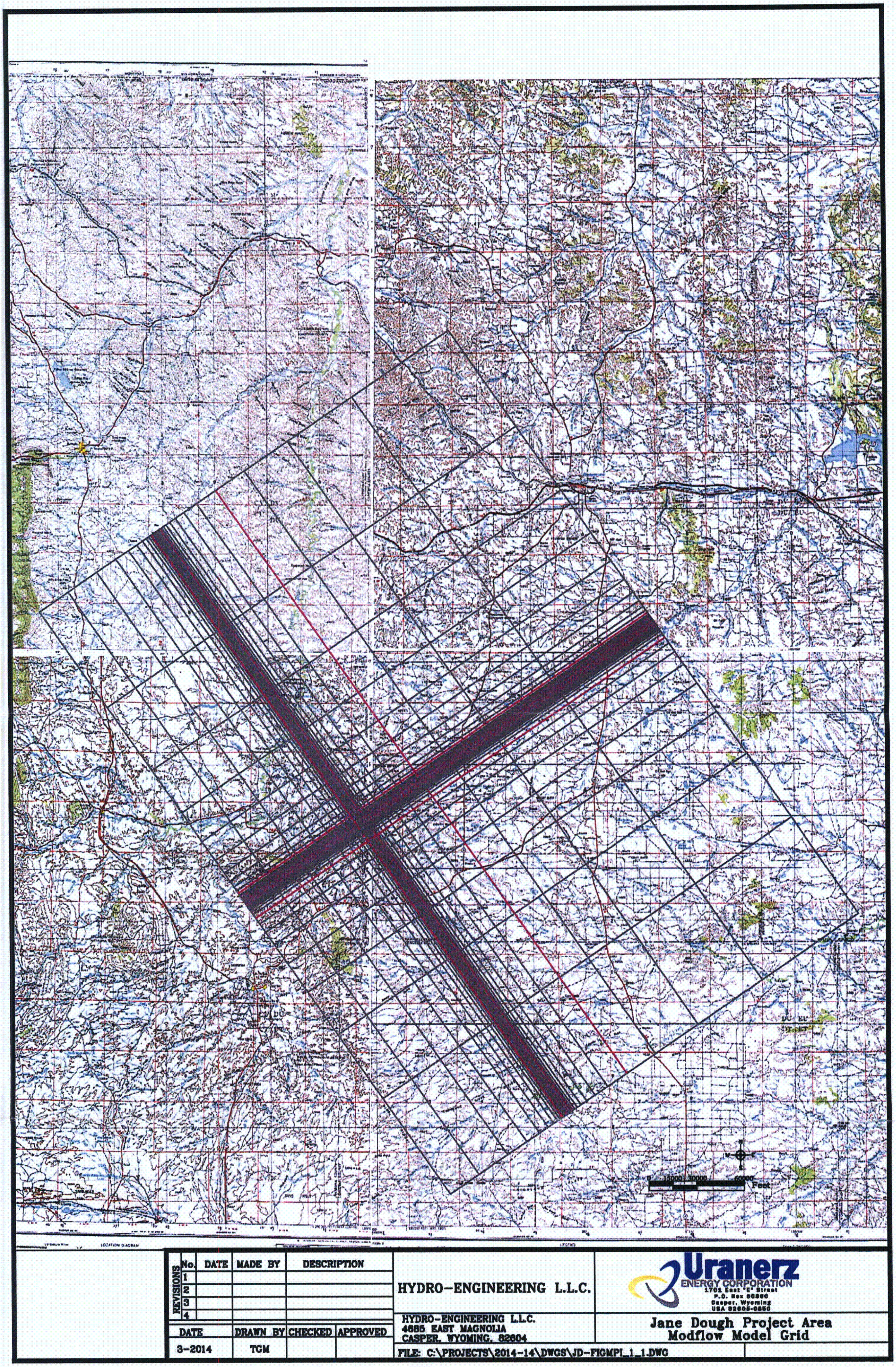

Figure MPI.1-1. Jane Dough Project Area MODFLOW Model Grid.

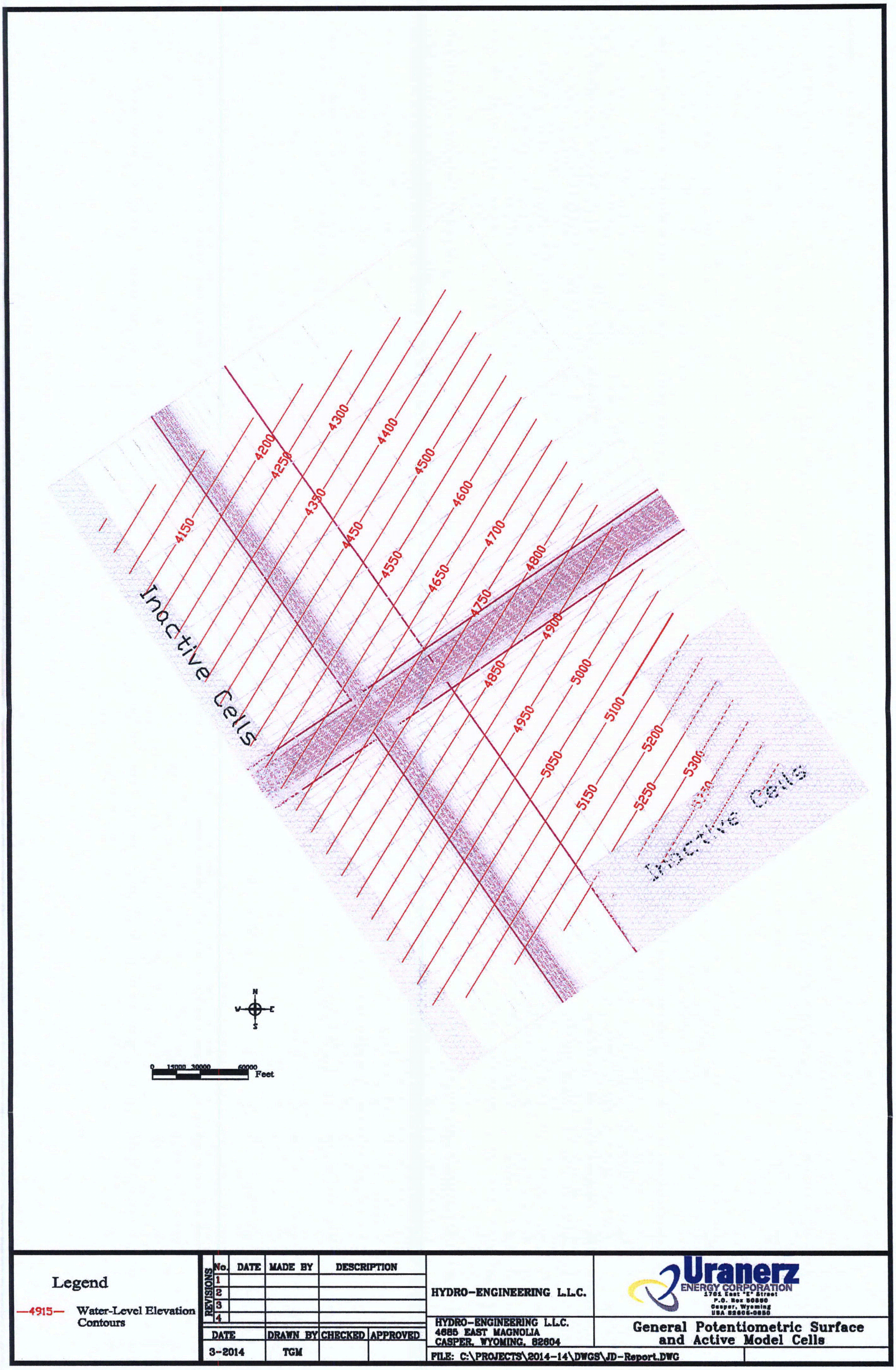

Figure MPI.1-2. General Potentiometric Surface and Active Model Cells.

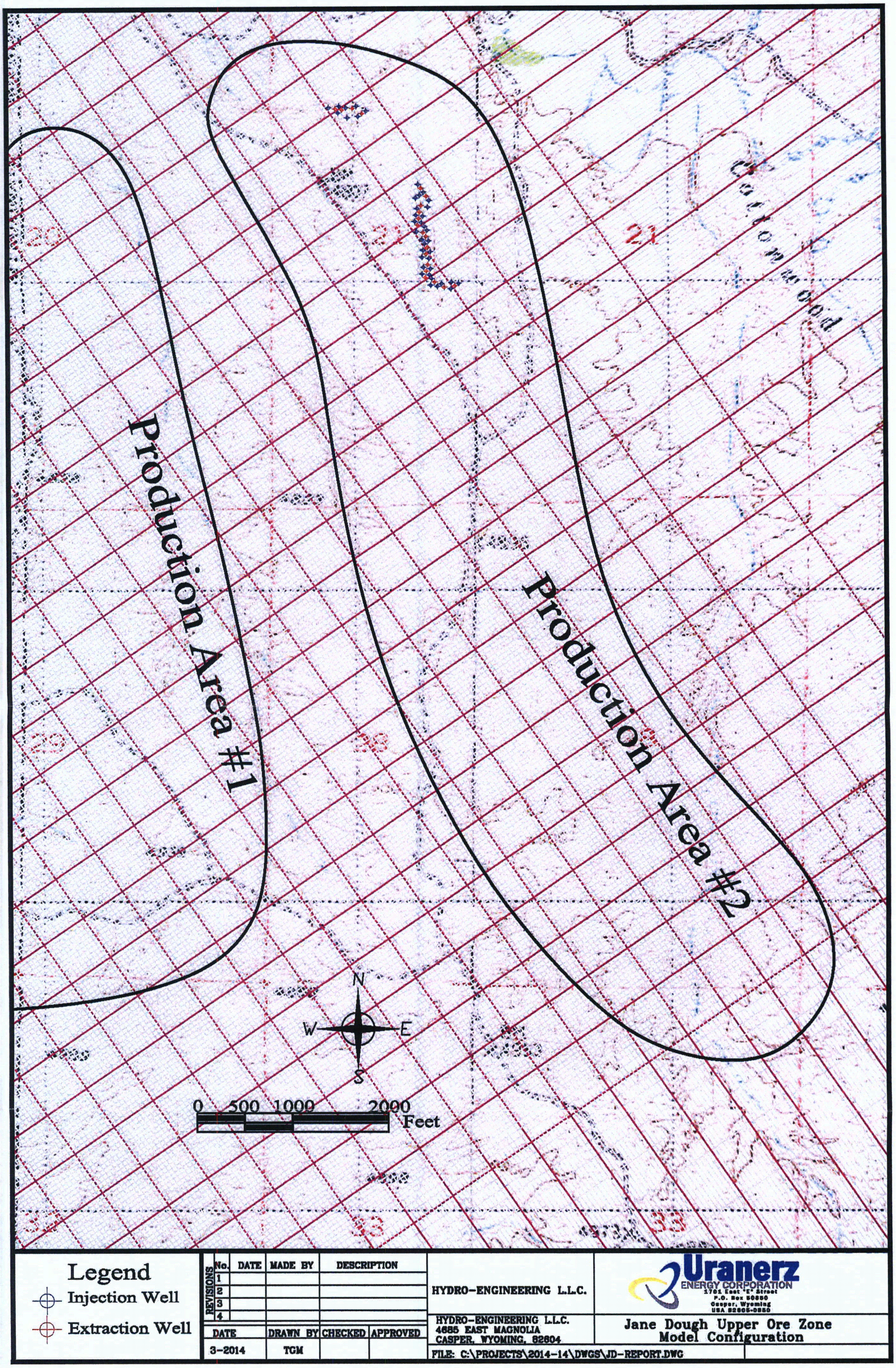

Figure MPI.1-3. Jane Dough Upper Ore Zone Model Configuration.

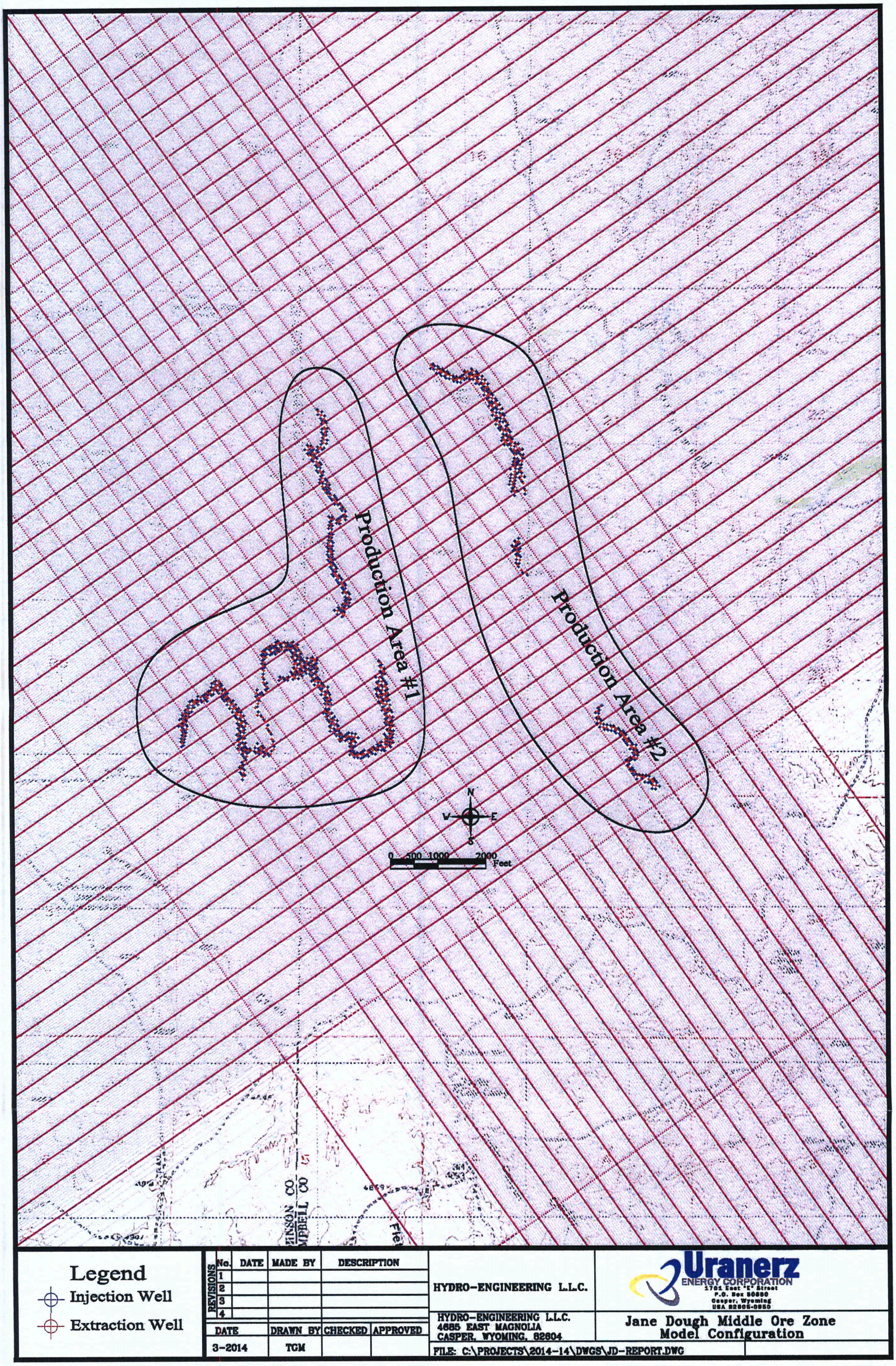

Figure MPI.1-4. Jane Dough Middle Ore Zone Model Configuration.

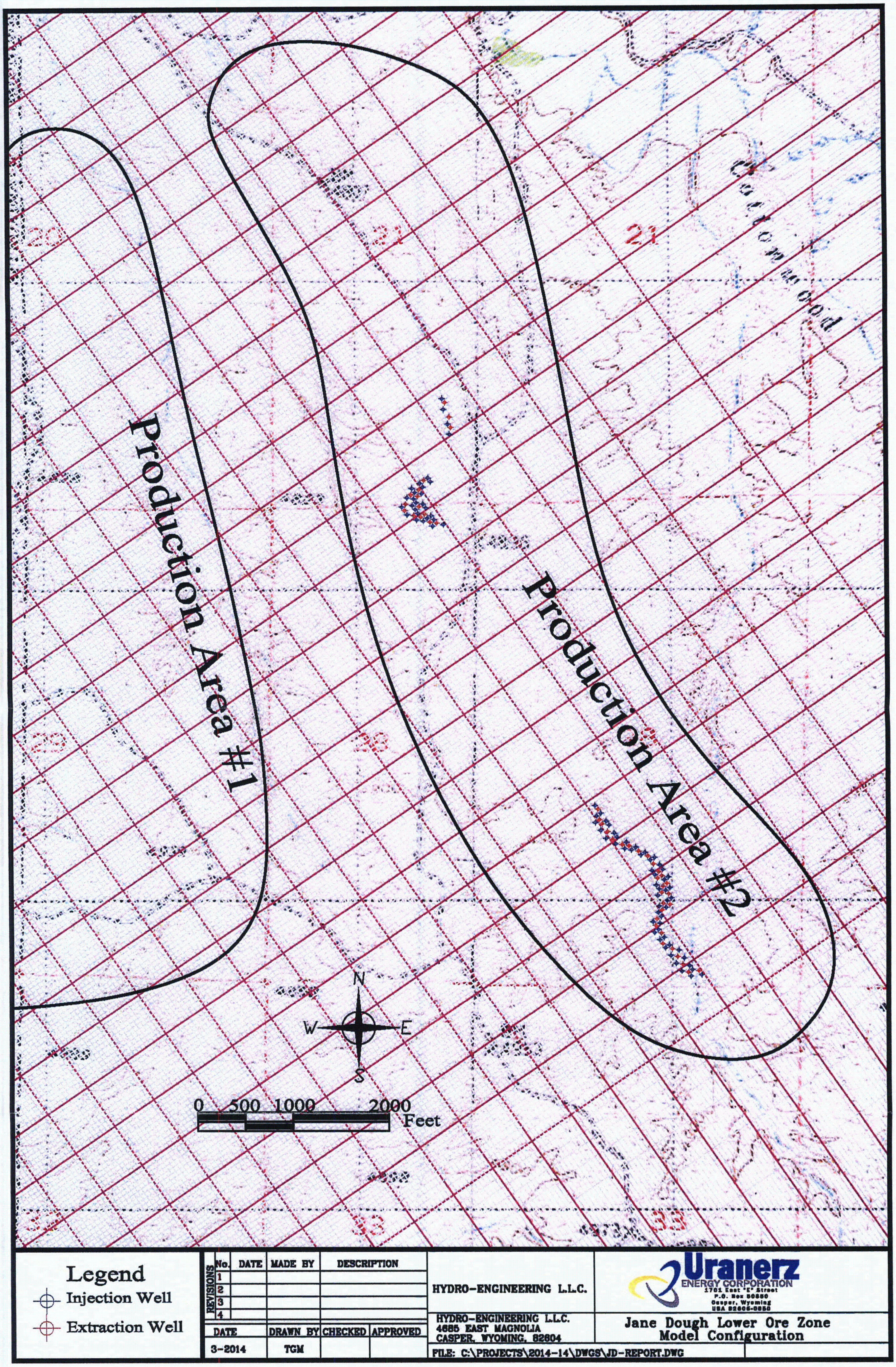

Figure MPI.1-5. Jane Dough Lower Ore Zone Model Configuration.

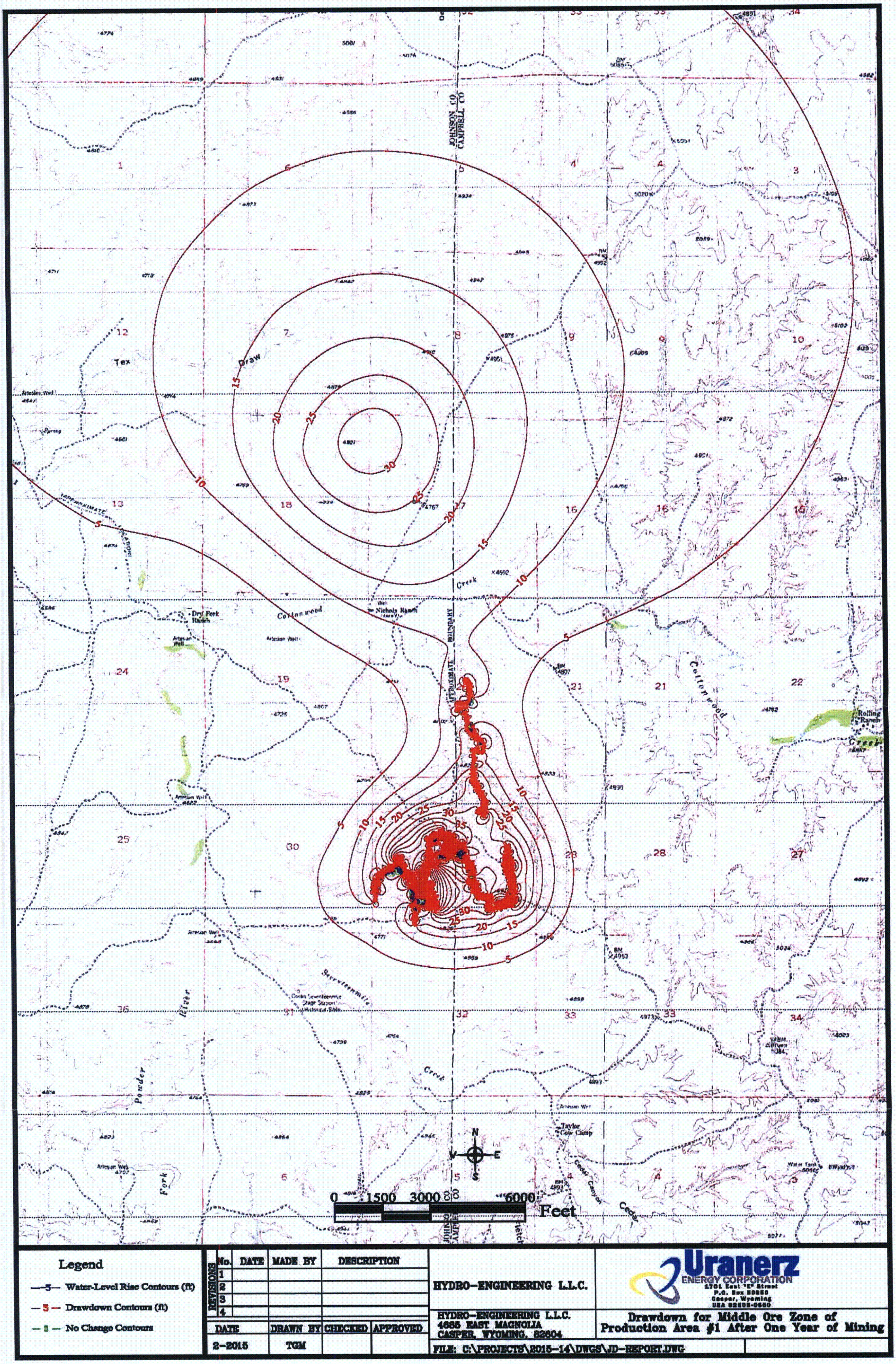

Figure MPI.1-6. Predicted Drawdown for Middle Ore Zone of Production Area #1 After One Year of Mining.

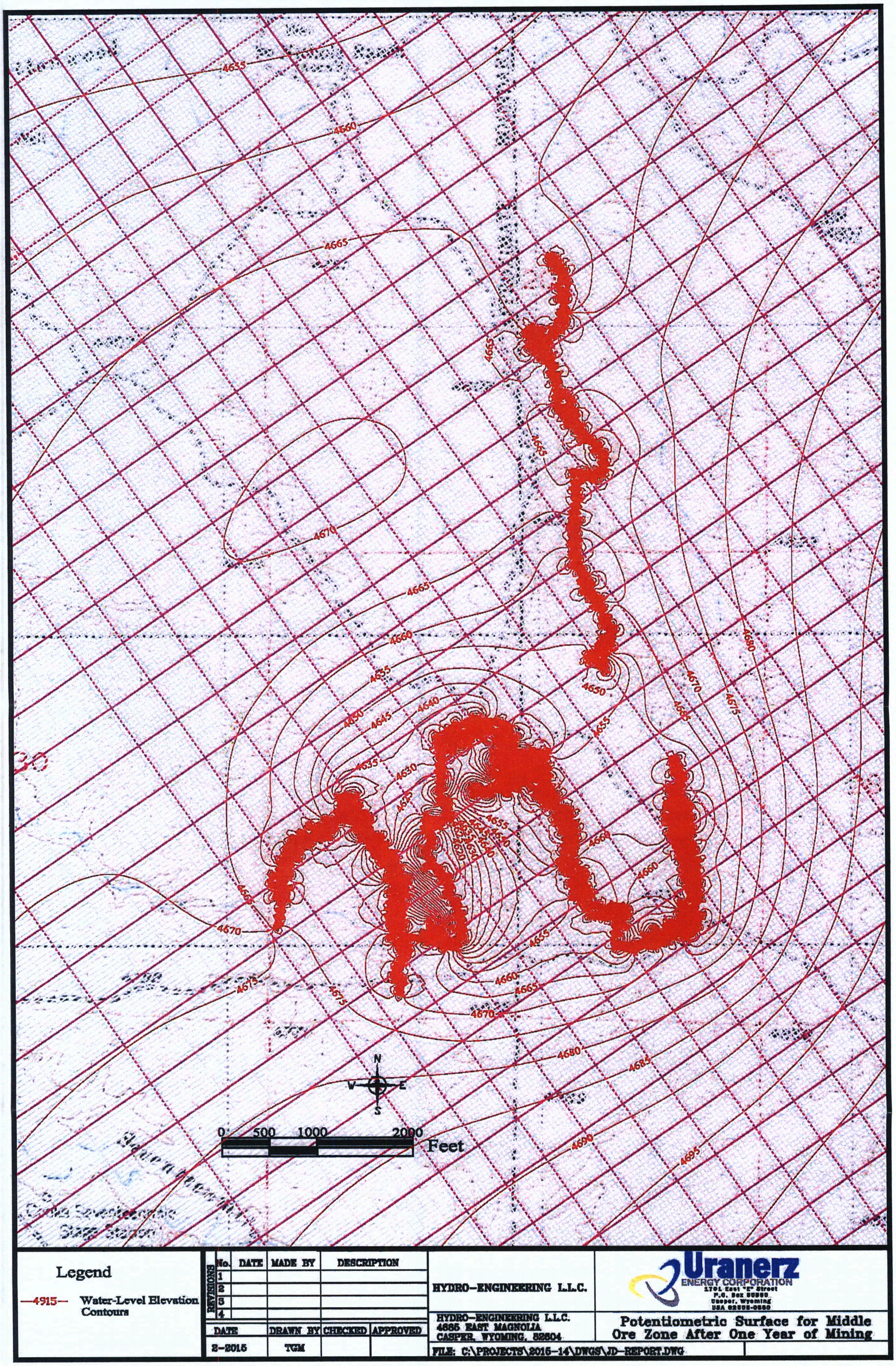

Figure MPI.1-7. Potentiometric Surface for Middle Ore Zone After One Year of Mining.

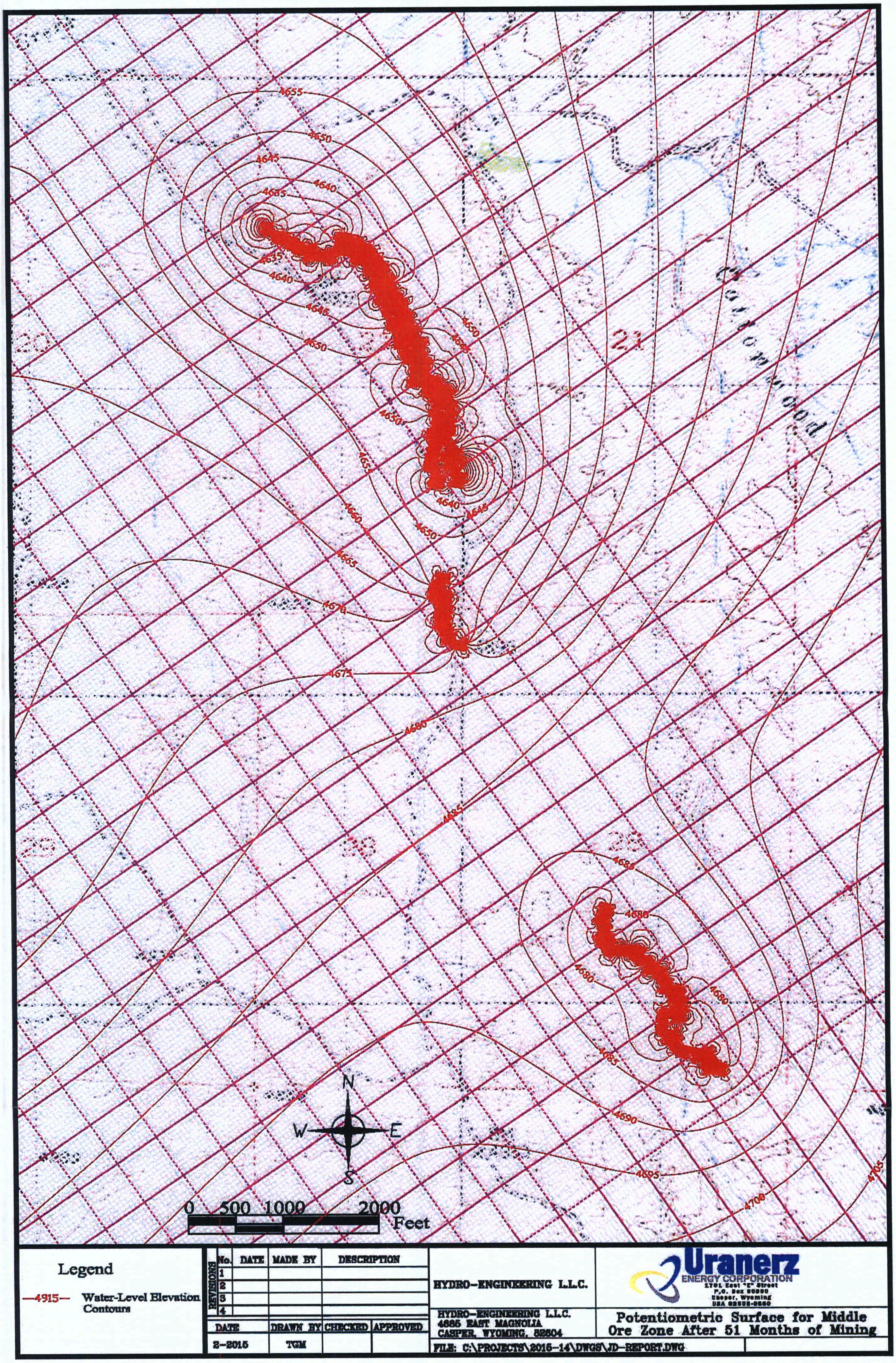

Figure MPI.1-8. Potentiometric Surface for Middle Ore Zone After 51 Months of Mining.

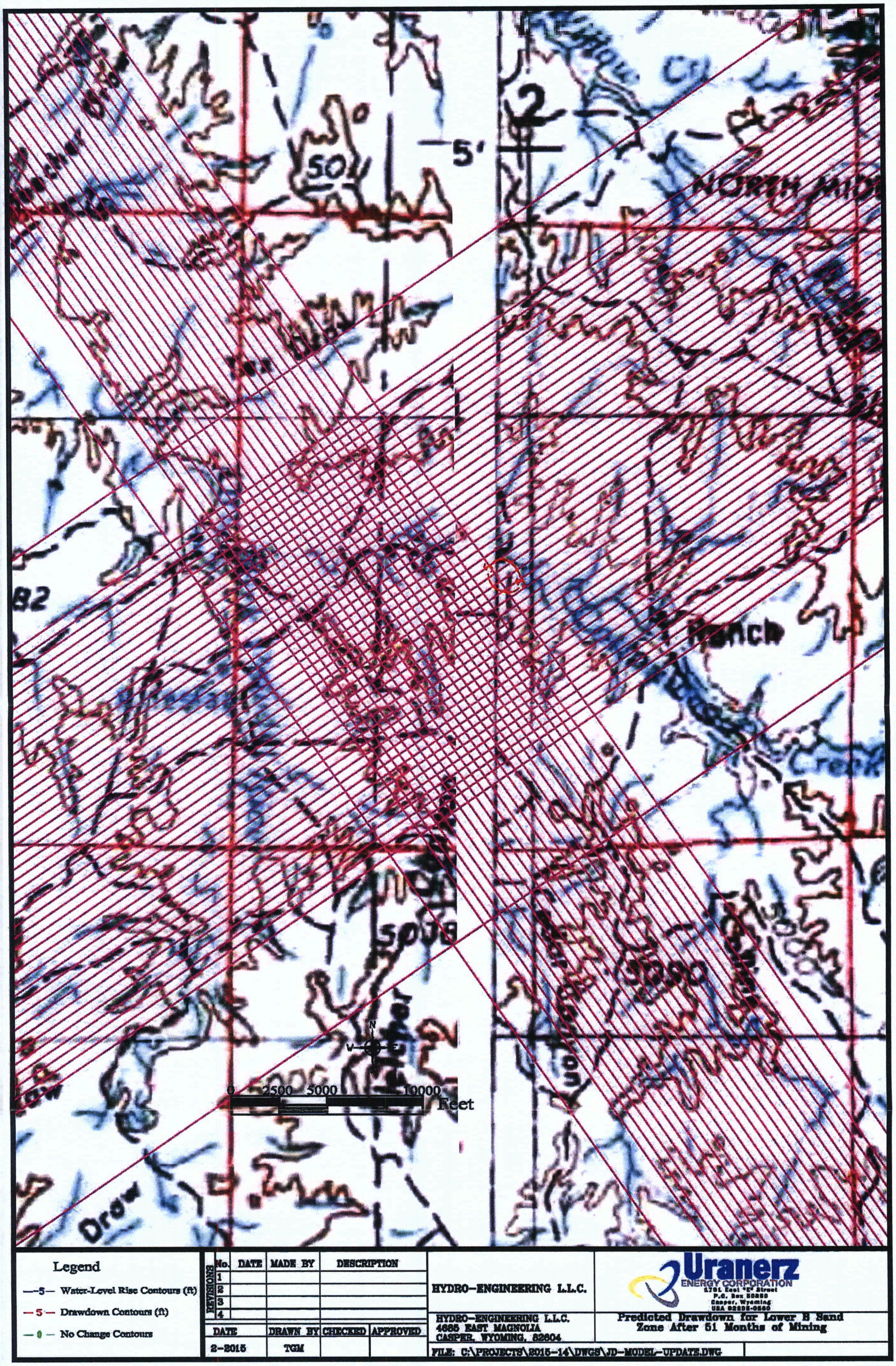

Figure MPI.1-9. Predicted Drawdown for Lower B Sand After 51 Months of Mining.

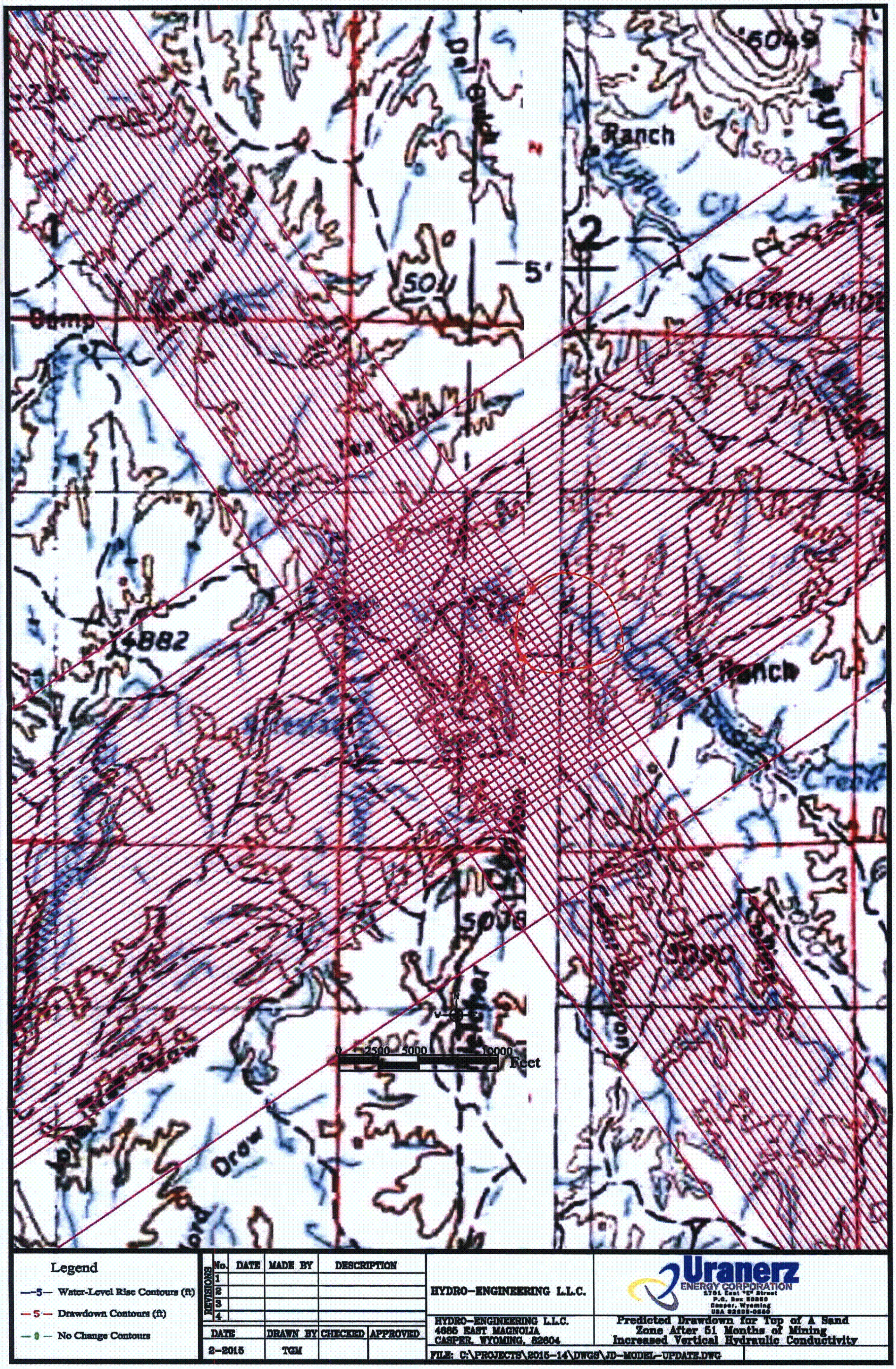

Figure MPI.1-10. Predicted Drawdown for Top of A Sand After 51 Months of Mining.