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May 7, 2012

VIA PDF AND FEDERAL EXPRESS

Mr. Rusty Lundberg
Executive Secretary
Utah Division of Radiation Control
Utah Department of Environmental Quality
195 North 1950 West
Salt Lake City, UT 84116-3097

Re: Response to March 19, 2012 DRC/URS Comments on Nitrate Corrective Action Plan – Docket No. UGW09-03

Dear Mr. Lundberg:

Please find enclosed Denison Mines (USA) Corp.'s ("Denison's") revisions, dated May 7, 2012, to the *Nitrate Corrective Action Plan for the White Mesa Mill Site* (the "Plan").

This revision has been prepared in response to comments from Utah Division of Radiation Control and URS Corporation dated March 19, 2012. The revision has been provided in both clean and track changes ("redline") format.

The responses to comments are summarized below. For ease of review each DRC comment has been provided in italics followed by Denison's response.

1. *General comment: Replace all instances of "discreet" with "'discrete" when discussing sampling.*

Denison Response: The change has been made throughout the document as requested.

2. *General comment: DUSA should include a statement that every reasonable effort will be made to ensure that corrective action implementation effort for the nitrate plume is performed in a manner that is mutually compatible with, and integrated with, the corrective action implementation effort for the chloroform plume in terms of scope and operation to ensure the effects of corrective action operations for the nitrate plume do not impede or substantially reduce the effectiveness of corrective action operations for the chloroform plume, and vice versa.*

Denison Response: The statement has been added to Section 1 as requested.

3. *Section 4.3, last paragraph: Please replace "permeability" with "conductivity" and define KGS.*

Denison Response: The Changes have been made to Section 4.3 as requested.

4. *Section 4.3.2, second paragraph: The revised CAP appears to state that the groundwater mound at TWN-2 (which is illustrated in Figure A.2) is a residual effect of the historical pond that has persisted due to "enhanced infiltration of precipitation before recent re-grading of the land surface in that area" and "low permeability conditions at TWN-2." Please define "recent" in this context. If nitrate concentrations in well TWN-2 and the groundwater mounding observed in this area do not decrease during Phase II, a re-examination of the elevated nitrate concentrations, and its possible source(s), and groundwater elevations in this well should be conducted during Phase III. Additionally, please replace "permeability" with "conductivity."*

Denison Response: As requested, "recent" has been defined as approximately 1980 in section 4.3.2. "Permeability" has also been changed to "conductivity" in this section.

5. *Section 5.1, second paragraph: The revised CAP states that "records or information have not been obtained to evidence the actual uses of the [historical] pond over the years." Because no records are available to document uses of the pond, all of the following sentences in this paragraph regarding nitrate and chloride concentrations in the pond water and potential impacts on the perched groundwater quality are unsubstantiated. The last four sentences in this paragraph must be deleted.*

Denison Response: The last four sentences of this paragraph have been deleted as requested.

6. *Section 7, third paragraph, first sentence: Please add the clarification that Phase III, if required, will be conducted in consultation with the Executive Secretary.*

Denison Response: The clarification has been added to Section 7.1 as requested.

7. *Section 7.1.1.1 third paragraph: After further consideration by DRC, the soil screening levels for the potential 54 soil core samples (per Part 7.1.1.1 of the CAP) to determine the final extent of the concrete cover and future soil removal volumes should be based on the 2 X UCL concentration of Nitrate + Nitrite (as N) and Ammonia (as N), instead of 20 X UCL concentrations as was stated in previous comments made by the DRC. These screening levels are set to 4.29 mg/kg for Ammonia (as N) and 4.384 mg/kg for Nitrate + Nitrite (as N) to maintain consistency with the previous investigations of nitrate sources at the site. These concentrations were established in the Preliminary results from Nitrate Phase 1 Investigation - data, mass balance and mass balance memo submitted by DUSA via e-mail on August 1, 2011.*

Denison Response: Section 7.1.1.1 has been changed to reflect soil screening concentration levels of 2 X UCL, as requested, in lieu of the soil screening levels of 20 X UCL requested in DRC's January 19, 2012 comments letter.

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8. *Figures 11-2A and 11-2B: It would be helpful to show sample locations GP-25B and GP-26B on these drawings.*

Denison Response: Sample locations for GP-25B and GP-26B have been added to Figures 11-2A and 11-2B as requested.

9. *Section 7.1.1.4, fourth paragraph: DUSA proposes to increase the reporting limits (RLs) for nitrate and ammonia in soil. The RLs for nitrate and ammonia, as reported in the tables transmitted to DRC on August 1, 2011 by DUSA, were 0.01 and 0.05, respectively. These RLs corresponded to dry weight compositions of approximately 0.24 mg/kg for nitrate and 1.1 mg/kg for ammonia. The revised CAP proposes RLs that are an order of magnitude higher (0.1 mg/kg and 0.5 mg/kg, respectively) based on detections in method blank samples in 2011. Increasing the RLs by an order of magnitude would result in samples containing up to 2.4 mg/kg of nitrate as N and 11 mg/kg ammonia as N being classified as non-detect. These concentrations significantly exceed the established background levels discussed in comment #7 above. While blank interferences during the 2011 are acknowledged, the analytical results presented in 2011 were appropriately flagged when the analytical result was less than five times the measured concentration in the method blank. The RLs and reporting procedures from the 2011 investigation should be retained.*

Denison Response: The RLs have been changed to 0.01 mg/L for nitrate and 0.05 mg/L for ammonia as requested.

10. *Section 7.1.1.5, first paragraph: DI water from the Mill should not be used to decontaminate sampling equipment or provide rinsate samples. The DI water should come from a commercial third-party source, as specified by the May 2011 revised Phase 1 Work Plan.*

Denison Response: DI water for decontamination and rinsate samples will be obtained from a third party commercial source. The text in Section 7.1.1.5 has been revised accordingly.

11. *Section 7.1.4: DUSA proposes to place the contaminated soil into the tailings cells during a future excavation. DUSA needs to demonstrate in this section, at least approximately, that there is sufficient space in the tailings cells upon facility closure to accommodate the nitrate-contaminated soil.*

Denison Response: Text discussing the insignificantly small volume of contaminated soil to be disposed of in the tailings system, in comparison to the known tailings volume, has been added to Section 7.1.4, as requested. Ample space is required to be maintained in the tailings cells at all times for the disposal of all Mill surface facilities and contaminated surface soils. The volume of soil to be excavated as a result of Phase I activities will be insignificant relative to the estimated volume for all surface facilities and contaminated surface soils at the site.

12. *Section 7.2, first paragraph at top of Page 37: The discussion of pyrite and the possible oxidation of pyrite is hindered by the lack of quantitative evidence of how much pyrite is present in the borings or how much of the pyrite may be oxidized. A separate study is currently being undertaken by DUSA to quantify the amount of pyrite in the formation, as part of a separate investigation of sources of decreasing pH trends and Out-of Compliance status at several of the White Mesa monitoring wells. Please provide language explaining that the oxidation of pyrite in the formation has not been substantiated with quantified core analysis or remove any references to pyrite in the Nitrate CAP. The presence of dichloromethane, which is the product of microbially-mediated anaerobic degradation of chloroform, is sufficient evidence that there are some localized zones within the saturated zone that may be anaerobic. Additionally, if the responses to comments provided in the DUSA cover letter dated 27 February 2012 are to be incorporated into the CAP, then the response to comment 23 of the previous round of comments (19 January 2012) should be similarly revised.*

Denison Response: Language has been added to Section 7.2 indicating that oxidation of pyrite has not been substantiated with quantified analyses, and that a separate study is being undertaken by Denison to gather this data. The CAP, as revised, is a stand-alone document and does not rely for completeness on content published in responses to comments. The February 27, 2012 comments, which are not incorporated in the CAP, have therefore not been changed.

13. *Section 7.2, third paragraph on Page 39 and Section 8, second paragraph: Please clarify that containment and hydraulic control of the nitrate plume that will prevent physical expansion of the nitrate plume (as required by the SCA) will be quantified by (1) nitrate concentrations below the 10 mg/L Groundwater Quality Standard in samples collected from monitoring wells downgradient of TWN-22 and TWN-24 and (2) demonstration of a hydraulic capture zone that includes all of the nitrate plume upgradient of TWN-22 and TWN-24 through groundwater elevation data. Note that the four criteria listed in Section 8 do not require modification since they account for these two factors.*

Denison Response: Based on our conversation with DRC on April 2, 2012, Denison understands that in referring to wells TWN-22 and TWN-24 in this comment, DRC meant to refer to chloroform wells TW4-22 and TW4-24.

Hydraulic containment and control will be evaluated in part based on water level data (in the same fashion as for the chloroform pumping system) and in part on concentrations in wells downgradient of pumping wells TW4-22 and TW4-24. Bounding stream tubes defining the capture zone of nitrate pumping wells will be generated from the kriged quarterly perched water level data. Hydraulic containment and control based on water level data will be considered successful if the entire nitrate plume upgradient of TW4-22 and TW4-24 falls within the combined capture of the nitrate pumping wells.

MW-5, MW-11, MW-30, and MW-31 are located downgradient of TW4-22 and TW4-24. MW-30 and MW-31 are within the plume near its downgradient edge, and MW-5 and MW-11 are outside of and downgradient of the plume. Hydraulic control based on concentration data will be considered successful if

the concentrations of nitrate in MW-30 and MW-31 remain stable or decline and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard.

Language to this effect has been added to Sections 7.2 and 8.

14. *Section 7.2, last paragraph and Section 8, second paragraph: This text implies that no actions would be taken if nitrate concentrations in downgradient wells increase but do not exceed 10 mg/L. If nitrate concentrations in any of the wells exceed their respective Ground Water Compliance Limit (GWCL) listed in Table 2 of the current Permit, which are less than 10 mg/L, then notification is required and sampling frequencies for the wells is required to be accelerated per the White Mesa Mill Groundwater Discharge Permit (GWDP UGW370004) Part G.1. Please revise the text accordingly.*

Denison Response: Text has been added to Section 7.2 and Section 8, as requested.

15. *Section 7.2.1: Clarify in this section that Wells TWN-1, TWN-2, TWN-3, TWN-4, TWN-7, and TWN-18 will be retained for Quarterly Nitrate and Chloride monitoring as well as field collection parameters per the approved field collection form (including water level measurements), and wells TWN-14 and TWN-19 will be retained for Quarterly water level monitoring only. Please also add wells TW4-6 and TW4-16 for water level monitoring.*

Denison Response: Based on our conversation with DRC on April 2, 2012, Denison understands that in referring to the additional two wells TW4-6 and TW4-16, DRC actually meant to refer to wells TWN-6 and TWN-16. Section 7.2.1 has been corrected as requested, with the correct two well names.

16. *Section 7.2.2: Table 1 includes a "Nitrate Operations and Maintenance Plan" but such a document is not discussed in Section 7.2.2. A brief description of the plan should be added to this section or another appropriate section.*

Denison Response: A description of the Operations and Maintenance Plan has been added to Section 7.2.2, as requested.

17. *Sections 7.2.2, 8.3, and 9.0 (all): These sections discuss the procedures to be used for conveying pumped groundwater to the tailings cells for disposal. Contingency Plan procedures, as presented in Sections 8.1 through 8.4, include procedures to be followed if groundwater pumping recovery rates drop from anticipated production levels. The CAP needs to include a discussion of procedures/measures to be taken for handling of pumped groundwater if pumped groundwater inventories conveyed to the tailings cells are found to lead to exceedances in maximum allowable specified threshold values (e.g., maximum allowable daily water level) in a cell containment system's leak detection system.*

Denison Response: A discussion has been added to Section 7.2.2, addressing management of pumped groundwater during circumstances involving exceedances in threshold values in the tailings system.

18. *Section 7.2.4, second paragraph: To be consistent with the Ground Water Monitoring Quality Assurance Plan dated March 22, 2010, the required purge volume is two casing volumes and stabilization of field parameters, not three pore volumes as stated in this paragraph. In this paragraph and elsewhere in the report, ensure that groundwater sampling procedures are consistent with the currently approved Quality Assurance Plan (QAP) (Currently Approved QAP dated 3/22/2010 Revision 6).*

Denison Response: The reference to three pore volumes has been removed from Section 7.2.4. The text has been modified to state that groundwater monitoring under the Nitrate program will also be conducted as described in the most current DRC-approved White Mesa Mill Groundwater Monitoring Quality Assurance Plan ("QAP"). This language has been added without a specific date for the approved QAP. Denison has recently submitted a proposed revision to the Groundwater Monitoring QAP at the request of DRC which is expected to result in a change to the approved version number and approval date. The reference, as worded in Section 7.2.4 will allow use of the most recently approved QAP independent of future changes to QAP version numbers or approval dates.

19. *Section 7.3: If Phase II active remediation efforts through groundwater pumping do not remediate all nitrate concentrations equal to or less than 10 mg/L at the "TWN/TW4" monitoring wells, and equal to or less than GWPL's at the "MW" monitoring wells within a time frame specified below, then further consideration of alternate remediation technologies will need to be evaluated per Phase III. DRC sees a 5-year time frame for limitation of Phase II implementation as suitable to demonstrate the effectiveness of Phase II groundwater pumping, elimination of the nitrate plume, and return of the facility monitoring wells to compliance with Ground Water Quality Standards and GWCL's. If definitive evidence does not show plume elimination and compliance within the 5 year timeline, then DUSA will be required to submit a revised CAP for Executive Secretary Review and Approval for Phase III. Please include language in the CAP that acknowledges the Phase II compliance time limitation.*

Denison Response: Denison considers 5 years to be a reasonable time frame for developing sufficient information for re-evaluation of the performance of Phase II effectiveness. At the end of 5 years, we anticipate having sufficient data to do one or more of the following:

a) Assess the rate of nitrate plume remediation (e.g. in terms of percent mass reduction per year or concentration reduction per year) with sufficient certainty to project the timeline for remediation through the continued implementation of Phase II and make appropriate adjustments to the reclamation surety estimate, or
b) Identify changes to Phase II to improve its effectiveness or accelerate the restoration timeline, or

c) Identify whether Phase III activities, including application for an Alternate Corrective Action Concentration Limit ("ACACL") may be necessary in lieu of, or in combination with, Phase II activities.

Section 7.3 has been revised to discuss activities at the end of five years of Phase II operation.

20. *Section 8.2 and Section 10.2.7: The revised CAP states that the progress of Phase II will be monitored, in part, through an assessment that nitrate concentrations are "generally stable or declining (disregarding short-term fluctuations)" or are not "generally increasing" within the plume. However, criteria for assessing whether the nitrate concentrations are stable, declining, or generally increasing are not provided. Specific, statistically-based criteria need to be provided in the CAP to quantify whether the nitrate concentrations are stable, declining, or increasing. The criteria should account for the potential for short-term fluctuations. Provide a detailed description of statistical methods which will be used.*

Denison Response:

Evaluating concentration trends within the plume was proposed because changes in concentration are an indication of the change in mass within the plume. Generally decreasing concentration trends (assuming the plume is not expanding in area) would be an indication that the nitrate mass within the plume is decreasing, and that Phase II is effective.

Changes in nitrate mass within the plume based on concentrations and saturated thicknesses will be used to determine any need for reevaluation of Phase II. Data used to calculate nitrate mass will utilize analytical and water level data collected from wells identified in Table 3 of the CAP, through Phase II CAP monitoring. Assuming that the plume boundaries do not expand, that concentrations within the plume will generally decrease, and that saturated thicknesses do not increase, the calculated mass of nitrate within the plume is expected to decrease over time. The changes in calculated mass within the plume will be evaluated as follows:

1) Calculate a baseline mass for the nitrate plume. This calculation will utilize the second quarter, 2010 concentration data (provided in Table 3) and saturated thickness data within the area of the kriged 10 mg/L plume boundary. This data set is appropriate because the second quarter, 2010 concentration peak at TWN-2 likely identifies a high concentration zone that still exists but has migrated away from the immediate vicinity of TWN-2.

2) Calculate the plume nitrate mass quarterly based on kriged nitrate concentrations and saturated thicknesses (within the kriged 10 mg/L plume boundary).

3) After eight quarters, fit a regression trend line to the calculated mass values for the plume and determine whether the mass calculation is increasing, decreasing, or stable.

4) Add data quarterly thereafter, recalculate the trend line for the plume quarterly, and evaluate.

If the mass trend line after eight quarters is flat or decreasing (and the plume boundaries are not expanding), then Phase II will be considered successful at that time. Ongoing quarterly trend analysis will then indicate whether or not Phase II continues to be successful.

If the mass trend line is increasing after eight quarters, the data will be examined to determine if the increase is the result of increases in concentration at only one or two wells within the plume that are having an outsize impact on the mass calculation. Changes in concentration at individual wells are expected to result in part from migration of nitrate toward pumping wells. Because of the potential for nitrate to exist at higher concentrations between existing wells (and to be undetected at the present time), movement induced by pumping may cause migration of a higher concentration zone into the vicinity of a particular well, causing a (presumably temporary) increase in concentration at that well. The existence of a higher concentration zone near TWN-2 is evidenced by the relatively large changes in concentration in TWN-2 from the first quarter of 2010 through the third quarter of 2011 (as shown in Table 3 of the CAP). Fluctuations in concentration at TWN-2, which has demonstrated the highest historic concentrations, could result in fluctuations in the mass calculation that temporarily affect the direction of a trend. Similar fluctuations at wells other than TWN-2 could have the same impact.

The usefulness of the mass-based methodology described above will be reevaluated if needed based on the eight quarters of collected data used to establish the initial trend line. If the method provides erratic values of limited usefulness, or is impacted unduly by the outsized impacts of one or more wells, a modified or new method will be developed at that time. The nature of the modified or new method will have the benefit of eight quarters of data to test its usefulness.

Language to this effect has been added to Sections 8.2 and 10.2.7

21. *Table 1: The newly proposed schedule for constructing the concrete cover around the ammonium sulfate tanks does not appear to include any review and approval of the analytical data or proposed cover area by DRC prior to construction of the cover. The proposed schedule must be modified to include such review and approval.*

Denison Response: Table 1 has been modified to include Executive Secretary review and approval of the analytical data and proposed cover design, as requested.

If you have any further questions please contact me at 303-389-4132.

Yours very truly,

DENISON MINES (USA) CORP.

Jo Ann Tischler
Director, Compliance and Permitting

cc: Robert D. Baird, URS
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Kathy A. Weinel

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ATTACHMENT 1
REDLINE CHANGES TO
NITRATE CORRECTIVE ACTION PLAN

CORRECTIVE ACTION PLAN FOR NITRATE
WHITE MESA URANIUM MILL
NEAR BLANDING, UTAH

May 7, 2012

Deleted: February 27

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CORRECTIVE ACTION PLAN FOR NITRATE
WHITE MESA URANIUM MILL
NEAR BLANDING, UTAH

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May 7, 2012

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1. INTRODUCTION, OVERVIEW, AND SCOPE

This document presents a Corrective Action Plan (CAP) to address nitrate + nitrite (as nitrate) (heretofore referred to as "nitrate") contamination in a shallow perched groundwater zone beneath the White Mesa Uranium Mill (the "site" or the "Mill"), located on White Mesa near Blanding, Utah, operated by Denison Mines (USA) Corp. ("Denison"). Figure 1-1 is a map showing site features including seeps and springs at the margins of White Mesa. Figure 1-2 is a map of the site showing the locations of perched zone monitoring wells and the area of the perched groundwater zone affected by nitrate concentrations exceeding 10 milligrams per liter (mg/L) that is the focus of this CAP. For the purposes of this document, all nitrate concentrations in groundwater have been expressed as mg/L nitrogen. Elevated concentrations of chloride were also detected in the monitoring wells having elevated concentrations of nitrate. In a letter dated December 1, 2009, the Co-Executive Secretary of the Utah Water Quality Board (the "Executive Secretary") recommended that Denison also address and explain the elevated chloride concentrations.

Nitrate within the area shown in Figure 1 was first detected in wells TW4-19, TW4-22, TW4-24, and TW4-25 that were installed as part of the investigation of a chloroform plume discovered at perched well MW-4 in 1999. Pumping of chloroform-laden perched water began in 2003 (HGC, 2007a) and continues to the present time via pumping of wells MW-4, MW-26, TW4-4, TW4-19, and TW4-20.

Investigation of nitrate exceeding 10 mg/L in the perched water included installation of 19 temporary TWN-series wells shown in Figure 1 and numerous shallow borings as part of a source investigation. Denison identified and prioritized potential sources of the nitrate in the December 2009 *Source Review Report for Nitrate and Chloride in Groundwater at the White Mesa Mill*, (INTERA, 2009a) and in the subsequent August 2011 *Nitrate Investigation Revised Phases 2 through 5 Work Plan*. (INTERA, 2011).

Based on the investigations, Denison and the Executive Secretary have agreed that the corrective actions will involve three Phases. Phase I will involve source control in the vicinity of the Mill's ammonium sulfate tanks, the one remaining potential source of contamination. Phase II will involve near term active remediation of the nitrate contamination by pumping contaminated water into the Mill's tailings cells for disposal, combined with monitored natural attenuation. Phase III, if necessary, will be at the discretion of Denison and would involve a long term solution for the nitrate contamination, in the event that the continuation of Phase II is not considered adequate or appropriate. Phases I and II are addressed in this CAP and will commence shortly upon Executive Secretary approval of this CAP. Phase III is not covered in

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detail in this CAP and, if determined to be necessary, will be addressed in a separate CAP revision.

Every reasonable effort will be made to ensure that corrective action implementation effort for the nitrate plume is performed in a manner that is mutually compatible with, and integrated with, the corrective action implementation effort for the chloroform plume in terms of scope and operation to ensure the effects of corrective action operations for the nitrate plume do not impede or substantially reduce the effectiveness of corrective action operations for the chloroform plume, and vice versa.

The elements of this CAP document include the following items:

- A History of the Nitrate Contamination Investigation
- A discussion of the decision to proceed with Corrective Action
- A summary of the applicable requirements
- CAP objectives
- A description of the site hydrogeology
- The nature and extent of nitrate in the perched zone
- Proposed corrective remedial actions and concentration limits
- Proposed corrective action contingencies

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2. HISTORY OF NITRATE CONTAMINATION INVESTIGATION

A brief discussion of the Nitrate Contamination Investigation and the decision to proceed with corrective action is provided in Sections 2.1 and 2.2.

2.1 Summary of Contamination Investigation Report Activities

On January 27, 2009 the Executive Secretary of the Utah Division of Radiation Control ("DRC") and Denison entered into the 2009 Stipulated Consent Agreement ("SCA"), which set forth the requirement that Denison would submit a written Contaminant Investigation Report (CIR) for Executive Secretary review and approval, to among other things, characterize the source(s), physical extent, transfer mechanisms and characteristics of the Nitrate contamination of the shallow aquifer at the site.

Denison submitted to the Executive Secretary a CIR which had been prepared by their consultant INTERA, Inc. The CIR was dated December 30, 2009 (INTERA, 2009b) and entitled "Nitrate Contamination Investigation Report White Mesa Uranium Mill Site Blanding, Utah" (2009 CIR). On October 5, 2010 the Executive Secretary issued a Notice of Additional Required Action (NARA) letter that notified Denison of the Executive Secretary's determination that the 2009 CIR was incomplete.

On December 20, 2010 Denison and the Executive Secretary entered into a Tolling Agreement (Tolling Agreement (Rev. 0)) to defer any monetary penalties that might accrue under the 2009 SCA, in order to provide a time period (Tolling Period) for:

1. Denison to prepare and submit a plan and schedule (Plan and Schedule) by which to conduct additional investigations to resolve open issues identified in the October 5, 2010 NARA on or before February 15, 2011,
2. The Executive Secretary to provide his initial comments on the Plan and Schedule on or before March 15, 2011, and for Denison and the Executive Secretary to finalize the Plan and Schedule, and
3. Denison and the Executive Secretary to negotiate, finalize and execute a revised or replacement SCA that incorporates the Plan and Schedule.

In addition, the Tolling Agreement (Rev. 0) required that the Tolling Period be extended from January 4, 2010 (submittal of the 2009 CIR to the Executive Secretary) until Apri1 30, 2011.

Pursuant to the Tolling Agreement (Rev. 0), Denison submitted a Plan and Schedule on February 14, 2011 and a revised Plan and Schedule on February 18, 2011, and the Executive Secretary provided his comments on the revised Plan and Schedule on March 21, 2011. In an April 20,

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2011 meeting, Denison and the Executive Secretary agreed that the Plan and Schedule to conduct additional nitrate investigations would be composed of at least four (4) and possibly five (5) phases of study, including:

1. Phase 1A through C - including geoprobe drilling, and soil sampling/analysis of soils to investigate:
    a. Possible natural nitrate salt reservoir in the vadose zone beyond the mill site area (Phase 1A);
    b. Potential nitrate sources in the mill site area (Phase 1 B); and
    c. Other potential nitrate sources (Phase 1 C).
2. Phase 2 - including groundwater quality sampling and analysis of existing monitoring wells for non-isotopic analytes.
3. Phase 3 - including deep bedrock core sampling/analysis of possible natural nitrate reservoir and potential nitrate source locations, with similar objectives as Phases 1 A through C.
4. Phase 4 - including stable isotopic sampling/analysis of groundwater in existing monitoring wells. Details of this investigation were to be determined at a later date, and approved by both parties.
5. Phase 5 - including stable isotopic sampling/analysis of soil/core samples, if needed.

On April 28, 2011, Denison and the Executive Secretary entered into a Revised Tolling Agreement (Tolling Agreement (Rev. 1), to extend the Tolling Period through June 30, 2011 and adopt the agreements made in the April 20, 2011 meeting. Under the Tolling Agreement (Rev. 1), Denison agreed to submit a Revised Phase 1 (A through C) Work Plan on or before May 6, 2011 and a Revised Phase 2 through 5 Work Plan and Schedule on or before June 3, 2011.

Pursuant to the Tolling Agreement (Rev. 1), Denison submitted a May 6, 2011 Revised Phase 1 Work Plan and Schedule for the Phase 1 A - C investigation prepared by INTERA, for Executive Secretary review. On May 11, 2011, the DRC: 1) provided via email, comments on the May 6, 2011 INTERA document, and requested that Denison resolve all DRC comments before initiation of field activities. All comments were resolved, and Denison conducted field and laboratory work for the Phase l A-C study in May and June, 2011.

Pursuant to the Tolling Agreement (Rev. 1), Denison submitted a June 3, 2011 Revised Phase 2 through 5 Work Plan and Schedule (Phase 2 - 5 Work Plan), prepared by INTERA, for Executive Secretary review. In a letter dated June 23, 2011 DRC provided comments on this Denison document in the form of a URS memorandum, dated June 23, 2011 and advised Denison that in order to revise the 2009 SCA to incorporate the deliverables and timelines set out in an

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approvable Phase 2 through 5 Work Plan, it would be necessary to provide a level of detail in revisions of that Work Plan for Phases 2, 3, 4, and 5 comparable to the level of detail for Phase 1 contained in Attachment 1 of the Tolling Agreement (Rev. 1).

On June 30, 2011, Denison and the Executive Secretary entered into a Revised Tolling Agreement [Tolling Agreement (Rev. 2)] to extend the Tolling Period to August 31, 2011, in order to facilitate the revision of the Phase 2 through 5 Work Plan to provide the level of detail required to construct a replacement SCA. Pursuant to the Tolling Agreement (Rev.2), Denison submitted a separate July 1, 2011 detailed Work Plan and Quality Assurance Plan ("QAP") for the Phase 2 investigation (Phase 2 Plan, Revision 0). Executive Secretary comments on this document were provided in a July 7, 2011 DRC letter. Denison provided a revised July 12, 2011 Phase 2 QAP and Work Plan (Phase 2, Revision 1.0), which DRC conditionally approved in a letter dated July 18, 2011.

On August 1 and 2, 2011 Denison submitted by email preliminary laboratory results for the Phase l A-C study to the Executive Secretary.

On August 4, 2011, Denison provided a revision to the Phase 2 - 5 Work Plan (Phase 2-5 Work Plan, Revision 1.0), prepared by INTERA, for Executive Secretary review. DRC comments on the Phase 2-5 Work Plan, Revision 1.0 and on the August 1, 2011 preliminary laboratory results for the Phase l A-C study, were provided to Denison on August 11, 2011 as part of a conference call, and a DRC email, which included an August 11, 2011 URS memorandum. Under a cover letter dated August 18, 2011, Denison submitted a revised Phase 2-5 Work Plan (Phase 2-5 Work Plan, Revision 2.0) for Executive Secretary review, in response to the comments provided to Denison on August 11, 2011.

As discussed in the following Sections, DRC and Denison have agreed to proceed with corrective action.

In an August 25, 2011 DRC letter, the Executive Secretary advised that per review of the Phase 2-5 Work Plan, Revision 2.0, the Executive Secretary has determined that a finalized Plan and Schedule, that meets the satisfaction of the Executive Secretary, and which would allow the preparation of a replacement SCA, is not possible at this time; and that the development of a replacement SCA for continued contaminant investigation activities is not supported.

At a meeting between Denison and DRC on August 29, 2011 to discuss the Executive Secretary's August 25, 2011 findings related to the Phase 2-5 Work Plan Rev. 2.0, the preliminary laboratory results for the Phase I A-C study, and the approach forward, Denison and DRC agreed that:

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1. After more than two years of investigation it has been determined that there are site conditions that make it difficult to determine the source(s) of the contamination at the White Mesa site;
2. As a result, resources will be better spent in developing a CAP in accordance with UAC R317-6-6.15(D), rather than continuing with further investigations as to the source(s) of the contamination.

During discussion throughout October 2011, Denison and the Executive Secretary acknowledged that it has not been possible to date to determine the source(s), cause(s), attribution, magnitudes of contribution, and proportion(s) of the local nitrate and chloride in groundwater, and thereby cannot eliminate Mill activities as a potential cause, either in full or in part, of the contamination. As a result, Denison and the Executive Secretary agreed that resources will be better spent in developing a CAP in accordance with UAC R317-6-6.15(D), rather than continuing with further investigations as to the source(s) and attribution of the groundwater contamination.

2.2 Conclusions from the Contamination Investigation

The contamination investigation program from 2009 to 2011 has provided a basis for development of a CAP. Specifically the investigation has determined:

- the areal and spatial extent of the plume,
- that the plume does not appear to be increasing in size or concentration,
- that there are no known unaddressed current or ongoing sources of contamination.

As discussed above, a number of potential mill and non-mill sources were identified in (INTERA (2009a), and INTERA (2011) Based on the investigation and source evaluations, there are no known current unidentified or unaddressed sources. There appear to have been a number of known and potential historic sources; however, it has not been possible to confirm or quantify the contribution of each.

Deleted: the December 2009 Source Review Report for Nitrate and Chloride in Groundwater at the Mill

Deleted: in the subsequent August 2011 Nitrate Investigation Revised Phases 2 through 5 Work Plan.

Analytical results indicate that neither the average concentration of the plume nor the areal extent of the plume have increased during the monitored period. The only potential current source identified and potentially requiring control is the ammonium sulfate tanks. This potential source is addressed in Phase I of the CAP, discussed in Sections 3.2.1 and 7.1 below.

The Executive Secretary determined that a CAP is required at the White Mesa facility, pursuant to UAC R317-6-6.15(C)(I) and Denison agreed to develop, secure Executive Secretary approval, and implement a CAP. The Executive Secretary has therefore determined, and Denison agreed to

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submit a CAP, pursuant to the requirements of the Utah Ground Water Quality Protection Rules [UAC R317 -6-6.15(C - E)].

The purpose of Phase I of this CAP is to remedy the effects of the ammonium sulfate tank potential source. The purpose of each of the proposed phases of this CAP is discussed further in section 3.2.

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3. FRAMEWORK AND OBJECTIVES OF THE CAP

Applicable regulations and requirements governing the CAP, and preliminary milestones are discussed in Sections 3.1 through 3.3.

3.1 Applicable Regulations and Requirements

Denison agreed to submit a CAP for Executive Secretary review and approval, on or before November 30, 2011 that meets the CAP related requirements of UAC R317-6-6.15 (D.2, 3 and E). This document constitutes the "Nitrate CAP".

The remaining sections of this CAP are intended to demonstrate, per the requirements in UAC R317 -6-6.15(D)(2) and (3), that:

- the proposed action(s) are protective of public health and the environment, including consideration of future impacts of the nitrate plume on land and water resources not owned and controlled by Denison.
- the corrective action meets the State Ground Water Quality Standards, pursuant to UAC R317 -6-6.15(F). Alternatively, Denison may petition the Utah Water Quality Board for approval of an Alternate Corrective Action Concentration Limit as part of the CAP, Phase III, pursuant to UAC R317 -6-6.15(G).
- the action will produce a permanent effect.

Per UAC R317 -6-6.15(D)(2) and (3) the action proposed in the CAP is required to meet any other additional measure required by the Executive Secretary under UAC R317 -6-6.15(E)(5).

Denison has agreed with the Executive Secretary that these additional measures shall include, but are not limited to:

- Remediation guidance found in the April, 2004 EPA Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (EPA530-R-04-030) or equivalent, to the extent applicable, as determined by the Executive Secretary;
- Determination of corrective action performance standards, objectives, and criteria for groundwater remediation system design, construction, operations and/or maintenance, as approved by the Executive Secretary in accordance with applicable regulations;
- Determination of long term operation, maintenance, system performance and groundwater quality monitoring requirements to evaluate effectiveness of the approved corrective action(s), at a frequency, and by methods approved by the Executive Secretary;
- Submittal of written quarterly Denison reports of pumping and monitoring well system performance and groundwater quality monitoring information for Executive Secretary review and approval. In the event that additional information is required of any report, Denison shall respond to and provide a Plan and Schedule for Executive Secretary

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approval to resolve all issues /concerns within 30 calendar days of receipt of written Executive Secretary notice;

- Timely Denison verbal and written notification of process or equipment failures, and corrective actions taken, or a timely schedule by which corrective action will be taken to return the facility to full compliance with CAP performance standards, objectives, and criteria; and
- Periodic Denison review, summation, and report submittal, for Executive Secretary approval, to demonstrate if the approved corrective action is protective of public health and the environment. The interval of said report period shall not exceed five (5) years.

3.2 Objectives of the CAP

The objectives of the CAP are the following:

- Minimize or prevent further downgradient migration of the perched nitrate plume (Figure 1-2) by a combination of pumping and reliance on natural attenuation,
- Prevent nitrate concentrations exceeding the action level from migrating to any potential point of exposure,
- Monitor to track changes in concentrations within the plume and to establish whether the plume boundaries are expanding, contracting, or stable,
- Provide contingency plans to address potential continued expansion of the plume and the need for additional monitoring and/or pumping points, and
- Ultimately reduce nitrate concentrations at all monitoring locations to the action level or below.

To achieve these objectives, the CAP proposes a phased approach.

3.2.1 Summary of Phase I Objectives and Scope

Per Section 11A(1) of the SCA, Phase I is required to include a control for the soil contamination observed at the ammonium sulfate tanks, a potential source of perched groundwater contamination. Pursuant to UAC 317-6-6.15 (E)(4)(b) this control will include at a minimum:

Determination, to the satisfaction of the Executive Secretary, of the physical extent of the soil contamination observed at the ammonium sulfate tanks near borings GP-25B (Nitrate + Nitrite (as N) 1,530 mg/kg-dry at depth of 6 feet) and GP-26B (Ammonia (as N) 1,590 mg/kg-dry at a depth of 16 feet) that were part of the nitrate investigation. Such effort shall include an estimate of the volume (the "Contaminated Soil Volume") of the contaminated soils down to but not including bedrock, and an estimate of the surface area (the "Contaminated Surface Area") at or above the estimated location of the Contaminated Soil Volume; and either a Plan and Schedule,

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to be submitted on or before January 1, 2012, for Executive Secretary approval, to cover the Contaminated Surface Area with at least six inches of concrete, to the extent not already covered by concrete or existing buildings, to prevent infiltration of surface water into the contaminated soils; and/or a Plan and Schedule, to be submitted on or before January 1, 2012, for Executive Secretary approval, to remove the Contaminated Soil Volume and dispose of the contaminated soils in the Mill's tailings impoundments. If Denison chooses to cover the Contaminated Surface Area with concrete, Denison must remove the Contaminated Soil Volume at a later date prior to site closeout and must submit a revised surety estimate on or before March 4, 2012 to include future costs to remove the Contaminated Soil Volume.

As discussed in Section 7.1 of this CAP, Denison proposes to construct a sloped and drained concrete pad of six inches in depth over an area covering the lateral extent of contamination to be determined as discussed in Section 7.1. Denison also proposes a future removal of contaminated soil at the time of Mill site reclamation and, for conservatism, proposes to revise the reclamation surety estimate to include a volume of soil to be removed and placed in the tailings area of twice the volume of contaminated soil identified in the contamination investigation. Further details are discussed in Section 7.1, below.

3.2.2 Summary of Phase II Objectives and Scope

Per Section 11A(2) of the SCA, Phase II is to include near term active remediation of the nitrate contamination by pumping contaminated water into the Mill's tailings cells for disposal. Said phase shall also include: 1) the development, implementation, operation, and monitoring requirements for a pumping well network designed to contain and hydraulically control the nitrate groundwater plume to maintain concentrations at or below the Utah Groundwater Quality Standard (10 mg/L), i.e., prevent physical expansion of said plume, and 2) monitoring of chloride concentrations.

Phase II constitutes an interim remedial action that consists of a combination of “active” and “passive” strategies. The active strategy consists of removing nitrate mass as rapidly as practical by pumping areas within the plume that have high nitrate concentrations and relatively high productivity. Continued monitoring within and outside the plume is considered part of the active strategy. The passive strategy consists of relying on natural attenuation processes to reduce nitrate concentrations. Reductions in concentrations would be achieved by physical processes such as hydrodynamic dispersion, and dilution via mixing with recharge and waters outside the plume.

Natural attenuation is expected to reduce nitrate concentrations within the entire plume. However, within upgradient portions of the plume that have the highest concentrations, direct

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mass removal via pumping will be the primary means to reduce concentrations. In downgradient portions of the plume where concentrations are lower, natural attenuation will be a more important mechanism in reducing concentrations.

3.2.3 Summary of Phase III Objectives and Scope

Per the SCA, Phase III, if necessary is to include a comprehensive long term solution for the nitrate groundwater contamination at the Mill Site. This phase will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

The CAP is not intended to address contamination located outside the Mill's restricted area and that is not contiguous with groundwater contamination inside the Mill's restricted area. The CAP will therefore evaluate which of the existing monitoring wells will be maintained and which wells (including certain upgradient and off-site wells) can be abandoned, subject to prior Executive Secretary approval.

It should be noted that while Phase II of the CAP requires monitoring of chloride concentrations, the CAP does not explicitly identify measures for controlling chloride levels per se, because there is no health standard for chloride in groundwater. However, as discussed and agreed to with DRC during meetings in October 2011, chloride appears to be co-located with nitrate in groundwater at the Mill and hydrogeological measures to contain nitrate will also contain chloride.

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3.3 Preliminary Milestones for the CAP

Per the SCA, Denison has committed to the following milestones for corrective action. Dates for the following milestones will be established based on the date of the Executive Secretary's approval of the CAP and issuance of a Consent Order approving the CAP.

- Within 30 calendar days of the Executive Secretary's approval of the CAP, pursuant to UAC R317-6-6.15(E), Denison shall commence implementation and execution of all corrective actions required under a future Consent Order to be issued by the Executive Secretary that addressed the approved CAP. A proposed schedule for implementation of the CAP is included as Table 1 to this CAP.
- Within 60 calendar days of the Executive Secretary's issuance of a future Consent Order regarding the approved CAP, pursuant to UAC R317-6-6.15(E), Denison will submit a revised Reclamation Plan and financial surety cost estimate (Revised Surety), for Executive Secretary review and approval which addresses the groundwater corrective action, with the surety sufficient to recover the anticipated cost and time frame for achieving compliance, before the land is transferred to the federal government for long-term custody. At a minimum, the Denison surety will provide for all costs for Phases I and II of the approved CAP for a period of time until Executive Secretary approval of Phase III of the CAP to restore groundwater to the established site specific groundwater cleanup standards pursuant to UAC R317-6-6.15 before the site is transferred to the federal government for long term custody.

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4. BACKGROUND

Sections 3.1 through 3.4 provide a brief description of site hydrogeology that is based primarily on TITAN (1994), but includes the results of more recent site investigations. Section 3.5 discusses the occurrence of nitrate in the perched water at the site and focuses on the nitrate plume shown in Figure 1-2.

4.1 Geologic Setting

The Mill is located within the Blanding Basin of the Colorado Plateau physiographic province. Typical of large portions of the Colorado Plateau province, the rocks underlying the site are relatively undeformed. The average elevation of the site is approximately 5,600 feet above mean sea level ("ft amsl").

The site is underlain by unconsolidated alluvium and indurated sedimentary rocks consisting primarily of sandstone and shale. The indurated rocks are relatively flat lying with dips generally less than 3º. The alluvial materials consist mostly of aeolian silts and fine-grained aeolian sands with a thickness varying from a few feet to as much as 25 to 30 feet across the site. The alluvium is underlain by the Dakota Sandstone and Burro Canyon Formation, which are sandstones having a total thickness ranging from approximately 100 to 140 feet. In portions of the site, a few feet to as much as about 30 feet of Mancos Shale lies between the alluvium and the Dakota Sandstone.

Beneath the Burro Canyon Formation lies the Morrison Formation, consisting, in descending order, of the Brushy Basin Member, the Westwater Canyon Member, the Recapture Member, and the Salt Wash Member. Figure 2 is a photograph of the contact between the Burro Canyon Formation and the underlying Brushy Basin Member taken from a location along highway 95 immediately north of the Mill. This photograph illustrates the transition from the cliff-forming sandstone of the Burro Canyon Formation to the slope-forming Brushy Basin Member.

The Brushy Basin and Recapture Members of the Morrison Formation, classified as shales, are very fine-grained and have a very low hydraulic conductivity. The Brushy Basin Member is primarily composed of bentonitic mudstones, siltstones, and claystones. The Westwater Canyon and Salt Wash Members also have a low average vertical hydraulic conductivity due to the presence of interbedded shales.

Beneath the Morrison Formation lie the Summerville Formation, an argillaceous sandstone with interbedded shales, and the Entrada Sandstone. Beneath the Entrada lies the Navajo Sandstone. The Navajo and Entrada Sandstones constitute the primary aquifer in the area of the site. The Entrada and Navajo Sandstones are separated from the Burro Canyon Formation by

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approximately 1,000 to 1,100 feet of materials having a low average vertical hydraulic conductivity. Groundwater within this system is under artesian pressure in the vicinity of the site, is of generally good quality, and is used as a secondary source of water at the site.

4.2 Hydrogeologic Setting

The site is located within a region that has a dry to arid continental climate, with an average annual precipitation of approximately 13.3 inches, and an average annual lake evaporation rate of approximately 47.6 inches. Recharge to the principal aquifers occurs mainly along the mountain fronts (for example, the Henry, Abajo, and La Sal Mountains), and along the flanks of folds such as Comb Ridge Monocline.

Although the water quality and productivity of the Navajo/Entrada aquifer are generally good, the depth of the aquifer (approximately 1,200 feet below land surface [ft bls]) makes access difficult. The Navajo/Entrada aquifer is capable of yielding significant quantities of water to wells (hundreds of gallons per minute ["gpm"]). Water in wells completed across these units at the site rises approximately 800 feet above the base of the overlying Summerville Formation.

Perched groundwater in the Dakota Sandstone and Burro Canyon Formation originates mainly from precipitation and local recharge sources such as unlined reservoirs (Kirby, 2008) and is used on a limited basis to the north (upgradient) of the site because it is more easily accessible than the Navajo/Entrada aquifer. Water quality of the Dakota Sandstone and Burro Canyon Formation is generally poor due to high total dissolved solids ("TDS"). The saturated thickness of the perched water zone is generally higher to the north of the site.

4.3 Perched Zone Hydrogeology

Perched groundwater beneath the site occurs primarily within the Burro Canyon Formation. Perched groundwater at the site has a generally low quality due to high total TDS in the range of approximately 1,100 to 7,900 milligrams per liter ("mg/L"), and is used primarily for stock watering and irrigation in the areas upgradient (north) of the site where generally higher saturated thicknesses increase well yields. Perched water is supported within the Burro Canyon Formation by the underlying, fine-grained Brushy Basin Member. Figure 3 is a contour map showing the approximate elevation of the contact of the Burro Canyon Formation with the Brushy Basin Member, which essentially forms the base of the perched water zone at the site.

Contact elevations between the Burro Canyon Formation and Brushy Basin Member in Figure 3 are based on perched monitoring well drilling and geophysical logs and surveyed land surface elevations. As indicated, the Burro Canyon Formation/Brushy Basin Member contact (although

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irregular because it represents an erosional surface) generally dips to the south/southwest beneath the site.

Appendix A contains hydrogeologic cross-sections that intersect within the nitrate plume. These cross-sections show the site lithology above the Brushy Basin Member, perched water within the Dakota Sandstone/Burro Canyon Formation, and the occurrence of nitrate within the perched water. As shown in Figure A.2, relatively thick conglomeratic intervals exist within the saturated zone at MW-31, located at the downgradient edge of the nitrate plume. As discussed below, these intervals appear to pinch out to the south (downgradient) and to the west (cross-gradient) of MW-31.

Less conglomeratic material is present in the saturated zone at MW-30 and MW-3A than at MW-31, as shown in the attached lithologic logs (Appendix B). Thin conglomeratic zones (approximately 1-2 feet thick) occur at the base of the perched zone in MW-31 and MW-3A. Detailed lithologic logs for MW-5, MW-11, MW-14 and MW-15 are not available to assess the presence of conglomeratic material at those locations. However, saturated conglomeratic materials were not encountered at MW-34 and MW-37 (located adjacent to MW-15), as shown in the attached lithologic logs.

Based on the available information, significant conglomeratic horizons within the saturated perched zone do not appear to exist at or downgradient of MW-30. Furthermore, hydraulic test data from MW-30 and MW-31 indicate that the conglomeratic zones in MW-31 do not enhance the conductivity at MW-31. The hydraulic conductivity estimates (based on Kansas Geological Survey ("KGS") solution analysis of automatically logged slug test data) for MW-30 and MW-31 are similar. The hydraulic conductivity estimates for MW-30 and MW-31, respectively, are 1 x 10^{-4} cm/s and 7 x 10^{-5} cm/s (HGC, 2005).

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4.3.1 Lithologic and Hydraulic Properties

Although the Dakota Sandstone and Burro Canyon Formations are often described as a single unit due to their similarity, previous investigators at the site have distinguished between them. The Dakota Sandstone is a relatively hard to hard, generally fine-to-medium grained sandstone cemented by kaolinite clays. The Dakota Sandstone locally contains discontinuous interbeds of siltstone, shale, and conglomeratic materials. Porosity is primarily intergranular. The underlying Burro Canyon Formation hosts most of the perched groundwater at the site. The Burro Canyon Formation is similar to the Dakota Sandstone but is generally more poorly sorted, contains more conglomeratic materials, and becomes argillaceous near its contact with the underlying Brushy Basin Member. The hydraulic conductivities of the Dakota Sandstone and Burro Canyon Formation at the site are generally low.

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No significant joints or fractures within the Dakota Sandstone or Burro Canyon Formation have been documented in any wells or borings installed across the site (Knight-Piésold, 1998). Any fractures observed in cores collected from site borings are typically cemented, showing no open space.

4.3.1.1 Dakota

Porosities of the Dakota Sandstone range from 13.4% to 26%, averaging 20%, and water saturations range from 3.7% to 27.2%, averaging 13.5%, based on samples collected during installation of wells MW-16 (abandoned) and MW-17 (Figure 1-2). The average volumetric water content is approximately 3%. The hydraulic conductivity of the Dakota Sandstone based on packer tests in borings installed at the site ranges from approximately 2.7 x 10^{-6} centimeters per second ("cm/s") to 9.1 x 10^{-4} cm/s, with a geometric average of 3.9 x 10^{-5} cm/s.

4.3.1.2 Burro Canyon

The average porosity of the Burro Canyon Formation is similar to that of the Dakota Sandstone. Porosity ranges from 2% to 29.1%, averaging 18.3%, and water saturations of unsaturated materials range from 0.6% to 77.2%, averaging 23.4%, based on samples collected from the Burro Canyon Formation at MW-16 (abandoned), located beneath new tailings Cell #4A. TITAN (1994) reported that the hydraulic conductivity of the Burro Canyon Formation ranges from 1.9 x 10^{-7} to 1.6 x 10^{-3} cm/s, with a geometric mean of 1.1 x 10^{-5} cm/s, based on the results of 12 pumping/recovery tests performed in monitoring wells and 30 packer tests performed in borings prior to 1994. Subsequent hydraulic testing of perched zone wells has yielded a range of 2 x 10^{-7} to 0.01 cm/s (HGC, 2009a).

In general, the highest hydraulic conductivities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher conductivity zone that is associated with the chloroform plume (HGC, 2007b) has been inferred to exist in this portion of the site. Analysis of drawdown data collected from this zone during long-term pumping of MW-4, MW-26, and TW4-19 (Figure 1-2) yielded estimates of hydraulic conductivity ranging from 4 x 10^{-5} to 1 x 10^{-3} cm/s (HGC, 2004). The decrease in perched zone hydraulic conductivity south to southwest of this area indicates that this higher conductivity zone "pinches out" (HGC, 2007b).

Hydraulic conductivities downgradient of the tailings cells are generally low. Hydraulic tests at wells located at the downgradient edge of the cells, and south and southwest of the cells yielded geometric average hydraulic conductivities of 2.3 x 10^{-5} and 4.3 x 10^{-5} cm/s depending on the testing and analytical methods. The low hydraulic conductivities and shallow hydraulic gradients

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downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site (approximately 1.7 ft/yr to 3.2 ft/yr based on calculations presented in HGC, 2009a).

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of slug tests at wells MW-27, MW-30, MW-31, TW4-20, TW4-21, TW4-22, TW4-24, TW-25, TWN-1, TWN-2, TWN-3, and TWN-18 (HGC, 2005 and HGC, 2009a). The hydraulic conductivity at MW-11 was based on a pumping test reported by UMETCO (1993) and the hydraulic conductivity at TW4-19 was based on long-term pumping of that well for chloroform removal (HGC, 2004). Hydraulic conductivity estimates range from approximately 2.7 x 10^{-5} to 1.4 x 10^{-3} cm/s, and have a geometric average of 1.2 x 10^{-4} cm/s, assuming unconfined conditions (Table 2). The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

4.3.2 Perched Groundwater Flow

Perched groundwater flow at the site has historically been to the south/southwest (HGC, 2007b). Figure 4 is a perched groundwater elevation contour map for the third quarter of 2011. These contours are based on water levels measured in the perched groundwater monitoring wells shown in the figure. Local depression of the perched water table occurs near wells MW-4, TW4-4, TW4-19, TW4-20, and MW-26. These wells are pumped to reduce chloroform mass in the perched zone east and northeast of the tailings cells as discussed in HGC (2007a).

Perched water mounds are associated with wildlife ponds on the east side of the site. The mounds are likely the result of seepage from the unlined ponds. An apparent perched water mound also exists in the vicinity of TWN-2 just north of the Mill site. The apparent perched water mound near TWN-2 is likely a residual mound resulting from low conductivity conditions (Table 2) and the location of TWN-2 within the footprint of the historical pond (Figure 8). Although the historical pond no longer exists and does not contain standing water, the remaining topographic depression associated with the pond likely resulted in enhanced infiltration of precipitation before re-grading of the land surface in that area, circa 1980. Slightly enhanced infiltration of precipitation and low conductivity conditions at TWN-2 likely allowed the mound to persist. The decay of the mound is expected to be slow because of the low conductivity.

A dry area to the southwest of Cell 4B is defined by the area where the kriged Brushy Basin contact elevation rises above the kriged perched water level elevation. The lateral extent of the dry area shown in Figure 4 is currently under investigation. The installation of wells along the southern and western margins of Cell 4B in August, 2010 and April, 2011 indicate that the dry

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zone extends at least from the southwest central portion of Cell 4B to the southwest corner of Cell 4B.

Beneath and downgradient of the tailings cells, on the west side of the site, perched water flow is south-southwest to southwest. On the eastern side of the site perched water flow is more southerly. Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). Perched zone hydraulic gradients currently range from a maximum of approximately 0.07 ft/ft east of tailings Cell #2 (near well TW4-14) to approximately 0.01 ft/ft downgradient of the tailings cells. Gradients may be steeper locally near pumping wells (for example near TW4-20, where the gradient reaches approximately 0.09 ft/ft)

Perched water discharges in springs and seeps along Westwater Creek Canyon and Cottonwood Canyon to the west-southwest of the site, and along Corral Canyon to the east of the site, (Figure 1-1) where the Burro Canyon Formation outcrops. The closest discharge points downgradient of the tailings cells are Westwater Seep (more than 2,000 feet downgradient) and Ruin Spring (more than 9,000 feet downgradient [HGC, 2010]).

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4.3.3 Saturated Thickness

The saturated thickness of the perched zone as of the third quarter of 2011 ranges from approximately 92 feet in the northeastern portion of the site to less than 5 feet in the southwest portion of the site (Figure 5). A saturated thickness of approximately 2 feet occurs in well MW-34 along the south dike of new tailings Cell 4B, and the perched zone is apparently dry at MW-33 located at the southwest corner of Cell 4B. Depths to water range from approximately 17 to 18 feet in the northeastern portion of the site (near the wildlife ponds) to approximately 114 feet at the southwest margin of tailings Cell #3 (Figure 6). The relatively large saturated thicknesses in the northeastern portion of the site are likely related to seepage from the wildlife ponds located northeast and east of the tailings cells.

Although sustainable yields of as much as 4 gpm have been achieved in wells intercepting the larger saturated thicknesses and higher conductivity zones in the northeast portion of the site, perched zone well yields are typically low (<0.5 gpm) due to the generally low hydraulic conductivity of the perched zone. Sufficient productivity can generally be obtained only in areas where the saturated thickness is greater, which is the primary reason that the perched zone has been used on a limited basis as a water supply to the north (upgradient) of the site, but has not been used downgradient of the site.

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4.4 Summary

Perched groundwater at the site is hosted primarily by the Burro Canyon Formation, which consists of a relatively hard to hard, fine- to medium-grained sandstone containing siltstone, shale and conglomeratic materials. The Burro Canyon Formation is separated from the underlying regional Navajo/Entrada aquifer by approximately 1,000 to 1,100 feet of Morrison Formation and Summerville Formation materials having a low average vertical hydraulic conductivity. The Brushy Basin Member of the Morrison Formation is a bentonitic shale that lies immediately beneath the Burro Canyon Formation and forms the base of the perched water zone at the site. Figure 2 is a photograph of the contact between the Burro Canyon Formation and the underlying Brushy Basin Member taken from a location along highway 95 immediately north of the Mill. This photograph illustrates the transition from the cliff-forming sandstone of the Burro Canyon Formation to the slope-forming Brushy Basin Member. Based on hydraulic tests at perched zone monitoring wells, the hydraulic conductivity of the perched zone ranges from approximately 2×10^{-7} to 0.01 cm/s.

Perched water flow is generally from northeast to southwest across the site. Beneath and downgradient of the tailings cells, on the west side of the site, perched water flow is south-southwest to southwest. On the eastern side of the site perched water flow is more southerly. Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). Perched water generally has a low quality, with total dissolved solids ranging from approximately 1,100 to 7,900 mg/L, and is used primarily for stock watering and irrigation north (upgradient) of the site.

Depths to perched water range from approximately 17 to 18 feet near the wildlife ponds in the northeastern portion of the site to approximately 114 feet at the southwestern margin of tailings Cell #3. Saturated thicknesses range from approximately 92 feet near the wildlife ponds to less than 5 feet in the southwest portion of the site, downgradient of the tailings cells. A saturated thickness of approximately 2 feet occurs in well MW-34 along the south dike of new tailings Cell 4B, and the perched zone is apparently dry at MW-33 located at the southwest corner of Cell 4B. Although sustainable yields of as much as 4 gpm have been achieved in wells penetrating higher transmissivity zones, well yields are typically low (<0.5 gpm) due to the generally low hydraulic conductivity of the perched zone.

Hydraulic testing of perched zone wells has yielded a range of approximately 2×10^{-7} to 0.01 cm/s. In general, the highest hydraulic conductivities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher hydraulic conductivity zone associated with the chloroform plume has been inferred to exist in this portion of the site. Analysis of drawdown data collected from this zone

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during long-term pumping of MW-4, TW4-19, and MW-26 (TW4-15) yielded estimates of hydraulic conductivity ranging from 4 x 10^{-5} to 1 x 10^{-3} cm/s.

Hydraulic conductivities downgradient of the tailings cells are generally low. Hydraulic tests at wells located at the downgradient edge of the cells, and south and southwest of the cells yielded geometric average hydraulic conductivities of 2.3 x 10^{-5} and 4.3 x 10^{-5} cm/s depending on the testing and analytical method. The low hydraulic conductivities and shallow hydraulic gradients downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site.

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of hydraulic tests as discussed in Section 4.3. Hydraulic conductivity estimates ranged from approximately 2.7 x 10^{-5} to 1.4 x 10^{-3} cm/s, and have a geometric average of 1.2 x 10^{-4} cm/s, assuming unconfined conditions. The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

4.5 Nitrate Occurrence

Nitrate within the area shown in Figure 1-2 was first detected in wells TW4-19, TW4-22, TW4-24, and TW4-25 that were installed as part of the investigation of a chloroform plume first discovered at perched well MW-4 in 1999. Investigation of nitrate has included the installation of 19 temporary (TWN-series) perched zone nitrate monitoring wells to delineate and monitor the nitrate (Figure 1-2). The extent of nitrate contamination is described below and in further detail in Section 5.1 and its associated figures.

Nitrate concentrations in the perched zone as of the third quarter of 2011 are shown in Figure 7. Nitrate concentrations in the perched zone have ranged from non-detect to a maximum of 69 µg/L at well TWN-2 in the second and third quarters of 2010. Nitrate concentrations at downgradient wells MW-30 and MW-31 have been relatively stable, ranging from 15 to 17 mg/L at MW-30 and from 20 to 22 mg/L at MW-31 between the first quarter of 2010 through the third quarter of 2011.

Constituents associated with the nitrate include chloride, and in the east-central portion of the plume, chloroform. The association of nitrate with chloroform is discussed in HGC, 2007b.

4.5.1 Source Areas

As discussed above, a number of potential Mill and non-Mill sources were identified in INTERA (2009a), and INTERA (2011), as listed below:

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1. Main leach field (also known as leach field east of scale house, 1985 to present)
2. Sewage vault/lift station (currently active)
3. Scale house leach field, (also known as leach field south of scale house, 1977-1979)
4. Former office leach field
5. Ammonia tanks
6. SAG leach field (leach field north of Mill building, 1998 to 2009)
7. Cell 1 leach field (leach field east of Cell #1, up to 1985)
8. Fly Ash Pond
9. Sodium chlorate tanks (as a potential chloride source)
10. Ammonium sulfate crystal tanks
11. Lawzy sump
12. Lawzy Lake
13. Former vault/lift station (to former office leach field, 1992 to 2009)
14. Truck shop leach field (1979-1985)
15. New Counter Current Decant/Solvent Extraction ("CCD/SX") leach field (currently active)
16. Historical Pond
17. Wildlife pond
18. CCD (included inadvertently and eliminated)
19. YC Precip Mini-Lab
20. V2O5 Mini-Lab & V2O5 Precip
21. SX Mini-Lab
22. Chem Lab
23. Met Lab
24. V2O5 oxidation tanks
25. Natural nitrate reservoir
26. – 32. Seven other ponds or pond-like sources

Figure 8 shows the locations of potential source areas 1 through 24.

Based on the investigation and source evaluations completed to date, there are no known current unidentified or unaddressed ongoing sources. There appear to have been a number of known and potential historic sources; however, it has not been possible to confirm or quantify the contribution of each. Soil contamination associated with the ammonium sulfate tanks as a potential source to perched groundwater is addressed as Phase I of this CAP.

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Although the actual source or sources have not been identified and quantified, based on analysis of the concentrations within and the areal extent of the plume over the past two years, Denison and DRC have concluded there is no known significant unaddressed currently active source. That is, analytical results indicate that neither the average concentration within the plume nor the areal extent of the plume has increased during the period it has been monitored. Therefore, although the source or sources have not been definitively determined, sufficient information exists to bound and characterize the plume and plan remedial actions for its control.

4.5.2 Nitrate Concentration Trends

Table 3 provides nitrate concentrations detected at wells within the nitrate plume from the first quarter, 2010 through the third quarter of 2011. Over the last year (between the third quarter, 2010 and third quarter, 2011) three wells decreased in concentration, three increased, and three remained the same. The well with the highest concentrations, TWN-2, decreased from 69 mg/L to 33 mg/L. The average nitrate concentration within the plume decreased from 24.4 mg/L to 19.7 mg/L. At the downgradient edge of the plume, monitor wells MW-30 and MW-31 have been sampled since June 2005. During the period from June 2005 to December 2011, samples from MW-30 have had an average nitrate concentration of 16 mg/L with a standard deviation of 1.4 mg/L (Figure 9-1). During the same period, samples from MW-31 have had an average nitrate concentration of 22 mg/L with a standard deviation of 2.7 mg/L (Figure 9-1). Thus, the downgradient edge of the plume has been relatively stable over a six and one half year period.

The information presented above indicates that concentrations within the plume are relatively stable but the highest concentrations appear to be declining. Figure 9-2 compares the extent of the nitrate plumes in the third quarter of 2010 and the third quarter of 2011. As indicated, the plume boundaries are relatively stable, likely the result of the generally low hydraulic conductivity of the perched zone, and the ongoing pumping related to the chloroform plume.

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5. CHARACTERIZATION OF STUDY AREA

The study area encompasses a region in the northeastern portion of the site where the nitrate plume (defined by concentrations > 10 mg/L) has been detected and bounded by a series of nitrate and chloroform investigation wells (Figure 1-2). Wells within the plume are MW-30 and MW-31, and temporary wells TW4-19, TW4-21, TW4-22, TW4-24, TW4-25, TWN-2 and TWN-3 (Figure 7). Wells MW-5, MW-11, MW-25, MW-26, MW-27, MW-28, MW-29, MW-32, TW4-16, TW4-18, TWN-1, TWN-4, TWN-7, and TWN-18 bound the plume. As of the second quarter of 2011, MW-5, MW-11, MW-25, MW-29, and MW-32 were non-detect for nitrate. Hydraulic characterization of the study area has been based on data collected from wells within and near the plume as discussed in Section 4. The extent and hydrogeology of the study area is discussed below.

5.1 Extent of Study Area

The nitrate plume that is the focus of this CAP is confined to the region of the perched zone containing nitrate concentrations exceeding 10 mg/L located south of TWN-18 and north of MW-11. The area having nitrate exceeding 10 mg/L, as of the third quarter of 2011, is shown in Figures 1-2 and 7. This area extends from the northeast portion of the tailings cells to the area upgradient (north-northeast) of the tailings cells. The highest nitrate concentrations have historically been detected at TWN-2, within the northern (upgradient) portion of the plume. TWN-2 is located within the area of the historical pond (Figure 8).

The historical pond was active as far back as the 1920s, as much as 60 years prior to the establishment of the White Mesa Mill. Satellite photos taken over the years and dating back to the 1950s indicate that the historical pond was one of the major agricultural/livestock ponds in the area and typically contained water. Records or information have not been obtained to evidence the actual uses of the pond over the years.

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Areas of detectable nitrate that are not continuous with the above defined area exist to the northwest (near TWN-9 and TWN-17) and to the east-southeast associated with the chloroform plume. Nitrate concentrations within these areas are typically less than 10 mg/L although sporadic detections at or slightly above 10 mg/L have occurred at some locations. Areas to the northeast are not a target of this CAP, and nitrate associated with the chloroform plume is addressed by the ongoing chloroform pumping.

The nitrate plume, as defined by the 10 mg/L concentration boundary, is bounded by wells MW-5, MW-11, MW-25, MW-26, MW-27, MW-28, MW-29, MW-32, TW4-16, TW4-18, TWN-1, TWN-4, TWN-7, and TWN-18. As of the second quarter of 2011, MW-5, MW-11, MW-25,

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MW-29, and MW-32 were non-detect for nitrate. The plume is bounded to the south by MW-5 and MW-11, to the east by MW-27, MW-28, MW-29 and TWN-7, to the north by TWN-18, and to the west by MW-25, MW-26, MW-32, TWN-1, TWN-4, TW4-18, TW4-16, and TW4-20. Additional wells to the south (downgradient) of the plume include MW-3, MW-14, MW-15 and MW-37.

5.2 Hydrogeology

A description of the hydrogeology of the site in the vicinity of the nitrate plume is provided in Section 3, and hydrogeologic cross-sections are provided in Appendix A. Perched zone hydraulic conductivities in the vicinity of the nitrate plume are in the middle to high end of the range measured at the site. The geometric average of approximately 1.2 x 10^{-4} cm/s is slightly lower than typical for the area of the chloroform plume located east and southeast of the nitrate plume (Figure 10).

Perched groundwater flow in the area of the nitrate plume is generally southwesterly. Saturated thicknesses in the vicinity of the plume are generally higher than in areas to the south and southwest. In the vicinity of the nitrate plume (Figure 5) they range from a maximum of approximately 87 ft at TW4-25 to approximately 30 ft at MW-30. In general, saturated thicknesses increase toward the northeast, where the wildlife ponds are located, and are locally affected in the vicinity of the plume by pumping at MW-26, TW4-19, and TW4-20.

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of slug tests as discussed in Section 3. Hydraulic conductivity estimates range from approximately 2.7 x 10^{-5} to 1.4 x 10^{-3} cm/s, and have a geometric average of 1.2 x 10^{-4} cm/s (Table 2). The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

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6. CORRECTIVE ACTION CONCENTRATION LIMITS

The corrective action concentration limit for nitrate is 10 mg/L. This concentration is considered to bound the outer extent of the plume and is the ultimate target for reducing nitrate concentrations within the plume. As discussed in Section 9, once the nitrate concentrations in all monitoring wells are 10mg/L or less, concurrence with DRC will be sought that the plume is remediated and the corrective action complete.

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7. CORRECTIVE ACTION PLAN - CONSTRUCTION AND OPERATION

The corrective action for the nitrate plume is proposed to occur in three phases.

In Phase I, Denison proposes to construct a sloped, curbed and drained concrete pad of six inches in depth over an area covering the areal extent of contamination identified during the contamination investigation. Denison also proposes a future removal of contaminated soil at the time of Mill site reclamation and, for conservatism, proposes to revise the reclamation surety estimate to include a volume of soil to be removed and placed in the tailings cells of twice the volume of contaminated soil identified in the contamination investigation.

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Phase II will consist of pumping four wells within the nitrate plume (TW4-22, TW4-24, TW4-25, and TWN-2). Phase II relies on both pumping and natural attenuation to remove nitrate mass, reduce nitrate concentrations within the plume, and minimize or prevent plume migration. Included in Phase II are continued monitoring within and outside the plume to verify plume boundaries (as defined by a concentration of 10 mg/L), estimate changes in hydraulic capture, and track changes in nitrate concentrations within the plume.

Phase III, if required, will be conducted in consultation with the Executive Secretary. If implemented, Phase III will consist of a transport assessment, a hazard assessment, and an exposure assessment along with a corrective action assessment including an evaluation of best available remedial technologies. Selection of a technology for implementation will be based on an evaluation whether the technology will remediate contamination to as low as is reasonably achievable, if the 10 mg/L standard is not reasonably achievable. One possible outcome of these evaluations could be an application for alternate corrective action concentration limits ("ACACL").

After implementation of Phase II and Phase III and once residual concentrations have dropped to 10 mg/L or less at all monitored locations or an ACACL has been granted, concurrence with the Executive Secretary will be sought that the corrective action is complete. Phase II has contingencies to be implemented if needed based on monitoring as discussed in Section 8. The termination of Phase II and implementation of Phase III will be with the concurrence of the Executive Secretary and will be based on assessments conducted during Phase II.

An important goal of Phase III is to ensure that nitrate concentrations exceeding the action level will not migrate to any point of exposure within the applicable regulatory time frame. This migration of the nitrate plume is not expected to occur. However, the decision as to when to terminate Phase II and implement Phase III will be based on Phase II monitoring data and

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quantitative calculations that indicate that, based on Phase II results, this Phase III goal is attainable.

7.1 Phase I Description and Rationale

The potential contamination source to be addressed in Phase I consists of alluvial soil in the area of the Mill's outdoor ammonium sulfate storage tanks as depicted in Figure 11-1. As shown in Figure 11-1, the ammonium sulfate tanks and associated soil contamination are located to the east of the Mill process building. The tanks are currently situated over an uncurbed concrete slab, which has suffered some deterioration over the years. The tank area is bounded to the west by the Mill building, to the south by the V_2O_5 Mini Lab and Precipitation Area, and to the north by the Mill's Pulp Storage Tanks. That is, the ammonium sulfate tanks are located in a relatively congested and (on three sides) built out area. The proximity of the Mill building and other tanks precludes the ability to perform an extensive soil excavation/contaminated soil removal at the current time. Therefore, consistent with the SCA, Denison proposes to perform the contaminated soil corrective action phase in two steps; 1) construction of a concrete cover to remain in place during the operating life of the Mill, and 2) a contaminated soil excavation to occur during the Mill reclamation at final Mill closure.

7.1.1 Approximation of the Lateral Extent of Contamination and Concrete Cover

Per Section 11A(1) of the SCA, Phase I is required to include a control for the soil contamination observed at the ammonium sulfate tanks. To meet this objective, Denison proposes to construct a sloped and drained concrete pad of six inches in depth over an area covering the areal extent of contamination identified during the contamination investigation to prevent infiltration of surface water into the contaminated soil. Existing data consists of analytical data from two of the soil borings collected during the June 2011 contamination investigation as shown in Figure 11-1. In order to verify that the proposed concrete pad meets the objective of covering the lateral extent of contamination, Denison will implement a soil sampling program prior to the completion of the concrete pad. The soil sampling program is designed to provide data to delineate, approximately, the lateral extent of contamination.

The soil sampling program will be conducted substantially in accordance with the DRC-approved field and quality assurance procedures implemented during the Phase 1, (Part 1) Nitrate Investigation as described in the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011. A summary of the soil sampling program to be conducted during Phase I of the CAP, with any necessary changes from the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011, is as follows.

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7.1.1.1 Soil Sampling Program Objective and Design

The objective of this soil sampling program is to delineate, approximately, the lateral extent of contamination in order to determine the extent of the concrete pad necessary to cover the soil contamination identified during the Phase I investigation. To meet this objective, 18 Geoprobe borings will be conducted down to bedrock refusal at each of the locations shown on Figure 11-2B. Three (3) samples will be collected from each Geoprobe core location. Soil core samples will be collected from the bottom one foot of each of the following intervals, based on the total depth of penetration at each site: top 1/3, middle 1/3, and bottom 1/3.

Select soil core samples will be sent to the analytical laboratory for analysis of nitrate (as N), and ammonia (as N) as described below. Since the purpose of this sampling program is to confirm the lateral extent of soil contamination (in the form of nitrate and ammonia) resulting from the ammonium sulfate tank source, no other analytes are required. Soil analysis will be conducted by an environmental laboratory currently certified by the State of Utah, using EPA approved sample and analysis methods.

Denison anticipates that the presence of ammonia contamination will diminish with distance from the ammonium sulfate tanks. The initial row of samples will be collected 3 feet from the northeast edge of the proposed concrete pad shown in Figure 11-2B. If the results of the analysis of the initial sample row indicate that ammonia and nitrate levels do not exceed DRC's proposed screening levels of 2 times the background levels determined in the June 2011 investigation, specifically 4.29 mg/kg for ammonia and 4.38 mg/kg for nitrate, no further samples will be analyzed and the pad will be constructed as shown in Figure 11-2B. That is, if the initial samples are below the screening levels, it will be concluded that the contamination will be adequately covered by the proposed design, and the soil sampling program will be considered complete.

If the results of analysis of the initial sample row indicate that the contamination extends beyond the area delineated by the initial row, that is, one or more samples in the initial row exceed the screening levels, the remaining samples for one or more additional sampling rows will be analyzed for nitrate (as N), and ammonia (as N). The concrete pad will be sized to extend to the first row of samples whose analysis do not indicate nitrate or ammonia exceeding the screening levels.

7.1.1.2 Field Activities/Sampling Methods

In order to minimize the potential for multiple mobilizations of the Geoprobe unit, three discrete sets of samples will be collected in one sampling event during this investigation. Each discrete set of samples will be collected in a lateral line or "row" along the northeast face of the proposed

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concrete pad as shown in Figure 11-2B. Samples will be collected every approximately 12.5 feet laterally along the edge of the concrete pad. The first row of discrete samples will be approximately three feet from the edge of the proposed concrete pad. The two successive rows will be stepped-out approximately ten feet from the previous row of samples. The samples collected in the two successive rows will be archived for potential later analysis of nitrate and ammonia if necessary. All archived samples will be stored in accordance with the analytical method requirements for temperature. Expedited turn around will be requested for the analysis of the first row of soil samples, so that if any additional analyses are required, the additional analyses can be completed within the specified analytical holding times. Based on this sampling strategy, 54 soil samples (and 6 duplicates and 3 rinsates), will be collected.

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7.1.1.3 Sample Handling and Custody

Each sample collected during this sampling program will be identified using a unique sample identification number ("lD"). The description of the sample type and the sample name will be recorded on the chain-of-custody ("COC") forms, as well as in the field notes. Geoprobe boring samples will be named according to the boring location and top and bottom of the depth interval at which they were collected, following the convention P1AXX-tt-dd, where P1AXX is the first boring in the first row of samples and tt is the top of the depth interval and dd is the bottom of depth interval expressed in feet below ground surface. Additional rows of samples will be identified as P1A2XX-tt-dd. Duplicate samples will carry the same identification as the parent sample with the terminal letter "D" to identify them as a duplicate. Similarly, rinsate samples will carry the sample identification of the sample collected prior to the rinsate followed by the terminal letter "R".

Samples will be collected into re-sealable plastic bags, which will be labeled with the sample identification and homogenized by vigorously shaking and mixing the contents until the samples are visibly uniform. A minimum sample volume of 100 grams will be collected from each location. Sample containers will be provided by the laboratory, certified as clean, and will be filled directly from the plastic bags. Archive sample aliquots will be maintained in the plastic bags at the Mill for the duration of the analytical holding times to provide additional backup sample for analysis if necessary. Archive sample aliquots will be stored in accordance with the analytical method requirements for sample preservation.

Standard sample custody procedures as described in the DRC-approved *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011 will be used to maintain and document sample integrity during collection, transportation, storage, and analysis.

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Samples will be shipped to the analytical laboratory using an overnight carrier such as Federal Express. Samples will be analyzed within the analytical method specified holding times.

7.1.1.4 Analytical Methods

For comparability, the soil analytical methods will be the same as those used for the 2011 nitrate contamination investigation.

All soil samples will be submitted to the analytical laboratory for SPLP using EPA Method 1312 using Extraction Fluid #3. Method 1312 will produce a leachate of all soil samples which will be analyzed for nitrate and nitrogen as ammonia using EPA Method 353.2, and EPA method 350.1 respectively. Method 1312 will produce a sufficient volume of leachate to complete the nitrate and ammonia analyses as well as any method-required QC analyses.

The soil samples are being leached and analyzed using water methodologies, which will yield concentrations in liquid units (such as mg/L*)*. The laboratory will report all soil samples in two ways: 1) as a leachate in mg/L and 2) as a soil in mg/kg on a dry weight basis.

The reporting limits ("RLs") for the methods are 0.01 mg/L for nitrate and 0.05 mg/L for ammonia. These RLs are sufficiently sensitive to allow determination of soil contamination below the screening levels.

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7.1.1.5 Quality Control

Quality control ("QC") samples will be collected in the field during the sampling effort and will include one duplicate per ten analytical samples and one rinsate sample per twenty samples. Rinsate samples will be collected using deionized ("DI") water from a third party commercial source. Duplicates will be assessed through the calculation of a relative percent difference ("RPD") and rinsate samples will be assessed based on any detections reported and their magnitude relative to the sample results. The QC procedures set forth in the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011 will be used for the assessment of the soil samples collected during this program.

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Analytical laboratory QC, audits, instrument calibration, internal QC procedures, detailed COC procedures, organizational responsibilities, and other specific details regarding sample collection will be completed in accordance with the DRC-approved *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011.

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7.1.2 Construction of the Phase I Action

Denison proposes to construct a sloped, curbed, and drained concrete pad of six inches in depth over an area covering the lateral extent of contamination identified during the contamination investigation. Because the ammonium sulfate tanks are surrounded by existing concrete structures to the south, west, and north, the new concrete pad will extend to the east of the Mill building. The existing concrete pad will be resurfaced and sloped to drain to the existing collection area/sump inside the Mill building, which returns solutions to the process. This resurfaced area will be constructed with a curb of approximately 6 inches in height. In addition, a new concrete slab will be extended to the eastern edge of the surrounding structures. This new slab will also be sloped to drain to an existing collection area/sump in the Mill building. A rolled curb will be constructed with an access ramp to allow supplier trucks sufficient access to refill the tanks. The proposed cover design is depicted in Figure 11-2A and B.

The only subsurface piping in the vicinity of the ammonium sulfate tanks is a segment of the underground portion of the Mill fire water system. Figure 11-3 shows the location of the subsurface portion of the fire water line. Due to the need to maintain continual pressure on the fire water system, the system already contains instrumentation (an alarm system) to indicate when the pressure makeup pump starts up as a response to leaks, breaks, or loss of pressure. As indicated by the pump alarm history, the firewater system has no history of leakage, and is not expected to be a source of hydraulic head in the vicinity. The only other subsurface process piping on the Mill site consists of two pairs of lines: one cooling water recirculation loop, and one vanadium product liquor loop, for which the buried portion begins approximately more than 100 feet southeast of the ammonium sulfate tanks (75 feet from the nearest corner of the concrete pad proposed in Figure 11-4), and "around the corner" from the ammonium sulfate tanks – east of the easternmost wall of the building's "L". These two piping loops are new, have had no history of leakages, and are too far from the ammonium sulfate tanks to be a source of hydraulic head in the vicinity of the tanks. All other process piping is above grade.

Consistent with Section 11A(1)(b)(i) of the SCA, Denison provided a detailed plan and schedule for construction of the concrete cover to DRC in Section 7.1 and Figures 11-1 and 11-2A and B of the November 30, 2011 version of this CAP.

7.1.3 Maintenance of the Phase I Action

Denison will provide a plan for annual inspection, required repairs, and annual documentation of the condition of the pad in a revised version of the Discharge Minimization Technology ("DMT") Plan, to be submitted following approval of the CAP by the Executive Secretary. The revised DMT Plan will address:

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- frequency of inspection and photographic documentation of the condition of the pad (annually),
- contents of inspection reports,
- inspection criteria,
- conditions requiring repairs,
- timing of repairs, and
- contents of repair reports.

7.1.4 Estimation and Removal of Contaminated Soil During Mill Reclamation

Denison also proposes a future excavation of contaminated soil at the time of Mill site reclamation, and disposal of the excavated soil in the tailings cells. To ensure a sufficient surety amount for reclamation of the known contaminated soil volume to the depth of bedrock, Denison proposes to revise the reclamation surety estimate to include a volume of soil of twice the volume of contaminated soil volume identified in the contamination investigation.

The following process will be used to estimate the volume of contaminated soil to be removed during reclamation. Once the total area to be covered by concrete has been determined based on the borehole analyses, the area will be multiplied by the average depth to bedrock, as determined from the logging of the boreholes.

Based on the geologic logging performed during the soil probe sampling in the Phase I Investigation in June, 2011, borings number GP-25B and GP-26B in the vicinity of the ammonium sulfate tanks indicated depth to bedrock of 19 feet and 16 feet, respectively. These values will be included, along with depths determined during the additional Geoprobe sampling to develop an average depth to bedrock. This average depth to bedrock will be multiplied by the area of contamination. For conservatism, Denison will double the volume determined by the above method for purposes of the reclamation surety estimate.

Consistent with Section 11A(1) of the SCA, Denison provided a revised surety estimate to DRC on March 4, 2012. The March 4, 2012 surety estimate included an overly conservative estimate for removal of the contaminated soil volume that was based on:

1. The preliminary proposed concrete cover area as depicted in Figure 11-2B
2. An approximate depth to bedrock of 20 feet (1 foot deeper than the maximum depth to bedrock measured to date during the June 2011 investigation)
3. A conservative overestimation factor of 3 times the volume estimated from items 1 and 2 above

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Following receipt of the additional depth-to-bedrock data and estimated lateral extent of contamination data that will be developed from the soil sampling program described above, Denison will review the March 4, 2012 volume and cost estimate. If additional data indicates an increase of the conservatively estimated soil volume in the March 4, 2012 surety estimate, Denison will provide a revised volume and cost estimate within 60 calendar days following issuance of the Consent Order contemplated in Section 11.E of the SCA.

The March 4, 2012 surety estimate was based on the overly conservative estimate of 6,000 CY. The current tailings cells hold in excess of 4 million tons (approximately 3.5 million CY) of tailings material. The anticipated 6,000 CY volume from the ammonium sulfate soil excavation is insignificantly small compared to the total current volume disposed of in the tailings system. As discussed above, following receipt of the data on depth-to-bedrock and lateral extent of contamination, Denison will revise the estimated volume and surety estimate accordingly. Even if the excavated soil volume were to increase by several factors following receipt of the data, it will still be insignificantly small relative to the total volume of the tailings and the total anticipated reclamation volume for the Mill site.

7.2 Phase II Description and Rationale

Phase II consists of three active components and one passive component. The active components are:

1. Removal of nitrate mass from the perched zone as rapidly as is practical by pumping from wells located in areas having high nitrate concentrations, relatively high productivities, or both.
2. Perched zone water level and nitrate monitoring to assess changes in nitrate concentrations within the plume, verify the location of the plume boundary over time, and estimate hydraulic capture zones. A general lowering of nitrate concentrations within the plume is expected as a result of Phase II operation.
3. Abandonment of TWN-series wells not needed for implementation of item 2.

Pumped water will be disposed in the tailings cells. In addition, all samples analyzed for nitrate will also be analyzed for chloride.

The passive component consists of relying on natural attenuation to reduce nitrate concentrations. Physical mechanisms that will reduce nitrate concentrations include processes such as hydrodynamic dispersion, and dilution via mixing with nitrate-free recharge and low nitrate waters outside the plume. Neither biologically mediated decomposition of nitrate nor abiotic chemical decomposition are expected to be significant mechanisms in reducing nitrate

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concentrations because the majority of the perched water is likely aerobic and unsuitable for rapid decomposition of either chloroform or nitrate. The persistence of chloroform and the persistence of nitrate associated with the chloroform plume are consistent with predominantly aerobic conditions. The presence of iron oxides within the perched zone in most of the site borings is also consistent with aerobic conditions.

As discussed in HGC (2007) chloroform daughter products, such as dichloromethane (DCM), have been detected but at low concentrations. The persistence of chloroform and the low concentrations of daughter products imply relatively low rates of chloroform degradation. Owing to its relatively high oxidation state, chloroform would be expected to degrade relatively rapidly, yielding higher concentrations of daughter products such as DCM, under primarily anaerobic conditions.

That chloroform daughter products have been detected suggests that conditions are locally favorable for anaerobic degradation. The presence of carbonaceous material in many of the site borings and the presence of pyrite in most of the borings suggests that at least local anaerobic conditions favorable to degradation of chloroform and nitrate exist. The formation hosting the perched zone was likely anaerobic in the past, and conducive to the preservation of carbonaceous material and the formation and preservation of pyrite, but, at least at some areas of the site, is now mainly aerobic with pyrite oxidizing to iron oxide. The oxidation of pyrite is likely enhanced near perched wells which provide a conduit for oxygen to the perched zone. The oxidation of pyrite in the formation has not been substantiated with quantified core analysis; however, Denison is currently undertaking a separate study to evaluate the amount and distribution of pyrite in the formation as part of a separate investigation into generally decreasing pH trends at the Mill site.

Wherever conditions may be favorable to anaerobic degradation, the actual degradation rates of nitrate from either abiotic or biologically mediated degradation may be, in fact, larger than anticipated, which will be favorable for removal of nitrate from the perched zone. However, Denison is not relying on either abiotic or biologically mediated degradation as important removal mechanisms.

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Furthermore, nitrate is not expected to be retarded by adsorption onto aquifer materials because of its high solubility and negative charge. The combination of pumping, hydrodynamic dispersion, and dilution by recharge are expected to be effective considering that less than an order of magnitude reduction in concentration is needed to reduce the highest detected nitrate concentrations within the plume (approximately 69 mg/L) to the target of 10 mg/L. The

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downgradient portion of the plume, defined by MW-30 and MW-31, will require reduction in concentration by only a factor of two to meet the 10 mg/L goal.

In general, Phase II is expected to function in a manner similar to ongoing chloroform removal from perched water at the site. Construction and operation will be similar to the chloroform pumping system which consists of five wells (MW-4, MW-26, TW4-4, TW4-19, and TW4-20) located within the chloroform plume that are pumped as continuously as practical and at rates that are as large as practical. Water from those wells is disposed in the tailings cells.

The nitrate pumping system will consist of four wells: TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2). Water will be pumped from these wells as continuously as practical and at rates as high as practical. These wells were selected for pumping because 1) they are located in middle to upgradient areas of the plume having the highest nitrate concentrations and will minimize the downgradient migration of these high concentrations, 2) they are expected to have productivities similar to the chloroform pumping wells, 3) pumping these wells is not expected to enhance the downgradient migration of chloroform, and 4) they are temporary chloroform (TW4-series) or nitrate (TWN-series) investigation wells and converting them to pumping wells will not impact tailings cell point of compliance monitoring under the Mill's Groundwater Discharge Permit ("GWDP").

Pumping these wells is expected to remove nitrate mass from the perched zone as rapidly as practical, and flatten hydraulic gradients within the plume to reduce rates of downgradient migration and allow natural attenuation to be more effective. Furthermore, the depression of the water table resulting from pumping in the upgradient portion of the plume will reduce interaction between the perched water and any residual shallow vadose zone sources that may exist. As a result plume migration is expected to be minimal or cease once Phase II is implemented. Currently the plume appears to be changing very slowly. Figure 9-2 compares the extents of the nitrate plume in the third quarters of 2010 and 2011. Over this period, the plume appears to be relatively stable, having expanded slightly in some areas and contracted slightly in others. The apparent stability of the plume is likely the result of the generally low hydraulic conductivities of the perched zone, and ongoing pumping within the adjacent chloroform plume. Implementation of Phase II is expected to further reduce or halt downgradient migration and to reduce concentrations within the plume. If ongoing monitoring indicates the plume continues to migrate, then contingencies will be implemented.

As discussed above, the productivities of the proposed nitrate pumping wells are expected to be similar to those of the chloroform pumping wells. The transmissivities at proposed nitrate pumping wells TW4-22, TW4-24, and TW4-25 are estimated to be between those of chloroform

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pumping wells MW-26 and TW4-19; and the transmissivity at TWN-2 is estimated to be about one third that of chloroform pumping well TW4-20 (Table 4). Therefore, the long-term productivities of TW4-22, TW4-24, and TW4-25 are expected to be between those of MW-26 and TW4-19; and the long-term productivity of TWN-2 is expected to be about one third that of TW4-20. Although expected pumping rates at TWN-2 will be relatively low, the high concentrations detected at that well will result in relatively high nitrate removal rates. Pumping at TWN-2 is expected to reduce or eliminate the apparent residual perched water mound at that location. As the mound is depleted, the productivity of TWN-2 is expected to diminish. However, continued operation of TWN-2, even at low average extraction rates, is expected to be beneficial.

The potential interaction of the chloroform plume with the nitrate pumping system is of concern. Figure 10 shows the locations of the nitrate and chloroform plumes as of the third quarter of 2011. The chloroform plume is located generally east-southeast of the nitrate plume, but the plumes mingle in the vicinity of TW4-19, TW4-20 and TW4-22 (northeast corner of tailings Cell #2). Pumping the proposed nitrate wells will impact chloroform migration to some extent, and any pumping that enhances downgradient migration of chloroform is undesirable. It is expected that pumping the proposed wells will at most draw chloroform cross-gradient to the west-northwest. However, pumping of any wells to the southwest of the chloroform plume (such as MW-30 and MW-31) would have the undesirable impact of enhancing the downgradient migration of chloroform, and is not considered to be an option. Furthermore, converting MW-30 or MW-31 to nitrate pumping wells would degrade the usefulness of these wells for tailings cell point of compliance monitoring under the GWDP.

Data collected during Phase II monitoring will be used to evaluate containment and hydraulic control of the nitrate plume. The data will be used to estimate the extent of hydraulic capture (the "capture zone"), and to calculate nitrate mass removal rates by pumping.

Hydraulic containment and control will be evaluated in part based on water level data (in the same fashion as for the chloroform pumping system) and in part on concentrations in wells downgradient of pumping wells TW4-22 and TW4-24. Bounding stream tubes defining the capture zone of nitrate pumping wells will be generated from the kriged quarterly perched water level data. Hydraulic containment and control based on water level data will be considered successful if the entire nitrate plume upgradient of TW4-22 and TW4-24 falls within the combined capture of the nitrate pumping wells.

MW-5, MW-11, MW-30, and MW-31 are located downgradient of TW4-22 and TW4-24. MW-30 and MW-31 are within the plume near its downgradient edge and MW-5 and MW-11 are

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outside and downgradient of the plume. Hydraulic control based on concentration data will be considered successful if the concentrations of nitrate in MW-30 and MW-31 remain stable or decline, and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard.

Denison will calculate the capture zones after four quarters of water level measurements have been taken, and will include the calculations, with figures, in the next quarterly nitrate monitoring report. Numerical and/or analytical models will be used if needed to assist in evaluating the data and estimating natural attenuation.

It is expected that the four pumping wells, in combination with the existing chloroform pumping wells, will adequately capture the nitrate plume, such that concentrations of nitrate in excess of the 10 mg/L standard are not expected to migrate beyond the current boundaries of the plume. Based on experience from the chloroform pumping results to date, it is expected that the capture zone from the four nitrate pumping wells will, by themselves extend upgradient to capture the entire plume north of TW4-22 and TW4-24 as well as more than 400 feet downgradient of TW4-22 and TW4-24. For example, the downgradient extent of the combined capture zone of chloroform pumping wells MW-26, TW4-19, and TW4-20 (Figure 12) extends more than 400 feet downgradient of MW-26. The capture zone from the four nitrate pumping wells alone is expected to likewise extend at least 400 feet southwest of TW4-22 and TW4-24, encompassing by themselves approximately three quarters of the plume (Figure 13). However, the proportion of the nitrate plume under hydraulic capture is expected to be larger than this estimate as the nitrate capture zone merges and is enhanced by the chloroform capture zone. The result is that either complete hydraulic capture will be achieved, or if not achieved, concentrations of nitrate in excess of 10 mg/L are not expected to migrate beyond the current boundaries of the plume. As discussed above, hydraulic control will be considered successful if the concentrations of nitrate in MW-30 and MW-31 remain stable or decline and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard.

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The nitrate plume is defined as that portion of the perched aquifer that has a concentration of nitrate in excess of 10 mg/L. In evaluating whether the pumping system has contained and controlled the plume, the proper parameter to evaluate is therefore whether the 10 mg/L boundary has moved beyond the currently defined plume boundary. MW-5 and MW-11 presently do not exceed the 10 mg/L Groundwater Quality Standard; that is, they are outside the currently defined plume, and act as bounding wells for the plume. So long as they continue to be less than or equal to 10 mg/L they will remain as bounding wells outside of the plume, and the plume will not have expanded.

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It is possible that there may still be some movement of impacted water (i.e., there may not be complete hydraulic capture), but so long as that movement of water does not cause the concentration in any downgradient well to exceed 10 mg/L, the plume itself will not have expanded and adequate hydraulic control will have been demonstrated. As a result, it is possible that there may be some future impact on MW-5 and MW-11, even though the plume has not expanded. However, any impacts on MW-5 and MW-11 will be monitored to ensure that the concentrations in those wells, if they do increase over time, do not exceed 10 mg/L. If the concentration of nitrate in either or both of those wells increases above 10 mg/L, then the plume will have expanded and plume capture will not have been successful. Further actions, such as modeling or the addition of more nitrate pumping wells, would need to be investigated at that time. Because numerous monitoring wells currently exist downgradient of MW-5 and MW-11 (i.e., MW-35, MW-36, MW-37, MW-15 and MW-14 as a first line of defense, and beyond that line, MW-17, MW-03, and MW-20), existing wells would continue to bound the plume, and there would be no chance that the plume could expand beyond the downgradient edge of the Mill's existing tailings cells, without being detected and without ample time to institute further mitigative actions.

If nitrate concentrations in any of the wells exceed their respective Ground Water Compliance Limits ("GWCLs") listed in Table 2 of the current Permit, which are less than 10 mg/L, then Denison will provide notification to the Executive Secretary, and sampling frequencies for the wells will be accelerated per the White Mesa Mill GWDP Part G.1.

7.2.1 Well Abandonment

Currently there are 19 TWN-series wells that were installed for the investigation of nitrate at the site. Wells in the vicinity of the nitrate plume will be retained for monitoring. TWN-series wells located north–northeast of TWN-18 are not needed for this purpose and are therefore selected for abandonment. Wells proposed for abandonment are TWN-5, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-15, and TWN-17. Wells to be retained for nitrate and chloride monitoring, as well as field collection parameters (including water level measurements) per the approved field collection form, are TWN-1, TWN-2, TWN-3, TWN-4, TWN-7, and TWN-18.

The foregoing wells will be abandoned within one year from the date of approval of this CAP, in accordance with applicable regulations (State of Utah Administrative Rules for Water Wells R655-4-14). Although not needed for nitrate plume monitoring, wells TWN-6, TWN-14, TWN-16, and TWN-19 will be retained for water level monitoring only, to provide ongoing water level data for the northeast portion of the site.

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A well abandonment report will be submitted to the Executive Secretary within 15 months after the date of approval of this CAP.

7.2.2 Groundwater Pumping System

The Phase II corrective action groundwater pumping system will consist of wells TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2). Each well will be equipped with a Grundfos Series SQE 1x200-240 Volt, 6.2 Amp submersible pump or the equivalent. To prevent damage to the pumps, each will operate on a cycle that allows pumping only when sufficient water is present in the well. The capacity of each pump will be greater than the sustainable pumping rate for each well. Therefore, the average amount of water pumped from each well will be, in general, the maximum practical. These wells were selected for pumping because they are located in areas of the perched zone having both high nitrate concentrations and relatively high transmissivities that allow relatively high rates of mass removal, and because they are not expected to have a negative impact on chloroform migration from the adjacent chloroform plume.

Water pumped from each well will be routed by ½ inch high-density polyethylene Drisco discharge lines, comparable to the transfer lines in the chloroform pumping system, to the tailings cells for disposal. A schematic drawing of the transfer piping system is provided in Figure 11-5. The discharge line near each wellhead will be equipped with an in-line Carlon ½" flow meter/totalizer (or equivalent). The flow meter/totalizer will be housed in an insulated wooden box with a heat source to prevent freezing. Readings from each totalizer will be used to report quarterly pumped volumes and average pumping rates.

Operation of the nitrate wellfield will be similar to that for the chloroform wellfield. The contingencies described in Section 8 will be implemented should nitrate mass removal rates drop significantly due to losses in well productivity.

As mentioned above, water pumped from the nitrate pumping system will be transferred to the tailings cells for disposal. If monitoring of any tailings cell indicates an exceedance in a leak detection system ("LDS") parameter regulated by the Mill's GWDP, or the Best Available Technology ("BAT") or Discharge Minimization Technology ("DMT") Plans, Denison will manage the response to LDS parameter exceedance consistent with the requirements of the GWDP or appropriate BAT or DMT Plan. The relatively low flow rates of the groundwater pumping systems, compared to the flow rates of process solutions and wastewaters managed in the tailings system, allow for rerouting of tailings cell solutions and adjustment of cell solution levels without interruption of the chloroform or nitrate pumping programs.

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Denison will prepare an Operation and Maintenance ("O&M") Plan for Executive Secretary approval which, like the Chloroform Program Operations and Maintenance Plan will address operations (including winterization procedures), maintenance (including inspection forms and response to and documentation of system failures), monitoring, and data reporting. The O&M Plan will be submitted per the schedule in Table 1.

7.2.3 Water Level Monitoring

Water levels will be monitored weekly in each of the four nitrate pumping wells. Water levels in the remaining wells listed in Table 3 will be monitored monthly for the first twelve months after commencement of Phase II pumping, and thereafter quarterly. Depths to water will be measured using an electric water level meter in the same way they are currently collected. Hydraulic capture zones will be estimated from water level contour maps generated quarterly from the water level data, with the first capture zones estimated after twelve months of data have been obtained. The contingencies described in Section 8 will be implemented should the proportion of the remaining nitrate plume that is under hydraulic capture shrink significantly.

7.2.4 Water Quality Monitoring

Pumping wells TW4-22, TW4-24, TW4-25, and TWN-2, and the other wells listed in Table 3, will be monitored quarterly. Sampling and analytical procedures will be the same as currently employed for the nitrate monitoring as described in the quarterly monitoring reports submitted by Denison to DRC and as described in the most current, DRC-approved White Mesa Mill Groundwater Monitoring Quality Assurance Plan ("QAP"). Each well will be sampled for the following constituents with respect to monitoring the nitrate plume:

- Chloride
- Nitrogen, Nitrate + Nitrite as N
- pH
- Temperature

Dissolved oxygen was not included in the Plan due to unique conditions at White Mesa. The required purge when sampling monitor wells at the site and low hydraulic conductivity in the perched aquifer causes slow recharge to the well bore after purging. This slow recharge allows oxygen to diffuse into the groundwater as it enters the well bore rendering any dissolved oxygen measurement unreliable.

Denison has also assessed the need for analyzing data from selected on site wells for other groundwater quality parameters that could be relevant to this Plan, and has concluded that the

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existing groundwater monitoring in existing GWDP compliance wells is adequate, and that no further constituents, other than nitrate and chloride in the TWN wells, need be added to any wells at the site, for the reasons discussed below.

The Mill is the subject of an ongoing groundwater compliance monitoring program, which monitors the complete list of constituents regulated in Table 2 of the GWDP. If any contaminant sources, whether or not associated with the nitrate plume, reach levels of concern in groundwater, they will be detected in the GWDP compliance monitoring program. It is therefore not necessary for the nitrate corrective action to attempt to monitor the same constituents which are adequately monitored under the existing GWDP program.

Further, since the Plan provides a nitrate plume pumping program designed to bound and control the known contamination, any other constituents present within the nitrate plume, related to nitrate as precursors or byproducts or otherwise, will also be captured by the pumping system.

Quarterly reports will be prepared that contain the same elements of the current chloroform corrective action monitoring reports submitted by Denison to DRC. Specific information elements to be included in the reports are listed in Sections 10.2.3 and 10.2.6.

Existing nitrate and chloride monitoring will continue in each of the other monitoring wells at the site at the frequency required under the GWDP or the chloroform investigation, as the case may be. Maintaining the current quarterly frequency at the closest downgradient well MW-11 and semi-annual frequency at the next-closest downgradient well MW-5 is reasonable considering the apparent stability of the plume at MW-30 and MW-31 and the hydraulic conductivity at MW-5 (3.5×10^{-6} cm/s) which is nearly three orders of magnitude lower than at MW-11 (1.4×10^{-3} cm/s)[HGC, 2007]. The sampling frequency for MW-5 and MW-11 was established under the GWDP based on the velocity of flow in the perched aquifer at these locations. More frequent monitoring was considered inappropriate due to the low flow rates and the potential to sample the same water or similar water in consecutive sampling events at each well.

Should concentrations within the plume begin to generally increase (disregarding short-term fluctuations), or the plume boundaries begin to expand, the contingencies discussed in Section 8 will be implemented.

7.2.5 Reporting

Reporting is proposed to occur quarterly, using a format and content similar to the quarterly chloroform monitoring reports submitted by Denison to DRC. The quarterly reports will include the following details:

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1. calculation of quarterly nitrate mass removed by pumping,
2. comparison of the current areal extent of the nitrate plume from the latest quarter with the latest quarter of the previous reporting period, and
3. discussion of any contingencies to be implemented.

7.3 Phase III

Following the collection of 5 years of performance data from Phase II activities, Denison will use the data to perform an evaluation of the Phase II program. The data collected during the 5-year operation may be used for any or all of the following assessments:

a) Estimate the rate of nitrate plume remediation (e.g. in terms of percent mass reduction and/or concentration reduction per year). If the rate of plume remediation can be estimated with sufficient certainty, Denison may be able to project a timeline for remediation through the continued implementation of Phase II that will allow appropriate adjustments to the reclamation surety estimate, or
b) Identify changes to Phase II to improve its effectiveness or accelerate the restoration timeline, or
c) Identify whether Phase III activities, including application for an ACACL may be necessary in lieu of, or in combination with, Phase II activities.

Phase III may be implemented at the discretion of Denison at any time (including prior to five years) if Denison determines that continuation of Phase II is not necessary or appropriate. If Denison decides to implement Phase III, Denison will submit a revised CAP to the Executive Secretary for approval, which incorporates Phase III. Phase II will continue until Phase III is approved by the Executive Secretary.

If implemented, Phase III will consist of a transport assessment, a hazard assessment, and an exposure assessment along with a corrective action assessment including an evaluation of best available remedial technologies. Selection of a technology for implementation will be based on an evaluation whether the technology will remediate contamination to as low as is reasonably achievable, if the 10 mg/L standard is not reasonably achievable. One possible outcome of these evaluations could be an application for alternate corrective action concentration limits ("ACACL"). As required by UAC R317-6-6.15(G), the proposed ACACL must be protective of human health, and the environment, and must utilize best available technologies. If an ACACL is proposed, the revised CAP will include the information required, under UAC R317-6-6.15(G), and any ACACL would require the approval of the Utah Water Quality Board.

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The transport assessment will identify any data gaps that exist and develop work plans to collect any data needed to support hydrologic and geochemical modeling. Such modeling will consist of appropriate quantitative models to predict flow paths, travel times, and potential points of exposure of nitrate contaminated groundwater. Any potential geochemical reactions or other attenuation mechanisms will also be identified. The transport assessment will inform the hazard assessment and the exposure assessment.

The hazard assessment will identify the risks and hazards to human health and the environment associated with nitrate to determine whether an ACACL should be proposed, if the subsequent exposure assessment concludes that an exposure is reasonably likely.

The purpose of the exposure assessment is to evaluate the potential harm to human health and the environment from the hazards identified in the hazard assessment. The exposure assessment takes into account site-specific circumstances that may reduce or enhance the potential for exposure to nitrate. This assessment identifies and evaluates exposure pathways, and provides forecasts of human and environmental population responses, based on the projected constituent concentrations, and available information on the chemical toxicity effects of the constituents. The assessment also addresses the underlying assumptions, variability, and uncertainty of the projected health and environmental effects. Exposure pathways are identified and evaluated using water classification and water use standards, along with existing and anticipated water uses.

The corrective action assessment consists of a review of ground-water corrective action alternatives in conjunction with the hazard assessment and the exposure assessment. Past, current, and proposed practicable corrective actions will be identified and evaluated against the costs and benefits associated with implementing each corrective action alternative. If ACACLs are identified as the proposed alternative, the corrective action assessment will demonstrate that the proposed ACACL is as low as is reasonably achievable, considering practicable corrective actions, and is therefore conservative and cost- effective, and would be granted with good cause. A principal way of demonstrating this is by estimating and comparing the benefits imparted by a corrective action measure against the cost of implementing that measure.

7.3.1 Water Level and Water Quality Monitoring

Water level and water quality monitoring plans will be proposed in the revised Phase III CAP prior to implementation of any proposed corrective action alternative.

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8. ASSESSMENT OF CORRECTIVE ACTION AND PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT AND CONTINGENCY PLAN

The effectiveness of Phase II of the corrective action will be assessed based on the following criteria:

1. stability of plume boundaries
2. concentration and nitrate mass trends within the plume
3. nitrate mass removal rates resulting from pumping, and
4. stability of capture zones.

Plume boundaries and capture zones will be considered stable, and containment and hydraulic control of the nitrate plume effective, if concentrations of nitrate in excess of the 10 mg/L standard do not migrate beyond the current boundaries of the plume. The portion of the plume downgradient of pumping wellsTW4-22 and TW4-24 is currently defined by MW-30 and MW-31, which are located within the plume at its downgradient edge, and MW-5 and MW-11 which are located outside and downgradient of the plume. Hydraulic capture will be considered successful if the combined capture zone of the nitrate pumping wells extends upgradient to capture the entire plume and if concentrations of nitrate in MW-30 and MW-31 remain stable or decline and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard. If nitrate concentrations in any of the wells exceed their respective GWCLs listed in Table 2 of the current Permit, which are less than 10 mg/L, then Denison will provide notification to the Executive Secretary and sampling frequencies for the wells will be accelerated per the White Mesa Mill GWDP Part G.1.The Contingency Plan schedules for each of the foregoing criteria are set out in the Sections 8.1 through 8.4 as applicable.

The criteria for assessment of the effectiveness of Phase III of the corrective action, if undertaken, will be determined once the elements of Phase III have been developed. As discussed in Section 3.2.3, Phase III will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

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This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary.

8.1 Stability of Plume Boundary (Phase II)

The stability of the plume boundary, based on Phase II CAP monitoring activities discussed in Sections 7 and 10, will be used to determine the following:

- Whether any additional pumping wells are needed, and
- The need to reevaluate the Phase II strategy.

Under conditions where the plume boundaries remain stable or contract, no additional pumping wells will be needed, and no reevaluation of Phase II will be needed. Under conditions where the plume migrates, with the concurrence of the Executive Secretary, one or more additional pumping wells will be added, if suitable wells are available, to slow the migration rates and/or to bring more of the plume under hydraulic capture. The installation of additional downgradient monitoring wells is not anticipated because two lines of wells currently exist downgradient of the nitrate plume. Any such additional pumping wells will be added in accordance with a schedule to be approved by the Executive Secretary. If the plume continues to migrate, or suitable additional pumping well locations are not available, then Phase II will be reevaluated, which may include commencement of Phase III. Analytical or numerical models will be used if needed in the reevaluation to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary.

Any nitrate concentrations above 10 mg/L associated with the chloroform plume, that are not part of the nitrate plume shown in Figure 1-2, will be included in the remedial action for the chloroform plume.

8.2 Concentration and Nitrate Mass Trends within the Plume (Phase II)

Concentration changes within the plume are expected to be reflective of changes in nitrate mass within the plume.

Changes in nitrate mass within the plume based on concentrations and saturated thicknesses will be used to determine any need for reevaluation of Phase II. Data used to calculate nitrate mass will utilize analytical and water level data collected from wells, identified in Table 3, through Phase II CAP monitoring. Assuming that the plume boundaries do not expand, that

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concentrations within the plume will generally decrease, and that saturated thicknesses do not increase, the calculated mass of nitrate within the plume is expected to decrease over time. The changes in calculated mass within the plume will be evaluated as follows:

1) Calculate a baseline mass for the nitrate plume. This calculation will utilize the second quarter, 2010 concentration data (provided in Table 3) and saturated thickness data within the area of the kriged 10 mg/L plume boundary. This data set is appropriate because the second quarter, 2010 concentration peak at TWN-2 likely identifies a high concentration zone that still exists but has migrated away from the immediate vicinity of TWN-2.

2) Calculate the plume nitrate mass quarterly based on kriged nitrate concentrations and saturated thicknesses (within the kriged 10 mg/L plume boundary).

3) After 8 quarters, fit a regression trend line to the calculated mass values for the plume and determine whether the mass calculation is increasing, decreasing, or stable

4) Add data quarterly thereafter, recalculate the trend line for the plume quarterly, and evaluate.

If the mass trend line after eight quarters is flat or decreasing (and the plume boundaries are not expanding), then Phase II will be considered successful at that time. Ongoing quarterly trend analysis will then indicate whether or not Phase II continues to be successful.

If the mass trend line is increasing after eight quarters, the data will be examined to determine if the increase is the result of increases in concentration at only one or two wells within the plume that are having an outsize impact on the mass calculation. Changes in concentration at individual wells are expected to result in part from migration of nitrate toward pumping wells. Because of the potential for nitrate to exist at higher concentrations between existing wells (and to be undetected at the present time), movement induced by pumping may cause migration of a higher concentration zone into the vicinity of a particular well, causing a (presumably temporary) increase in concentration at that well. The existence of a higher concentration zone near TWN-2 is evidenced by the relatively large changes in concentration inTWN-2 from the first quarter of 2010 through the third quarter of 2011 (Table 3). Fluctuations in concentration at TWN-2, which has demonstrated the highest historic concentrations, could result in fluctuations in the mass calculation that affect the slope or direction of a trend line. Similar fluctuations at wells other than TWN-2 could have the same impact.

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The usefulness of the mass-based methodology described above will be reevaluated if needed based on the 8 quarters of collected data used to establish the initial trend line. If the method provides erratic values of limited usefulness, or is impacted unduly by the outsized impacts of one or more wells, a modified or new method will be developed at that time. The nature of the modified or new method will have the benefit of eight quarters of data to test its usefulness.

If the trend in nitrate mass calculations indicates a need to reevaluate the effectiveness of Phase II, analytical or numerical models will be used in the reevaluation if needed to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary. Anticipated responses to this condition would likely include adding existing or new wells to the pumping network, if suitable well locations are available, or other measures designed to achieve a more rapid rate of mass reduction. If suitable well locations are not available, then Phase III will be considered.

Deleted: Under conditions where concentrations within the plume are generally stable or declining (disregarding short-term fluctuations), no reevaluation will be required. Should concentrations within the plume begin to generally increase (disregarding short term fluctuations), then reevaluation of Phase II will be required. A

8.3 Nitrate Mass Removal Rates Resulting from Pumping (Phase II)

Under conditions where nitrate mass removal rates by pumping drop substantially as a result of reduced concentrations within the plume, no action will be taken. Under conditions where nitrate mass removal rates by pumping drop substantially as a result of lost well productivities, then an evaluation of the lost productivity will be undertaken. If the lost productivity is determined to be a well efficiency problem, the inefficient wells will be re-developed or replaced in accordance with a schedule to be approved by the Executive Secretary. Should the lost productivity be determined to be due to a general reduction in saturated thickness, analytical or numerical models will be used to evaluate the potential effectiveness of adding existing or new wells to the pumping network to improve overall productivity, if suitable well locations are available. If the analysis indicates that overall productivity will not improve significantly by adding wells, or if suitable well locations are not available, then no action will be taken.

A loss in productivity due to a general decrease in saturated thickness will likely be offset by the benefits of the reduced saturated thickness. First, this condition would indicate that removal of a substantial amount of nitrate laden water had already taken place. Second, the reduced saturated thickness within the nitrate plume would reduce average hydraulic gradients and reduce the potential for downgradient migration. These factors will be considered in any reevaluation that may be performed.

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8.4 Stability of the Proportion of the Nitrate Plume under Hydraulic Capture (Phase II)

Under conditions where concentrations of nitrate in excess of the 10 mg/L standard migrate beyond the current boundaries of the plume, as evidenced by concentrations of nitrate in MW-30 and MW-31 increasing and/or concentrations of nitrate in downgradient wells MW-5 and MW-11 exceeding the 10 mg/L standard, an evaluation of the factors resulting in this condition will be undertaken. If the condition is determined to result from lost productivity of the pumping wells due to well efficiency problems, the inefficient wells will be re-developed or replaced in accordance with a schedule to be approved by the Executive Secretary. Should the loss in capture be determined to result from other conditions, then Phase II will be reevaluated, which may include commencement of Phase III. Analytical or numerical models will be used in the reevaluation if needed to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary.

Anticipated responses to this condition would likely include adding existing or new wells to the pumping network to bring a larger proportion of the plume within hydraulic capture, if suitable well locations are available. If suitable well locations are not available, then Phase III will be considered.

Any nitrate concentrations above 10 mg/L associated with the chloroform plume, that are not part of the nitrate plume shown in Figure 1-2, will be included in the remedial action for the chloroform plume.

8.5 Phase III

As discussed in Section 3.2.3, Phase III, if necessary, will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal

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of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

8.6 Permanent Effect of Corrective Action

Phase II, Phase III, and the contingencies outlined above (Sections 8.1 through 8.5) are designed to protect the public health and the environment by containing the nitrate plume within the site property boundary and reducing nitrate concentrations within the plume to the concentration limit of 10 mg/L. As concentrations will then continue to be reduced by natural attenuation, demonstration that the corrective action will have a permanent effect will be based on appropriate future evaluations.

8.7 In-Place Contaminant Control

As discussed in Section 7, the corrective action relies on active and passive strategies to meet CAP objectives. The passive strategy includes in-place contaminant control by reducing nitrate concentrations via natural attenuation.

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9. IMPACTS OF OFFSITE ACTIVITIES

As discussed in Section 7, nitrate will be treated in place by natural attenuation and removed from the perched zone by pumping. Because all pumped water will be disposed onsite in the tailings cells, there will be no offsite impacts resulting from CAP implementation.

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10. PROPOSED PLUME CORRECTIVE ACTION ACTIVITIES

Phase II and Phase III corrective action activities and contingencies are discussed in detail in Sections 7 and 8. These activities are summarized in Sections 10.1 and 10.2 below.

10.1 Phase I

The Phase I source control action was discussed in Section 7.1, above.

10.2 Phase II

Phase II corrective action activities include pumping of wells TW4-22, TW4-24, TW4-25, and TWN-2, monitoring and maintenance of the pumping system, water level monitoring, monitoring for nitrate and chloride, estimation of hydraulic capture, implementation of contingencies as needed, and reporting.

10.2.1 Groundwater Pumping

Wells TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2) will be pumped at the maximum practical rates. Pumped water will be disposed in the tailings cells. The wellfield will be operated and maintained in the same fashion as the chloroform removal wellfield. Monitoring will include pumping rates and volumes for each well.

10.2.2 Water Level Monitoring

Water level monitoring will consist of weekly water level monitoring of pumping wells TW4-22, TW4-24, TW4-25, and TWN-2, and, for the first twelve months after approval of this CAP, monthly monitoring of non-pumped wells MW-27, MW-30, MW-31, TW4-21, TWN-1, TWN-3, TWN-4, TWN-7, and TWN-18 (Figure 1-2). Thereafter, water level monitoring of those non-pumping wells will continue quarterly. Water level contour maps of the data will be generated quarterly.

10.2.3 Water Quality Monitoring

Water quality monitoring for pumped wells TW4-22, TW4-24, TW4-25, and TWN-2 and all other wells listed on Table 3 will be quarterly. Samples will be analyzed for chloride, and for nitrogen (nitrate and nitrite as N). Field parameters pH and temperature will be recorded. (Section 6.2.4). Water quality monitoring for chloride, nitrate, and field parameters for all other wells at the site will continue at the frequency required under the GWDP or chloroform investigation, as the case may be.

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10.2.4 Estimation of Capture Zones

Hydraulic capture zones will be generated from the quarterly water level contour maps in the same manner as they are currently generated for the chloroform pumping.

10.2.5 Estimation of Pumped Nitrate Mass and Nitrate Mass within the Plume

Quarterly estimates of nitrate mass removed by pumping will be made based on cumulative pumped volumes at each pumped well and nitrate concentrations at each pumped well. Quarterly estimates of the nitrate mass remaining within the plume will also be calculated based on kriged concentrations in wells listed in Table 3 and saturated thicknesses, as discussed in Section 8.2.

10.2.6 Reporting

Quarterly reports will be prepared that contain the same elements of the current chloroform corrective action monitoring reports submitted by Denison to DRC and will include the following:

1. Tabular compilations of groundwater level measured in non-pumped wells over time,
2. Water level data from pumped wells over time,
3. Running and cumulative groundwater volumes removed from each pumping well,
4. Calculations and/or spreadsheets documenting quarterly nitrate mass removed by pumping,
5. comparison of the areal extent of the nitrate plume from the latest quarter with the latest quarter of the previous reporting period, and
6. discussion of any contingencies implemented or to be implemented.

10.2.7 Additional Measures

Based on Phase II monitoring, and the criteria discussed in Section 8, contingencies that include potential installation of additional wells, well rehabilitation or replacement, potential expansion of the pumping well network, if suitable well locations are available, and reevaluation of the Phase II strategy and consideration of commencement of Phase III activities will be implemented as needed. Factors that could trigger the implementation of contingencies include 1) expansion of the plume boundaries, 2) generally increasing nitrate concentrations and calculated nitrate mass within the plume, 3) reductions in nitrate mass removal rates due to losses in pumping well productivities, and 4) decreases in the effectiveness of hydraulic capture.

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10.3 Phase III

As discussed in Section 3.2.3, Phase III, if necessary, will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Utah Water Quality Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

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12. LIMITATIONS STATEMENT

The opinions and recommendations presented in this report are based upon the scope of services and information obtained through the performance of the services, as agreed upon by HGC and the party for whom this report was originally prepared. Results of any investigations, tests, or findings presented in this report apply solely to conditions existing at the time HGC's investigative work was performed and are inherently based on and limited to the available data and the extent of the investigation activities. No representation, warranty, or guarantee, express or implied, is intended or given. HGC makes no representation as to the accuracy or completeness of any information provided by other parties not under contract to HGC to the extent that HGC relied upon that information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and for the particular purpose that it was intended. Reuse of this report, or any portion thereof, for other than its intended purpose, or if modified, or if used by third parties, shall be at the sole risk of the user.

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TABLES

FIGURES

APPENDIX A

HYDROGEOLOGIC CROSS SECTIONS

APPENDIX B

LITHOLOGIC LOGS FOR
MW-3A, MW-30, MW-31, MW-34, AND MW-37

ATTACHMENT 2
CLEAN COPY OF REVISIONS TO
NITRATE CORRECTIVE ACTION PLAN

CORRECTIVE ACTION PLAN FOR NITRATE
WHITE MESA URANIUM MILL
NEAR BLANDING, UTAH

May 7, 2012

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1. INTRODUCTION, OVERVIEW, AND SCOPE

This document presents a Corrective Action Plan (CAP) to address nitrate + nitrite (as nitrate) (heretofore referred to as "nitrate") contamination in a shallow perched groundwater zone beneath the White Mesa Uranium Mill (the "site" or the "Mill"), located on White Mesa near Blanding, Utah, operated by Denison Mines (USA) Corp. ("Denison"). Figure 1-1 is a map showing site features including seeps and springs at the margins of White Mesa. Figure 1-2 is a map of the site showing the locations of perched zone monitoring wells and the area of the perched groundwater zone affected by nitrate concentrations exceeding 10 milligrams per liter (mg/L) that is the focus of this CAP. For the purposes of this document, all nitrate concentrations in groundwater have been expressed as mg/L nitrogen. Elevated concentrations of chloride were also detected in the monitoring wells having elevated concentrations of nitrate. In a letter dated December 1, 2009, the Co-Executive Secretary of the Utah Water Quality Board (the "Executive Secretary") recommended that Denison also address and explain the elevated chloride concentrations.

Nitrate within the area shown in Figure 1 was first detected in wells TW4-19, TW4-22, TW4-24, and TW4-25 that were installed as part of the investigation of a chloroform plume discovered at perched well MW-4 in 1999. Pumping of chloroform-laden perched water began in 2003 (HGC, 2007a) and continues to the present time via pumping of wells MW-4, MW-26, TW4-4, TW4-19, and TW4-20.

Investigation of nitrate exceeding 10 mg/L in the perched water included installation of 19 temporary TWN-series wells shown in Figure 1 and numerous shallow borings as part of a source investigation. Denison identified and prioritized potential sources of the nitrate in the December 2009 *Source Review Report for Nitrate and Chloride in Groundwater at the White Mesa Mill*, (INTERA, 2009a) and in the subsequent August 2011 *Nitrate Investigation Revised Phases 2 through 5 Work Plan*. (INTERA, 2011).

Based on the investigations, Denison and the Executive Secretary have agreed that the corrective actions will involve three Phases. Phase I will involve source control in the vicinity of the Mill's ammonium sulfate tanks, the one remaining potential source of contamination. Phase II will involve near term active remediation of the nitrate contamination by pumping contaminated water into the Mill's tailings cells for disposal, combined with monitored natural attenuation. Phase III, if necessary, will be at the discretion of Denison and would involve a long term solution for the nitrate contamination, in the event that the continuation of Phase II is not considered adequate or appropriate. Phases I and II are addressed in this CAP and will commence shortly upon Executive Secretary approval of this CAP. Phase III is not covered in

detail in this CAP and, if determined to be necessary, will be addressed in a separate CAP revision.

Every reasonable effort will be made to ensure that corrective action implementation effort for the nitrate plume is performed in a manner that is mutually compatible with, and integrated with, the corrective action implementation effort for the chloroform plume in terms of scope and operation to ensure the effects of corrective action operations for the nitrate plume do not impede or substantially reduce the effectiveness of corrective action operations for the chloroform plume, and vice versa.

The elements of this CAP document include the following items:

- A History of the Nitrate Contamination Investigation
- A discussion of the decision to proceed with Corrective Action
- A summary of the applicable requirements
- CAP objectives
- A description of the site hydrogeology
- The nature and extent of nitrate in the perched zone
- Proposed corrective remedial actions and concentration limits
- Proposed corrective action contingencies

2. HISTORY OF NITRATE CONTAMINATION INVESTIGATION

A brief discussion of the Nitrate Contamination Investigation and the decision to proceed with corrective action is provided in Sections 2.1 and 2.2.

2.1 Summary of Contamination Investigation Report Activities

On January 27, 2009 the Executive Secretary of the Utah Division of Radiation Control ("DRC") and Denison entered into the 2009 Stipulated Consent Agreement ("SCA"), which set forth the requirement that Denison would submit a written Contaminant Investigation Report (CIR) for Executive Secretary review and approval, to among other things, characterize the source(s), physical extent, transfer mechanisms and characteristics of the Nitrate contamination of the shallow aquifer at the site.

Denison submitted to the Executive Secretary a CIR which had been prepared by their consultant INTERA, Inc. The CIR was dated December 30, 2009 (INTERA, 2009b) and entitled "Nitrate Contamination Investigation Report White Mesa Uranium Mill Site Blanding, Utah" (2009 CIR). On October 5, 2010 the Executive Secretary issued a Notice of Additional Required Action (NARA) letter that notified Denison of the Executive Secretary's determination that the 2009 CIR was incomplete.

On December 20, 2010 Denison and the Executive Secretary entered into a Tolling Agreement (Tolling Agreement (Rev. 0)) to defer any monetary penalties that might accrue under the 2009 SCA, in order to provide a time period (Tolling Period) for:

1. Denison to prepare and submit a plan and schedule (Plan and Schedule) by which to conduct additional investigations to resolve open issues identified in the October 5, 2010 NARA on or before February 15, 2011,
2. The Executive Secretary to provide his initial comments on the Plan and Schedule on or before March 15, 2011, and for Denison and the Executive Secretary to finalize the Plan and Schedule, and
3. Denison and the Executive Secretary to negotiate, finalize and execute a revised or replacement SCA that incorporates the Plan and Schedule.

In addition, the Tolling Agreement (Rev. 0) required that the Tolling Period be extended from January 4, 2010 (submittal of the 2009 CIR to the Executive Secretary) until Apri1 30, 2011.

Pursuant to the Tolling Agreement (Rev. 0), Denison submitted a Plan and Schedule on February 14, 2011 and a revised Plan and Schedule on February 18, 2011, and the Executive Secretary provided his comments on the revised Plan and Schedule on March 21, 2011. In an April 20,

2011 meeting, Denison and the Executive Secretary agreed that the Plan and Schedule to conduct additional nitrate investigations would be composed of at least four (4) and possibly five (5) phases of study, including:

1. Phase 1A through C - including geoprobe drilling, and soil sampling/analysis of soils to investigate:
    a. Possible natural nitrate salt reservoir in the vadose zone beyond the mill site area (Phase 1A);
    b. Potential nitrate sources in the mill site area (Phase 1 B); and
    c. Other potential nitrate sources (Phase 1 C).
2. Phase 2 - including groundwater quality sampling and analysis of existing monitoring wells for non-isotopic analytes.
3. Phase 3 - including deep bedrock core sampling/analysis of possible natural nitrate reservoir and potential nitrate source locations, with similar objectives as Phases 1 A through C.
4. Phase 4 - including stable isotopic sampling/analysis of groundwater in existing monitoring wells. Details of this investigation were to be determined at a later date, and approved by both parties.
5. Phase 5 - including stable isotopic sampling/analysis of soil/core samples, if needed.

On April 28, 2011, Denison and the Executive Secretary entered into a Revised Tolling Agreement (Tolling Agreement (Rev. 1), to extend the Tolling Period through June 30, 2011 and adopt the agreements made in the April 20, 2011 meeting. Under the Tolling Agreement (Rev. 1), Denison agreed to submit a Revised Phase 1 (A through C) Work Plan on or before May 6, 2011 and a Revised Phase 2 through 5 Work Plan and Schedule on or before June 3, 2011.

Pursuant to the Tolling Agreement (Rev. 1), Denison submitted a May 6, 2011 Revised Phase 1 Work Plan and Schedule for the Phase 1 A - C investigation prepared by INTERA, for Executive Secretary review. On May 11, 2011, the DRC: 1) provided via email, comments on the May 6, 2011 INTERA document, and requested that Denison resolve all DRC comments before initiation of field activities. All comments were resolved, and Denison conducted field and laboratory work for the Phase l A-C study in May and June, 2011.

Pursuant to the Tolling Agreement (Rev. 1), Denison submitted a June 3, 2011 Revised Phase 2 through 5 Work Plan and Schedule (Phase 2 - 5 Work Plan), prepared by INTERA, for Executive Secretary review. In a letter dated June 23, 2011 DRC provided comments on this Denison document in the form of a URS memorandum, dated June 23, 2011 and advised Denison that in order to revise the 2009 SCA to incorporate the deliverables and timelines set out in an

approvable Phase 2 through 5 Work Plan, it would be necessary to provide a level of detail in revisions of that Work Plan for Phases 2, 3, 4, and 5 comparable to the level of detail for Phase 1 contained in Attachment 1 of the Tolling Agreement (Rev. 1).

On June 30, 2011, Denison and the Executive Secretary entered into a Revised Tolling Agreement [Tolling Agreement (Rev. 2)] to extend the Tolling Period to August 31, 2011, in order to facilitate the revision of the Phase 2 through 5 Work Plan to provide the level of detail required to construct a replacement SCA. Pursuant to the Tolling Agreement (Rev.2), Denison submitted a separate July 1, 2011 detailed Work Plan and Quality Assurance Plan ("QAP") for the Phase 2 investigation (Phase 2 Plan, Revision 0). Executive Secretary comments on this document were provided in a July 7, 2011 DRC letter. Denison provided a revised July 12, 2011 Phase 2 QAP and Work Plan (Phase 2, Revision 1.0), which DRC conditionally approved in a letter dated July 18, 2011.

On August 1 and 2, 2011 Denison submitted by email preliminary laboratory results for the Phase l A-C study to the Executive Secretary.

On August 4, 2011, Denison provided a revision to the Phase 2 - 5 Work Plan (Phase 2-5 Work Plan, Revision 1.0), prepared by INTERA, for Executive Secretary review. DRC comments on the Phase 2-5 Work Plan, Revision 1.0 and on the August 1, 2011 preliminary laboratory results for the Phase l A-C study, were provided to Denison on August 11, 2011 as part of a conference call, and a DRC email, which included an August 11, 2011 URS memorandum. Under a cover letter dated August 18, 2011, Denison submitted a revised Phase 2-5 Work Plan (Phase 2-5 Work Plan, Revision 2.0) for Executive Secretary review, in response to the comments provided to Denison on August 11, 2011.

As discussed in the following Sections, DRC and Denison have agreed to proceed with corrective action.

In an August 25, 2011 DRC letter, the Executive Secretary advised that per review of the Phase 2-5 Work Plan, Revision 2.0, the Executive Secretary has determined that a finalized Plan and Schedule, that meets the satisfaction of the Executive Secretary, and which would allow the preparation of a replacement SCA, is not possible at this time; and that the development of a replacement SCA for continued contaminant investigation activities is not supported.

At a meeting between Denison and DRC on August 29, 2011 to discuss the Executive Secretary's August 25, 2011 findings related to the Phase 2-5 Work Plan Rev. 2.0, the preliminary laboratory results for the Phase I A-C study, and the approach forward, Denison and DRC agreed that:

1. After more than two years of investigation it has been determined that there are site conditions that make it difficult to determine the source(s) of the contamination at the White Mesa site;
2. As a result, resources will be better spent in developing a CAP in accordance with UAC R317-6-6.15(D), rather than continuing with further investigations as to the source(s) of the contamination.

During discussion throughout October 2011, Denison and the Executive Secretary acknowledged that it has not been possible to date to determine the source(s), cause(s), attribution, magnitudes of contribution, and proportion(s) of the local nitrate and chloride in groundwater, and thereby cannot eliminate Mill activities as a potential cause, either in full or in part, of the contamination. As a result, Denison and the Executive Secretary agreed that resources will be better spent in developing a CAP in accordance with UAC R317-6-6.15(D), rather than continuing with further investigations as to the source(s) and attribution of the groundwater contamination.

2.2 Conclusions from the Contamination Investigation

The contamination investigation program from 2009 to 2011 has provided a basis for development of a CAP. Specifically the investigation has determined:

- the areal and spatial extent of the plume,
- that the plume does not appear to be increasing in size or concentration,
- that there are no known unaddressed current or ongoing sources of contamination.

As discussed above, a number of potential mill and non-mill sources were identified in (INTERA (2009a), and INTERA (2011) Based on the investigation and source evaluations, there are no known current unidentified or unaddressed sources. There appear to have been a number of known and potential historic sources; however, it has not been possible to confirm or quantify the contribution of each.

Analytical results indicate that neither the average concentration of the plume nor the areal extent of the plume have increased during the monitored period. The only potential current source identified and potentially requiring control is the ammonium sulfate tanks. This potential source is addressed in Phase I of the CAP, discussed in Sections 3.2.1 and 7.1 below.

The Executive Secretary determined that a CAP is required at the White Mesa facility, pursuant to UAC R317-6-6.15(C)(I) and Denison agreed to develop, secure Executive Secretary approval, and implement a CAP. The Executive Secretary has therefore determined, and Denison agreed to

submit a CAP, pursuant to the requirements of the Utah Ground Water Quality Protection Rules [UAC R317 -6-6.15(C - E)].

The purpose of Phase I of this CAP is to remedy the effects of the ammonium sulfate tank potential source. The purpose of each of the proposed phases of this CAP is discussed further in section 3.2.

3. FRAMEWORK AND OBJECTIVES OF THE CAP

Applicable regulations and requirements governing the CAP, and preliminary milestones are discussed in Sections 3.1 through 3.3.

3.1 Applicable Regulations and Requirements

Denison agreed to submit a CAP for Executive Secretary review and approval, on or before November 30, 2011 that meets the CAP related requirements of UAC R317-6-6.15 (D.2, 3 and E). This document constitutes the "Nitrate CAP".

The remaining sections of this CAP are intended to demonstrate, per the requirements in UAC R317 -6-6.15(D)(2) and (3), that:

- the proposed action(s) are protective of public health and the environment, including consideration of future impacts of the nitrate plume on land and water resources not owned and controlled by Denison.
- the corrective action meets the State Ground Water Quality Standards, pursuant to UAC R317 -6-6.15(F). Alternatively, Denison may petition the Utah Water Quality Board for approval of an Alternate Corrective Action Concentration Limit as part of the CAP, Phase III, pursuant to UAC R317 -6-6.15(G).
- the action will produce a permanent effect.

Per UAC R317 -6-6.15(D)(2) and (3) the action proposed in the CAP is required to meet any other additional measure required by the Executive Secretary under UAC R317 -6-6.15(E)(5).

Denison has agreed with the Executive Secretary that these additional measures shall include, but are not limited to:

- Remediation guidance found in the April, 2004 EPA Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (EPA530-R-04-030) or equivalent, to the extent applicable, as determined by the Executive Secretary;
- Determination of corrective action performance standards, objectives, and criteria for groundwater remediation system design, construction, operations and/or maintenance, as approved by the Executive Secretary in accordance with applicable regulations;
- Determination of long term operation, maintenance, system performance and groundwater quality monitoring requirements to evaluate effectiveness of the approved corrective action(s), at a frequency, and by methods approved by the Executive Secretary;
- Submittal of written quarterly Denison reports of pumping and monitoring well system performance and groundwater quality monitoring information for Executive Secretary review and approval. In the event that additional information is required of any report, Denison shall respond to and provide a Plan and Schedule for Executive Secretary

approval to resolve all issues /concerns within 30 calendar days of receipt of written Executive Secretary notice;

- Timely Denison verbal and written notification of process or equipment failures, and corrective actions taken, or a timely schedule by which corrective action will be taken to return the facility to full compliance with CAP performance standards, objectives, and criteria; and
- Periodic Denison review, summation, and report submittal, for Executive Secretary approval, to demonstrate if the approved corrective action is protective of public health and the environment. The interval of said report period shall not exceed five (5) years.

3.2 Objectives of the CAP

The objectives of the CAP are the following:

- Minimize or prevent further downgradient migration of the perched nitrate plume (Figure 1-2) by a combination of pumping and reliance on natural attenuation,
- Prevent nitrate concentrations exceeding the action level from migrating to any potential point of exposure,
- Monitor to track changes in concentrations within the plume and to establish whether the plume boundaries are expanding, contracting, or stable,
- Provide contingency plans to address potential continued expansion of the plume and the need for additional monitoring and/or pumping points, and
- Ultimately reduce nitrate concentrations at all monitoring locations to the action level or below.

To achieve these objectives, the CAP proposes a phased approach.

3.2.1 Summary of Phase I Objectives and Scope

Per Section 11A(1) of the SCA, Phase I is required to include a control for the soil contamination observed at the ammonium sulfate tanks, a potential source of perched groundwater contamination. Pursuant to UAC 317-6-6.15 (E)(4)(b) this control will include at a minimum:

Determination, to the satisfaction of the Executive Secretary, of the physical extent of the soil contamination observed at the ammonium sulfate tanks near borings GP-25B (Nitrate + Nitrite (as N) 1,530 mg/kg-dry at depth of 6 feet) and GP-26B (Ammonia (as N) 1,590 mg/kg-dry at a depth of 16 feet) that were part of the nitrate investigation. Such effort shall include an estimate of the volume (the "Contaminated Soil Volume") of the contaminated soils down to but not including bedrock, and an estimate of the surface area (the "Contaminated Surface Area") at or above the estimated location of the Contaminated Soil Volume; and either a Plan and Schedule,

to be submitted on or before January 1, 2012, for Executive Secretary approval, to cover the Contaminated Surface Area with at least six inches of concrete, to the extent not already covered by concrete or existing buildings, to prevent infiltration of surface water into the contaminated soils; and/or a Plan and Schedule, to be submitted on or before January 1, 2012, for Executive Secretary approval, to remove the Contaminated Soil Volume and dispose of the contaminated soils in the Mill's tailings impoundments. If Denison chooses to cover the Contaminated Surface Area with concrete, Denison must remove the Contaminated Soil Volume at a later date prior to site closeout and must submit a revised surety estimate on or before March 4, 2012 to include future costs to remove the Contaminated Soil Volume.

As discussed in Section 7.1 of this CAP, Denison proposes to construct a sloped and drained concrete pad of six inches in depth over an area covering the lateral extent of contamination to be determined as discussed in Section 7.1. Denison also proposes a future removal of contaminated soil at the time of Mill site reclamation and, for conservatism, proposes to revise the reclamation surety estimate to include a volume of soil to be removed and placed in the tailings area of twice the volume of contaminated soil identified in the contamination investigation. Further details are discussed in Section 7.1, below.

3.2.2 Summary of Phase II Objectives and Scope

Per Section 11A(2) of the SCA, Phase II is to include near term active remediation of the nitrate contamination by pumping contaminated water into the Mill's tailings cells for disposal. Said phase shall also include: 1) the development, implementation, operation, and monitoring requirements for a pumping well network designed to contain and hydraulically control the nitrate groundwater plume to maintain concentrations at or below the Utah Groundwater Quality Standard (10 mg/L), i.e., prevent physical expansion of said plume, and 2) monitoring of chloride concentrations.

Phase II constitutes an interim remedial action that consists of a combination of “active” and “passive” strategies. The active strategy consists of removing nitrate mass as rapidly as practical by pumping areas within the plume that have high nitrate concentrations and relatively high productivity. Continued monitoring within and outside the plume is considered part of the active strategy. The passive strategy consists of relying on natural attenuation processes to reduce nitrate concentrations. Reductions in concentrations would be achieved by physical processes such as hydrodynamic dispersion, and dilution via mixing with recharge and waters outside the plume.

Natural attenuation is expected to reduce nitrate concentrations within the entire plume. However, within upgradient portions of the plume that have the highest concentrations, direct

mass removal via pumping will be the primary means to reduce concentrations. In downgradient portions of the plume where concentrations are lower, natural attenuation will be a more important mechanism in reducing concentrations.

3.2.3 Summary of Phase III Objectives and Scope

Per the SCA, Phase III, if necessary is to include a comprehensive long term solution for the nitrate groundwater contamination at the Mill Site. This phase will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

The CAP is not intended to address contamination located outside the Mill's restricted area and that is not contiguous with groundwater contamination inside the Mill's restricted area. The CAP will therefore evaluate which of the existing monitoring wells will be maintained and which wells (including certain upgradient and off-site wells) can be abandoned, subject to prior Executive Secretary approval.

It should be noted that while Phase II of the CAP requires monitoring of chloride concentrations, the CAP does not explicitly identify measures for controlling chloride levels per se, because there is no health standard for chloride in groundwater. However, as discussed and agreed to with DRC during meetings in October 2011, chloride appears to be co-located with nitrate in groundwater at the Mill and hydrogeological measures to contain nitrate will also contain chloride.

3.3 Preliminary Milestones for the CAP

Per the SCA, Denison has committed to the following milestones for corrective action. Dates for the following milestones will be established based on the date of the Executive Secretary's approval of the CAP and issuance of a Consent Order approving the CAP.

- Within 30 calendar days of the Executive Secretary's approval of the CAP, pursuant to UAC R317-6-6.15(E), Denison shall commence implementation and execution of all corrective actions required under a future Consent Order to be issued by the Executive Secretary that addressed the approved CAP. A proposed schedule for implementation of the CAP is included as Table 1 to this CAP.
- Within 60 calendar days of the Executive Secretary's issuance of a future Consent Order regarding the approved CAP, pursuant to UAC R317-6-6.15(E), Denison will submit a revised Reclamation Plan and financial surety cost estimate (Revised Surety), for Executive Secretary review and approval which addresses the groundwater corrective action, with the surety sufficient to recover the anticipated cost and time frame for achieving compliance, before the land is transferred to the federal government for long-term custody. At a minimum, the Denison surety will provide for all costs for Phases I and II of the approved CAP for a period of time until Executive Secretary approval of Phase III of the CAP to restore groundwater to the established site specific groundwater cleanup standards pursuant to UAC R317-6-6.15 before the site is transferred to the federal government for long term custody.

4. BACKGROUND

Sections 3.1 through 3.4 provide a brief description of site hydrogeology that is based primarily on TITAN (1994), but includes the results of more recent site investigations. Section 3.5 discusses the occurrence of nitrate in the perched water at the site and focuses on the nitrate plume shown in Figure 1-2.

4.1 Geologic Setting

The Mill is located within the Blanding Basin of the Colorado Plateau physiographic province. Typical of large portions of the Colorado Plateau province, the rocks underlying the site are relatively undeformed. The average elevation of the site is approximately 5,600 feet above mean sea level ("ft amsl").

The site is underlain by unconsolidated alluvium and indurated sedimentary rocks consisting primarily of sandstone and shale. The indurated rocks are relatively flat lying with dips generally less than 3º. The alluvial materials consist mostly of aeolian silts and fine-grained aeolian sands with a thickness varying from a few feet to as much as 25 to 30 feet across the site. The alluvium is underlain by the Dakota Sandstone and Burro Canyon Formation, which are sandstones having a total thickness ranging from approximately 100 to 140 feet. In portions of the site, a few feet to as much as about 30 feet of Mancos Shale lies between the alluvium and the Dakota Sandstone.

Beneath the Burro Canyon Formation lies the Morrison Formation, consisting, in descending order, of the Brushy Basin Member, the Westwater Canyon Member, the Recapture Member, and the Salt Wash Member. Figure 2 is a photograph of the contact between the Burro Canyon Formation and the underlying Brushy Basin Member taken from a location along highway 95 immediately north of the Mill. This photograph illustrates the transition from the cliff-forming sandstone of the Burro Canyon Formation to the slope-forming Brushy Basin Member.

The Brushy Basin and Recapture Members of the Morrison Formation, classified as shales, are very fine-grained and have a very low hydraulic conductivity. The Brushy Basin Member is primarily composed of bentonitic mudstones, siltstones, and claystones. The Westwater Canyon and Salt Wash Members also have a low average vertical hydraulic conductivity due to the presence of interbedded shales.

Beneath the Morrison Formation lie the Summerville Formation, an argillaceous sandstone with interbedded shales, and the Entrada Sandstone. Beneath the Entrada lies the Navajo Sandstone. The Navajo and Entrada Sandstones constitute the primary aquifer in the area of the site. The Entrada and Navajo Sandstones are separated from the Burro Canyon Formation by

approximately 1,000 to 1,100 feet of materials having a low average vertical hydraulic conductivity. Groundwater within this system is under artesian pressure in the vicinity of the site, is of generally good quality, and is used as a secondary source of water at the site.

4.2 Hydrogeologic Setting

The site is located within a region that has a dry to arid continental climate, with an average annual precipitation of approximately 13.3 inches, and an average annual lake evaporation rate of approximately 47.6 inches. Recharge to the principal aquifers occurs mainly along the mountain fronts (for example, the Henry, Abajo, and La Sal Mountains), and along the flanks of folds such as Comb Ridge Monocline.

Although the water quality and productivity of the Navajo/Entrada aquifer are generally good, the depth of the aquifer (approximately 1,200 feet below land surface [ft bls]) makes access difficult. The Navajo/Entrada aquifer is capable of yielding significant quantities of water to wells (hundreds of gallons per minute ["gpm"]). Water in wells completed across these units at the site rises approximately 800 feet above the base of the overlying Summerville Formation.

Perched groundwater in the Dakota Sandstone and Burro Canyon Formation originates mainly from precipitation and local recharge sources such as unlined reservoirs (Kirby, 2008) and is used on a limited basis to the north (upgradient) of the site because it is more easily accessible than the Navajo/Entrada aquifer. Water quality of the Dakota Sandstone and Burro Canyon Formation is generally poor due to high total dissolved solids ("TDS"). The saturated thickness of the perched water zone is generally higher to the north of the site.

4.3 Perched Zone Hydrogeology

Perched groundwater beneath the site occurs primarily within the Burro Canyon Formation. Perched groundwater at the site has a generally low quality due to high total TDS in the range of approximately 1,100 to 7,900 milligrams per liter ("mg/L"), and is used primarily for stock watering and irrigation in the areas upgradient (north) of the site where generally higher saturated thicknesses increase well yields. Perched water is supported within the Burro Canyon Formation by the underlying, fine-grained Brushy Basin Member. Figure 3 is a contour map showing the approximate elevation of the contact of the Burro Canyon Formation with the Brushy Basin Member, which essentially forms the base of the perched water zone at the site.

Contact elevations between the Burro Canyon Formation and Brushy Basin Member in Figure 3 are based on perched monitoring well drilling and geophysical logs and surveyed land surface elevations. As indicated, the Burro Canyon Formation/Brushy Basin Member contact (although

irregular because it represents an erosional surface) generally dips to the south/southwest beneath the site.

Appendix A contains hydrogeologic cross-sections that intersect within the nitrate plume. These cross-sections show the site lithology above the Brushy Basin Member, perched water within the Dakota Sandstone/Burro Canyon Formation, and the occurrence of nitrate within the perched water. As shown in Figure A.2, relatively thick conglomeratic intervals exist within the saturated zone at MW-31, located at the downgradient edge of the nitrate plume. As discussed below, these intervals appear to pinch out to the south (downgradient) and to the west (cross-gradient) of MW-31.

Less conglomeratic material is present in the saturated zone at MW-30 and MW-3A than at MW-31, as shown in the attached lithologic logs (Appendix B). Thin conglomeratic zones (approximately 1-2 feet thick) occur at the base of the perched zone in MW-31 and MW-3A. Detailed lithologic logs for MW-5, MW-11, MW-14 and MW-15 are not available to assess the presence of conglomeratic material at those locations. However, saturated conglomeratic materials were not encountered at MW-34 and MW-37 (located adjacent to MW-15), as shown in the attached lithologic logs.

Based on the available information, significant conglomeratic horizons within the saturated perched zone do not appear to exist at or downgradient of MW-30. Furthermore, hydraulic test data from MW-30 and MW-31 indicate that the conglomeratic zones in MW-31 do not enhance the conductivity at MW-31. The hydraulic conductivity estimates (based on Kansas Geological Survey ("KGS") solution analysis of automatically logged slug test data) for MW-30 and MW-31 are similar. The hydraulic conductivity estimates for MW-30 and MW-31, respectively, are 1 x 10^{-4} cm/s and 7 x 10^{-5} cm/s (HGC, 2005).

4.3.1 Lithologic and Hydraulic Properties

Although the Dakota Sandstone and Burro Canyon Formations are often described as a single unit due to their similarity, previous investigators at the site have distinguished between them. The Dakota Sandstone is a relatively hard to hard, generally fine-to-medium grained sandstone cemented by kaolinite clays. The Dakota Sandstone locally contains discontinuous interbeds of siltstone, shale, and conglomeratic materials. Porosity is primarily intergranular. The underlying Burro Canyon Formation hosts most of the perched groundwater at the site. The Burro Canyon Formation is similar to the Dakota Sandstone but is generally more poorly sorted, contains more conglomeratic materials, and becomes argillaceous near its contact with the underlying Brushy Basin Member. The hydraulic conductivities of the Dakota Sandstone and Burro Canyon Formation at the site are generally low.

No significant joints or fractures within the Dakota Sandstone or Burro Canyon Formation have been documented in any wells or borings installed across the site (Knight-Piésold, 1998). Any fractures observed in cores collected from site borings are typically cemented, showing no open space.

4.3.1.1 Dakota

Porosities of the Dakota Sandstone range from 13.4% to 26%, averaging 20%, and water saturations range from 3.7% to 27.2%, averaging 13.5%, based on samples collected during installation of wells MW-16 (abandoned) and MW-17 (Figure 1-2). The average volumetric water content is approximately 3%. The hydraulic conductivity of the Dakota Sandstone based on packer tests in borings installed at the site ranges from approximately 2.7×10^{-6} centimeters per second ("cm/s") to 9.1×10^{-4} cm/s, with a geometric average of 3.9×10^{-5} cm/s.

4.3.1.2 Burro Canyon

The average porosity of the Burro Canyon Formation is similar to that of the Dakota Sandstone. Porosity ranges from 2% to 29.1%, averaging 18.3%, and water saturations of unsaturated materials range from 0.6% to 77.2%, averaging 23.4%, based on samples collected from the Burro Canyon Formation at MW-16 (abandoned), located beneath new tailings Cell #4A. TITAN (1994) reported that the hydraulic conductivity of the Burro Canyon Formation ranges from 1.9×10^{-7} to 1.6×10^{-3} cm/s, with a geometric mean of 1.1×10^{-5} cm/s, based on the results of 12 pumping/recovery tests performed in monitoring wells and 30 packer tests performed in borings prior to 1994. Subsequent hydraulic testing of perched zone wells has yielded a range of 2×10^{-7} to 0.01 cm/s (HGC, 2009a).

In general, the highest hydraulic conductivities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher conductivity zone that is associated with the chloroform plume (HGC, 2007b) has been inferred to exist in this portion of the site. Analysis of drawdown data collected from this zone during long-term pumping of MW-4, MW-26, and TW4-19 (Figure 1-2) yielded estimates of hydraulic conductivity ranging from 4×10^{-5} to 1×10^{-3} cm/s (HGC, 2004). The decrease in perched zone hydraulic conductivity south to southwest of this area indicates that this higher conductivity zone "pinches out" (HGC, 2007b).

Hydraulic conductivities downgradient of the tailings cells are generally low. Hydraulic tests at wells located at the downgradient edge of the cells, and south and southwest of the cells yielded geometric average hydraulic conductivities of 2.3×10^{-5} and 4.3×10^{-5} cm/s depending on the testing and analytical methods. The low hydraulic conductivities and shallow hydraulic gradients

downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site (approximately 1.7 ft/yr to 3.2 ft/yr based on calculations presented in HGC, 2009a).

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of slug tests at wells MW-27, MW-30, MW-31, TW4-20, TW4-21, TW4-22, TW4-24, TW-25, TWN-1, TWN-2, TWN-3, and TWN-18 (HGC, 2005 and HGC, 2009a). The hydraulic conductivity at MW-11 was based on a pumping test reported by UMETCO (1993) and the hydraulic conductivity at TW4-19 was based on long-term pumping of that well for chloroform removal (HGC, 2004). Hydraulic conductivity estimates range from approximately 2.7×10^{-5} to 1.4×10^{-3} cm/s, and have a geometric average of 1.2×10^{-4} cm/s, assuming unconfined conditions (Table 2). The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

4.3.2 Perched Groundwater Flow

Perched groundwater flow at the site has historically been to the south/southwest (HGC, 2007b). Figure 4 is a perched groundwater elevation contour map for the third quarter of 2011. These contours are based on water levels measured in the perched groundwater monitoring wells shown in the figure. Local depression of the perched water table occurs near wells MW-4, TW4-4, TW4-19, TW4-20, and MW-26. These wells are pumped to reduce chloroform mass in the perched zone east and northeast of the tailings cells as discussed in HGC (2007a).

Perched water mounds are associated with wildlife ponds on the east side of the site. The mounds are likely the result of seepage from the unlined ponds. An apparent perched water mound also exists in the vicinity of TWN-2 just north of the Mill site. The apparent perched water mound near TWN-2 is likely a residual mound resulting from low conductivity conditions (Table 2) and the location of TWN-2 within the footprint of the historical pond (Figure 8). Although the historical pond no longer exists and does not contain standing water, the remaining topographic depression associated with the pond likely resulted in enhanced infiltration of precipitation before re-grading of the land surface in that area, circa 1980. Slightly enhanced infiltration of precipitation and low conductivity conditions at TWN-2 likely allowed the mound to persist. The decay of the mound is expected to be slow because of the low conductivity.

A dry area to the southwest of Cell 4B is defined by the area where the kriged Brushy Basin contact elevation rises above the kriged perched water level elevation. The lateral extent of the dry area shown in Figure 4 is currently under investigation. The installation of wells along the southern and western margins of Cell 4B in August, 2010 and April, 2011 indicate that the dry

zone extends at least from the southwest central portion of Cell 4B to the southwest corner of Cell 4B.

Beneath and downgradient of the tailings cells, on the west side of the site, perched water flow is south-southwest to southwest. On the eastern side of the site perched water flow is more southerly. Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). Perched zone hydraulic gradients currently range from a maximum of approximately 0.07 ft/ft east of tailings Cell #2 (near well TW4-14) to approximately 0.01 ft/ft downgradient of the tailings cells. Gradients may be steeper locally near pumping wells (for example near TW4-20, where the gradient reaches approximately 0.09 ft/ft)

Perched water discharges in springs and seeps along Westwater Creek Canyon and Cottonwood Canyon to the west-southwest of the site, and along Corral Canyon to the east of the site, (Figure 1-1) where the Burro Canyon Formation outcrops. The closest discharge points downgradient of the tailings cells are Westwater Seep (more than 2,000 feet downgradient) and Ruin Spring (more than 9,000 feet downgradient [HGC, 2010]).

4.3.3 Saturated Thickness

The saturated thickness of the perched zone as of the third quarter of 2011 ranges from approximately 92 feet in the northeastern portion of the site to less than 5 feet in the southwest portion of the site (Figure 5). A saturated thickness of approximately 2 feet occurs in well MW-34 along the south dike of new tailings Cell 4B, and the perched zone is apparently dry at MW-33 located at the southwest corner of Cell 4B. Depths to water range from approximately 17 to 18 feet in the northeastern portion of the site (near the wildlife ponds) to approximately 114 feet at the southwest margin of tailings Cell #3 (Figure 6). The relatively large saturated thicknesses in the northeastern portion of the site are likely related to seepage from the wildlife ponds located northeast and east of the tailings cells.

Although sustainable yields of as much as 4 gpm have been achieved in wells intercepting the larger saturated thicknesses and higher conductivity zones in the northeast portion of the site, perched zone well yields are typically low (<0.5 gpm) due to the generally low hydraulic conductivity of the perched zone. Sufficient productivity can generally be obtained only in areas where the saturated thickness is greater, which is the primary reason that the perched zone has been used on a limited basis as a water supply to the north (upgradient) of the site, but has not been used downgradient of the site.

4.4 Summary

Perched groundwater at the site is hosted primarily by the Burro Canyon Formation, which consists of a relatively hard to hard, fine- to medium-grained sandstone containing siltstone, shale and conglomeratic materials. The Burro Canyon Formation is separated from the underlying regional Navajo/Entrada aquifer by approximately 1,000 to 1,100 feet of Morrison Formation and Summerville Formation materials having a low average vertical hydraulic conductivity. The Brushy Basin Member of the Morrison Formation is a bentonitic shale that lies immediately beneath the Burro Canyon Formation and forms the base of the perched water zone at the site. Figure 2 is a photograph of the contact between the Burro Canyon Formation and the underlying Brushy Basin Member taken from a location along highway 95 immediately north of the Mill. This photograph illustrates the transition from the cliff-forming sandstone of the Burro Canyon Formation to the slope-forming Brushy Basin Member. Based on hydraulic tests at perched zone monitoring wells, the hydraulic conductivity of the perched zone ranges from approximately 2×10^{-7} to 0.01 cm/s.

Perched water flow is generally from northeast to southwest across the site. Beneath and downgradient of the tailings cells, on the west side of the site, perched water flow is south-southwest to southwest. On the eastern side of the site perched water flow is more southerly. Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). Perched water generally has a low quality, with total dissolved solids ranging from approximately 1,100 to 7,900 mg/L, and is used primarily for stock watering and irrigation north (upgradient) of the site.

Depths to perched water range from approximately 17 to 18 feet near the wildlife ponds in the northeastern portion of the site to approximately 114 feet at the southwestern margin of tailings Cell #3. Saturated thicknesses range from approximately 92 feet near the wildlife ponds to less than 5 feet in the southwest portion of the site, downgradient of the tailings cells. A saturated thickness of approximately 2 feet occurs in well MW-34 along the south dike of new tailings Cell 4B, and the perched zone is apparently dry at MW-33 located at the southwest corner of Cell 4B. Although sustainable yields of as much as 4 gpm have been achieved in wells penetrating higher transmissivity zones, well yields are typically low (<0.5 gpm) due to the generally low hydraulic conductivity of the perched zone.

Hydraulic testing of perched zone wells has yielded a range of approximately 2×10^{-7} to 0.01 cm/s. In general, the highest hydraulic conductivities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher hydraulic conductivity zone associated with the chloroform plume has been inferred to exist in this portion of the site. Analysis of drawdown data collected from this zone

during long-term pumping of MW-4, TW4-19, and MW-26 (TW4-15) yielded estimates of hydraulic conductivity ranging from 4 x 10^{-5} to 1 x 10^{-3} cm/s.

Hydraulic conductivities downgradient of the tailings cells are generally low. Hydraulic tests at wells located at the downgradient edge of the cells, and south and southwest of the cells yielded geometric average hydraulic conductivities of 2.3 x 10^{-5} and 4.3 x 10^{-5} cm/s depending on the testing and analytical method. The low hydraulic conductivities and shallow hydraulic gradients downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site.

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of hydraulic tests as discussed in Section 4.3. Hydraulic conductivity estimates ranged from approximately 2.7 x 10^{-5} to 1.4 x 10^{-3} cm/s, and have a geometric average of 1.2 x 10^{-4} cm/s, assuming unconfined conditions. The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

4.5 Nitrate Occurrence

Nitrate within the area shown in Figure 1-2 was first detected in wells TW4-19, TW4-22, TW4-24, and TW4-25 that were installed as part of the investigation of a chloroform plume first discovered at perched well MW-4 in 1999. Investigation of nitrate has included the installation of 19 temporary (TWN-series) perched zone nitrate monitoring wells to delineate and monitor the nitrate (Figure 1-2). The extent of nitrate contamination is described below and in further detail in Section 5.1 and its associated figures.

Nitrate concentrations in the perched zone as of the third quarter of 2011 are shown in Figure 7. Nitrate concentrations in the perched zone have ranged from non-detect to a maximum of 69 µg/L at well TWN-2 in the second and third quarters of 2010. Nitrate concentrations at downgradient wells MW-30 and MW-31 have been relatively stable, ranging from 15 to 17 mg/L at MW-30 and from 20 to 22 mg/L at MW-31 between the first quarter of 2010 through the third quarter of 2011.

Constituents associated with the nitrate include chloride, and in the east-central portion of the plume, chloroform. The association of nitrate with chloroform is discussed in HGC, 2007b.

4.5.1 Source Areas

As discussed above, a number of potential Mill and non-Mill sources were identified in INTERA (2009a), and INTERA (2011), as listed below:

1. Main leach field (also known as leach field east of scale house, 1985 to present)
2. Sewage vault/lift station (currently active)
3. Scale house leach field, (also known as leach field south of scale house, 1977-1979)
4. Former office leach field
5. Ammonia tanks
6. SAG leach field (leach field north of Mill building, 1998 to 2009)
7. Cell 1 leach field (leach field east of Cell #1, up to 1985)
8. Fly Ash Pond
9. Sodium chlorate tanks (as a potential chloride source)
10. Ammonium sulfate crystal tanks
11. Lawzy sump
12. Lawzy Lake
13. Former vault/lift station (to former office leach field, 1992 to 2009)
14. Truck shop leach field (1979-1985)
15. New Counter Current Decant/Solvent Extraction ("CCD/SX") leach field (currently active)
16. Historical Pond
17. Wildlife pond
18. CCD (included inadvertently and eliminated)
19. YC Precip Mini-Lab
20. V2O5 Mini-Lab & V2O5 Precip
21. SX Mini-Lab
22. Chem Lab
23. Met Lab
24. V2O5 oxidation tanks
25. Natural nitrate reservoir
26. – 32. Seven other ponds or pond-like sources

Figure 8 shows the locations of potential source areas 1 through 24.

Based on the investigation and source evaluations completed to date, there are no known current unidentified or unaddressed ongoing sources. There appear to have been a number of known and potential historic sources; however, it has not been possible to confirm or quantify the contribution of each. Soil contamination associated with the ammonium sulfate tanks as a potential source to perched groundwater is addressed as Phase I of this CAP.

Although the actual source or sources have not been identified and quantified, based on analysis of the concentrations within and the areal extent of the plume over the past two years, Denison and DRC have concluded there is no known significant unaddressed currently active source. That is, analytical results indicate that neither the average concentration within the plume nor the areal extent of the plume has increased during the period it has been monitored. Therefore, although the source or sources have not been definitively determined, sufficient information exists to bound and characterize the plume and plan remedial actions for its control.

4.5.2 Nitrate Concentration Trends

Table 3 provides nitrate concentrations detected at wells within the nitrate plume from the first quarter, 2010 through the third quarter of 2011. Over the last year (between the third quarter, 2010 and third quarter, 2011) three wells decreased in concentration, three increased, and three remained the same. The well with the highest concentrations, TWN-2, decreased from 69 mg/L to 33 mg/L. The average nitrate concentration within the plume decreased from 24.4 mg/L to 19.7 mg/L. At the downgradient edge of the plume, monitor wells MW-30 and MW-31 have been sampled since June 2005. During the period from June 2005 to December 2011, samples from MW-30 have had an average nitrate concentration of 16 mg/L with a standard deviation of 1.4 mg/L (Figure 9-1). During the same period, samples from MW-31 have had an average nitrate concentration of 22 mg/L with a standard deviation of 2.7 mg/L (Figure 9-1). Thus, the downgradient edge of the plume has been relatively stable over a six and one half year period.

The information presented above indicates that concentrations within the plume are relatively stable but the highest concentrations appear to be declining. Figure 9-2 compares the extent of the nitrate plumes in the third quarter of 2010 and the third quarter of 2011. As indicated, the plume boundaries are relatively stable, likely the result of the generally low hydraulic conductivity of the perched zone, and the ongoing pumping related to the chloroform plume.

5. CHARACTERIZATION OF STUDY AREA

The study area encompasses a region in the northeastern portion of the site where the nitrate plume (defined by concentrations > 10 mg/L) has been detected and bounded by a series of nitrate and chloroform investigation wells (Figure 1-2). Wells within the plume are MW-30 and MW-31, and temporary wells TW4-19, TW4-21, TW4-22, TW4-24, TW4-25, TWN-2 and TWN-3 (Figure 7). Wells MW-5, MW-11, MW-25, MW-26, MW-27, MW-28, MW-29, MW-32, TW4-16, TW4-18, TWN-1, TWN-4, TWN-7, and TWN-18 bound the plume. As of the second quarter of 2011, MW-5, MW-11, MW-25, MW-29, and MW-32 were non-detect for nitrate. Hydraulic characterization of the study area has been based on data collected from wells within and near the plume as discussed in Section 4. The extent and hydrogeology of the study area is discussed below.

5.1 Extent of Study Area

The nitrate plume that is the focus of this CAP is confined to the region of the perched zone containing nitrate concentrations exceeding 10 mg/L located south of TWN-18 and north of MW-11. The area having nitrate exceeding 10 mg/L, as of the third quarter of 2011, is shown in Figures 1-2 and 7. This area extends from the northeast portion of the tailings cells to the area upgradient (north-northeast) of the tailings cells. The highest nitrate concentrations have historically been detected at TWN-2, within the northern (upgradient) portion of the plume. TWN-2 is located within the area of the historical pond (Figure 8).

The historical pond was active as far back as the 1920s, as much as 60 years prior to the establishment of the White Mesa Mill. Satellite photos taken over the years and dating back to the 1950s indicate that the historical pond was one of the major agricultural/livestock ponds in the area and typically contained water. Records or information have not been obtained to evidence the actual uses of the pond over the years.

Areas of detectable nitrate that are not continuous with the above defined area exist to the northwest (near TWN-9 and TWN-17) and to the east-southeast associated with the chloroform plume. Nitrate concentrations within these areas are typically less than 10 mg/L although sporadic detections at or slightly above 10 mg/L have occurred at some locations. Areas to the northeast are not a target of this CAP, and nitrate associated with the chloroform plume is addressed by the ongoing chloroform pumping.

The nitrate plume, as defined by the 10 mg/L concentration boundary, is bounded by wells MW-5, MW-11, MW-25, MW-26, MW-27, MW-28, MW-29, MW-32, TW4-16, TW4-18, TWN-1, TWN-4, TWN-7, and TWN-18. As of the second quarter of 2011, MW-5, MW-11, MW-25,

MW-29, and MW-32 were non-detect for nitrate. The plume is bounded to the south by MW-5 and MW-11, to the east by MW-27, MW-28, MW-29 and TWN-7, to the north by TWN-18, and to the west by MW-25, MW-26, MW-32, TWN-1, TWN-4, TW4-18, TW4-16, and TW4-20. Additional wells to the south (downgradient) of the plume include MW-3, MW-14, MW-15 and MW-37.

5.2 Hydrogeology

A description of the hydrogeology of the site in the vicinity of the nitrate plume is provided in Section 3, and hydrogeologic cross-sections are provided in Appendix A. Perched zone hydraulic conductivities in the vicinity of the nitrate plume are in the middle to high end of the range measured at the site. The geometric average of approximately 1.2×10^{-4} cm/s is slightly lower than typical for the area of the chloroform plume located east and southeast of the nitrate plume (Figure 10).

Perched groundwater flow in the area of the nitrate plume is generally southwesterly. Saturated thicknesses in the vicinity of the plume are generally higher than in areas to the south and southwest. In the vicinity of the nitrate plume (Figure 5) they range from a maximum of approximately 87 ft at TW4-25 to approximately 30 ft at MW-30. In general, saturated thicknesses increase toward the northeast, where the wildlife ponds are located, and are locally affected in the vicinity of the plume by pumping at MW-26, TW4-19, and TW4-20.

Hydraulic conductivities within the general area of the nitrate plume are based primarily on analysis of slug tests as discussed in Section 3. Hydraulic conductivity estimates range from approximately 2.7×10^{-5} to 1.4×10^{-3} cm/s, and have a geometric average of 1.2×10^{-4} cm/s (Table 2). The transmissivities of many wells within the nitrate plume are similar to wells that are pumped for chloroform removal.

6. CORRECTIVE ACTION CONCENTRATION LIMITS

The corrective action concentration limit for nitrate is 10 mg/L. This concentration is considered to bound the outer extent of the plume and is the ultimate target for reducing nitrate concentrations within the plume. As discussed in Section 9, once the nitrate concentrations in all monitoring wells are 10mg/L or less, concurrence with DRC will be sought that the plume is remediated and the corrective action complete.

7. CORRECTIVE ACTION PLAN - CONSTRUCTION AND OPERATION

The corrective action for the nitrate plume is proposed to occur in three phases.

In Phase I, Denison proposes to construct a sloped, curbed and drained concrete pad of six inches in depth over an area covering the areal extent of contamination identified during the contamination investigation. Denison also proposes a future removal of contaminated soil at the time of Mill site reclamation and, for conservatism, proposes to revise the reclamation surety estimate to include a volume of soil to be removed and placed in the tailings cells of twice the volume of contaminated soil identified in the contamination investigation.

Phase II will consist of pumping four wells within the nitrate plume (TW4-22, TW4-24, TW4-25, and TWN-2). Phase II relies on both pumping and natural attenuation to remove nitrate mass, reduce nitrate concentrations within the plume, and minimize or prevent plume migration. Included in Phase II are continued monitoring within and outside the plume to verify plume boundaries (as defined by a concentration of 10 mg/L), estimate changes in hydraulic capture, and track changes in nitrate concentrations within the plume.

Phase III, if required, will be conducted in consultation with the Executive Secretary. If implemented, Phase III will consist of a transport assessment, a hazard assessment, and an exposure assessment along with a corrective action assessment including an evaluation of best available remedial technologies. Selection of a technology for implementation will be based on an evaluation whether the technology will remediate contamination to as low as is reasonably achievable, if the 10 mg/L standard is not reasonably achievable. One possible outcome of these evaluations could be an application for alternate corrective action concentration limits ("ACACL").

After implementation of Phase II and Phase III and once residual concentrations have dropped to 10 mg/L or less at all monitored locations or an ACACL has been granted, concurrence with the Executive Secretary will be sought that the corrective action is complete. Phase II has contingencies to be implemented if needed based on monitoring as discussed in Section 8. The termination of Phase II and implementation of Phase III will be with the concurrence of the Executive Secretary and will be based on assessments conducted during Phase II.

An important goal of Phase III is to ensure that nitrate concentrations exceeding the action level will not migrate to any point of exposure within the applicable regulatory time frame. This migration of the nitrate plume is not expected to occur. However, the decision as to when to terminate Phase II and implement Phase III will be based on Phase II monitoring data and

quantitative calculations that indicate that, based on Phase II results, this Phase III goal is attainable.

7.1 Phase I Description and Rationale

The potential contamination source to be addressed in Phase I consists of alluvial soil in the area of the Mill's outdoor ammonium sulfate storage tanks as depicted in Figure 11-1. As shown in Figure 11-1, the ammonium sulfate tanks and associated soil contamination are located to the east of the Mill process building. The tanks are currently situated over an uncurbed concrete slab, which has suffered some deterioration over the years. The tank area is bounded to the west by the Mill building, to the south by the V_2O_5 Mini Lab and Precipitation Area, and to the north by the Mill's Pulp Storage Tanks. That is, the ammonium sulfate tanks are located in a relatively congested and (on three sides) built out area. The proximity of the Mill building and other tanks precludes the ability to perform an extensive soil excavation/contaminated soil removal at the current time. Therefore, consistent with the SCA, Denison proposes to perform the contaminated soil corrective action phase in two steps; 1) construction of a concrete cover to remain in place during the operating life of the Mill, and 2) a contaminated soil excavation to occur during the Mill reclamation at final Mill closure.

7.1.1 Approximation of the Lateral Extent of Contamination and Concrete Cover

Per Section 11A(1) of the SCA, Phase I is required to include a control for the soil contamination observed at the ammonium sulfate tanks. To meet this objective, Denison proposes to construct a sloped and drained concrete pad of six inches in depth over an area covering the areal extent of contamination identified during the contamination investigation to prevent infiltration of surface water into the contaminated soil. Existing data consists of analytical data from two of the soil borings collected during the June 2011 contamination investigation as shown in Figure 11-1. In order to verify that the proposed concrete pad meets the objective of covering the lateral extent of contamination, Denison will implement a soil sampling program prior to the completion of the concrete pad. The soil sampling program is designed to provide data to delineate, approximately, the lateral extent of contamination.

The soil sampling program will be conducted substantially in accordance with the DRC-approved field and quality assurance procedures implemented during the Phase 1, (Part 1) Nitrate Investigation as described in the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011. A summary of the soil sampling program to be conducted during Phase I of the CAP, with any necessary changes from the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011, is as follows.

7.1.1.1 Soil Sampling Program Objective and Design

The objective of this soil sampling program is to delineate, approximately, the lateral extent of contamination in order to determine the extent of the concrete pad necessary to cover the soil contamination identified during the Phase I investigation. To meet this objective, 18 Geoprobe borings will be conducted down to bedrock refusal at each of the locations shown on Figure 11-2B. Three (3) samples will be collected from each Geoprobe core location. Soil core samples will be collected from the bottom one foot of each of the following intervals, based on the total depth of penetration at each site: top 1/3, middle 1/3, and bottom 1/3.

Select soil core samples will be sent to the analytical laboratory for analysis of nitrate (as N), and ammonia (as N) as described below. Since the purpose of this sampling program is to confirm the lateral extent of soil contamination (in the form of nitrate and ammonia) resulting from the ammonium sulfate tank source, no other analytes are required. Soil analysis will be conducted by an environmental laboratory currently certified by the State of Utah, using EPA approved sample and analysis methods.

Denison anticipates that the presence of ammonia contamination will diminish with distance from the ammonium sulfate tanks. The initial row of samples will be collected 3 feet from the northeast edge of the proposed concrete pad shown in Figure 11-2B. If the results of the analysis of the initial sample row indicate that ammonia and nitrate levels do not exceed DRC's proposed screening levels of 2 times the background levels determined in the June 2011 investigation, specifically 4.29 mg/kg for ammonia and 4.38 mg/kg for nitrate, no further samples will be analyzed and the pad will be constructed as shown in Figure 11-2B. That is, if the initial samples are below the screening levels, it will be concluded that the contamination will be adequately covered by the proposed design, and the soil sampling program will be considered complete.

If the results of analysis of the initial sample row indicate that the contamination extends beyond the area delineated by the initial row, that is, one or more samples in the initial row exceed the screening levels, the remaining samples for one or more additional sampling rows will be analyzed for nitrate (as N), and ammonia (as N). The concrete pad will be sized to extend to the first row of samples whose analysis do not indicate nitrate or ammonia exceeding the screening levels.

7.1.1.2 Field Activities/Sampling Methods

In order to minimize the potential for multiple mobilizations of the Geoprobe unit, three discrete sets of samples will be collected in one sampling event during this investigation. Each discrete set of samples will be collected in a lateral line or "row" along the northeast face of the proposed

concrete pad as shown in Figure 11-2B. Samples will be collected every approximately 12.5 feet laterally along the edge of the concrete pad. The first row of discrete samples will be approximately three feet from the edge of the proposed concrete pad. The two successive rows will be stepped-out approximately ten feet from the previous row of samples. The samples collected in the two successive rows will be archived for potential later analysis of nitrate and ammonia if necessary. All archived samples will be stored in accordance with the analytical method requirements for temperature. Expedited turn around will be requested for the analysis of the first row of soil samples, so that if any additional analyses are required, the additional analyses can be completed within the specified analytical holding times. Based on this sampling strategy, 54 soil samples (and 6 duplicates and 3 rinsates), will be collected.

7.1.1.3 Sample Handling and Custody

Each sample collected during this sampling program will be identified using a unique sample identification number ("lD"). The description of the sample type and the sample name will be recorded on the chain-of-custody ("COC") forms, as well as in the field notes. Geoprobe boring samples will be named according to the boring location and top and bottom of the depth interval at which they were collected, following the convention P1AXX-tt-dd, where P1AXX is the first boring in the first row of samples and tt is the top of the depth interval and dd is the bottom of depth interval expressed in feet below ground surface. Additional rows of samples will be identified as P1A2XX-tt-dd. Duplicate samples will carry the same identification as the parent sample with the terminal letter "D" to identify them as a duplicate. Similarly, rinsate samples will carry the sample identification of the sample collected prior to the rinsate followed by the terminal letter "R".

Samples will be collected into re-sealable plastic bags, which will be labeled with the sample identification and homogenized by vigorously shaking and mixing the contents until the samples are visibly uniform. A minimum sample volume of 100 grams will be collected from each location. Sample containers will be provided by the laboratory, certified as clean, and will be filled directly from the plastic bags. Archive sample aliquots will be maintained in the plastic bags at the Mill for the duration of the analytical holding times to provide additional backup sample for analysis if necessary. Archive sample aliquots will be stored in accordance with the analytical method requirements for sample preservation.

Standard sample custody procedures as described in the DRC-approved *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011 will be used to maintain and document sample integrity during collection, transportation, storage, and analysis.

Samples will be shipped to the analytical laboratory using an overnight carrier such as Federal Express. Samples will be analyzed within the analytical method specified holding times.

7.1.1.4 Analytical Methods

For comparability, the soil analytical methods will be the same as those used for the 2011 nitrate contamination investigation.

All soil samples will be submitted to the analytical laboratory for SPLP using EPA Method 1312 using Extraction Fluid #3. Method 1312 will produce a leachate of all soil samples which will be analyzed for nitrate and nitrogen as ammonia using EPA Method 353.2, and EPA method 350.1 respectively. Method 1312 will produce a sufficient volume of leachate to complete the nitrate and ammonia analyses as well as any method-required QC analyses.

The soil samples are being leached and analyzed using water methodologies, which will yield concentrations in liquid units (such as mg/L*)*. The laboratory will report all soil samples in two ways: 1) as a leachate in mg/L and 2) as a soil in mg/kg on a dry weight basis.

The reporting limits ("RLs") for the methods are 0.01 mg/L for nitrate and 0.05 mg/L for ammonia. These RLs are sufficiently sensitive to allow determination of soil contamination below the screening levels.

7.1.1.5 Quality Control

Quality control ("QC") samples will be collected in the field during the sampling effort and will include one duplicate per ten analytical samples and one rinsate sample per twenty samples. Rinsate samples will be collected using deionized ("DI") water from a third party commercial source. Duplicates will be assessed through the calculation of a relative percent difference ("RPD") and rinsate samples will be assessed based on any detections reported and their magnitude relative to the sample results. The QC procedures set forth in the *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011 will be used for the assessment of the soil samples collected during this program.

Analytical laboratory QC, audits, instrument calibration, internal QC procedures, detailed COC procedures, organizational responsibilities, and other specific details regarding sample collection will be completed in accordance with the DRC-approved *Nitrate Investigation Phase 1 Work Plan,* dated May 13, 2011.

7.1.2 Construction of the Phase I Action

Denison proposes to construct a sloped, curbed, and drained concrete pad of six inches in depth over an area covering the lateral extent of contamination identified during the contamination investigation. Because the ammonium sulfate tanks are surrounded by existing concrete structures to the south, west, and north, the new concrete pad will extend to the east of the Mill building. The existing concrete pad will be resurfaced and sloped to drain to the existing collection area/sump inside the Mill building, which returns solutions to the process. This resurfaced area will be constructed with a curb of approximately 6 inches in height. In addition, a new concrete slab will be extended to the eastern edge of the surrounding structures. This new slab will also be sloped to drain to an existing collection area/sump in the Mill building. A rolled curb will be constructed with an access ramp to allow supplier trucks sufficient access to refill the tanks. The proposed cover design is depicted in Figure 11-2A and B.

The only subsurface piping in the vicinity of the ammonium sulfate tanks is a segment of the underground portion of the Mill fire water system. Figure 11-3 shows the location of the subsurface portion of the fire water line. Due to the need to maintain continual pressure on the fire water system, the system already contains instrumentation (an alarm system) to indicate when the pressure makeup pump starts up as a response to leaks, breaks, or loss of pressure. As indicated by the pump alarm history, the firewater system has no history of leakage, and is not expected to be a source of hydraulic head in the vicinity. The only other subsurface process piping on the Mill site consists of two pairs of lines: one cooling water recirculation loop, and one vanadium product liquor loop, for which the buried portion begins approximately more than 100 feet southeast of the ammonium sulfate tanks (75 feet from the nearest corner of the concrete pad proposed in Figure 11-4), and "around the corner" from the ammonium sulfate tanks – east of the easternmost wall of the building's "L". These two piping loops are new, have had no history of leakages, and are too far from the ammonium sulfate tanks to be a source of hydraulic head in the vicinity of the tanks. All other process piping is above grade.

Consistent with Section 11A(1)(b)(i) of the SCA, Denison provided a detailed plan and schedule for construction of the concrete cover to DRC in Section 7.1 and Figures 11-1 and 11-2A and B of the November 30, 2011 version of this CAP.

7.1.3 Maintenance of the Phase I Action

Denison will provide a plan for annual inspection, required repairs, and annual documentation of the condition of the pad in a revised version of the Discharge Minimization Technology ("DMT") Plan, to be submitted following approval of the CAP by the Executive Secretary. The revised DMT Plan will address:

- frequency of inspection and photographic documentation of the condition of the pad (annually),
- contents of inspection reports,
- inspection criteria,
- conditions requiring repairs,
- timing of repairs, and
- contents of repair reports.

7.1.4 Estimation and Removal of Contaminated Soil During Mill Reclamation

Denison also proposes a future excavation of contaminated soil at the time of Mill site reclamation, and disposal of the excavated soil in the tailings cells. To ensure a sufficient surety amount for reclamation of the known contaminated soil volume to the depth of bedrock, Denison proposes to revise the reclamation surety estimate to include a volume of soil of twice the volume of contaminated soil volume identified in the contamination investigation.

The following process will be used to estimate the volume of contaminated soil to be removed during reclamation. Once the total area to be covered by concrete has been determined based on the borehole analyses, the area will be multiplied by the average depth to bedrock, as determined from the logging of the boreholes.

Based on the geologic logging performed during the soil probe sampling in the Phase I Investigation in June, 2011, borings number GP-25B and GP-26B in the vicinity of the ammonium sulfate tanks indicated depth to bedrock of 19 feet and 16 feet, respectively. These values will be included, along with depths determined during the additional Geoprobe sampling to develop an average depth to bedrock. This average depth to bedrock will be multiplied by the area of contamination. For conservatism, Denison will double the volume determined by the above method for purposes of the reclamation surety estimate.

Consistent with Section 11A(1) of the SCA, Denison provided a revised surety estimate to DRC on March 4, 2012. The March 4, 2012 surety estimate included an overly conservative estimate for removal of the contaminated soil volume that was based on:

1. The preliminary proposed concrete cover area as depicted in Figure 11-2B
2. An approximate depth to bedrock of 20 feet (1 foot deeper than the maximum depth to bedrock measured to date during the June 2011 investigation)
3. A conservative overestimation factor of 3 times the volume estimated from items 1 and 2 above

Following receipt of the additional depth-to-bedrock data and estimated lateral extent of contamination data that will be developed from the soil sampling program described above, Denison will review the March 4, 2012 volume and cost estimate. If additional data indicates an increase of the conservatively estimated soil volume in the March 4, 2012 surety estimate, Denison will provide a revised volume and cost estimate within 60 calendar days following issuance of the Consent Order contemplated in Section 11.E of the SCA.

The March 4, 2012 surety estimate was based on the overly conservative estimate of 6,000 CY. The current tailings cells hold in excess of 4 million tons (approximately 3.5 million CY) of tailings material. The anticipated 6,000 CY volume from the ammonium sulfate soil excavation is insignificantly small compared to the total current volume disposed of in the tailings system. As discussed above, following receipt of the data on depth-to-bedrock and lateral extent of contamination, Denison will revise the estimated volume and surety estimate accordingly. Even if the excavated soil volume were to increase by several factors following receipt of the data, it will still be insignificantly small relative to the total volume of the tailings and the total anticipated reclamation volume for the Mill site.

7.2 Phase II Description and Rationale

Phase II consists of three active components and one passive component. The active components are:

1. Removal of nitrate mass from the perched zone as rapidly as is practical by pumping from wells located in areas having high nitrate concentrations, relatively high productivities, or both.
2. Perched zone water level and nitrate monitoring to assess changes in nitrate concentrations within the plume, verify the location of the plume boundary over time, and estimate hydraulic capture zones. A general lowering of nitrate concentrations within the plume is expected as a result of Phase II operation.
3. Abandonment of TWN-series wells not needed for implementation of item 2.

Pumped water will be disposed in the tailings cells. In addition, all samples analyzed for nitrate will also be analyzed for chloride.

The passive component consists of relying on natural attenuation to reduce nitrate concentrations. Physical mechanisms that will reduce nitrate concentrations include processes such as hydrodynamic dispersion, and dilution via mixing with nitrate-free recharge and low nitrate waters outside the plume. Neither biologically mediated decomposition of nitrate nor abiotic chemical decomposition are expected to be significant mechanisms in reducing nitrate

concentrations because the majority of the perched water is likely aerobic and unsuitable for rapid decomposition of either chloroform or nitrate. The persistence of chloroform and the persistence of nitrate associated with the chloroform plume are consistent with predominantly aerobic conditions. The presence of iron oxides within the perched zone in most of the site borings is also consistent with aerobic conditions.

As discussed in HGC (2007) chloroform daughter products, such as dichloromethane (DCM), have been detected but at low concentrations. The persistence of chloroform and the low concentrations of daughter products imply relatively low rates of chloroform degradation. Owing to its relatively high oxidation state, chloroform would be expected to degrade relatively rapidly, yielding higher concentrations of daughter products such as DCM, under primarily anaerobic conditions.

That chloroform daughter products have been detected suggests that conditions are locally favorable for anaerobic degradation. The presence of carbonaceous material in many of the site borings and the presence of pyrite in most of the borings suggests that at least local anaerobic conditions favorable to degradation of chloroform and nitrate exist. The formation hosting the perched zone was likely anaerobic in the past, and conducive to the preservation of carbonaceous material and the formation and preservation of pyrite, but, at least at some areas of the site, is now mainly aerobic with pyrite oxidizing to iron oxide. The oxidation of pyrite is likely enhanced near perched wells which provide a conduit for oxygen to the perched zone. The oxidation of pyrite in the formation has not been substantiated with quantified core analysis; however, Denison is currently undertaking a separate study to evaluate the amount and distribution of pyrite in the formation as part of a separate investigation into generally decreasing pH trends at the Mill site.

Wherever conditions may be favorable to anaerobic degradation, the actual degradation rates of nitrate from either abiotic or biologically mediated degradation may be, in fact, larger than anticipated, which will be favorable for removal of nitrate from the perched zone. However, Denison is not relying on either abiotic or biologically mediated degradation as important removal mechanisms.

Furthermore, nitrate is not expected to be retarded by adsorption onto aquifer materials because of its high solubility and negative charge. The combination of pumping, hydrodynamic dispersion, and dilution by recharge are expected to be effective considering that less than an order of magnitude reduction in concentration is needed to reduce the highest detected nitrate concentrations within the plume (approximately 69 mg/L) to the target of 10 mg/L. The

downgradient portion of the plume, defined by MW-30 and MW-31, will require reduction in concentration by only a factor of two to meet the 10 mg/L goal.

In general, Phase II is expected to function in a manner similar to ongoing chloroform removal from perched water at the site. Construction and operation will be similar to the chloroform pumping system which consists of five wells (MW-4, MW-26, TW4-4, TW4-19, and TW4-20) located within the chloroform plume that are pumped as continuously as practical and at rates that are as large as practical. Water from those wells is disposed in the tailings cells.

The nitrate pumping system will consist of four wells: TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2). Water will be pumped from these wells as continuously as practical and at rates as high as practical. These wells were selected for pumping because 1) they are located in middle to upgradient areas of the plume having the highest nitrate concentrations and will minimize the downgradient migration of these high concentrations, 2) they are expected to have productivities similar to the chloroform pumping wells, 3) pumping these wells is not expected to enhance the downgradient migration of chloroform, and 4) they are temporary chloroform (TW4-series) or nitrate (TWN-series) investigation wells and converting them to pumping wells will not impact tailings cell point of compliance monitoring under the Mill's Groundwater Discharge Permit ("GWDP").

Pumping these wells is expected to remove nitrate mass from the perched zone as rapidly as practical, and flatten hydraulic gradients within the plume to reduce rates of downgradient migration and allow natural attenuation to be more effective. Furthermore, the depression of the water table resulting from pumping in the upgradient portion of the plume will reduce interaction between the perched water and any residual shallow vadose zone sources that may exist. As a result plume migration is expected to be minimal or cease once Phase II is implemented. Currently the plume appears to be changing very slowly. Figure 9-2 compares the extents of the nitrate plume in the third quarters of 2010 and 2011. Over this period, the plume appears to be relatively stable, having expanded slightly in some areas and contracted slightly in others. The apparent stability of the plume is likely the result of the generally low hydraulic conductivities of the perched zone, and ongoing pumping within the adjacent chloroform plume. Implementation of Phase II is expected to further reduce or halt downgradient migration and to reduce concentrations within the plume. If ongoing monitoring indicates the plume continues to migrate, then contingencies will be implemented.

As discussed above, the productivities of the proposed nitrate pumping wells are expected to be similar to those of the chloroform pumping wells. The transmissivities at proposed nitrate pumping wells TW4-22, TW4-24, and TW4-25 are estimated to be between those of chloroform

pumping wells MW-26 and TW4-19; and the transmissivity at TWN-2 is estimated to be about one third that of chloroform pumping well TW4-20 (Table 4). Therefore, the long-term productivities of TW4-22, TW4-24, and TW4-25 are expected to be between those of MW-26 and TW4-19; and the long-term productivity of TWN-2 is expected to be about one third that of TW4-20. Although expected pumping rates at TWN-2 will be relatively low, the high concentrations detected at that well will result in relatively high nitrate removal rates. Pumping at TWN-2 is expected to reduce or eliminate the apparent residual perched water mound at that location. As the mound is depleted, the productivity of TWN-2 is expected to diminish. However, continued operation of TWN-2, even at low average extraction rates, is expected to be beneficial.

The potential interaction of the chloroform plume with the nitrate pumping system is of concern. Figure 10 shows the locations of the nitrate and chloroform plumes as of the third quarter of 2011. The chloroform plume is located generally east-southeast of the nitrate plume, but the plumes mingle in the vicinity of TW4-19, TW4-20 and TW4-22 (northeast corner of tailings Cell #2). Pumping the proposed nitrate wells will impact chloroform migration to some extent, and any pumping that enhances downgradient migration of chloroform is undesirable. It is expected that pumping the proposed wells will at most draw chloroform cross-gradient to the west-northwest. However, pumping of any wells to the southwest of the chloroform plume (such as MW-30 and MW-31) would have the undesirable impact of enhancing the downgradient migration of chloroform, and is not considered to be an option. Furthermore, converting MW-30 or MW-31 to nitrate pumping wells would degrade the usefulness of these wells for tailings cell point of compliance monitoring under the GWDP.

Data collected during Phase II monitoring will be used to evaluate containment and hydraulic control of the nitrate plume. The data will be used to estimate the extent of hydraulic capture (the "capture zone"), and to calculate nitrate mass removal rates by pumping.

Hydraulic containment and control will be evaluated in part based on water level data (in the same fashion as for the chloroform pumping system) and in part on concentrations in wells downgradient of pumping wells TW4-22 and TW4-24. Bounding stream tubes defining the capture zone of nitrate pumping wells will be generated from the kriged quarterly perched water level data. Hydraulic containment and control based on water level data will be considered successful if the entire nitrate plume upgradient of TW4-22 and TW4-24 falls within the combined capture of the nitrate pumping wells.

MW-5, MW-11, MW-30, and MW-31 are located downgradient of TW4-22 and TW4-24. MW-30 and MW-31 are within the plume near its downgradient edge and MW-5 and MW-11 are

outside and downgradient of the plume. Hydraulic control based on concentration data will be considered successful if the concentrations of nitrate in MW-30 and MW-31 remain stable or decline, and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard.

Denison will calculate the capture zones after four quarters of water level measurements have been taken, and will include the calculations, with figures, in the next quarterly nitrate monitoring report. Numerical and/or analytical models will be used if needed to assist in evaluating the data and estimating natural attenuation.

It is expected that the four pumping wells, in combination with the existing chloroform pumping wells, will adequately capture the nitrate plume, such that concentrations of nitrate in excess of the 10 mg/L standard are not expected to migrate beyond the current boundaries of the plume. Based on experience from the chloroform pumping results to date, it is expected that the capture zone from the four nitrate pumping wells will, by themselves extend upgradient to capture the entire plume north of TW4-22 and TW4-24 as well as more than 400 feet downgradient of TW4-22 and TW4-24. For example, the downgradient extent of the combined capture zone of chloroform pumping wells MW-26, TW4-19, and TW4-20 (Figure 12) extends more than 400 feet downgradient of MW-26. The capture zone from the four nitrate pumping wells alone is expected to likewise extend at least 400 feet southwest of TW4-22 and TW4-24, encompassing by themselves approximately three quarters of the plume (Figure 13). However, the proportion of the nitrate plume under hydraulic capture is expected to be larger than this estimate as the nitrate capture zone merges and is enhanced by the chloroform capture zone. The result is that either complete hydraulic capture will be achieved, or if not achieved, concentrations of nitrate in excess of 10 mg/L are not expected to migrate beyond the current boundaries of the plume. As discussed above, hydraulic control will be considered successful if the concentrations of nitrate in MW-30 and MW-31 remain stable or decline and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard.

The nitrate plume is defined as that portion of the perched aquifer that has a concentration of nitrate in excess of 10 mg/L. In evaluating whether the pumping system has contained and controlled the plume, the proper parameter to evaluate is therefore whether the 10 mg/L boundary has moved beyond the currently defined plume boundary. MW-5 and MW-11 presently do not exceed the 10 mg/L Groundwater Quality Standard; that is, they are outside the currently defined plume, and act as bounding wells for the plume. So long as they continue to be less than or equal to 10 mg/L they will remain as bounding wells outside of the plume, and the plume will not have expanded.

It is possible that there may still be some movement of impacted water (i.e., there may not be complete hydraulic capture), but so long as that movement of water does not cause the concentration in any downgradient well to exceed 10 mg/L, the plume itself will not have expanded and adequate hydraulic control will have been demonstrated. As a result, it is possible that there may be some future impact on MW-5 and MW-11, even though the plume has not expanded. However, any impacts on MW-5 and MW-11 will be monitored to ensure that the concentrations in those wells, if they do increase over time, do not exceed 10 mg/L. If the concentration of nitrate in either or both of those wells increases above 10 mg/L, then the plume will have expanded and plume capture will not have been successful. Further actions, such as modeling or the addition of more nitrate pumping wells, would need to be investigated at that time. Because numerous monitoring wells currently exist downgradient of MW-5 and MW-11 (i.e., MW-35, MW-36, MW-37, MW-15 and MW-14 as a first line of defense, and beyond that line, MW-17, MW-03, and MW-20), existing wells would continue to bound the plume, and there would be no chance that the plume could expand beyond the downgradient edge of the Mill's existing tailings cells, without being detected and without ample time to institute further mitigative actions.

If nitrate concentrations in any of the wells exceed their respective Ground Water Compliance Limits ("GWCLs") listed in Table 2 of the current Permit, which are less than 10 mg/L, then Denison will provide notification to the Executive Secretary, and sampling frequencies for the wells will be accelerated per the White Mesa Mill GWDP Part G.1.

7.2.1 Well Abandonment

Currently there are 19 TWN-series wells that were installed for the investigation of nitrate at the site. Wells in the vicinity of the nitrate plume will be retained for monitoring. TWN-series wells located north–northeast of TWN-18 are not needed for this purpose and are therefore selected for abandonment. Wells proposed for abandonment are TWN-5, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-15, and TWN-17. Wells to be retained for nitrate and chloride monitoring, as well as field collection parameters (including water level measurements) per the approved field collection form, are TWN-1, TWN-2, TWN-3, TWN-4, TWN-7, and TWN-18.

The foregoing wells will be abandoned within one year from the date of approval of this CAP, in accordance with applicable regulations (State of Utah Administrative Rules for Water Wells R655-4-14). Although not needed for nitrate plume monitoring, wells TWN-6, TWN-14, TWN-16, and TWN-19 will be retained for water level monitoring only, to provide ongoing water level data for the northeast portion of the site.

A well abandonment report will be submitted to the Executive Secretary within 15 months after the date of approval of this CAP.

7.2.2 Groundwater Pumping System

The Phase II corrective action groundwater pumping system will consist of wells TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2). Each well will be equipped with a Grundfos Series SQE 1x200-240 Volt, 6.2 Amp submersible pump or the equivalent. To prevent damage to the pumps, each will operate on a cycle that allows pumping only when sufficient water is present in the well. The capacity of each pump will be greater than the sustainable pumping rate for each well. Therefore, the average amount of water pumped from each well will be, in general, the maximum practical. These wells were selected for pumping because they are located in areas of the perched zone having both high nitrate concentrations and relatively high transmissivities that allow relatively high rates of mass removal, and because they are not expected to have a negative impact on chloroform migration from the adjacent chloroform plume.

Water pumped from each well will be routed by ½ inch high-density polyethylene Drisco discharge lines, comparable to the transfer lines in the chloroform pumping system, to the tailings cells for disposal. A schematic drawing of the transfer piping system is provided in Figure 11-5. The discharge line near each wellhead will be equipped with an in-line Carlon ½" flow meter/totalizer (or equivalent). The flow meter/totalizer will be housed in an insulated wooden box with a heat source to prevent freezing. Readings from each totalizer will be used to report quarterly pumped volumes and average pumping rates.

Operation of the nitrate wellfield will be similar to that for the chloroform wellfield. The contingencies described in Section 8 will be implemented should nitrate mass removal rates drop significantly due to losses in well productivity.

As mentioned above, water pumped from the nitrate pumping system will be transferred to the tailings cells for disposal. If monitoring of any tailings cell indicates an exceedance in a leak detection system ("LDS") parameter regulated by the Mill's GWDP, or the Best Available Technology ("BAT") or Discharge Minimization Technology ("DMT") Plans, Denison will manage the response to LDS parameter exceedance consistent with the requirements of the GWDP or appropriate BAT or DMT Plan. The relatively low flow rates of the groundwater pumping systems, compared to the flow rates of process solutions and wastewaters managed in the tailings system, allow for rerouting of tailings cell solutions and adjustment of cell solution levels without interruption of the chloroform or nitrate pumping programs.

Denison will prepare an Operation and Maintenance ("O&M") Plan for Executive Secretary approval which, like the Chloroform Program Operations and Maintenance Plan will address operations (including winterization procedures), maintenance (including inspection forms and response to and documentation of system failures), monitoring, and data reporting. The O&M Plan will be submitted per the schedule in Table 1.

7.2.3 Water Level Monitoring

Water levels will be monitored weekly in each of the four nitrate pumping wells. Water levels in the remaining wells listed in Table 3 will be monitored monthly for the first twelve months after commencement of Phase II pumping, and thereafter quarterly. Depths to water will be measured using an electric water level meter in the same way they are currently collected. Hydraulic capture zones will be estimated from water level contour maps generated quarterly from the water level data, with the first capture zones estimated after twelve months of data have been obtained. The contingencies described in Section 8 will be implemented should the proportion of the remaining nitrate plume that is under hydraulic capture shrink significantly.

7.2.4 Water Quality Monitoring

Pumping wells TW4-22, TW4-24, TW4-25, and TWN-2, and the other wells listed in Table 3, will be monitored quarterly. Sampling and analytical procedures will be the same as currently employed for the nitrate monitoring as described in the quarterly monitoring reports submitted by Denison to DRC and as described in the most current, DRC-approved White Mesa Mill Groundwater Monitoring Quality Assurance Plan ("QAP") . Each well will be sampled for the following constituents with respect to monitoring the nitrate plume:

- Chloride
- Nitrogen, Nitrate + Nitrite as N
- pH
- Temperature

Dissolved oxygen was not included in the Plan due to unique conditions at White Mesa. The required purge when sampling monitor wells at the site and low hydraulic conductivity in the perched aquifer causes slow recharge to the well bore after purging. This slow recharge allows oxygen to diffuse into the groundwater as it enters the well bore rendering any dissolved oxygen measurement unreliable.

Denison has also assessed the need for analyzing data from selected on site wells for other groundwater quality parameters that could be relevant to this Plan, and has concluded that the

existing groundwater monitoring in existing GWDP compliance wells is adequate, and that no further constituents, other than nitrate and chloride in the TWN wells, need be added to any wells at the site, for the reasons discussed below.

The Mill is the subject of an ongoing groundwater compliance monitoring program, which monitors the complete list of constituents regulated in Table 2 of the GWDP. If any contaminant sources, whether or not associated with the nitrate plume, reach levels of concern in groundwater, they will be detected in the GWDP compliance monitoring program. It is therefore not necessary for the nitrate corrective action to attempt to monitor the same constituents which are adequately monitored under the existing GWDP program.

Further, since the Plan provides a nitrate plume pumping program designed to bound and control the known contamination, any other constituents present within the nitrate plume, related to nitrate as precursors or byproducts or otherwise, will also be captured by the pumping system.

Quarterly reports will be prepared that contain the same elements of the current chloroform corrective action monitoring reports submitted by Denison to DRC. Specific information elements to be included in the reports are listed in Sections 10.2.3 and 10.2.6.

Existing nitrate and chloride monitoring will continue in each of the other monitoring wells at the site at the frequency required under the GWDP or the chloroform investigation, as the case may be. Maintaining the current quarterly frequency at the closest downgradient well MW-11 and semi-annual frequency at the next-closest downgradient well MW-5 is reasonable considering the apparent stability of the plume at MW-30 and MW-31 and the hydraulic conductivity at MW-5 (3.5×10^{-6} cm/s) which is nearly three orders of magnitude lower than at MW-11 (1.4×10^{-3} cm/s)[HGC, 2007]. The sampling frequency for MW-5 and MW-11 was established under the GWDP based on the velocity of flow in the perched aquifer at these locations. More frequent monitoring was considered inappropriate due to the low flow rates and the potential to sample the same water or similar water in consecutive sampling events at each well.

Should concentrations within the plume begin to generally increase (disregarding short-term fluctuations), or the plume boundaries begin to expand, the contingencies discussed in Section 8 will be implemented.

7.2.5 Reporting

Reporting is proposed to occur quarterly, using a format and content similar to the quarterly chloroform monitoring reports submitted by Denison to DRC. The quarterly reports will include the following details:

1. calculation of quarterly nitrate mass removed by pumping,
2. comparison of the current areal extent of the nitrate plume from the latest quarter with the latest quarter of the previous reporting period, and
3. discussion of any contingencies to be implemented.

7.3 Phase III

Following the collection of 5 years of performance data from Phase II activities, Denison will use the data to perform an evaluation of the Phase II program. The data collected during the 5-year operation may be used for any or all of the following assessments:

a) Estimate the rate of nitrate plume remediation (e.g. in terms of percent mass reduction and/or concentration reduction per year). If the rate of plume remediation can be estimated with sufficient certainty, Denison may be able to project a timeline for remediation through the continued implementation of Phase II that will allow appropriate adjustments to the reclamation surety estimate, or
b) Identify changes to Phase II to improve its effectiveness or accelerate the restoration timeline, or
c) Identify whether Phase III activities, including application for an ACACL may be necessary in lieu of, or in combination with, Phase II activities.

Phase III may be implemented at the discretion of Denison at any time (including prior to five years) if Denison determines that continuation of Phase II is not necessary or appropriate. If Denison decides to implement Phase III, Denison will submit a revised CAP to the Executive Secretary for approval, which incorporates Phase III. Phase II will continue until Phase III is approved by the Executive Secretary.

If implemented, Phase III will consist of a transport assessment, a hazard assessment, and an exposure assessment along with a corrective action assessment including an evaluation of best available remedial technologies. Selection of a technology for implementation will be based on an evaluation whether the technology will remediate contamination to as low as is reasonably achievable, if the 10 mg/L standard is not reasonably achievable. One possible outcome of these evaluations could be an application for alternate corrective action concentration limits ("ACACL"). As required by UAC R317-6-6.15(G), the proposed ACACL must be protective of human health, and the environment, and must utilize best available technologies. If an ACACL is proposed, the revised CAP will include the information required, under UAC R317-6-6.15(G), and any ACACL would require the approval of the Utah Water Quality Board.

The transport assessment will identify any data gaps that exist and develop work plans to collect any data needed to support hydrologic and geochemical modeling. Such modeling will consist of appropriate quantitative models to predict flow paths, travel times, and potential points of exposure of nitrate contaminated groundwater. Any potential geochemical reactions or other attenuation mechanisms will also be identified. The transport assessment will inform the hazard assessment and the exposure assessment.

The hazard assessment will identify the risks and hazards to human health and the environment associated with nitrate to determine whether an ACACL should be proposed, if the subsequent exposure assessment concludes that an exposure is reasonably likely.

The purpose of the exposure assessment is to evaluate the potential harm to human health and the environment from the hazards identified in the hazard assessment. The exposure assessment takes into account site-specific circumstances that may reduce or enhance the potential for exposure to nitrate. This assessment identifies and evaluates exposure pathways, and provides forecasts of human and environmental population responses, based on the projected constituent concentrations, and available information on the chemical toxicity effects of the constituents. The assessment also addresses the underlying assumptions, variability, and uncertainty of the projected health and environmental effects. Exposure pathways are identified and evaluated using water classification and water use standards, along with existing and anticipated water uses.

The corrective action assessment consists of a review of ground-water corrective action alternatives in conjunction with the hazard assessment and the exposure assessment. Past, current, and proposed practicable corrective actions will be identified and evaluated against the costs and benefits associated with implementing each corrective action alternative. If ACACLs are identified as the proposed alternative, the corrective action assessment will demonstrate that the proposed ACACL is as low as is reasonably achievable, considering practicable corrective actions, and is therefore conservative and cost- effective, and would be granted with good cause. A principal way of demonstrating this is by estimating and comparing the benefits imparted by a corrective action measure against the cost of implementing that measure.

7.3.1 Water Level and Water Quality Monitoring

Water level and water quality monitoring plans will be proposed in the revised Phase III CAP prior to implementation of any proposed corrective action alternative.

8. ASSESSMENT OF CORRECTIVE ACTION AND PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT AND CONTINGENCY PLAN

The effectiveness of Phase II of the corrective action will be assessed based on the following criteria:

1. stability of plume boundaries
2. concentration and nitrate mass trends within the plume
3. nitrate mass removal rates resulting from pumping, and
4. stability of capture zones.

Plume boundaries and capture zones will be considered stable, and containment and hydraulic control of the nitrate plume effective, if concentrations of nitrate in excess of the 10 mg/L standard do not migrate beyond the current boundaries of the plume. The portion of the plume downgradient of pumping wellsTW4-22 and TW4-24 is currently defined by MW-30 and MW-31, which are located within the plume at its downgradient edge, and MW-5 and MW-11 which are located outside and downgradient of the plume. Hydraulic capture will be considered successful if the combined capture zone of the nitrate pumping wells extends upgradient to capture the entire plume and if concentrations of nitrate in MW-30 and MW-31 remain stable or decline and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard. If nitrate concentrations in any of the wells exceed their respective GWCLs listed in Table 2 of the current Permit, which are less than 10 mg/L, then Denison will provide notification to the Executive Secretary and sampling frequencies for the wells will be accelerated per the White Mesa Mill GWDP Part G.1.The Contingency Plan schedules for each of the foregoing criteria are set out in the Sections 8.1 through 8.4 as applicable.

The criteria for assessment of the effectiveness of Phase III of the corrective action, if undertaken, will be determined once the elements of Phase III have been developed. As discussed in Section 3.2.3, Phase III will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary.

8.1 Stability of Plume Boundary (Phase II)

The stability of the plume boundary, based on Phase II CAP monitoring activities discussed in Sections 7 and 10, will be used to determine the following:

- Whether any additional pumping wells are needed, and
- The need to reevaluate the Phase II strategy.

Under conditions where the plume boundaries remain stable or contract, no additional pumping wells will be needed, and no reevaluation of Phase II will be needed. Under conditions where the plume migrates, with the concurrence of the Executive Secretary, one or more additional pumping wells will be added, if suitable wells are available, to slow the migration rates and/or to bring more of the plume under hydraulic capture. The installation of additional downgradient monitoring wells is not anticipated because two lines of wells currently exist downgradient of the nitrate plume. Any such additional pumping wells will be added in accordance with a schedule to be approved by the Executive Secretary. If the plume continues to migrate, or suitable additional pumping well locations are not available, then Phase II will be reevaluated, which may include commencement of Phase III. Analytical or numerical models will be used if needed in the reevaluation to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary.

Any nitrate concentrations above 10 mg/L associated with the chloroform plume, that are not part of the nitrate plume shown in Figure 1-2, will be included in the remedial action for the chloroform plume.

8.2 Concentration and Nitrate Mass Trends within the Plume (Phase II)

Concentration changes within the plume are expected to be reflective of changes in nitrate mass within the plume..

Changes in nitrate mass within the plume based on concentrations and saturated thicknesses will be used to determine any need for reevaluation of Phase II. Data used to calculate nitrate mass will utilize analytical and water level data collected from wells, identified in Table 3, through Phase II CAP monitoring. Assuming that the plume boundaries do not expand, that

concentrations within the plume will generally decrease, and that saturated thicknesses do not increase, the calculated mass of nitrate within the plume is expected to decrease over time. The changes in calculated mass within the plume will be evaluated as follows:

1) Calculate a baseline mass for the nitrate plume. This calculation will utilize the second quarter, 2010 concentration data (provided in Table 3) and saturated thickness data within the area of the kriged 10 mg/L plume boundary. This data set is appropriate because the second quarter, 2010 concentration peak at TWN-2 likely identifies a high concentration zone that still exists but has migrated away from the immediate vicinity of TWN-2.

2) Calculate the plume nitrate mass quarterly based on kriged nitrate concentrations and saturated thicknesses (within the kriged 10 mg/L plume boundary).

3) After 8 quarters, fit a regression trend line to the calculated mass values for the plume and determine whether the mass calculation is increasing, decreasing, or stable

4) Add data quarterly thereafter, recalculate the trend line for the plume quarterly, and evaluate.

If the mass trend line after eight quarters is flat or decreasing (and the plume boundaries are not expanding), then Phase II will be considered successful at that time. Ongoing quarterly trend analysis will then indicate whether or not Phase II continues to be successful.

If the mass trend line is increasing after eight quarters, the data will be examined to determine if the increase is the result of increases in concentration at only one or two wells within the plume that are having an outsize impact on the mass calculation. Changes in concentration at individual wells are expected to result in part from migration of nitrate toward pumping wells. Because of the potential for nitrate to exist at higher concentrations between existing wells (and to be undetected at the present time), movement induced by pumping may cause migration of a higher concentration zone into the vicinity of a particular well, causing a (presumably temporary) increase in concentration at that well. The existence of a higher concentration zone near TWN-2 is evidenced by the relatively large changes in concentration inTWN-2 from the first quarter of 2010 through the third quarter of 2011 (Table 3). Fluctuations in concentration at TWN-2, which has demonstrated the highest historic concentrations, could result in fluctuations in the mass calculation that affect the slope or direction of a trend line. Similar fluctuations at wells other than TWN-2 could have the same impact.

The usefulness of the mass-based methodology described above will be reevaluated if needed based on the 8 quarters of collected data used to establish the initial trend line. If the method provides erratic values of limited usefulness, or is impacted unduly by the outsized impacts of one or more wells, a modified or new method will be developed at that time. The nature of the modified or new method will have the benefit of eight quarters of data to test its usefulness.

If the trend in nitrate mass calculations indicates a need to reevaluate the effectiveness of Phase II, analytical or numerical models will be used in the reevaluation if needed to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary. Anticipated responses to this condition would likely include adding existing or new wells to the pumping network, if suitable well locations are available, or other measures designed to achieve a more rapid rate of mass reduction. If suitable well locations are not available, then Phase III will be considered.

8.3 Nitrate Mass Removal Rates Resulting from Pumping (Phase II)

Under conditions where nitrate mass removal rates by pumping drop substantially as a result of reduced concentrations within the plume, no action will be taken. Under conditions where nitrate mass removal rates by pumping drop substantially as a result of lost well productivities, then an evaluation of the lost productivity will be undertaken. If the lost productivity is determined to be a well efficiency problem, the inefficient wells will be re-developed or replaced in accordance with a schedule to be approved by the Executive Secretary. Should the lost productivity be determined to be due to a general reduction in saturated thickness, analytical or numerical models will be used to evaluate the potential effectiveness of adding existing or new wells to the pumping network to improve overall productivity, if suitable well locations are available. If the analysis indicates that overall productivity will not improve significantly by adding wells, or if suitable well locations are not available, then no action will be taken.

A loss in productivity due to a general decrease in saturated thickness will likely be offset by the benefits of the reduced saturated thickness. First, this condition would indicate that removal of a substantial amount of nitrate laden water had already taken place. Second, the reduced saturated thickness within the nitrate plume would reduce average hydraulic gradients and reduce the potential for downgradient migration. These factors will be considered in any reevaluation that may be performed.

8.4 Stability of the Proportion of the Nitrate Plume under Hydraulic Capture (Phase II)

Under conditions where concentrations of nitrate in excess of the 10 mg/L standard migrate beyond the current boundaries of the plume, as evidenced by concentrations of nitrate in MW-30 and MW-31 increasing and/or concentrations of nitrate in downgradient wells MW-5 and MW-11 exceeding the 10 mg/L standard, an evaluation of the factors resulting in this condition will be undertaken. If the condition is determined to result from lost productivity of the pumping wells due to well efficiency problems, the inefficient wells will be re-developed or replaced in accordance with a schedule to be approved by the Executive Secretary. Should the loss in capture be determined to result from other conditions, then Phase II will be reevaluated, which may include commencement of Phase III. Analytical or numerical models will be used in the reevaluation if needed to develop a response. The reevaluation process will be completed in accordance with a schedule to be approved by the Executive Secretary.

Anticipated responses to this condition would likely include adding existing or new wells to the pumping network to bring a larger proportion of the plume within hydraulic capture, if suitable well locations are available. If suitable well locations are not available, then Phase III will be considered.

Any nitrate concentrations above 10 mg/L associated with the chloroform plume, that are not part of the nitrate plume shown in Figure 1-2, will be included in the remedial action for the chloroform plume.

8.5 Phase III

As discussed in Section 3.2.3, Phase III, if necessary, will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal

of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

8.6 Permanent Effect of Corrective Action

Phase II, Phase III, and the contingencies outlined above (Sections 8.1 through 8.5) are designed to protect the public health and the environment by containing the nitrate plume within the site property boundary and reducing nitrate concentrations within the plume to the concentration limit of 10 mg/L. As concentrations will then continue to be reduced by natural attenuation, demonstration that the corrective action will have a permanent effect will be based on appropriate future evaluations.

8.7 In-Place Contaminant Control

As discussed in Section 7, the corrective action relies on active and passive strategies to meet CAP objectives. The passive strategy includes in-place contaminant control by reducing nitrate concentrations via natural attenuation.

9. IMPACTS OF OFFSITE ACTIVITIES

As discussed in Section 7, nitrate will be treated in place by natural attenuation and removed from the perched zone by pumping. Because all pumped water will be disposed onsite in the tailings cells, there will be no offsite impacts resulting from CAP implementation.

10. PROPOSED PLUME CORRECTIVE ACTION ACTIVITIES

Phase II and Phase III corrective action activities and contingencies are discussed in detail in Sections 7 and 8. These activities are summarized in Sections 10.1 and 10.2 below.

10.1 Phase I

The Phase I source control action was discussed in Section 7.1, above.

10.2 Phase II

Phase II corrective action activities include pumping of wells TW4-22, TW4-24, TW4-25, and TWN-2, monitoring and maintenance of the pumping system, water level monitoring, monitoring for nitrate and chloride, estimation of hydraulic capture, implementation of contingencies as needed, and reporting.

10.2.1 Groundwater Pumping

Wells TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 1-2) will be pumped at the maximum practical rates. Pumped water will be disposed in the tailings cells. The wellfield will be operated and maintained in the same fashion as the chloroform removal wellfield. Monitoring will include pumping rates and volumes for each well.

10.2.2 Water Level Monitoring

Water level monitoring will consist of weekly water level monitoring of pumping wells TW4-22, TW4-24, TW4-25, and TWN-2, and, for the first twelve months after approval of this CAP, monthly monitoring of non-pumped wells MW-27, MW-30, MW-31, TW4-21, TWN-1, TWN-3, TWN-4, TWN-7, and TWN-18 (Figure 1-2). Thereafter, water level monitoring of those non-pumping wells will continue quarterly. Water level contour maps of the data will be generated quarterly.

10.2.3 Water Quality Monitoring

Water quality monitoring for pumped wells TW4-22, TW4-24, TW4-25, and TWN-2 and all other wells listed on Table 3 will be quarterly. Samples will be analyzed for chloride, and for nitrogen (nitrate and nitrite as N). Field parameters pH and temperature will be recorded. (Section 6.2.4). Water quality monitoring for chloride, nitrate, and field parameters for all other wells at the site will continue at the frequency required under the GWDP or chloroform investigation, as the case may be.

10.2.4 Estimation of Capture Zones

Hydraulic capture zones will be generated from the quarterly water level contour maps in the same manner as they are currently generated for the chloroform pumping.

10.2.5 Estimation of Pumped Nitrate Mass and Nitrate Mass within the Plume

Quarterly estimates of nitrate mass removed by pumping will be made based on cumulative pumped volumes at each pumped well and nitrate concentrations at each pumped well. Quarterly estimates of the nitrate mass remaining within the plume will also be calculated based on kriged concentrations in wells listed in Table 3 and saturated thicknesses, as discussed in Section 8.2.

10.2.6 Reporting

Quarterly reports will be prepared that contain the same elements of the current chloroform corrective action monitoring reports submitted by Denison to DRC and will include the following:

1. Tabular compilations of groundwater level measured in non-pumped wells over time,
2. Water level data from pumped wells over time,
3. Running and cumulative groundwater volumes removed from each pumping well,
4. Calculations and/or spreadsheets documenting quarterly nitrate mass removed by pumping,
5. comparison of the areal extent of the nitrate plume from the latest quarter with the latest quarter of the previous reporting period, and
6. discussion of any contingencies implemented or to be implemented.

10.2.7 Additional Measures

Based on Phase II monitoring, and the criteria discussed in Section 8, contingencies that include potential installation of additional wells, well rehabilitation or replacement, potential expansion of the pumping well network, if suitable well locations are available, and reevaluation of the Phase II strategy and consideration of commencement of Phase III activities will be implemented as needed. Factors that could trigger the implementation of contingencies include 1) expansion of the plume boundaries, 2) generally increasing nitrate concentrations and calculated nitrate mass within the plume, 3) reductions in nitrate mass removal rates due to losses in pumping well productivities, and 4) decreases in the effectiveness of hydraulic capture.

10.3 Phase III

As discussed in Section 3.2.3, Phase III, if necessary, will be undertaken at a later date only after public participation and Executive Secretary approval. Phase III may include, but is not limited to: continuation of Phases I and II activities alone or in combination with monitored natural attenuation, evaluation of additional remediation and monitoring technologies/techniques, determination of any additional hydrogeologic characterization, groundwater contaminant travel times and directions, determination of ultimate points of exposure to the public and/or wildlife, appropriate risk analysis, a cost/benefit analysis, and the possible development of and petition to the Utah Water Quality Board for alternate corrective action concentration limits pursuant to UAC R317 -6-6 .15 (G).

This CAP does not specify the details of Phase III, at this time. A Phase III preliminary plan and schedule for the evaluation of alternatives, for the completion of any further studies, analyses, applications and petitions, and for the ultimate definition of Phase III, may be proposed by Denison at a later date, after completion of such studies and evaluations, followed by submittal of a proposed CAP revision to the Executive Secretary. Until such time, the activities of the Phase I and Phase II remediation will continue as stipulated in the approved CAP.

11. REFERENCES

HGC. 2004. Final Report. Long Term Pumping at MW-4, TW4-19, and TW4-15, White Mesa Uranium Mill Near Blanding, Utah. Submitted to International Uranium (USA) Corporation, Denver, Colorado.

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12. LIMITATIONS STATEMENT

The opinions and recommendations presented in this report are based upon the scope of services and information obtained through the performance of the services, as agreed upon by HGC and the party for whom this report was originally prepared. Results of any investigations, tests, or findings presented in this report apply solely to conditions existing at the time HGC's investigative work was performed and are inherently based on and limited to the available data and the extent of the investigation activities. No representation, warranty, or guarantee, express or implied, is intended or given. HGC makes no representation as to the accuracy or completeness of any information provided by other parties not under contract to HGC to the extent that HGC relied upon that information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and for the particular purpose that it was intended. Reuse of this report, or any portion thereof, for other than its intended purpose, or if modified, or if used by third parties, shall be at the sole risk of the user.

TABLES

TABLE 1
Nitrate Corrective Action Schedule

STEP OR ACTION	***DATE***
Executive Secretary Issuance of Consent Order Approving Corrective Action Plan	No set date
Commence Corrective Actions	within 30 days of CAP approval
Phase I	
Submit Phase 1 Plan and Schedule for Ammonium Sulfate Corrective Action	1/1/2012
Submit Revised Reclamation Plan and Financial Surety Estimate for Phase I	3/4/2012
Submit Evidence of Adequate Surety for Phase 1	within 30 days of approval of Phase I revised surety estimate
Perform Initial Soil Sampling	within 30 days of CAP approval
Perform additional analysis if required	within analytical holding time
Submit analytical data and proposed Sulfate Area Cover design to Executive Secretary	within 60 days of receipt of all required soil sampling data
Construct Ammonium Sulfate Area Cover	within 60 days of receipt of Executive Secretary approval of design
Submit DMT Plan revisions with concrete pad maintenance and inspection requirements.	within 45 days of CAP approval
Phase II	
Submit Revised Reclamation Plan and Financial Surety Estimate for Phase I and II	within 60 days of Consent Order
Submit Evidence of Adequate Surety for Phase I and II	within 30 days of approval of Phase I and II revised surety estimate
Submit Nitrate Operations and Maintenance Plan	within 30 days of Consent Order
Install Pumps in Wells TW4-22, TW4-24, TW4-25, and TWN-2	within 30 days of Consent Order
Begin Pumping Wells TW4-22, TW4-24, TW4-25, and TWN-2	within 45 days of Consent Order
Cease Sampling of TWN-5, TWN-6, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-14, TWN-15, TWN-16, TWN-17, TWN-19	upon issuance of Consent Order
Cease Water Level Monitoring of TWN-5, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-15, TWN-17	upon issuance of Consent Order
Abandon Wells TWN-5, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-15, TWN-17	within 15 months of Consent Order
Reporting of Monitoring and Pumping Data	as part of ongoing quarterly nitrate monitoring reports

TABLE 1
Nitrate Corrective Action Schedule

STEP OR ACTION	***DATE***
Submit Capture Zone Maps	In quarterly report after four quarters of monthly groundwater level data
Submit Well Abandonment Report	within 15 months of Consent Order
Evaluate Phase II performance information	After collection of 5 years of Phase II performance data
Provide Phase II performance report to Executive Secretary	within 180 days of collection of 5 years of Phase II data.
Phase III	
To be determined at discretion of Denison	- - -

TABLE 2
Hydraulic Conductivity Estimates for Wells in the Nitrate Plume Area

Well	k (cm/s)[1]	Method
MW-11	1.40E-03	pumping
MW-27	8.20E-05	[2]slug
MW-30	1.00E-04	[2]slug
MW-31	7.10E-05	[2]slug
TW4-19	2.50E-04	pumping
TW4-20	5.90E-05	[2]slug
TW4-21	1.90E-04	[2]slug
TW4-22	1.30E-04	[2]slug
TW4-24	1.60E-04	[2]slug
TW4-25	5.80E-05	[2]slug
TWN-1	1.70E-04	[2]slug
TWN-2	1.49E-05	[2]slug
TWN-3	8.56E-06	[2]slug
TWN-18	2.27E-03	[2]slug

Notes:

[1] *hydraulic conductivity in centimeters per second*

[2] *KGS slug test solution results for automatically logged data*

TABLE 3
Nitrate Concentrations (mg/L) at Wells Within the Nitrate Plume

Well	Q1 2010	Q2 2010	Q3 2010	Q4 2010	Q1 2011	Q2 2011	Q3 2011
MW-30	16.1	15.8	15	16	16	17	16
MW-31	21.7	22.5	21	20	21	22	21
[1]TW4-19	2	4.4	5.9	2.7	17	12	3
TW4-21	8.4	12	14	7	9	12	14
TW4-22	36.6	19	15	16	18	17	15
TW4-24	33.1	30	31	31	31	35	34
TW4-25	14.4	16	14	15	15	16	16
TWN-2	62.1	69	69	48	43	40	33
TWN-3	25.3	26	27	24	24	26	25
average	24.4	23.9	23.5	20.0	21.6	21.9	19.7

Note:

[1] *TW4-19 is a chloroform pumping well*

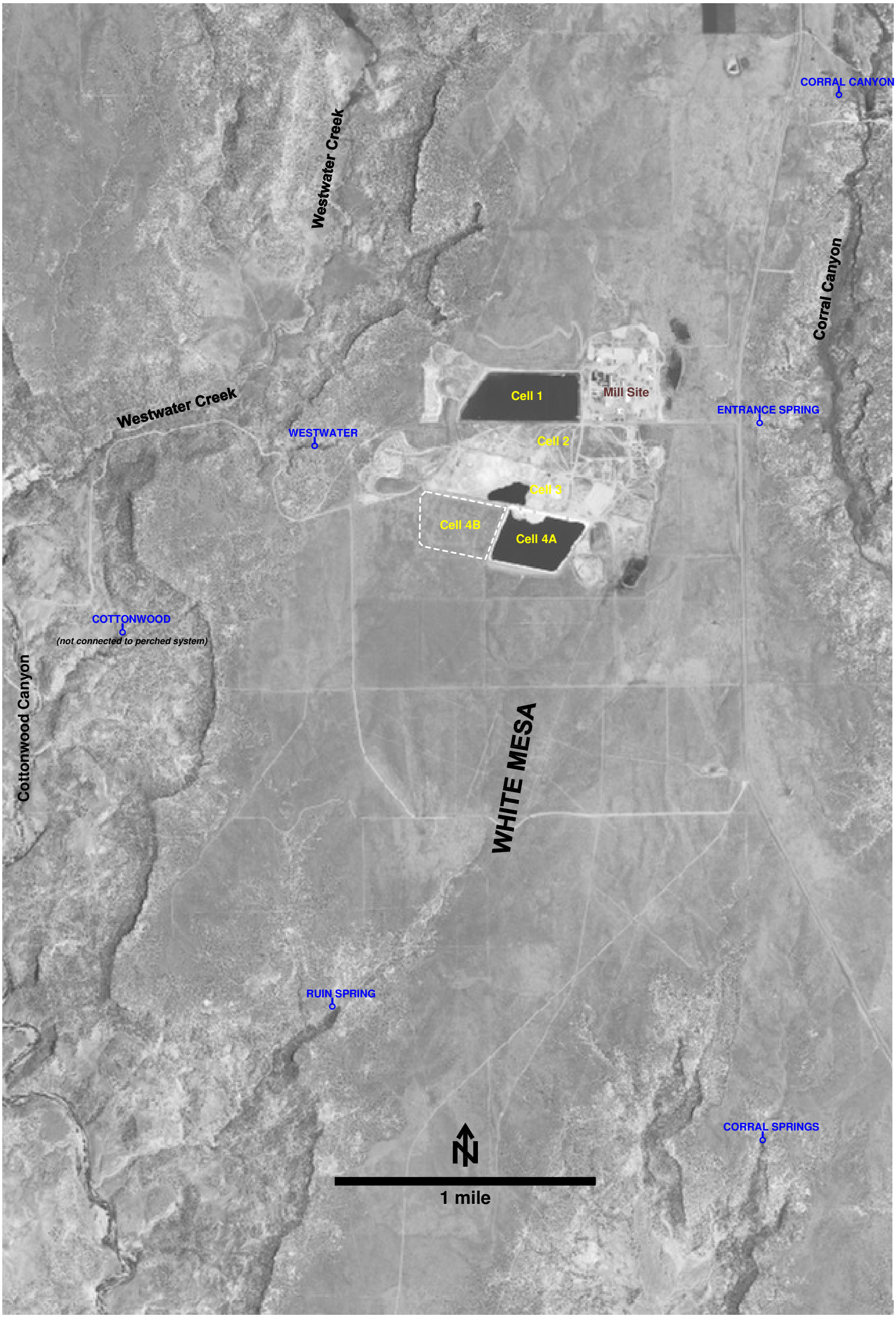
TABLE 4
Comparison of Chloroform Pumping Well Transmissivities to Proposed Nitrate Pumping Well Transmissivities

Well	Type	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (ft/day)	Saturated Thickness[1] (feet)	Transmissivity (ft2/day)
MW-4	chloroform pumping	1.00E-04	0.280	40	11
MW-26	chloroform pumping	8.00E-05	0.224	50	11
TW4-4	chloroform pumping	1.70E-03	4.760	22	105
TW4-19	chloroform pumping	2.50E-04	0.700	62	43
TW4-20	chloroform pumping	5.90E-05	0.165	52	9
TW4-22	proposed pumping	1.30E-04	0.364	59	21
TW4-24	proposed pumping	1.60E-04	0.448	57	26
TW4-25	proposed pumping	5.80E-05	0.162	88	14
TWN-2	proposed pumping	1.49E-05	0.042	76	3

Note:

[1] *estimated non-pumping saturated thickness*

FIGURES



EXPLANATION

RUIN SPRING

seep or spring

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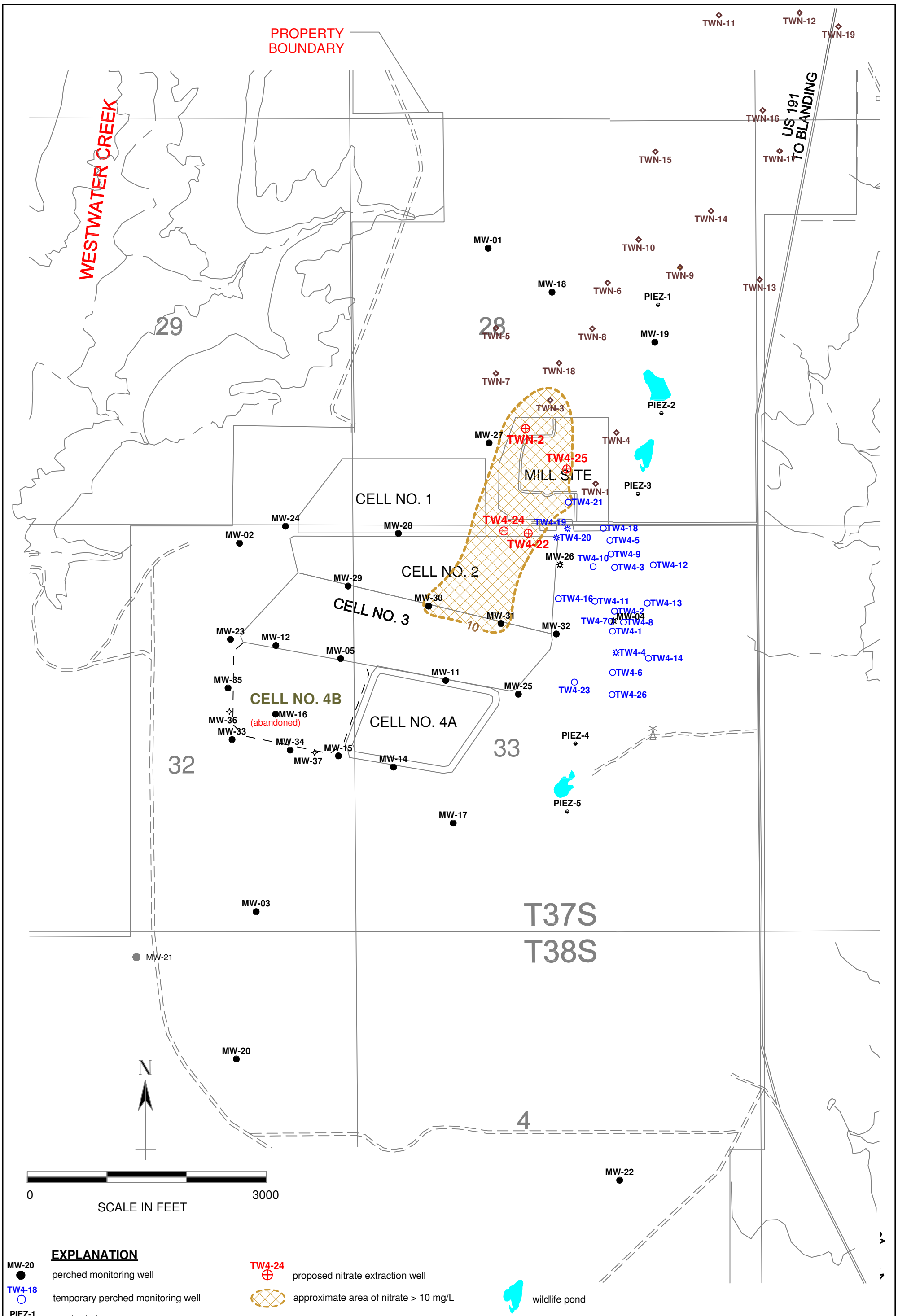
WHITE MESA MILL SITE PLAN SHOWING LOCATIONS OF SEEPS AND SPRINGS

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/nirtrate2011/CAP/UTMsitemap.srf	1-1



EXPLANATION

- MW-20 — perched monitoring well
- TW4-18 — temporary perched monitoring well
- PIEZ-1 — perched piezometer
- TWN-1 — temporary perched nitrate monitoring well
- MW-36 — perched monitoring well installed April, 2011
- MW-4 — perched chloroform extraction well
- TW4-24 — proposed nitrate extraction well
- approximate area of nitrate > 10 mg/L
- wildlife pond

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SITE PLAN SHOWING PERCHED WELL LOCATIONS AND 3rd QUARTER, 2011 NITRATE PLUME EXTENT WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/nitplume11v2.srf	1-2

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PHOTOGRAPH OF THE CONTACT BETWEEN THE BURRO CANYON FORMATION AND THE BRUSHY BASIN MEMBER

APPROVED	DATE	REFERENCE	FIGURE
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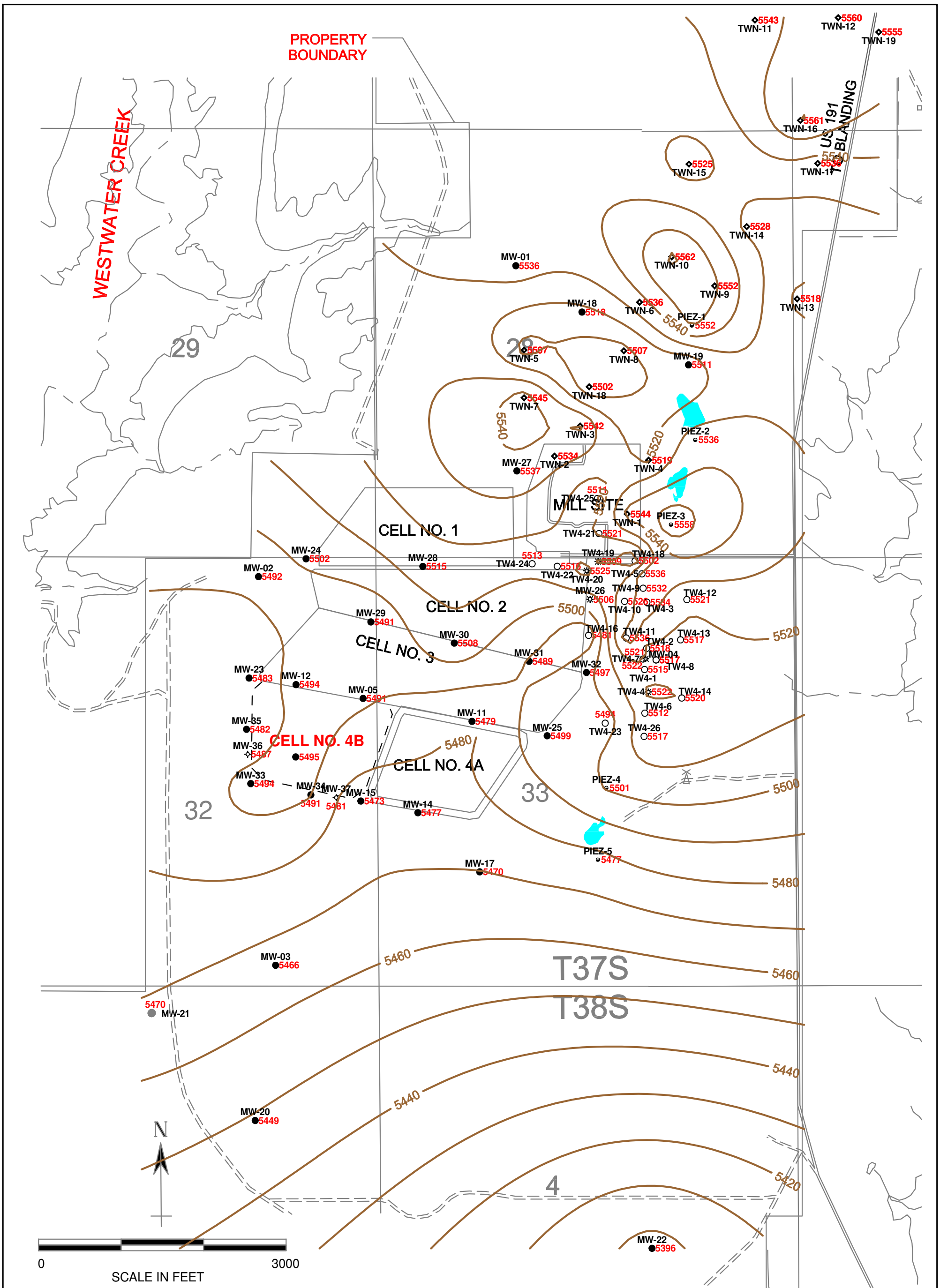

EXPLANATION

MW-22 ● 5396	perched monitoring well showing elevation in feet amsl
TW4-1 ○ 5514	temporary perched monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5552	perched piezometer showing elevation in feet amsl
TWN-4 ◇ 5519	temporary perched nitrate monitoring well showing elevation in feet amsl
MW-36 ✧ 5487	perched monitoring well installed April, 2011 showing elevation in feet amsl
MW-4 ✲ 5521	perched chloroform extraction well showing elevation in feet amsl

HYDRO GEO CHEM, INC.

KRIGED TOP OF BRUSHY BASIN ELEVATIONS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
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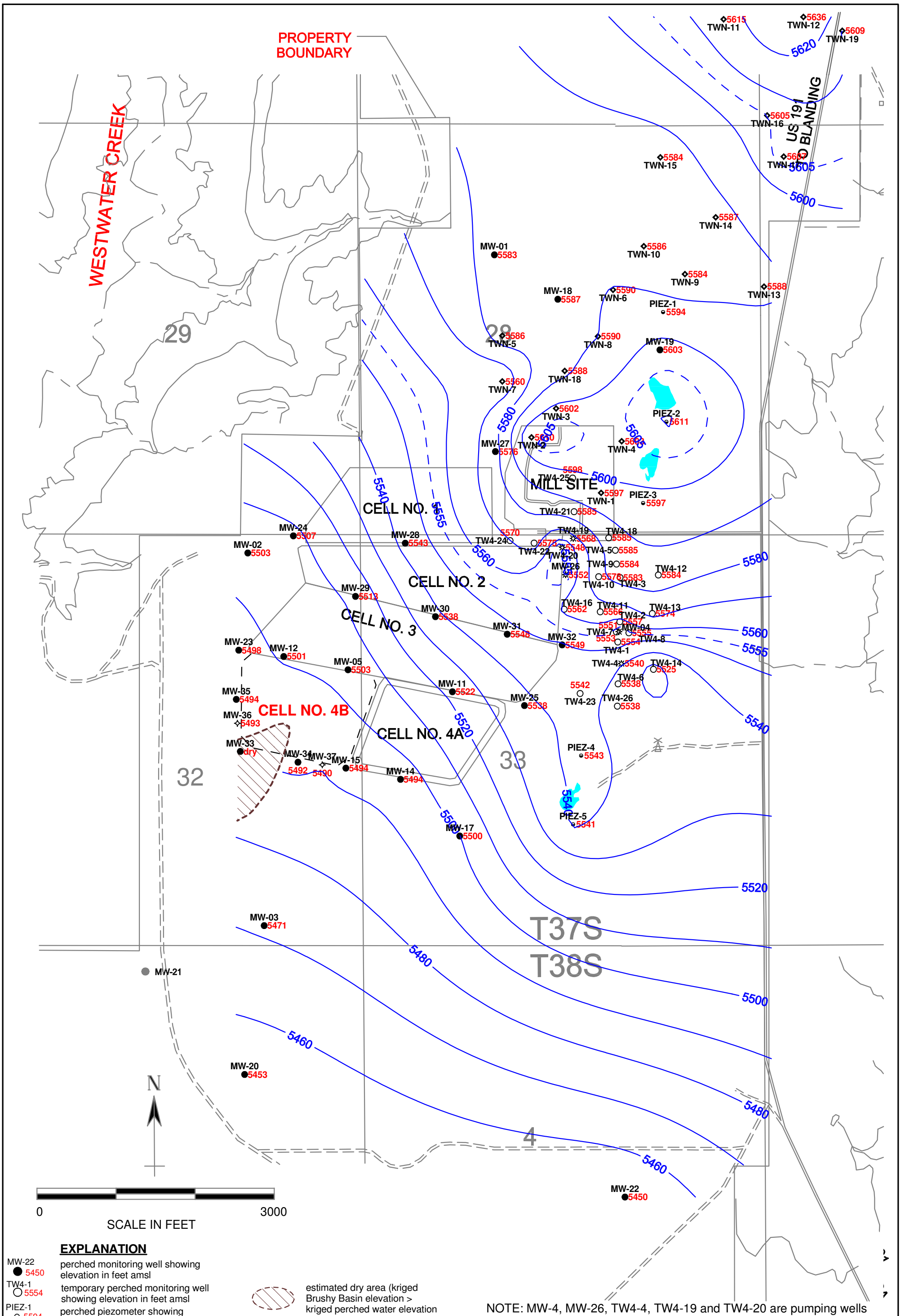


EXPLANATION

MW-22 ● 5450	perched monitoring well showing elevation in feet amsl
TW4-1 ○ 5554	temporary perched monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5594	perched piezometer showing elevation in feet amsl
TWN-4 ◇ 5603	temporary perched nitrate monitoring well showing elevation in feet amsl
MW-36 ✧ 5493	perched monitoring well installed April, 2011 showing elevation in feet amsl
MW-4 ✲ 5551	perched chloroform extraction well showing elevation in feet amsl

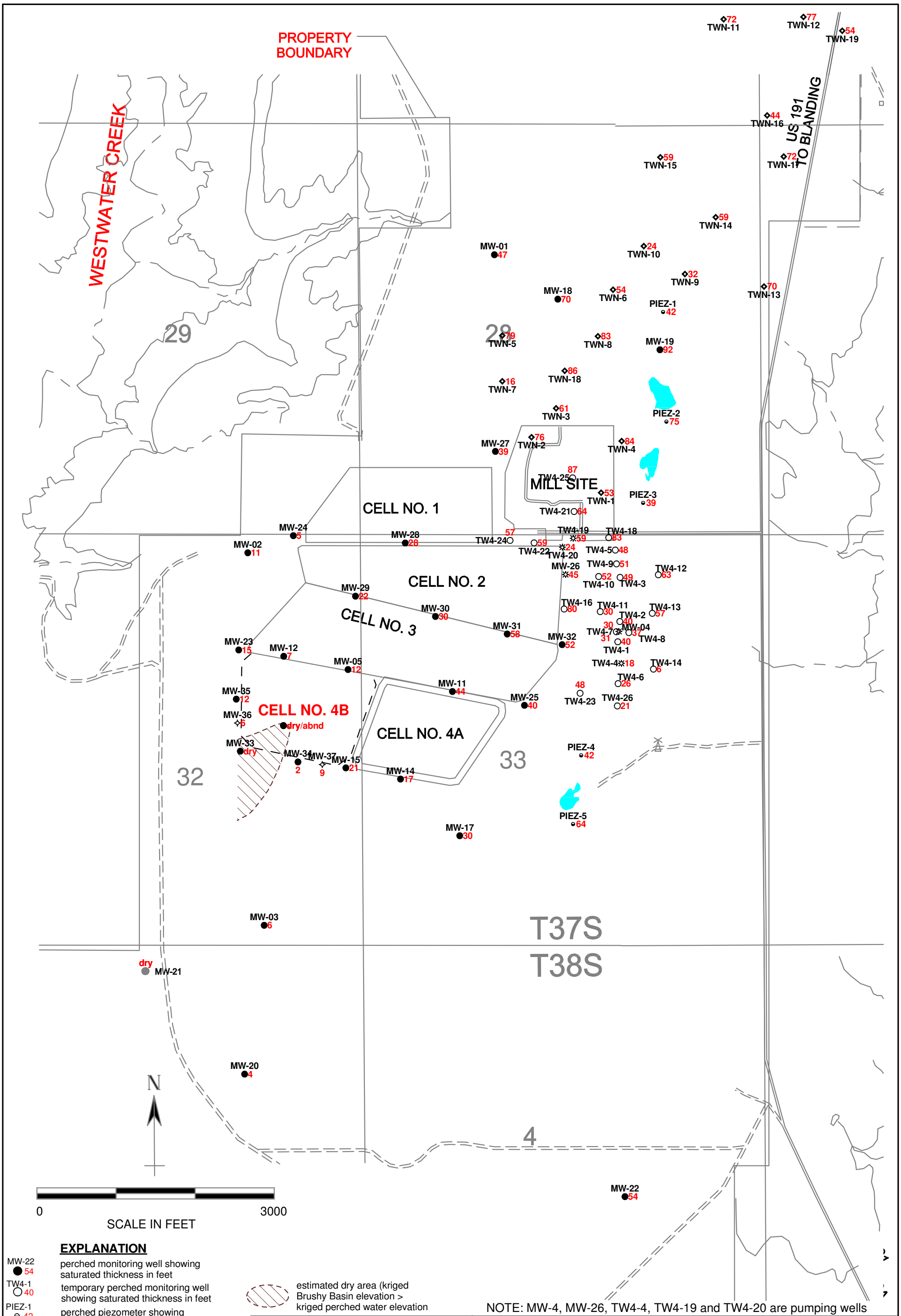
estimated dry area (kriged Brushy Basin elevation > kriged perched water elevation

NOTE: MW-4, MW-26, TW4-4, TW4-19 and TW4-20 are pumping wells

HYDRO GEO CHEM, INC.

KRIGED 3rd QUARTER, 2011 WATER LEVELS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/wl0911dv2.srf	4



EXPLANATION

MW-22 ● 54	perched monitoring well showing saturated thickness in feet
TW4-1 ○ 40	temporary perched monitoring well showing saturated thickness in feet
PIEZ-1 ◒ 42	perched piezometer showing saturated thickness in feet
TWN-4 ◇ 84	temporary perched nitrate monitoring well showing saturated thickness in feet
MW-36 ✧ 6	perched monitoring well installed April, 2011 showing saturated thickness in feet
MW-4 ✲ 30	perched chloroform extraction well showing saturated thickness in feet

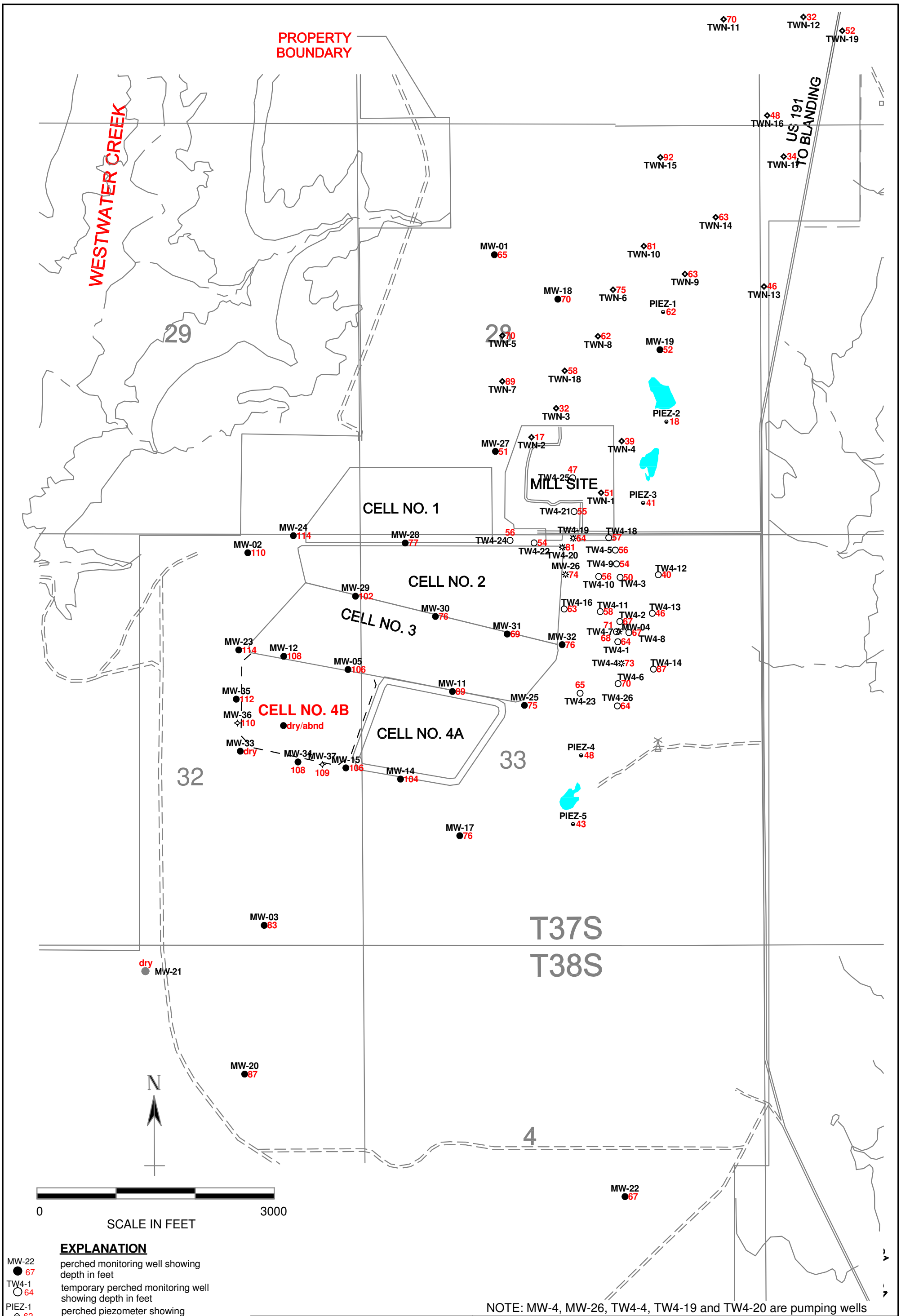
estimated dry area (kriged Brushy Basin elevation > kriged perched water elevation

NOTE: MW-4, MW-26, TW4-4, TW4-19 and TW4-20 are pumping wells

HYDRO GEO CHEM, INC.

3rd QUARTER, 2011 SATURATED THICKNESS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/bbelev/sat0911v2.srf	5



EXPLANATION

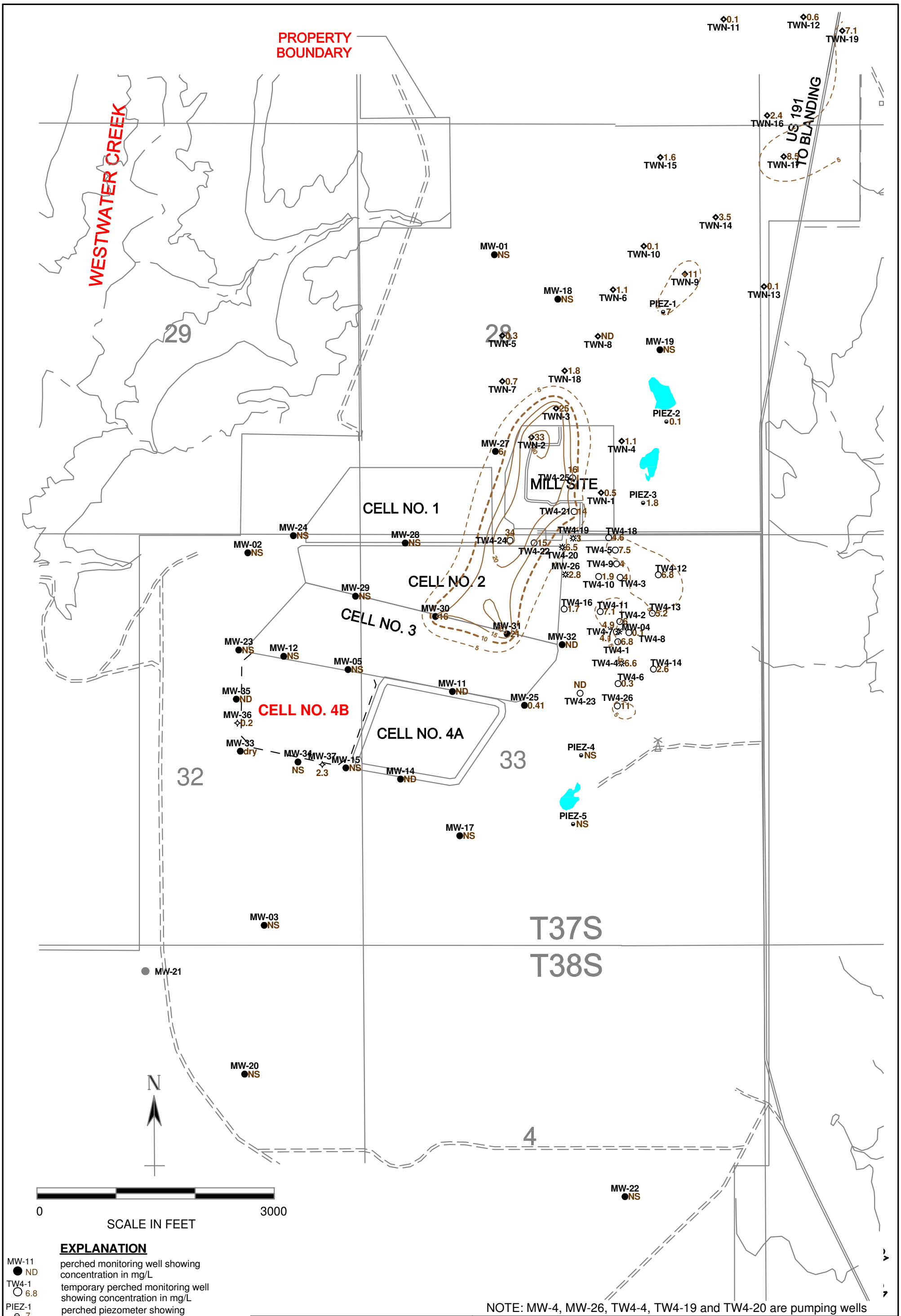
MW-22 ● 67	perched monitoring well showing depth in feet
TW4-1 ○ 64	temporary perched monitoring well showing depth in feet
PIEZ-1 ◒ 62	perched piezometer showing depth in feet
TWN-4 ◇ 39	temporary perched nitrate monitoring well showing depth in feet
MW-36 ⌖ 110	perched monitoring well installed April, 2011 showing depth in feet
MW-4 ✲ 71	perchedchloroform extraction well showing depth in feet

NOTE: MW-4, MW-26, TW4-4, TW4-19 and TW4-20 are pumping wells

HYDRO GEO CHEM, INC.

3rd QUARTER, 2011 DEPTHS TO WATER
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/nov11/ bbelev/dtw0911v2.srf	6



NOTE: MW-4, MW-26, TW4-4, TW4-19 and TW4-20 are pumping wells

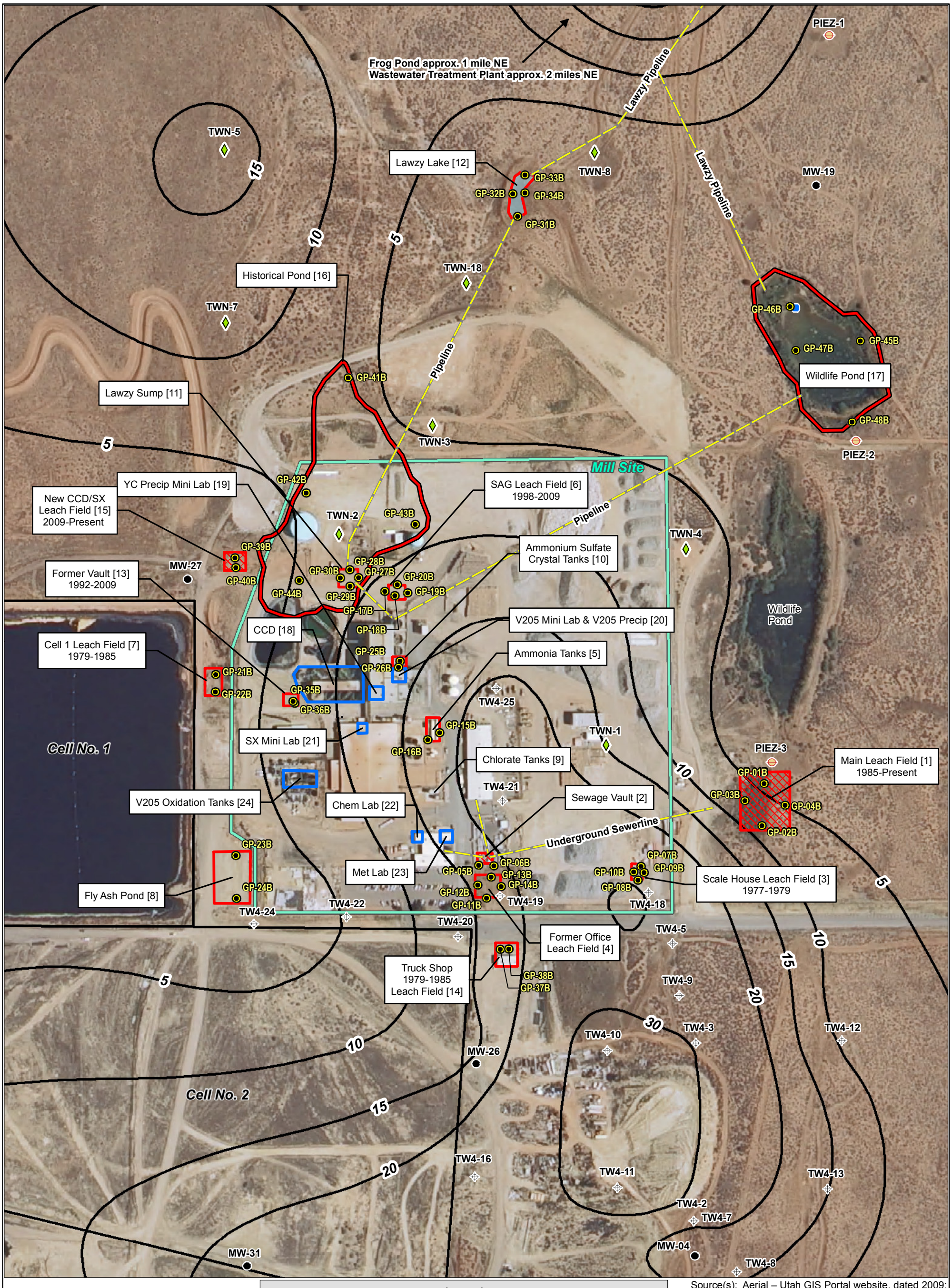
EXPLANATION

MW-11 ND	perched monitoring well showing concentration in mg/L
TW4-1 6.8	temporary perched monitoring well showing concentration in mg/L
PIEZ-1 7	perched piezometer showing concentration in mg/L
TWN-1 0.5	temporary perched nitrate monitoring well showing concentration in mg/L
MW-36 0.2	perched monitoring well installed April, 2011 showing concentration in mg/L
MW-4 4.9	chlorofrom extraction well showing concentration in mg/L

HYDRO GEO CHEM, INC.

KRIGED 3rd QUARTER, 2011 NITRATE (mg/L) (NITRATE + NITRITE AS N) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/nit0911v2.srf	7



Source(s): Aerial – Utah GIS Portal website, dated 2009; Wells – HGC, Inc., May 2008 report.

N
S

300 150 0 300 Feet

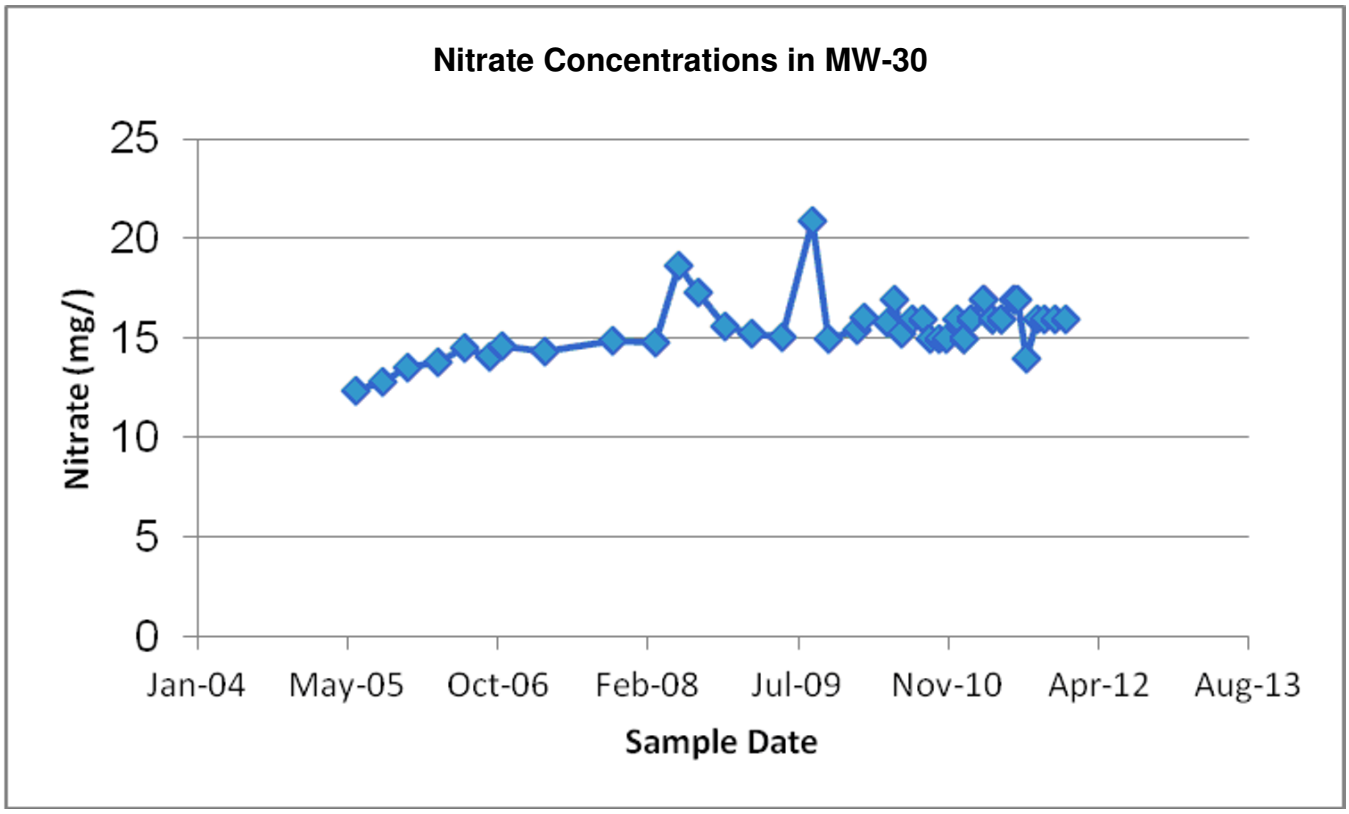
INTERA

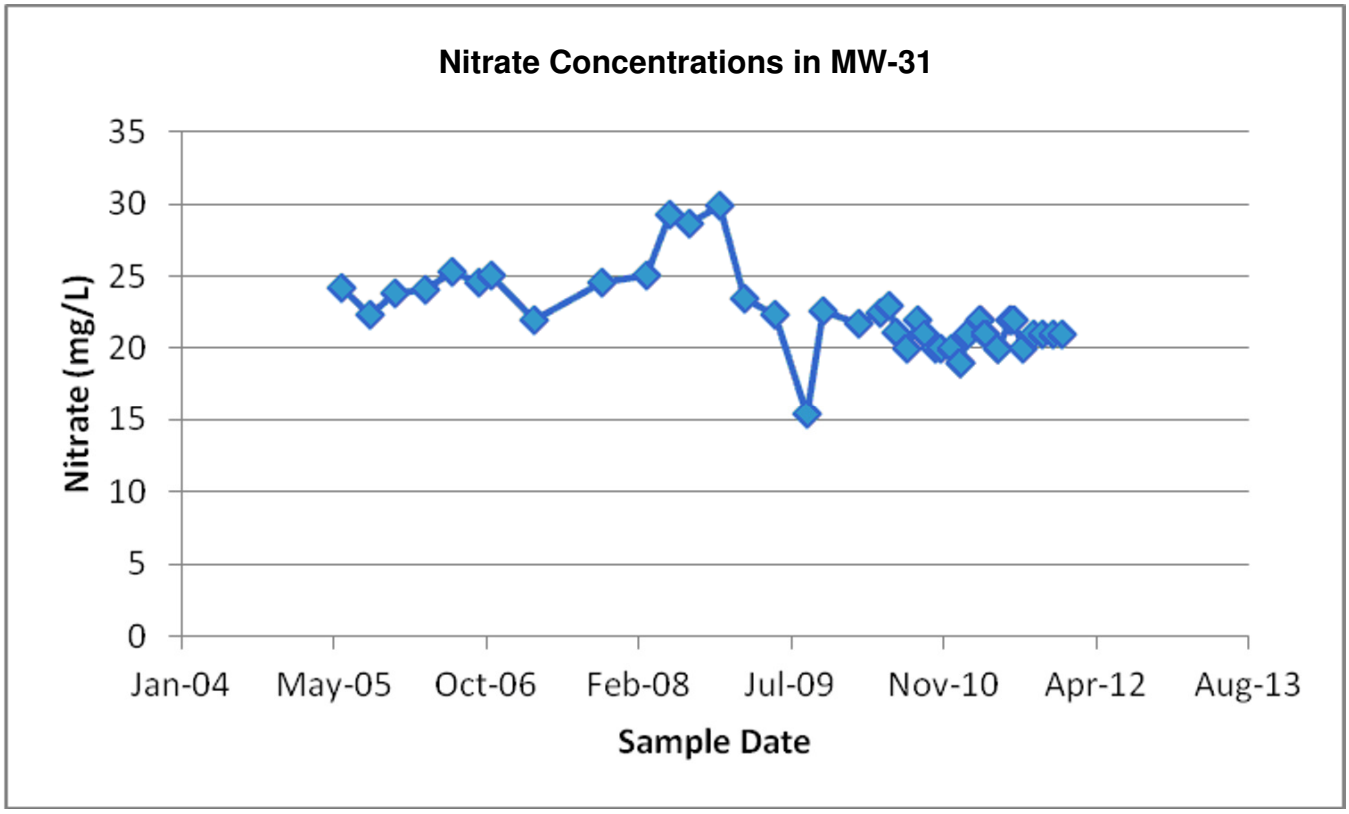
Legend

- Geoprobe Boring Location
- Monitoring Well
- Piezometer
- Spring/Seep
- Surface Water
- Chloroform Monitoring Well
- Nitrate Monitoring Well
- Leach Field (currently in operation) Sampling Method to be Determined
- Potential Mill Site Source – Geoprobe Boring
- Other Potential Nitrate and Chloride Source – Geoprobe Boring
- Inaccessible Potential Mill Site Source – No Geoprobe Boring
- Mancos Shale Thickness Contour (feet)

Figure 8
Potential Nitrate Source Areas and Geoprobe Locations Showing the Thickness of the Mancos Shale

S:\Projects\IUC-001-01-001 Denison Mines\GIS\mapdocs\NitrateReport\20120206_mancosThickness.mxd





HYDRO GEO CHEM, INC.

NITRATE CONCENTRATIONS IN MW-30 AND MW-31

Approved	Date	Author	Date	File Name	Figure
SJS	2/23/12		2/23/12	FX1-FX2	9-1

PROPERTY BOUNDARY

WESTWATER CREEK

US 191 TO BLANDING

29

28

32

33

4

T37S

T38S

CELL NO. 1

CELL NO. 2

CELL NO. 3

CELL NO. 4A

CELL NO. 4B

MILL SITE

TWN-11 TWN-12 TWN-19 TWN-16 TWN-15 TWN-17 TWN-14 TWN-10 TWN-9 TWN-13 TWN-6 TWN-5 TWN-8 TWN-18 TWN-7 TWN-3 TWN-2 TWN-4 TWN-1

MW-01 MW-18 MW-19 MW-27 MW-24 MW-28 MW-02 MW-29 MW-30 MW-31 MW-32 MW-23 MW-12 MW-05 MW-11 MW-25 MW-35 MW-36 MW-33 MW-34 MW-37 MW-15 MW-14 MW-17 MW-03 MW-21 MW-20 MW-22

PIEZ-1 PIEZ-2 PIEZ-3 PIEZ-4 PIEZ-5

TW4-25 TW4-21 TW4-19 TW4-18 TW4-24 TW4-22 TW4-20 TW4-5 TW4-9 TW4-12 TW4-10 TW4-3 TW4-16 TW4-11 TW4-13 TW4-2 TW4-7 TW4-8 TW4-1 TW4-4 TW4-14 TW4-6 TW4-23 TW4-26

N

0 3000

SCALE IN FEET

EXPLANATION

MW-20 perched monitoring well

TW4-1 temporary perched monitoring well

PIEZ-1 perched piezometer

TWN-1 temporary perched nitrate monitoring well

MW-36 perched monitoring well installed April, 2011

MW-4 perched chloroform extraction well

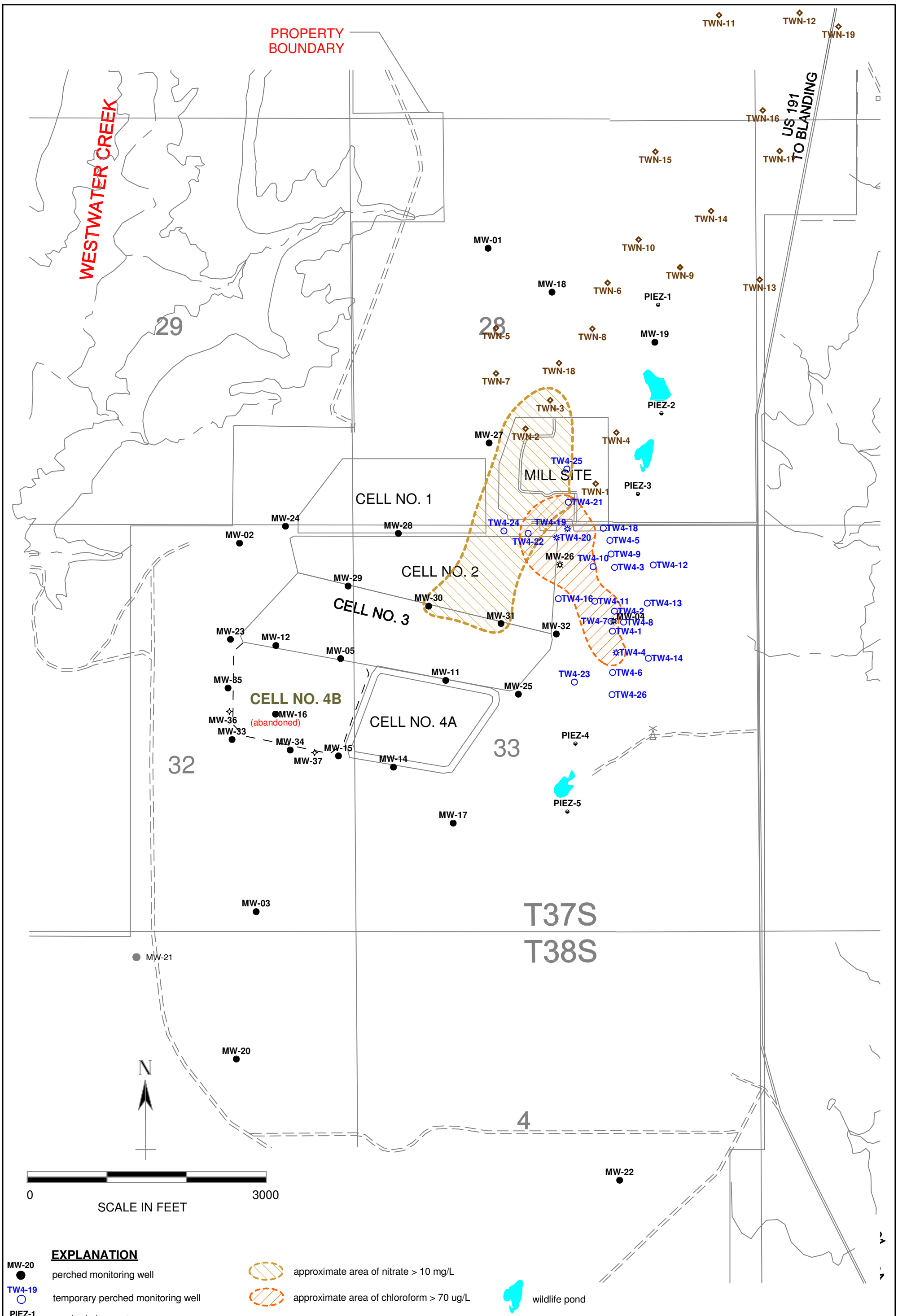
3rd quarter, 2011 nitrate plume boundary

3rd quarter, 2010 nitrate plume boundary

HYDRO GEO CHEM, INC.

COMPARISON OF NITRATE PLUME BOUNDARIES 3rd QUARTER 2010 AND 3rd QUARTER 2011

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/nitcompv2.srf	9-2



HYDRO GEO CHEM, INC.

3rd QUARTER, 2011
NITRATE AND CHLOROFORM PLUMES
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/nitchl11v2.srf	10

Sample ID	Collection Date	Ammonia as N mg/kg	Nitrate/Nitrite as N mg/kg
UCLs		*2.97*	*2.14*
GP-25B-5.5-6.5	6/8/2011	**1050**	**1530**
GP-25B-13-14	6/8/2011	**1350**	**27.6**
GP-25B-13-14D	6/8/2011	**1270**	**27.3**
GP-25B-18-19	6/8/2011	**1620**	**18.3**
GP-26B-4.5-5.5	6/9/2011	**1,190**	**5.05**
GP-26B-10-11	6/9/2011	**912**	0.301
GP-26B-15-16	6/9/2011	**1,590**	**6.23**

Source(s): Aerial – Utah GIS Portal website, dated 2009; Wells – HGC, Inc., May 2008 report.

N
S

80 40 0 80 Feet

Legend

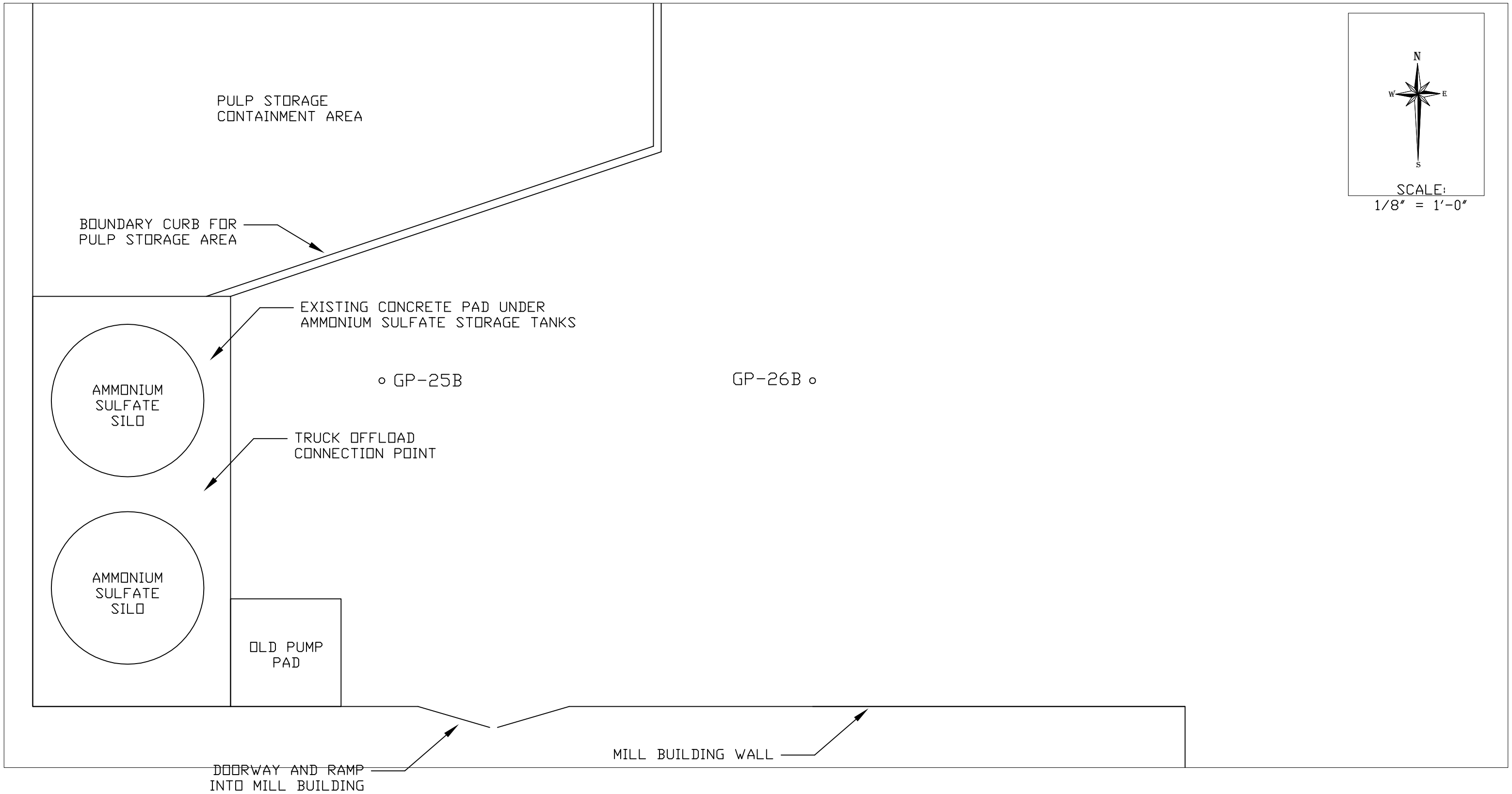
Geoprobe Boring Location

Potential Mill Site Source - Geoprobe Boring

INTERA

Figure 11-1
Ammonium Sulfate Contamination

S:\Projects\IUC-001-01-001 Denison Mines\GIS\mapdocs\NitrateReport\20111122ammoniumSulfate_8.mxd



Denison Mines (USA) Corp.

DENISON MINES

Project: AMMONIUM SULFATE NITRATE CONTROL

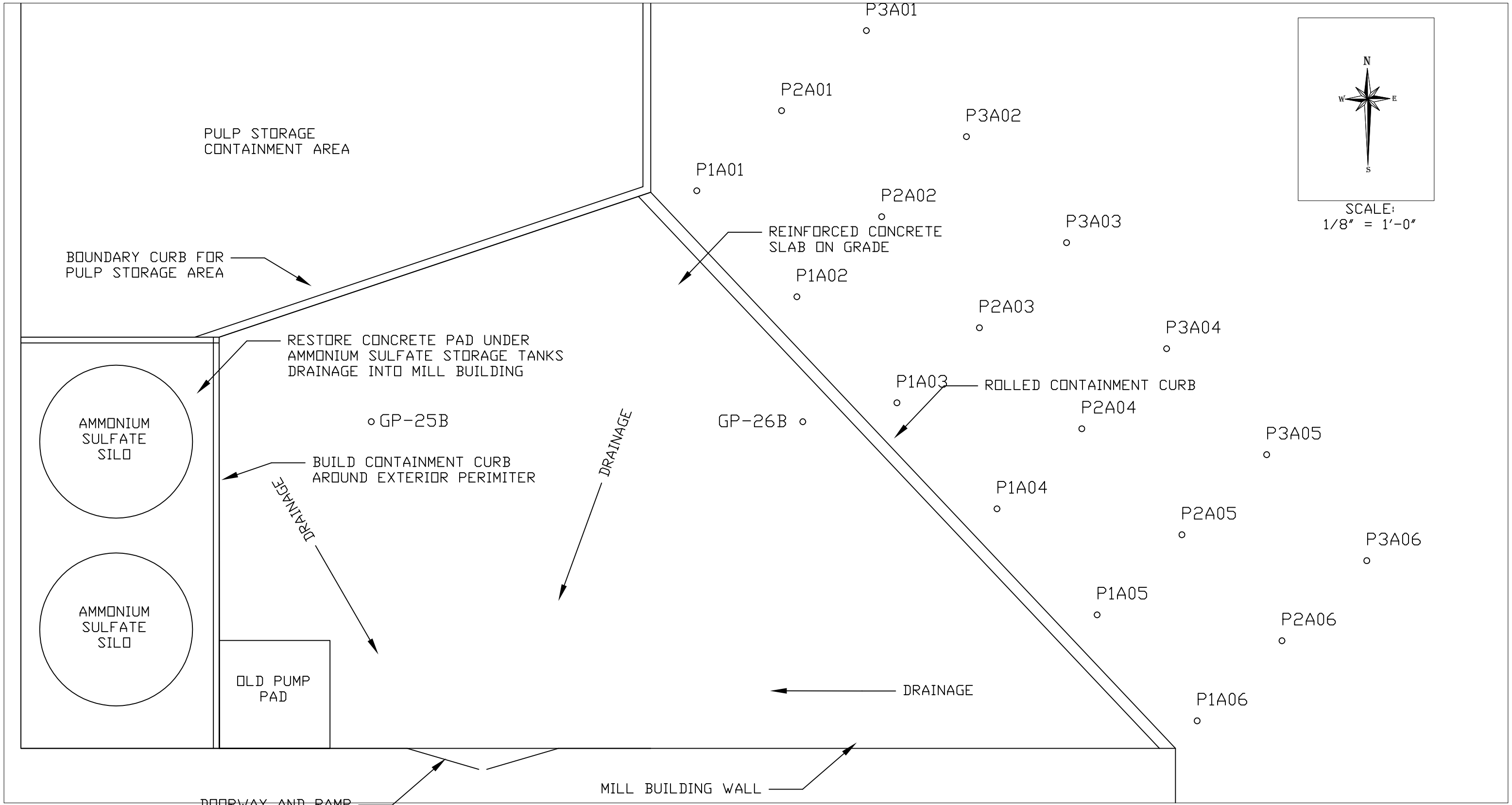
County: San Juan | State: Utah

FIGURE 11-2A

AMMONIUM SULFATE TANK AREA

(CURRENT LAYOUT)

Date: | Design: | Drafted By: S. SNYDER



Denison Mines (USA) Corp.

DENISON MINES

Project:	AMMONIUM SULFATE NITRATE CONTROL
County: San Juan	State: Utah

FIGURE 11-2B

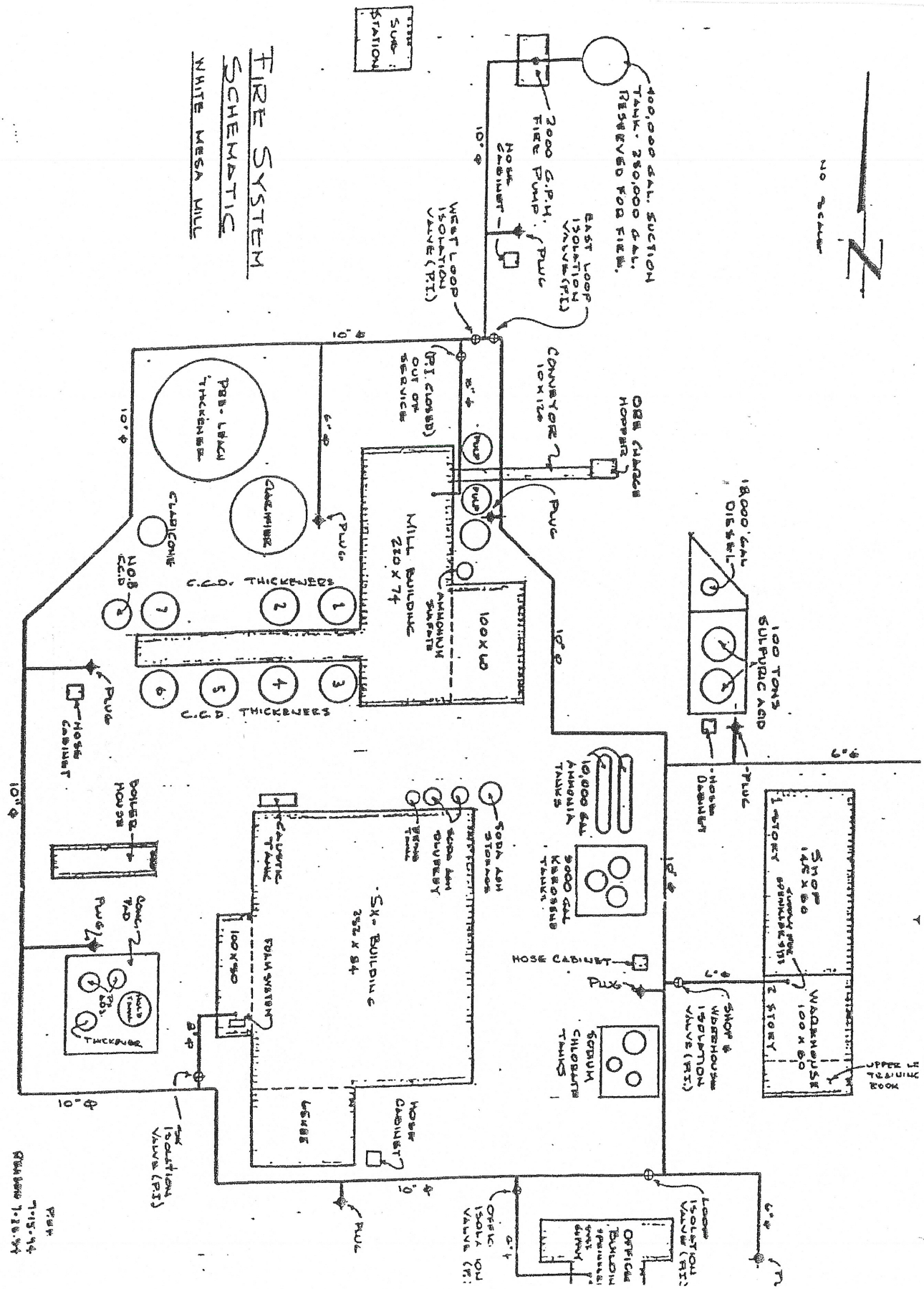
AMMONIUM SULFATE CONCRETE COVER

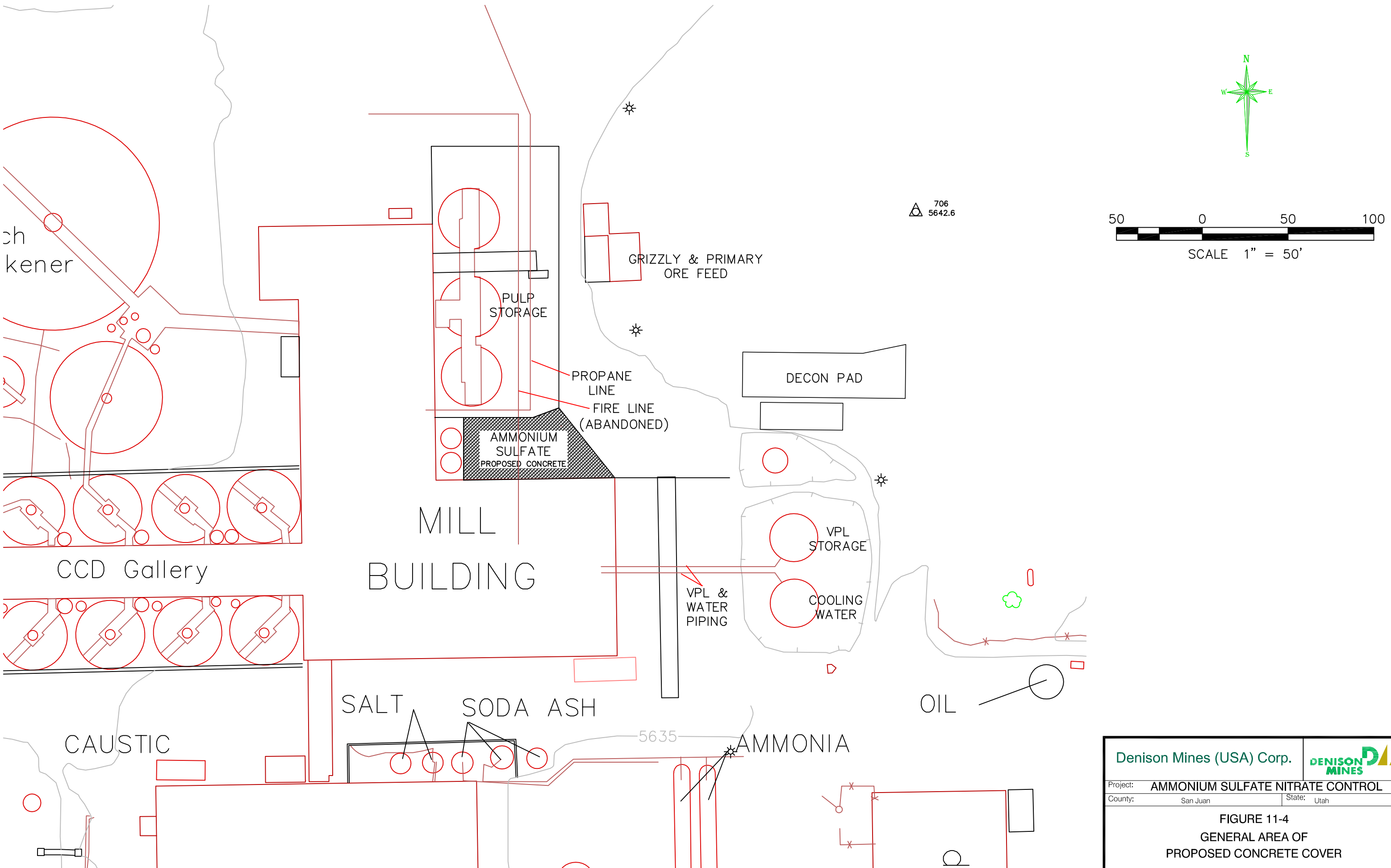
(PROPOSED LAYOUT)

Date:	Design:	Drafted By: S. SNYDER

Figure 11-3

Fire System Schematic





Denison Mines (USA) Corp.

DENISON MINES

Project: AMMONIUM SULFATE NITRATE CONTROL

County: San Juan

State: Utah

FIGURE 11-4

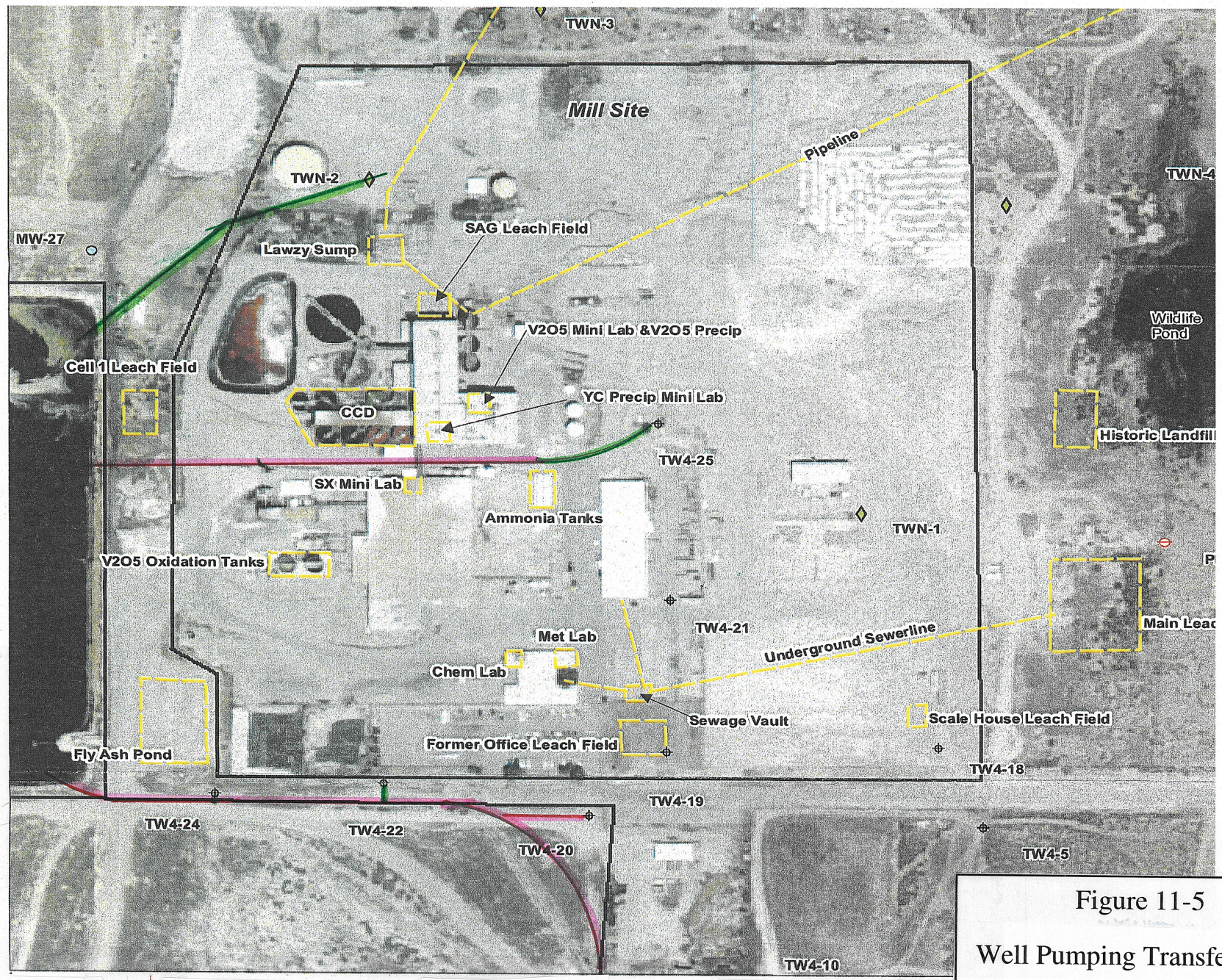
GENERAL AREA OF

PROPOSED CONCRETE COVER

Date:

Design:

Drafted By: S. SNYDER

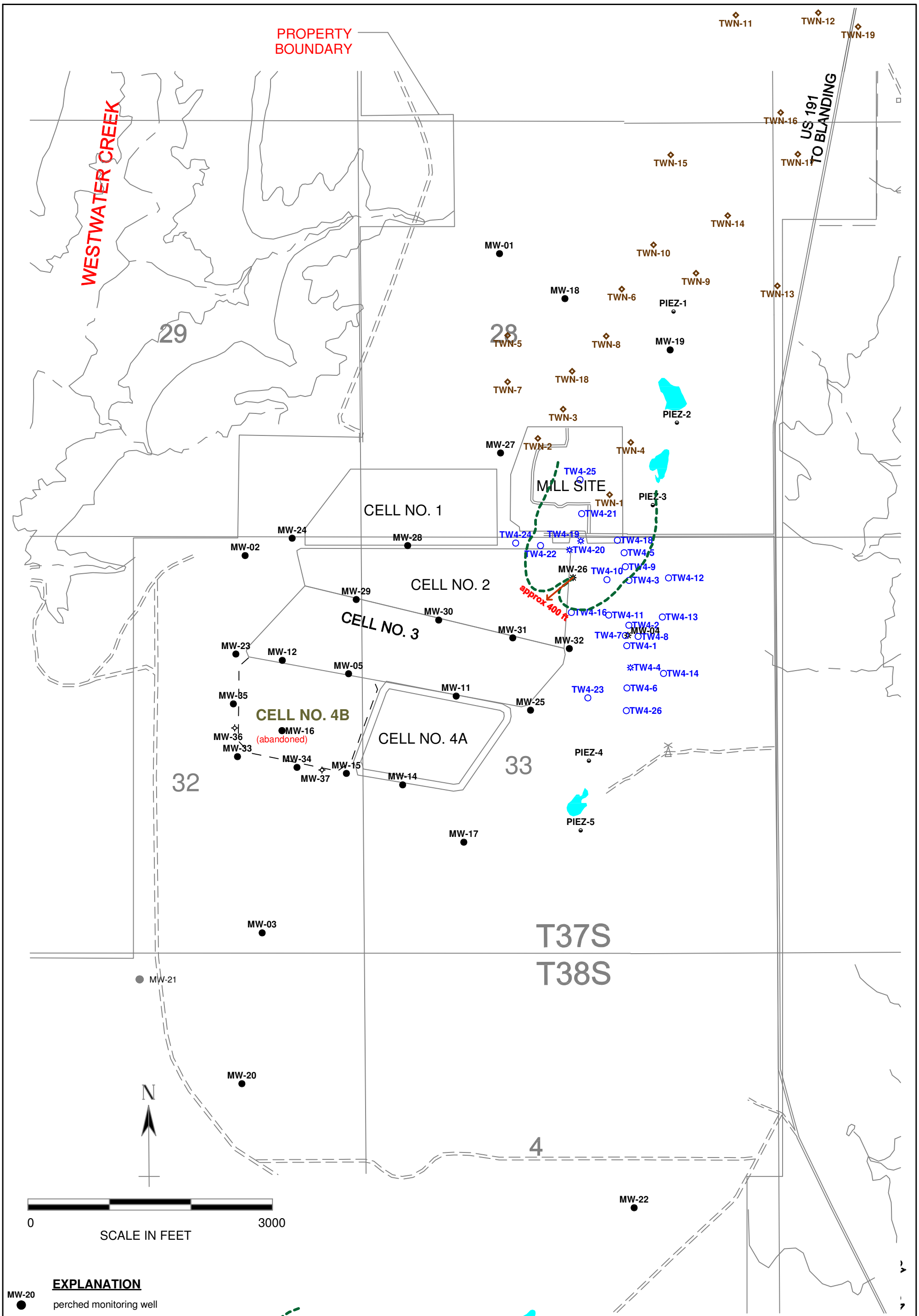


Legend

- Monitoring Well (MW)
- Piezometer
- Chloroform MW
- Nitrate MW
- Existing Pipeline
- Proposed Pipeline

Figure 11-5

Well Pumping Transfer Lines



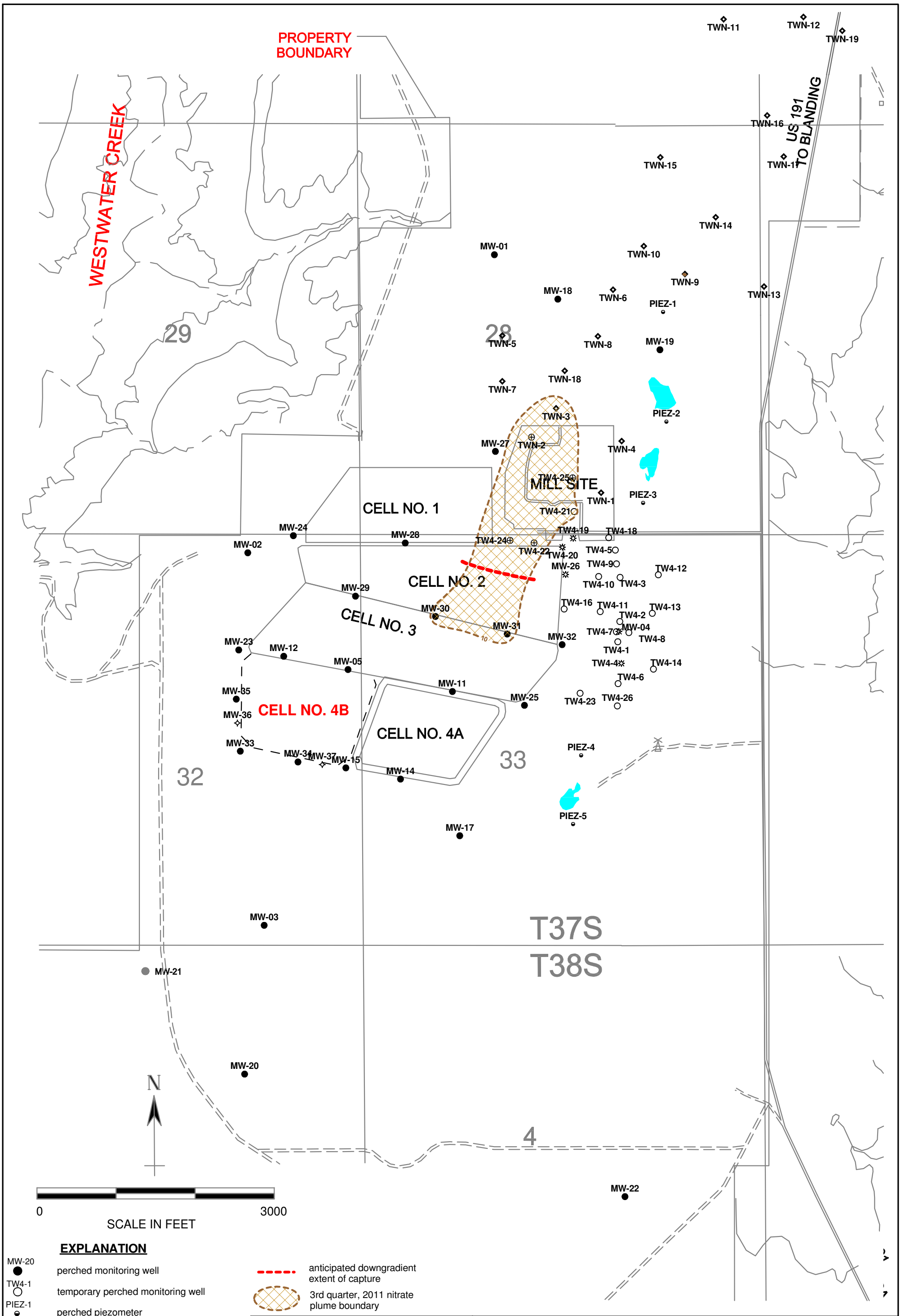
EXPLANATION

- MW-20 — perched monitoring well
- TW4-19 — temporary perched monitoring well
- PIEZ-1 — perched piezometer
- TWN-1 — temporary perched nitrate monitoring well
- MW-36 — perched monitoring well installed April, 2011
- MW-4 — perched chloroform extraction well
- estimated Q3, 2011 extent of capture of chloroform pumping well MW-26
- wildlife pond

HYDRO GEO CHEM, INC.

ESTIMATED EXTENT OF CAPTURE OF CHLOROFORM PUMPING WELL MW-26 3rd QUARTER, 2011

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/mw26capv2.srf	12



EXPLANATION

MW-20	perched monitoring well
TW4-1	temporary perched monitoring well
PIEZ-1	perched piezometer
TWN-1	temporary perched nitrate monitoring well
MW-36	perched monitoring well installed April, 2011
MW-4	perched chloroform extraction well
TW4-22	proposed nitrate extraction well
	anticipated downgradient extent of capture
	3rd quarter, 2011 nitrate plume boundary

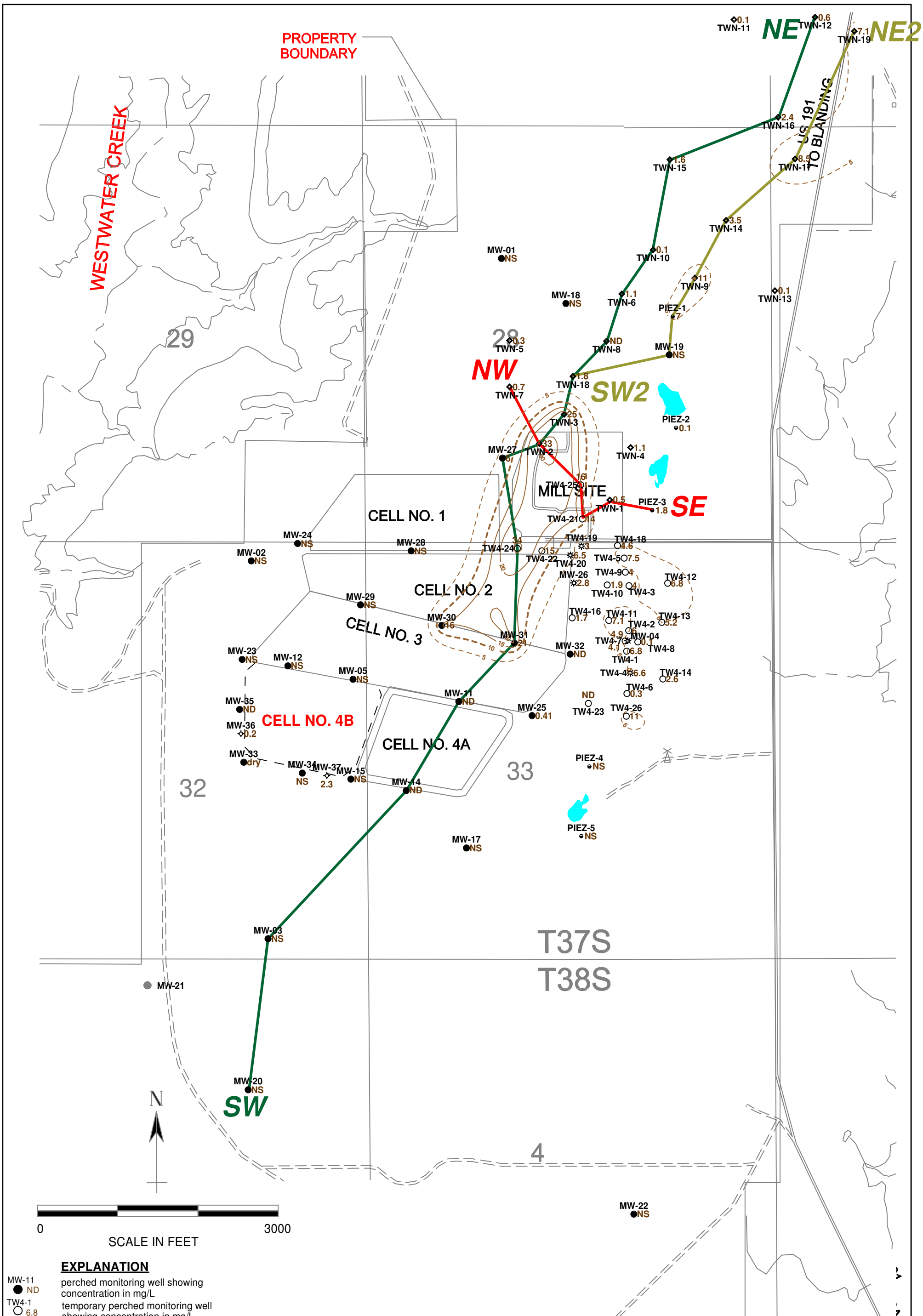
HYDRO GEO CHEM, INC.

ANTICIPATED MINIMUM DOWNGRADIENT EXTENT OF CAPTURE RESULTING FROM PUMPING TW4-22, TW4-24, TW4-25, AND TWN-2

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/ nov11/nitrate/Ndgcaptrv2.srf	13

APPENDIX A

HYDROGEOLOGIC CROSS SECTIONS



NOTE: MW-4, MW-26, TW4-4, TW4-19 and TW4-20 are pumping wells

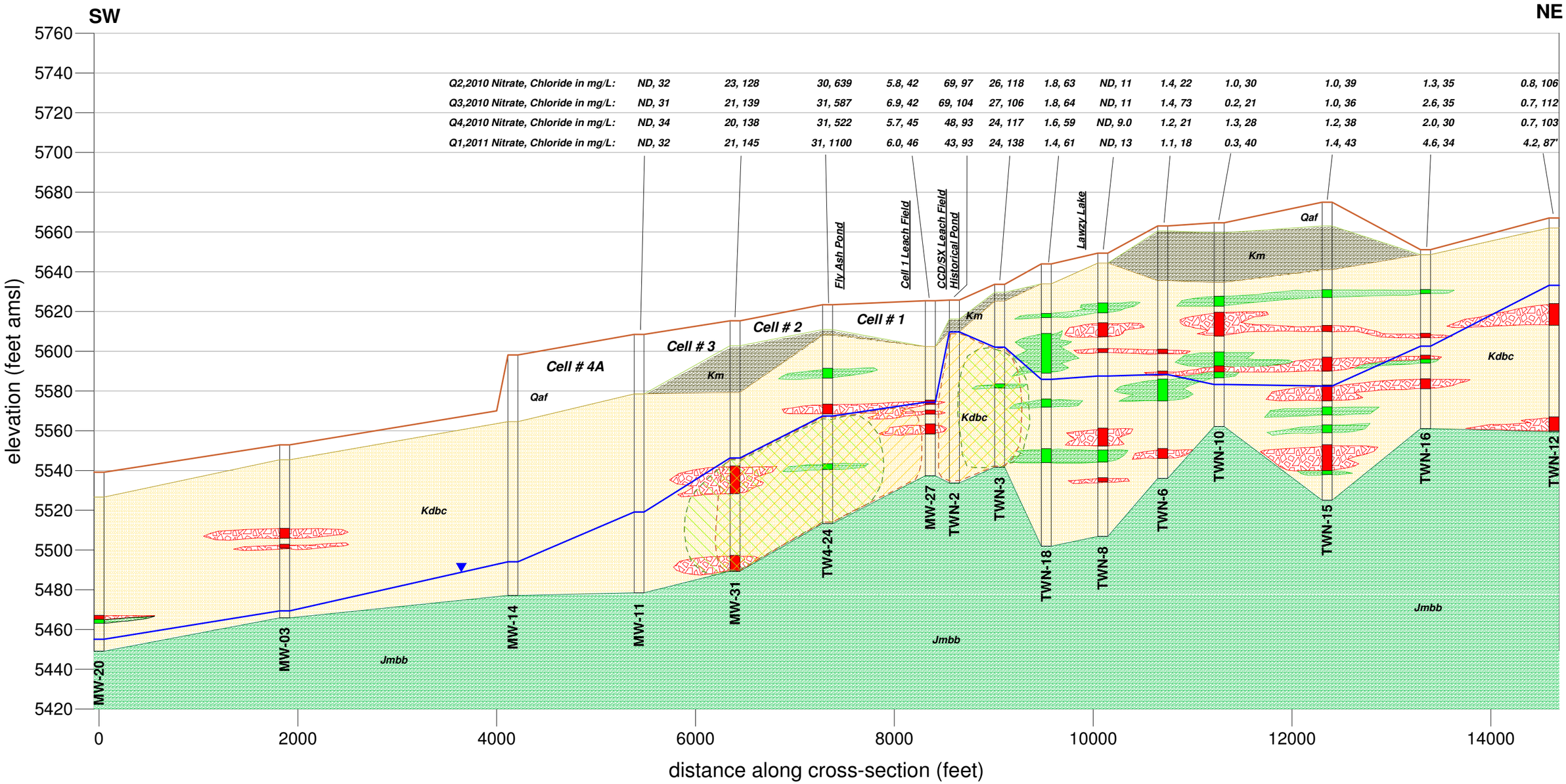
EXPLANATION

MW-11 ND	perched monitoring well showing concentration in mg/L
TW4-1 6.8	temporary perched monitoring well showing concentration in mg/L
PIEZ-1 7	perched piezometer showing concentration in mg/L
TWN-1 0.5	temporary perched nitrate monitoring well showing concentration in mg/L
MW-36 0.2	perched monitoring well installed April, 2011 showing concentration in mg/L
MW-4 4.9	perched chloroform extraction well showing concentration in mg/L

HYDRO GEO CHEM, INC.

LOCATIONS OF CROSS SECTIONS AND KRIGED 3rd QUARTER, 2011 NITRATE (mg/L) (NITRATE + NITRITE AS N)

APPROVED	DATE	REFERENCE	FIGURE
SJS	05/01/2012	H:/718000/nitrate2011/CAP/AppA/nit0911xsv2.srf	A.1



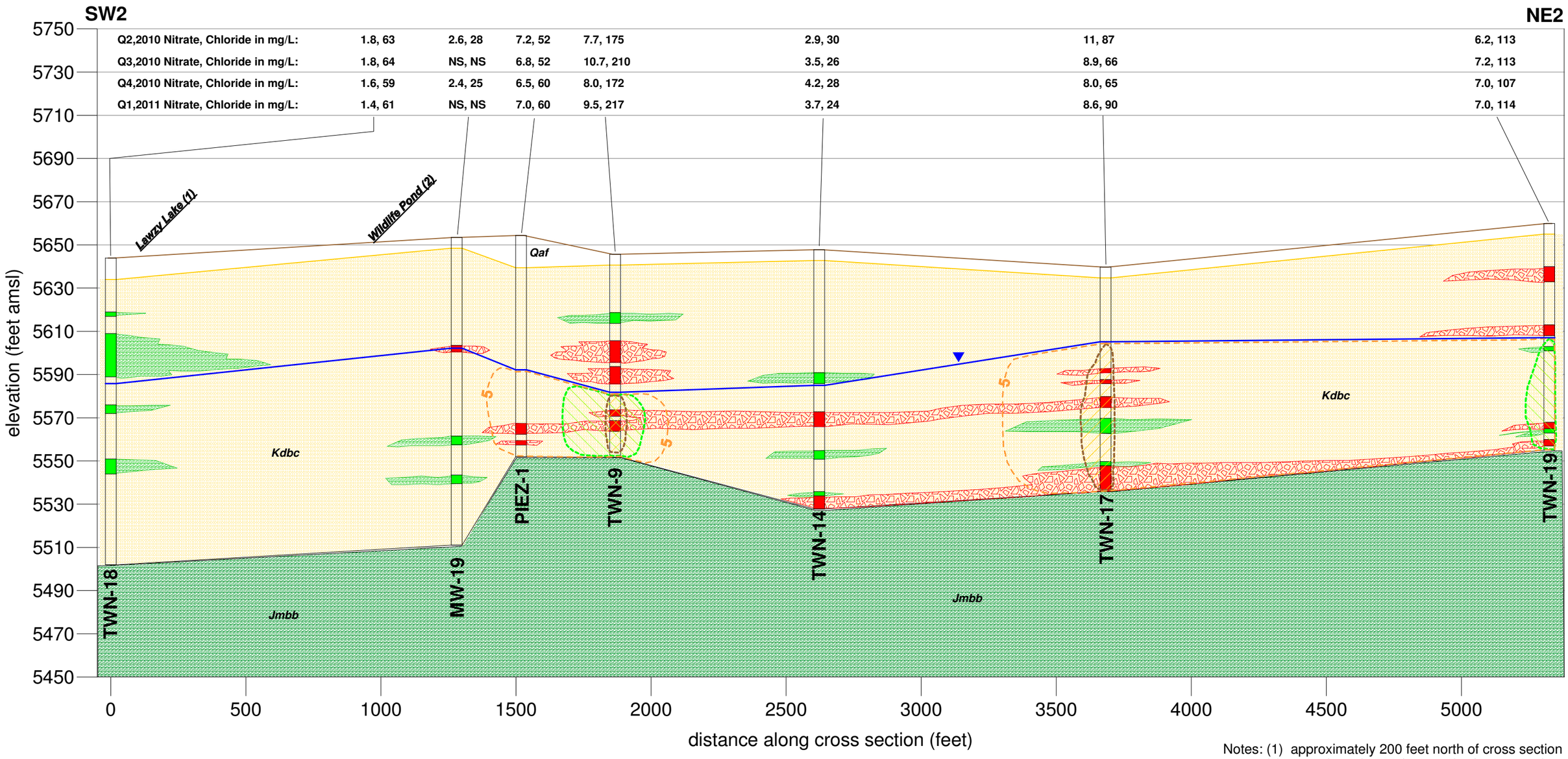
EXPLANATION

- Qaf — Alluvium/Fill
- Km — Mancos Shale
- Kdbc — Dakota Sandstone/ Burro Canyon Formation
- Jmbb — Brushy Basin Member of Morrison Formation
- Shale in Dakota / Burro Canyon Formation
- Conglomerate in Dakota / Burro Canyon Formation
- Piezometric Surface
- Approximate Area >10 mg/L Nitrate
- Approximate Area >100 mg/L Chloride

HYDRO GEO CHEM, INC.

INTERPRETIVE NORTHEAST-SOUTHWEST CROSS SECTION (NE-SW) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	5/24/11	H:/718000/nitrate2011/ CAP/AppA/CAPxsswnever2.srf	A.2



Notes: (1) approximately 200 feet north of cross section
(2) approximately 200 feet south of cross section

vertical exaggeration = 8 : 1

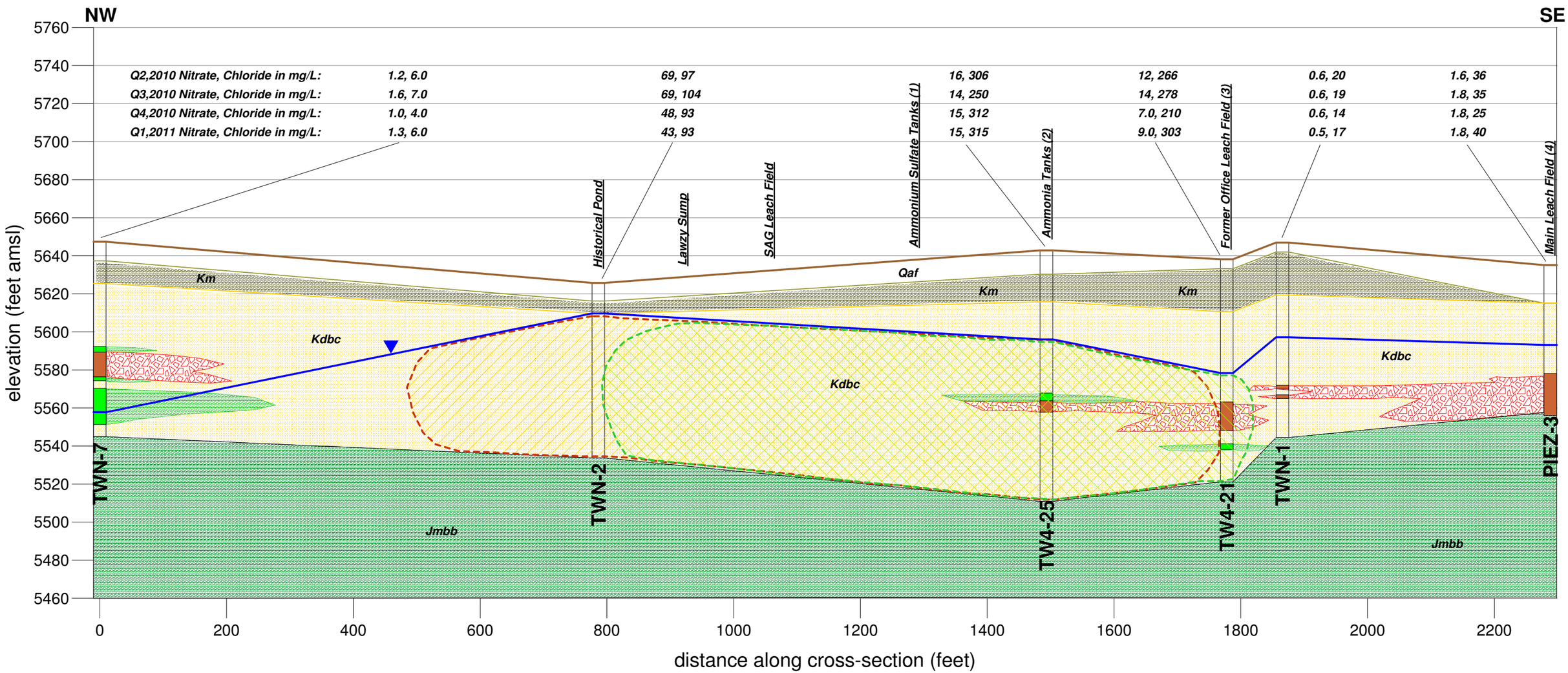
EXPLANATION

- Qaf — Alluvium/Fill
- Kdbc — Dakota Sandstone/ Burro Canyon Formation
- Jmbb — Brushy Basin Member of Morrison Formation
- Piezometric Surface
- Shale in Dakota / Burro Canyon Formation
- Conglomerate or Conglomeratic Sandstone in Dakota / Burro Canyon Formation
- Approximate 5 mg/L Nitrate Icocon
- Approximate Area > 10 mg/L Nitrate
- Approximate Area >100 mg/L Chloride

HYDRO GEO CHEM, INC.

INTERPRETIVE NORTHEAST-SOUTHWEST CROSS SECTION (NE2-SW2) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	5/24/11	H:/718000/nitrate2011/ CAP/AppA/CAPxssw2ne2.srf	A.3



Notes: (1) approximately 115 feet southwest of cross-section
(2) approximately 150 feet southwest of cross-section
(3) approximately 300 feet south of cross-section
(4) immediately south of cross-section

vertical exaggeration = 3 : 1

EXPLANATION

- Qaf — Alluvium/Fill
- Km — Mancos Shale
- Kdbc — Dakota Sandstone/ Burro Canyon Formation
- Jmbb — Brushy Basin Member of Morrison Formation
- Shale in Dakota / Burro Canyon Formation
- Conglomerate or Conglomeratic Sandstone in Dakota / Burro Canyon Formation
- Piezometric Surface
- Approximate Area >10 mg/L Nitrate
- Approximate Area > 100 mg/L Chloride

HYDRO GEO CHEM, INC.

INTERPRETIVE NORTHWEST-SOUTHEAST CROSS SECTION (NW-SE) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS	5/24/11	H:/718000/nitrate2011/ CAP/AppA/CAPxsnwse.srf	A.4

APPENDIX B

LITHOLOGIC LOGS FOR
MW-3A, MW-30, MW-31, MW-34, AND MW-37

Date 4-19-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-3A
Property White Mesa Mill Project _____ Unit No. _____ Sec. _____ Twp. _____ Rge. _____
County San Juan State Utah Location _____ Elev. _____

PAGE 1 OF 1
T.D. PROBE _____
T.D. DRILL 95.0
FLUID LEVEL _____

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						Sndy sh	rdbn	vf-m	P									VS			Surface soil/Shale
5.0						Sndy sh	rdbn-tn	vf-m	P									VS			
7.5						ss-sltst	rdbn	vf f	M									Vs			
10.0						qtz ss	vltgy-wh	f	W	sa								W			Upper Dakota Fm Ct @ approx 7.5 ft
12.5						qtz ss	lttn	f	W	sr								N			
15.0						qtz ss	ltgytn	f cr	P	sr								N			sparse pk-wh chert grains
17.5						qtz ss	ltgytn	f m	P	sr								N			
20.0						qtz ss	ltgytn	f m	P	sr								N			
22.5						qtz ss	ltgytn	f	W	sr								N			
25.0						qtz ss	lttn	f m	P	sr								N			sparse multicolor chert grains
27.5						qtz ss	lttn	f m	W	sr								N			
30.0						qtz ss	tn	m-v cr	P	sa								N			abnt. multi color chert grains
						qtz ss-peb	tn	m-v cr	P	a								N			congl. zone abnt chert frags.
35.0						qtz ss-sh	tn-blgy	m cr	P	sr								N			blgy shale frags
37.5						qtz ss, sh, l	blgy-tn	m-v cr	P	sa								N			blgy shale frags, chert frags, congl. zone
40.0						qtz ss	tn	vf-v cr	P	sa								N			chert frags
42.5						qtz ss	tn	m-v cr	P	sr								N			
45.0						qtz ss, cgl	tn	f-v cr	P	sr								N			congl. zone
47.5						qtz ss, cgl	tn	f-v cr	P	sr								N			congl. zone
50.0						qtz ss	tn	m-v cr	P	sr								N			
52.5						cgl, qtz ss	dkgytn	cr-v cr	P	a								N			cgl. zone abnt. chert frags
55.0						qtz ss	tn	f-m	P	sr								N			
57.5						qtz ss, sh	vltgy	vf	W	r.								N			sparse blgy sh
60.0						sltst, ss, cgl	ltblgy	f-peb	P	sa								N			cgl. zone, sparse chert frags
62.5						qtz ss	lttn-	f-cr	P	sr								N			some chert frags
65.0						qtz ss	ltgytn	f-v cr	m	r								N			" " "
67.5						qtz ss	ltgytn	f-v cr	m	r								N			" " "
70.0						qtz ss	ltgytn	f-v cr	P	sr								N			qtz ss, begin coring
72.5						qtz ss	dkgybn	m-v cr	f	sr		LT						N			abnt. chert frags
75.0						qtz ss	dkgybn	m-v cr	f	sr		LT						N			
77.5						qtz ss	ltgy	vf-m	P	sa								N			abnt. wh chert grains
80.0						qtz ss	ltgy	vf-cr	P	sa								N			
82.5						qtz ss	ltgy	f-cr	P	sr								N			
85						qtz ss	ltgy	f-m	f	sr								N			
87.5						qtz ss	ltgy	m-vcr	P	sa								VW			25% chert frags, trace blgy sh
90.0						qtz ss	gytn	vcr-peb	P	sa								VW			
92.5						cgl, qtz ss	gytn	vcr-peb	P	sa								N			Upper Brushy Basin Mbr. Ct @ 92.5 ft (from core)
95.0						sh, cgl	gybl-bn	cr-peb	P	sa								N			95.0 T.D.

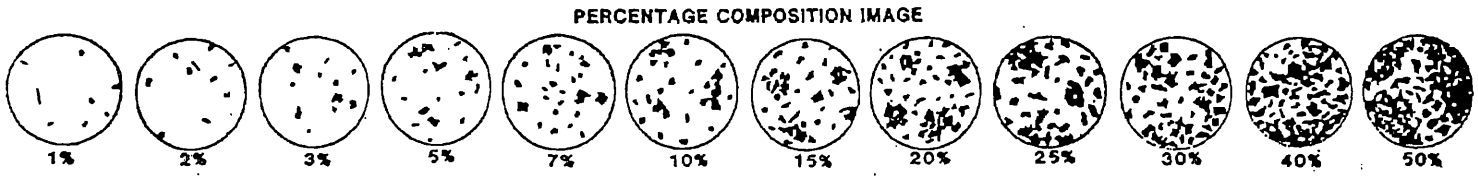
PERCENTAGE COMPOSITION IMAGE

Date 4-6-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-30
Property White Mesa Mill Project _____ Unit No. _____ Sec. 33 Twp. 37S Rge. _____
County San Juan State Utah Location _____ Elev. ≈5612

PAGE 1 OF 1
T.D. PROBE _____
T.D. DRILL 110.0
FLUID LEVEL _____

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						Sndy sh	lt yw bn											VS			Surface soil/fill, frags. of flyash from mill
5.0						Sndy sh	lt bn											VS			Possible fill material
7.5						Sndy sh	lt gy wh bn											VS			Possible fill material
10.0						Sh	lt yw											VS			
12.5						Slty sh	lt bn											VS			possible bedrock contact, abnt. gyp. (selenite) frags.
15.0						Sh	lt gn yw											VS			trace selenite
17.5						Sh	lt yw-gy											VS			trace selenite
20.0						Sh	lt yw gy											S			Trace selenite
22.5						Sh, qtz ss	lt pp bn-	vf	m	p	sa							S			upper Dakota Fm. Ct. @ approx 22.0 ft.
25.0						qtz ss	lt yw tn	f-	m	f	sa							S			
27.5						qtz ss, cgl	wh-lt tn bn	f-	vcr	p	sa							S			dk chert fragments
30.0						qtz ss, cgl	lt tn-dk gy	m-	vcr	f	sr							S			note: some contamination with flyash
						qtz ss, cgl	lt gy-lt tn	f-	vcr	f	sr							S			
35.0						qtz ss	lt gy tn.	m-	vcr	w	sr							S			
37.5						sltst, sh.	lt tn-lt gy		vf									N			
40.0						sltst, sh	lt gy-vlt tn		vf									W			
42.5						sltst, qtz ss	wh-vlt gy	vf	-f									m			
45.0						qtz ss,	vlt gy-wh		f									m			
47.5						sltst-qtz ss	lt gy	vf	-f									m			
50.0						qtz ss	vlt bn		vf									m			
52.5						Sndy sltst	lt pp bn	vf	f	p	sa							VS			
55.0						sltst, qtz ss	rd bn-lt gy	vf	m	p	sa							S			
57.5						sltst, qtz ss	rd bn-gy	vf	m	p	sa							S			
60.0						qtz ss, cgl	tn-gy	f-	peb	p	sa							W			abnt. multicolored chert frags. & pebbles
62.5						qtz ss, cgl.	gy tn	m-	peb	p	sa							VW			" " " " "
65.0						qtz ss	or tn	m-	vcr	p	sa		L	T				N			" " " " "
67.5						sltst, sh, ss	yw tn-gy	vf	f	f	sa		L	T				N			
70.0						sltst, sh, ss	gy bn	vf	f	f	sa		L	T				N			
72.5						qtz ss-sltst	vlt gy	vf	f	f	sa							N			
75.0						qtz ss-	wh	vf	f	f	sa							N			
77.5						qtz ss	wh-vlt gy	vf-	f	f	sa							N			frags. very soft & friable
80.0						qtz ss	lt tn	f-	m	f	sa							N			
82.5						qtz ss, sh	lt gy gn-rd	f-	m	p	sa							N			frags soft & friable
						qtz ss, sh	lt gy gn-wh	f-	m	p	sa							N			
85.0						qtz ss	vlt tn-wh	f-	m	f	sr							N			
90.0						qtz ss	vlt tn-wh	f-	m	w	sr							N			some dk chert grains
92.5						qtz ss	wh	f-	m	w	sr							N			
95.0						qtz ss	wh	f-	m	w	sr							N			
97.5						qtz ss	wh	f-	m	w	sr							N			
100.0						qtz ss	wh	f	m	w	sr							N			
102.5						qtz ss	wh	f	m	w	sr							N			
105.0						qtz ss cgl	vlt gy wh	m-	peb	p	sa							N			abnt dk chert frags.
107.5						sh	blgn											N			Upper Brushy Basin Mbr @ approx 105.0 ft.
110.0						sh	blgn											N			T.D.

PERCENTAGE COMPOSITION IMAGE

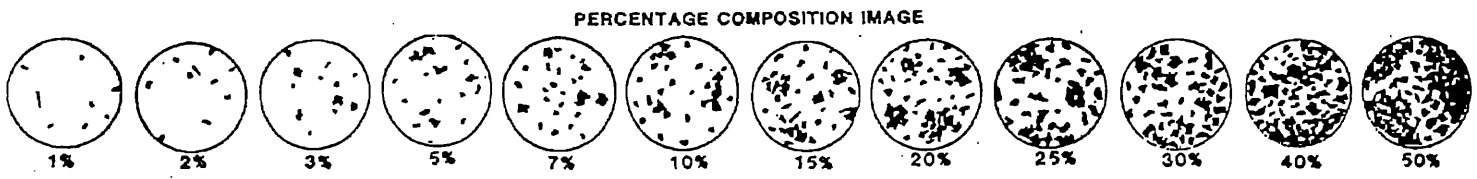


Date 4-5-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-31
Property White Mesa Mill Project _____ Unit No. _____ Sec. 33 Twp. 37S Rge. _____
County San Juan State Utah Location _____ Elev. ≈ 5614

PAGE 1 OF 2
T.D. PROBE _____
T.D. DRILL 130
FLUID LEVEL _____

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						sndy sltst	lt rdbn	vf-m	p	sa								S			possible fill material from dike
5.0						sndy sltst	lt pk tn	vf-m	p	sa								S			possible fill material from dike
7.5						sndy sh, ss	lt pk tn	vf-m	p	sa								S			possible fill material from dike
10.0						Sndy sh,	lt pk-v lt tn	vf-m	p	sa								S			possible fill material from dike
12.5						Sndy sh,	lt pk tn	vf-m	p	sa								VS			Mancos Shale Fm.
15.0						Sndy sh	rdbn-ywtn	f-m	f	sa								VS			
17.5						Slty sh	rdbn-ywtn	vf-f	p	sa								S			
20.0						Sh	ywgy-lt pk											S			
22.5						Sh	ywgy-lt pk											m			
25.0						Sh	ywgy											S			
						Sh	ywgy											m			
30.0						qtz ss, sh	ywgy	vf-f	p	sa	Lm							VW			
32.5						Sndy sltst	gybn	vf-f	p	sa								W			
35.0						Sndy sltst	gybn	vf-f	p	sa								W			
37.5						qtz ss, sh	gy-tn	vf-m	f	sa								VW			Upper contact Dakota Fm. @ approx 36.0
40.0						qtz ss	tn	m	f	sa	Lm							N			
42.5						qtz ss	tn	m-cr	f	sa	LT							N			
45.0						qtz ss	gytn	m-vcr	p	a								N			
47.5						qtz ss	lt bn	m-vcr	p	a								N			sparse chert frags.
50.0						qtz ss	lt bn	m-vcr	p	a								N			sparse chert frags.
52.5						qtz ss	lt ywbn	m-peb	p	a								N			abnt. chert frags.
55.0						qtz ss	lt tn	m	w	sr								N			
57.5						qtz ss	lt tn	m	w	sa								N			
60.0						qtz ss	lt tn	m	w	sr								N			
62.5						qtz ss	lt tn	m-cr	f	sa								N			
65.0						qtz ss	lt tn	m	f	sa								N			sparse wh chert grains
67.5						qtz ss	lt tn	m	f	sr								N			
70.0						qtz ss	lt tn	m-cr	f	sa								N			some dk gy chert grains
72.5						qtz ss	lt tn	m-cr	f	sa								N			" " " " "
75.0						qtz ss, cgl.	lt tn	m-peb	p	sa								W			" " " " pebbles
77.5						qtz ss, cgl	ywgy	m-peb	p	a								W			" " " " "
80						qtz ss, cgl	lt tn	m-vcr	p	sr								N			abnt. multicolored chert frags & pebbles
82.5						qtz ss cgl	gytn	m-peb	p	a								W			" " " " " "
85.0						qtz ss, cgl	gytn	m-peb	p	a								W			" " " " " "
87.5						qtz ss, cgl	gytn	cr-peb	p	a								W			" " " " " "
90.0						qtz ss	tn	m	w	sr								N			
92.5						qtz ss, sltst	lt gy-lt blgy	f-m	f	sr								N			
95.0						qtz ss, sltst	lt tn-lt blgy	vf-m	f	sr								N			
97.5						qtz ss	v lt tn-wh	f-m	f	sr	LT	T	C					N			
100.0						qtz ss	v lt tn-wh	m	w	sr								N			
102.5						qtz ss	v lt tn	m-cr	f	sr								N			dk gr chert frags
105.0						qtz ss	v lt tn	m-cr	f	r								N			" " " "
107.5						qtz ss	v lt tn-wh	m	w	r								N			
110						qtz ss	v lt tn-wh	m	w	r								N			
112.5						qtz ss	v lt tn-wh	m	w	r								N			
115.0						qtz ss	v lt tn-wh	m	w	r								N			
117.5						qtz ss	v lt tn-wh	m	w	r								N			
120.0						qtz ss, chert	lt tn-dk gy	cr-peb	p	a								N			cgl. zone multicolored chert frags & pebbles
122.5						qtz ss, chert	lt tn-tn	m-peb	p	a								N			" " " " " " "
125.0						qtz ss, chert	lt tn-tn	vcr	p	sr		T	C					N			" " " " " " "

PERCENTAGE COMPOSITION IMAGE



ate 4-11-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-31

Property White Mesa Mill Project _____ Unit No. _____ Sec. 33 Twp. 37S Rge. _____

County San Juan State Utah Location _____ Elev. ≈ 5614

PAGE 2 OF 2

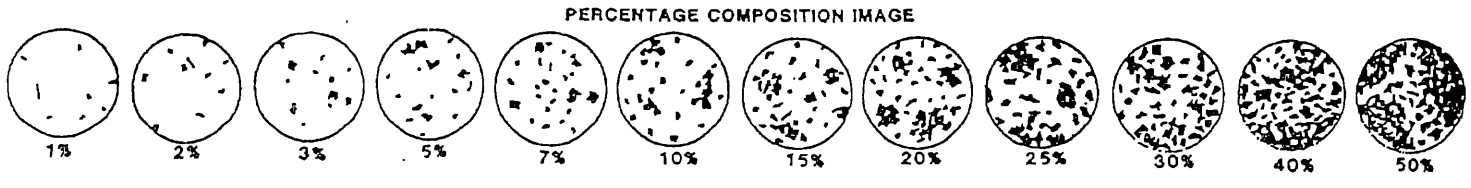
T.D. PROBE _____

T.D. DRILL 130

FLUID LEVEL _____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						qtz ss, cgl, sh	wh-gy gn	m-peb	p	a							m				Upper Brushy Basin Mbr Ct @ approx 126.0 ft.
130.0						sh	gy gn-pp bn										w				

PERCENTAGE COMPOSITION IMAGE

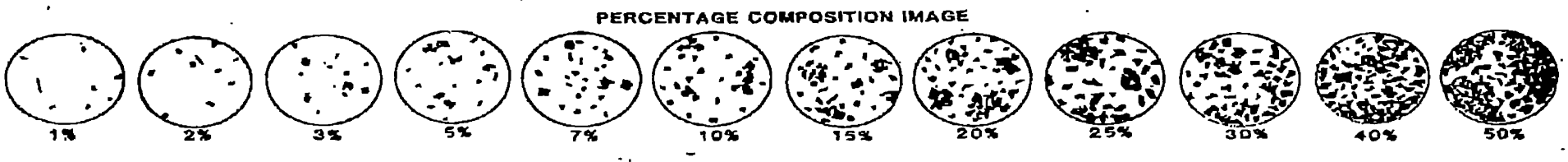


Date 8-31-10 Geologist [redacted] L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. MW-34
Property White Mesa Project Tailings Cell Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location Tailings Cell Dike Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 115.0
FLUID LEVEL ____

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						mdst	rd bn											VS			Compacted fill material for cell dike
5.0						mdst	rd bn-yw bn											VS			" " " " " "
7.5						mdst	rd bn											VS			" " " " " "
10.0						mdst	rd bn											VS			" " " " " "
12.5						mdst	rd bn											VS			" " " " " "
15.0						mdst	rd bn											VS			" " " " " "
17.5						mdst	pk bn											VS			" " " " " "
20.0						sndy mdst	yw gy bn	f-	m	p	a							VS			" " " " " "
22.5						sndy mdst	rd bn	f-	m	p	a							VS			" " " " " "
25.0						sndy mdst	lt rd bn	f-	m	m	a							VS			" " " " " "
27.5						sndy mdst	lt rd bn	f-	m	m	a							VS			" " " " " "
30.0						sndy sh	lt pk tn	f-	m	p	a							VW			" " " " " "
32.5						qtz ss	tn-		m	m	a		L					VW			Mancos Shale fm.
35.0						sndy sh	yw gy bn	m-	cr	m	a							N			" " "
37.5						qtz ss	lt bn	m-	cr	m	a		L					N			Dakota fm. contact @ 35.0 ft.
40.0						qtz ss	lt gy bn	f-	cr	p	a							M	tr	HC	poss. tr of hydrocarbon
42.5						qtz ss	v lt tn-wh	f-	vcr	p	A							VW			Very hard drilling
45.0						qtz ss	v lt tn	f-	m	m	a							N			" " "
47.5						qtz ss	wh	m-	vcr	p	A							N			" " " sparse chert grains
50.0						qtz ss	wh	m-	gr	p	A							VW			" " " chert grains
52.5						qtz ss	v lt tn	f-	vcr	p	A							VW			
55.0						qtz ss	tn		m	w	R							N			
57.5						qtz ss	tn	f-	m	m	a							N			
60.0						qtz ss, sh	lt tn - v lt gn	m-	vcr	p	a							N			
62.5						qtz ss, sh	lt tn - lt gn	cr-	gr	p	a							N			abund multi colored chert grains & frags.
65.0						qtz ss, sh	lt tn - lt gn	m-	gr	p	a							N			" " " " " "
67.5						sh, cgl	dk gy - lt gy gn		gr	p	a							N			" " " " " "
70.0						qtz ss, sh	yw tn - gy gn	f-	cr	p	a			tr				N			dissem. pyrite
72.5						qtz ss	dk tn	f-	cr	p	a		L					N			sparse chert grains
75.0						qtz ss	tn	f-	cr	p	a							S			sparse chert grains
77.5						qtz ss, sh	tn - lt gy	f-	cr	p	a		L					S			
80.0						qtz ss	tn	m-	cr	p	a							S			
82.5						qtz ss	tn	f-	m	m	r							N			
85.0						qtz ss	tn		f	w	r							S			sparse chert grains
87.5						qtz ss	tn		f	w	r							N			
90.0						qtz ss, sh	v lt gy tn		f	w	r							VW			
92.5						qtz ss	v lt tn	f-	m	m	r							N			
95.0						qtz ss	v lt tn		m	m	r							N			
97.5						qtz ss	v lt tn		m	w	r							N			
100.0						qtz ss	v lt tn		m	w	a							N			
102.5						qtz ss, sh	v lt tn-wh	f-	m	m	r							S			
105.0						qtz ss	gy bn	m-v	cr	p	a							S	tr	hy	
107.5						qtz ss	gy bn	m-v	cr									M			Moisture first noted @ 107.5
110.0						sh, qtz ss	gy bn	v-v	cr									M			Brushy Basin fm contact @ 107.5
112.5						sh	lt gy gn -											N			
115.0						sh	gy gn - pp bn											N			mottled frags.

PERCENTAGE COMPOSITION IMAGE



Date 25 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. MW-37
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location CELL 4B DIKE Elev. 5618 ≈

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 120.0
FLUID LEVEL ____

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						mdst	rdbn											VS			Compacted Tailings Cell Dike Material
5.0						mdst	rdbn											VS			"
7.5						mdst	rdbn											VS			"
10.0						mdst	rdbn											VS			"
12.5						mdst	rdbn											VS			"
15.0						mdst	rdbn											VS			"
17.5						mdst	rdbn											VS			"
20.0						mdst	rdbn											VS			"
22.5						mdst	rdbn											VS			"
25.0						mdst	rdbn											VS			"
27.5						sh	ywbn											VS			Mancos Sh
30.0						sh-mdst	rdbn-ltpk											VS			Mancos Sh.
32.5						qtzss, sh	tn	f.	m	w	r							VS			Upper Dakota Ct @ 300'
35.0						qtzss	tn	f-	m	w	r							VW			
37.5						qtz ss, sh	tn	f.	m	w	r							N			
40.0						qtz ss, sh	gybn		m	w	r							N			
42.5						qtz ss, sh	wh-ltorbn-dkgy		m	w	r							N			
45.0						qtz ss	wh-ltorbn	f-	m	w	r		L					N			
47.5						qtz ss	vlttn		m	w	R		L					VW			
50.0						qtz ss, qtzite	wh		m	w	R							N			Very hard drilling
52.5						qtz ss-qtzite	wh	f-	m	w	r							N			extremely hard drilling
55.0						qtz ss-qtzite	wh-lttn	f-	m	w	r							N			moisture first noted @ 54'
57.5						qtz ss	tn	f-	m	w	r							N			abund. chert grains
60.0						qtz ss, cgl	lttn	m-	peb	p	a							N			very abund chert grains and pebbles.
62.5						cgl-sh	ltywgygn		pe	p	a							N			some chert pebble frags.
65.0						sh-cgl	ltgn-tn		peb	p	a							N			" " " "
67.5						sltst, qtz ss	lttn	vf-	peb	p	a							N			
70.0						qtz ss	lttn	vf-	peb	p	r							N			
72.5						qtz ss	lttn	f-	peb	p	r							VW			
75.0						qtz ss	lttn	m-	peb	p	r							S			
77.5						qtz ss	vlttn	m-	pe	p	r		L					VW			abund chert frags.
80.0						qtz ss	vltbn		m	w	r		L					N			
82.5						qtz ss, cgl	wh-vdkgy	m	peb	p	r		L					N			Abund. water @ 80.0' abund chert frags & pebbles.
85.0						sh, qtz ss, cgl	lttn-gn	f-	peb	p	r		L					N			abund chert frags and pebble.
87.5						sh, qtz ss	gn-wh	f-	peb	p	r							N			
90.0						qtz ss	wh	m-	peb	m	r							N			
92.5						qtz ss	ltgybn	m-	peb	m	r		L					N			
95.0						qtz ss	vlttn		m	w	R		L					N			
97.5						qtz ss	vlttn	m-	peb	p	r							N			
100.0						qtz ss	lttn	m-	c	f	r							N			
102.5						qtz ss	lttn	f-	m	m	r							W			
105.0						qtz ss	lttn	f-	m	m	r							N			
107.5						qtz ss, sh	lttn-gn	f-	peb	p	r							N			
110.0						qtz ss	wh-tn		m	w	R			Tr	C			N			
112.5						qtz ss	vlttn		m	w	R			3%	C			W			
115.0						qtz ss	wh-blgn	f-	m	m	r			1%	C			W			
117.5						qtz ss, sh	wh-blgn											N			Brushy basin Ct @ 117.0' (good contact)
120.0						sh	blgn-gnbn											N			120.0 T.D.
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE